GEOTECHNICAL INVESTIGATION

MASTER PLAN REVISION

CHIQUITA CANYON LANDFILL

CASTAIC, CALIFORNIA

FOR

CHIQUITA CANYON LANDFILL

JANUARY 27, 2012

JOB NO. 2002-036-004

VOLUME 1 OF 2

RTF&A

GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

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January 27, 2012

Chiquita Canyon Landfill
29201 Henry Mayo Drive
Castaic, California 91384

Job No. 2002-036-004

Attention: Mr. Michael Dean
District Manager

Gentlemen:

We are pleased to submit our report of "Geotechnical Investigation, Master Plan Revision (MPR), Chiquita Canyon Landfill, Castaic, California" for the site. This report summarizes our opinions on the stability of slopes planned for the proposed landfill development, and for slopes associated with the entrance road area.

Based on the current field conditions and our knowledge of the site geologic conditions, the proposed Master Plan Revision development will be safe from hazard of landslide, settlement, or slippage, and will not adversely affect the geotechnical conditions of off-site properties, provided our recommendations and the requirements of the Los Angeles County Building Code are followed.

Our report incorporates the latest Golder Associates (Golder) Excavation Plan, dated November 2011. This geotechnical report supersedes our August 12, 2011 report, which was based on Golder's April 2011 plan.

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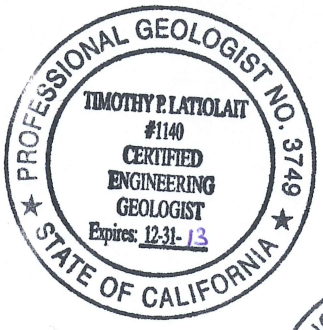
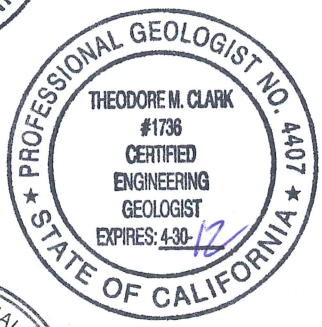
If you should have any questions regarding this report please feel free to contact us.





Respectfully submitted,

R. T. FRANKIAN & ASSOCIATES

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TPL/TMC/AWR/eaw

Distribution: (2) Chiquita Canyon Landfill (plus CD containing PDF file)
Attn: Mr. Michael Dean
(1) Law Offices of Scott Gordon (plus CD containing PDF file)
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CHIQUITA CANYON LANDFILL

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INTRODUCTION

This report presents the results of R. T. Frankian & Associates (RTF&A) geotechnical investigation for the Master Plan Revision (MPR) for the Chiquita Canyon Landfill (CCL). The investigation was performed at the request of Mr. Michael Dean of CCL and is based on the November 2011 *Excavation Plan* for the MPR, prepared by Golder Associates (Golder) and presented in Appendix A. The MPR includes extending the currently approved landfill footprint into the areas northeast and south of the active Main Canyon landfill, the relocation of the entrance road, and changes to the existing south and east sedimentation basins. The report summarizes our opinions on the stability of slopes planned in the following areas:

- northeast of the Main Canyon landfill, where the MPR grading limits include the lined landfill area, permanent cut slopes above the landfill perimeter, and grading for the east stormwater basin; and

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- south of the Main Canyon landfill, where the MPR grading limits include the lined landfill area, permanent cut slopes above the landfill, grading for the south stormwater basin, and the future entrance road south of Primary Canyon.

This geotechnical report does not, however, address future grading within the MPR areas designated as "Potential Borrow Area" and "MRF and Household Hazardous Waste Facilities Location."

This report presents the results of RTF&A's evaluation of the geologic and geotechnical conditions at the subject site. The purpose of the evaluation is to identify existing or potential geologic hazards and substantiate that the site is suitable for the proposed development from a geotechnical and geologic perspective. This data is provided for incorporation into an Environmental Impact Report (EIR). Our findings and recommendations are based on the results of our site geologic mapping and subsurface investigation, review of published data, and appropriate engineering and geologic analyses. The assessment of general site environmental conditions for the presence of contaminants in the soils and groundwater at the site was beyond the scope of this investigation.

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been prepared for CCL and their design consultants, to be used solely for planning and design of the MPR and associated grading.

PROJECT DESCRIPTION

NORTH AND EAST CANYON EXCAVATION AREA

The North and East Canyon Excavation Area will encompass northern portions of the property known as North Canyon and East Canyon. In this area, the MPR extends the lined landfill footprint north and northeast of the active Main Canyon landfill and includes a proposed east stormwater basin in the vicinity of the existing east sedimentation basin. The MPR grading plan includes permanent cut slopes above the perimeter of the proposed landfill, lined cut slopes and fill slopes within the landfill area, and permanent cut slopes above the proposed east basin. The proposed landfill liner limit is approximately coincident with the downslope side of the perimeter road.

North Canyon is located in the north portion of the site, just north of the active Main Canyon landfill (Figure 1). The topography of the North Canyon site is dominated by a southerly-draining canyon with moderately-steep bedrock slopes forming the west, north, and east canyon walls. These slopes descend to the canyon bottom at an overall gradient of approximately 1½:1 (horizontal:vertical). The floor of the canyon has been modified by at least two episodes of filling, including fill placed in the mid-1990s during construction of Canyon C Cell 2, and in 2003-2004 when fill material was generated during removal of the Northridge earthquake landslide. As much as 70± feet of fill has been placed in North Canyon since the 1990s, changing the canyon configuration from a steeply-incised canyon to one that is somewhat broad and flat-bottomed.

The East Canyon topography is characterized by a series of southerly- to easterly-descending ridges that border two southerly-draining tributaries of Castaic Creek. The natural slopes descend toward the two canyons at gradients ranging generally from 1½:1 to 3:1. The northern portion of the East Canyon includes an existing 3:1 southeasterly-facing 180± feet high fill slope constructed for two off-site water tanks. Approximately two-thirds of the fill slope is located within the CCL property.

Existing site elevations range from approximately 1,660 feet above mean sea level (msl) at the upper reaches of North Canyon to 1,100 feet msl at the confluence of the two tributary canyons of Castaic Creek.

The North and East Canyon Excavation Area extends from the northwest corner of CCL (above the perimeter road of Main Canyon landfill) to the eastern property line, immediately north of Canyon "B" landfill and northwest of the post office. The proposed floor of the excavation will range from approximate elevations 1,175 feet msl to 1,125 feet msl. Numerous cut slopes will be graded as part of the North and East Canyon development. Proposed slope gradients will range from 2:1 to 4:1. The maximum proposed cut slope height will be approximately 300 feet.

The location of North and East Canyon areas are shown on the Geotechnical Map, North and East Canyon Excavation Area (Figure 2.1).

SOUTH MAIN CANYON AND ENTRANCE ROAD

The South Main Canyon and Entrance Road areas lie within the southwest portion of the property. The geologic/geotechnical conditions within South Main Canyon were previously addressed by RTF&A in our November 20, 2009 report (RTF&A, 2009b); the geologic/geotechnical conditions along the Entrance Road were presented in RTF&A's January 13, 2012 report (RTF&A, 2012b). In the South Main Canyon area, the MPR grading plan includes extending the lined landfill footprint south of the active Main Canyon landfill. The proposed MPR entrance road is east of the existing landfill entrance, along the south side of the closed Primary Canyon landfill.

The South Main Canyon includes the main southerly-draining canyon, an easterly-draining tributary canyon, and ascending canyon slopes, located northwest of an existing sedimentation basin. Natural slope gradients range from 1½:1, for the slopes at the head of the canyon, to 4:1. Elevations range from approximately 1,330 feet msl to 980 feet msl.

A new stormwater basin is proposed for the South Main Canyon area, coinciding with the footprint of the existing sedimentation basin, with the basin bottom established at approximate elevation 965 feet msl. Side slopes for this basin will be graded at an inclination of 2:1 and attain a maximum height of approximately 125 feet.

A new landfill Entrance Road is proposed in the southwest corner of the site, with the road alignment beginning at the current intersection of Franklin Parkway and Wolcott Way, extending west-southwesterly toward the current landfill entrance. The topography along the proposed Entrance Road is characterized by a relatively flat alluviated area along the north side of State Highway 126, bordering moderately to steeply-ascending bedrock slopes. Cut-and-fill grading will be utilized for the Entrance Road, including south- and west-facing cut slopes up to 160 feet high. Proposed slope grades will range from 1½:1 to 2:1.

The South Main Canyon area and the future Entrance Road are depicted on the Geotechnical Map, South Main Canyon and Entrance Road (Figure 2.2).

SUBSURFACE EXPLORATION

Field exploration was conducted within the project site to develop and refine our understanding of the geologic surface and subsurface conditions. In particular, attention was focused on the underlying geologic structure and stratigraphy that will affect the slope stability of the proposed excavation plan. The explorations were conducted within North Canyon (for this current MPR investigation), East Canyon (RTF&A, 2006a and 2006b), South Main Canyon (RTF&A, 2009a), and the area of the future Entrance Road (RTF&A, 2012b).

The North Canyon investigation included exploring the subsurface conditions beneath the site by excavating 10 bucket auger borings (designated Borings B-1-10 through B-7-10, B-9-10, and B-11-10) and four hollow-stem auger borings (designated HS-1-10 through HS-4-10). The East Canyon investigation included the excavation of

eight bucket auger borings, designated B-1-03 through B-8-03. The South Main Canyon investigation included the excavation of three bucket-auger borings (B-1-09 through B-3-09) and three rotary-wash borings (WB-1-09 through WB-3-09). Investigation of the Entrance Road consisted of exploring the subsurface conditions by excavating six bucket auger borings (designated Borings B-8-10 and B-1-11 through B-5-11).

We obtained undisturbed samples from the borings for laboratory examination and testing. Standard Penetration Test (SPT) samples were also obtained from the hollow-stem auger borings.

The locations of the various borings are depicted on the Geologic Map, presented as Figure 1, and the Geotechnical Map, Figures 2.1 and 2.2. The logs of the borings are presented in Appendix B.

The surface geologic conditions within the landfill were previously mapped by EMCON (1990a), Harding Lawson and Associates (1987), and GeoLogic Associates (2005c), and mapped at a regional scale by professionals of the Dibblee Foundation (1993), the United States Geological Survey (USGS) (Winter and Durham, 1962), and California Division of Mines and Geology (CDMG) (Barrows, 1986).

LABORATORY ANALYSES

We performed laboratory tests on selected samples obtained from the borings to aid in the classification of the soils, for use in slope stability analyses, and to determine the pertinent engineering properties of the subsurface earth materials. The following tests were performed:

- moisture content and dry density determinations;
- direct shear tests;
- consolidation tests;
- plasticity index; and
- grain size analyses.

The results of the tests are presented in Appendix C.

GEOLOGY

REGIONAL GEOLOGY

CCL is located at the eastern end of the Ventura basin within the Transverse Ranges geomorphic province of California. The Ventura basin consists of a narrow, elongate sedimentary trough extending from the Santa Barbara Channel on the west to the San Gabriel fault on the east. The axis of the trough trends east-west, reflecting the overall east-west trend of the Transverse Ranges, and generally coincides with the Santa Clara River Valley and Santa Barbara Channel. The Ventura basin has been an area of subsidence and sediment accumulation since the beginning of the Tertiary period, with the present trough-like form developing near the beginning of the Miocene epoch (Winterer and Durham, 1962).

The structure of the basin is defined as a highly folded "synclinorium" formed by north-south compressional forces (Kew, 1924) and containing a maximum 50,000± feet of marine and nonmarine Tertiary through Quaternary age sediments (Bailey and Jahns, 1954). Two main periods of general deformation of the Ventura basin are indicated by the regional geologic structure: one in middle to late Miocene (represented by deposition of the Modelo Formation) and the other during the Pleistocene epoch, after deposition of the Plio-Pleistocene Saugus Formation (Kew, 1924; Winterer and Durham, 1962; Yeats et al., 1994). The flanks of the Ventura basin synclinorium are broken by a series of large reverse/thrust faults including the Santa Susana and Oak Ridge faults on the southern flank, and the Red Mountain and San Cayetano faults on the northern flank (Bailey and Jahns, 1954; Yeats et al., 1994). The San Gabriel fault, the dominant geologic feature in the Santa Clarita Valley, forms the eastern Ventura basin boundary and separates the Ventura basin from the structurally similar Soledad basin.

Sedimentary rock units comprising the eastern Ventura basin include approximately 2,000 feet of undifferentiated middle to late Eocene age rocks; 1,000± feet of the middle Miocene age Topanga Formation; 5,000± feet of the late Miocene age Modelo Formation; 4,000± feet of the late Miocene to early Pliocene age Towsley Formation; 5,000± feet of the Pliocene age Pico Formation; and 7,000± feet of the Plio-Pleistocene Saugus Formation (Winterer and Durham, 1962). The undifferentiated Eocene units and the Topanga, Modelo, Towsley, and Pico formations are composed of marine sediments; the Saugus Formation is composed of interfingering shallow-water marine, brackish water, and nonmarine units (Kew, 1924; Winterer and Durham, 1962). These Tertiary period rocks rest unconformably on pre-Cretaceous age metamorphic and igneous basement rocks of the San Gabriel Mountains.

Within the Santa Clarita Valley, the primary sedimentary rock formations are the Pico and Saugus formations. The Pico Formation outcrops along the northern flanks of the Santa Susana Mountains and in the Chiquita Canyon-Val Verde area. The Saugus Formation overlies the Pico Formation and comprises most of the hills of the valley between Newhall and Castaic. These two formations have been deformed into a series of closely spaced anticlines and synclines whose moderately to steeply-dipping flanks are broken by the Holser fault and cut off diagonally by the San Gabriel fault (Bailey and Jahns, 1954). Other geologic materials exposed within the valley include Pleistocene fanglomerate deposits of the Pacoima Formation (exposed in the southern portion of the valley) (Oakeshott, 1958), sporadic remnant terrace deposits of Pleistocene age, and Holocene alluvium mantling the valley floor.

The site is located within a region of high seismic activity primarily related to the active San Cayetano, Oak Ridge, Santa Susana, and San Gabriel faults, all of which are located within six miles of the site. Secondary, potentially active faults near the site include the nearby Holser fault.

LOCAL GEOLOGY

The site is situated on the northerly limb of the Ventura basin "synclinorium," approximately 1,000 feet south of the Holser fault. The Holser fault is a regional structure and may branch from the active San Gabriel fault (Winterer and Durham, 1962). Data compiled from oil company well logs indicate that the Holser fault is a south-dipping reverse fault with approximately 2,200 feet of dip-slip separation within the area of the Castaic Junction Oil field (Stitt, 1986). Studies completed by Allen E. Seward Engineering Geology (Seward, 1986 and 1993) examined the Holser fault for Holocene activity in the Hasley Industrial Park north of the site. Seward (1986) concluded that while deformation of the fault has clearly affected Quaternary sediments of the Saugus Formation, no offset has occurred in the overlying Holocene sediments.

The geologic structure beneath the site is dominated by four subparallel northwest-southeast trending, through-going folds. The folds are related to the north-south compressional forces within the hanging wall of the Holser fault system, which lies north of the study site. The axial traces of the folds are shown on the Geologic Map, Figure 1. Two of the through-going folds, consisting of an anticline on the south and a syncline to the north, transect the North and East Canyon Excavation Area. The geologic structure beneath the site is shown on the Site Geologic Sections, presented as Figure 3.

Geologic mapping of the site was previously performed by RTF&A in 2003 and 2004 as part of our Slope Stability Study and Geologic Fault Study for East Canyon (RTF&A, 2006a and 2006b). Additional geologic mapping was performed during our 2010 site exploration. The geologic units identified within the site during the geologic mapping are discussed below.

GEOLOGIC UNITS

The soil and bedrock materials encountered within the site consist of man-made deposits, alluvium, landslide debris, terrace deposits, and bedrock units of the Saugus and Pico formations. The various geologic units exposed within the landfill are depicted on the 1" = 200 feet Geologic Map, Figure 1. Units specific to the North and East Canyon Excavation Area and the South Main Canyon Entrance Road are presented on the 1" = 100 feet Geotechnical Maps, included as Figures 2.1 and 2.2, respectively. A description of each unit is presented as follows:

Man-made Deposits (af, afr, afs and cef): Man-made deposits consist of uncompacted artificial fill (map unit "af") and compacted (or certified) engineered fill (map unit "cef") associated with past grading activities on-site, and artificial fill materials related to landfill refuse disposal activities including stockpile fill (map unit "afs") and refuse fill (map unit "afr"). The fill materials are composed primarily of reworked Pico and Saugus Formation units and, in the case of the refuse fill, compacted municipal solid waste and associated cover materials primarily derived from reworked Pico and Saugus Formation materials.

Alluvium (Qal): Holocene age alluvium ("Qal") is present in the canyons and major drainage courses within the site and as Santa Clara River flood plain deposits adjacent to State Highway 126. As observed, the alluvium generally consists of sand and silty sand with scattered gravel and cobbles, derived from local bedrock exposures. The alluvium is generally loose to moderately dense and uncemented.

Older Alluvium (Qoa): Pleistocene age (older) alluvium ("Qoa") is limited to the southerly-draining tributary in the East Canyon area, immediately west of landslide Qols A. The older alluvium is composed of unconsolidated to poorly consolidated mixtures of sand, gravel, silt, and clay.

Terrace Deposits (Qt): Pleistocene age terrace deposits occur on-site along State Highway 126 southeast of the existing landfill entrance and as isolated and limited

remnant stream channel deposits. The terrace deposits are typically composed of poorly consolidated deposits of coarse sand, gravel and silt with cobbles, and, to a lesser extent, boulders.

Landslide Debris (Qd, Qls, Qols): Three types of deposits attributable to slope failure have been identified at the site, and these consist of debris flow deposits (Qd), Holocene landslides (Qls), and a Pleistocene landslide (Qols). The debris flow deposits are derived from weathered bedrock and slope wash materials and consist of unconsolidated sand, silt, and clay. These deposits typically occur within ravines and on slopes steeper than approximately 2:1.

Materials designated as Holocene landslide debris range from poorly consolidated, highly weathered rock materials to relatively coherent, moderately hard to hard sandstone, siltstone, and claystone units derived from the underlying Saugus or Pico formations. Depending on the amount of movement, the entire landslide or the upper portions of the landslide debris are disturbed.

The central portion of the East Canyon is mantled by an older landslide deposit (Qols) that appears to be comprised of older alluvium as well as Pico and Saugus Formation materials.

Saugus Formation (QTs): Plio-Pleistocene age non-marine sedimentary rock units of the Saugus Formation ("map unit "QTs") outcrop in the eastern and southern portions of the site. Saugus Formation units typically consist of poorly to moderately well-bedded, light yellowish brown to pinkish gray, fine- to coarse-grained, pebble- to cobble-bearing sandstone and silty sandstone with moderate brown siltstone to clayey siltstone. This formation is poorly to moderately well-bedded and ranges from friable to moderately hard. The fine-grained clayey beds, typical of the lower Saugus Formation, represent some of the weakest material within the formation.

Pico Formation (Tp): Marine sedimentary rock units of the Pliocene age Pico Formation (map unit "Tp") are exposed in the northern and western portions of the site.

These units are comprised of grayish orange to light gray sandstone, yellowish gray to yellowish brown siltstone, and limited brownish gray fossiliferous siltstone and sandstone. These units range from soft near the surface to moderately hard at depth. The fossiliferous beds tend to be more resistant than surrounding units, as indicated by the prominent, ridge-forming fossiliferous siltstone ("Ridge-Forming Coquina") near the mouth of North Canyon.

The Pico formational contact with the overlying Saugus Formation is interfingering, gradational, and not always readily discernible, particularly in exploratory borings. Within the site and for the purposes of this study, RTF&A has defined the top of the Pico Formation as the first appearance of fossiliferous beds. Where fossiliferous beds are missing from the stratigraphic section, we have defined the contact using color as an indicator. In particular, the presence of Munsell hues "5Y" is more common within the Pico Formation and may indicate the approximate contact with the Saugus Formation.

GROUNDWATER

Groundwater occurs in both the Saugus and Pico formations in the Chiquita Canyon area. In these sedimentary rocks, groundwater is present primarily in the intergranular porosity, with the more permeable, coarser-grained sandstone and conglomeratic units yielding more water than the siltstone and finer-grained sedimentary rocks.

Beneath most of the site, the uppermost water-bearing unit is the Saugus Formation, except in the northwest area approximately coincident with the Pico Formation outcrop area (Figure 1). The majority of the groundwater monitoring wells and piezometers are completed in the Saugus Formation, where the depth to groundwater ranges from approximately 33 feet at well DW-7 to 345 feet at well DW-23. Groundwater elevations in Saugus wells vary from near 920 feet msl along the south

property line (DW-7 and DW-12) to 1,080 feet msl in the East Canyon (DW-26 and PZ-7). Seasonal groundwater elevation variations are less than a few feet at most hillside locations, with greater fluctuations in wells along canyon bottoms.

Groundwater is also present in the Pico Formation. Eight monitoring points (DW-8, DW-19, DW-25, DW-27, DW-28, PZ-5, PZ-6, and PZ-8) have been completed in the Pico Formation (Figure 1). Groundwater depths range from approximately 72 feet at PZ-6 in the East Canyon to 335 feet at DW-28 on the slope of the northwest ridgeline. Pico Formation groundwater elevations vary from about 1,105 feet msl in the East Canyon (PZ-6) to 1,221 feet msl in the North Canyon (PZ-8). The seasonal groundwater elevation variations are less than a few feet at wells DW-8, DW-19, DW-25, and PZ-5. Piezometer PZ-6, located in the bottom of the East Canyon, showed a greater seasonal groundwater elevation fluctuation of over 10 feet.

SLOPE STABILITY

GENERAL

Twenty cut slopes are planned for development of the North and East Canyon Excavation Area; six cut slopes are proposed for the South Main Canyon and Entrance Road. In both areas, the proposed landfill liner limit is approximately coincident with the downslope side of the perimeter road, shown on Figures 2.1 and 2.2. The cut slopes are designated Cut Slope CS-1 through Cut Slope CS-25, with locations shown on Figures 2.1 and 2.2. Proposed cut slope gradients will range from 2:1 to 4:1. The maximum cut slope height is approximately 300 feet (Cut Slope CS-1). The lower 200 feet of this cut slope will be lined and eventually buried by refuse. Cut Slope CS-24 is the highest proposed permanent cut slope, with a permanent height of approximately 225 feet. Data specific to all of the cut slopes, including slope height, gradient, and underlying geologic conditions are summarized in Table 1, Summary of Cut Slopes.

Natural slopes within the site are underlain by bedrock of the Pliocene age Pico

Formation and the younger Plio-Pleistocene age Saugus Formation. Collectively, these formations are composed of bedded sedimentary rock units. Claystone units are common within both formations. These claystone units are most likely responsible for the landslides within the site, including the landslide complex located in East Canyon (landslides Qls G through Qls L, Figure 2.1).

Bedding planes within the Pico Formation are well developed and are poorly to moderately well developed within the Saugus Formation. The bedding can constitute planes of weakness. Where bedding is adversely oriented, or "daylighted," with respect to natural or cut slopes, potential for "block-glide" failure exists. Block-glide slides are common within both the Saugus and Pico formations.

STABILITY ANALYSES

Slope stability analyses were performed using the program Slope/W by GEO-SLOPE International Ltd., which utilized Spencer's or Bishop's Method. Within Los Angeles County, a static factor of safety of 1.5 and a seismic factor of safety of 1.1 is required for permanent slopes. The MPR excavation slopes outside of the lined landfill footprint are considered permanent slopes. Within the landfill liner limit, the temporary excavation slopes will be lined and eventually covered with refuse. We understand that for a particular lined cut slope, the local placement of refuse may continue for several years before the final landfill grade is attained. However, there will not be any structures or access by the public below these temporary slopes. Within Los Angeles County, temporary slopes are required to meet a static factor of safety of 1.25, which was utilized in this report for the evaluation of the excavation plan for slopes that are proposed to be lined.

The slope stability evaluation presented in this report addresses the proposed slopes indicated on the MPR Excavation Plan (Appendix A) associated with construction of the landfill liner, the east and south stormwater basins, and the entrance road. We

understand that the static and seismic stability of the MPR landfill liner and the refuse fill will be evaluated by Golder Associates.

SHEAR STRENGTH PARAMETERS

The recommended shear strength parameters are based on the results of the direct shear test results, presented in Appendix C, performed on representative samples of the earth materials encountered within our exploratory borings. In addition, we also reviewed shear strength parameters presented in the referenced reports for the subject site and nearby vicinity. The plots of peak, single shear residual (SSR), and multi-shear residual (MSR), as appropriate, are presented on the attached direct shear test summaries. Presented below are the selected bedding plane shear strengths, as well as the cross-bedding and compacted fill shear strengths recommended for slope stability evaluation at the site.

MATERIAL	COHESION (psf)	ANGLE OF SHEARING RESISTANCE (degrees)
Landslide Failure Plane (MSR)	100	10
QTs & Tp Bedding Plane (MSR)	200	18
QTs Cross Bedding (SSR)	600	36
Tp Cross Bedding (SSR)	500	30
Compacted Fill (SSR)	350	30

GEOLOGIC SECTIONS AND ASSUMED CRITICAL FAILURE SURFACE

The analyses were based on subsurface conditions, as depicted on the Geologic Sections, Figures 4.1 and 4.2. The existing topography, proposed grading scheme, and subsurface geologic structure are shown on the attached Geologic Sections. Where Geologic Sections traverse the proposed landfill perimeter, the lined slopes (temporary slopes within the landfill footprint) and permanent slopes (above the landfill perimeter) are also designated. For analyses where the location of weak bedding planes is unknown

or uncertain, one is assumed to be located at the critical location, typically near the toe of the slope. Although the highest measured groundwater level is indicated on the Geologic Sections, the analyses generally assumed a phreatic surface above the critical failure surface for bedding plane failures. The critical failure surfaces and factors of safety are added to the Geologic Sections for presentation as Geotechnical Sections in this report. The Geotechnical Sections and Slope Stability Analyses results are presented as Figure 5. The slope stability calculations are presented in Appendix D.

RESULTS OF STABILITY ANALYSES

Cut Slope CS-1: Cut Slope CS-1 (Figure 2.1) will be graded as a south- to southeast-facing, 2:1 slope. The total slope height is approximately 300 feet. The upper 200 feet of the slope (above the proposed perimeter road) is planned as a permanent cut slope; the lower 100 feet of the slope (below the perimeter road) will be lined in the future and covered by waste. The cut slope will expose Pico Formation units in which the underlying bedding strikes generally east-west to east-northeast and dips 36 to 50 degrees to the south. As depicted on Geologic Section S11-S11' (Figure 4.1), the bedding is favorably oriented with respect to Cut Slope CS-1, and the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-2: Cut Slope CS-2 (Figure 2.1) is proposed as a south-southeast-facing, 2:1 slope. The total slope height is approximately 150 feet, with the upper (permanent) portion of the cut slope approximately 80 feet high and the lower (lined) portion of the slope 70 feet high. The cut slope will expose Pico Formation units in which the underlying bedding strikes generally east-northeast and dips 40 to 47 degrees to the southeast. As depicted on Geologic Section S12-S12' (Figure 4.1), this bedding orientation is favorable with respect to Cut Slope CS-2, and the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-3a: Cut Slope CS-3a (Figure 2.1) is proposed as a south- to east-southeast-facing, 2:1 slope. The total slope height is approximately 220 feet, with the upper (permanent) portion of the cut slope approximately 175 feet high and the lower (lined) portion of the slope 45 feet high. Bedding within the underlying Pico Formation strikes east-northeast and dips 39 to 52 degrees toward the southeast. As depicted on Geologic Section S26-S26" (Figure 4.2), a 19-degree bedding component is defined by a distinctive marker bed, identified as a "Ridge-Forming Coquina." The 19-degree bedding is essentially parallel to the apparent slope gradient, as reflected on the Geologic Section, and Cut Slope CS-3a is considered grossly stable from a geologic standpoint.

Cut Slope CS-3b: Cut Slope CS-3b (Figure 2.1) will be graded as an east-southeast-facing, 2:1 slope to a height of approximately 75 feet. The entire slope represents a temporary slope that will be lined and eventually buried by waste. As depicted on Geologic Section S26-S26' (Figure 4.2), bedding within the underlying Pico Formation strikes generally east-west and dips approximately 58 degrees toward the south, resulting in an apparent dip of 33 degrees south, relative to the proposed cut slope. As the apparent bedding dips steeper than the proposed cut slope gradient, Cut Slope CS-3b is considered grossly stable from a geologic standpoint.

Cut Slope CS-4: Cut Slope CS-4 (Figure 2.1) will be graded as a 2:1 to 4:1, southeast-facing cut slope. The overall slope height is approximately 210 feet, with the proposed permanent and lined portions of the slope approximately 120 feet and 90 feet high, respectively. The cut slope will expose Pico Formation units, landslides Qls E and Qls F, and artificial fill. The bedding in the underlying Pico Formation strikes generally northwest to north-south and dips 25 to 40 degrees to the south and east. As depicted on Geologic Section S16-S16' (Figure 4.1), the bedding is essentially parallel to the slope gradient, as reflected on the Geologic Section, and Cut Slope CS-4 is considered grossly stable from a geologic standpoint.

The proposed cut slope will remove Qls E and the artificial fill. Qls F, which underlies the artificial fill in the area of the cut slope, will also require removal during grading. Any removals exceeding proposed grade will require restoration of grade by placement of certified engineered fill.

Cut Slope CS-5: Cut Slope CS-5 (Figure 2.1) is proposed as a southeast- to south-facing, 2:1 to 3:1 slope. The total slope height is approximately 120 feet, with the upper (permanent) portion of the cut slope approximately 30 feet high and the lower (lined) portion of the slope 90 feet high. The cut slope will encounter Pico Formation units, landslide Qls F, and artificial fill. Bedding within the underlying Pico Formation strikes northeast and dips 27 to 33 degrees toward the southeast. As depicted on Geologic Section S15-S15' (Figure 4.1), a 24-degree bedding component is adversely oriented, or "daylighted," with respect to Cut Slope CS-5. Stability analyses performed for potential failure along the adversely oriented bedding indicate that the proposed cut slope exceeds the temporary factor of safety requirements of 1.25. The slope stability results are indicated on the Geotechnical Sections (Figure 5), and the slope stability calculations are presented in Appendix D.

Landslide Qls F and artificial fill, depicted on Geologic Section S24-S24' (Figure 4.2), should be removed to elevation 1,400 feet msl. Proposed slope grades should then be re-established with compacted fill as a stability fill. The need for backdrains above the proposed landfill liner should be evaluated during grading operations. The stability fill and backdrains should be constructed in accordance with the recommendations presented in this report and as shown on Figure 6 – Stability Fill Details for Grossly Stable Slopes.

Cut Slope CS-6: Cut Slope CS-6 (Figure 2.1) will be graded as a south-southeast-facing, 2½:1 to 3:1 slope. The overall slope height is approximately 290 feet, with the proposed permanent and lined portions of the slope approximately 95 feet and 195 feet high, respectively. The cut slope will encounter Pico and Saugus Formation

units and landslide Qls H through Qls J. Strike of the bedding in the underlying formations ranges from northwest to northeast, with easterly dips between 16 and 44 degrees. As indicated on Geologic Sections S17-S17' (Figure 4.1) and S20-S20' (Figure 4.2), a bedding component ranging from 19 to 25 degrees will likely be exposed in the cut slope. Stability analyses performed for potential failure along the adversely oriented bedding indicate that the proposed cut slope exceeds the temporary factor of safety requirements of 1.25. The slope stability results are indicated on the Geotechnical Sections (Figure 5), and the slope stability calculations are presented in Appendix D.

It is anticipated that grading of Cut Slope CS-6 will remove Qls H through Qls J. If any landslide debris remains after completion of the cut slope, the debris should be removed and compacted fill placed to restore grade.

Cut Slope CS-7: Cut Slope CS-7 (Figure 2.1) will be graded as a southeast- to southwest-facing, 2:1 to 3:1 slope. The total slope height is approximately 205 feet high, with the upper (permanent) portion of the cut slope approximately 35 feet high and the lower (lined) portion of the slope 170 feet high. The cut slope will encounter Saugus Formation units and landslides Qls G through Qls I, and Qls L. Bedding in the underlying Saugus Formation strikes from north-south to northeast with easterly dips between 20 and 40 degrees. As indicated on Geologic Section S5-S5' (Figure 4.1), a daylighted bedding component of 17 degrees will be exposed in the cut slope. Stability analyses performed for potential failure along the adversely oriented bedding indicate that proposed cut slope exceeds the temporary factor of safety requirements of 1.25. The slope stability results are indicated on the Geotechnical Sections (Figure 5), and the slope stability calculations are presented in Appendix D.

It is anticipated that grading of Cut Slope CS-7 will remove landslides Qls G through Qls I, and Qls L. If any landslide debris remains after completion of the cut slope, the debris should be removed and certified engineered fill placed to restore grade.

Cut Slope CS-8: Cut Slope CS-8 (Figure 2.1) is proposed as a southwest-facing, 2:1 slope. The total slope height is approximately 225 feet, with the upper (permanent) portion of the cut slope approximately 75 feet high and the lower (lined) portion of the slope 150 feet high. The cut slope will encounter Saugus Formation units in which the underlying bedding strikes northwest to northeast and dips 20 to 53 degrees toward the east. This bedding orientation is favorable with respect to Cut Slope CS-8, and the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-9: Cut Slope CS-9 (Figure 2.1) will be graded as a 150-feet-high, 2:1, south-facing slope. The entire slope represents a temporary slope that will be lined and eventually buried by waste. The cut slope will encounter Saugus Formation units, landslides Qls N and Qls O, and Pleistocene (older) landslide Qols A. The axis of an easterly-plunging syncline will cross the footprint of Cut Slope CS-9. Bedding on the north flank of the syncline, relative to the cut slope, strikes north-south to northeast and dips 23 to 31 degrees to the east; bedding along the south flank of the syncline strikes northwest and dips 30 to 50 degrees to the northeast. As depicted on Geologic Sections S19-S19' and S25-S25' (Figure 4.2), this bedding orientation is unfavorable relative to stability of Cut Slope CS-9. Stability analyses performed for potential failure along the adversely oriented bedding indicate that the proposed cut slope exceeds the temporary factor of safety requirements of 1.25. The slope stability results are indicated on the Geotechnical Sections (Figure 5), and the slope stability calculations are presented in Appendix D.

It is anticipated that grading of Cut Slope CS-9 will remove Qols A and Qls O. If any debris remains from these two landslides after completion of the cut slope, the debris should be removed and compacted fill placed to restore grade. The upper portion of Qls N lies outside of the grading footprint. This slide is estimated to be between 15 and 20 feet thick at this location (see Geologic Section S25-S25', Figure 4.2). It is recommended that the entire landslide be removed during grading and the existing

grades above the grading footprint be re-established by placing compacted fill. The need for backdrains above the proposed liner should be evaluated during grading operations.

Cut Slope CS-10: Cut Slope CS-10 (Figure 2.1) will be graded as a southwest-facing, 2:1 slope. The overall slope height is approximately 185 feet, with the proposed permanent and lined portions of the slope approximately 75 feet and 110 feet high, respectively. The cut slope will expose Saugus Formation units in which the underlying bedding strikes northwest and dips 45 to 60 degrees toward the northeast (see Geologic Section S2-S2', Figure 4.1). Based on the northeasterly bedding dip, the southwesterly-facing cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-11: Cut Slope CS-11 (Figure 2.1) is proposed as a west-southwest-facing, 2:1 slope. The total slope height is approximately 150 feet, with the permanent portion of the cut slope approximately 65 feet high and the lined portion of the slope 85 feet high. As depicted on Geologic Section S1-S1' (Figure 4.1), the cut slope will expose Saugus Formation units in which the underlying bedding strikes northwest and dips 40 to 60 degrees to the northeast. This bedding orientation is favorable with respect to the southwest-facing cut slope, and Cut Slope CS-11 is considered grossly stable from a geologic standpoint.

Cut Slope CS-12: Cut Slope CS-12 (Figure 2.1) is planned as a 100-feet-high, 2:1 slope that will face northwest and southeast. The cut slope will be graded to develop the east stormwater basin and will be a permanent slope, unassociated with grading of future landfill cells. The cut slope will encounter Saugus Formation units and landslide Qls P. The axis of a northwest-southeast-trending anticline will cross the footprint of Cut Slope CS-12. Bedding on the north flank of the anticline, where the proposed cut slope will face to the northwest, strikes northwest and dips 27 to 40 degrees to the northeast. The bedding is favorably oriented with respect to the northwest-facing segment of Cut Slope CS-12 and is considered grossly stable from a geologic standpoint.

On the south flank of the anticline, where the proposed cut slope will face southeast, the bedding strikes generally east-west and dips 49 to 79 degrees to the south (see Geologic Section S21-S21', Figure 4.2). This bedding orientation is favorable relative to the southeast-facing segment of Cut Slope CS-12, and the cut slope is considered grossly stable from a geologic standpoint.

It is anticipated that the proposed grading will remove all of Qls P. If any landslide debris from Qls P remains after completion of the cut slope, the debris should be removed and certified engineered fill placed to restore grade.

Cut Slopes CS-13, CS-14 and CS-15: Cut Slopes CS-13, CS-14, and CS-15 (Figure 2.1) will consist of permanent, southwest-facing, 2:1 cut slopes graded along the northeast side of the future east stormwater basin. Cut Slopes CS-13, CS-14, and CS-15 will be graded to maximum heights of approximately 50 feet, 20 feet, and 50 feet, respectively. The three cut slopes will expose Saugus Formation units in which the underlying bedding strikes generally east-west and dips 35 degrees to near-vertical. This bedding orientation is favorable relative to the three southwest-facing cut slopes, and Cut Slope CS-13, CS-14, and CS-15 are considered grossly stable from a geologic standpoint.

Cut Slope CS-16: Cut Slope CS-16 (Figure 2.1) is planned as a 110-feet-high, 2:1 slope that will face northwest. This cut slope will be graded as a temporary slope that will be lined and eventually buried by waste. Cut Slope CS-16 will encounter Saugus Formation units in which the underlying bedding strikes generally east-west and dips 50 degrees to the south. This bedding orientation is favorable with respect to Cut Slope CS-16, and the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-17: Cut Slope CS-17 is planned as a 2:1 slope that will face south and attain a maximum height of approximately 155 feet. The cut slope will encounter Saugus Formation units and Pleistocene terrace deposits. As depicted on Geologic Sections S22-S22' and S27-S27' (Figure 4.2), the axis of an anticline is located in the

area of the proposed toe of the cut slope. Bedding north of the anticlinal axis and beneath the proposed cut slope strikes northwest and dips 9 to 24 degrees towards the northeast. This bedding orientation is considered favorable with respect to stability of Cut Slope CS-17. South of the anticlinal axis the bedding strikes northeast and dips 10 to 20 degrees to the southeast, with an apparent out-of-slope bedding dip of 5 degrees. Due to the relatively flat bedding angle, the portion of the cut slope south of the anticline is considered grossly stable by inspection.

Terrace deposits will likely be exposed in the lower portion of Cut Slope CS-17. Bedding within the terrace deposits is essentially flat-lying and is grossly stable.

Both the Saugus Formation and the terrace deposits are subject to erosion and surficial failures due to the weakly cemented nature of the materials. Furthermore, grading of the slope as currently designed will result in some adverse fill-over-cut conditions where the slope crosses minor drainage gullies. Consequently, it is recommended that a stability fill slope with backdrains be constructed against the face of Cut Slope CS-17, both above and below the proposed Entrance Road. Above the Entrance Road, the stability fill should have a keyway measuring 35 feet wide and three feet deep, with the stability fill extending upslope from the Entrance Road to the upper drainage terrace.

Below the road the stability fill slope should be 15 feet wide and three feet deep. The stability fill should extend from the Entrance Road down to State Highway 126 (Henry Mayo Drive) from proposed road elevation 1000 feet to 975 feet. Upgradient of the proposed road elevation 1000 feet, the stability fill slope should extend from the terrace drain down to Henry Mayo Drive.

Cut Slope CS-18 Cut Slope CS-18 (Figure 2.2) is planned as a 200-feet-high, east-facing, permanent, 2:1 slope on the west side of the proposed South Main Canyon stormwater basin. The cut slope is underlain by Saugus Formation units in which the underlying bedding strikes northwest to northeast and dips nine to 32 degrees to the

east. As depicted on Geologic Section S23-S23', easterly-dipping bedding ranging from 10 to 17 degrees will be exposed in the planned 2:1 cut slope. Stability analyses performed for potential failure along the adversely-dipping bedding indicate that proposed Cut Slope CS-18 meets the temporary factor of safety of 1.25.

A portion of landslide Qls A will encroach into CS-18. The landslide should be removed and compacted fill placed, if necessary, to restore slope grades.

Cut Slope CS-19: Cut Slope CS-19 (Figure 2.1) is proposed as a west-southwest-facing, 2:1 slope. The slope is located above the future perimeter road in the East Canyon area and is planned as a permanent, 50±-feet-high cut slope. Cut Slope CS-19 will expose Saugus Formation units in which the underlying bedding strikes northeast and dips 18 to 23 degrees to the southeast. This bedding orientation is favorable with respect to west-southwest-facing cut slope, and Cut Slope CS-19 is considered grossly stable from a geologic standpoint.

Cut Slope CS-20: Cut Slope CS-20 will be graded as a southeast-facing, 2:1 slope, to a height of approximately 100 feet. The cut slope will be graded for a debris basin along the north side of the project. As depicted on Geologic Section S28-S28', the upper portion of the cut slope (above the proposed terrace drain) will expose Saugus Formation units; Pleistocene terrace deposits will likely be encountered below the terrace drain. Bedding in the Saugus Formation strikes northwest and dips 15 degrees to the northeast, with an apparent bedding of 6 degrees dipping into the proposed cut slope. The Saugus Formation bedding orientation is favorable with respect to the southeast-facing cut slope. Bedding within the terrace deposits is essentially flat-lying and is grossly stable. Accordingly, Cut Slope CS-20 is considered grossly stable from a geologic standpoint.

Cut Slope CS-21: Cut Slope CS-21 (Figure 2.2) is proposed as a west-facing, permanent, 2:1 slope that will be graded along the east side of the future Entrance Road. The cut slope, attaining a maximum height of approximately 85 feet, will encounter

Saugus Formation units in which the underlying bedding strikes northwest and dips 14 to 22 degrees to the northeast. This bedding orientation is favorable with respect to Cut Slope CS-21, and the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-22: Cut Slope CS-22 (Figure 2.2) will consist of a limited exposure of bedrock surrounded by compacted fill along the northern slope of the proposed South Main Canyon stormwater basin. The cut slope will be graded at 2:1, face south-southeast, and attain a maximum height of approximately 100 feet. Cut Slope CS-22 is underlain by Saugus Formation units in which the bedding strikes north-northwest and dips 11 to 18 degrees to the east. This bedding orientation is favorable with respect to Cut Slope CS-22, and the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-23: Cut Slope CS-23 (Figure 2.1) will constitute the western limit of the floor of the North and East Canyon Excavation Area. The slope will be graded at 2:1, face east-northeast to east, and attain a maximum height of 85 feet. Cut Slope CS-23 will be a temporary cut slope that will be lined and eventually buried by waste. The cut slope will expose sedimentary rock units of the Pico and Saugus formations in which the underlying bedding strikes generally east-west and dips 47 to 64 degrees toward the south. This bedding orientation is favorable with respect to Cut Slope CS-23, and the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-24: Cut Slope CS-24 (Figure 2.2) will be graded as an east- to north-facing, 2½:1 slope. The overall slope height is approximately 235 feet, with the proposed permanent and lined portions of the slope approximately 70 feet and 165 feet high, respectively. The cut slope will be graded in South Main Canyon, south of the existing Main Canyon landfill. This area is currently covered by stockpile fill soil. The cut slope will, for the most part, expose the fill soils and, to a lesser extent, Saugus Formation units. Bedding within the underlying Saugus Formation strikes north-northwest to northwest and dips 20 to 44 degrees toward the east. In general, this

bedding is oriented parallel to, or dipping steeper than, the proposed 2½:1 (approximately 22-degree) cut slope gradient. Development of Cut Slope CS-24 will require removal of the stockpile fill soil. Once the stockpile is removed, the slope will need to be reconstructed as an engineered fill slope to reestablish the proposed landfill slope grades. This engineered fill would essentially buttress any potential daylighted bedding that may be encountered in the cut slope. Accordingly, the cut slope is considered grossly stable from a geologic standpoint.

Cut Slope CS-25: Cut Slope CS-25 (Figure 2.1) is proposed as a permanent, southeast-facing, 2:1 slope to a height of approximately 35 feet. The cut slope will expose Pico Formation units in which the underlying bedding strikes north-south and dips 30 to 40 degrees to the east. This bedding orientation dips steeper than the 2:1 (26-degree) slope gradient, and Cut Slope CS-25 is considered grossly stable from a geologic standpoint.

Proposed Fill Slopes: A proposed fill slope of about 125 feet in height is proposed for South Main Canyon above the proposed basin. Stability analysis for a 130-feet-high, 2:1, compacted fill slope is presented in Appendix D and meets the static and seismic factor of safety requirements for grossly stable permanent fill slopes of 1.5 and 1.1, respectively.

Permanent Cut Slopes: Several permanent cut slopes will remain after landfill closure of the proposed MPR. The highest cut slope (Cut Slope CS-1) will be about 200 feet high, as illustrated on Geologic Section S11-S11'. Slope stability calculations for a cross bedding failure for Geologic Section S11-S11' are presented in Appendix D and meet the permanent and seismic factor of safety requirements for grossly stable permanent slopes of 1.5 and 1.1, respectively.

GEOLOGIC HAZARDS

GENERAL

Potential geologic hazards include, but are not limited to, primary earthquake hazards (ground shaking and ground rupture), secondary earthquake hazards from earthquake ground shaking (such as liquefaction, tsunamis, and seiches), and landslides/slope instability. Earthquakes have the potential to inflict the greatest loss of life and property damage. Consequently, the proximity of a site to active or potentially active faults is a key element in assessing the potential for earthquake damage.

The major cause of damage from earthquakes is generally the result of strong ground shaking from movement along a fault or fault zone. Ground shaking could occur not only immediately adjacent to the earthquake epicenter, but also within areas for many miles in all directions. Damage due to actual fault displacement or ground rupture beneath a structure may also occur; however, fault ground rupture is much less common and is typically confined to areas along, or immediately adjacent to, the fault surface trace.

Landslides are common hazards in southern California, particularly in hillside areas underlain by sedimentary rock units. Landslides can occur in terrain ranging from vertical cliffs to slopes as gentle as one or two degrees. Materials on slopes that are subject to landsliding include rock, soil, artificial fill, or combinations of these materials.

FAULTS

General: Earthquakes result from movement along faults or volcanic activity. In California, earthquakes are more commonly associated with faults or fault zones, and the southern California region is historically seismically active. The numerous faults in California include both active and potentially active faults. In accordance with criteria established for the Alquist-Priolo Earthquake Fault Zoning program (Hart and Bryant, 1999) by the California Geological Survey (CGS), formerly known as CDMG, a fault can

be considered active if it has demonstrated movement within the Holocene epoch, or approximately the last 11,000 years. Faults that have demonstrated Quaternary movement (last 1.6 million years), but lack strong evidence of Holocene movement, are classified as potentially active. Faults that have not moved since the beginning of the Quaternary period are deemed inactive.

Site Faults: As part of CCL's MPR for landfill development, a fault study (including an extensive subsurface investigation) was performed by RTF&A (2006b) within the footprint of the future North and East Canyon Excavation Area. The purpose of this fault study was to investigate previously mapped faults in the North and East Canyon area to determine if the site meets the State Class III landfill siting criteria for ground rupture that states, "landfills shall not be located on a known Holocene fault" (27 California Code of Regulations, Section 20260[d] and the Federal location restriction for fault areas [40 Code of Federal Regulations, Part 258.13]).

Based on the geologic fault investigation, RTF&A concluded that no mappable, through-going, continuous active or potentially active faults underlie the site, and the site is not within an Alquist-Priolo Earthquake Fault Zone, as established by CGS. The closest active (and zoned) fault to the site is the San Gabriel fault, located approximately 3.3 miles to the east-northeast. In our opinion, there is little probability of surface rupture due to faulting occurring on-site during the design life of the project.

A discussion of nearby active and potentially active faults is presented in the following sections.

Active Faults: The site is located within an area potentially susceptible to severe ground shaking, due to the close proximity of several active faults, including the San Gabriel, Oak Ridge, Santa Susana, and San Cayetano faults.

San Gabriel Fault: The nearest active fault is the San Gabriel fault, located approximately 3.3 miles east-northeast of the site. The San Gabriel fault extends approximately 90 miles through the Transverse Ranges of southern California. The San

Gabriel fault consists of a zone of imbricate, steeply north-dipping faults. Throughout most of its extent, the fault has strong geomorphic expression, with the faults comprising the zone characterized by displaced geologic units, deflected drainages, strike valleys, notched ridges, subparallel faulting, fracturing, and folding (Oakeshott, 1958; Wentworth and Yerkes, 1971).

Within the Santa Clarita Valley, from Castaic Creek to the San Gabriel Mountains, the fault crosses the Castaic lowlands and the Santa Clara River, where its course is marked by a belt of braided small faults and steep dips in Pliocene and Pleistocene beds. Since most of the displacement within the fault zone took place before deposition of these geologically young beds, the fault's trend through this area is not nearly as conspicuous as within the rocks along the southwestern margin of the Ridge basin or in the basement rocks of the San Gabriel Mountains (Crowell, 1982). The location of the fault, however, is somewhat defined by the steeply-dipping and folded beds of the Plio-Pleistocene Saugus Formation, and the fault is exposed in cut slopes, roadcuts, and trenches.

Prior to 1979, most geologists studying the San Gabriel fault acknowledged that late Pleistocene (approximately the past 100,000 years) activity along the fault zone was probable, but evidence for possible Holocene activity was judged to be very questionable (Kahle, 1986). However, after completing a geologic and geomorphic investigation of the San Gabriel fault, Weber (1979) concluded that some evidence strongly suggested Holocene activity. Subsequently, Cotton and Seward (1984) conducted exploratory trenching along segments of the fault zone in the Santa Clarita Valley. Although no surface evidence of faulting was recognized, at least two trenches revealed displacement of Holocene age alluvial deposits. Radiocarbon analyses of detrital charcoal from faulted alluvial materials in a trench excavated in Rye Canyon yielded an age of 3,500±250 years before present. Alluvium dated as 1,550±190 years before present was

shown to be unfaulted in the same trench, establishing limits of latest movement on the Castaic-Bouquet Junction segment of the San Gabriel fault.

Based on the findings of Weber (1979), Cotton and Seward (1984), and the recommendations of Kahle (1986) for a CDMG Fault Evaluation Report for the fault, the State Geologist established an Alquist-Priolo Earthquake Fault Zone for the San Gabriel fault in 1987 within the Newhall Quadrangle.

Santa Susana Fault: The Santa Susana fault, located approximately six miles southwest of the site, consists of a complex zone of primarily north-dipping thrust faults. The fault zone extends northeastward from the Santa Susana Mountains across San Fernando Pass, and into the San Gabriel Mountains. A short segment of the Santa Susana fault ruptured during the 1971 San Fernando earthquake (Southern California Earthquake Data Center [SCEDC], 2010); however, the remainder of the fault zone has not demonstrated displacement since late Pleistocene time (Slosson and Barnhart, 1967).

Oak Ridge Fault: The Oak Ridge fault is a south-dipping reverse fault that forms a ridge to the south of its trace. The fault extends for a distance of approximately 56 miles from Piru, on the east, to offshore, at a point about 20 miles south of Santa Barbara. The onshore segment of the Oak Ridge fault is roughly parallel to both the Santa Clara River and State Highway 126. The offshore segment is associated with a definite zone of active seismicity (Southern California Earthquake Data Center [SCEDC], 2010). The only known Holocene surface rupture is found onshore, between the towns of Bardsdale and Fillmore (Yeats et al., 1986b; Powell, 1991).

At its eastern end, the Oak Ridge fault appears to be overthrust by the Santa Susana fault, becoming a “blind thrust fault” (SCEDC, 2010). The fault associated with the 1994 Northridge earthquake is probably associated with the Oak Ridge fault system. At its closest point, the Oak Ridge fault is situated approximately seven miles west-southwest of the site.

San Cayetano Fault: The San Cayetano fault is an east-west trending, north-dipping thrust fault that extends approximately 28 miles from the foothills north of Piru to the southeastern edge of Ojai Valley. Weber et al. (1973) and Kahle (1985) suggest that Holocene fault activity is indicated by well-defined fault scarps and offset Holocene sediments. The San Cayetano fault is located approximately 9.5 miles west of the site.

Other Active Faults: Other, more distant but significantly active faults include the San Fernando fault zone, located approximately 12 miles southeast of the site, and the San Andreas fault zone, located approximately 20 miles to the northeast.

Potentially Active Faults: The potentially active Holser fault is situated approximately 1,000 feet north of the site. The Holser fault consists of a south-dipping, sharply folded reverse fault (Winterer and Durham, 1962) that trends east-southeast from near Piru Creek to at least Castaic Junction. The Holser fault post-dates deposition of the Pico Formation and is believed to be a "backthrust" of a subsurface thrust fault that represents the intersection of the San Cayetano and Santa Susana faults at depth (Yeats et al., 1994). Weber (1979) states that there is no clear evidence of Holocene activity along the Holser fault but "plentiful evidence" that activity has occurred in the past 100,000 years. Geolabs (2007) recently conducted a surface fault rupture hazard assessment for the Holser fault within Parcel Map 18108, located east of CCL. Geolabs concluded that the last known movement on the Holser fault was approximately 40,000 to 100,000 years ago. Consequently, the fault is considered potentially active.

Inactive Faults: The inactive Del Valle fault is located approximately 1.2 miles southwest of the site. This fault trends eastward from the Los Angeles-Ventura County Line for nearly two miles, turning southward before crossing San Martinez Grande Canyon near its confluence with the Santa Clara River. According to Winterer and Durham (1962), the eastward-trending segment of the Del Valle fault consists of a

south-dipping reverse fault; the southward-trending segment is considered a tear (strike-slip) fault.

Blind-Thrust Faults: A growing body of geologic and seismologic data, supplemented by regional structural interpretations, suggests Pliocene to modern deformation in the Los Angeles basin is partly accommodated by developing basement-involved fold and thrust belts (Davis et al., 1989; Hauksson, 1990; Shaw and Suppe, 1996). The fold and thrust belts are expressed at the ground surface by elongate, low-lying anticlinal ridges. At the core of these anticlinal ridges are low-angle, blind-thrust faults rising off a basal detachment surface. Recognized blind-thrust faults in the Los Angeles and Ventura basins include the Elysian Park, Compton-Los Alamitos, Oak Ridge, and Northridge blind-thrust faults.

The closest known blind-thrust to the site is the Northridge blind-thrust fault. The site, however, is not underlain by any known blind-thrust fault.

LANDSLIDES

The site is mantled by several landslides. Most of the major landslides were previously identified by EMCON (1990a) and other workers within the subject site boundaries. The landslides are, in part, due to the orientation of the geologic structure, as well as the weak materials exposed within the upper Pico Formation and lower Saugus Formation.

Several Holocene landslides (designated “Qls A” through “R”) and one Pleistocene (older) landslide (designated “Qols A”) have been identified within the proposed MPR grading limits. The landslides typically consist of translational slides that failed along a weak, unsupported bedding plane. Landslides located within the footprint of the North and East Canyon Excavation Area include Qls E through Qls R, and Qols A. Landslides located within the proposed grading limits of the South Main Canyon landfill and Entrance Road consist of Qls A through Qls D.

Landslide Qls G constitutes a major landslide complex within the northern portion of the site that was reactivated during the 2004-2005 winter storms when a record rainfall of 48.15 inches occurred at the site. In addition to the Qls G complex, numerous smaller slides have been identified adjacent to Qls G, including Qls H through Qls L.

An older, previously unidentified landslide was discovered by RTF&A during exploration for the 2006 fault study (RTF&A, 2006b). The older landslide appears to be derived primarily from bedrock of the Pico Formation, although lithologies of Saugus Formation and older alluvium are intermixed within the landslide mass. The geomorphology of the landslide suggests that no recent movement has occurred within the mass, as there are no signs of open fractures, scarps, grabens, or hummocky terrain. The base of the older landslide was identified in borings B-1-03 and B-9-10 at depths of 40 feet and 17 feet, respectively. Geologic sections were constructed through the slide (Geologic Sections S1-S1' and S19-S19') and indicate the landslide will likely be removed as part of development of the North and East Canyon Excavation Area. Any Qols A material remaining at the completion of the excavation to proposed grade should be removed and replaced with certified compacted fill.

DEBRIS FLOW HAZARD

Debris flows, consisting of a moving mass of heterogeneous debris lubricated by water, are generated by shallow soil slips in response to heavy rainfall. Whereas landslides depend on deep percolation of groundwater and may not respond to the effects of heavy rainfall until long after a storm, debris flows "occur during, and only during, heavy rainfall" (Campbell, 1975). According to Campbell (1975), damage from debris flows is due chiefly to inundation by, or high-velocity impact of, the debris mass. Campbell identifies three conditions for debris flow potential:

- a mantle of colluvial soil or a wedge of colluvial ravine soil;

- a slope angle ranging from 27 to 56 degrees (slopes steeper than 56 degrees generally do not have a continuous mantle of colluvium and are most commonly bare bedrock); and

- soil moisture equal to or greater than the colluvial soil's liquid limit.

No existing debris flow deposits have been identified within the proposed MPR grading footprint. Within the MPR footprint, the proposed grading will eliminate most of the debris flow hazard by the removal of debris flow–susceptible material (i.e., weathered bedrock, slope wash, and residual soil) and with the construction of drainage/stormwater basins. The potential for debris flows still exists along the perimeter of the proposed MPR development area. The proposed landfill design should allow for the clean-up or control of any debris flows that may encroach into the landfill area and perimeter maintenance road.

The potential for debris flows also exists within the natural drainages and slopes along the north side of the future entrance road, specifically where the entrance road will cross in front of three significant drainage gullies. As presently designed, there is no protection from debris flows emanating from the three gullies, and any such flows would greatly impact use of the entrance road and operation of the scales. The project design should consider elevating the roadway higher than the mouths of the gullies so that runoff and debris flows could be diverted around and/or beneath the roadway. Other alternatives for debris protection could include debris walls and/or debris basins at the mouths of the three gullies. Additional debris flow evaluation and mitigation should be performed as part of future development of rough grading plans for the entrance road.

EXPANSIVE SOILS

The site is underlain by bedrock of the Pico and Saugus formations, both of which contain potentially expansive clay-rich strata, as discussed above. Additional testing of

expansive properties of the soils may be required if improvements, buildings, or other structures sensitive to expansive soils are planned for the site. Additional testing should be completed during the grading plan review, if deemed necessary by the project geotechnical and civil engineers.

FLOODING

Review of Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps indicate that the site is not within a known flood zone. The nearest mapped flood zone boundary related to Castaic Creek is approximately 1,500 feet southeast of the site.

LIQUEFACTION

The State of California Seismic Hazard Map for the Val Verde Quadrangle (California Geological Survey, 2002) indicates that portions of the alluvial soils at site are located within a potential liquefaction area.

Liquefaction may occur when saturated, loose to medium dense, cohesionless soils are densified by ground vibrations. The densification results in increased pore water pressures if the soils are not sufficiently permeable to dissipate these pressures during, and immediately following, an earthquake. When the pore water pressure is equal to, or exceeds, the overburden pressure, liquefaction of the affected soil layers occurs. For liquefaction to occur, three conditions are required:

- ground shaking of sufficient magnitude and duration;
- soils that are susceptible to liquefaction; and
- a groundwater level at or above the level of the susceptible soils during the ground shaking.

For a site to be considered susceptible to liquefaction using the criteria and methodology initially developed by Seed and Idriss (1982), liquefaction of underlying soil layers must result in an observed surface effect such as sand boils, mud-spouts, surface water seepage, ground cracking, or quicksand-like conditions.

Lateral spreading can result in ground cracking and may occur when a site is sloped or is near a free-face and there is a sufficiently continuous liquefiable layer on which the overlying soils can move laterally.

Ground settlement may occur during seismic shaking of an area. The settlement can be caused by liquefaction of loose, granular soils and by compaction of loose, but not necessarily liquefiable, soils.

As a result of the existing and proposed grading, loose alluvial soils within the proposed development area will be removed and replaced with compacted fill soils. The alluvium within the proposed development area will be mantled by certified engineered fill. The alluvial soils are underlain by bedrock materials. Accordingly, the site will be underlain by a combination of bedrock materials, dense alluvial deposits, and certified engineered fill.

Due to the historic, high groundwater levels at the site, which are lower than the base of alluvial deposits (RTF&A, 2012b), the site is considered to have a very low potential for liquefaction. The site is also not considered as being subject to lateral spreading.

CONCLUSIONS AND RECOMMENDATIONS

GEOLOGIC CONSIDERATIONS

General: Based on the geologic data developed during the MPR geotechnical investigation, it is our opinion that the site may be developed as planned, provided our recommendations are incorporated in the design of the project.

Faulting: No mapped active or potentially active faults underlie the site, and the site is not within an Alquist-Priolo Earthquake Fault Zone, as established by CGS

(Hart and Bryant, 1999). The closest active fault to the site is the San Gabriel fault, located approximately 3.3 miles to the east-northeast.

Landslides: Several landslides are located within the site boundaries, as depicted on the Geologic Map, Figure 1. Landslides lying within the proposed grading limits of the North and East Canyon Excavation Area are designated as Qols A, and Qls E through Qls R (see Figure 2.1.); landslides located within the South Main Canyon landfill area include Qls A through D (see Figure 2.2).

North and East Canyon Excavation Area: Landslides Qols A, Qls E, and Qls G through Qls R lie within the proposed grading limits of the North and East Canyon Excavation Area and will require complete removal. Most of these landslides occur above planned excavation grades and will be removed as part of the excavation. Any of these landslides not eliminated by the proposed excavation will need to be removed below proposed excavation grade, and the grades restored by placement of certified engineered fill.

Landslide Qls F will be removed below elevation 1,400 feet msl, with the remaining portion of the slide mass above elevation 1,400 feet remaining in place.

Other landslides lie upslope and outside of the expansion grading limits. These landslides, in their present configuration, are stable. Any renewed movement or partial movement of these slides will result in debris accumulating on the future perimeter road, which may require some maintenance but will not adversely impact the landfill or future landfill operations.

South Main Canyon and Entrance Road: Landslides Qls A through Qls D are located along the west side of the South Main Canyon landfill area. As indicated on the grading plan, the majority of landslide Qls A lies within a future fill area associated with the toe berm for the proposed landfill. This entire landslide mass, estimated to be approximately 15 to 20 feet deep, should be removed prior to placement of certified

engineered fill. The cut area impacted by removal of the landslide should have proposed grade restored by placement of certified engineered fill.

Landslides Qls B through Qls D lie within a future fill area and should be removed prior to fill placement.

Debris Flow: The natural drainages and slopes within the site will be susceptible to debris flows generated during repeated heavy rains. The proposed design should allow for the clean-up or control of any debris flows that may encroach into the landfill area and perimeter maintenance road.

The natural drainages and slopes along the north side of the entrance road will be susceptible to debris flows generated during repeated heavy rains. The project design for the entrance road should consider elevating the roadway higher than the mouths of the existing gullies north of the road so that runoff and debris flows could be diverted around and/or beneath the roadway. Other alternatives for debris protection could include debris walls and/or debris basins at the mouths of the three gullies. Additional debris flow evaluation and mitigation should be performed as part of future development of rough grading plans.

Groundwater: The measured groundwater elevations beneath the site lie below the proposed excavation grades for the North and East Canyon Excavation Area, and the South Main Canyon and Entrance Road development. Accordingly, groundwater is not likely to be encountered during site grading.

Rippability: Grading operations can be performed using conventional grading equipment. Heavy ripping may be needed when excavating well-cemented sandstone or conglomerate beds.

GRADING

Site Preparation: Prior to performing earthwork, the existing vegetation and any deleterious debris should be removed from the area of proposed grading. Existing

utility lines should be relocated or properly protected in-place. All unsuitable soils, landslide material, and uncertified fills in the areas of grading receiving new fill should be removed to competent earth materials and replaced with engineered fill.

Material for Fill: The on-site soils, less any debris or organic matter, may be used in required fills. Rocks or hard fragments larger than eight inches may not be placed in the fill without special treatment. Rocks or hard fragments larger than four inches shall not compose more than 25 percent of the fill or a lift. Soils containing more than 25 percent rock or hard fragments larger than four inches must be compacted with successive passes (e.g., with a sheepsfoot roller) until rock or hard fragments larger than four inches constitute less than 25 percent of the fill or lift.

Compaction: After the site is cleared and excavated as recommended, the exposed soils should be carefully observed for the removal of all unsuitable deposits. Next, the exposed soils should be scarified to a depth of six inches, brought to about two percent above optimum moisture content, and rolled with heavy compaction equipment. The upper six inches of exposed soils should be compacted to at least 90 percent of the maximum dry density obtainable by the ASTM D 1557-02 Method of Compaction.

After compacting the exposed soils, all required fills should be placed in loose lifts not more than eight inches in thickness, and compacted to at least 90 percent. The moisture content of the fill soils at the time of compaction should be about two to four percent above optimum moisture content. Compacted fill should not be allowed to dry out before subsequent lifts are placed.

Grades should be sloped so as not to direct water flow over slope faces; surface water should be directed to proposed drainage devices (i.e., terrace benches and downdrains).

GENERAL GRADING REQUIREMENTS

1. All fills, unless otherwise specifically designed, shall be compacted to at least 90 percent of the maximum dry unit weight as determined by ASTM D 1557-02 Method of Soil Compaction.

2. No fill shall be placed until the area to receive the fill has been adequately prepared, and subsequently approved by the Geotechnical Consultant of Record or his representative.

3. Fill soils should be kept free of debris and organic material.

4. Rocks or hard fragments larger than eight inches may not be placed in the fill without approval of the Geotechnical Consultant of Record or his representative, and in a manner specified for each occurrence.

   Bedrock fragments larger than eight inches or fill soils containing greater than 25 percent of bedrock fragments larger than four inches in diameter must be compacted using successive passes of a sheepsfoot compactor, or until rock fragments constitute less than 25 percent of the fill material.

5. The fill material shall be placed in layers which, when compacted, shall not exceed eight inches per layer. Each layer shall be spread evenly and shall be mixed thoroughly during the spreading to ensure uniformity of material and moisture.

6. When moisture content of the fill material is too low to obtain adequate compaction, water shall be added and thoroughly dispersed until the soil is approximately two to four percent above optimum moisture content.

7. When the moisture content of the fill material is too high to obtain adequate compaction, the fill material shall be aerated by blading, or other satisfactory methods, until the soil is approximately two to four percent above optimum moisture content.

8. Fill and cut slopes should not be constructed at gradients steeper than 2:1.

GRADING OBSERVATION

Construction observation should be made by a Geotechnical Consultant of Record during any grading activities within the site, to verify the findings within this report. Additional recommendations may be required for landfill design based on conditions uncovered during grading.

SEISMICITY

The following parameters were determined based on the USGS website, 2007 California Building Code (CBC), and ASCE Standard 7-05. Additional analyses of the seismic criteria of the site, including spectral response, may be necessary for the design of the proposed cell slopes. The need for this additional evaluation to support the evaluation of the cell slopes is referred to Golder.

CALIFORNIA BUILDING CODE SEISMIC DESIGN

Under Section 1613 Earthquake Loads of the CBC, the following coefficients and factors apply to seismic force design at the subject site. The ground motion parameters were determined using the Ground Motion Parameter Calculator at the USGS website.

Latitude	34.427722
Longitude	-118.648116
Site Class	C
Ss	2.247
S1	0.687
SMs	2.247
SM1	0.893
SDs	1.498
SD1	0.595

SEISMIC HAZARD ZONE REPORT

The seismic hazard zone report for the Val Verde Quadrangle was reviewed to determine the site Peak Ground Acceleration (PGA) (California Geological Survey, 2002).

Based on review of Figure 3.5 of the seismic hazard zone report, the Magnitude Weighted Pseudo-Peak Acceleration with a 10 percent exceedance in 50 years is about 0.59g.

SEISMIC SPECTRUM

The USGS website was utilized to determine the response spectrum for the subject site. The Site Modified Spectrum, MCE Spectrum, and the Design Response Spectrum from the USGS website is presented in Figure 7.

DEAGGREGATED SEISMIC SOURCE PARAMETERS

The USGS website was used to determine the Probability Seismic Hazard Deaggregation for a 2,475-year return period for a site with Vs = 760 m/s. The graph from the USGS website is presented in Figure 8.

FRISK SITE-SPECIFIC GROUND MOTION ANALYSIS

The probabilistic MCE was determined in accordance with Section 21.2.1 of ASCE Standard 7-05 for five percent damped acceleration response spectrum having approximately two percent probability of exceedance within a 50-year period (return interval 2,500 years) using the program FRISK for the Bozorgnia, Campbell, Niazi (1999) Holocene, Soil-pseudo, Rel Vel, with five percent damping attenuation relationship. The results are presented in Figure 9, and the factors are summarized below.

Factors	Value
Sds	1.95
Sd1	1.25
Sms	2.92
Sm1	1.87

PGA = Sds/2.50 = 0.78

SECTION 111 STATEMENT

Based on our review of the MPR grading plan and the referenced reports, it is our professional opinion that the proposed MPR development will be safe from hazard of landslide, settlement, or slippage and will not adversely affect the geotechnical conditions of off-site properties, provided our recommendations and the requirements of the Los Angeles County Building Code are followed.

LIMITATIONS

Our professional services have been performed using that degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical engineers and engineering geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the professional advice included in this report. This report has been prepared for Chiquita Canyon Landfill and their design consultants, to be used solely for planning and design. The report has not been prepared for use by other parties and may not contain sufficient information for purposes of other parties or other uses.

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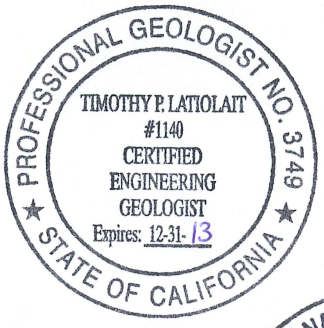
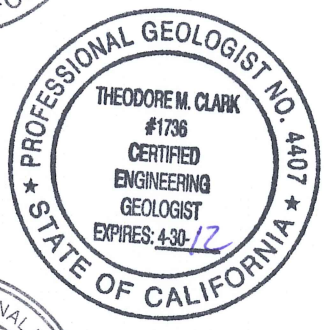
Please contact us if you have any questions regarding the recommendations presented in this report.





Respectfully submitted,

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Table 1

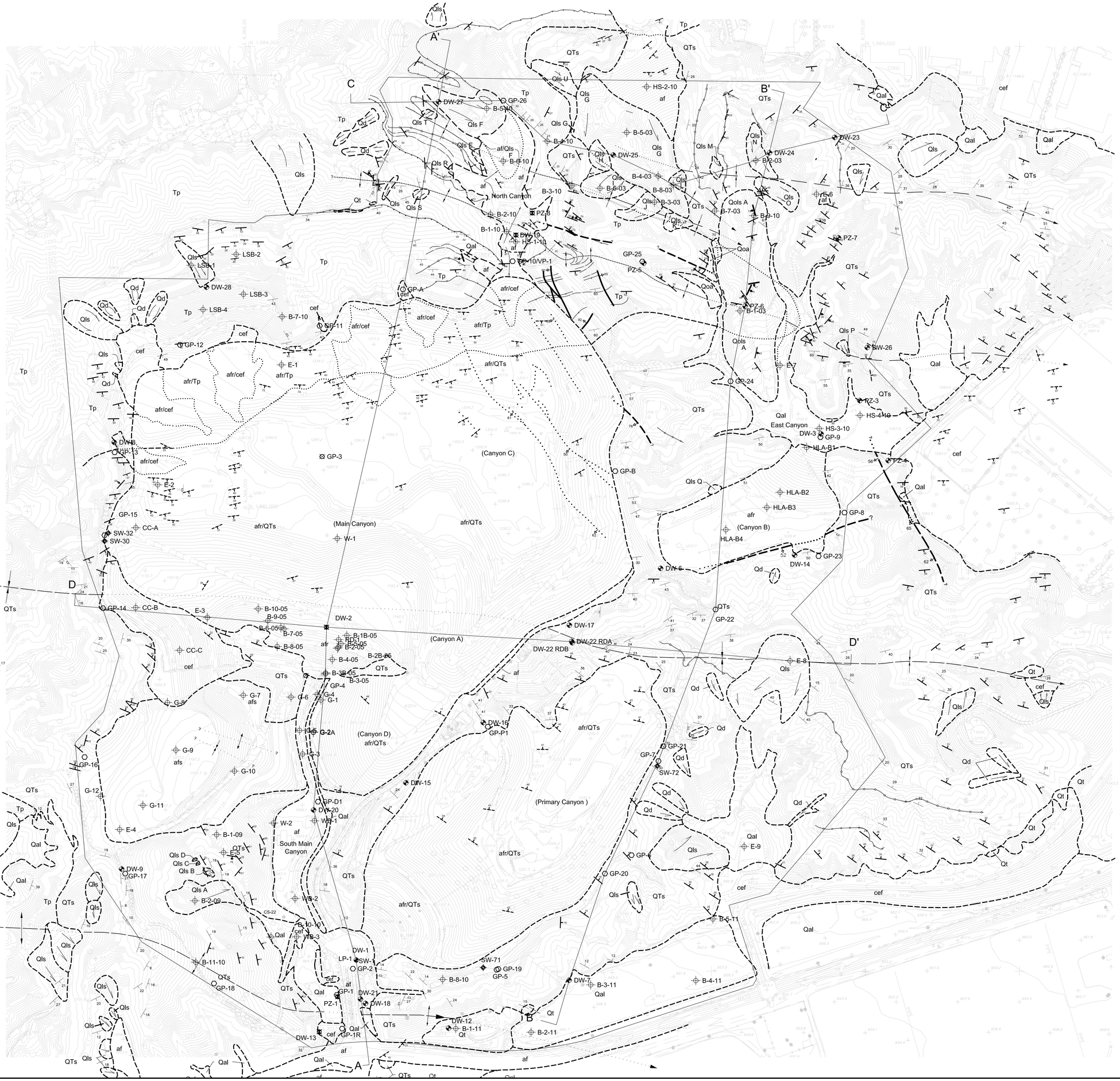
Summary of Cut Slopes
Chiquita Canyon Landfill
Master Plan Revision

CUT SLOPE	FIGURE NO.	SLOPE GRADIENT	SLOPE HEIGHT (total/permanent)	SLOPE FACE DIRECTION	GEOLOGIC MATERIALS	GEOLOGIC SECTION	GEOLOGIC STABILITY	MITIGATION
CS-1	2.1	2:1	300'/200'	S to SE	Tp	S11-S11'	Bedding dipping steeper than slope gradient; grossly stable	None
CS-2	2.1	2:1	150'/80'	SSE	Tp	S12-S12'	Bedding dipping steeper than slope gradient; grossly stable	None
CS-3a	2.1	2:1	220'/175'	ESE	Tp	S13-S13', S26-S26'	Bedding dipping parallel to or steeper than slope gradient; grossly stable	None
CS-3b	2.1	2:1	75'/0	ESE	Tp	S26-S26'	Bedding dipping steeper than slope gradient; grossly stable	None
CS-4	2.1	2:1 to 4:1	210'/120'	SE	Tp, Qls E, Qls F, af	S16-S16'	Bedding dipping parallel to or steeper than slope gradient; grossly stable	Qls E & Qls F and af to be removed during grading
CS-5	2.1	2:1 to 3:1	120'/30'	SE to S	Tp, Qls F, af	S15-S15', S24-S24'	Daylighted bedding; stable by analyses	Remove Qls F and af below elevation 1400 feet; reconstruct as stability fill to restore grade
CS-6	2.1	2½:1 to 3:1	290'/95'	SSE	Tp, QTs, Qls H-J	S17-S17', S20-S20'	Daylighted bedding; stable by analyses	Remove Qls H through Qls J during grading
CS-7	2.1	2:1 to 3:1	205'/35'	SE to SW	QTs, Qls G - I, & Qls L, af	S5-S5'	Daylighted bedding; stable by analyses	Qls G - I, Qls L to be removed during grading.
CS-8	2.1	2:1	225'/75'	SW	QTs	---	Favorable bedding; grossly stable	None
CS-9	2.1	2:1	150'/0	S	QTs, Qols A, Qls N, Qls O	S19-S19', S25-S25'	Daylighted bedding; stable by analyses	Qols A, Qls N & Qls O to be removed during grading. Restore existing grades above MPR grading footprint with compacted fill
CS-10	2.1	2:1	185'/75'	SW	QTs	S2-S2'	Favorable bedding; grossly stable	None
CS-11	2.1	2:1	150'/65'	WSW	QTs	S1-S1'	Favorable bedding; grossly stable	None
CS-12	2.1	2:1	100'/100'	NW and SE	QTs, Qls P	S21-S21'	Favorable bedding; grossly stable	None
CS-13	2.1	2:1	50'/50'	SW	QTs	---	Favorable bedding; grossly stable	None
CS-14	2.1	2:1	20'/20'	SW	QTs	---	Favorable bedding; grossly stable	None
CS-15	2.1	2:1	50'/50'	SW	QTs	---	Favorable bedding; grossly stable	None
CS-16	2.1	2:1	110'/0	NW	QTs	---	Favorable bedding; grossly stable	None

Table 1

Summary of Cut Slopes
Chiquita Canyon Landfill
Master Plan Revision

CUT SLOPE	FIGURE NO.	SLOPE GRADIENT	SLOPE HEIGHT (total/permanent)	SLOPE FACE DIRECTION	GEOLOGIC MATERIALS	GEOLOGIC SECTION	GEOLOGIC STABILITY	MITIGATION
CS-17	2.2	2:1	160'/160'	S	QTs, Qt	S22-S22', S27-S27'	Favorable bedding; grossly stable	Construct stability fills above and below entrance to control erosion
CS-18	2.2	2:1	200'/200'	E	QTs, Qls A	S23-S23'	Daylighted bedding; stable by analyses	Remove Qls A during grading; if needed, place compacted fill to restore slope grades
CS-19	2.1	2:1	50'/50'	WSW	QTs	---	Favorable bedding; grossly stable	None
CS-20	2.2	2:1	100'100'	SE	QTs, Qt	S28-S28'	Favorable bedding; grossly stable	None
CS-21	2.2	2:1	85'/85'	W	QTs	---	Favorable bedding; grossly stable	None
CS-22	2.2	2:1	100'/100'	SSE	QTs	---	Favorable bedding; grossly stable	None
CS-23	2.1	2:1	85'/0	ENE to E	Tp, QTs	---	Favorable bedding; grossly stable	None
CS-24	2.2	2-1/2:1	235'/60'	E to N	QTs, afs	---	Bedding dipping steeper than slope gradient; grossly stable	Remove "afs" and reconstruct as engineered fill slope
CS-25	2.1	2:1	35'/35'	SE	Tp	---	Bedding dipping steeper than slope gradient; grossly stable	None



EXPLANATION

- GEOLOGIC CONTACT; QUERIED WHERE UNCERTAIN OR INFERRED; DOTTED WHERE CONCEALED
- GRADATIONAL GEOLOGIC CONTACT
- ANTICLINAL FOLD; APPROXIMATELY LOCATED, QUERIED WHERE UNCERTAIN, DOTTED WHERE CONCEALED
- SYNCLINAL FOLD; APPROXIMATELY LOCATED QUERIED WHERE UNCERTAIN, DOTTED WHERE CONCEALED
- STRIKE AND DIP OF BEDDING
- STRIKE AND DIP OF CONCEALED BEDDING
- STRIKE AND DIP OF SLIDE PLANE
- STRIKE AND DIP OF JOINT
- SILTSTONE BED
- SANDSTONE BED
- FOSSIL BED
- RIDGE-FORMING COQUINA
- SURFICIAL FAILURE

af	ARTIFICIAL FILL
afr	ARTIFICIAL FILL, REFUSE - FILLED AND COMPACTED SOLID WASTE
afs	ARTIFICIAL FILL STOCKPILE
cef	CERTIFIED ENGINEERED FILL
Qal	ALLUVIUM
Qd	DEBRIS FLOW
Qls	LANDSLIDE DEBRIS
Qols	OLDER LANDSLIDE DEBRIS
Qoa	OLDER ALLUVIUM
Qt	TERRACE DEPOSITS
QTs	SAUGUS FORMATION
Tp	PICO FORMATION

- B-2-10 EXPLORATORY BORING
- DW-24/PZ-3 GROUNDWATER MONITORING WELL
- DW-19/PZ-8 GROUNDWATER MONITORING WELL DESTROYED
- SW-1 VADOSE ZONE MONITORING WELL
- GP-14 VADOSE GAS PROBE
- LP-2 VACUUM PRESSURE LYSIMETER
- A A' GEOLOGIC SECTION LINE

SCALE 1"= 200'

200' 0 200' 400' 600'

CONTOUR INTERVAL 5'

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Geologic Map

PREPARED FOR: Chiquita Canyon Landfill

Project Location: Chiquita Canyon Landfill, Master Plan Revision, Castaic, California

SCALE	DRAWN BY	CHECKED BY
AS SHOWN	JH	TMC
DATE		JOB NO.
1-27-2012	Figure 1	2002-036-004

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Remove Qls F
below Elevation 1400 feet
Portion of Qls F to remain in place
(Above Elevation 1400 feet)
Perimeter Road
STORMWATER BASIN
(Canyon B)
EXPLANATION
GEOLOGIC CONTACT; QUERIED WHERE UNCERTAIN OR INFERRED; DOTTED WHERE CONCEALED
GRADATIONAL GEOLOGIC CONTACT
ANTICLINAL FOLD; APPROXIMATELY LOCATED, QUERIED WHERE UNCERTAIN, DOTTED WHERE CONCEALED
SYNCLINAL FOLD; APPROXIMATELY LOCATED QUERIED WHERE UNCERTAIN, DOTTED WHERE CONCEALED
STRIKE AND DIP OF BEDDING
STRIKE AND DIP OF CONCEALED BEDDING
STRIKE AND DIP OF SLIDE PLANE
STRIKE AND DIP OF JOINT
SILTSTONE BED
SANDSTONE BED
FOSSIL BED
RIDGE-FORMING COQUINA
SURFICIAL FAILURE
af ARTIFICIAL FILL
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afs ARTIFICIAL FILL STOCKPILE
cef CERTIFIED ENGINEERED FILL
Qal ALLUVIUM
Qd DEBRIS FLOW
Qls LANDSLIDE DEBRIS
Qols OLDER LANDSLIDE DEBRIS
Qoa OLDER ALLUVIUM
QT TERRACE DEPOSITS
QTs SAUGUS FORMATION
Tp PICO FORMATION
B-2-10 EXPLORATORY BORING
DW-24/PZ-3 GROUNDWATER MONITORING WELL
SW-1 VADOSE ZONE MONITORING WELL
GP-14 VADOSE GAS PROBE
LP-2 VACUUM PRESSURE LYSIMETER
A A' GEOLOGIC SECTION LINE
CR COMPLETE REMOVAL OF Qls
PR PARTIAL REMOVAL OF Qls
R=8'-12' RECOMMENDED REMOVAL DEPTH PRIOR TO PLACING FILL
B-1-10
B-2-10
B-3-10
B-4-10
B-5-10
B-6-10
B-7-10
B-9-10
Geotechnical Map
PREPARED FOR
Chiquita Canyon Landfill
Project Location
North and East Canyon Excavation Area
Master Plan Revision
Castaic, California
SCALE 1"=100'
DRAWN BY JH
CHECKED BY TPL/TMC
DATE 1-27-2012
Figure 2.1
JOB NO. 2002-036-004
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Geotechnical Map

PREPARED FOR
Chiquita Canyon Landfill

Project Location
South Main Canyon and Entrance Road
Master Plan Revision
Castaic, California

SCALE 1"=100'	DRAWN BY JH	CHECKED BY TPL/TMC
DATE 1-27-2011	Figure 2.2	JOB NO. 2002-036-004

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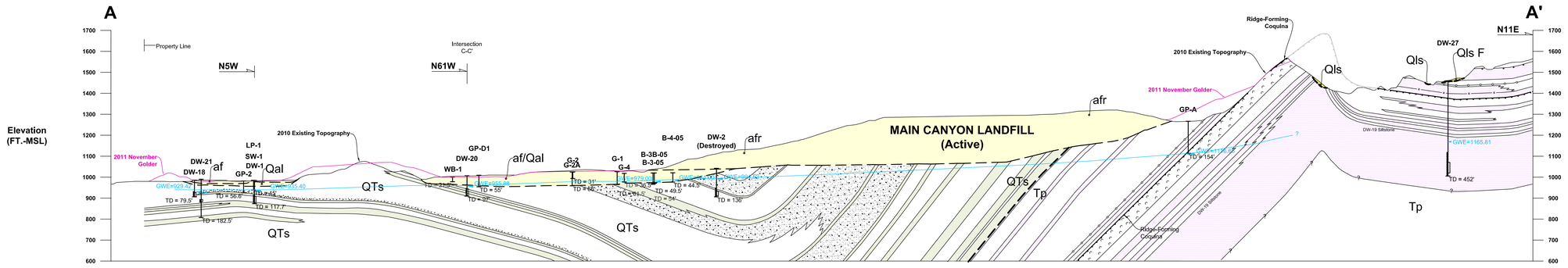
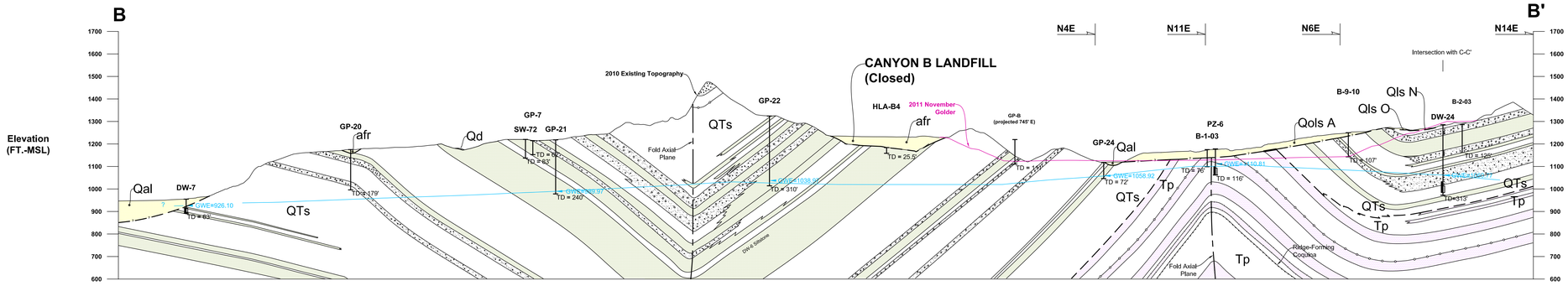
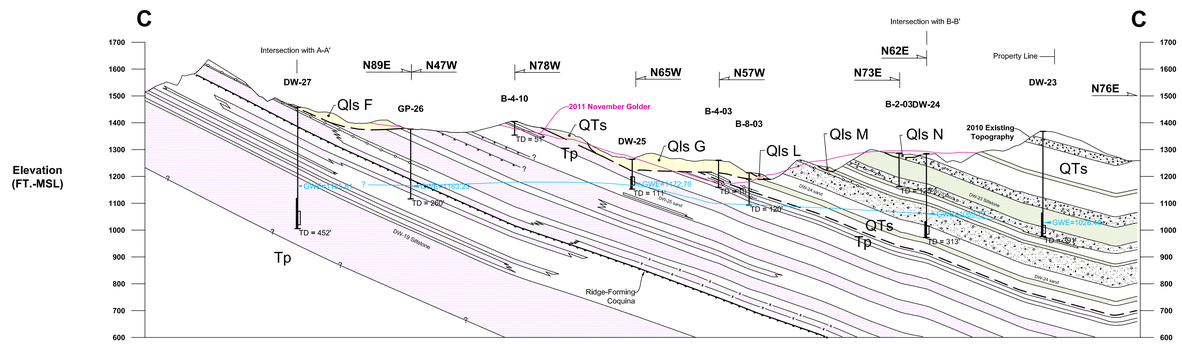
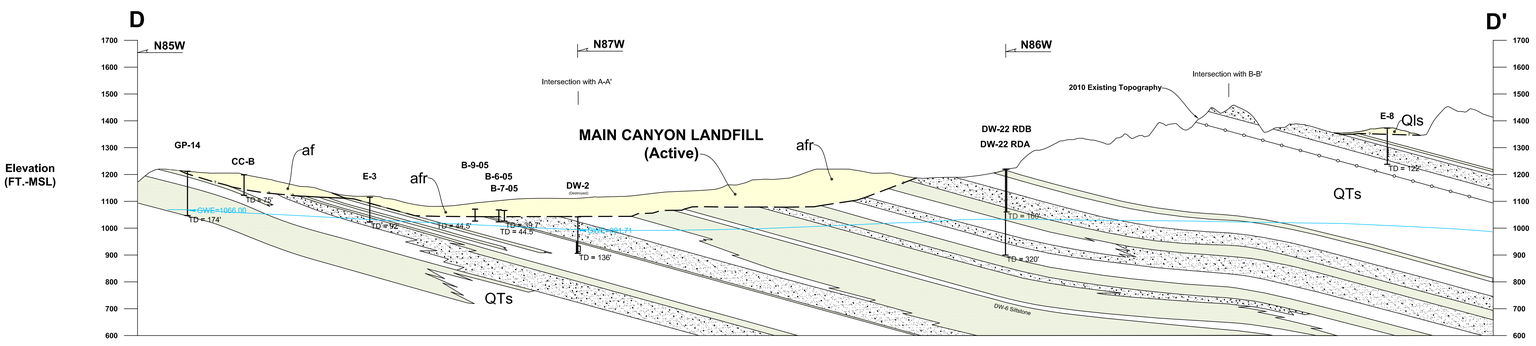




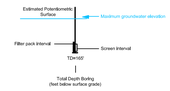




EXPLANATION

- af — Artificial Fill
- afr — Artificial Fill Refuse
- Qal — Quaternary Alluvium
- Qsaug — Saugus Formation Coarse-grained; sandstone with gravel
- QTs — Saugus Formation Coarse-grained; primarily sandstone
- QTs — Saugus Formation Fine-grained; primarily siltstone, mudstone or claystone
- Tp — Pico Formation Coarse-grained; primarily sandstone
- Tp — Pico Formation Fine-grained; primarily siltstone, mudstone or claystone
- Tp — Fossil rich; Primarily Sandstone
- Siltstone Bed
- Sandstone Bed
- Fossil Bed

DW-15 — Monitoring Well or Piezometer



Geologic Sections

PREPARED FOR: Chiquita Canyon Landfill

Project Location: Chiquita Canyon Landfill, Castaic, California

SCALE	DRAWN BY	CHECKED BY
1"=200'	JH	TMC
DATE: 1-27-2012	Figure 3	JOB NO: 2002-036-004

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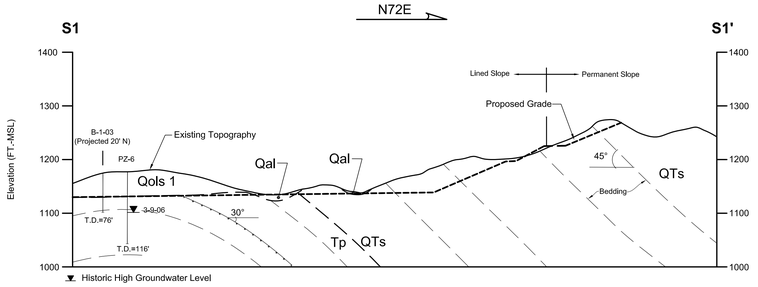

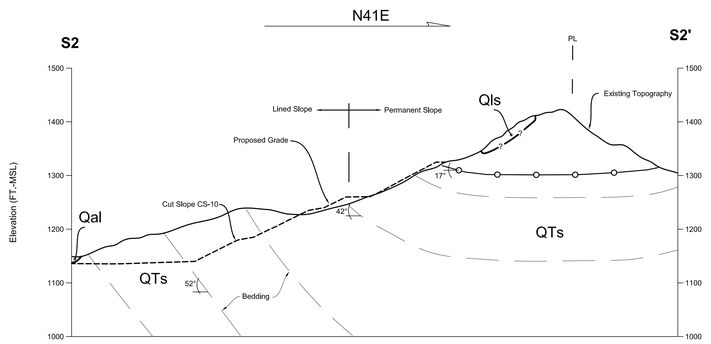

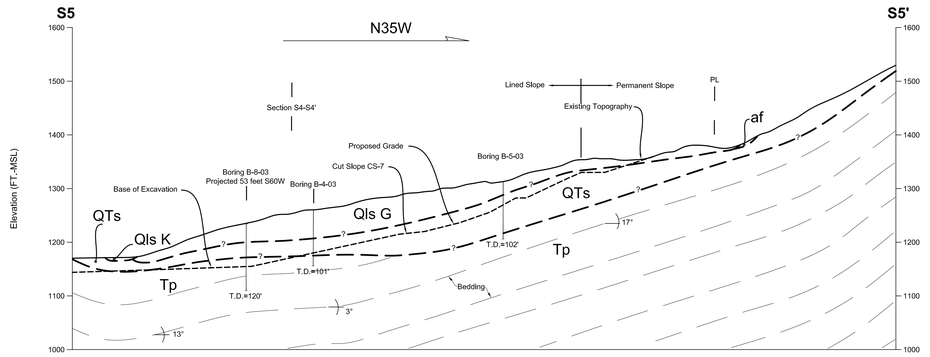

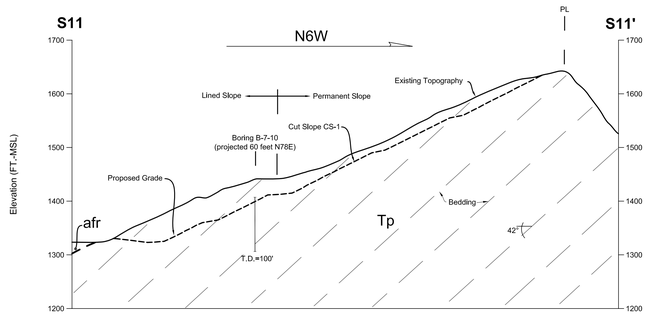

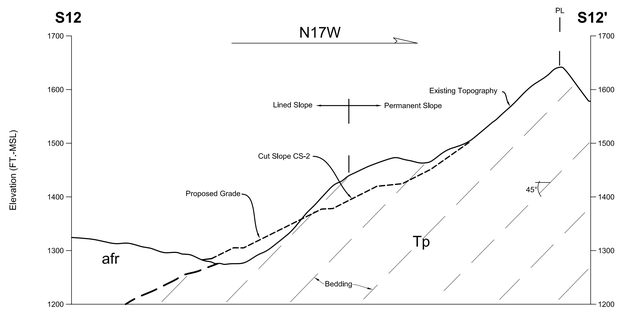

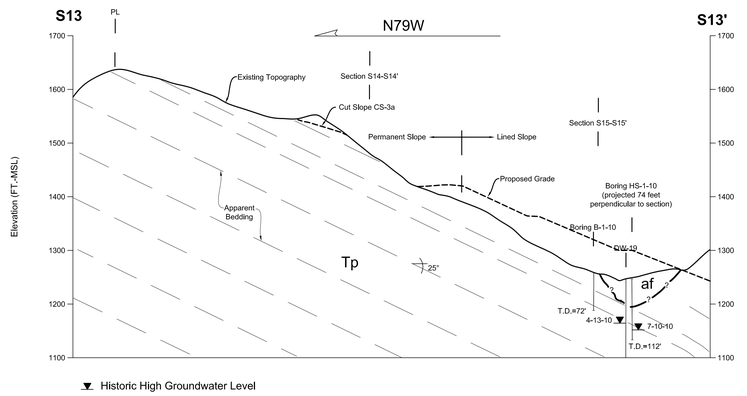

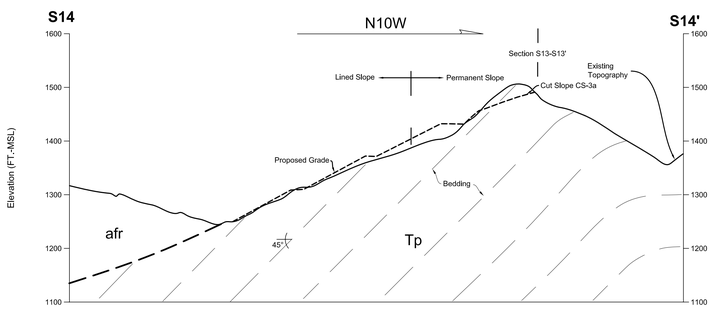

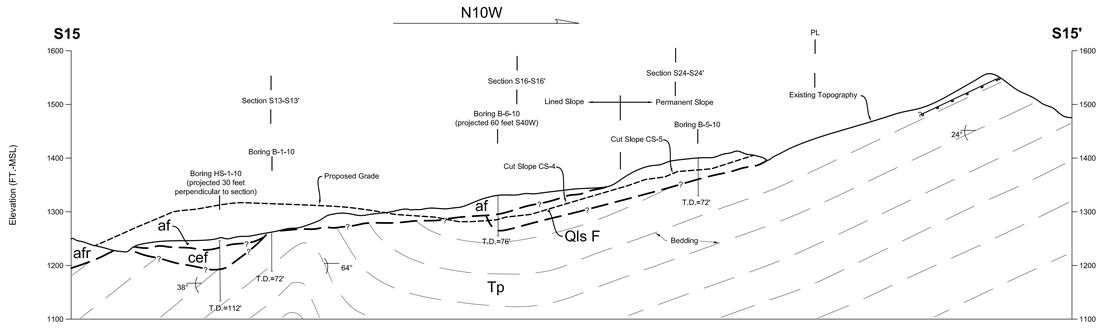

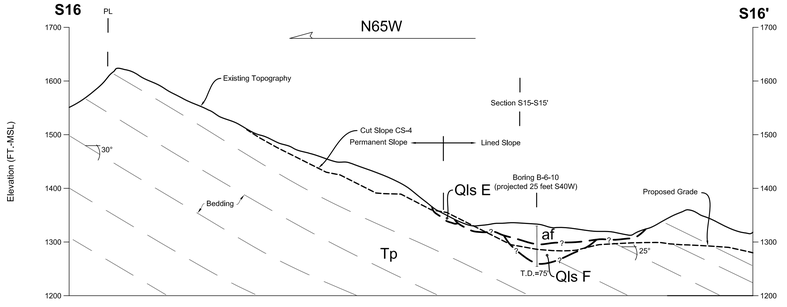

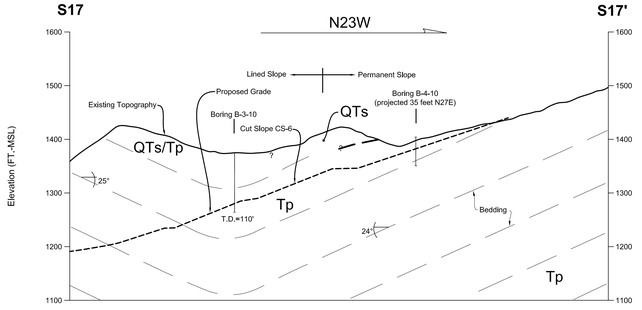

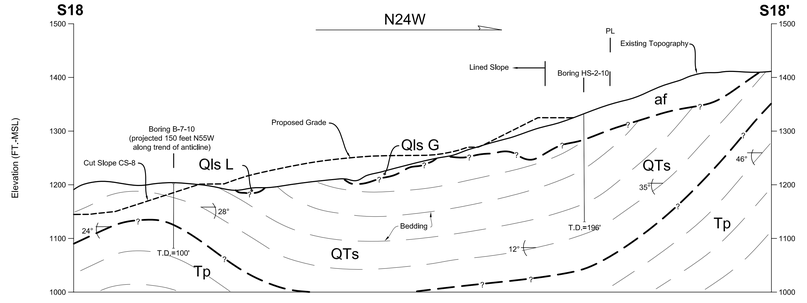

Geologic Sections

PREPARED FOR

Chiquita Canyon Landfill

Project Location

Master Plan Revision
Castaic, California

SCALE	DRAWN BY	CHECKED BY
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1-27-2012	Figure 4.1	2002-036-004

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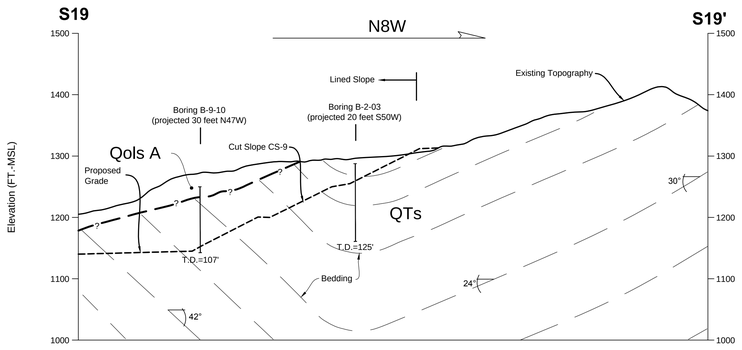

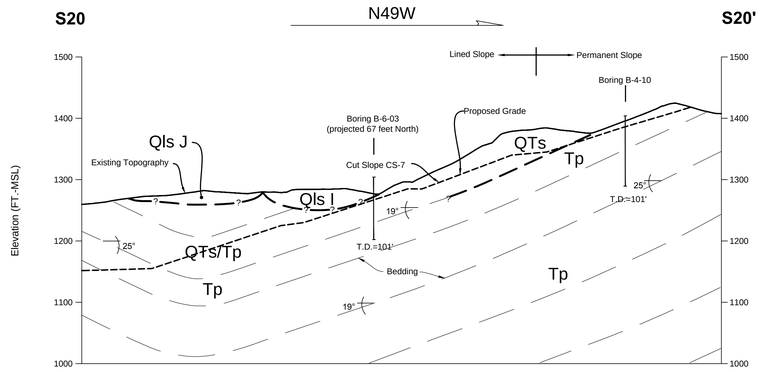

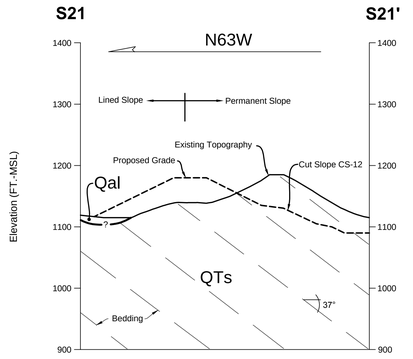

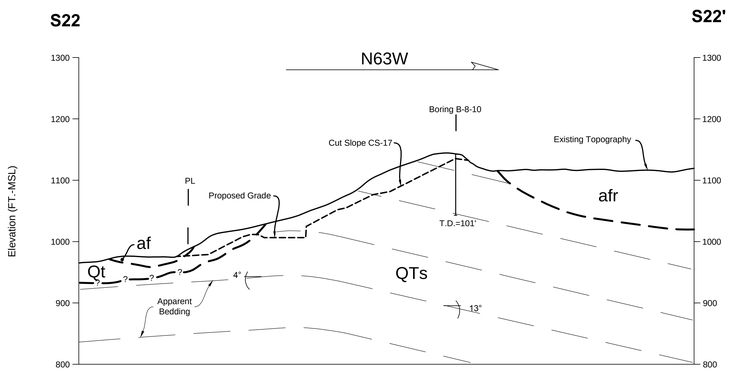

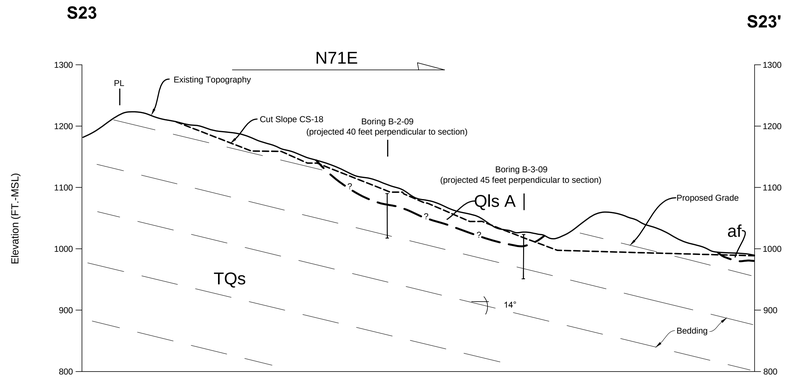

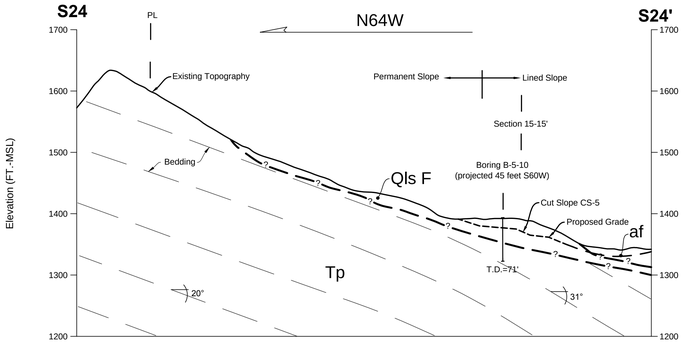

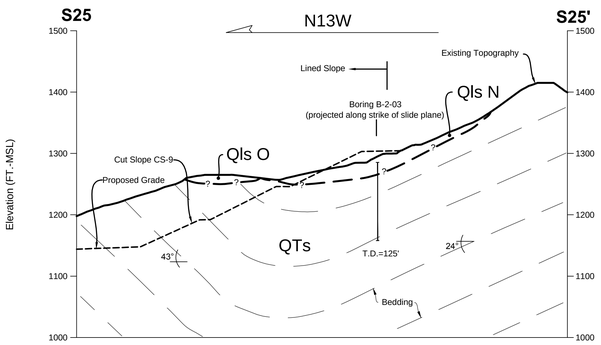

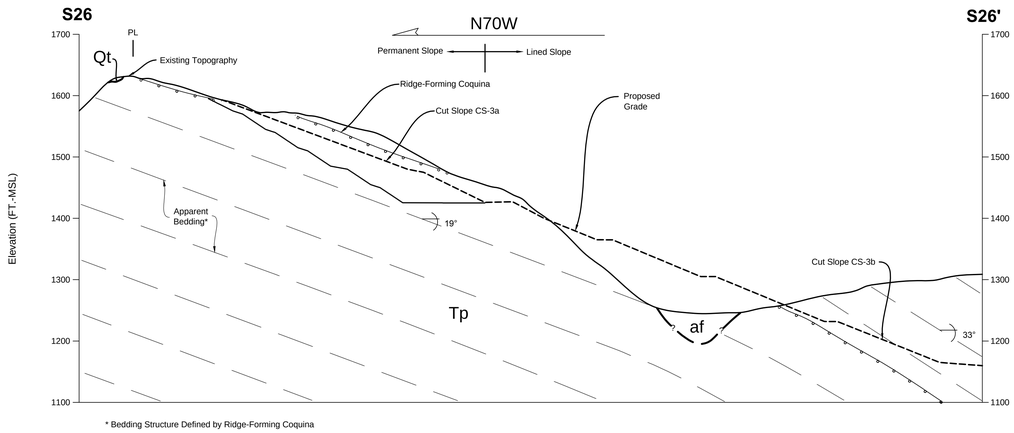

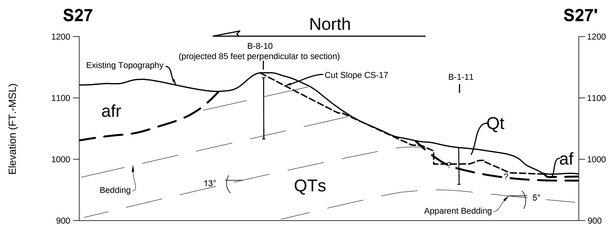

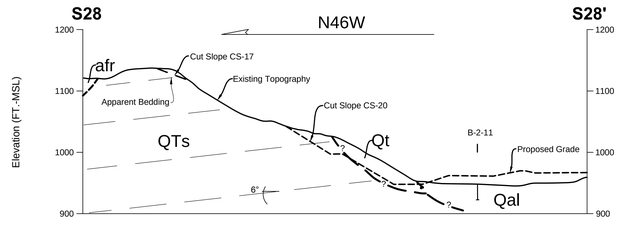

Geologic Sections

PREPARED FOR
Chiquita Canyon Landfill

Project Location
Master Plan Revision
Castaic, California

SCALE	DRAWN BY	CHECKED BY
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DATE		JOB NO.
1-27-2012	Figure 4.2	2002-036-004

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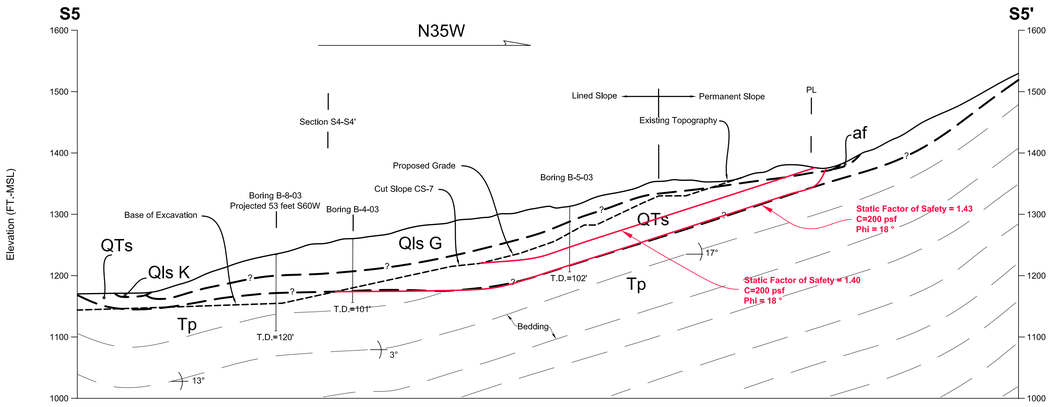
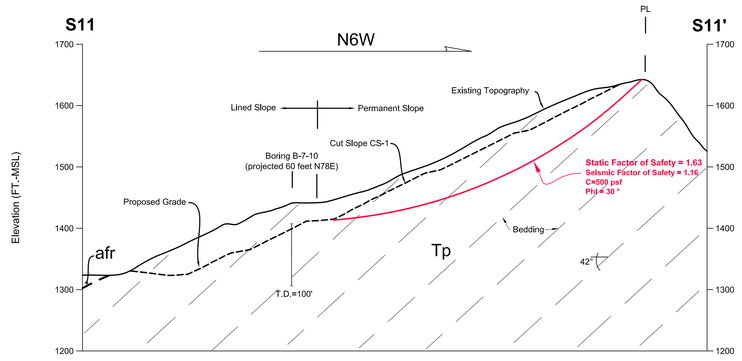
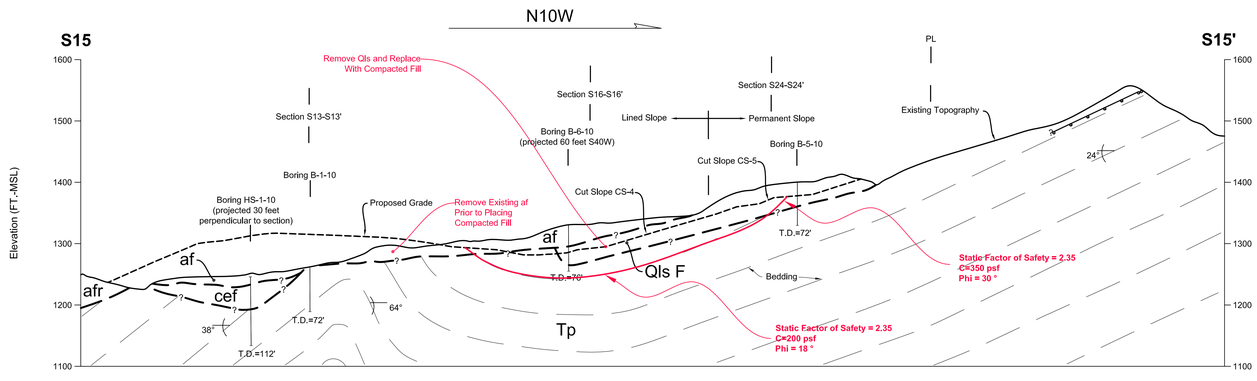
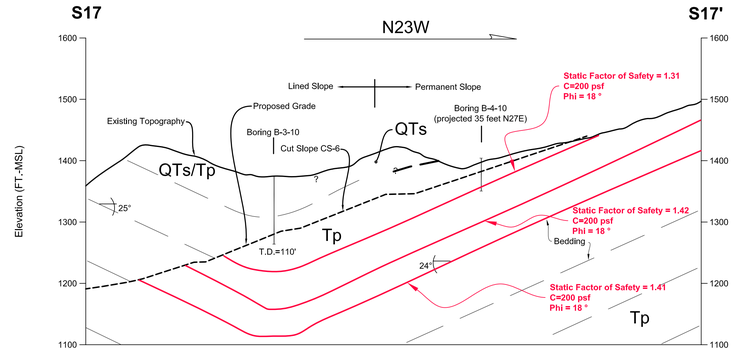
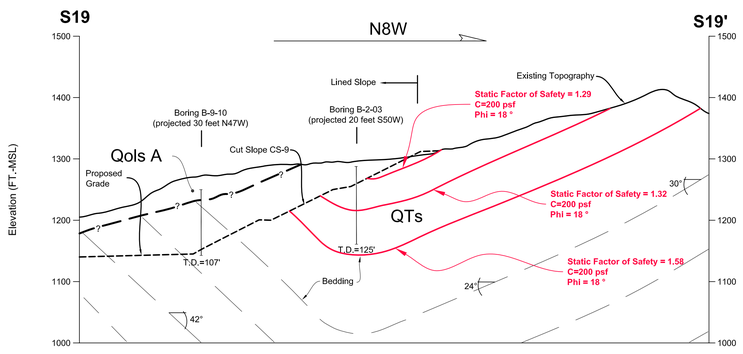
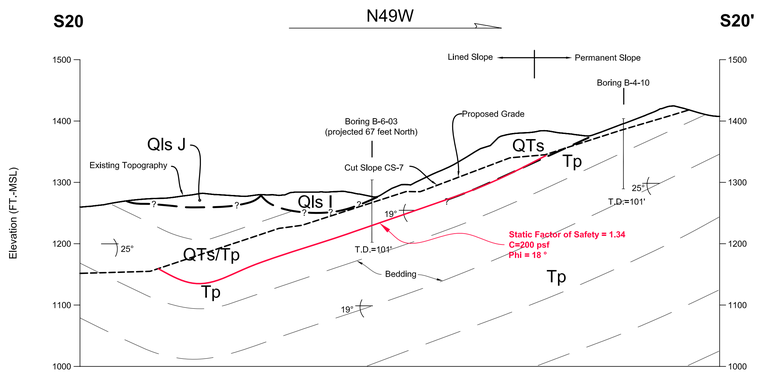


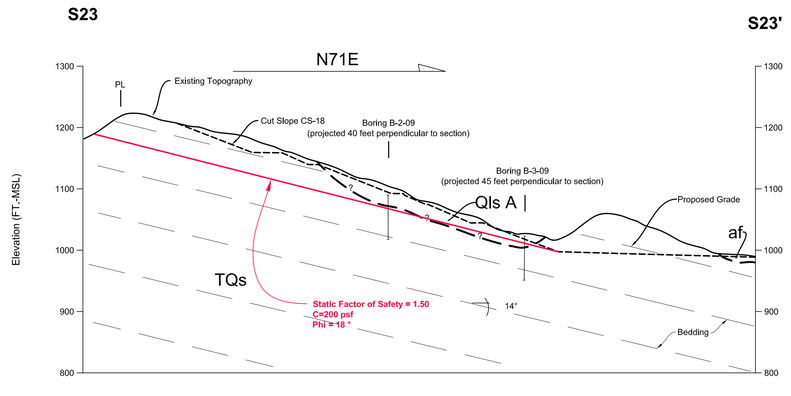


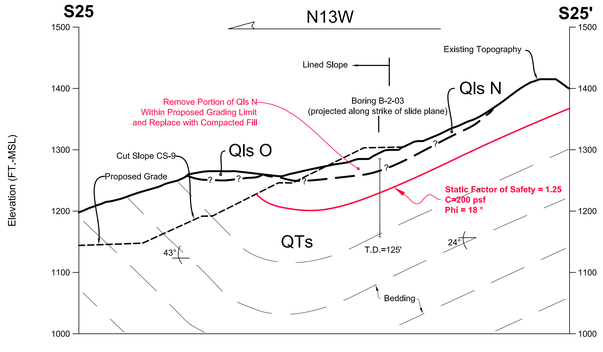












Geotechnical Sections

PREPARED FOR

Chiquita Canyon Landfill

Project Location

Master Plan Revision
Castaic, California

SCALE	DRAWN BY	CHECKED BY
AS SHOWN	JH	TPL
DATE		JOB NO.
1-27-2012	Figure 5	2002-036-004

1329 SCOTT ROAD
BURBANK, CA, 91504
TEL: (818) 531-1501
FAX: (818) 531-1511
www.rtfrankian.com

RTFA
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

GEOTECHNICAL INVESTIGATION

MASTER PLAN REVISION

CHIQUITA CANYON LANDFILL

CASTAIC, CALIFORNIA

FOR

CHIQUITA CANYON LANDFILL

JANUARY 27, 2012

JOB NO. 2002-036-004

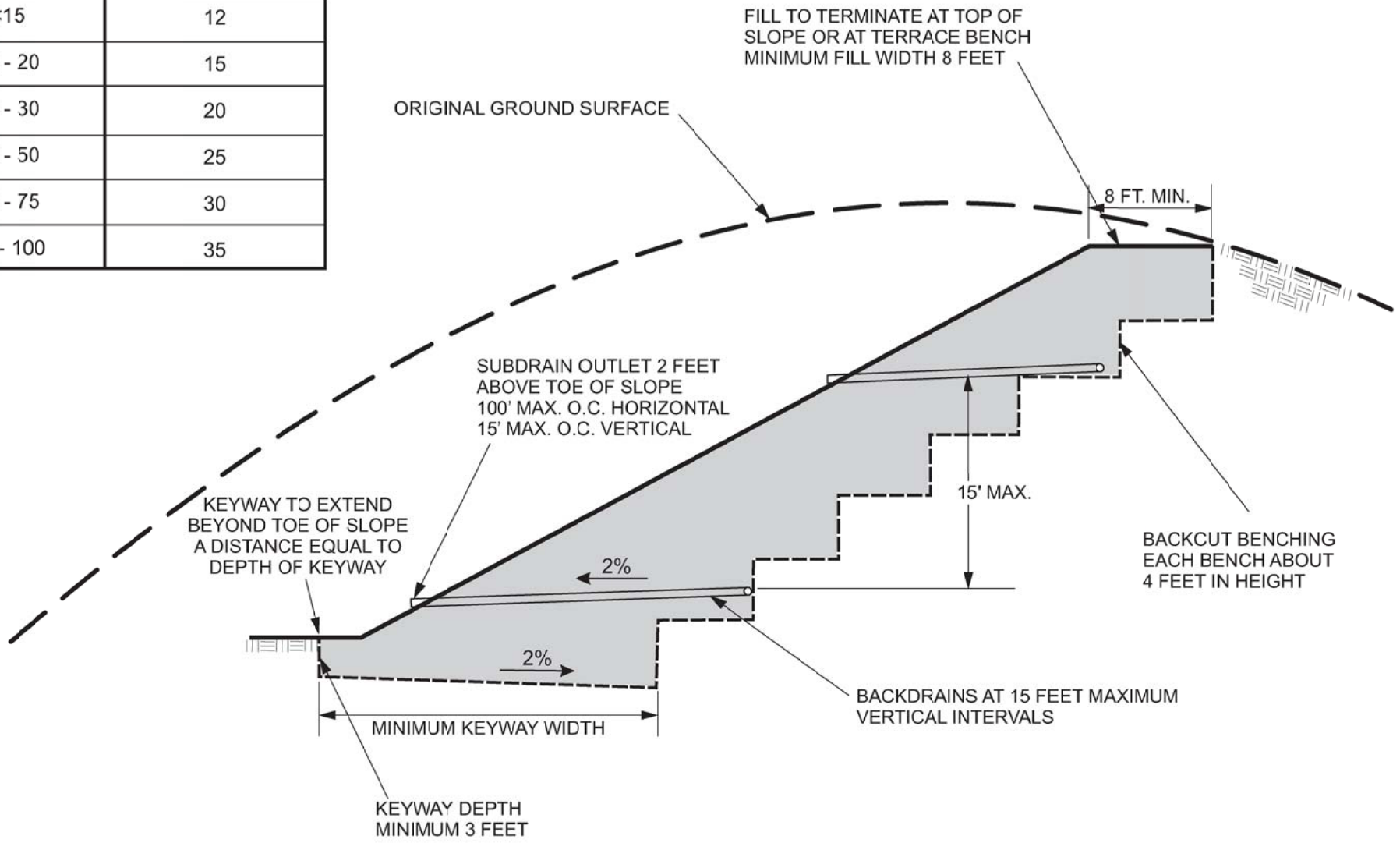
VOLUME 2 OF 2

RTF&A

GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

STAB2

STABILITY FILL HEIGHT (FEET)	MINIMUM WIDTH OF KEYWAY (FEET)
<15	12
15 - 20	15
20 - 30	20
30 - 50	25
50 - 75	30
75 - 100	35

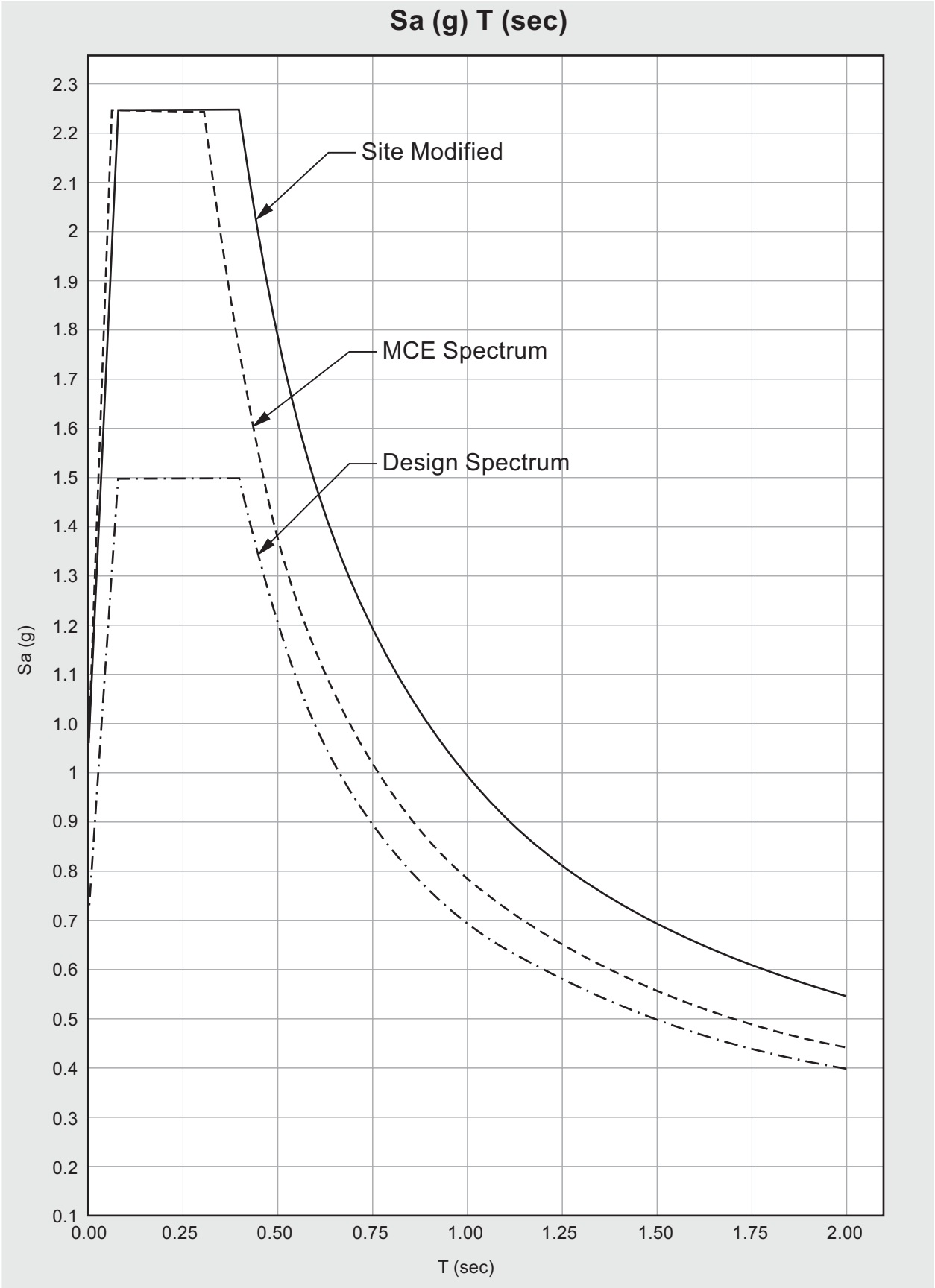


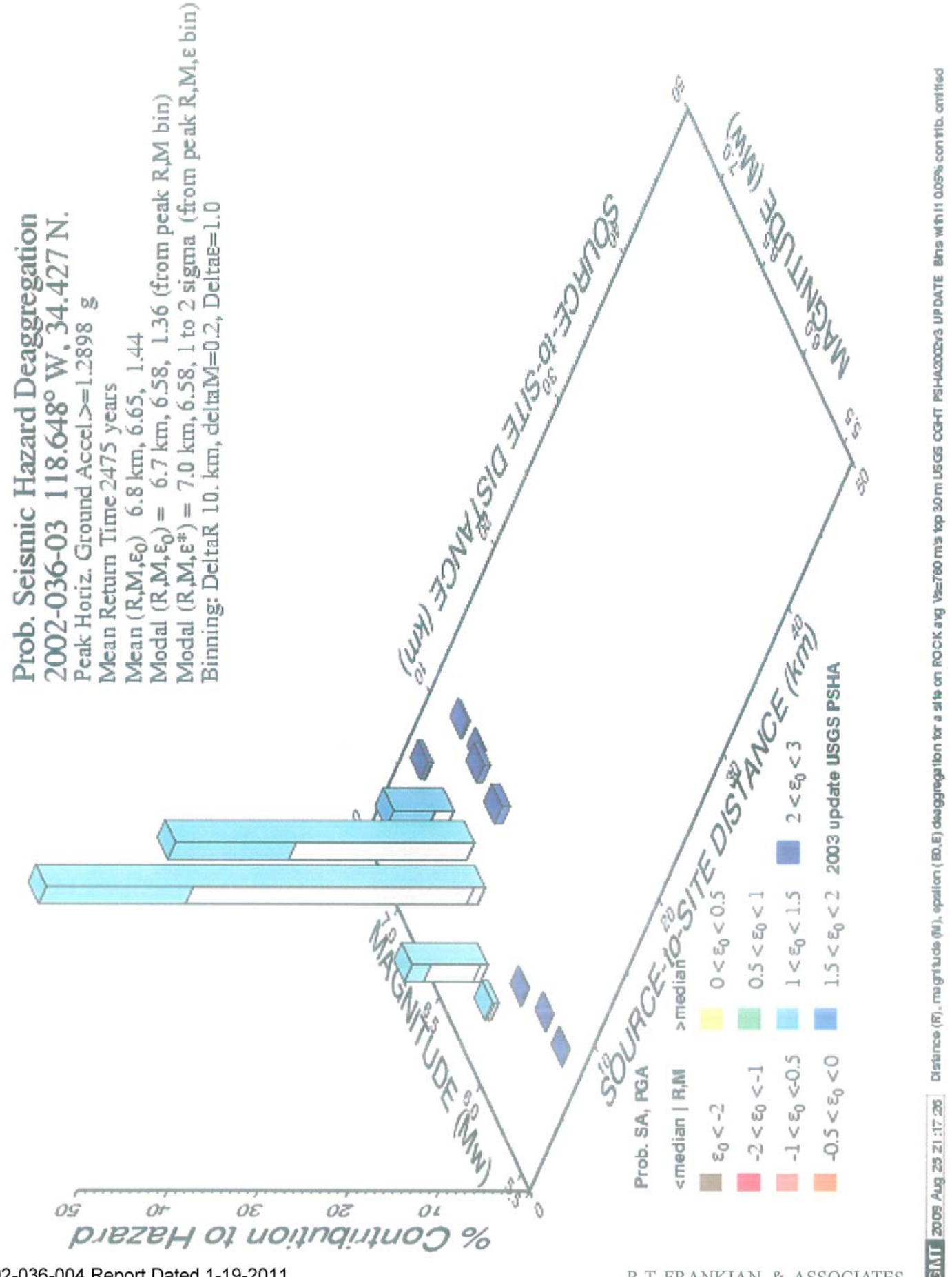
STABILITY FILL DETAILS FOR GROSSLY STABLE SLOPES

NOT TO SCALE

NOTE:
SUBDRAIN PIPES ALONG BACKCUT SHOULD CONSIST OF AT LEAST 4" DIAMETER SLOTTED PIPE WITH AT LEAST 6" OF F-1 FILTER MATERIAL ON ALL SIDES OF THE PIPE.

SEISMIC SPECTRUM

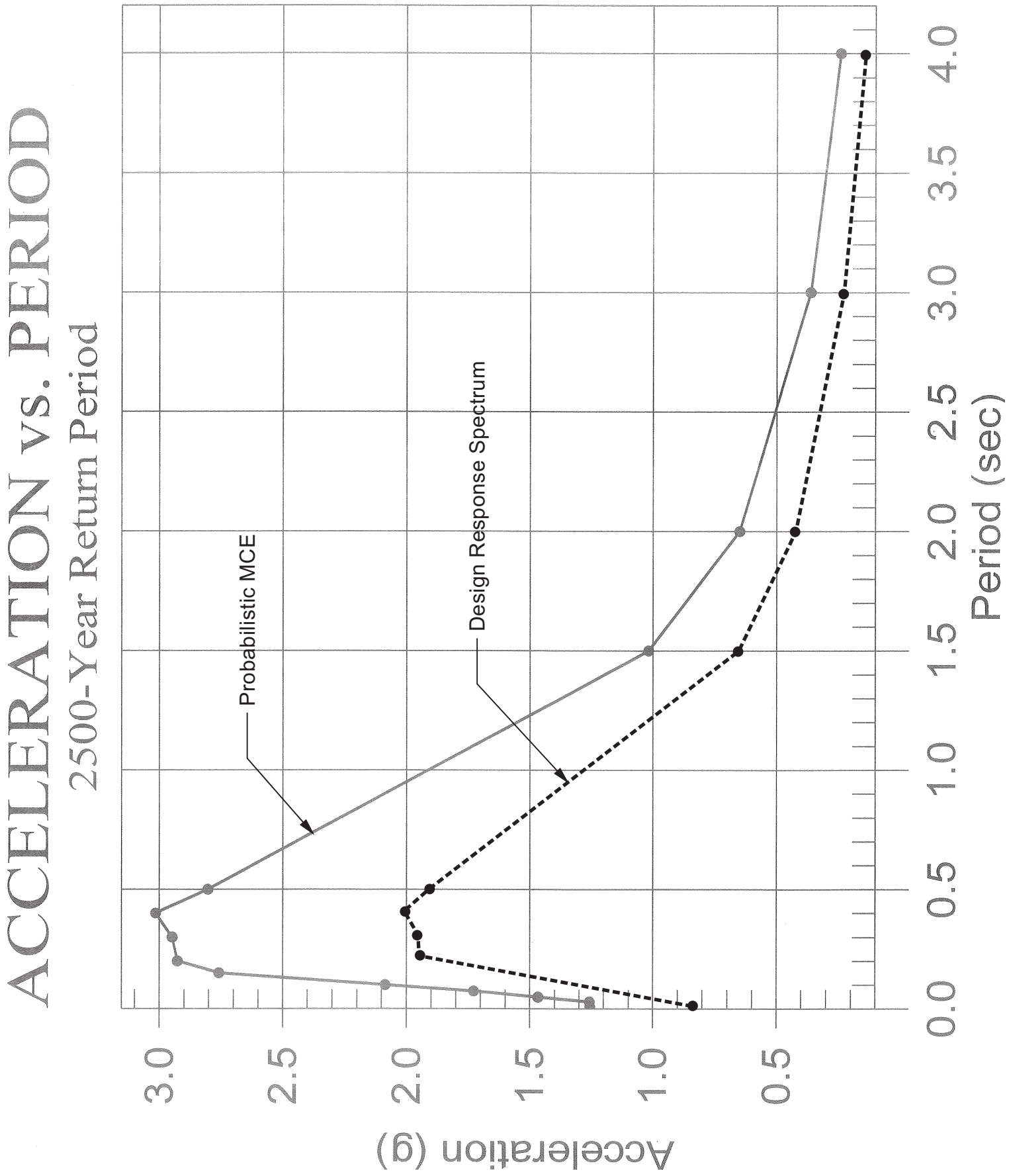




R.T. FRANKIAN & ASSOCIATES

Figure 8

PROBABILISTIC MCE

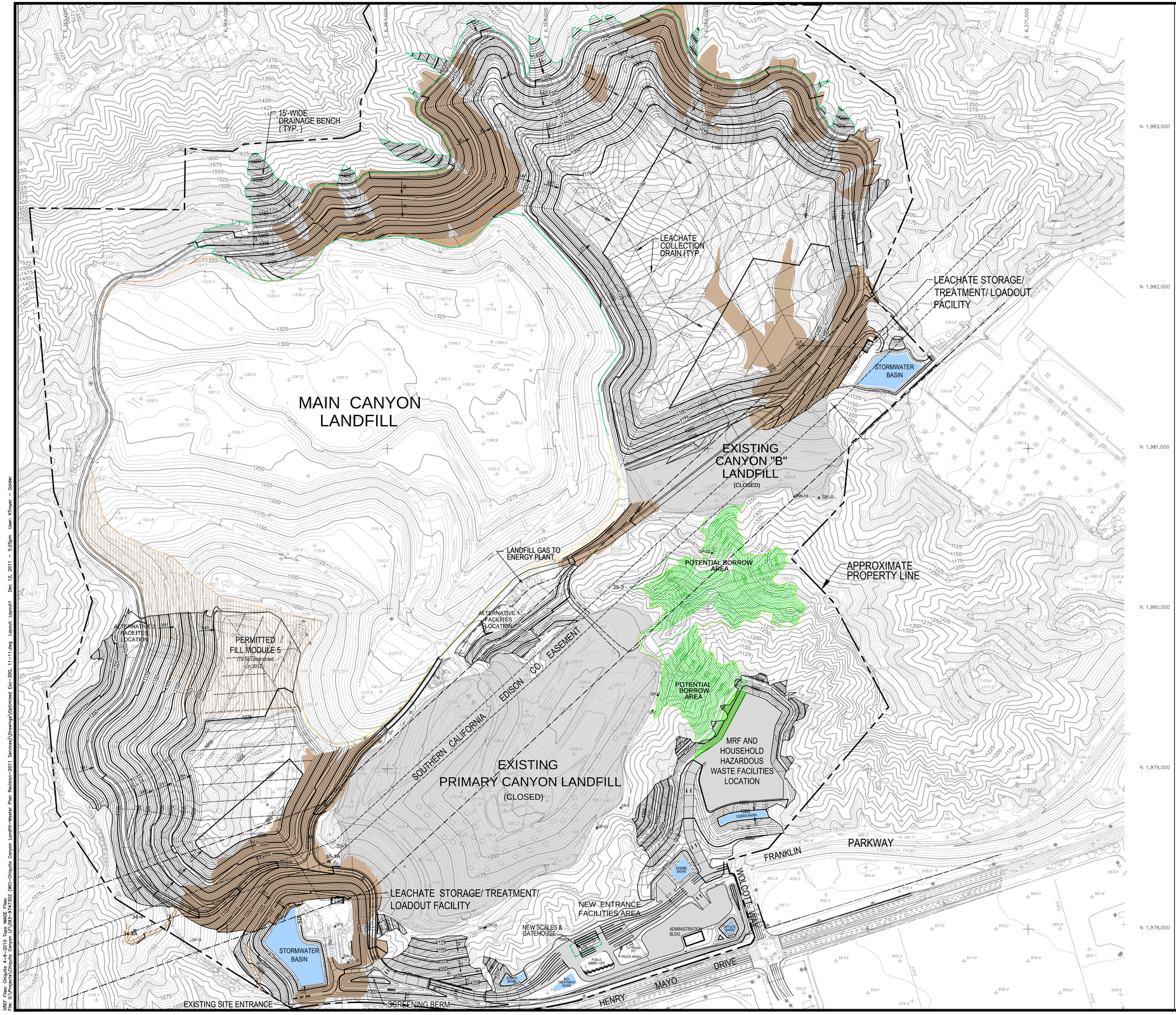


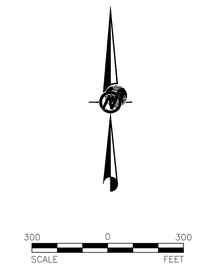
Chiquita Canyon Landfill
January 27, 2012
2002-036-004

APPENDIX A

EXCAVATION PLAN (GOLDER ASSOCIATES, NOVEMBER 2011)

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY





NOTE: Areas contoured with green contours represent borrow areas and are not mandatory for the construction of the landfill, but are designed to help the project soil balance. The space that is gained around the MRF due to the borrow areas is the area shaded green and equals 0.6 additional acreage.

Base compiled by photogrammetric methods
by Don Read Corporation, Brea, CA
Date of photography: April 6, 2010

PROJECT

WASTE CONNECTIONS, INC.
CHIQUITA CANYON LANDFILL
LOS ANGELES COUNTY, CALIFORNIA

TITLE

EXCAVATION PLAN

Golder Associates
Sunnyvale, California

PROJECT No. 093-9747302			FILE No.		
DESIGN	SER	NOV 2011	SCALE AS NOTED		REV. 0
CADD	KLT	DEC 2011	2		
CHECK					
REVIEW					

Chiquita Canyon Landfill
January 27, 2012
2002-036-004

APPENDIX B

FIELD EXPLORATIONS

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

APPENDIX B

FIELD EXPLORATIONS

RECONNAISSANCE GEOLOGIC MAPPING

During geologic mapping, local surficial deposits (both natural and man-made) and bedrock units were mapped on a 1 inch = 100 feet topographic base map compiled by Don Read Corporation, based on April 4, 2010 photography. Geologic structural features, including bedding, were observed, measured, and plotted on the base map. Previous geologic mapping of the North and East Canyon was conducted in 2003.

EXCAVATION AND LOGGING OF EXPLORATORY BORINGS

The project site exploration has been conducted over a nine year period beginning in 2003 and concluding in 2011 as detailed below:

- eight bucket auger borings, designated B-1-03 through B-8-03, that were excavated for East Canyon in 2003;
- five bucket auger borings (B-1-09 through B-3-09, B-10-10 and B-11-10) and three rotary wash borings (WB-1-09 through WB-3-09) excavated within South Main Canyon in 2009 and 2010;
- nine bucket auger borings (B-1-10 through B-9-10) and four hollow-stem auger borings (HS-1-10 through HS-4-10) excavated within North & East Canyon, and above the future Entrance Road, in 2009; and
- five bucket auger borings (B-1-11 through B-5-11) excavated for the future Entrance Road in 2011.

Several of the bucket auger borings were down-hole logged by a Certified Engineering Geologist to directly observe the subsurface geologic units and structure. The locations of the various exploratory borings are shown on the attached Geotechnical Maps, Figure 2.1 and 2.2. The soils/rock units encountered were classified in accordance with the Unified Soil Classification System. Rock types were identified using standard rock nomenclature. The boring logs are presented in this appendix.

Boring HS-1-10, drilled to a depth of 112 feet below existing ground surface, was completed as a temporary piezometer, with well screen placed from 88 feet to 108 feet. Boring HS-2-10 was drilled to a depth of 199 feet and completed as a temporary

piezometer with well screen placed from 180 to 190 feet. Both temporary piezometers were monitored for water levels prior to destruction on July 14, 2010.

Undisturbed and bulk samples of the subsurface materials were collected for laboratory inspection and testing. The lined-barrel sampler used to take undisturbed samples has an external diameter of 3.25 inches and an internal diameter of 2.625 inches. The depths at which the undisturbed samples were obtained are indicated on the logs. The number of blows required to drive the sampler 12 inches with the hammer is also shown on the boring logs.

In addition to obtaining undisturbed samples, Standard Penetration Tests (SPT) were performed within some of the hollow-stem auger borings. The results of the tests are indicated on the boring logs. The Standard Penetration Tests were performed in accordance with the ASTM D1586 Test Method.

BORING B-1-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 10-13-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1175+/-
SURFACE CONDITIONS:
SAMPLING METHOD: 2 5/8-inch drive

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG (SW NE)	SOIL TYPE

0-40 feet: OLDER LANDSLIDE (Qols)

@ 0 feet: CLAYEY SILTSTONE, plastic to moderate stiff, moist, caliche pods, brownish gray (5Y 4/1)

@ 5 feet: blebs of dark brown siltstone within light reddish brown silty sand

@ 11 feet: CLAYSTONE, plastic, moist, dark reddish brown (10R 3/4)

Slide Plane: N60W, 85W, 1"-2" thick

@ 11.3 feet: CLAYEY SILTSTONE, olive gray (5Y 4/1)

@ 14 feet: SANDSTONE, fine to coarse grained, moderately hard, moist, moderate yellowish brown (10YR 5/4)

@ 19 feet: CLAYEY SILTSTONE, stiff, moist, micaceous, pale yellowish brown (10YR 6/2)

@ 21 feet: Sheared Claystone, Irregular dips to NW, 1"-2" thick

@ 25 feet: CLAYEY SANDSTONE, fine grained, clayey to silty sand, moderately hard, moist, moderate yellowish brown (10YR 5/4)
@ 26 feet: Shear, N30E, 45NW, 1/4" reddish brown clay gouge
@ 26.5 feet: Bedding, approx. N70W, 20NE, sandstone
@ 27 feet: SILTSTONE (ML), some fine grained sand and clay, moderately hard, moist, light brown (5YR 5/6)
@ 27.5 feet: Shear, irregular, bedding discontinuos N10E, 52SE

@ 30 feet: color changes to light olive gray (5Y 5/2)

@ 35 feet: SANDSTONE, fine to medium grained with small cobbles, moderately hard, moist, light olive gray (5Y 5/2)

@ 38 feet: SILTSTONE, minor to trace clay, moderately hard, moist, light olive gray (5Y 5/2)
@ 39.5 feet: Shear, N35W, 65SW well defined clay shear polished, below 39.5 feet gradual color change to olive gray, no distinct shears or slide planes

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-1-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-13-03

By: D.G. Francuch

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
26				45, 50, 55, 60, 65, 70, 75, 80		SW NE; no log	

40-76 feet: PICO FORMATION (Tp)

@ 40 feet: SILTY CLAYSTONE, dark reddish brown (10R 3/4) to olive gray (5Y 4/1), Bedding parallel to shear

@ 43 feet: SILTY CLAYSTONE, hard, moist, olive gray (5Y 4/1), conchoidal fracture possible contact with bedrock, note hardness and color change

@ 45.5 feet: Bedding N85W, 47SW , sandstone bed in siltstone

@ 47 feet: fossiliferous, small clam fragments and caliche bed, Bedding: N90W, 54S, 1 foot thick

@ 56 feet: zone of sandstone blocks in clay matrix, discontinuous high angle shear, polished claystone above with hackly fracture

@ 57 feet: CLAYEY SANDSTONE: fine grained sand with silt and clay, hard, moist, greenish gray (5GY 6/1)

@ 59 feet: Shear, N75E, 50SE, poorly developed zone of discontinuous sandstone blocks within siltstone

@ 60 feet: SILTY CLAYSTONE, approximately 6" thick

@ 61 feet: SANDSTONE, fine grained sand, hard, moist, light olive gray (5Y 6/1)

@ 68 feet: Bedding, N80W, 52SW, dark brown clayey siltstone bed in sandstone 4" thick ,Fault offsets siltstone bed

@ 69 feet: CLAYSTONE, moderately hard, moist, semi-plastic, dark yellowish brown (10YR 4/2)

70 feet: increase in moisture

@ 72 feet: CLAYEY SANDSTONE, fine to medium grained sand with clay, hard, moist, light olive gray (5Y 6/1)

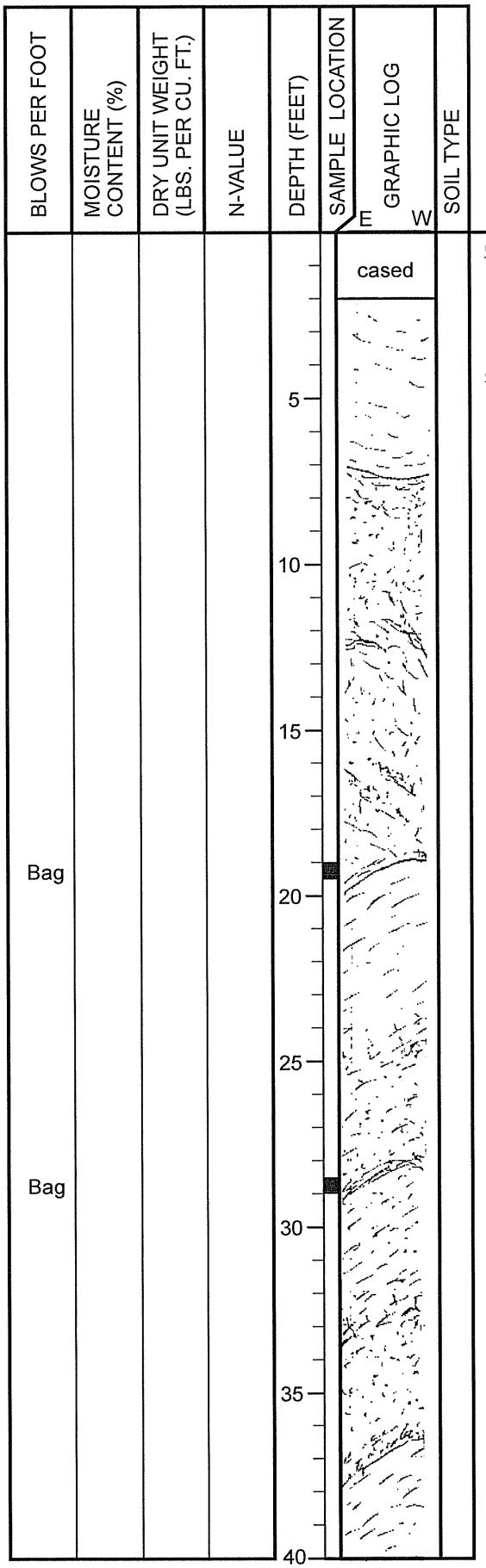
TOTAL DEPTH 76 FEET.
No Groundwater. No caving.
Downhole logged to 71 feet.

SAMPLE DEPTH	KELLY WEIGHT
0-28'	5952 lbs.
28-55'	3921 lbs.
55-84'	2531 lbs.
84-114'	1407 lbs
+1000 lbs/30 ft. stem	

LOG OF BORING

BORING B-2-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 10-13-03 - 10-14-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1287+/-
SURFACE CONDITIONS:
SAMPLING METHOD: 2 5/8-inch drive



0-4 feet: ARTIFICIAL FILL (af)
@ 0 feet: SANDY SILT (SM), silt with fine sand, loose, dry, pale yellowish brown (10YR 6/2)

4-19 feet: LANDSLIDE (Qls)
@ 4 feet: SILTSTONE, soft, moist, light olive gray (5Y 5/2)

@ 7 feet: Slide Plane: N75W, 11SW, olive gray siltstone over brown sandy siltstone 8" thick soil zone with sandstone blocks
@ 8 feet: stopped drilling on 10/13/03 @ 15:30
Resume drilling on 10/14/03 @ 7:00

@ 11 feet: SANDY SILTSTONE: fine sand, moderately hard, moist, moderate yellowish brown (10YR 5/4)
@ 12 feet: chaotic assemblage of sandy silt and clayey siltstone

@ 19 feet: Slide Plane: N25E, 22SE 2-3"zone of dark brown polished clay, moderately plastic

19-125 feet: SAUGUS FORMATION (QTs)
@ 19 feet: SILTSTONE, moderately hard to hard, moist, light olive gray (5Y 5/2)

@ 24 feet: Bedding; N40E, 34SE; limey siltstone bed, 8" thick

@ 28 feet: Bedding; N30E, 28SE, dark olive green clayey siltstone

@ 31 feet: CLAYEY SILTSTONE, trace fine sand, hard, moist, dark yellowish brown (10YR 4/2)
@ 32 feet: Bedding; N50E, 31SE, limey siltstone
@ 32 feet: wood fragments in siltstone
@ 33 feet: SANDSTONE, fine grained, hard, moist, yellowish gray (5Y 7/2)

@ 36 feet: Increased drilling effort
@ 37 feet: Bedding N60E, 38SE; pebble bed in sandstone
@ 37 feet: CLAYEY SILTSTONE, hard, moist, moderate yellowish brown (10 YR 5/4)

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-2-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-13-03 - 10-15-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
Bag				45	E	W	
				50			
				55			
Bag				60			
				65			
				70			
				75			
				80			

@ 49.5 feet: Bedding; N40E, 22SE, limey siltstone
@ 50 feet: SANDY SILTSTONE, some fine sand, moderately hard, dry to moist, yellowish gray (5Y 7/2)

@ 56 feet: CLAYEY SILTSTONE, moderately hard to hard, moist, light olive gray (5Y 5/2), Bedding; N40E, 25SE, clay bed 1" thick

@ 63.9 feet: Bedding; N40E, 24SE, clay bed 1" thick
@ 64 feet: SANDSTONE, fine grained sand, moderately hard, moist, pale olive (10Y 6/2)
@ 65.5 feet: Bedding; N25E, 28SE, clay bed 8" thick
@ 66 feet: CLAYEY SILTSTONE, hard moist, moderate yellowish brown (10YR 5/4)

@ 73 feet: limey siltstone

@ 79 feet: SILTSTONE, trace fine sand, hard, moist, dark yellowish brown (10YR 4/2)
@ 79.3 feet: bedding; N40E, 29SE, limey siltstone bed, 12" thick

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-2-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-13-03 - 10-15-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG (E / W)	SOIL TYPE
				85			
				90			
				95			
				100			
				105			
				110			
				115			
				120			

@ 89 feet: Bedding; N45E, 28SE
@ 89 feet: SILTSTONE, trace fine to medium grained sand, moderately hard to hard, moist, dusky yellow (6Y 6/4)

@ 90 feet: SANDSTONE, fine to medium grained sand, trace silt, moderately hard, moist, moderate yellowish brown (10YR 5/4)

@ 95 feet: SANDSTONE, fine to coarse grained with large pebbles, moderately hard, moist, yellowish gray (5Y 7/2)

@ 98 feet: Bedding; N55E, 28SE, pebbly sandstone bed 6" thick

@ 104 feet: Bedding; N30E, 31SE, heavy mineral, fine sand bed

@ 110 feet: SANDSTONE, fine to coarse grained sand with medium pebbles, moderately hard, moist, yellowish gray (5Y 7/2)

@ 115 feet: Bedding; N40E, 22SE, gray sandstone over reddish brown sandstone
@ 115 feet: SILTY SANDSTONE, fine to coarse grained sand, some silt, trace small pebbles, moderately hard to hard, moist, grayish orange (10YR 7/4)
@ 118 feet: Stopped drilling at 15:30 on 10-14-03
resume drilling @ 7:00 on 10-15-03

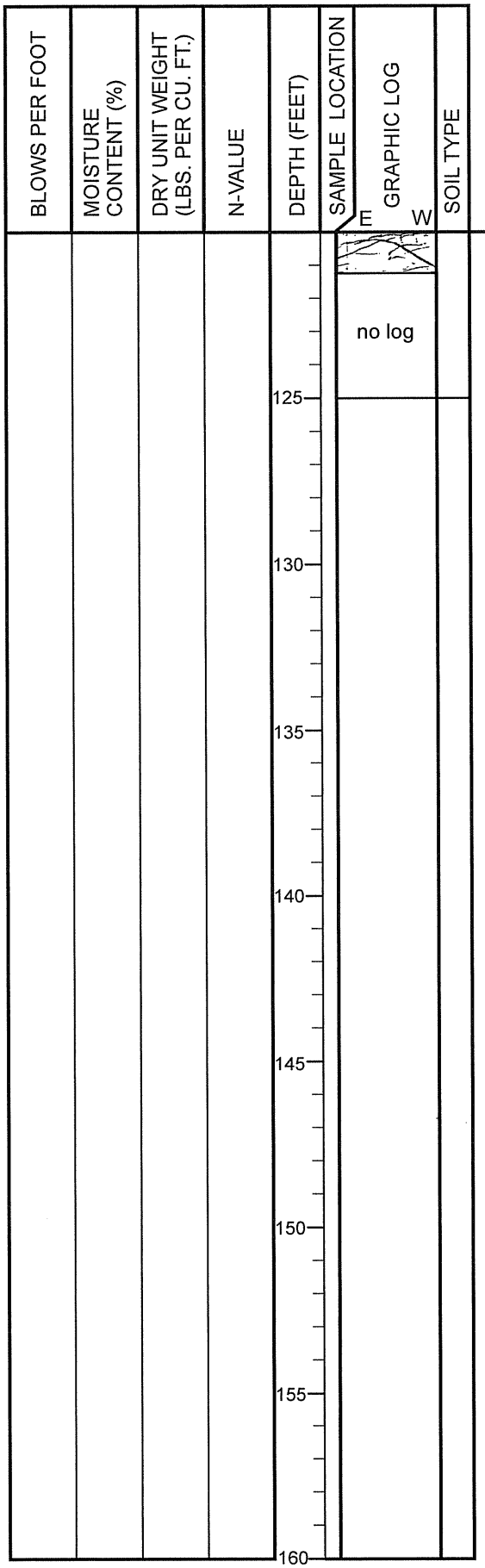
Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-2-03 (CONTINUED)

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 10-13-03 - 10-15-03



@ 120.5 feet: Bedding; N45E, 24SE at contact
@ 121 feet: SILTSTONE, trace clay, moderately hard, moist, light brown (5YR 5/6)

@ 124 feet: small cobbles

TOTAL DEPTH 125 FEET.
No Groundwater. No caving.
Downhole logged to 121 feet.

SAMPLE DEPTH	KELLY WEIGHT
0-28'	5952 lbs.
28-55'	3921 lbs.
55-84'	2531 lbs.
84-114'	1407 lbs
+1000 lbs/30 ft. stem	

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

BORING B-3-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 10-16-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1203.5
SURFACE CONDITIONS:
SAMPLING METHOD: 2 5/8-inch drive

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG (S / N)	SOIL TYPE

0-6 feet: LANDSLIDE (Qls)

@ 0 feet: SILT (ML), soft, dry, some caliche staining, light olive gray (5Y 6/1)

@ 4 feet: SILTY SANDSTONE, fine grained sand with silt, moderately hard, dry, moderate yellowish brown (10YR 5/4)

@ 6 feet: Slide Plane; N60W, 14SW, dark brown clay, 2" thick, gypsum

6-16 feet: ALLUVIUM (Qal)

@ SILT (ML), trace clay, moderately hard to moderately soft, dry, yellowish gray, (5Y 7/2)

@ 8 feet: PEBBLY SAND (SP), fine to coarse grained sand with small to large pebbles, hard, dry, intermixed with silt, yellowish gray, (5Y 7/2)

@ 11-14 feet: well bedded sand deposits, shallow dip to north

@ 13 feet: medium cobbles up to 6" diameter

@ 14-16 feet: base of alluvium, irregular erosional contact

16-110 feet: PICO FORMATION (Tp)

@ 16 feet: SILTY SANDSTONE, fine sand with some silt, hard, moist, dusky yellow (5Y 6/4)

@ 16 feet: Bedding approximate; N40W, 52NE, limey siltstone

@ 22 feet: Fracture; N35W, 52NE, 54 SE,1/16" clay gouge

@ 25 feet: increased drilling effort

@ 28 feet: Minor fault; N10E, 54SE, 1/8" clay gouge

@ 29 feet: Minor fault; N20W, 34NE, ½" - 2" wide zone, clay shears 1/16" thick

@ 29 feet : Bedding; N55W, 47NE siltstone bed cut by fault

@ 33 feet: Minor Fault; N/S, 43E, ½"- 1" wide shear zone of 1/16" clay gouge

@ 34 feet: SANDSTONE, fine to medium grained, trace silt, hard, moist, yellowish gray (5Y 7/2)

@ 36 feet: Bedding approximate; N30W, 57NE, fine grain sandstone/ siltstone

@ 36 feet: SANDY SILTSTONE, some fine grained sand, moderately hard, moist, light olive gray (5Y 5/2)

@ 39 feet: Minor Fault; N80W, 72NE, 1/8" -1/4" thick red clay gouge

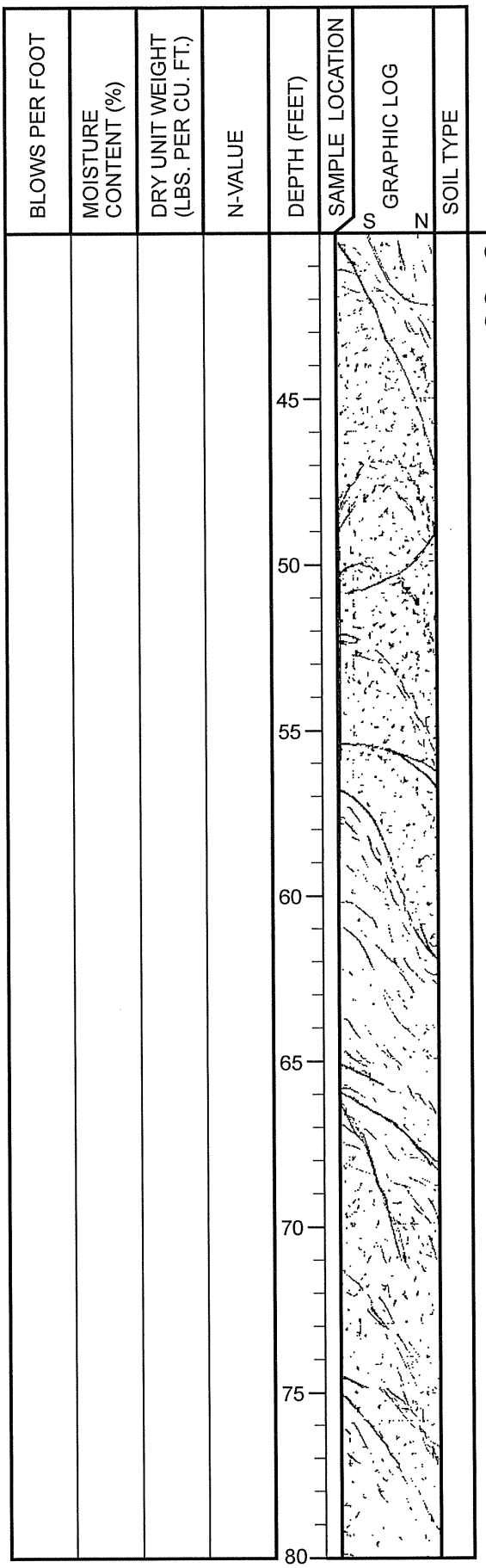
Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-3-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-16-03



@39 feet: CLAYEY TO SANDY SILTSTONE, some clay, some fine sand, hard, moist, moderate yellowish brown (10YR 5/4)
@ 40 feet: Shear; subparallel to minor fault at 39 feet
@ 42 feet: SANDSTONE, fine to coarse grained sand, trace silt, hard, moist, pale yellowish brown (10YR 6/2)

@ 49 feet: Bedding; N50W, 63NE, coarse sandstone

@ 53 feet: PEBBLY SANDSTONE, fine to coarse sand with small to medium pebbles, moderately hard to hard, moist, pale yellowish brown (10YR 6/2)
@ 55.5 feet: Minor Fault; N75W, 24NE, 1/4" to 1" thick shear zone of 1/8" - 1/4" clay gouge

@ 57 feet: Bedding; N55W, 57NE, coarse sandstone / siltstone
@ 57 feet: SILTSTONE, trace fine grained sand, trace clay, hard, moist, moderate yellowish brown (10YR 5/4)

@ 65 feet: moisture increase
@ 66 feet: Minor Fault; N15E, 30SE, 1/8" - 1/4" thick clay gouge

@ 72 feet: increase in clay content

@ 75 feet: SILTSTONE, trace clay, hard, moist, moderate yellowish brown (10YR 5/4)
@ 75 feet: Bedding; N50W, 62NE

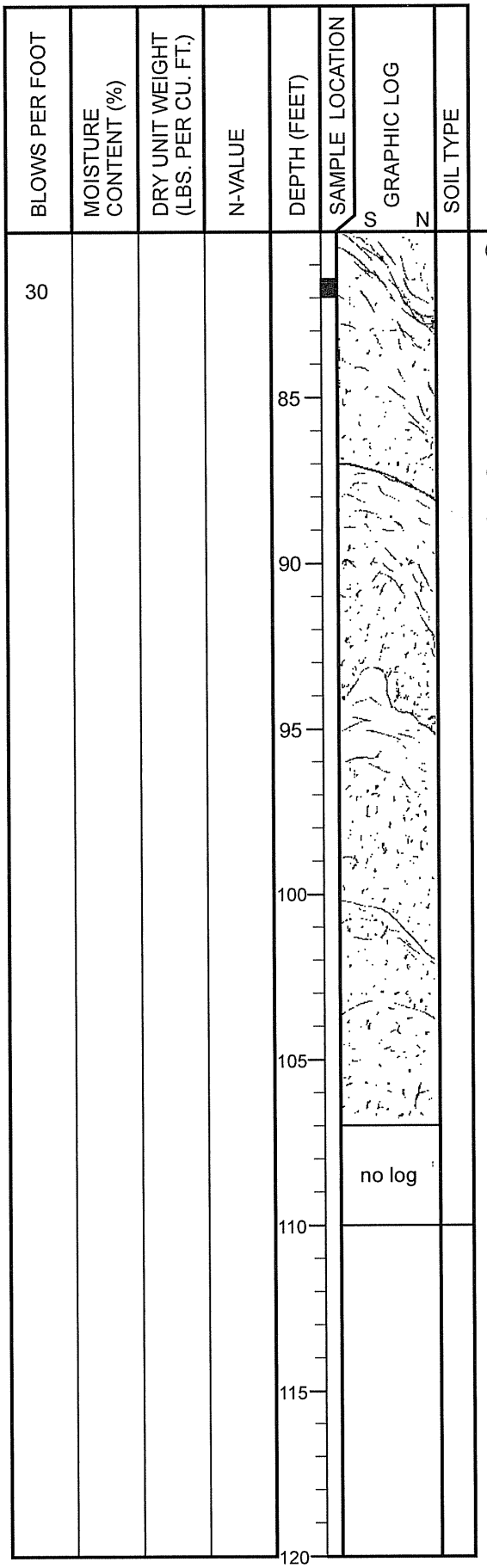
Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-3-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-16-03



@ 80 feet: CLAYEY SILTSTONE, hard, moist, moderate yellowish brown (10YR 5/4)

@ 87 feet: Minor Fault, N20E, 25SE, 1/8" clay gouge, separates silty sandstone from siltstone

@ 87 feet: SILTSTONE, trace fine sand, hard, moist, moderate yellowish brown (10YR 5/4)

@ 90 feet: SANDSTONE, fine to coarse grained sand, trace small pebbles, hard, moist, pale yellowish brown (10YR 6/2)

@ 94 feet: SILTSTONE, moderately hard, moist, moderate yellowish brown, (10YR 5/4), Erosion surface; N/S 33E

@ 96 feet: Bedding approximate; N35E, 24SE

@ 100 feet: SANDY SILTSTONE: some fine grained sand, moderately hard, moist, pale yellowish brown (10YR 6/2)

@ 103 feet: SILTY SANDSTONE, fine to coarse grained sand, some silt, hard, moist, moderate brown (5YR 4/4), Bedding approx. N20E, 23SE

@ 105 feet: SANDSTONE, fine to coarse grained, hard, moist, pale yellowish brown (10YR 6/2)

TOTAL DEPTH 110FEET.
No Groundwater.
Minor caving at 8-15 feet.
Downhole logged to 106 feet.

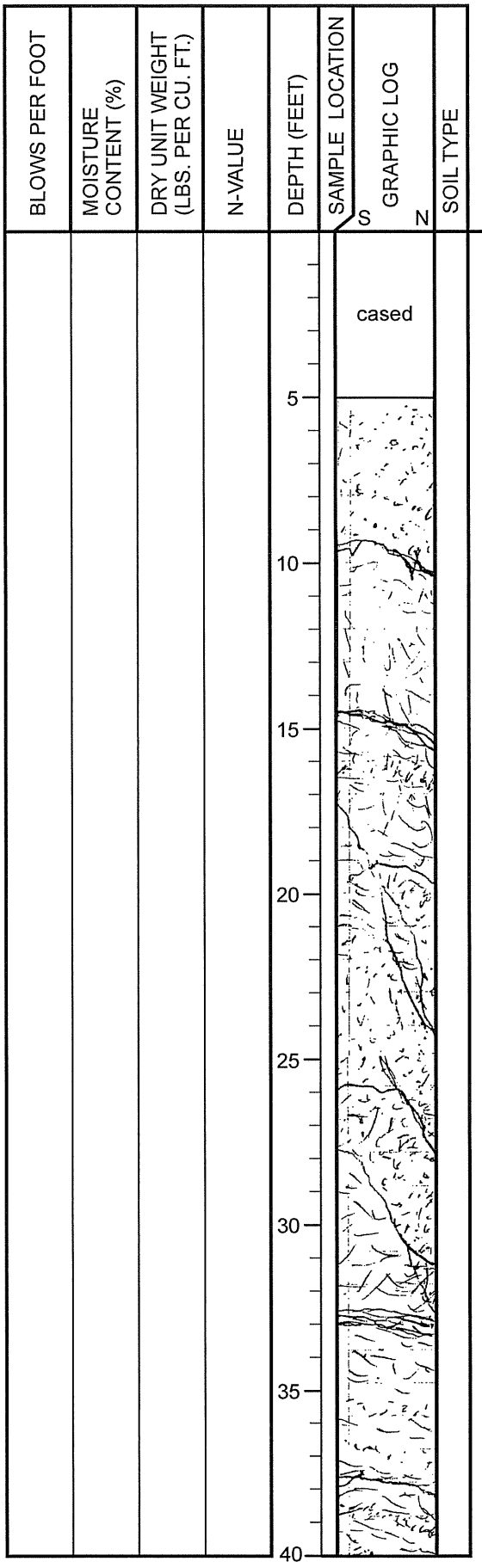
SAMPLE DEPTH	KELLY WEIGHT
0-28'	5952 lbs.
28-55'	3921 lbs.
55-84'	2531 lbs.
84-114'	1407 lbs
+1000 lbs/30 ft. stem	

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

BORING B-4-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 10-21-03 - 10-28-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1260.6
SURFACE CONDITIONS:
SAMPLING METHOD: 2 5/8-inch drive



0-53 feet: LANDSLIDE (Qls)

@ 0 feet: GRAVELLEY SANDSTONE, fine to coarse grained sand with pebbles and gravel up to 6" diameter, soft, dry, pale yellowish brown (10YR 6/2)

@ 10 feet: Bedding approximate; N50E, 16SE

@ 10.5 feet: SILTSTONE, moderately soft, dry, moderate yellowish brown (10YR 5/4),

@13 feet: density increase

@ 15.5 feet: Slide Plane, N40E, 28SE, reddish brown silty clay, 3"-5" thick

@ 19 feet: SANDSTONE, fine to coarse grained sand with trace small pebbles, moderately hard, dry to moist, pale yellowish brown (10YR 6/2),

@ 22 feet: cobbles up to 6" diameter

@ 27 feet: SANDY SILTSTONE, fine sand, hard, moist, moderate yellowish brown (10YR 5/4),

@ 32 feet: CLAYEY SILTSTONE, moderately hard to hard, moist, moderate yellowish brown (10YR 5/4),

@ 33.2 feet: Slide Plane: N70E, 6SE 4"-5" thick reddish brown waxy clay

@ 36 feet: SANDY SILTSTONE, fine grained sand and silt, moderately hard, moist, moderate yellowish brown (10YR 5/4),

@ 40 feet: pods of sand in siltstone matrix

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

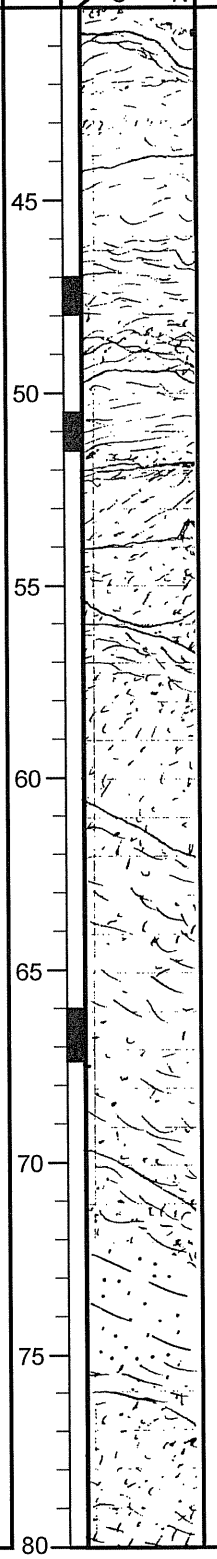
LOG OF BORING

BORING B-4-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-21-03 - 10-28-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
					S	N	



Bag
Bag
Bag

@ 40 feet: slight increase in grain size
@ 41.5 feet: Slide Plane N80E, 29SE, 4"-5" thick reddish brown waxy clay
@ 42 feet: CLAYEY SILTSTONE: some clay, hard, moist, moderate yellowish brown (10 YR 5/4),
@ 43 feet: SILTSTONE to SANDY SILTSTONE, cobbles up to 8" diameter
@ 45.5 feet: waxy to plastic brown clay
@ 47 feet: SILTY CLAYSTONE, some silt, moderately hard, moist, moderately plastic, moderate yellowish brown (10YR 5/4),
@ 48 feet: SANDY SILTSTONE, fine grained sand, hard, moist, trace large pebbles of cemented sandstone, moderate yellowish brown (10YR 5/4),
@ 48.5 to 50.5 feet: numerous low angle fractures
@ 50.5 feet: CLAYEY SILTSTONE, moderate yellowish brown (10YR 5/4)
@ 51 feet: CLAYSTONE, plastic, moist, possible, slide plane, dark yellowish brown (10YR 4/2),
@ 51.9 feet: Slide Plane, N5W, 7SW, 1"-2" thick reddish brown clay, plastic
@ 52 feet: SANDSTONE, fine to medium grained sand, trace silt, pale yellowish brown (10YR 6/2),
@ 53 feet: Slide Plane, N60W, 6SW, ½" thick red clay gouge

53 - 81 feet: SAUGUS FORMATION (QTs)

@ 53 feet: SANDSTONE, fine to medium grained sand, trace silt, hard, moist, pale yellowish brown (10YR 6/2)
@ 56 feet: Minor fault; N25W, 25NE ½" thick red clay gouge
@ 56.5 feet: Bedding; N/S, 40E, sandstone/siltstone
@ 62 feet: Bedding; N30E, 28SE, fine grained sandstone/siltstone
@ 62 feet: SILTSTONE, hard, moist, dark yellowish brown (10YR 4/2)
@ 65 feet: SILTY CLAYSTONE, some silt, hard to very hard, moist, dark yellowish brown (10YR 4/2)
@ 70 feet: Drilling rate slows
@ 71 feet: Bedding approximate; N40E, 29SE, clayey silt/silty sandstone
@ 71 feet: SILTY SANDSTONE; fine to coarse grained sand with silt, hard, moist, dark yellowish brown (10YR 4/2)
@ 77 feet: Gradational contact

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-4-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-21-03 - 10-28-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG (S / N)	SOIL TYPE
				85, 90, 95, 100, 105, 110, 115, 120		no log	

81 -101 feet: PICO FORMATION (Tp)

@ 81 feet: Bedding, N40E, 24SE, limey siltstone bed 5" thick

@ 82 feet:
Rig down 13:50 on 10-21-03
Resume drilling 7:30 on 10-28-03

@ 84.7 feet: Bedrock, N40E, 33SE

@ 85 feet: PEBBLY SANDSTONE, yellowish gray (5Y 7/2), fine to coarse grained sand, trace medium to large pebbles, hard, moist

@ 90 feet: Bedding, N10E, 20SE, pebbly sandstone / silty sandstone

@ 91 feet: Bedding, N40E, 31SE, 1" thick clayey siltstone

93.5 feet: Bedding, N40E, 35SE, coarse grained sandstone / siltstone

93.5 feet: SANDY SILTSTONE, moderate yellowish brown (10YR 5/4), some fine to medium grained sand, hard, moist

@ 98 feet: moisture increase

TOTAL DEPTH 101FEET.
No Caving.
No Groundwater.
Downhole logged to 95 feet.

SAMPLE DEPTH	KELLY WEIGHT
0-30'	5962 lbs.
30-57'	3921 lbs.
57-86'	2531 lbs.
86-116'	1407 lbs
+600 lbs/30 ft. stem	

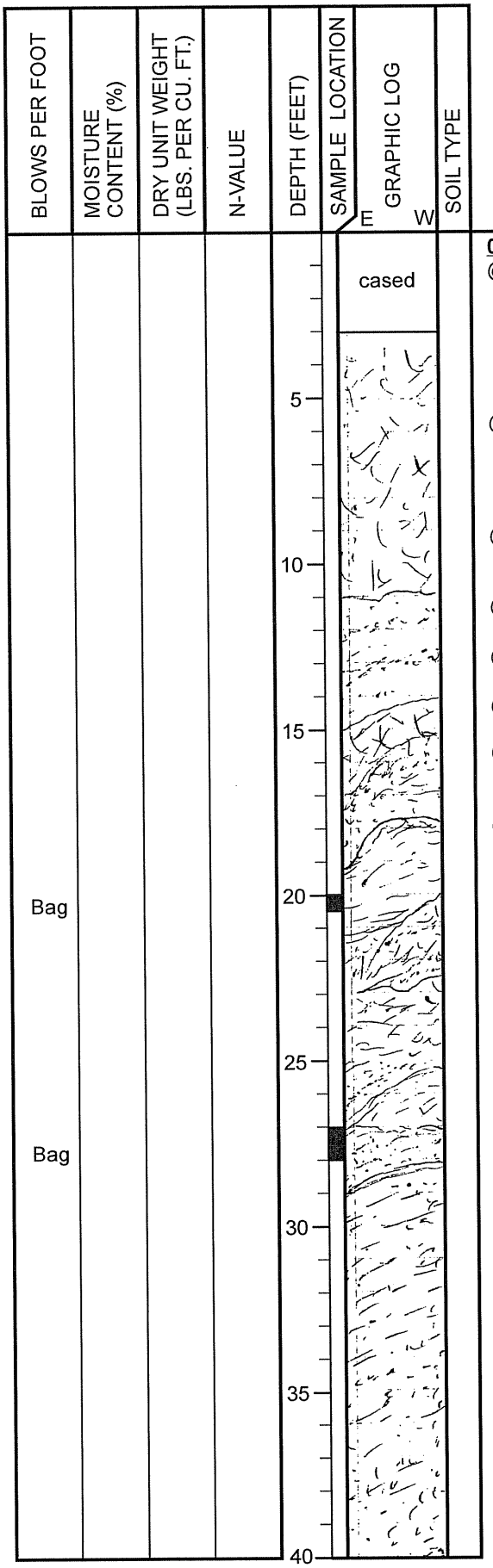
Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-5-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 10-29-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1306.8
SURFACE CONDITIONS:
SAMPLING METHOD: 2 5/8-inch drive



0-28 feet: LANDSLIDE (Qls)

@ 0 feet: SANDSTONE, fine to medium grained sand, soft, dry, pale yellowish brown, (10YR 6/2)

Hole cased from 0-3 feet

@ 6 feet: SANDY SILTSTONE, silt with fine grained sand, moderately hard, dry to moist, moderate yellowish brown (10YR 5/4)

@ 9 feet: color change to grayish orange (10YR 7/4)

@ 11 feet: SANDSTONE, fine to coarse grained sand, trace silt, trace small to medium pebbles, soft, dry, yellowish gray (5Y 7/2),

@ 11-14 feet: Minor caving of sands

@ 14 feet: SILTSTONE, moderately hard, moist, moderate yellowish brown (10YR 5/4),

@ 14 to 17.8 feet: chaotic mix of sand and siltstone

@ 17.8 feet: Slide Plane, N/S, 40E, 2"-3" thick reddish brown clay, waxy, no distinct slide surface

@ 19 feet: CLAYEY SILTSTONE, silt with clay, moderately soft, moist, moderate yellowish brown (10YR 5/4)

@ 20 feet: SILTSTONE, hard, moist, moderate yellowish brown (10YR 5/4)

@ 25 feet: Bedding approximate, N10W, 43NE

@ 25 feet: CLAYSTONE, plastic, moist, moderate yellowish brown (10YR 5/4) to olive gray (5Y 4/1)

@ 28 feet: Slide Plane, N40E, 24SE, 1"-3' thick red to dark gray clay gouge, striations 12,° S 15° E

@ 28 feet: CLAYEY SILTSTONE, moderately hard to hard, moist, dark yellowish brown (10YR 4/2),

28.1-95.5 feet: SAUGUS FORMATION (QTs)

@ 34 feet: SILTSTONE, trace fine sand, hard, moist, moderate yellowish brown (10YR 5/4)

@ 37 feet: SILTY SANDSTONE, fine to medium grained sand with silt, hard, moist, moderate yellowish brown (10YR 5/4)

(CONTINUED ON THE FOLLOWING FIGURE)

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

BORING B-5-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-21-03 - 10-28-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				45	E	 W	
				50			
				55			
				60			
				65			
				70			
				75			
				80			

@ 40.3 feet: Bedding approximate, N10E, 28SE, coarse sandstone

@ 40 feet: PEBBLY SANDSTONE, pale yellowish brown (10YR 6/2), fine to coarse grained sand with small to large pebbles, hard, moist

@ 46 feet: Bedding, N30E, 33SE, coarse sandstone

@ 51.7 feet: Fracture, N30E, 63NW, 1/4" thick silt gouge, approximate ½"-1" normal offset

@ 52.3 feet: Bedding, N/S, 26E, coarse sandstone

@ 62 feet: Bedding, N15E, 22SE, medium to coarse grained sandstone

@ 69 feet: Bedding, N/S, 18E, fine to coarse grained sandstone

@ 70 feet: PEBBLY SANDSTONE, fine to coarse grained sand with small to large pebbles, hard, moist, yellowish gray (5Y 7/2)

@ 74 feet: Bedding, N10E, 22SE, coarse sandstone / siltstone

@ 74 feet: SILTY SANDSTONE, fine to coarse grained sand with silt, hard, moist, moderate yellowish brown (10YR 5/4)

@ 77 feet: Bedding, N15E, 30SE, fine to coarse grained sandstone in silty sandstone

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

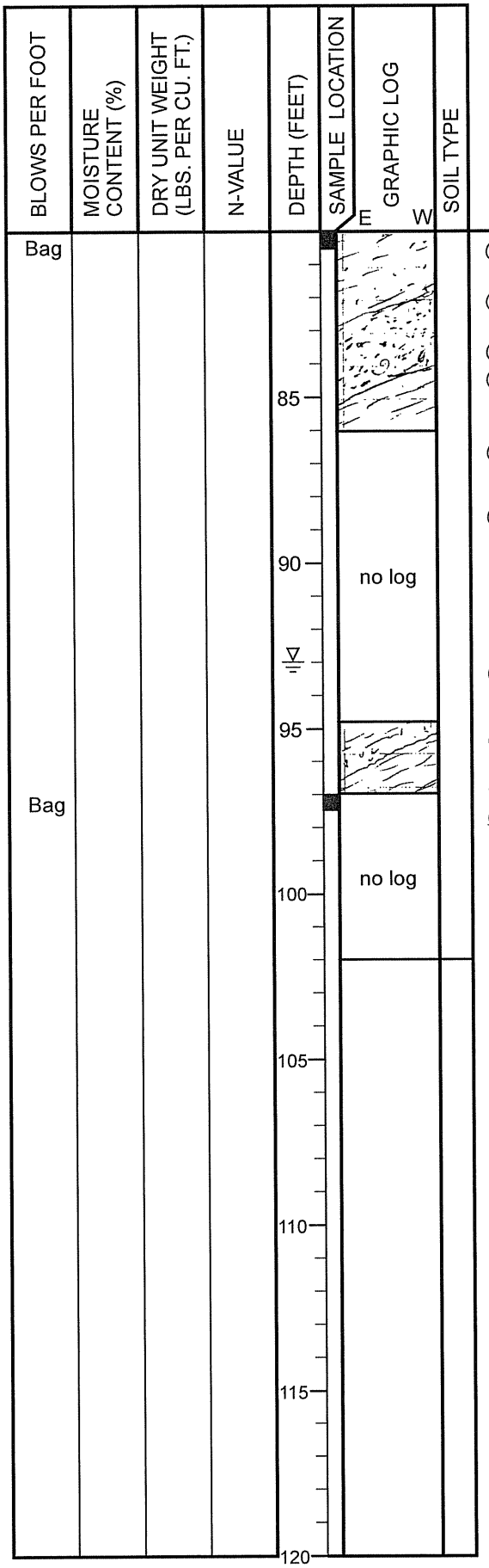
(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-5-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-21-03 - 10-28-03

By: D.G. Francuch



@ 79 feet: SILTSTONE, trace fine to coarse sand, hard, moist, moderate yellowish brown (10YR 5/4)

@ 80 feet: CLAYEY SILTSTONE, some clay, hard, moist, moderate yellowish brown (10YR 5/4)

@ 82 feet: Bedding, N30E, 22SE, siltstone/fine to coarse sandstone

@ 82 feet: SANDSTONE, fine to coarse grained sand with some small to medium pebbles, hard, moist, moderate yellowish brown (10YR 5/4)

@ 84 feet: SILTSTONE, hard, moist, moderate yellowish brown (10YR 5/4)

@ 86-95 feet: No log due to low oxygen

@ 93-97 feet: perched groundwater, boring wall wet but no free water

@ 95 feet: CLAYEY SILTSTONE, silt with some clay, hard, moist, moderate yellowish brown (10YR 5/4)

@ 95.5 feet: Bedding, N/S, 24E

@ 95.5-102 feet: PICO FORMATION (Tp)

@ 95.5 feet: CLAYSTONE, trace silt, hard to very hard, moist, medium dark gray (N4),
No seepage below 97 feet.

@ 100 feet: SILTY SANDSTONE, fine grained sand with silt, hard, moist, dark greenish gray (5GY 4/1)

TOTAL DEPTH 102 FEET.
Minor Caving 11-14 feet.
Minor seepage 93-97 feet.
Downhole logged to 97 feet.

SAMPLE DEPTH	KELLY WEIGHT
0-30'	5962 lbs.
30-57'	3921 lbs.
57-86'	2531 lbs.
84-116'	1407 lbs
+600 lbs/30 ft. stem	

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES
FIGURE A-2.5c

BORING B-6-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 10-30-03 - 10-31-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1305.3
SURFACE CONDITIONS:
SAMPLING METHOD: 2 5/8-inch drive

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
23				40	S N	cased	

0-31.1 feet LANDSLIDE (Qls)

@ 0 feet: SILTY SANDSTONE, fine to grained sand with silt, hard, moist, pale yellowish brown (10YR 6/2)

@ 4 feet: Fracture

@ 5 feet: pebbles up to 2" in diameter

@ 8 feet: color change to moderate yellowish brown (10YR 5/4), Bedding approximate; N65E, 55SE

@ 8.5 feet: rootlets

@ 9 feet: SANDY SILTSTONE, silt with fine grained sand, moderately hard, moist, moderate yellowish brown (10YR 5/4)

@ 10 feet: Fracture; N55W, 45NE, 1/8" -1/4" clay gouge separates silty sandstone from pebbly sandstone

@ 13 feet: SANDSTONE, fine to medium grained sand, hard, dry to moist, yellowish gray (5Y 7/2)

@ 13-15 feet: rootlets

@ 17 feet: SILTY SANDSTONE, fine to coarse grained sand with silt, moderately hard, moist, grayish orange (10YR 7/4)

@ 17 feet: Fracture; N65W, 82NE

@ 20 feet: rootlets

@ 20.5 feet: Bedding; N10E, 26SE, irregular contact

@ 21.5 feet: PEBBLY SANDSTONE, fine to coarse grained sand, trace silt, pebbles up to 2" diameter, hard, moist, pale yellowish brown (10YR 6/2)

@ 25 feet: Fracture splits into two strands, separates fine grained sand from coarse grained sand

@ 28 feet: Bedding? N10E, 46SE, irregular contact

@ 28 feet: SILTSTONE, moderately hard, moist, moderate yellowish brown (10YR 5/4)

@ 31.1 feet: Slide Plane; N5W, 22NE, 3" wide zone of waxy clay sandwiched between two shears each 1/16"-1/8" thick gouge

31.5-96 feet: SAUGUS FORMATION (QTs)

@ 31.5 feet: CLAYEY SILTSTONE, trace fine to medium grained sand, hard, moist, moderate yellowish brown (10YR 5/4)

@ 34 feet: Minor Fault; N50W, 42NE, 1/16" wide clay gouge, 4"reverse offset (apparent)

@ 35 feet: SANDSTONE, fine to medium grained sand, moderately hard, moist, moderate yellowish brown (10YR 5/4)

@ 38 feet: Fracture N45W, 46NE, 1/16"-1/8" wide silt gouge

@ 39 feet: SANDSTONE, fine to coarse grained sand, trace pebbles up to 2" diameter, moderately hard, moist, pale yellowish brown (10YR 6/2),

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

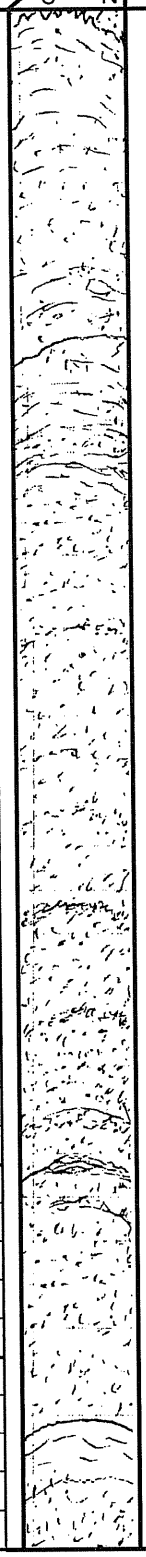
(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-6-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-30-03 - 10-31-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				45	S N		
				50			
				55			
				60			
				65			
				70			
				75			
				80			

@ 40 feet: Bedding, N/S, 23E, contact, worm burrows
@ 40 feet: SANDY SILTSTONE, silt with fine sand, trace clay, hard, moist, moderate brown (5YR 4/4),

@ 46 feet: SILTY SANDSTONE, fine grained sand with silt, hard, moist, gradational contact, moderate brown (5YR 4/4),

@ 47 feet: PEBBLY SANDSTONE, fine to coarse grained sand with pebbles and small cobbles, up to 4" diameter, hard, moist, moderate yellowish brown (10YR 5/4)

@ 50 feet: Fracture; N40E, 30SE, 1/8" wide clay gouge

@ 50 feet: SANDY SILTSTONE, silt with fine to medium sand, moderately hard, moist, moderate yellowish brown (10YR 5/4)

@ 52 feet: SILTY SANDSTONE, fine grained sand with silt, moderately hard, moist, pale yellowish brown (10YR 6/2)

@ 54 feet: Bedding, N10E, 26SE

@ 54 feet: SANDSTONE, fine to coarse grained sand, trace small pebbles, moderately hard, moist, yellowish gray (5Y 7/2)

@ 60.5 feet: Bedding; N5W, 24NE, fine grained sandstone,

@ 63 feet: PEBBLY SANDSTONE, fine to coarse grained sand with medium pebbles, trace cobbles up to 8" diameter, hard, moist, yellowish gray (5Y 7/2)

Stopped @ 69 feet, @ 15:30 on 10/30/03
Resume @ 7:00 on 10/31/03

@ 70.7 feet: Bedding; N5E, 22SE, coarse grained sandstone / fine grained sandstone

@ 71.6 feet: Bedding; N/S, 26E ½"-3" thick clayey siltstone

@ 72 feet PEBBLY SANDSTONE, fine to coarse grained sand with small pebbles, moderately hard, moist, yellowish gray (5Y 7/2)

@ 77.8 feet: Bedding; N5W, 23NE contact
@ 77.8 feet: SANDY SILTSTONE, silt with fine to coarse grained sand, trace clay, hard, moist, moderate yellowish brown (10 YR 5/4),

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

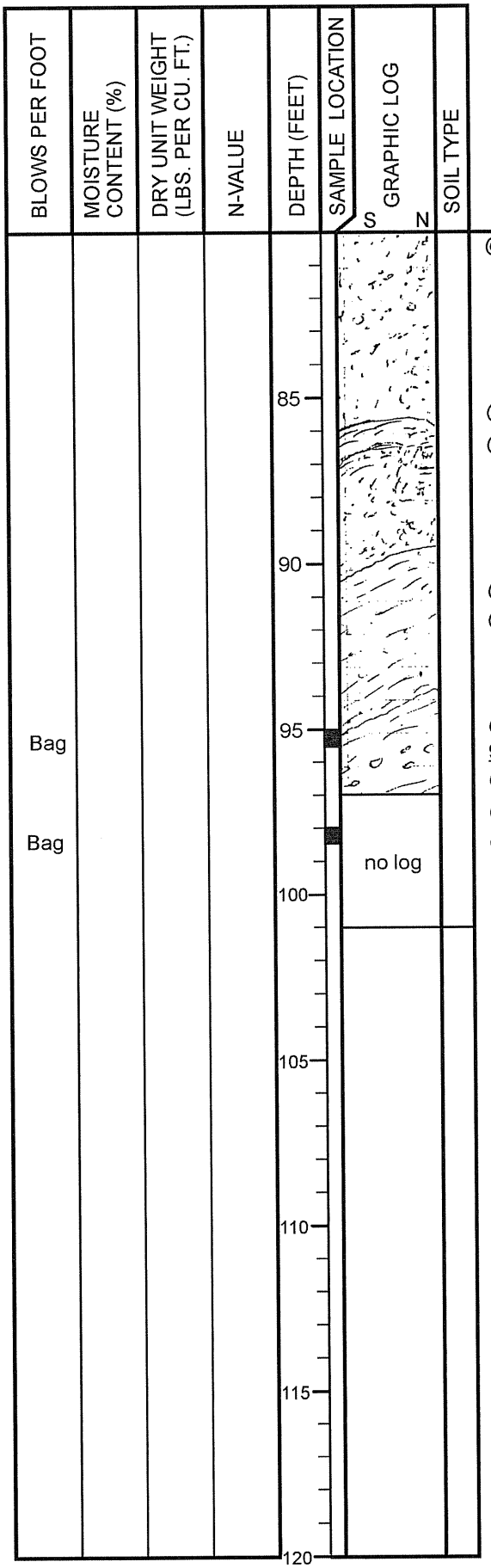
(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-6-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 10-30-03 - 10-31-03

By: D.G. Francuch



@ 81 feet: SANDSTONE, fine to coarse grained sand, trace small pebbles up to 1" diameter, moderately hard, moist, pale yellowish brown (10YR 6/2),

@ 85.5 feet: Bedding N15W, 27NE, contact

@ 85.5 feet: SILTY SANDSTONE, fine grained sand with silt, hard, moist, moderate yellowish brown (10YR 5/4)

@ 90.7 feet: Bedding; N/S, 23E, contact

@ 90.7 feet: CLAYEY SILTSTONE, silt with clay, hard, moist, moderate yellowish brown (10YR 5/4),

@ 95 feet: Bedding N/S, 27E, parting in siltstone

96-101 feet: PICO FORMATION (Tp)

@ 96 feet: limey siltstone

@ 97 feet: CLAYEY SILTSTONE, hard, moist, light olive gray (5Y 5/2)

@ 98 feet: SILTY CLAYSTONE, clay with silt, moderately hard to hard, moist, medium dark gray (N4)

TOTAL DEPTH 101 FEET.
No Caving.
No groundwater.
Downhole logged to 97 feet.

SAMPLE DEPTH	KELLY WEIGHT
0-30'	5962 lbs.
30-57'	3921 lbs.
57-86'	2531 lbs.
86-116'	1407 lbs
+600 lbs/30 ft. stem	

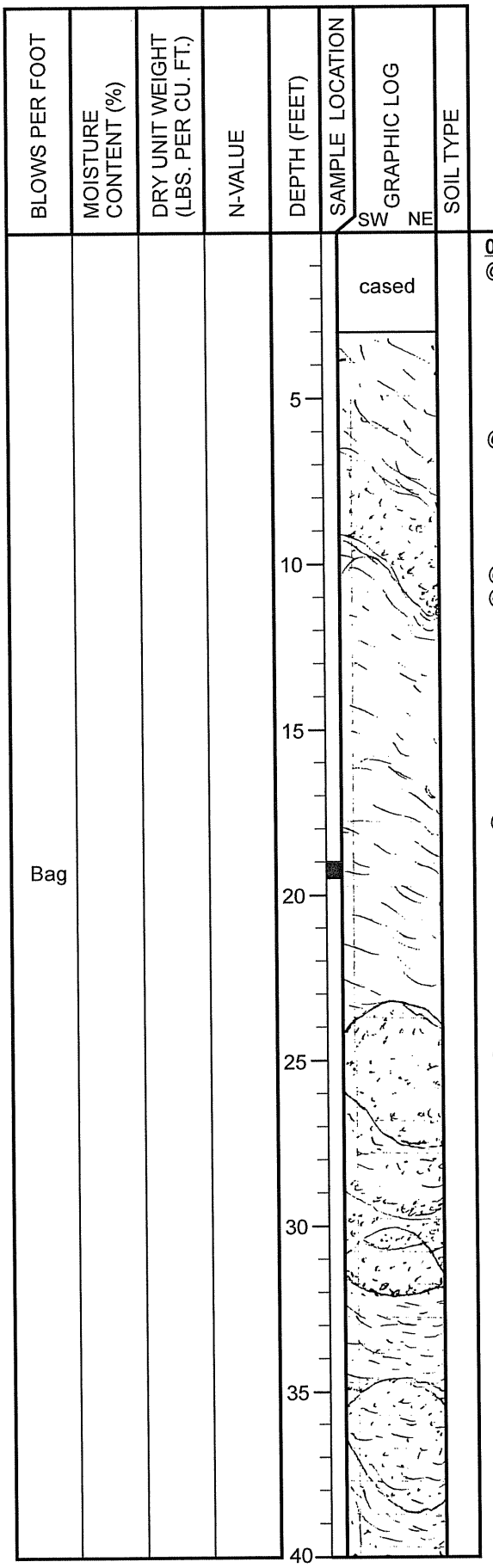
Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-7-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 11-3-03 - 11-4-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1201+/-
SURFACE CONDITIONS:
SAMPLING METHOD: 2 5/8-inch drive



0-74 feet: SAUGUS FORMATION (QTs)

@ 0 feet: SILTY SANDSTONE, fine to medium grained sand with silt, moderately hard, moist, light brown (5YR 6/4)

@ 6 feet: SANDY SILTSTONE, silt with fine grained sand, trace coarse grained sand, moderately hard, moist to dry, grayish orange (10YR 7/4)

@ 10 feet: Bedding; N40W, 50NE
@ 10 feet: SILTY CLAYSTONE, clay with silt, hard, moist, moderate yellowish brown (10YR 5/4)

@ 18 feet: plastic clay, gray

@ 24.4 feet: Minor Fault; N75E, 35SE, 1/4" wide brown silt gouge

@ 26 feet: Bedding; N60W, 44NE
@ 26 feet: SILTY SANDSTONE, fine grained sand with silt, moderately hard, moist, pale yellowish brown (10YR 6/2)

@ 31 feet: Minor Fault; N90W, 44S, 1/8" wide silt gouge, 2" normal apparent offset
@ 32 feet: Bedding N30W, 46NE

@ 34 feet: CLAYEY SILTSTONE, silt with clay, trace fine to medium grained sand, hard, moist, moderate yellowish brown (10YR 5/4)

@ 35.5 feet: Minor Fault; N90W, 37S, 1/16" -1/8" wide clay gouge

@ 36 feet: CLAYSTONE, clay with trace silt, moderately hard, moist, dark yellowish brown (10YR 4/2)

@ 36.5 feet: Bedding N40W, 53NE, silt/silty clay

(CONTINUED ON THE FOLLOWING FIGURE)

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

BORING B-7-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 11-3-03 - 11-4-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
						SW NE	
Bag				45			
7				50			
				55			
				60			
				65			
				70			
				75			
				80			

@ 42 feet: SILTY CLAYSTONE, clay with silt, moderately hard, moist, light olive gray (5Y 6/1)

@ 44 feet: Minor Fault N55W, 90, joins clay bed at 44'

@ 44 feet: SILTY SANDSTONE, fine grained sand with silt, moderately hard, moist, yellowish gray (5Y 7/2)

@ 45 feet: Bedding: N35W, 33NE, 1"thick gray clay

@ 46 feet: CLAYSTONE, moderately soft, moist, plastic, light olive gray (5Y 5/2)

@ 48 feet: CLAYEY SILTSTONE, silt with clay, hard, moist, olive gray (5Y 4/1)

@ 53 feet: CLAYSTONE, moderately soft, moist, plastic, medium dark gray (N4)

@ 54 feet: Bedding N30W,49 NE, 4-5" thick plastic gray clay

@ 58 feet: SILTSTONE, hard, moist, medium dark gray (N4)

@ 63 feet: Minor Fault: N10W, 47SW, ½"-1" wide zone of silt and clay gouge

@ 65 feet: Shear: N10E, 55SE, along base of sheared claystone

@ 67 feet: Bedding: N35W, 35NE

@ 70 feet: CLAYSTONE, moderately soft, moist, plastic, medium dark gray (N4)

@ 72 feet: Bedding: N20W, 35NE

@ 72 feet: SANDY SILTSTONE, silt with fine grained sand, moderately hard, moist, pale olive (10Y 6/2)

@ 74-111 feet: PICO FORMATION (Tp)

@ 74 feet: SILTY CLAYSTONE, clay with silt, hard, moist, fossiliferrous, dark gray (N3),

@ 77 feet: Bedding: N50E, 43SE, truncated by sheared clay

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

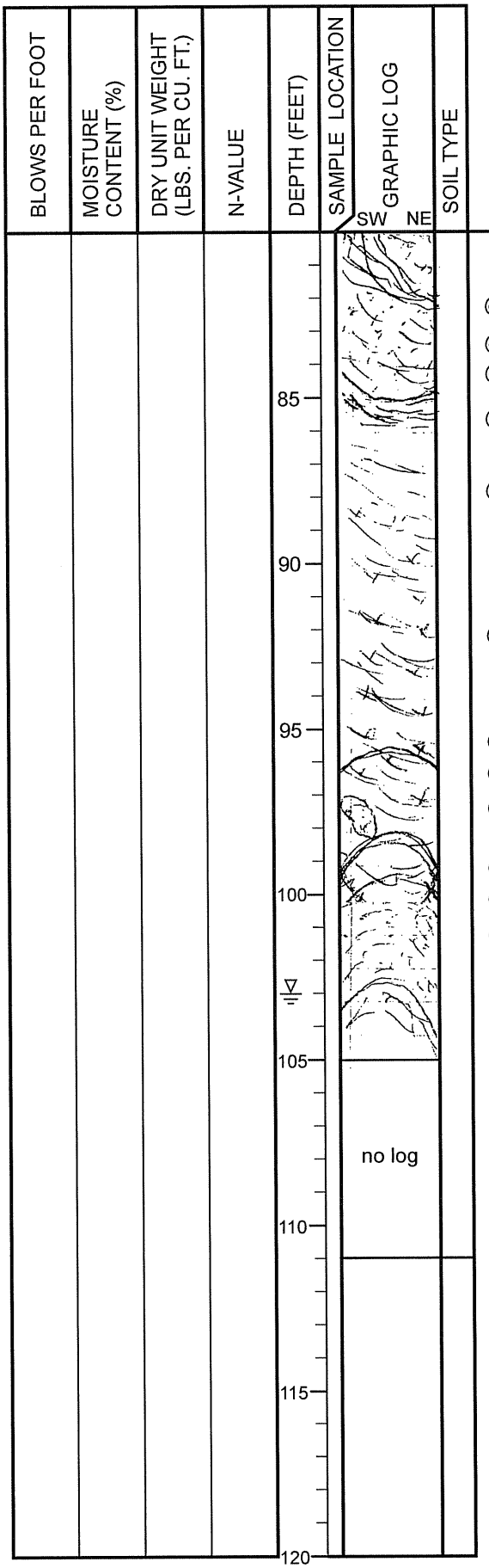
LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-7-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 11-3-03 - 11-4-03

By: D.G. Francuch



@ 82 feet: CLAYSTONE, moderately soft, moist, plastic, dark gray (N3)

@ 84 feet: Bedding: N10W, 26NE, siltstone/claystone

@ 84 feet: SILTSTONE, hard, moist, fossiliferrous, dark greenish gray (5GY 4/1)

@ 85 feet: Rig down @ 13:00 on 11/3/03
resume drilling @ 7:55 on 11/4/03
No water from bottom of boring @ 85 feet

@ 87 feet: limey siltstone, very hard

@ 92 feet: CLAYSTONE, hard, moist, moderate plasticity, dark greenish gray (5GY 4/1)

@ 95 feet: SILTSTONE, hard, moist, dark greenish gray (5GY 4/1)

@ 96 feet: Shear: N60W, 35SW, brown clay 1" thick

@ 97 feet: sandstone block 12" diameter in claystone matrix, sheared

@ 99 feet: Shear N40E, 50SE, 1" clay gouge

@ 100 feet: Bedding N40E, 46SE

@ 100 feet: increase in moisture, perched groundwater above clay at 103 feet

@ 104 feet: CLAYEY SILTSTONE, silt with clay, hard to very hard, moist, dark greenish gray (5GY 4/1)

@ 104 feet: Bedding N50E, 39SE, siltstone / claystone

TOTAL DEPTH 111 FEET.
No Caving.
Minor perched water at 100-103 feet.
Downhole logged to 105 feet.

SAMPLE DEPTH	KELLY WEIGHT
0-30'	5952 lbs.
30-57'	3921 lbs.
57-86'	2531 lbs.
86-116'	1407 lbs
+600 lbs/30 ft. stem	

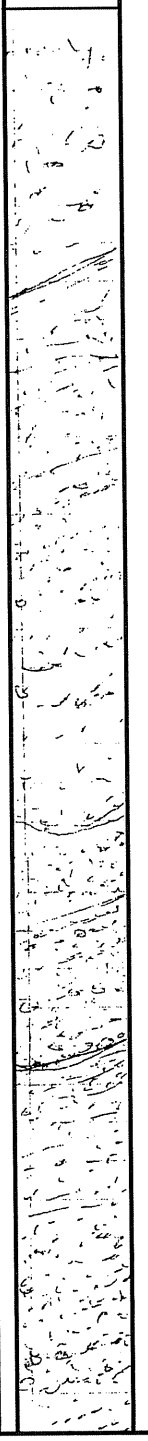
Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-8-03

JOB NUMBER: 2002-036-01 By: D.G. Francuch
DATE DRILLED: 11-4-03 - 11-5-03
EQUIPMENT USED: 24"-Diameter Bucket Auger
ELEVATION: 1213.6
SURFACE CONDITIONS:

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				5, 10, 15, 20, 25, 30, 35, 40	E W		

0-30.5 feet: LANDSLIDE (Qls)

@ 0 feet: SANDY SILTSTONE, silt with fine grained sand, moderately soft, dry to moist, moderate yellowish brown (10YR 5/4)

@ 7 feet: PEBBLY SANDSTONE, fine to coarse grained sand with pebbles up to 3" in diameter, moderately soft, moist, yellowish gray (5Y 7/2),

@ 10 feet: Slide plane; N/S, 31E, 1" thick plastic clay gouge, reddish brown

@ 10 feet: SANDY TO CLAYEY SILTSTONE, moderately soft, moist, semi plastic, moderate yellowish brown (10YR 5/4)

@ 15 feet: Bedding; N10E, 28SE

@ 15 feet: SANDSTONE, fine to coarse grained sand with small pebbles, moderately hard, moist, yellowish gray (5Y 7/2)

@ 18 feet: PEBBLY SANDSTONE, fine to coarse grained sand with pebbles up to 3" diameter, pale yellowish brown (10YR 6/2)

@ 24 feet: Bedding; N70E, 24SE, cross-bedding coarse sandstone

@ 27 feet: Bedding; N55E, 20SE

@ 27 feet: COBBLY SANDSTONE, fine to coarse grained sand with pebbles and cobbles up to 5", hard, moist, yellowish gray (5Y 7/2)

@ 30.5 feet: Slide plane: N25E, 31SE, polished surface

30.5 -76 feet: SAUGUS FORMATION (QTs)

@ 30.6 feet: CLAYSTONE, moderately soft, moist, plastic (possible slide plane), moderate brown (5YR 4/4)

@ 32.5 feet: SILTSTONE, trace fine sand, trace clay, moderately hard, moist, moderate brown (5YR 4/4)

@ 35 feet: PEBBLY SANDSTONE, fine to coarse grained sand with pebbles up to 2" diameter, moderately hard, moist, pale yellowish brown (10YR 6/2)

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

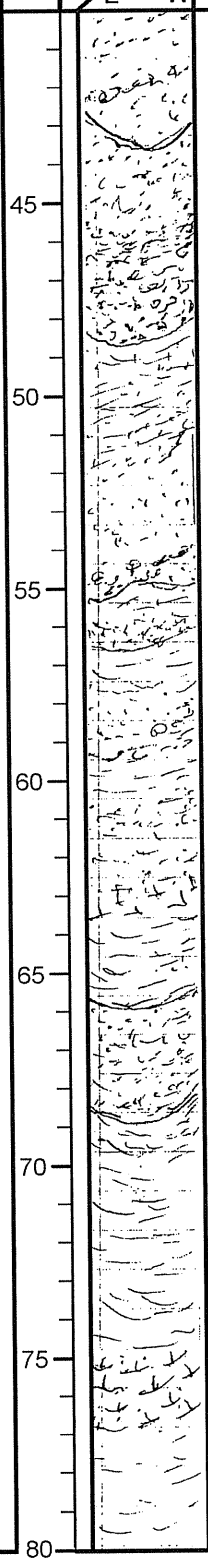
LOG OF BORING

BORING B-8-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 11-4-03 - 11-5-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG (E / W)	SOIL TYPE



@ 42.7 feet: Fault; N65E, 49SE, reddish brown, clayey silt gouge ½"-1" wide
@ 43 feet: interbedded silt and clay within sandstone

@ 45.5 feet: Bedding; N20E, 22SE, medium to coarse grained sandstone

@ 48 feet: Bedding; N20E, 22SE, striations 20° due south
@ 48 feet: SILTSTONE, trace clay, moderately hard to hard, moist, moderate brown (5YR 4/4)
@ 50 feet: Stopped drilling @ 17:05 on 11/4/03
Resume drilling @ 6:40 on 11/5/03

@ 52 feet: SANDSTONE, fine to coarse grained sand, some pebbles up to 2" diameter, moderately hard to hard, moist, yellowish gray (5Y 7/2)

@ 56 feet: SANDY SILTSTONE, silt with fine grained sand, moderately hard, moist, gradational contact, moderate yellowish brown (10YR 5/4)
@ 57 feet: Bedding, N5E, 22SE, fine grained sandstone in siltstone

@ 60 feet: PEBBLY SANDSTONE, fine to coarse grained sand with pebbles up to 1" diameter, moderately hard to hard, moist, pale yellowish brown (10YR 6/2),

@ 65 feet: SANDY SILTSTONE, silt with fine grained sand, hard, moist, moderate yellowish brown (10YR 5/4)

@ 69 feet: Bedding; N65E, 40SE
@ 69 feet: SILTY SANDSTONE, fine grained sand with silt, hard, moist, pale yellowish brown (10YR 6/2)

@ 72 feet: SILTSTONE, hard, moist, laminated, moderate yellowish brown (10YR 5/4),

@ 74 feet: CLAYEY SILTSTONE, silt with clay, hard, moist, moderate yellowish brown (10YR 5/4),

76-120 feet: PICO FORMATION (Tp)
@ 76 feet: limey siltstone

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

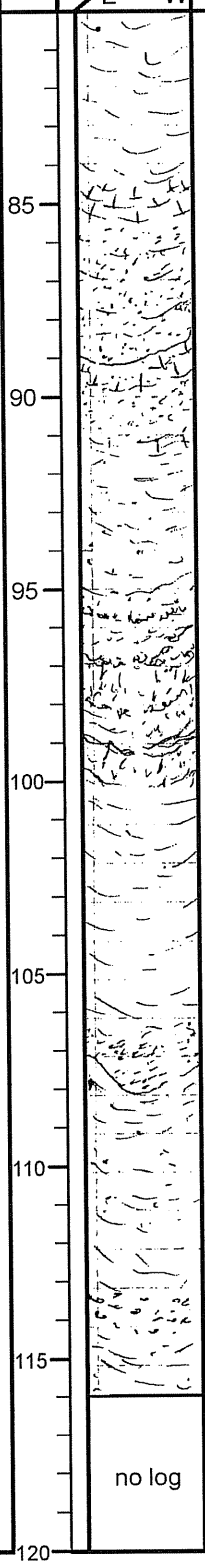
R.T. FRANKIAN & ASSOCIATES
FIGURE A-2.8b

BORING B-8-03 (CONTINUED)

JOB NUMBER: 2002-036-01
DATE DRILLED: 11-4-03 - 11-5-03

By: D.G. Francuch

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE



@ 82 feet: SILTY SANDSTONE, fine to medium grained sandstone with silt, hard, moist, dark yellowish brown (10YR 4/2)

@ 85 feet: Bedding approximate; N50E, 38SE, limey siltstone
@ 85 feet: SANDY SILTSTONE, silt with fine grained sand, hard, moist, limey, moderate yellowish brown (10YR 5/4),

@ 89 feet: Bedding; N45E, 27SE
@ 89 feet: SILTY SANDSTONE, fine to medium grained sand with silt, moderately hard, moist, limey, yellowish gray (5Y 7/2),
@ 91 feet: CLAYEY SILTSTONE, silt with clay, trace fine grained sand, hard, moist, moderate yellowish brown (10YR 5/4)
@ 92 feet: SILTSTONE, hard, moist, moderate yellowish brown (10YR 5/4)

@ 95.5 feet: Bedding; N30E, 23SE
@ 96 feet, PEBBLY SANDSTONE, fine to coarse grained sand with pebbles up to 2" diameter, hard moist, yellowish gray (5Y 7/2)

Stopped logging @ 96 feet on 11/5/03 at 16:50
Resume logging on 11/6/03 @ 7:15
@ 98 to 100 feet: interbedded siltstone and sandstone
@ 100 feet: SILTSTONE, hard to very hard, moist, limey, moderate yellowish brown (10YR 5/4)

@ 107 feet: Bedding approximate: N30E, 28SE, fine grained sandstone

@ 107 feet: CLAYEY SILTSTONE, silt with clay, moderately hard to hard, moist, dark yellowish orange (10YR 6/6)

@ 108 feet: increase in moisture

@ 112 feet: Begin stemming @ 12:10
@ 113 feet: Bedding, approximate, N35E, 27SE, pebble bed
@ 114 feet: SILTY SANDSTONE, fine grained sand with silt, hard, moist, moderate yellowish brown (10YR 5/4)

SAMPLE DEPTH	KELLY WEIGHT
0-30'	5952 lbs.
30-57'	3921 lbs.
57-86'	2531 lbs.
86-116'	1407 lbs
+600 lbs/30 ft. stem	

TOTAL DEPTH 120 FEET.
No Caving.
No Groundwater
Downhole logged to 116 feet.

Note: The log of subsurface conditions shown hereon applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES
FIGURE A-2.8c

BORING B-1-09

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/13/09
EQUIPMENT USED: 24" Rotary Bucket rig with Sleeve sampler. Driving weights - 5952 lbs. (0-30'), 3921 lbs. (30-57'), and 2531 lbs. (57-86')
ELEVATION: 1150'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-84.5'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				0			ML
4	2.6	121	-	10			
8	3.1	120	-	20			
10	4.5	118	-	30			
				40			

ARTIFICIAL FILL (af)
SANDY SILT: soft, dry, light gray

SAUGUS FORMATION (QTs)
INTERBEDDED SANDSTONE, SILTY SANDSTONE, and SANDY SILTSTONE, very fine to medium, low hardness, dry, light gray (N7) to greenish gray (5GY 6/1), average bed thickness is 1-2', weakly cemented, poorly-defined bedding
@ 3 feet: 6" thick reddish brown lenticular siltstone
@ 3.5 feet: Contact N26W, 43NE

BEDDING: N5E, 22SE

pale yellowish brown (10YR 6/2) to yellowish gray (5Y 7/2)

BEDDING: N10E, 14SE

SANDSTONE: very fine to coarse, with gravel, weakly cemented, low hardness, slightly moist

BEDDING: N20W, 9NE: undulatory contact

SILTSTONE: massive, trace fine to coarse sand, low hardness, slightly moist, pale yellowish brown (10YR 6/2)

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

BORING B-1-09 (CONTINUED)

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/13/09
EQUIPMENT USED: 24" Rotary Bucket rig with Sleeve sampler. Driving weights - 5952 lbs. (0-30'), 3921 lbs. (30-57'), and 2531 lbs. (57-86')
ELEVATION: 1150'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-84.5'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
14	6.6	127	-	45			
20	4.8	124	-	50			
11	9.2	122	-	55			
15	7.2	123	-	60			
				65			
				70			
				75			
				80			

SANDSTONE: fine to coarse, weakly cemented, low hardness, slightly moist, light gray (N7) to light brownish gray (5YR 6/1), poorly defined bedding

CROSS-BEDDING: N2E, 27NW

fine to medium, light gray (N7)

BEDDING: N18W, 26NE

SILTSTONE: slightly clayey, massive, soft, slightly moist, pale reddish brown (10R 5/4)

SILTY SANDSTONE/SANDY SILTSTONE: very fine, micaceous, weakly cemented, low hardness, slightly moist, light gray (N7)

BEDDING: N30W, 22NE

SILTSTONE: micaceous, some very fine sand, massive, low hardness, moist, pale reddish brown (10R 5/4) to light brownish gray (5YR 6/1)

light seepage

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-1-09 (CONTINUED)

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/13/09
EQUIPMENT USED: 24" Rotary Bucket rig with Sleeve sampler. Driving weights - 5952 lbs. (0-30'), 3921 lbs. (30-57'), and 2531 lbs. (57-86')
ELEVATION: 1150'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-84.5'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
40/6"	7.2	117	-	85			

Bottom of Boring at 84.5 feet.
No caving. Light seepage at 72.5'.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-2-09

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/14/09
EQUIPMENT USED: 24" Rotary Bucket rig with Sleeve sampler. Driving weights - 3160 lbs. (0-24'), 2040 lbs. (24-46'), and 1120 lbs. (46-72')
ELEVATION: 1095'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-71.5'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
				0	ML	**LANDSLIDE DEBRIS (Qls)** SANDY SILT: very fine, soft, dry, light brownish gray (10R 5/4)
10	6.3	124	-	10		SILTSTONE: fine to medium sand, soft, dry, light brown (5YR 6/4), no discernible structure 3/4" to 2" thick plastic clay, slightly undulatory, moderate reddish brown (10R 4/6), N70E, 27SE
			-	15		SLIDE PLANE: N15E, 22SE: 1" thick plastic clay, moderate reddish brown (10R 4/6)
12	10.4	121	-	20		**SAUGUS FORMATION (QTs)** SANDSTONE: very fine to medium, weathered, low hardness, moist, light gray (N7) to light brownish gray (10R 5/4) SILTSTONE: micaceous, low hardness, moist, light grayish brown (10R 5/4)
				25		SILTY SANDSTONE: very fine to medium, micaceous, laminated, low hardness, slightly moist, yellowish gray (5Y 7/2), weakly cemented BEDDING: N10W, 14NE PEBBLY SANDSTONE: fine to very coarse, well-cemented, moderately hard, slightly moist, light gray (N7) to yellowish gray (5Y 7/2)
52/9"	1.9	134	-	30		BEDDING: N40W, 14NE INTERBEDDED SANDSTONE and PEBBLY SANDSTONE, weakly cemented to moderately cemented, low hardness, slightly moist, light gray (N7) to yellowish gray (5Y 7/2)
				35		BEDDING: N18W, 11NE: defined by fine laminations in
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

BORING B-2-09 (CONTINUED)

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/14/09
EQUIPMENT USED: 24" Rotary Bucket rig with Sleeve sampler. Driving weights - 3160 lbs. (0-24'), 2040 lbs. (24-46'), and 1120 lbs. (46-72')
ELEVATION: 1095'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-71.5'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
57/9"	4.7	124	-					sandstone
								BEDDING: N-S, 16E
				45				BEDDING: N18E, 25SE
								SILTSTONE: slightly clayey, micaceous, low hardness, slightly moist, greenish gray (5GY 6/1)
58	10.6	131	-	50				
				55				
62/9"	15.3	117	-					4-6" thick plastic clay bed, dark gray (N3)
62/8"	11.8	123	-	60				unoxidized, medium light gray (N5)
				65				pale yellowish brown (10YR 6/2)
62	15.9	114	-	70				
								Bottom of Boring at 71.5 feet. No groundwater. No caving.
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-3-2009

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/13/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1026'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-72'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
							SM/ML	**LANDSLIDE DEBRIS (Qls)** SILTY SAND/ SANDY SILT: fine, light olive brown (2.5Y 5/3), silty appears as mixture of fine grained sandstone & siltstone
5			-	5				
7/9"			-	10				laminated fine sands, near horizontal slightly clayey
12/10"			-	15				concretionary layer, near horizontal sandy, hard, cemented layer, fractured, olive gray (5Y 5/2)
							ML	CLAYEY SILT: base of Qls near horizontal
14			-	20				**SAUGUS FORMATION (QTs)** SANDSTONE: fine to medium, moderately well sorted, moderately hard, slightly moist BEDDING: N25W, 8NE
27/7"			-	25				BEDDING: N21W, 14NE: coarse sand layer N5W, 16NE
								CONGLOMERATE: coarse sand, pebbly, moderately hard, slightly moist
36/7"			-	30				
24/7"			-	35				BEDDING: N10, 15E: silty layer in pebble conglomerate
				40				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-3-2009 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/13/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1026'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-72'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
39/7"			-				
42/9"			-	45			
42			-	50			
46			-	55			
45/10"			-	60			
68			-	65			
58/9"			-	70			
				75			
				80			

SANDSTONE: fine to medium, well sorted, slightly laminated, very moist to wet, yellowish brown

CONTACT/BEDDING: N10W, 14E: light seepage

SILTSTONE: with clay, massive, moderately hard, moist, bluish gray to dark gray (5Y, 4/1), seepage along fractures from 45'-48'

becomes very clayey, slickensides within clay layer

SANDSTONE: fine to medium, poorly sorted, dense, moist, dark olive gray

Bottom of Boring at 72 feet.
Light seepage at 45'. No caving. Minor sloughing in saturated sand @ 43' to 45'. Slickenslide clay layer at 62'-64'.
Downhole logged to 50'.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-1-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/14/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1260.5'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-72'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)
12	7.4	126	-	5
12/9"	4.2	126	-	10
15	4.6	119	-	15
9	12.1	119	-	20
21/9"	3.3	115	-	25
21/9"	2.9	118	-	30
12/9"	4	123	-	35
				40

SAMPLE LOCATION | GRAPHIC LOG | SOIL TYPE

PICO FORMATION (Tp)

SANDSTONE: medium to coarse, with granules (10%) and occasional pebbles (2-5%), slightly moist, light olive brown (2.5Y 5/4)

fine to medium

BEDDING: N50E, 35SE

drilling slower, rock appears to be more cemented

becomes primarily medium, slightly silty

BEDDING: N70E, 35S

CLAYSTONE/SILTSTONE: massive, dense, olive brown to dark olive brown (2.5Y 4/3)

BEDDING: N40E, 30SE

PEBBLY SANDSTONE: fine to coarse, with gravel (5-10%), poorly sorted, damp, yellowish brown to tan (2.5Y, 6/6)

BEDDING: N80E, 38S (pebble lineation)

BEDDING: N79E, 41S

BEDDING: N70E, 35S
coarse, with granules and pebbles

SHEAR: N50E, 80S
BEDDING: N75E, 33S
with rounded to sub-rounded gravel, occasional cobles to 5"

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-1-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/14/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1260.5'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-72'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
19/6"	3.9	116	-					minor cobbles (5%) to 4"
								CLAYSHEAR: N60W, 61S
23	3.9	119	-	45				BEDDING: N68E, 36S
35/6"	3.7	113	-	50				BEDDING: N60E, 38S (SANDSTONE OVER CLAYSTONE)
								CLAYSTONE: fine to medium, massive to thickly bedded, dense, slightly moist, olive greenish gray (5Y 5/4) to yellowish gray
38/6"	8.1	113	-	55				CLAYEY LAYER: N30E, 38S
								fine, laminated, clayey
47/11"	11.3	118	-	60				BEDDING: N60E, 38S: clay
								CLAYEY SILTSTONE: interlayered, laminated, soft, slightly moist, brown to bluish gray
25	9.2	119	-	65				BEDDING: N70E, 42S BEDDING: N72E, 41S silt and clayey silt and fine sand with bluish gray to reddish brown layers of clayey silt with yellowish brown sandy layers
								becomes olive gray
40/6"	8.9	113	-	70				SANDSTONE: fine to medium, slightly silty, dense, moist, bluish gray (unoxidized)
								Bottom of Boring at 72 feet. No groundwater. No caving.
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-2-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/15/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1300'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-52'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				0			SM
5	4.6	113	-	10			
7	11	114	-	20			
5	16.4	108	-	25			
			-	30			
8	15.8	108	-	35			
				40			

ARTIFICIAL FILL (af)
SILTY SAND: fine to medium, massive, medium dense, damp, light olive brown (2.5Y, 5/3)

base of fill in clean contact with bedrock and horizontal

PICO FORMATION (Tp)
SILTSTONE: massive, damp, olive gray (5Y, 4/2) to light olive gray (5Y 6/2)

CONTACT: N80E, 38S
BEDDING: N78E, 36S

CLAYSTONE

red with slick dark reddish brown (2.5YR 3/3)

silty, firm, moist, locally slickensided where more clayey

SANDSTONE: fine, massive, dense, damp, light olive gray (5Y 6/2)

contact approximately 70 degrees between sandstone and claystone. Minor shearing along and throughout, but no gouge or fault gouge, appears to be axis of fold
SHEAR: EW, 75N

SHEAR: N86E, 78N

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-2-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/15/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1300'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-52'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
11	9.8	117	-	45				BEDDING/CONTACT: N50W, 65NE; N48W, 68NE CLAYSTONE: fine, massive, dense, damp, red, with slicks very plastic, stiff, no bedding discernable downhole, occasional sandy interlayers, but not laterally extensive, massive
28	4.6	133	-	50				SILTSTONE: fine, dense, damp, light olive gray (5Y 6/2), laminated with claystone interlayers, appears in sample as near vertical, approximately 80 degree dip
				55				Bottom of Boring at 52 feet. No groundwater. No caving.
				60				
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-3-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/14/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1376'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-111'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
12/8"	4.9	128	-	10			
19	6.1	134	-	20			
22	3.4	123	-	30			

PICO FORMATION (Tp)

SANDSTONE/ MUDSTONE: fine to coarse, with minor pebbles, poorly sorted, plastic, moist to slightly moist, yellowish red to reddish brown (5YR, 4/4)

becoming coarser with depth and better sorted

SANDSTONE: medium to coarse, slightly silty with minor granules, very hard, very dense, damp to slightly moist, yellowish brown to gray (5YR, 6/1)

BEDDING: N85W, 43N

BEDDING: N89W, 42N

fine to medium, moist, yellowish brown (10YR, 5/4)

BEDDING: N85W, 44N

coarse, with approximately 5% gravel, very hard, well cemented

BEDDING: E-W, 38N

cobble layer (pink quartzite) cobble to 6"

fine

PEBBLE CONGOMERATE: medium to coarse, with minor gravel and cobbles, well cemented, moderately well sorted, light gray

BEDDING: N60W, 47N

increase in moisture and increase in fines, poorly sorted with approximately 5-15% rounded gravel

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-3-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/14/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1376'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-111'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
30/9"	5.1	126	-	45			
31/9"	7.9	121	-	50			
34/9"	7.2	111	-	55			
41/6"	6.5	103	-	60			
				65			
				70			
				75			
				80			

CROSS-BEDDING: N80E, 34N

SANDSTONE: fine to medium, poorly sorted, slightly plastic, medium dense, moist, yellowish brown (10YR, 5/4)

BEDDING: 50W, 36NE

SILTSTONE: slightly plastic, dark brown

SANDSTONE: coarse, with gravel, hard, dense, yellowish brown (10YR, 5/4)

BEDDING: N60W, 37NE

BEDDING: N59W, 39NE

SILTY SANDSTONE: light olive brown (2.5Y, 5/4)

BEDDING: N61W, 37N

MUDSTONE: slightly plastic, moist, dark gray (5Y, 4/1)

SILTSTONE: grayish brown (2.5Y, 5/2)

very hard, well cemented, massive, damp, fractured, concretionary from 69-71'

massive, well sorted, micaceous, dense, moist, olive (5Y, 4/3)

CONTACT: N58W, 37N

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-3-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/14/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1376'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-111'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
29	21.5	109	-					CLAYSTONE: with slickensides, plastic, soft, moist, black
								with bi-valve shells approximately 1%, small white thin clamshells to 1/2" (freshwater), and reed casts to 82'. Grading to clayey siltstone
				85				MUDSTONE: clayey, slightly plastic, moist, olive gray (10YR, 4/3)
38/9"	9.7	116	-	90				SANDSTONE: fine, locally well cemented, dense, slightly moist, brown (10YR, 4/3)
								CLAYSHEAR CONTACT: N40E, 30SE, N35E, 29SE
				95				SILTSTONE: massive, slightly plastic, dense, moist, greenish gray to olive gray (5Y, 4/2), and with minor fine sand (10%)
								BEDDING: N38, 32SE
37/9"	11.9	124	-	100				
				105				SANDSTONE: fine to medium, poorly sorted, with 20-30% silt and 5% clay, damp to slightly moist, yellowish brown (10YR, 5/4)
								becoming better sorted with depth
				110				clean
								Bottom of Boring at 111 feet. No groundwater. No caving.
				115				
				120				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-4-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/14/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1405'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-51'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
15/9"	7.7	129	-	10			
15	14.4	120	-	20			
23/11"	15.9	117	-	30			

PICO FORMATION (Tp)

CLAYSTONE/MUDSTONE: massive, slightly plastic, moist, dark yellowish brown (10YR, 4/4)

CLAYEY SANDSTONE: fine, silty (10-20%) with occasional coarse (2%), poorly sorted, dense, damp, yellowish brown (10YR, 5/4)

@12' BEDDING: N40E, 25SE

PEBBLY SANDSTONE: fine to medium, with minor gravel (2-5%), moderately sorted, light brownish gray (10YR, 6/2)

BEDDING: N26E, 24SE

BEDDING: N31E, 22SE
BEDDING: N28E, 26SE
slight change in color to brown (7.5YR, 5/4)
BEDDING: N15E, 26SE

SILTSTONE/MUDSTONE: dark brown (7.5YR, 3/3)

SILTY SANDSTONE: fine to medium, dense, damp, light brownish gray (2.5Y, 6/2)
@ 25'-26': concretionary layer of nodules in sandy clay layer

BEDDING: N21E, 21SE

BEDDING: N18E, 22SE

BEDDING: N39E, 25SE

SILTSTONE: micaceous, slightly laminated, dense, slightly moist, dark olive gray (5Y, 3/2)
BEDDING: N36E, 26SE

BEDDING: N36E, 25SE

BEDDING: N32E, 24SE

SANDSTONE: fine to medium, moderately well sorted, damp, light

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-4-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/14/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1405'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-51'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
35	4.6	113	-	45				brownish gray (2.5Y, 6/2) BEDDING: N27E, 24SE BEDDING: N26E, 25SE BEDDING: N28E, 24SE grading to predominately medium grained
42	6.3	109	-	50				
				55				Bottom of Boring at 51 feet. No groundwater. No caving.
				60				
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-5-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/19/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1398'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-71'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
				0			SM	**LANDSLIDE DEBRIS (Qls)** SILTY SAND: fine to meduim, loose, moist, light olive brown (2.5Y, 5/3)
				5				
5	3	102	-	10				fine, loose to medium dense, damp to slightly moist, light yellowish brown (2.5Y, 6.4)
				15				
4	3.1	104	-	20				fine to medium
				25				with pebbles and cobbles, increase in moisture
							ML	CLAYEY SILT: soft to firm, moist, brown @30' SHEAR: N10W, 24W
6	13.4	115	-	30			CL	SILTY CLAY: soft to firm, moist, brown @31' SHEAR: N10W, 12W @31'-32': CLAY/SAND CONTACT: N60E, 20SE @32': BEDDING: N50W, 30SW
							SP	@ 32' SAND: fine, moderately well sorted, micaceous, loose to medium dense, light yellowish brown (2.5Y, 5/3) rock exhibits shearing
				35				SHEAR: N5W, 15E
				40				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-5-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/19/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1398'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-71'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
18	5.6	111	-					@41': SLIDE PLAN CONTACT: N21E, 31SE: Base of landslide/top of bedrock
								PICO FORMATION (Tp)
								SANDSTONE: medium to coarse, with pebbles, dense, slightly moist, yellowish brown (2.5Y, 5/3)
				45				
42/9"			-	50				(Sample fell out)
								BEDDING: N30E, 34SE
								BEDDING: N15E, 29SE
				55				
								BEDDING: N32E, 31SE
								BEDDING: N28E, 29SE
42/9"	7.1	120	-	60				
				65				
								SILTY SANDSTONE: fine, moist, olive (5Y, 5/4)
								light yellowish brown (10YR, 6/4)
35/9"	5.5	111	-	70				
								Bottom of Boring at 71 feet. No groundwater. No caving.
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-6-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/20/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1330'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-76'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				0			SM
3	7.4	118	-	10			
4	6	117	-	20			
5	7.6	117	-	30			
				40			

ARTIFICIAL FILL (af)
SILTY SAND: fine to medium, loose, moist, light yellowish brown (2.5Y, 6/3)

Note: fill appears relatively "clean" with no organic debris and minimized clay

LANDSLIDE DEBRIS (Qls)
SILTY SANDSTONE: dense, light yellowish brown (2.5Y, 6/3), (clean contact with fill)

fine, very clean, massive

slightly clayey, very hard drilling in concretionary layer

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

BORING B-6-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/20/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1330'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-76'

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
27	2.6	126	-	45			
20	6.8	109	-	50			
21	6.9	104	-	55			
				60			
				65			
12	17.6	102	-	70			
				75			
				80			

PEBBLY CONGLOMERATE: medium to coarse, with granules and pebbles, poorly sorted, dense, damp, light yellowish brown (2.5Y, 6/3), with coarse sand size shell fragments

N59E, 35S: pebble layer

@46'-48': orange layer, olive yellow (2.5Y, 6/8)

BEDDING: N30E, 34SE

BEDDING: N60E, 40S

softer

SANDSTONE: medium to coarse, moderately sorted, dense, damp to slightly moist, light yellowish brown (2.5Y, 6/3)
BEDDING: N10E, 35E
BEDDING: N12E, 33E

BEDDING: N16E, 34SE

SILTSTONE: with clam fossils, micaceous, moist, bluish gray

@68': CLAY SEAM: N50E, 20SE: (landslide plane)

CLAYSTONE: plastic, moist, reddish brown
@69' BEDDING: N52, 18SE

PICO FORMATION (Tp)

MUDSTONE/CLAYEY SILTSTONE: massive, with sand and granules, mottled brown and olive gray

(no discernable bedding)

Bottom of Boring at 76 feet.
No groundwater. Minor caving in sandy fill.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 8/19/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-7-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/21/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1408'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-100'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
16/9"	7.2	112	-	10			
18/9"	4.3	116	-	20			
34/9"	6.1	107	-	30			

PICO FORMATION (Tp)

SANDSTONE: fine to medium, moderately well sorted, dense, damp, light yellowish brown

BEDDING: N75E, 41S

BEDDING: N75E, 42S

BEDDING: N78E, 42S

CONGLOMERATE: with pebbles

SANDSTONE: fine, moderately well sorted, dense, damp, pale yellow (2.5Y, 8/2), with minor pebbles, minimal to no fines

medium to coarse

pebble conglomerate layer: N78E, 44S

BEDDING: N76E, 48S

fine to medium, slightly silty, light gray (2.5Y, 7/1)

medium to coarse, with granules and pebbles, yellow

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

BORING B-7-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/21/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1408'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-100'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION / GRAPHIC LOG / SOIL TYPE	
33/9"			-			
						PEBBLY SANDSTONE: medium to coarse, with granules and pebbles (5%), moderately well sorted (no fines), dense, damp, pale yellow (2.5Y, 7/3)
				45		
						well cemented, (slow drilling)
						BEDDING: N88W, 39S: (pebble layer)
30/4"			-	50		
				55		BEDDING: N80E, 47S
						BEDDING: N80E, 42S
50	6.7	114	-	60		FOSSILIFEROUS SILTSTONE: with numerous shells, dense, slightly moist, olive (5Y, 5/3), concretionary, cemented
						SILTY SANDSTONE: fine to medium, poorly sorted, olive (5Y, 5/3)
				65		
30/9"	10.2	121	-	70		hard cemented zone
						BEDDING: N82E, 43S
				75		
						SANDSTONE: fine, well sorted, dense, moist, pale yellow to olive (5Y, 7/3)
						BEDDING: N78E, 40S
				80		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BORING B-7-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/21/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1408'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-100'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
34/9"	10.1	113	-	85			
52/9"	6.8	122	-	90			
				95			
				100			
				105			
				110			
				115			
				120			

N83E, 42S

BEDDING: N86W, 39S: (shell layer), slightly silty and concretionary

SANDY SILTSTONE: laminated, locally concretionary, dense, moist, mottled bluish gray and brown

no clay in matrix

BEDDING: N88E, 41S

SILTY SANDSTONE: fine to medium, poorly sorted, dense, slightly moist, olive brown

SANDSTONE: fine, slightly silty, moderately well sorted, light gray (5Y, 7/1)

Bottom of Boring at 100 feet.
No groundwater. No caving.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-8-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/23/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1135'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-101'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
3	2.9	109	-	10			
2	7.9	123	-	20			
7	3.6	118	-	30			

SAUGUS FORMATION (QTs)

SILTSTONE: micaceous, soft, dry, light grayish brown (10YR 5/2)

BEDDING: N72W, 16N

BEDDING: N80W, 12N

CLAYSTONE: moderately soft, dark grayish brown (10YR 4/2)

massive

CLAYEY SANDSTONE: with sand and silt, moderately soft, light reddish brown (5YR 4/3)

BEDDING: N72W, 8N): (top of sandstone)

SANDSTONE: fine, moderately well sorted, micaceous, medium dense, damp, light olive brown (2.5Y, 5/3)

BEDDING: N32W, 12NE: pebble layer cross bed

grading coarser with pebbles

BEDDING: N51W, 19NE

BEDDING: N53W, 12NE

FAULT: N60E, 58S

BEDDING: N85E, 24N

SANDY SILTSTONE: fine sand and trace gravel to 1/2", with fraction of clay, poorly sorted, dense, slightly moist, dark grayish brown (2.5Y 4/2)

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-8-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/23/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1135'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-101'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
12	7.1	118	-	40			
				45			
33	2.8	123	-	50			
				55			
39	4.5	115	-	60			
				65			
28	13.8	113	-	70			
				75			

grading to mudstone

CONGLOMERATE: medium to coarse sand, with pebble to 1" and few cobbles to 6", dark grayish brown (2.5Y, 4/2)

BEDDING: N81W, 9N

OFFSET LITHOLOGY BUT NO SHEARING OBSERVEABLE FAULT: N80E, 68S: (hard drilling)

medium, light bluish gray (2.5Y, 6/2)

silty and well cemented

BEDDING: N86E, 26N

SANDSTONE: fine to medium, laminated, light gray

BEDDING: N55W, 16NE: clean sand layer

SANDY SILTSTONE: damp, olive gray (5Y, 5/2)

SILTSTONE: micaceous, soft, moist, olive gray (5Y, 5/2)

BEDDING: N48W, 24NE: thin clay bed

increasing clay with depth

CLAYSTONE: plastic, firm, moist, dark olive gray

SILTSTONE: with clay, slightly plastic, locally micaceous and laminated, slightly firm to soft, moist, olive gray (5Y, 5/2)
@74': BEDDING: 50W, 22NE

CLAYSTONE: with silt, massive, firm, slightly moist, olive gray (5Y,

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BORING B-8-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/23/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1135'
DRILLING CO.: Tri-Valley
LOGGED BY: TL
BORING DEPTH: 0-101'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
18	16.4	115	-	80			
				85			
42	3.9	124	-	90			
				95			
38/10"	5.3	112	-	100			
				105			
				110			
				115			

5/2)
@79' BEDDING: N60W, 14N: clay seam

SILTSTONE: laminated, soft

SANDSTONE: medium, moderately sorted with small pebble inclusions, hard, light olive gray (5Y 6/2), (cuttings fell out of basket)

CROSS-BEDDING: N20W, 15E

CONGLOMERATE: fine to medium sand, with granules and pebbles, well cemented and poorly sorted, slightly moist, light olive gray (5Y 6/2)
BEDDING: N32W, 13NE: fine sand layer

BEDDING: N36W, 14NE

fine sand, no pebbles, massive, well sorted, light gray

Bottom of Boring at 101 feet.
No groundwater. No caving.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-9-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/27/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1250'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-107'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				0			
				5			
				10			
7	13	120	-				
				15			
				20			
9/7"	4.2	131	-				
				25			
				30			
20/9"	4	131	-				
				35			
				40			

OLDER LANDSLIDE DEBRIS (Qols)

SILTY SANDSTONE: fine, soft, damp, light olive brown (2.5Y, 5/3), appears jumbled

SANDY SILTSTONE: clean, slightly laminated, soft, olive brown (2.5Y, 4/3)

SILTY SANDSTONE: medium to coarse, with pebbles, poorly sorted, slightly moist, light olive brown (2.5Y, 5/3)

hard zone

CLAYSTONE: with silt, massive, slightly plastic, moist, dark brown (10YR, 3/3), (jumbled)

MUDSTONE: with coarse sand & granules in silty matrix, massive, poorly sorted, slightly plastic, slightly moist, dark brown (10YR, 3/3)

CONTACT: N20W, 17SW

SAUGUS FORMATION (QTs)

SANDSTONE: fine to medium, moderately well sorted, cemented, hard, light gray (2.5Y, 7/2)

BEDDING: N40W, 60NE: (pebble layer)

CONGLOMERATE: coarse sand, with pebbles and cobbles, hard, light gray (2.5Y, 7/2)

BEDDING: N25W, 37NE

medium to coarse sand, no fines

BEDDING: N25W, 31NW: fine sand layer

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-9-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/27/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1250'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-107'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
24/9"	3.9	128	-	45			
38/9"	5.5	108	-	50			
57/9"	4.7	110	-	55			
53	9.6	132	-	60			
				65			
				70			
				75			
				80			

CONTACT/BEDDING: N61W, 53NE

SILTSTONE: with clay, poorly sorted, massive, dense, brown (10YR, 4/3)

SANDSTONE: medium, with granules, hard, olive gray (5Y, 5/2)

BEDDING: N50W, 41NE

PEBBLY SANDSTONE: fine to medium, poorly sorted with granules, grayish brown (2/5Y, 4/2)
BEDDING: N38W, 42NE

SHEAR: N15W, 67NE

BEDDING: N38W, 71NE

SHEAR: N18W, 44NE: (with slicks)
CONTACT: N61W, 43NE: (top of siltstone)

SILTSTONE: with clay, firm, massive, slightly plastic, slightly moist, reddish brown (5YR, 4/4)

SHEAR: N31W, 55NE: (clay slicks)

grades to brown silty sandstone to 72'

very plastic

SILTY SANDSTONE: fine, poorly sorted, massive, dense, yellowish brown (10YR, 5/4)

BEDDING: N51W, 52N

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BORING B-9-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 4/27/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-72'(1120 lbs.). 400 lb stem added each 20' after 72'.
ELEVATION: 1250'
DRILLING CO.: Tri-Valley
LOGGED BY: KGF
BORING DEPTH: 0-107'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
51/9"	10.9	116	-	85				BEDDING: N61W, 58W: (sandy layer)
53/11"	7.1	133	-	90				fine to medium, olive brown (2.5Y, 4/4)
				95				CONGLOMERATE: with pebbles, medium to coarse sand, slightly silty, massive, light brownish gray (2.5Y, 6/2)
								BEDDING: N38W, 43NE
40/10"	3.7	121	-	100				SANDSTONE: fine to medium, clean, well sorted, dense, light gray (2.5Y, 7/2), well indurated
				105				
								Bottom of Boring at 107 feet. No groundwater. No caving.
				110				
				115				
				120				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-10-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 10/7/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-70'(1120 lbs.).
ELEVATION: 1002.5'
DRILLING CO.: Tri-Valley
LOGGED BY: TPL
BORING DEPTH: 0-70'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				0			ML
				5			
				10			
				15			
				20			
				25			
				30			
				35			
				40			

ALLUVIUM (Qal)
SANDY SILT: very fine sand, soft, slightly moist, grayish brown (10YR 5/2)

minor caliche veins

trace cobbles, medium stiff

angular sandstone cobble; 8" long, 3" wide

siltstone rip up clasts

SAUGUS FORMATION (QTs)
SANDY SILTSTONE: very fine sand, micaceous, some caliche pods, soft, slightly moist, yellowish gray (5Y 7/2)
slight orangish brown mottling

BEDDING: N10E, 20SE: defined by 1/4" thick caliche at contact

SILTY SANDSTONE: very fine, trace pebbles, some siltstone interbeds up to 6" thick, friable, slightly moist, yellowish gray (5Y 7/2)
very fine to medium with cross bedding
BEDDING: N27E, 17SE

SANDY SILTSTONE: very fine to fine sand, low hardness, slightly moist, yellowish gray (5Y 7/2)

SANDSTONE: fine to coarse, minor amount of pebbles, moderately hard, slightly moist, yellowish gray (5Y 7/2)

CROSS-BEDDING: N57E, 15SE: moderately well cemented

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-10-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 10/7/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-70'(1120 lbs.).
ELEVATION: 1002.5'
DRILLING CO.: Tri-Valley
LOGGED BY: TPL
BORING DEPTH: 0-70'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE

BEDDING: N5E, 17SE

PEBBLY SANDSTONE: fine to very coarse, moderately cemented, moderately hard, moist, yellowish gray (5Y 7/2), light seepage

45

moderate seepage

50

CONTACT: N10W, 15NE

SANDY SILTSTONE: very fine to fine sand, weakly cemented, micaceous, low hardness, moist, light olive gray (5Y 5/2)
thin very fine sandstone interbed @ 52'

1" thick siltstone; 4" thick very fine sandstone

55

SILTSTONE: moderately indurated, moderately hard, slightly moist, medium dark gray (N4)

60

65

light olive gray (5Y 5/2)

dark yellowish brown (10YR 4/2)

70

Bottom of Boring at 70 feet.
Light seepage at 44', moderate seepage at 47 '. No caving.

75

80

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-11-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 10/7/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-70'(1120 lbs.).
ELEVATION: 1145.5'
DRILLING CO.: Tri-Valley
LOGGED BY: TPL
BORING DEPTH: 0-70'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
				5			ML
				10			
				15			
				20			
				25			
				30			
				35			
				40			

RESIDUAL SOIL

SANDY SILT: very fine to fine sand, minor caliche, soft, slightly moist, dark yellowish brown (10YR 4/2)

yellowish brown (10YR 5/4)

SAUGUS FORMATION (QTs)

SANDY SILTSTONE: very fine sand, micaceous, soft, dry, yellowish gray (5Y 7/2)
BEDDING: N20E, 10SE
BEDDING: N40E, 10SE: some siltstone interbeds, 1" to 2" thick

SILTSTONE: moderately indurated, low hardness, slightly moist, light olive gray (5Y 5/2)

SILTY SANDSTONE: very fine to fine, micaceous, soft, slightly moist, yellowish gray (5Y 7/2)

SILTSTONE: moderately indurated, low hardness, slightly moist, light olive gray (5Y 5/2)

SANDSTONE: very fine to fine, low hardness, slightly moist, light olive gray (5Y 6/1), laminated bedding defined by aligned mafic minerals

SANDY SILTSTONE: very fine sand, micaceous, soft, slightly moist, yellowish gray (5Y 7/2)

SANDSTONE: very fine to medium, weakly cemented, slightly micaceous, soft, dry, yellowish gray (5Y 7/2), laminated

trace pebbles
BEDDING: N-S, 12E
some cross bedding

BEDDING: N10E, 8SE

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

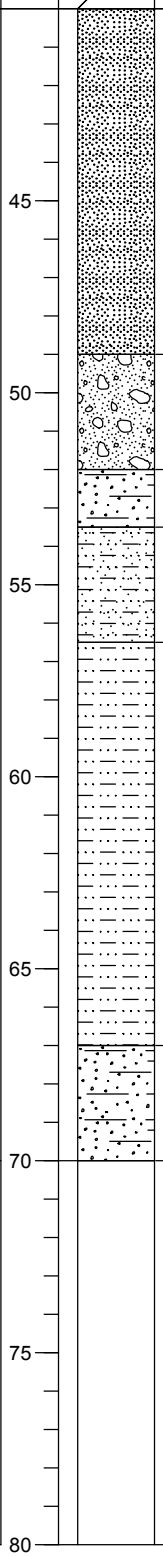
LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-11-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 10/7/10
EQUIPMENT USED: 24" Bucket auger with heavy duty sampler. 0-24' (3160 lbs.), 24-46'(2040 lbs.), 46-70'(1120 lbs.).
ELEVATION: 1145.5'
DRILLING CO.: Tri-Valley
LOGGED BY: TPL
BORING DEPTH: 0-70'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE



BEDDING: N15E, 10SE

PEBBLY SANDSTONE: fine to coarse, trace cobbles, weakly cemented, low hardness, dry, yellowish gray (5Y 7/2)

SILTY SANDSTONE: very fine to fine, micaceous, soft, slightly moist, light olive gray (5Y 5/2)

SANDY SILTSTONE: very fine sand, micaceous, soft, slightly moist, light olive gray (5Y 5/2)
BEDDING: N11E, 15SE: 2" thick siltstone interbed

SILTSTONE: micaceous, moderately hard, slightly moist, moderate olive brown (5Y 4/4), some very fine to fine sandstone interbeds
dark yellowish brown (10YR 4/2)

massive
olive gray (5Y 4/1)

minor very fine sand, caliche coating on fracture surfaces

medium bluish gray (5B 5/1)

SILTY SANDSTONE: fine to coarse, trace pebbles, moderately hard, slightly moist, light olive gray (5Y 5/2)

Bottom of Boring at 70 feet.
No groundwater. No caving.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-1-11

JOB NUMBER: 2002-036-006
DATE DRILLED: 11/22/11
EQUIPMENT USED: 24" diameter bucket rig #7 with triple scope weights of 3160 lbs. (0-24'), 2040 lbs. (24-46'), 1120 lbs. (46-72')
ELEVATION: 1025'
DRILLING CO.: Tri-Valley
LOGGED BY: BKP
BORING DEPTH: 0-61'
SURFACE CONDITIONS: Dirt Access Road

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
					ML	**TERRACE DEPOSITS (Qt)** SANDY SILT: fine, moderately firm, moist, medium brown
P	5.8	95	-			grades occasional small gravel, less moist, grayish brown
P	6.5	101	-	5		grades more sandy, occasional gravel and cobbles
P	7.9	104	-			grades more firm, slightly porous
P	7.6	106	-	10	ML/SM	SILTY SAND: fine, grades more sandy
1	8.2	106	-	15	SM	SILTY SAND: fine, gravel, dense, moist, medium brown to grayish brown
1	8.1	107	-	20		grades less silty grades light brown
2	5.7	111	-	25		less silty, fine to medium, occasional coarse sand, dense, damp to moist, light grayish brown
						grades less silty, light gray
5	16.3	105	-	30		silty, dense to very dense, moist, mottled light gray and olive gray
						occasional rounded cobbles
6	7	109	-	35		**SAUGUS FORMATION (QTs)** SILTY SANDSTONE: very fine, friable, damp moist, olive gray
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

LOG OF BORING

BORING B-1-11 (CONTINUED)

JOB NUMBER: 2002-036-006
DATE DRILLED: 11/22/11
EQUIPMENT USED: 24" diameter bucket rig #7 with triple scope weights of 3160 lbs. (0-24'), 2040 lbs. (24-46'), 1120 lbs. (46-72')
ELEVATION: 1025'
DRILLING CO.: Tri-Valley
LOGGED BY: BKP
BORING DEPTH: 0-61'
SURFACE CONDITIONS: Dirt Access Road

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
5	8.2	108	-					grades more moist
								large cobble (10"+/-)
6	7.9	111	-	45				BEDDING: N30E, 10SE
								some gravel and small cobbles
10	4.5	107	-	50				SANDSTONE: fine to coarse, slightly silty, friable, damp to moist, light gray
								fine, silty, occasional gravel, light olive gray
10	5.3	111	-	55				
								SANDY SILTSTONE: fine, soft, moist, olive gray
13	9.5	113	-	60				
								Bottom of Boring at 61 feet. No water. No caving.
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-2-11

JOB NUMBER: 2002-036-006
DATE DRILLED: 11/21/11
EQUIPMENT USED: 24" diameter bucket rig #7 with triple scope weights of 3160 lbs. (0-24'), 2040 lbs. (24-46'), 1120 lbs. (46-72')
ELEVATION: 948'
DRILLING CO.: Tri-Valley
LOGGED BY: BKP
BORING DEPTH: 0-24.5'
SURFACE CONDITIONS: Grass Field

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
					ML	**ALLUVIUM (Qal)** CLAYEY SILT: moderately firm, moist, medium brown
P	6.2	95	-		ML	SANDY SILT: fine, less moist, lighter medium brown
P&T	4.8	96	-	5	SM	SILTY SAND: fine to coarse, damp, tan
P&T	9.8	90	-			fine, medium dense to dense, grayish brown
1	8	91	-	10		lens of sandy silt grades less silty
2	11.9	95	-			alternating layers of moist to very moist clayey silt and damp, clean, fine to coarse sand, dense
2	1.8	103	-	15	SP	SAND: fine to coarse, dense, dry to damp, buff to white
					ML	CLAYEY SILT: very moist to wet, dark brown
3	3	115	-	20	SP-GP	GRAVELLY SAND: medium to coarse with occasional fine, abundant gravel with occasional small cobble, dense, damp, grayish brown difficult drilling; clean damp sand with abundant gravel & cobbles, moderate caving
				25		Bottom of Boring at 24.5 feet. No water. Moderate caving below 22'
				30		
				35		
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-3-11

JOB NUMBER: 2002-036-006
DATE DRILLED: 11/21/11
EQUIPMENT USED: 24" diameter bucket rig #7 with triple scope weights of 3160 lbs. (0-24'), 2040 lbs. (24-46'), 1120 lbs. (46-72')
ELEVATION: 948'
DRILLING CO.: Tri-Valley
LOGGED BY: BKP
BORING DEPTH: 0-29'
SURFACE CONDITIONS: Open Field

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
					SM/SP	**ALLUVIUM (Qal)** SILTY SAND: fine to medium, with occasional coarse sand, occasional gravel, medium dense to dense, damp to moist, tan to light brown
1	2.5	107	-			lens of clean and damp sand
						grades more clayey
2	15.4	107	-	5	CL	SILTY CLAY: approaching clayey silt, moderately firm, moist to very moist, medium brown
					SM	SILTY SAND: fine, medium dense to dense, moist, light to medium brown
2	14.7	101	-			
10*	14	100	-	10	ML	SANDY SILT: firm, very moist, olive gray
5	5.2	109	-		SP	CLEAN SAND: fine to medium, with occasional coarse sand, occasional gravel, damp, light reddish brown
1	5.9	93	-	15		dry to damp
					ML	SANDY SILT: moderately firm, moist, mottled rust brown and olive gray
					SP	CLEAN SAND: fine to coarse, dry to damp, buff
2	2.9	93	-	20		difficult drilling - soil not staying in bucket (too sandy, too dry) grades to clean fine sand
					CL	SILTY CLAY: very moist to wet, dark grayish brown
6	20.6	100	-	25		lens of silt and sand (sample sleeve wet)
					SM/GP	SILTY SAND: fine to coarse, with abundant gravel, cobbles, damp to moist, tan to light brown
				30		Bottom of Boring at 29 feet. No water. No caving.
				35		
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-4-11

JOB NUMBER: 2002-036-006
DATE DRILLED: 11/22/11
EQUIPMENT USED: 24" diameter bucket rig #7 with triple scope weights of 3160 lbs. (0-24'), 2040 lbs. (24-46'), 1120 lbs. (46-72')
ELEVATION: 952'
DRILLING CO.: Tri-Valley
LOGGED BY: BKP
BORING DEPTH: 0-25'
SURFACE CONDITIONS: Grass Field

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	SOIL TYPE	
				ML	**ALLUVIUM (Qal)** SANDY SILT: fine, occasional coarse sand, occasional small gravel, firm, damp to moist, grayish brown
1+T	5.2	110	-		
				SP-SM	SILTY SAND: fine to coarse, medium dense, damp, grayish tan
P	2.4	103	-		
				ML	SANDY SILT: firm, moist, grayish brown
P	15.1	92	-		
9	24	90.3	13		
				SM-SP	SILTY SAND: fine to coarse, occasional gravel and cobble, damp, tan, some slight caving
1	2.4	103	-		
				ML	SANDY SILT: fine, moist, medium brown
2	1.8	104	-	SP	SAND: fine to coarse, medium dense to dense, damp to moist, mottled light gray and rust brown alternating layers of silt and sand
				SM	SILTY SAND: occasional gravel, damp, tannish yellow
1	2.3	106	-		
				SP	SAND: fine to coarse, dense, damp, light gray
				ML	CLAYEY SILT: very moist, medium to dark brown
1	13	98	-	SP/SM	SILTY SAND: fine to medium, dense, damp to moist, mottled light gray and rust brown

Bottom of Boring at 25 feet.
No water. Some slight caving at 11'.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-5-11

JOB NUMBER: 2002-036-006
DATE DRILLED: 11/21/11
EQUIPMENT USED: 24" diameter bucket rig #7 with triple scope weights of 3160 lbs. (0-24'), 2040 lbs. (24-46'), 1120 lbs. (46-72')
ELEVATION: 967'
DRILLING CO.: Tri-Valley
LOGGED BY: BKP
BORING DEPTH: 0-49'
SURFACE CONDITIONS: Grass Field

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
			-		SM-SP	**ALLUVIUM (Qal)**
1	2.5	106	-			SILTY SAND: fine to medium, with occasional coarse sand, slightly silty, medium dense, moist, light to medium brown
						grades fine to coarse, occasional small gravel, medium dense to dense, damp to moist, light grayish brown
3	3.9	110	-	5		lens of fine silty sand
						abundant cobbles
1	7.9	107	-	10	SM	SILTY SAND: fine to medium, with occasional coarse sand, occasional cobbles, dense, moist, light grayish brown
5	11.3	111	-			no coarse sand, very silty, moist to very moist, medium grayish brown
3	22	105	-	15		grades less silty, fine, moist
						fine to coarse, abundant gravel, dense to very dense, grayish brown
						abundant cobbles
2	24.5	97	-	20	SM-SP	SILTY SAND: fine to medium with occasional coarse sand, occasional gravel, slightly silty, moist, light brown
4	24.4	97	-	25	SM	SILTY SAND: fine to medium, dense, moist, grayish brown
3	13.3	107	-	30		more fines, more moist
5	24.4	97	-	35	SM-SP	SILTY SAND: fine, with occasional coarse sand, slightly silty, dense, moist, mottled light gray and rust brown
					ML	CLAYEY SILT: moist to very moist, dark gray
				40	SP-GP	SAND: fine to coarse, with abundant gravel, almost clean, very dense, damp to moist, light brown

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING B-5-11 (CONTINUED)

JOB NUMBER: 2002-036-006
DATE DRILLED: 11/21/11
EQUIPMENT USED: 24" diameter bucket rig #7 with triple scope weights of 3160 lbs. (0-24'), 2040 lbs. (24-46'), 1120 lbs. (46-72')
ELEVATION: 967'
DRILLING CO.: Tri-Valley
LOGGED BY: BKP
BORING DEPTH: 0-49'
SURFACE CONDITIONS: Grass Field

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
12	13.3	107	-				SP-GP	abundant cobbles
15			-	45				(sample disturbed)
							ML	SANDY SILT: fine, moist to very moist, greenish gray
				▽				grades wet
				50				Bottom of Boring at 49 feet. Water at 49'. Moderate ravelling below 36'
				55				
				60				
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-1-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/10/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1248'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-112'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
				0	SM	**ARTIFICIAL FILL (af)** SILTY SAND: medium to coarse, loose, moist, light brown (2.5Y, 5/4)
22	9.9	111	-	5		
-			18	10		fine to medium, olive brown (2.5Y, 5/4)
32	13.6	117	-	15		has red clayey inclusions, shows compaction layering
-			27	20		fine to medium, poorly sorted, small shell fragments, slightly plastic, olive brown (2.5Y, 4/3)
59	10.4	118	-	25		
-			38	30		increase in moisture, slightly clayey (5-10%) in matrix
67	10.5	125	-	35		medium to coarse, trace pebbles
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BORING HS-1-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/10/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1248'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-112'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
-			32		SM	slightly clayey
41	6.1	120	-	45		fine to medium, with gravel, moderately to poorly sorted, olive brown (2.5Y, 4/3)
						with abundant fossil shell fragments
-			50/3"	50		**PICO FORMATION (Tp)**
						SANDSTONE: medium to coarse, moderately well sorted, well cemented, hard, dark yellowish brown (10YR, 4/4)
50/4"	8.3	107	-	55		(hard drilling)
						PEBBLY SANDSTONE: medium, well cemented, light yellowish brown (10YR, 6/4), poorly sorted with granules (10%) and pebbles (5-10%)
-			65/3"	60		(sampler bouncing)
70/4"			-	65		(sampler bouncing)
						medium to coarse, moderately well sorted, well cemented, damp
-			65/5"	70		(bouncing after 5")
						(very hard drilling, adding water to cool bit)
						hard, with localized olive brown fine clayey mottling
75/5"	8.1	123	-	75		
						becomes coarser with pebbles
				80		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BORING HS-1-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/10/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1248'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-112'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
-			30/1"				
80/4"			-	85			
-				90			
68/5"			-	95			
-			50/6"	100			
				105			
				110			
				115			
				120			

coarse, (bouncing after 6")

(bouncing after 4")

▽ groundwater at 87.08 feet 7/1/10

(bouncing after 5")

medium to coarse

▽ groundwater at 97.5 feet 5/14/10

MUDSTONE: dark gray, mixture of sand (25%), silt (50%), and clay (25%)

Bottom of Boring at 112 feet.
Very slight groundwater seep noted at about 100'

Installed temporary piezometer of 2" schedule 80 PVC with bottom at 108'; 0.020" machine-slotted screen from 108-88'; blank PVC to surface. Backfilled with #3 sand up to 85', and sealed with medium bentonite chips to 81'. Destroyed piezometer on July 14, 2010 by removing PVC casing and backfilling to surface with cement grout and 5% bentonite.

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-2-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/11/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1333'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-199'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
							SM	**ARTIFICIAL FILL (af)** SILTY SAND: fine to medium, slightly moist, light brown to pale yellow (2.5Y, 7/3)
44	5.4	110	-	5				
								fine, poorly graded, light olive brown(2.5Y, 5/3) to light gray
-			12	10				
23	13.3	112	-	15			ML	CLAYEY SILT: well graded with some sand in localized layers, moist, dark reddish brown (7.5YR, 5/3), interlayered soils
-			16	20				
28	11	109	-	25			SM	SILTY SAND: fine, moist, light olive brown, locally with clayey silt matrix
							ML	CLAYEY SILT: sandy, slightly plastic, stiff, moist, brown to reddish brown
-			24	30				
30	11.1	124	-	35			CL	SILTY CLAY: plastic, moist, reddish brown to brown, locally mottled with greenish gray silt and sand
								very stiff
-			39	40				locally sandy but mostly in reddish brown clay matrix
								(difficult drilling)
				45			ML	SANDY SILT: well graded, clayey, stiff, slightly plastic, reddish brown

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-2-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/11/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1333'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-199'

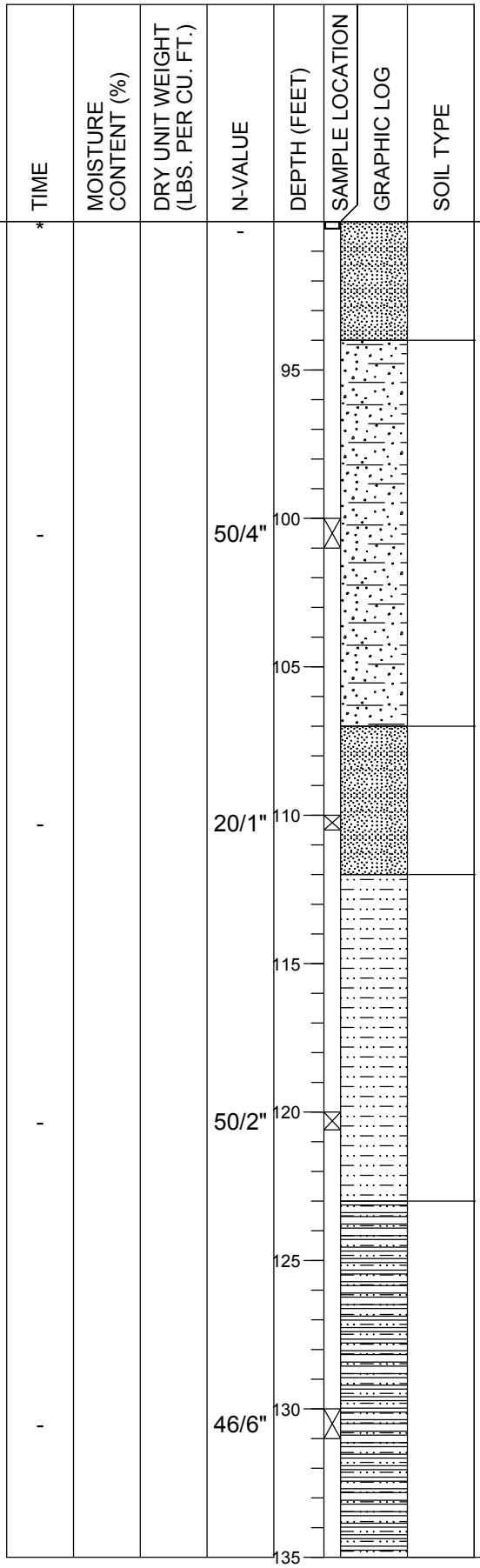
TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
132/11"	12.1	117	-				ML	to brown (adding water during drilling)
-			97/9"	50				
							SM	SILTY SAND: fine to medium, dense, slightly moist, brown to light reddish brown
129/9"	9.5	117	-	55				
-			78/6"	60				
								SAUGUS FORMATION (QTs) SANDSTONE: fine to medium, dense, grayish brown
100/6"			-	65				Note: fine grained clean sandy residue left in sampler tip medium to coarse
-			50/3"	70				fine to coarse, clean with granules and pebbles
								CLAYSTONE: plastic, very stiff, moist, natural brown to reddish brown
100/11"	14.1	112	-	75				
								SILTY SANDSTONE: fine, moderately well sorted, grayish brown
*			-	80				(* Sampler bouncing after first 5")
				85				
								SANDSTONE: medium to coarse with granules and few gravel, moderately sorted, massive, dense, damp, brown
				90				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BORING HS-2-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/11/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1333'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-199'



(* Sampler bouncing after first 3")

SILTY SANDSTONE: fine, poorly sorted, dark olive gray

becomes clayey siltstone @99-100'

SANDSTONE: fine, moderately sorted, dense, damp, light brownish gray

SILTSTONE: massive (without lamination), dense, moist, brown

MUDSTONE: plastic, massive, moist, dark yellowish brown, clayey silt with few sand (5-10%)

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-2-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/11/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1333'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-199'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
								SILTSTONE: well cemented, gray
								MUDSTONE
-			*	140				* sub-parallel partings in core tube appear to have ~10-15 degree dip
								SILTSTONE: fine sand, damp, dark grayish brown, locally very hard and well cemented
				145				
								fine sand
				150				
				155				becoming slightly clayey
-			50/5"	160				
								very plastic (30% clay), moist, dark gray to dark olive
				165				
				170				Squeezing Hole
								very dark/black, very sticky
				175				
				180				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

BORING HS-2-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/11/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1333'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-199'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
				185				dark olive MUDSTONE: fine to medium sand, trace clayey silt, olive gray
				190				slight increase in sand content, but still clayey silt matrix
				195				
				200				Bottom of Boring at 199 feet. No groundwater in boring or in temporary piezometer monitored 5/17/10 to 6/25/10. Installed temporary piezometer of 2" schedule 80 PVC with bottom at 190'; 0.020" machine-slotted screen from 190-180'; blank PVC to surface. Backfilled with #3 sand up to 178', and sealed with medium bentonite chips to 176'. Destroyed piezometer on July 14, 2010 by removing PVC casing and backfilling to surface with cement grout and 5% bentonite.
				205				
				210				
				215				
				220				
				225				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-3-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/13/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1102'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-41'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
					SM	**ALLUVIUM (Qal)** SILTY SAND: soft, moist, light brown to olive brown (2.5Y, 4/3)
12	13.8	115	-	5	ML	CLAYEY SILT: soft, moist, dark brown (10YR, 3/3)
-			12			some fine to coarse sand (10-15%), well graded, light brown to yellowish brown
62			-	10	SM	SILTY SAND: fine to medium, well graded, clayey (plastic), slightly moist, dark brown (10YR, 3/3)
-			13			
					SP/SM	SILTY SAND: poorly graded, loose, damp, yellowish brown (10YR, 5/4)
18	8.1	117	-	15		
-			8			
					SM	SILTY SAND: medium to coarse, with gravel, loose, damp, yellowish brown (10YR, 5/4)
18	8.5	109	-	20		
-			8			
25	4.2	118	-	25		
-			14			
-			44	30		**SAUGUS FORMATION (QTs)** SANDSTONE: fine to medium, locally laminated, well cemented, dense, damp, light olive brown (2.5Y, 4/3)
90/10"	8.7	130	-	35		CLAYSTONE: massive, dense, moist, reddish brown
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BORING HS-3-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/13/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1102'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-41'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
75/6"	6.8	120	-				

Bottom of Boring at 41 feet.
No groundwater. No caving.

45
50
55
60
65
70
75
80

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING HS-4-10

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/14/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1099'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-41.5'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
					SM	**ALLUVIUM (Qal)** SILTY SAND: fine to medium with few coarse, localized gravel, dry to damp, light olive brown (2.5Y, 5/3)
-			19			
53/10"	10.8	119	-	5	ML	SANDY SILT: fine to medium sand, well graded, slightly plastic, damp, brown to dark brown (10YR, 3/3)
-			45			
					SM	SILTY SAND: fine to medium, moderately well graded, slightly moist, light olive brown (2/5Y, 5/3)
-			27	10		
55	8.7	125	-			increase in fines
-			30	15		
						becomes dark brown
						brown (10YR, 4/3)
-			8	20		
20	5.8	112	-			with gravel (5%)
-			16	25		
					SP/SM	SILTY SAND: fine, poorly graded, damp, light yellowish brown (10YR, 6/4)
-			30	30		
						SAUGUS FORMATION (QTs)
47	11.4	108	-	35		SILTSTONE: massive, poorly indurated (soft), damp, light olive gray (5Y, 6/2)
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

BORING HS-4-10 (CONTINUED)

JOB NUMBER: 2002-036-004
DATE DRILLED: 5/14/10
EQUIPMENT USED: Hollow Stem Auger CME 95 with heavy duty sampler and SPT sampler
ELEVATION: 1099'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-41.5'

TIME	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE
-			55				

Bottom of Boring at 41.5 feet.
No groundwater. No caving.

45
50
55
60
65
70
75
80

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-004.GPJ FRANKIAN.GDT 11/16/10

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING WB-1

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/13/09
EQUIPMENT USED: Rotary wash rig with Sleeve and SPT samplers.
ELEVATION: 1000'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-21.5'
HAMMER WEIGHT: 140lbs; DROP: 30"

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
							SM	**ARTIFICIAL FILL (af)** SILTY SAND: fine to medium, well graded, dense, slightly moist, dark brown
61	9.2	116	-					minor inert debris (glass & concrete)
-			23	5				
28	14.6	109	-					minor concrete, moist
-			12	10			SP	**ALLUVIUM (Qal)** SAND: medium, poorly graded, loose, slightly moist, light brown to grayish brown
102	11	119	-					**SAUGUS FORMATION (QTs)** SANDSTONE: coarse, with gravel, dense, damp to slightly moist, tan to gray
-			63	15				medium to coarse, silty, slightly moist, light brown to tan
119	13.01 11.6	120.02 119	94 -	20				medium, light brown to reddish brown
-			44					
								Bottom of Boring at 21.5 feet.
				25				
				30				
				35				
				40				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

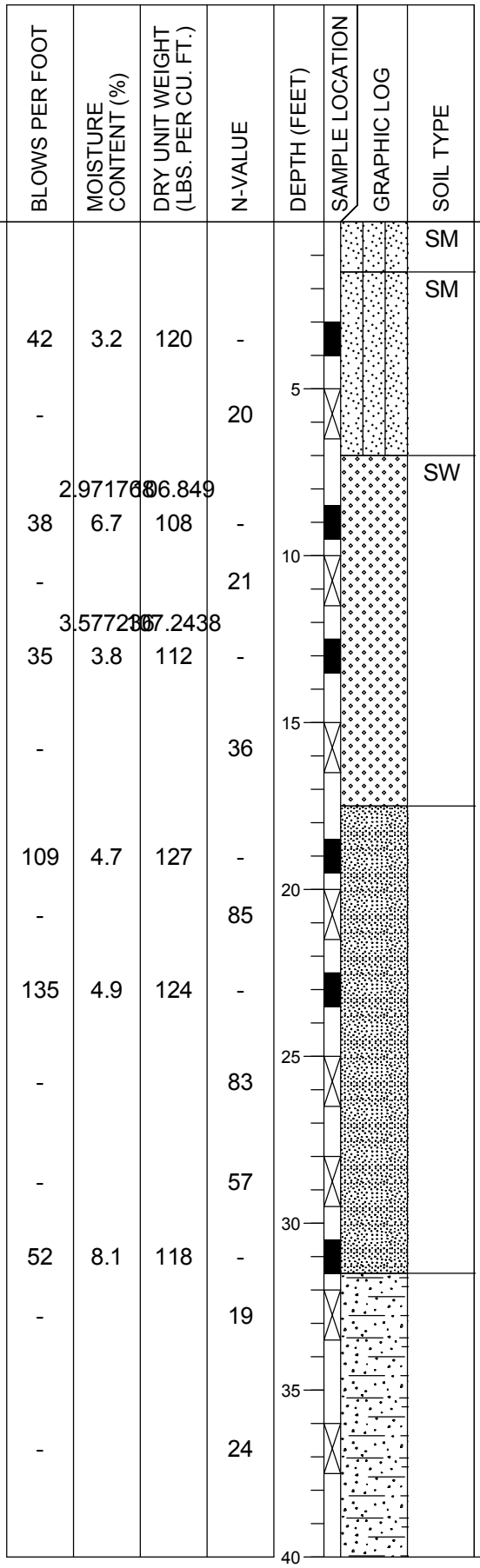
BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING WB-2

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/14/09
EQUIPMENT USED: Rotary wash rig with Sleeve and SPT samplers.
ELEVATION: 996'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-51'
HAMMER WEIGHT: 140lbs; DROP: 30"



ARTIFICIAL FILL (af)
SILTY SAND: fine to medium, well graded, medium dense, slightly moist, brown to dark brown

ALLUVIUM (Qal)
SILTY SAND: fine to medium, loose to medium dense, moist, dark brown to brown

SAND: medium to coarse, massive to poorly layered, loose to medium dense, slightly moist, light brown to tan

poorly graded, yellowish brown

SAUGUS FORMATION (QTs)
SANDSTONE: medium to coarse, with minor gravel, massive, dense, gray

coarse, appears slightly cemented, very tight

tan to light brown

small gravel 2-5%

fine to medium, massive, medium dense, slightly moist, light brown

SILTY SANDSTONE: fine to medium, slightly laminated, loose, moist, light brown

light brown to dark olive brown

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING WB-2 (CONTINUED)

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/14/09
EQUIPMENT USED: Rotary wash rig with Sleeve and SPT samplers.
ELEVATION: 996'
DRILLING CO.: WDC
LOGGED BY: KGF
BORING DEPTH: 0-51'
HAMMER WEIGHT: 140lbs; DROP: 30"

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
-			20					
-			100/12"	45				SANDSTONE: coarse, with gravel (5%), massive, low hardness, slightly moist, grayish orange (10YR 7/4) to light gray (N7)
-			100/12"					poorly bedded, light brown to tan, bedding observed (distorted) in sampler at about 25 to 35 degree dip
175/8"	10	124	-	50				Bottom of Boring at 51 feet.

55
60
65
70
75
80

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING WB-3

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/15/09
EQUIPMENT USED: Rotary wash rig with Sleeve and SPT samplers.
ELEVATION: 976'
DRILLING CO.: WDC
LOGGED BY: BKP
BORING DEPTH: 0-50.2'
HAMMER WEIGHT: 140lbs; DROP: 30"
SURFACE CONDITIONS: dry grass adjacent to asphalt road

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SOIL TYPE	
				0	SM	**CERTIFIED ENGINEERED FILL (cef)** SILTY SAND: fine to coarse, compact, moist, mottled light grayish brown and medium dark brown
99/8"	6.2	129	-			
-			30	5		occasional layer of dark to medium gray silty sand
118/8"	12.8	123	-			fine to medium, occasional small gravel, very compact, more moist, dark grayish brown
-			40	10		
	7.692307	110.5975			SM	**ALLUVIUM (Qal)** SILTY SAND: fine to coarse, occasional gravel, medium dense, damp, light grayish brown
21	8.3	115	-			fine to medium, with occasional coarse sand, medium dense to dense, damp to moist
-			11	15		fine, occasional thin lens of sandy silt, loose to medium dense
	11.52815	113.9889				
23	11.7	121	-			fine to medium, with occasional coarse sand, more silty
-			19	20		
145	2.4	124	-			**SAUGUS FORMATION (QTs)** SANDSTONE: fine to coarse, with some silt, occasional small gravel, low hardness, damp, light brownish gray (5YR 6/1)
-			19	25		
-			27			moist, occasional thin lens of pale reddish brown (10R 5/4) fine sandy siltstone
132	4.7	138	-	30		fine to very coarse, pebbly, low hardness, slightly moist, light brownish gray (5YR 6/1)
-			96/9"			occasional thin lens of light gray (N7) sandstone, damp, low hardness, occasional small gravel
-			65	35		
				40		

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

(CONTINUED ON THE FOLLOWING FIGURE)

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

BORING WB-3 (CONTINUED)

JOB NUMBER: 2002-036-03
DATE DRILLED: 7/15/09
EQUIPMENT USED: Rotary wash rig with Sleeve and SPT samplers.
ELEVATION: 976'
DRILLING CO.: WDC
LOGGED BY: BKP
BORING DEPTH: 0-50.2'
HAMMER WEIGHT: 140lbs; DROP: 30"
SURFACE CONDITIONS: dry grass adjacent to asphalt road

BLOWS PER FOOT	MOISTURE CONTENT (%)	DRY UNIT WEIGHT (LBS. PER CU. FT.)	N-VALUE	DEPTH (FEET)	SAMPLE LOCATION	GRAPHIC LOG	SOIL TYPE	
-			84					fine to coarse, slightly silty, damp to moist, light gray (N7) to medium brownish gray (5YR 6/1)
-			22	45				SANDY SILTSTONE: fine, soft to low hardness, moist, pale reddish brown (10R 5/4)
-			96					SILTSTONE: low hardness, moist, light gray (N7) to medium light gray (N5)
100/2"			-	50				Bottom of Boring at 50.2 feet.
				55				
				60				
				65				
				70				
				75				
				80				

Note: The log of subsurface conditions shown hereon is approximate and applies only at the specific location and date indicated. It is not warranted to be representative of subsurface conditions at other locations or times.

BOREHOLE LOG 2002-036-03.GPJ FRANKIAN.GDT 11/20/09

LOG OF BORING

R.T. FRANKIAN & ASSOCIATES

Chiquita Canyon Landfill
January 27, 2012
2002-036-004

APPENDIX C

LABORATORY TESTING

GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

APPENDIX C

LABORATORY TESTING

Laboratory tests were performed on selected samples obtained from the borings to aid in the classification of the soils and to determine their engineering properties.

The field moisture content and dry density of the soils encountered were determined by performing tests on the undisturbed samples. The results of the tests are shown to the left of the boring logs in Appendix B.

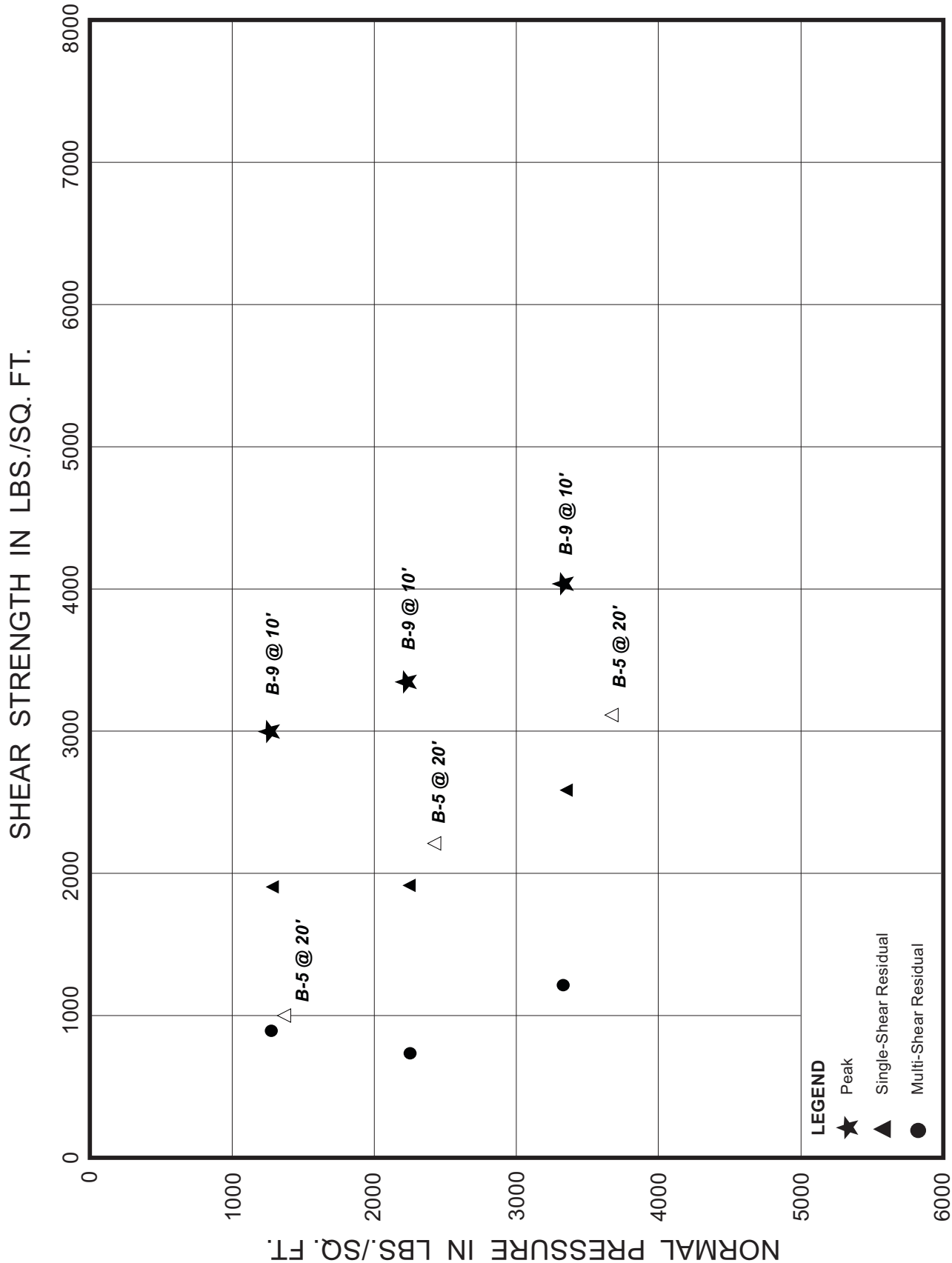
Direct shear tests were performed on selected undisturbed samples to determine the strength of the soils. The tests were performed after soaking the samples to near-saturated moisture content and at various surcharge pressures. The ultimate strength values determined from the direct shear tests are presented on the Shear Test Data page.

Confined consolidation tests were performed on four undisturbed samples. Water was added during the tests to each of the samples to illustrate the effect of moisture on the compressibility. The results of the tests are presented on the Consolidation Test Data pages.

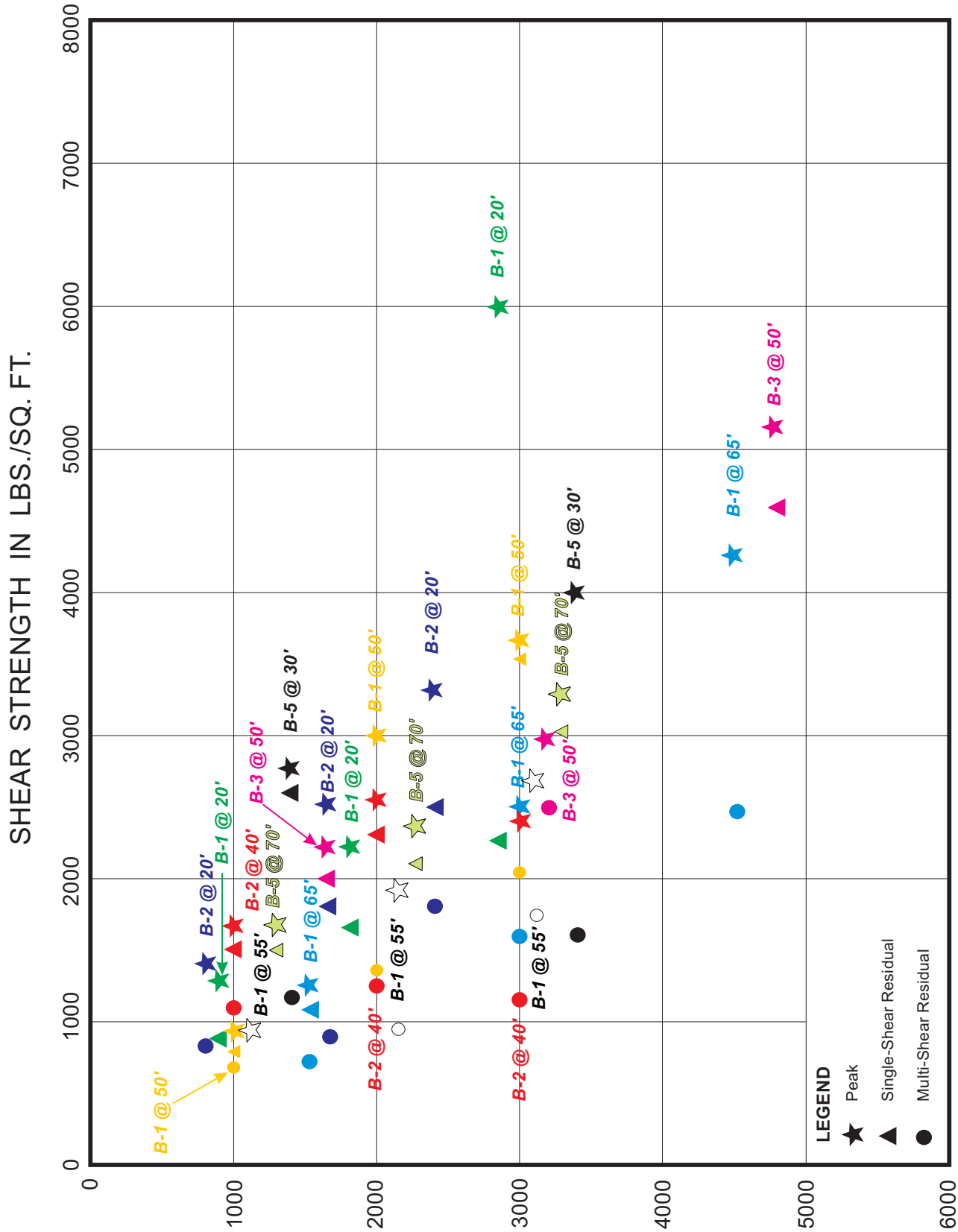
Atterberg limits (liquid and plastic limit) tests were conducted on selected samples to aid in classifying the soils and determining index properties. Test results are presented on the attached graphic, "Atterberg Limit's Test Data."

The gradation of selected samples was determined by performing sieve analyses. Hydrometer tests were performed on some of the sieve analyses samples. The results of the tests are presented on Gradation Test Data pages.

SUMMARY OF SHEAR TEST DATA



SUMMARY OF SHEAR TEST DATA



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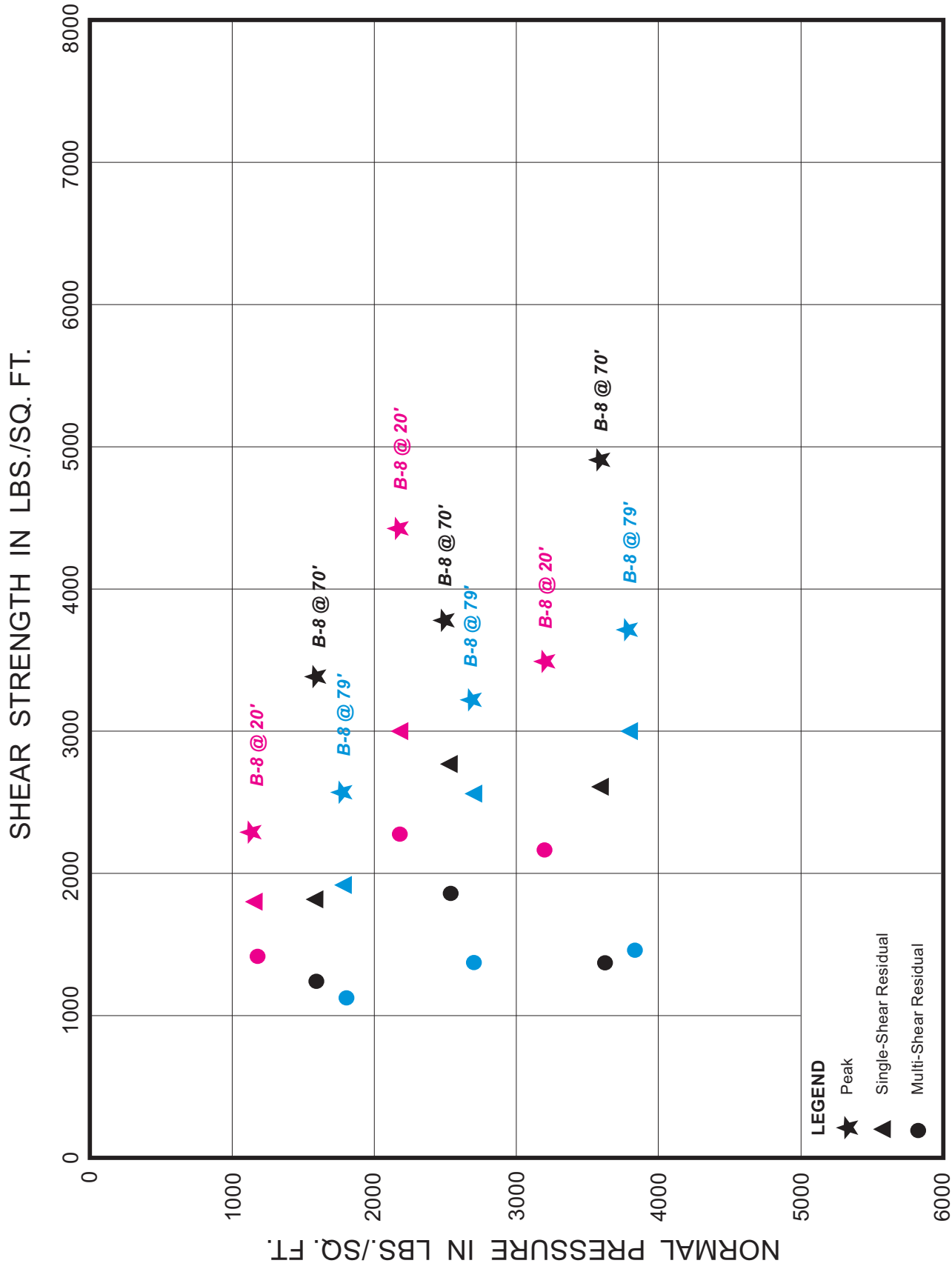
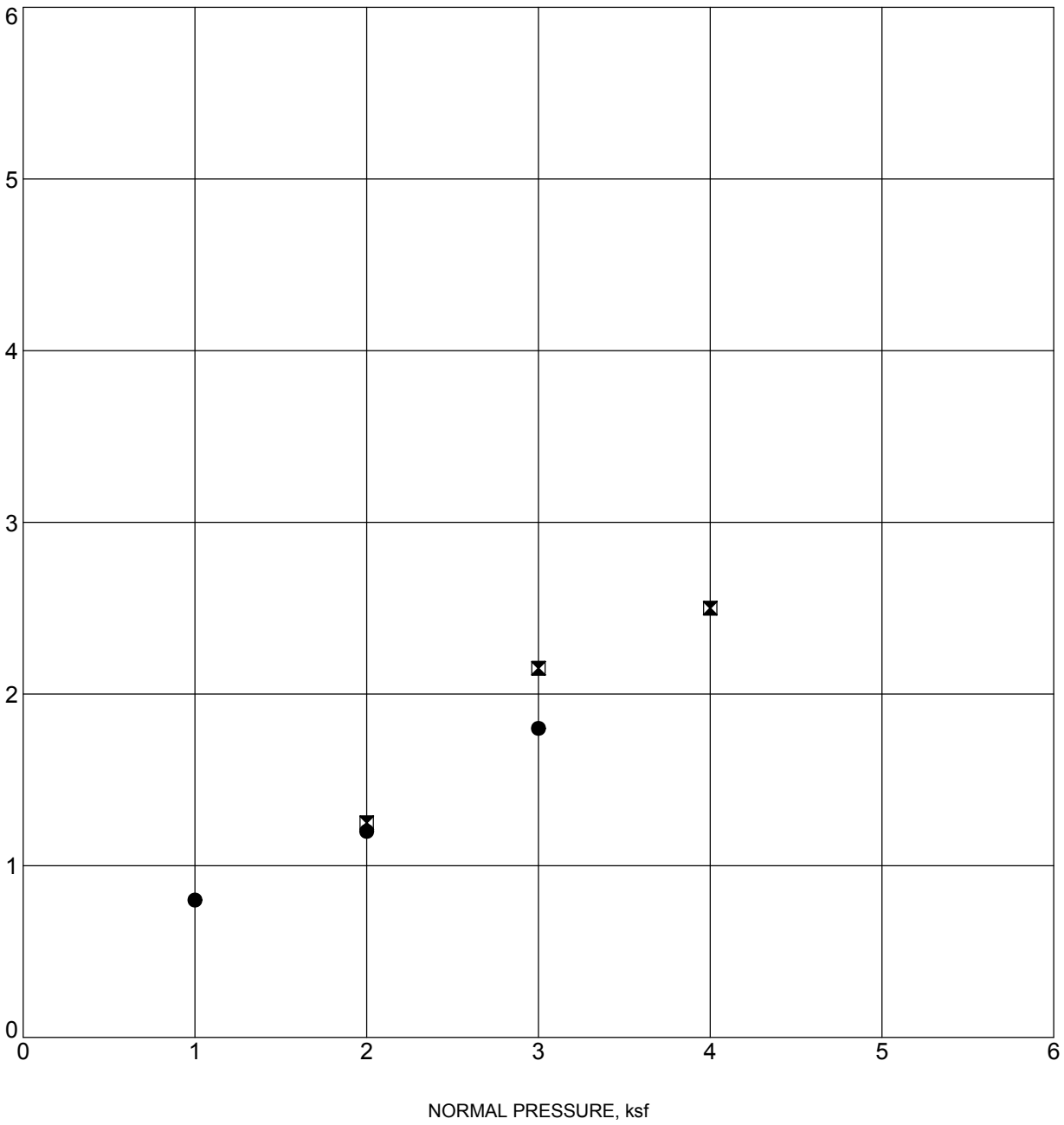




Specimen Identification		Classification				
●	**B-1-11 11.0'**					
⊠	**B-1-11 45.0'**					

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

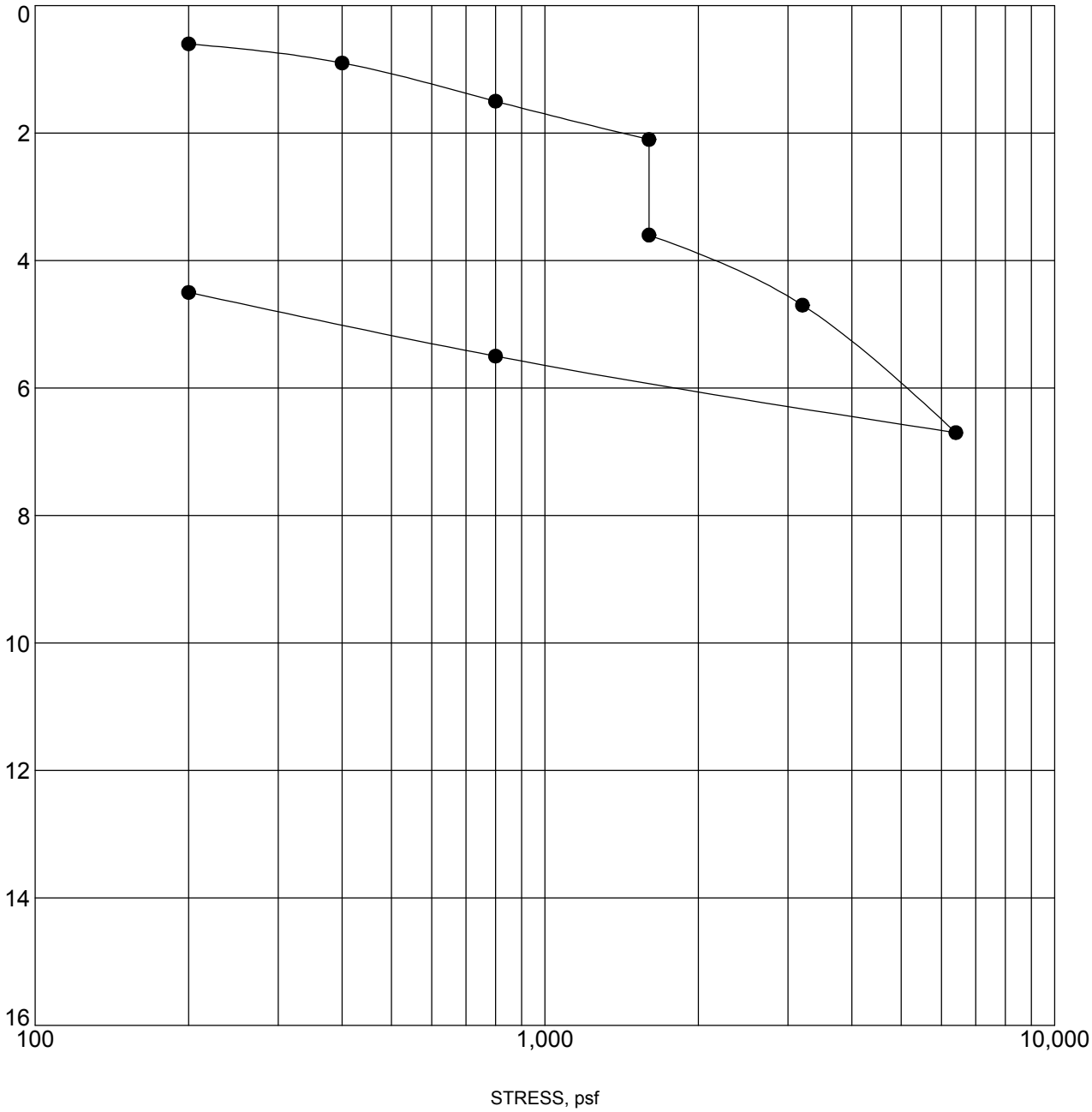
DIRECT SHEAR TEST

JOB NUMBER: 2002-036-006

REPORT DATED: 01-13-2012

US DIRECT SHEAR 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

	Specimen Identification		Classification		
●	**B-2-10**	**10.0'**			

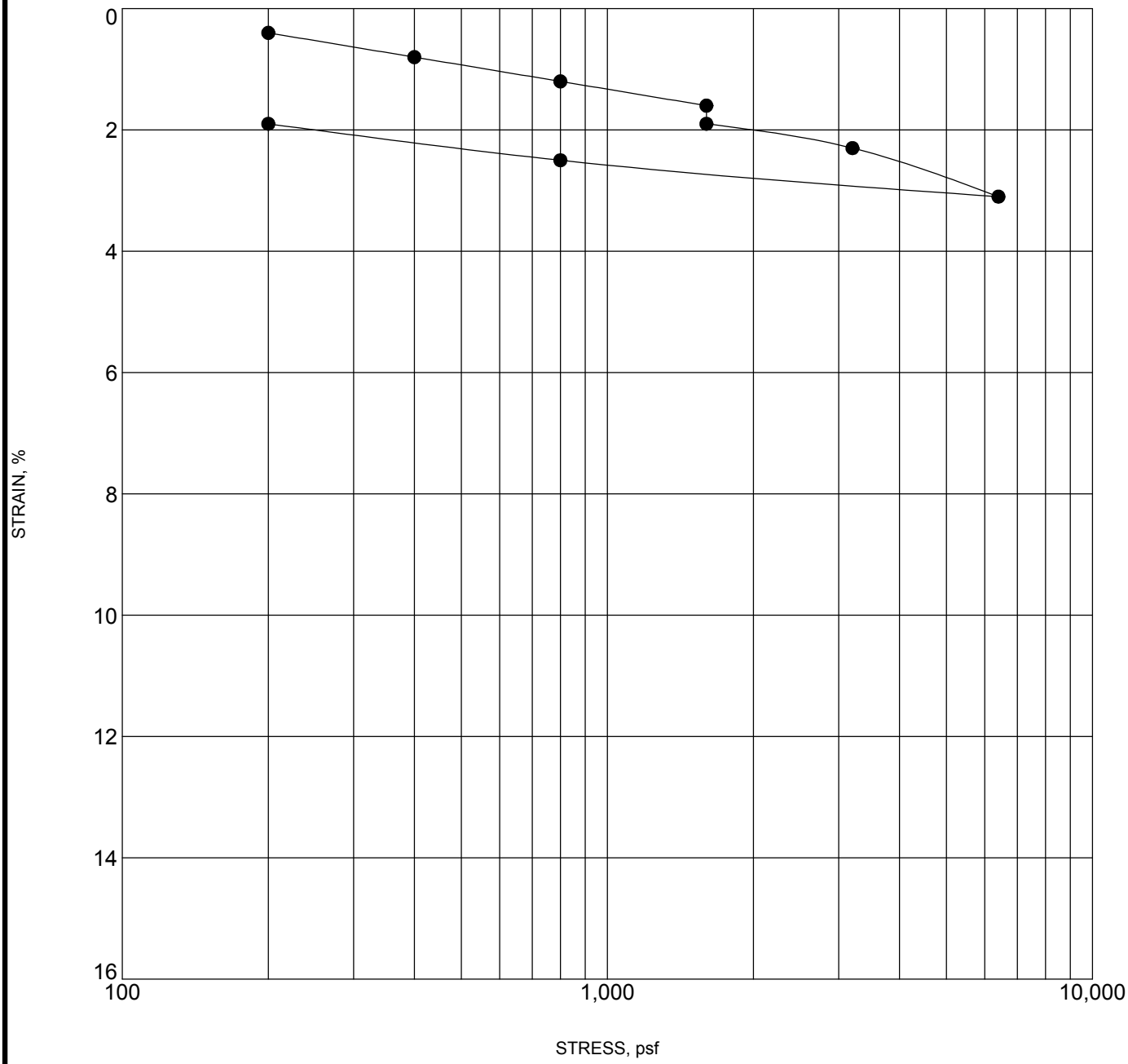
R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-6-10 10.0'**			

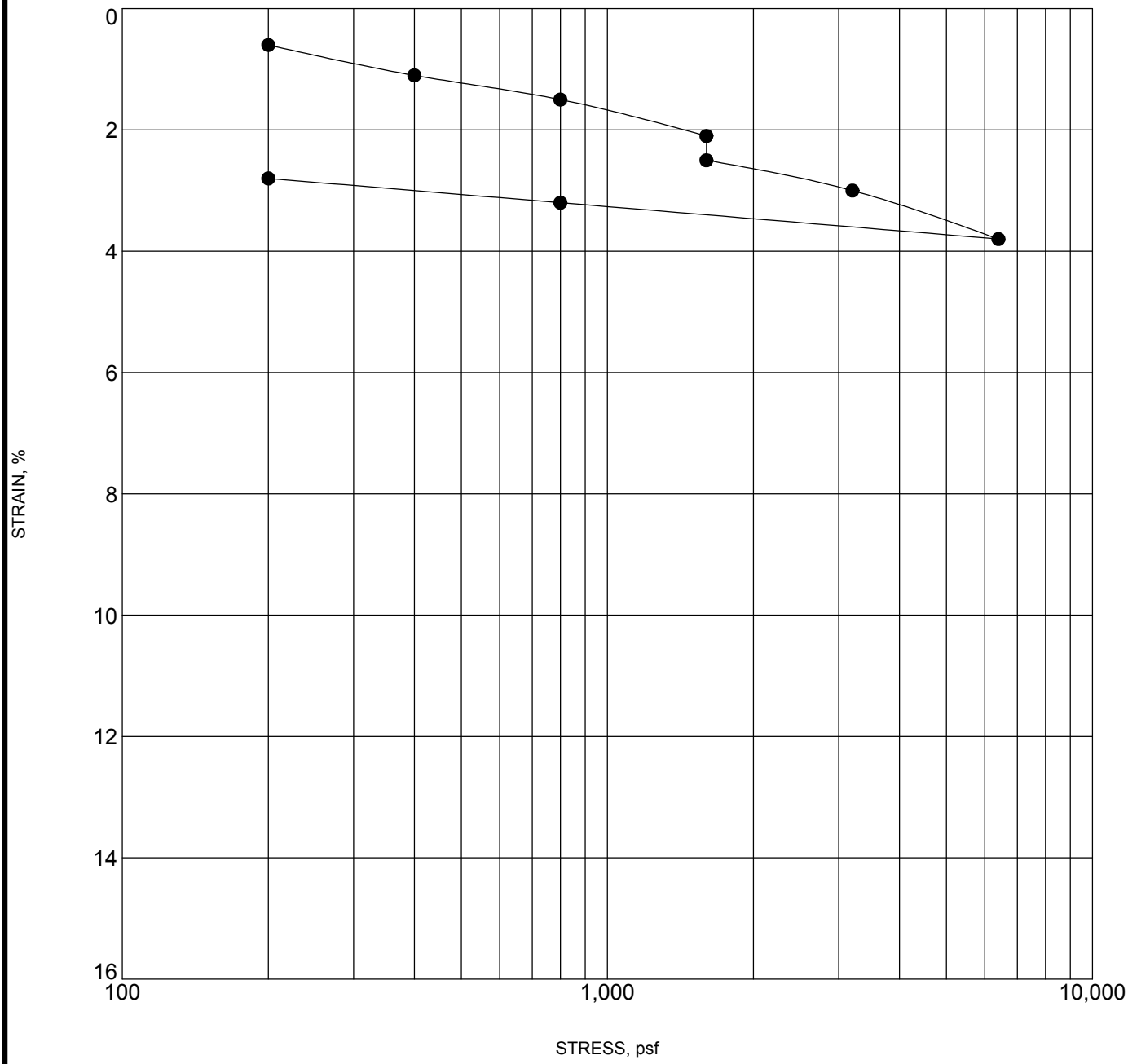
R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



Water added at 1600 psf

	Specimen Identification		Classification		
●	**B-6-10**	**20.0'**			

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
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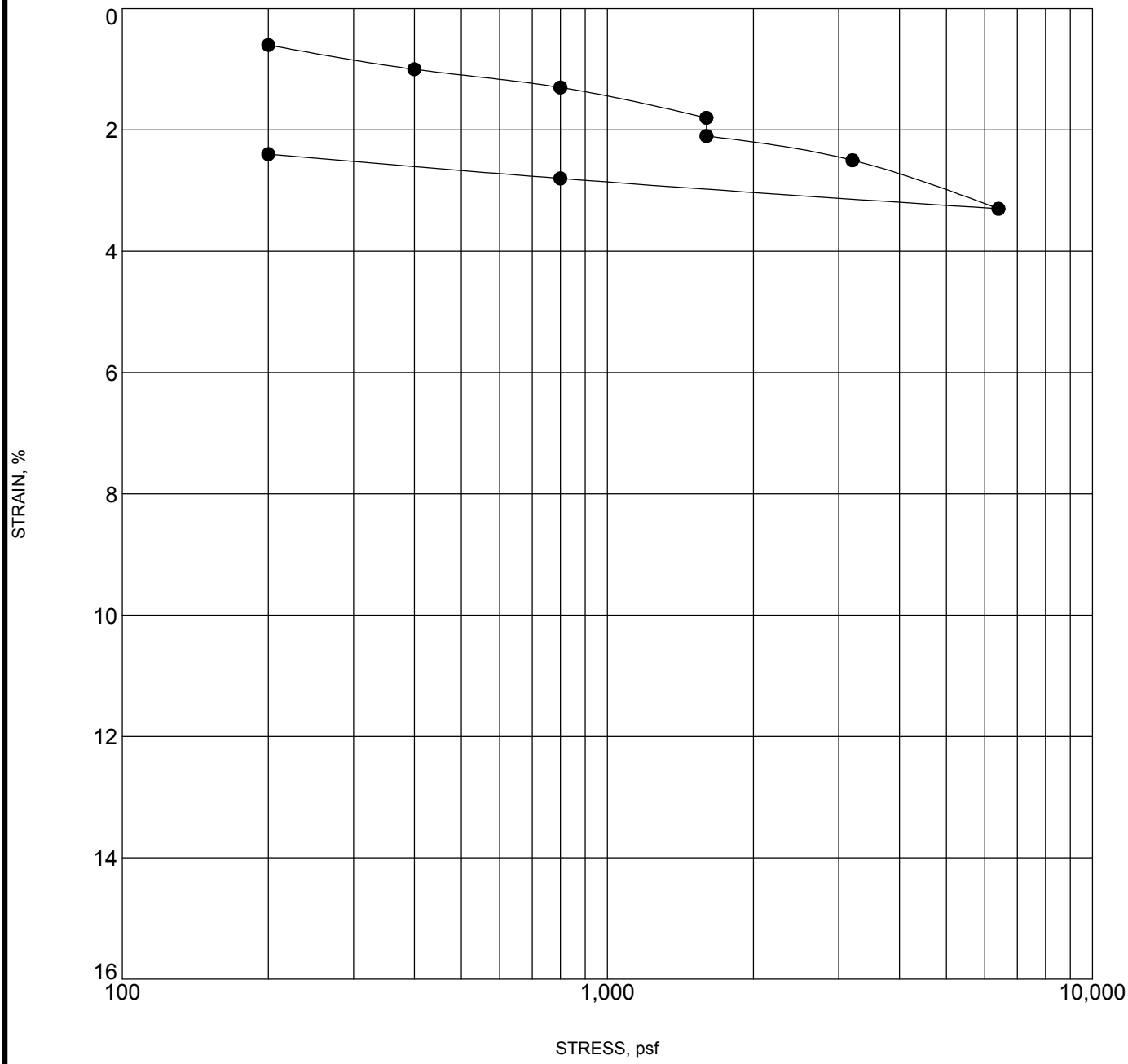
Fax: (818) 531-1511

CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-6-10 30.0'**			

R. T. Frankian & Associates
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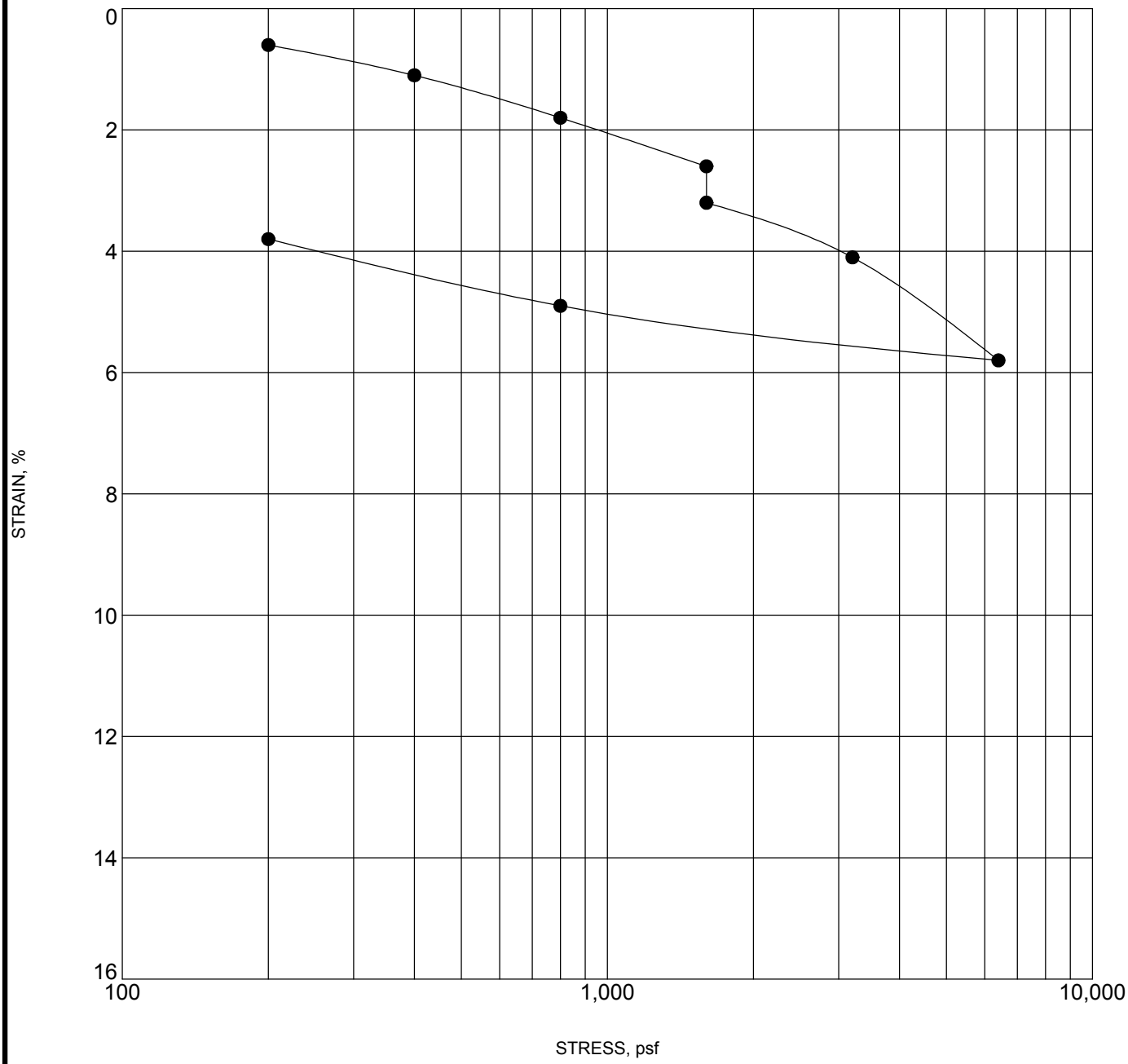
Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



Water added at 1600 psf

	Specimen Identification		Classification		
●	**HS-1-10**	**5.0'**			

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
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Fax: (818) 531-1511

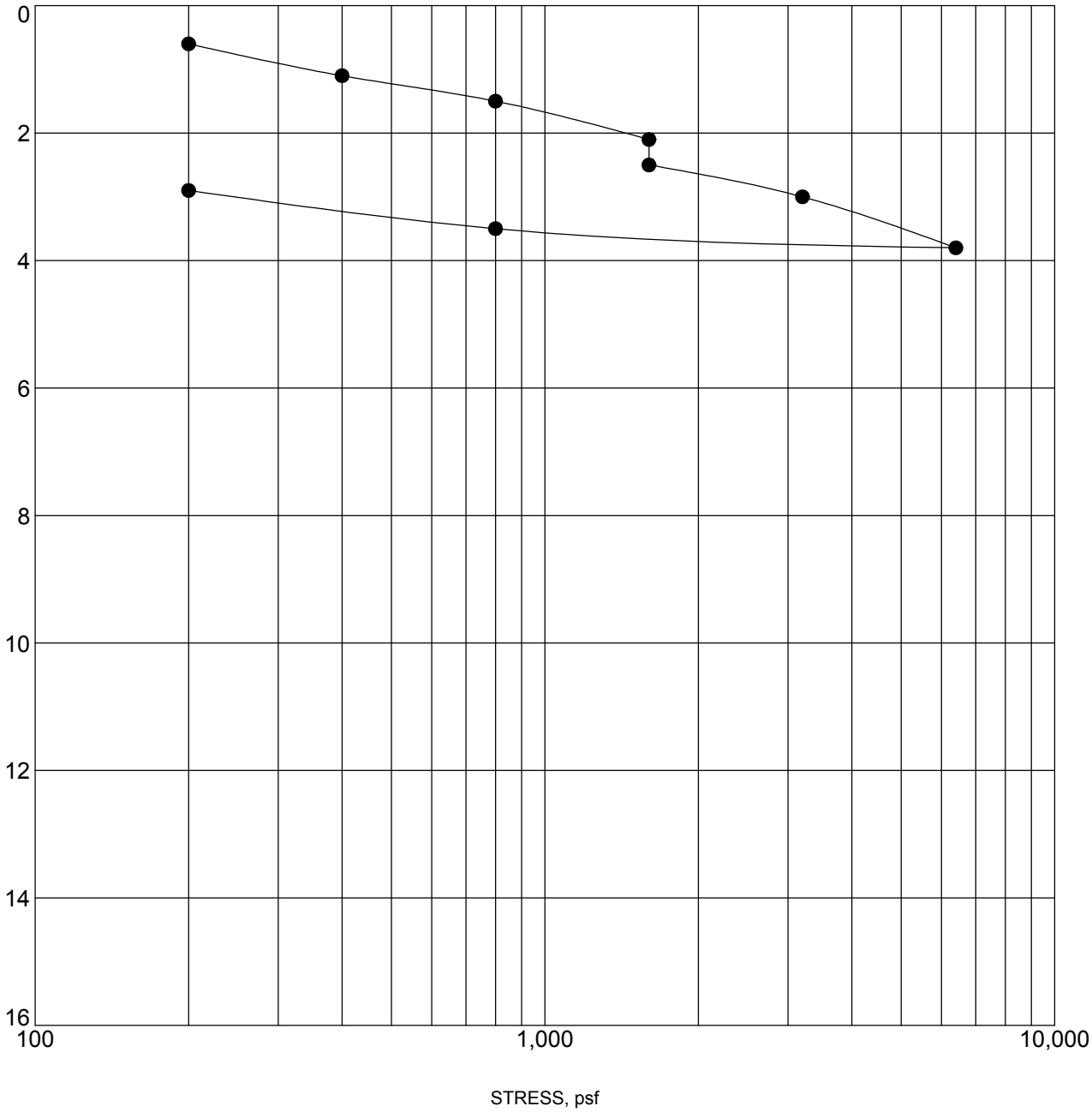
CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

	Specimen Identification		Classification		
●	**HS-1-10**	**15.0'**			

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

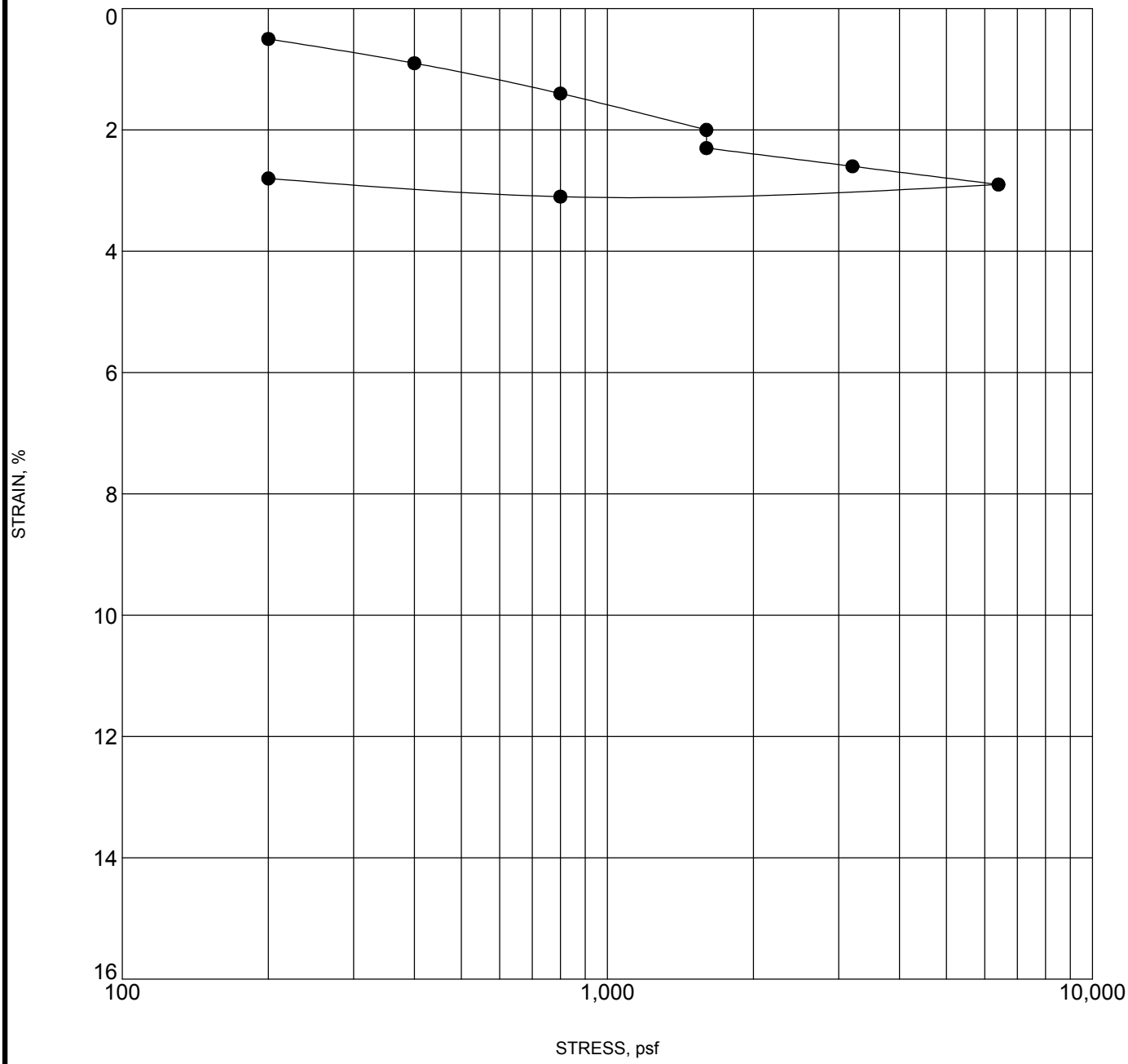
CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

	Specimen Identification		Classification		
●	**HS-1-10**	**25.0'**			

R. T. Frankian & Associates
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Burbank, Ca 91504
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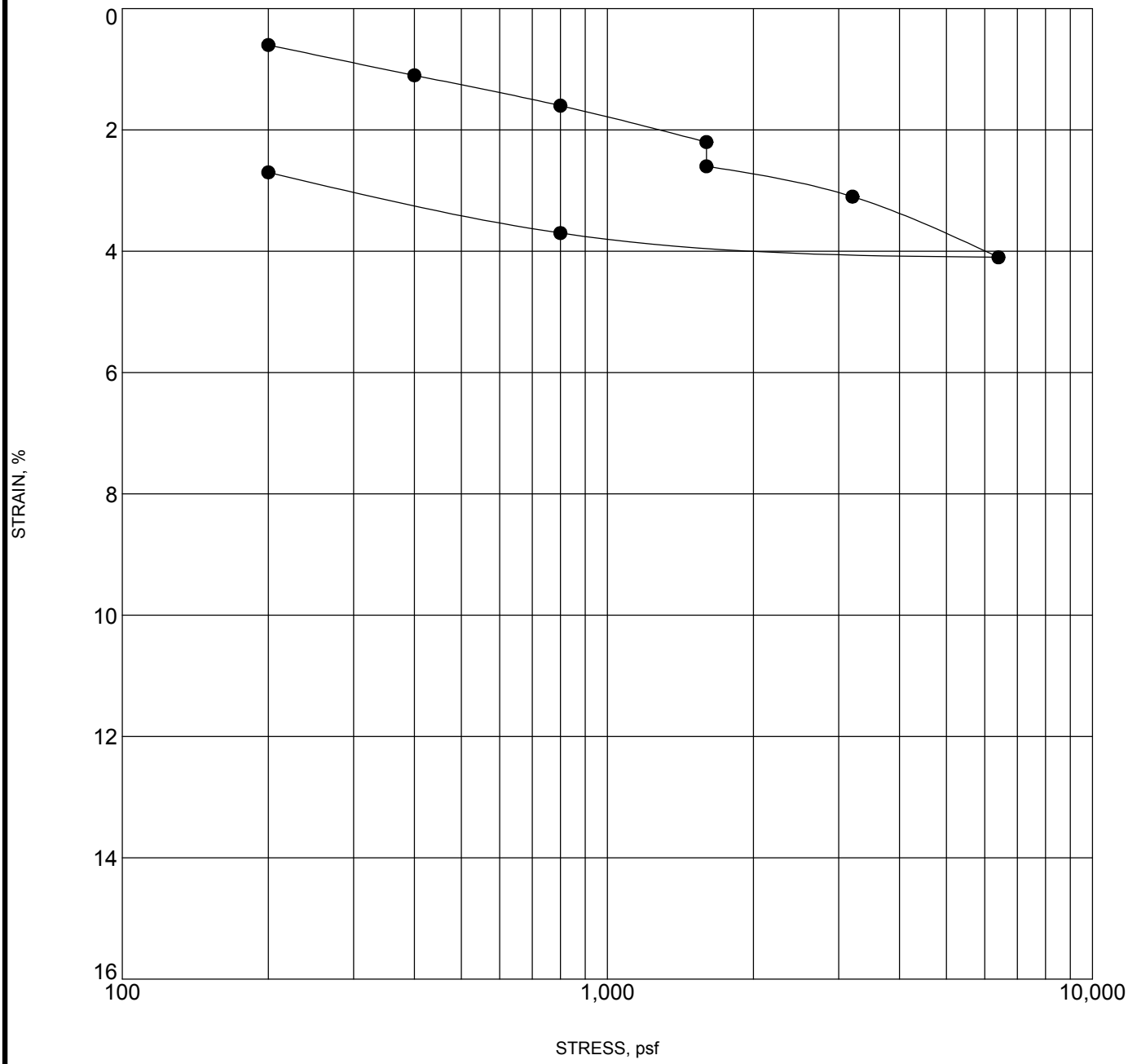
CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



Water added at 1600 psf

	Specimen Identification		Classification		
●	**HS-1-10**	**35.0'**			

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
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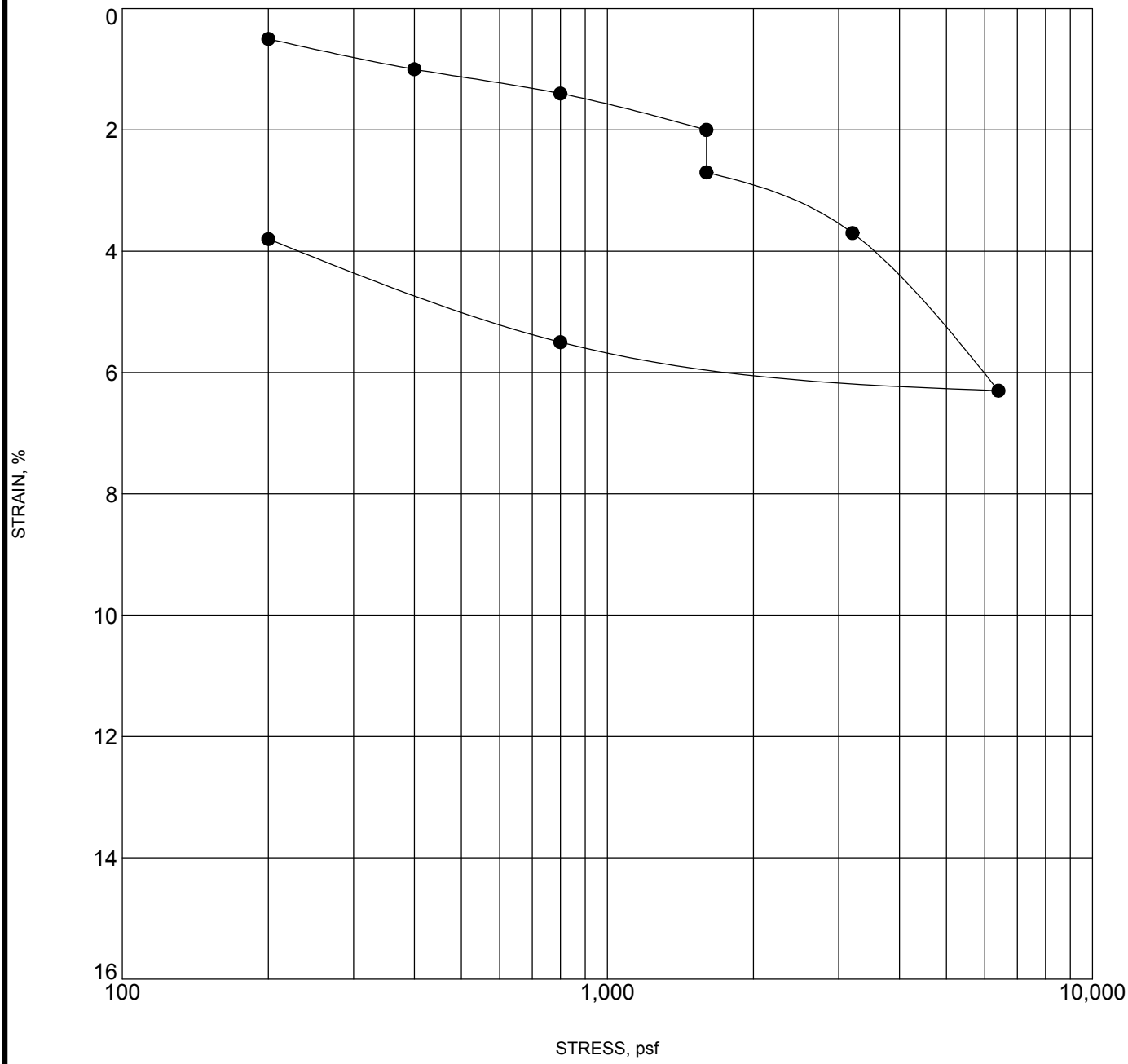
CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



Water added at 1600 psf

	Specimen Identification		Classification		
●	**HS-2-10**	**5.0'**			

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
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Fax: (818) 531-1511

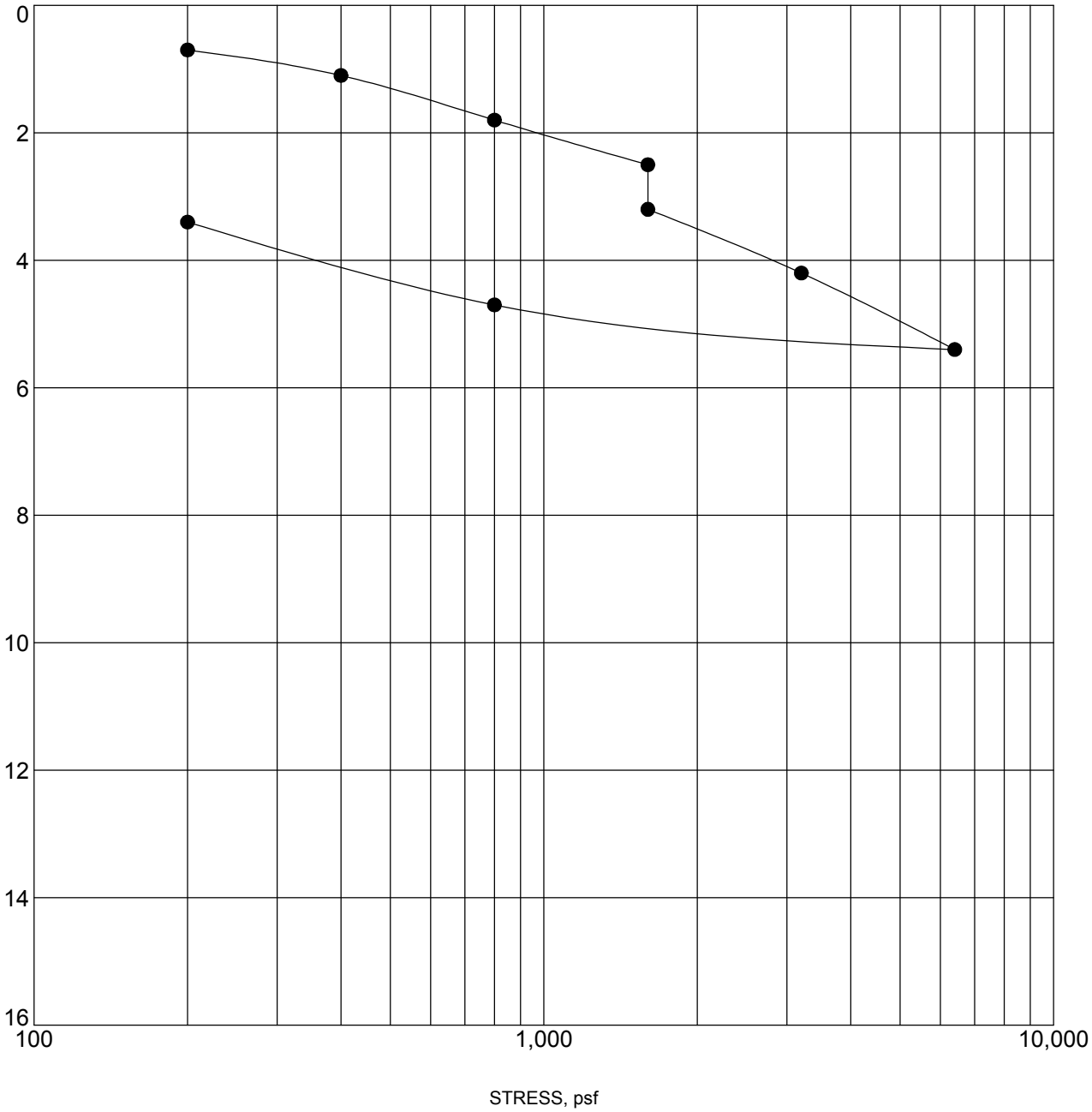
CONSOLIDATION TEST

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US CONSOL STRAIN 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-2-11 5.0'**			

R. T. Frankian & Associates
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Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

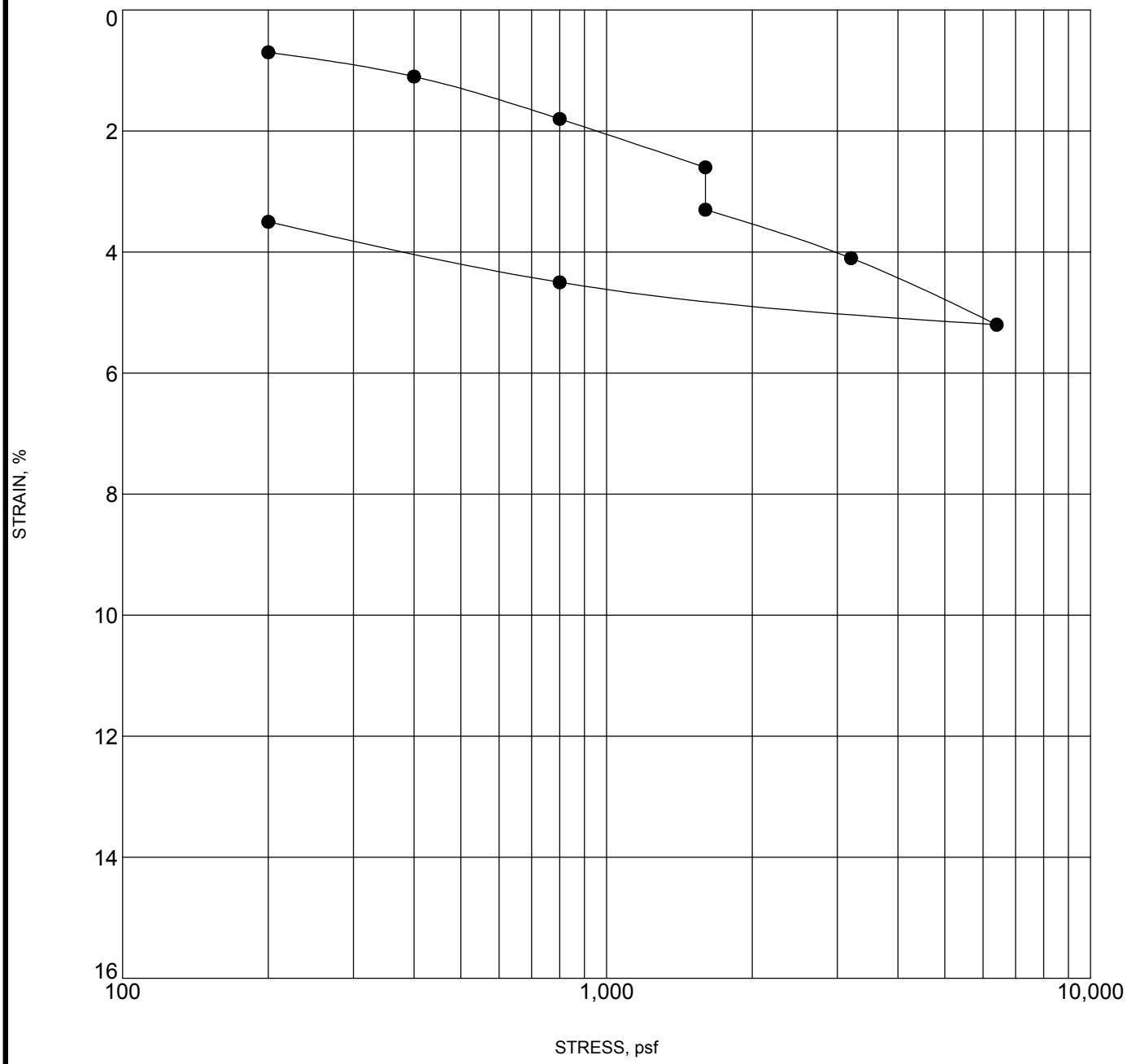
CONSOLIDATION TEST

JOB NUMBER: 2002-036-006

REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-2-11 10.5'**			

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1329 Scott Road
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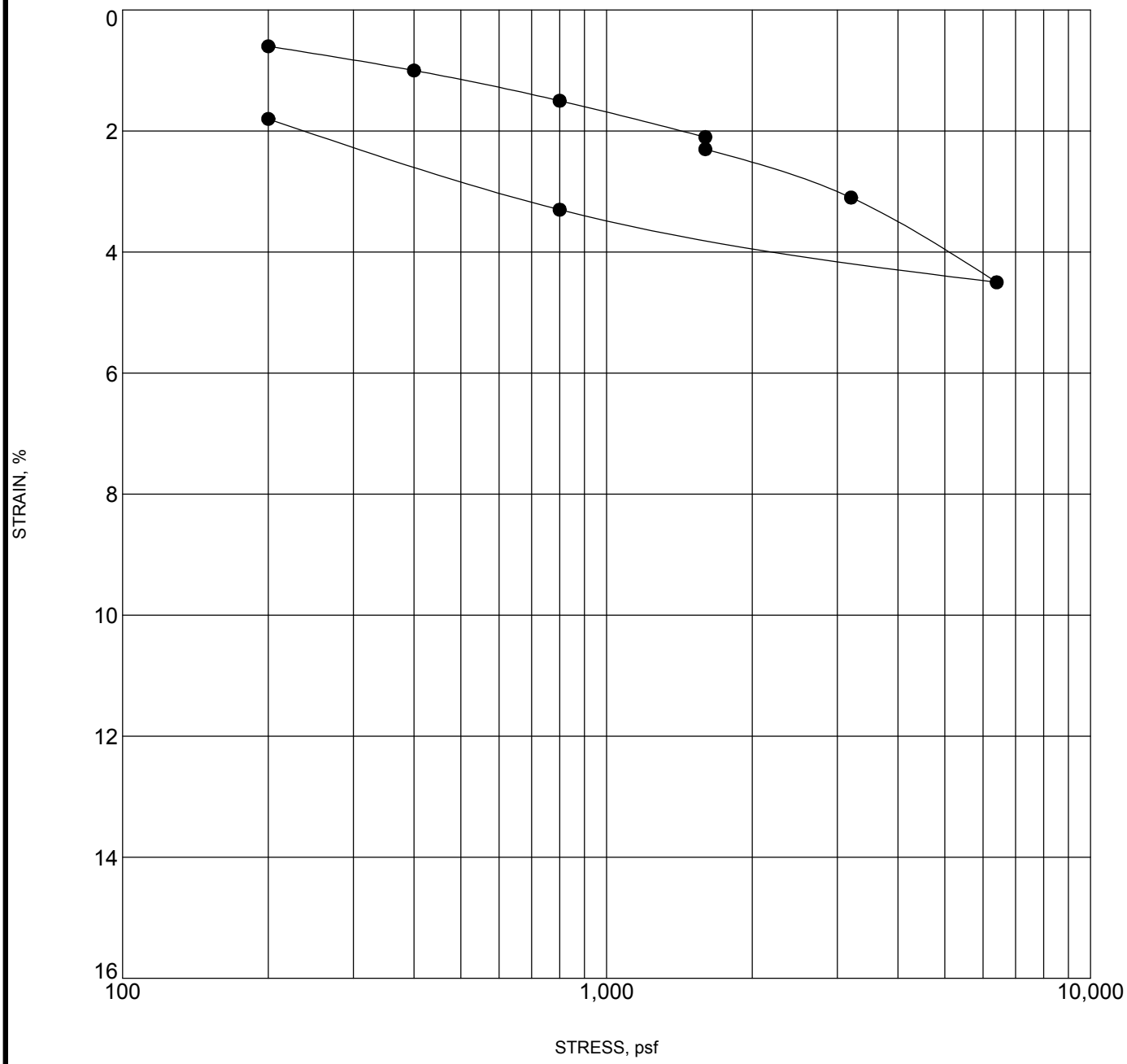
CONSOLIDATION TEST

JOB NUMBER: 2002-036-006

REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-3-11 5.0'**			

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

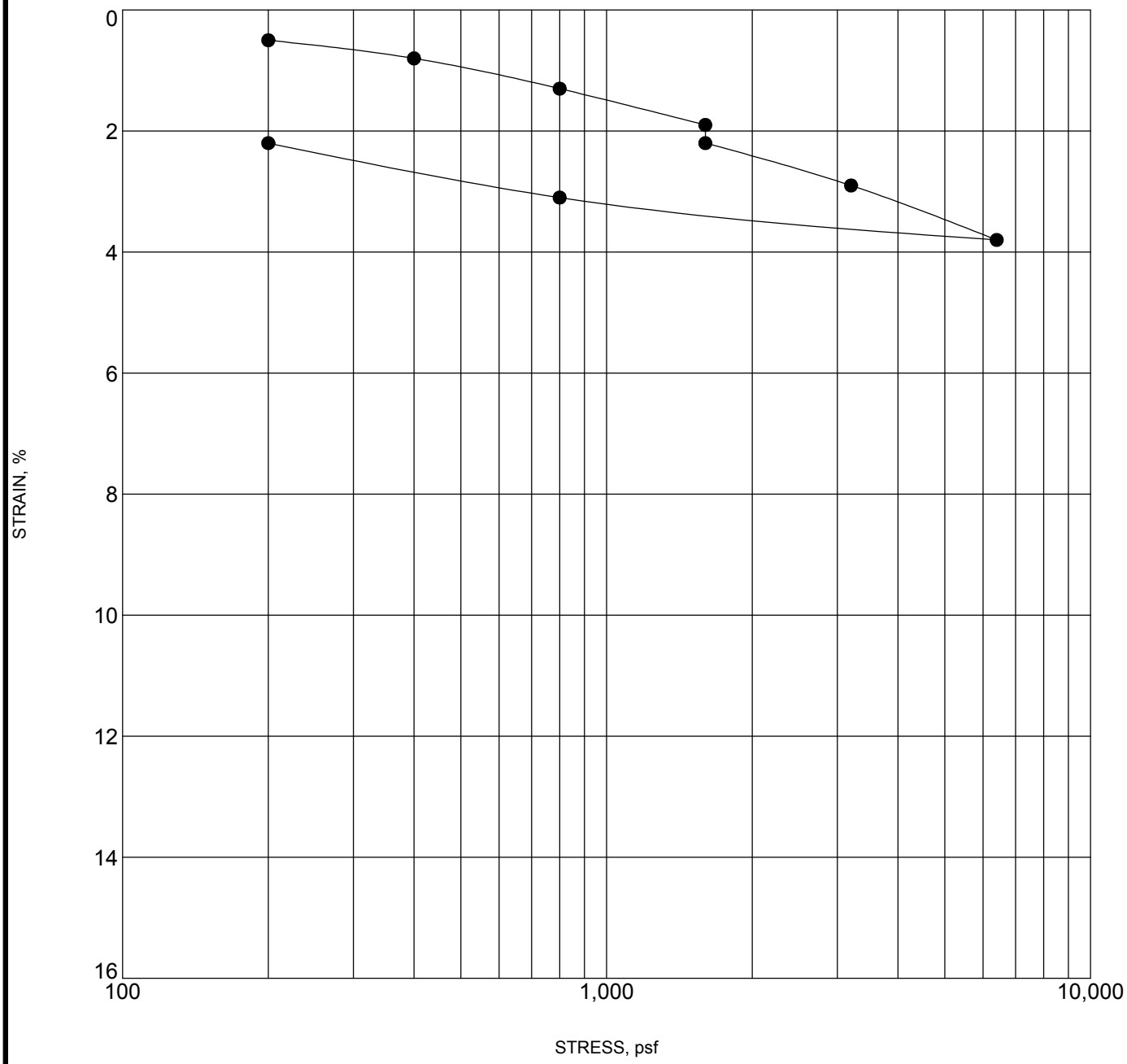
CONSOLIDATION TEST

JOB NUMBER: 2002-036-006

REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-3-11 8.0'**			

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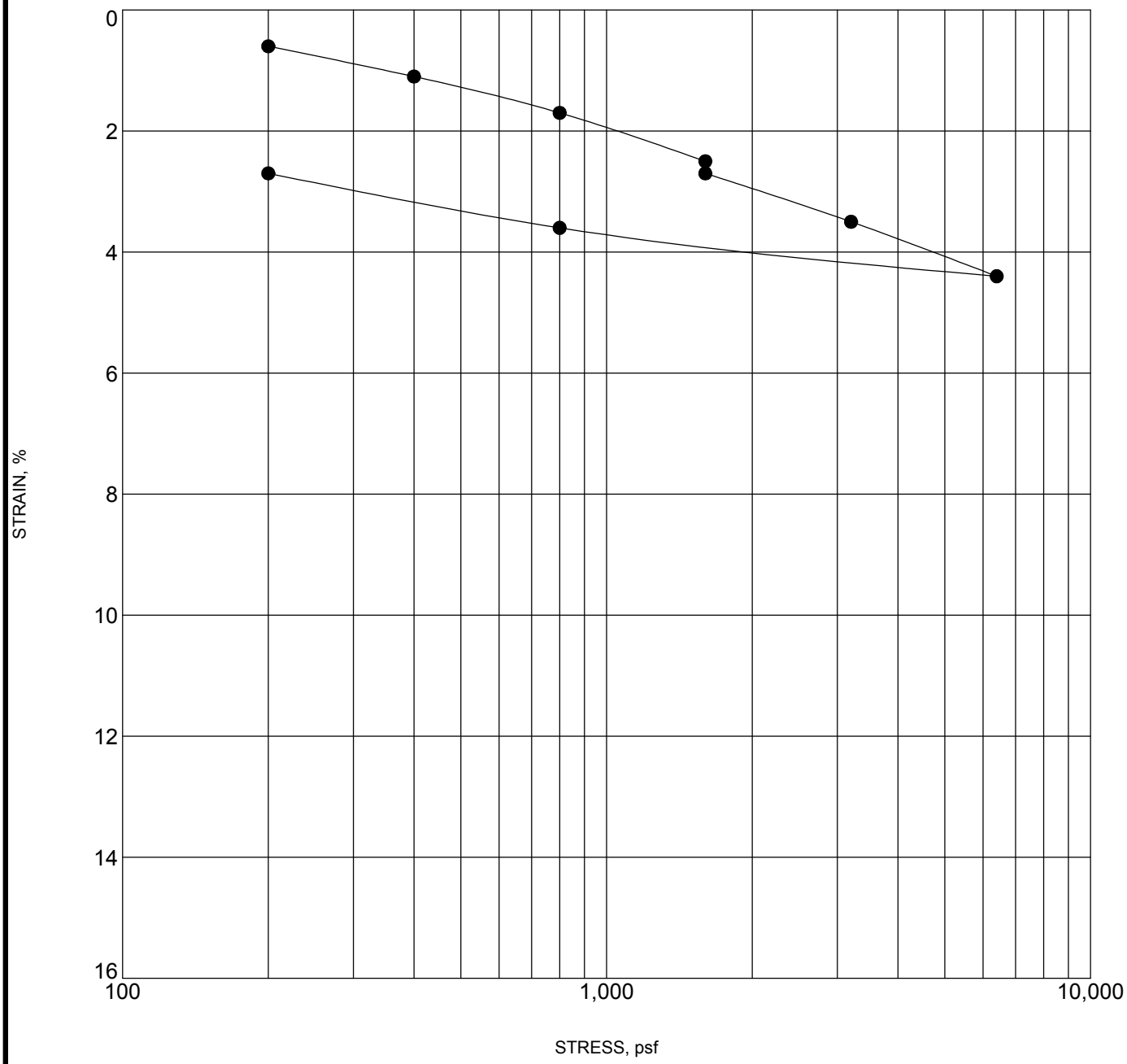
CONSOLIDATION TEST

JOB NUMBER: 2002-036-006

REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-3-11 10.0'**			

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Burbank, Ca 91504
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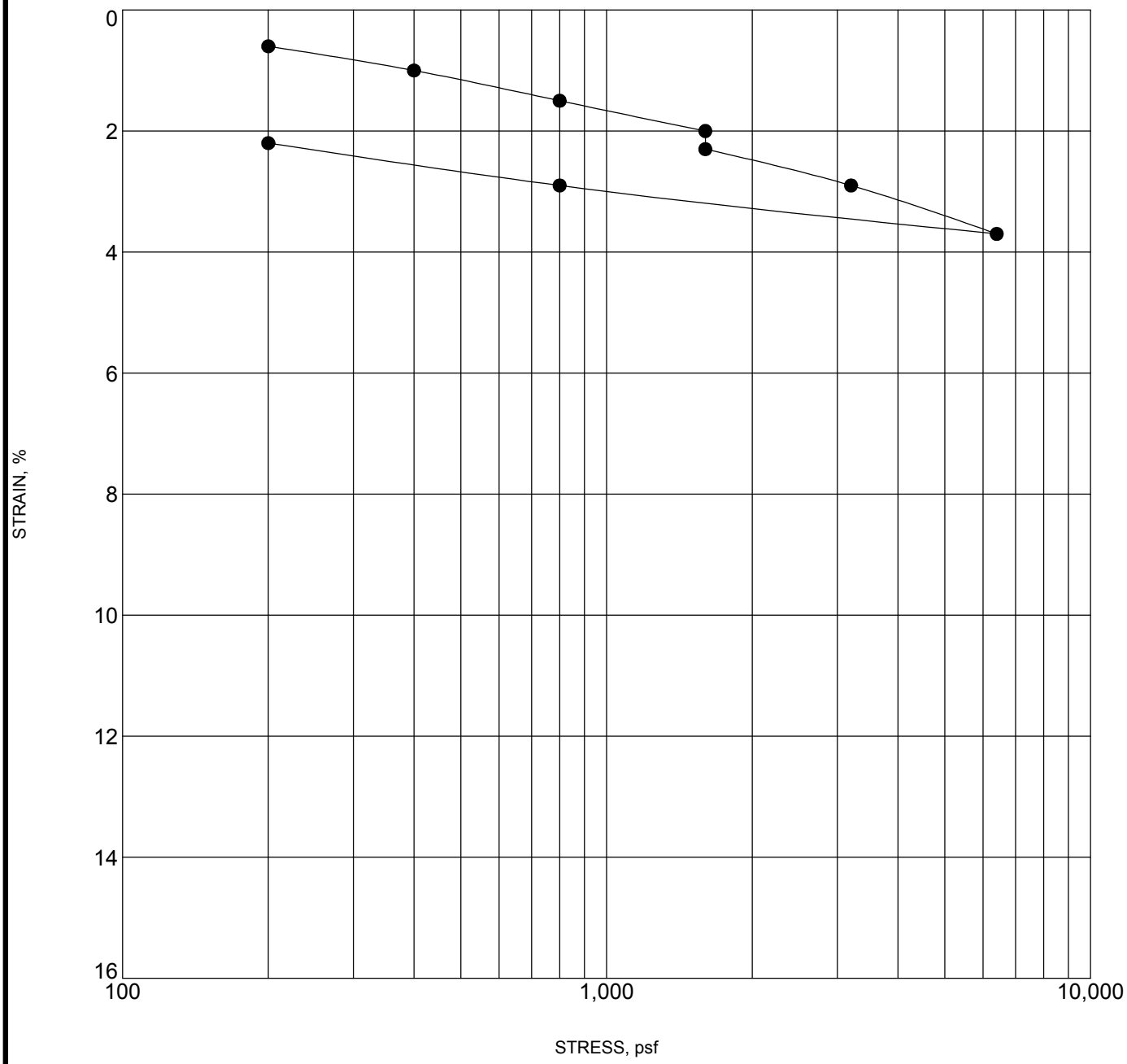
CONSOLIDATION TEST

JOB NUMBER: 2002-036-006

REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-3-11 15.0'**			

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Burbank, Ca 91504
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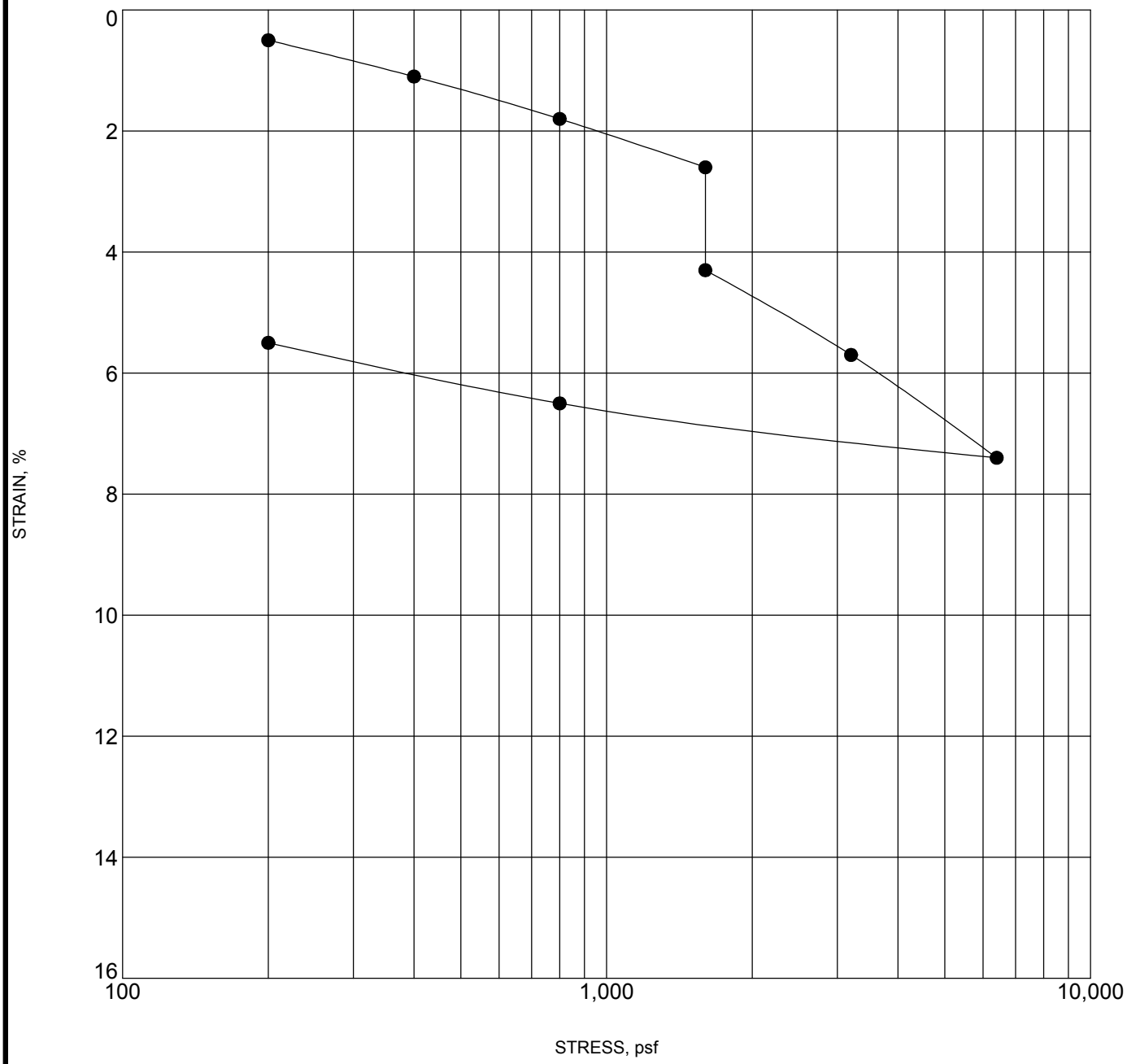
CONSOLIDATION TEST

JOB NUMBER: 2002-036-006

REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-4-11 5.0'**			

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
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CONSOLIDATION TEST

JOB NUMBER: 2002-036-006

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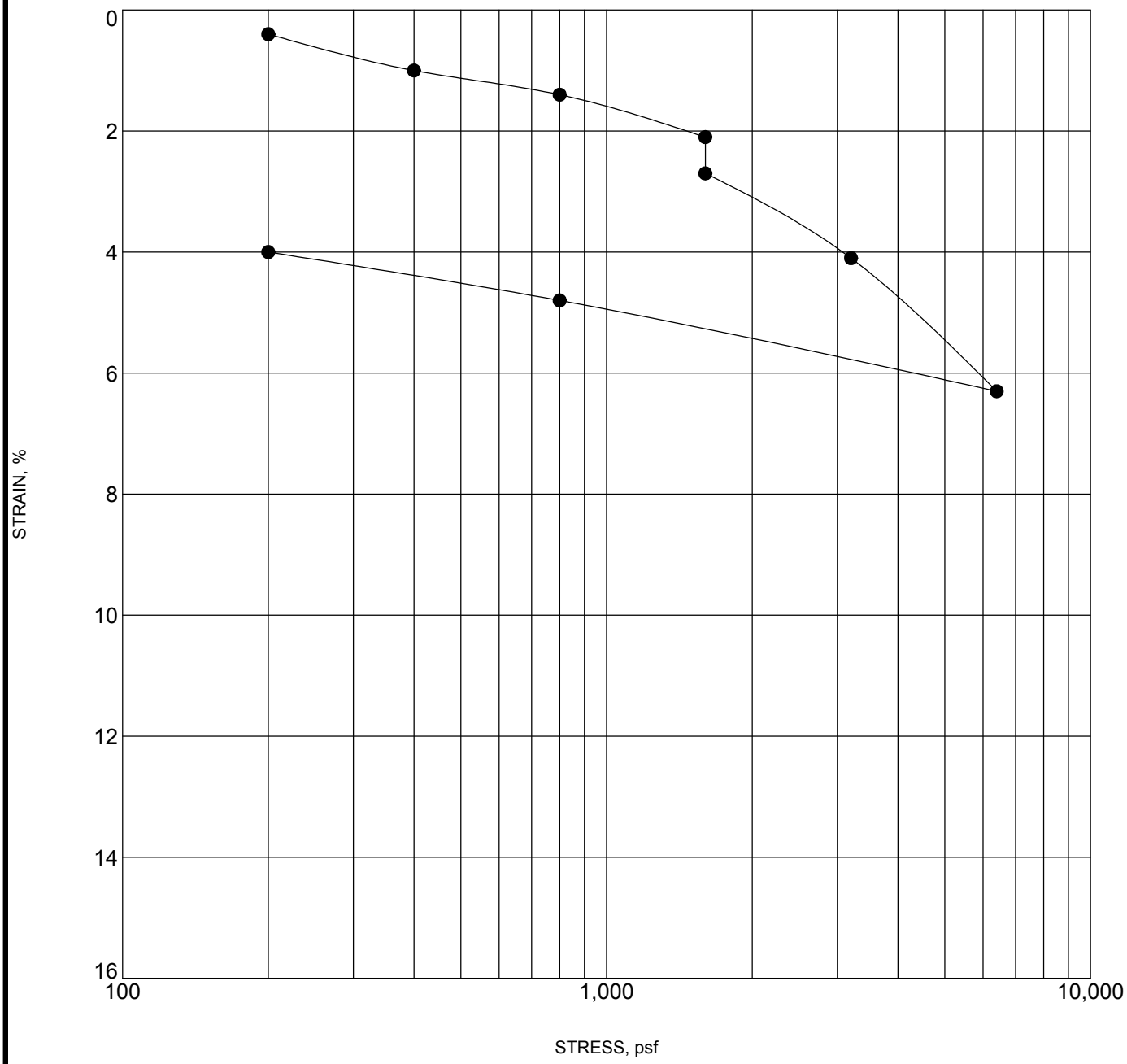
US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-4-11 9.0'**			

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US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

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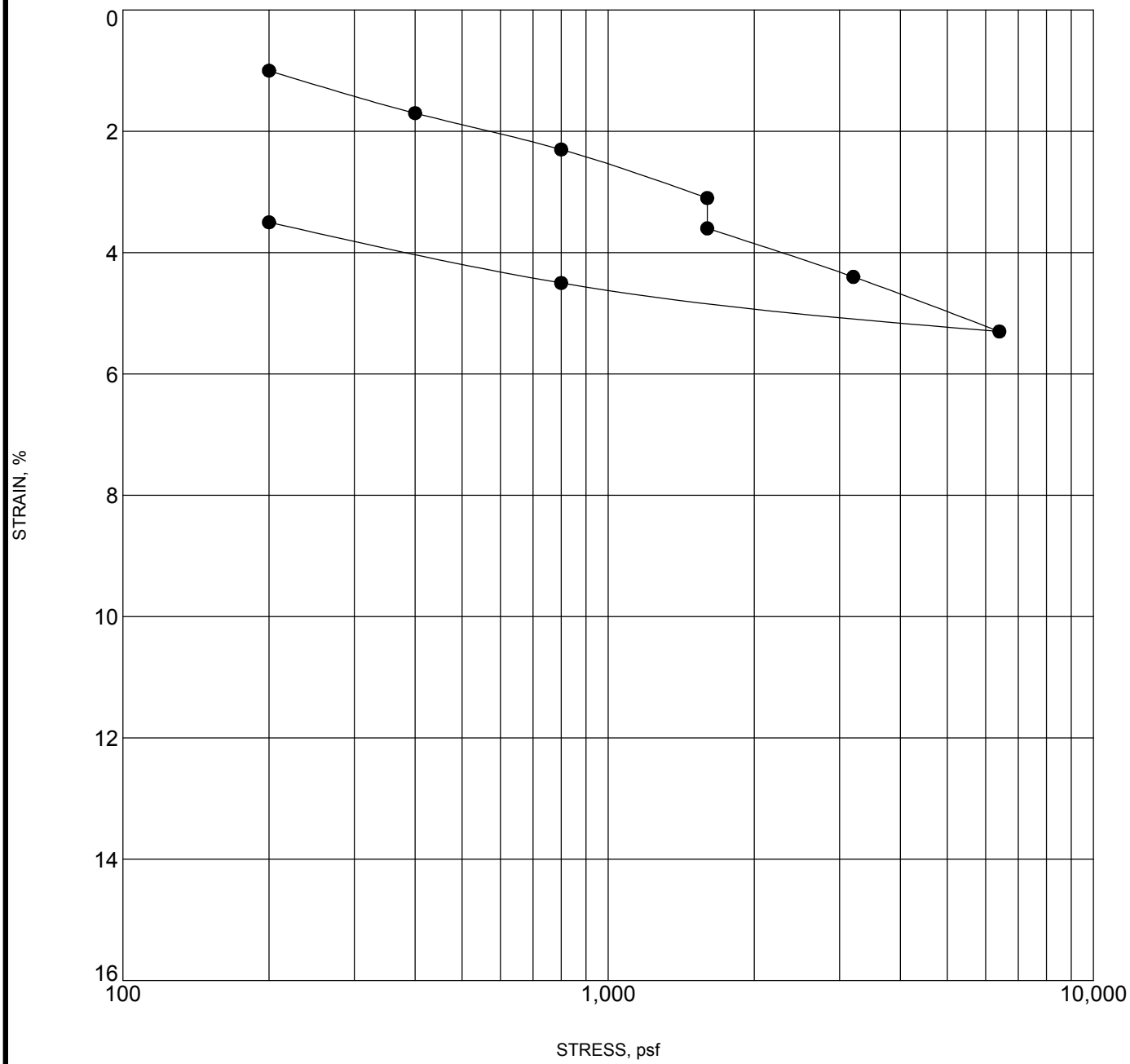

Water added at 1600 psf

Specimen Identification		Classification		
●	**B-4-11 12.5'**			

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CONSOLIDATION TEST

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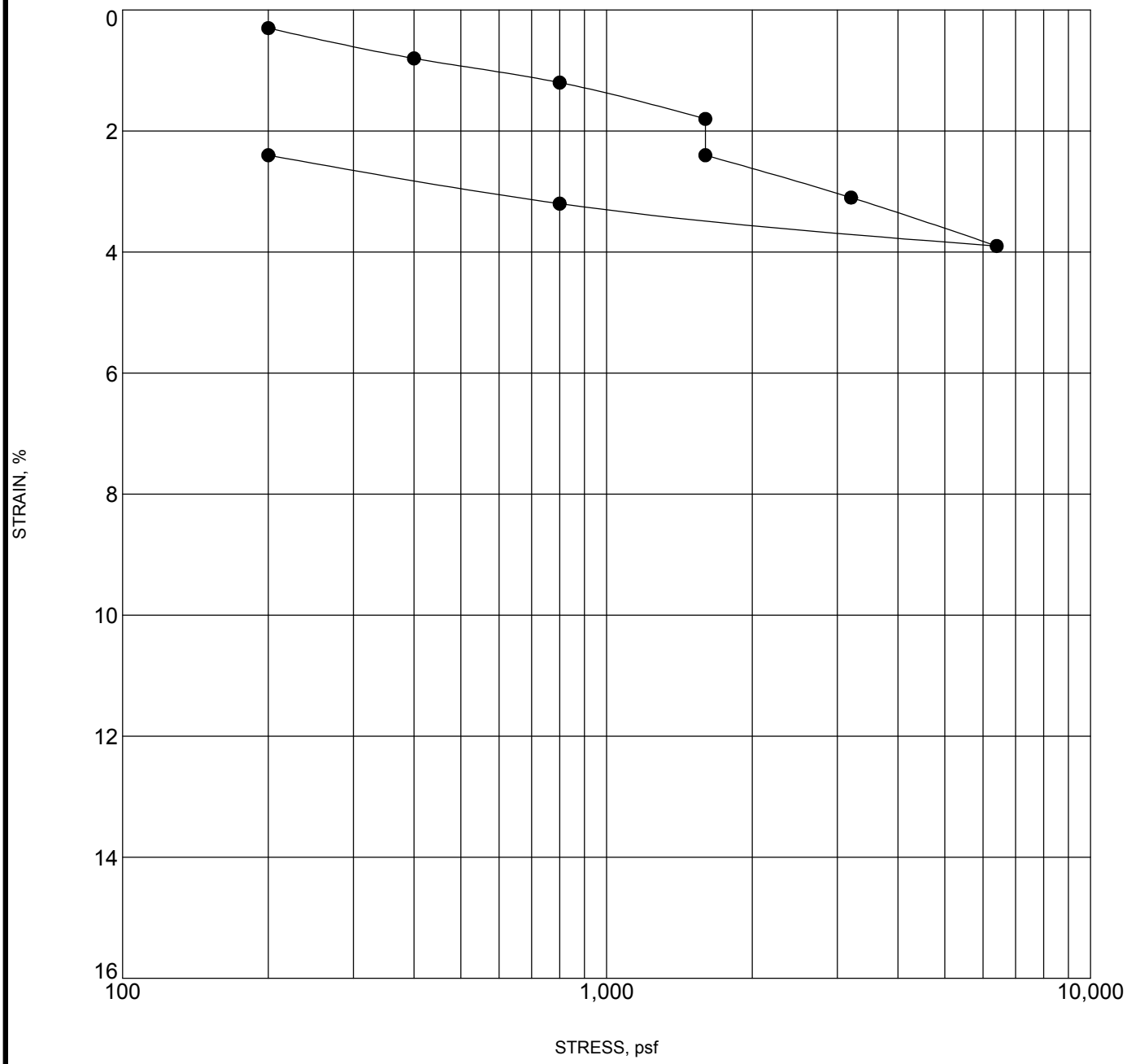
US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-5-11 5.0'**			

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CONSOLIDATION TEST

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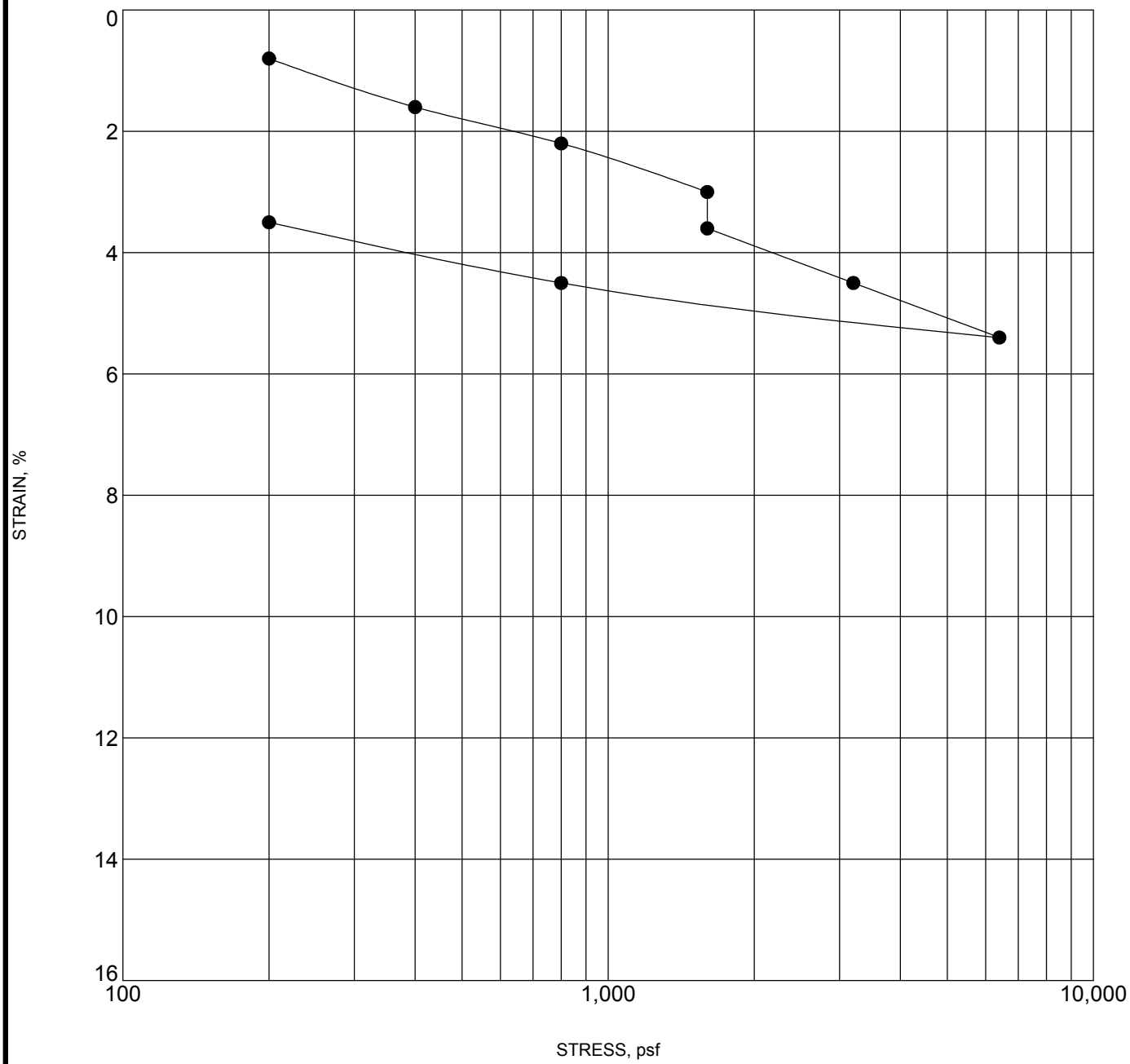
REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-5-11 9.0'**			

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CONSOLIDATION TEST

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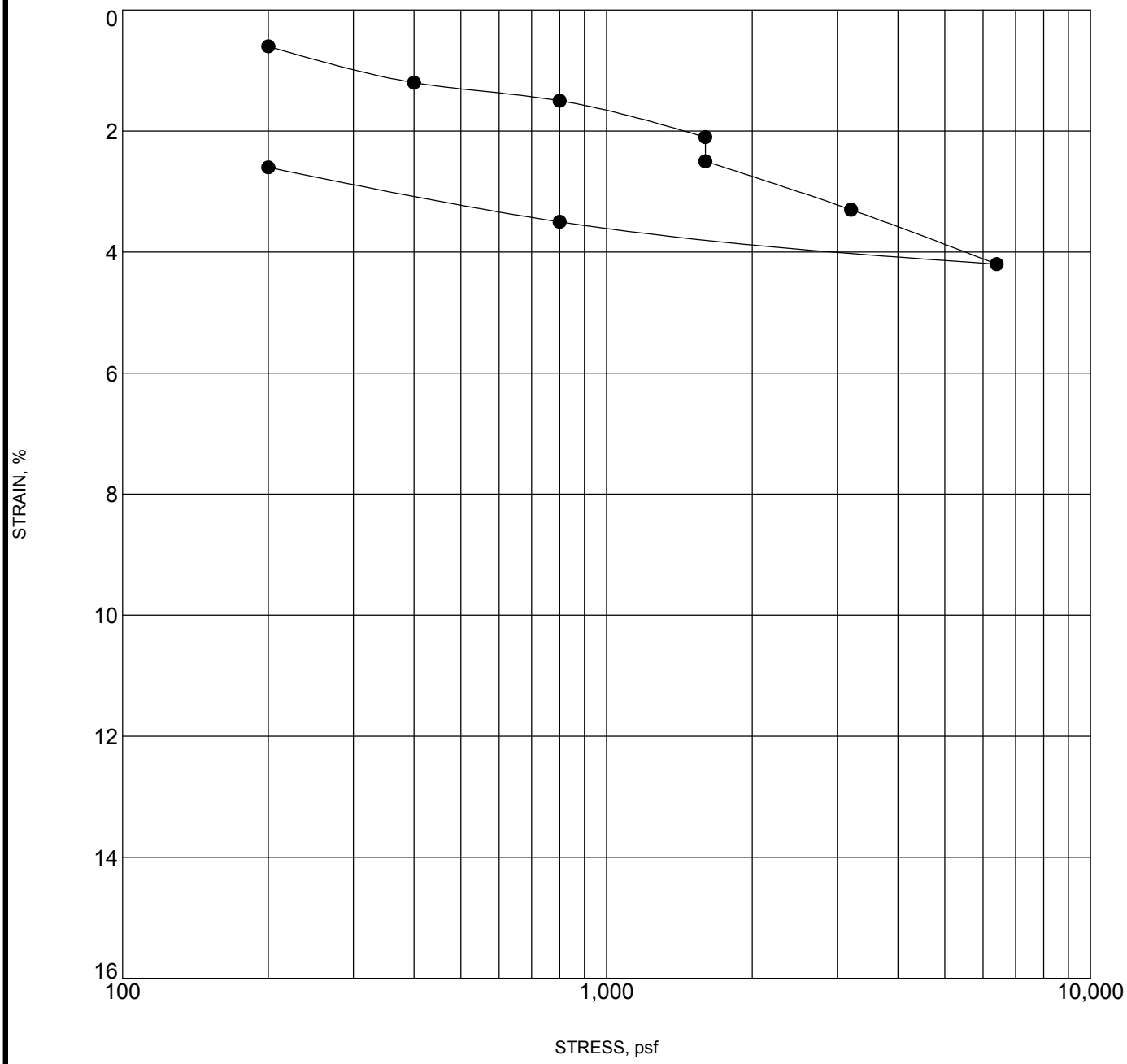
REPORT DATED: 01-13-2012

US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



Water added at 1600 psf

Specimen Identification		Classification		
●	**B-5-11 12.0'**			

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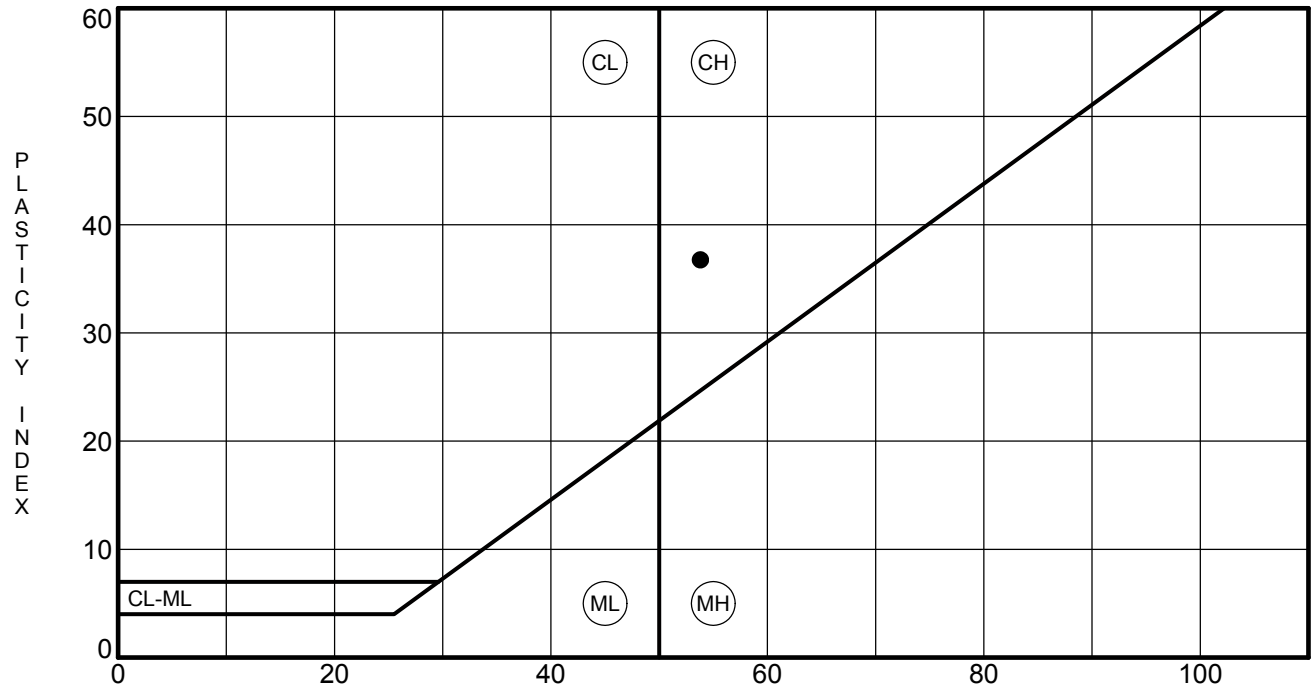
US CONSOL STRAIN 2002-036-006.GPJ FRANKIAN.GDT 1/11/12

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**B-1-10**	**65.0**	**54**	**17**	**37**	**82**	**FAT CLAY with SAND(CH)**

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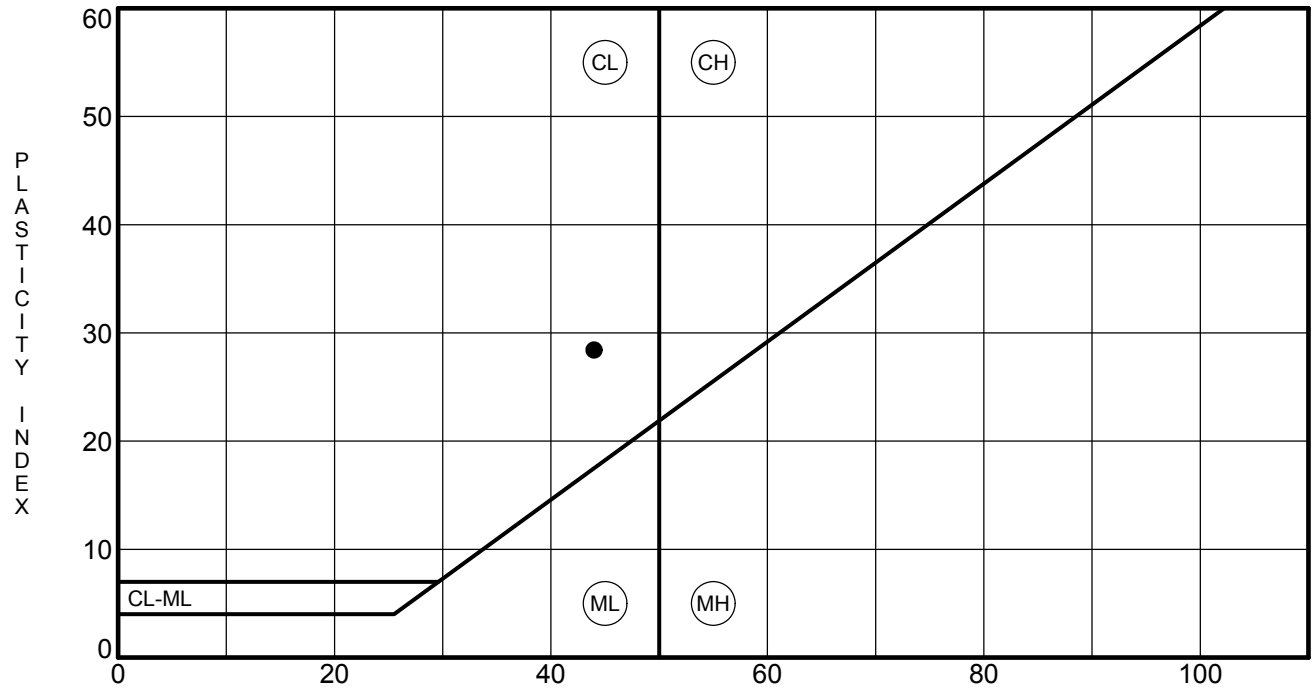
ATTERBERG LIMITS' RESULTS

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US ATTERBERG LIMITS 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**HS-2-10**	**20.0**	**44**	**16**	**28**	**72**	**LEAN CLAY with SAND(CL)**

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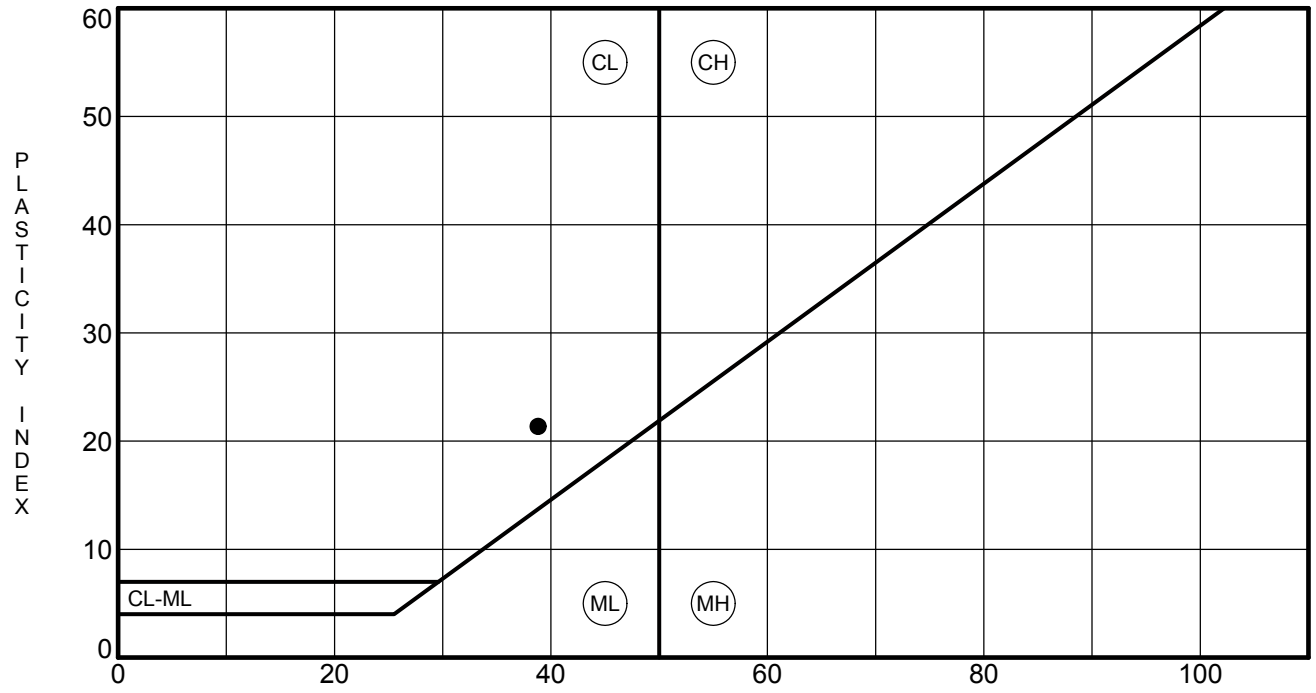
ATTERBERG LIMITS' RESULTS

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US ATTERBERG LIMITS 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**HS-2-10**	**30.0**	**39**	**17**	**22**	**63**	**SANDY LEAN CLAY(CL)**

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ATTERBERG LIMITS' RESULTS

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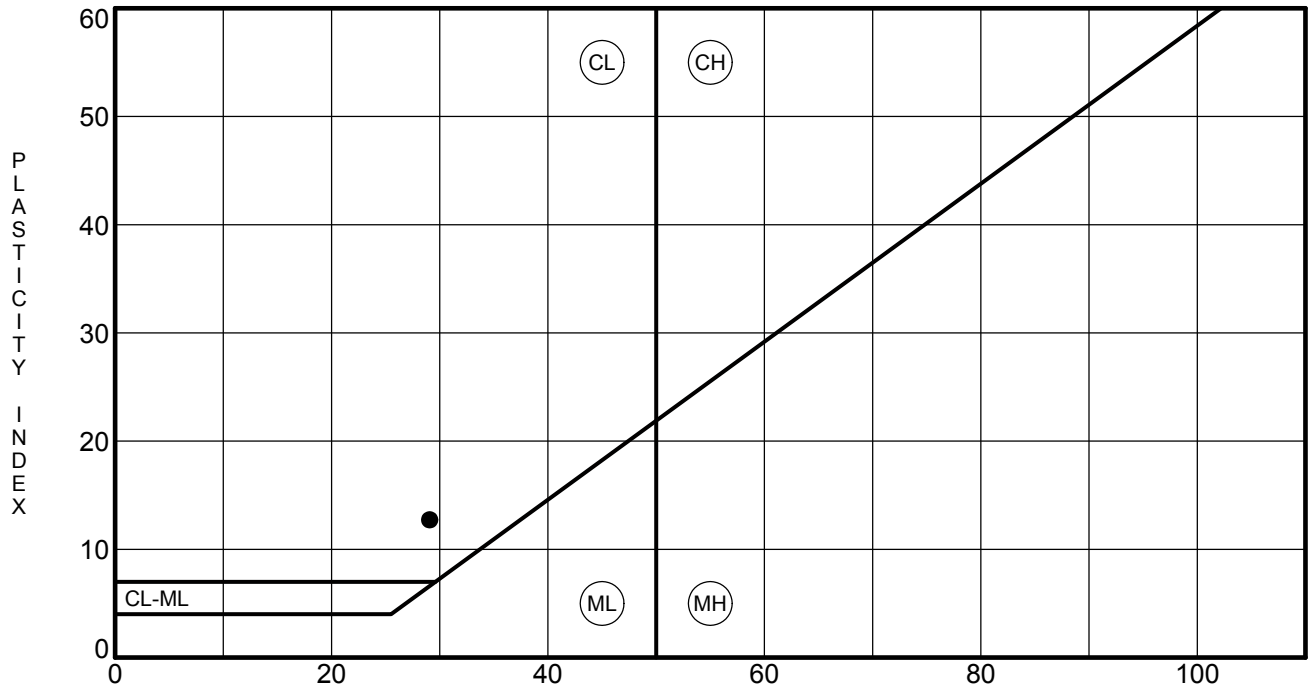
US ATTERBERG LIMITS 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**HS-4-10**	**25.0**	**29**	**16**	**13**	**50**	**CLAYEY SAND(SC)**

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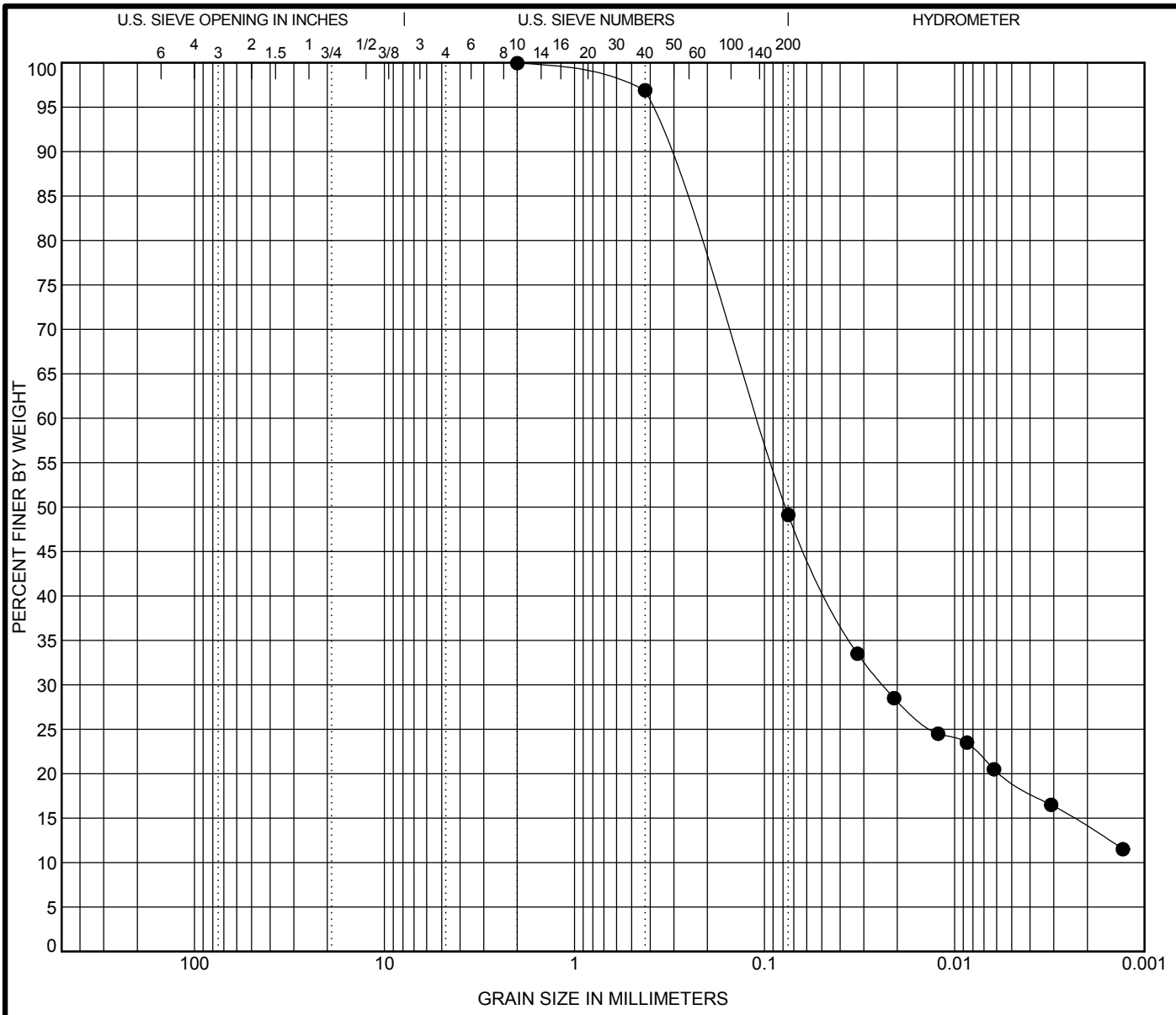
ATTERBERG LIMITS' RESULTS

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

US ATTERBERG LIMITS 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**B-1-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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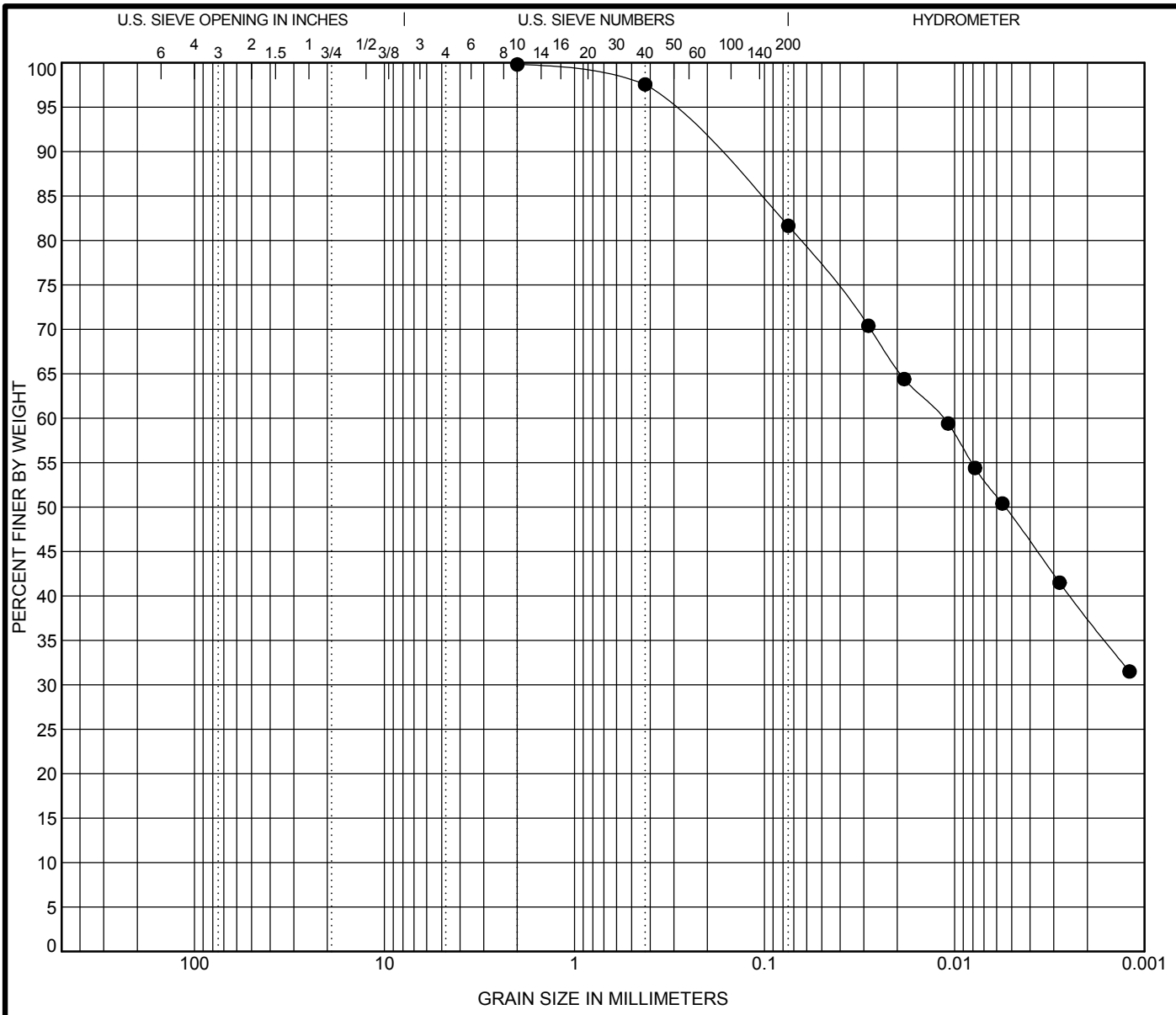
GRAIN SIZE DISTRIBUTION

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**B-1-10**	**FAT CLAY with SAND(CH)**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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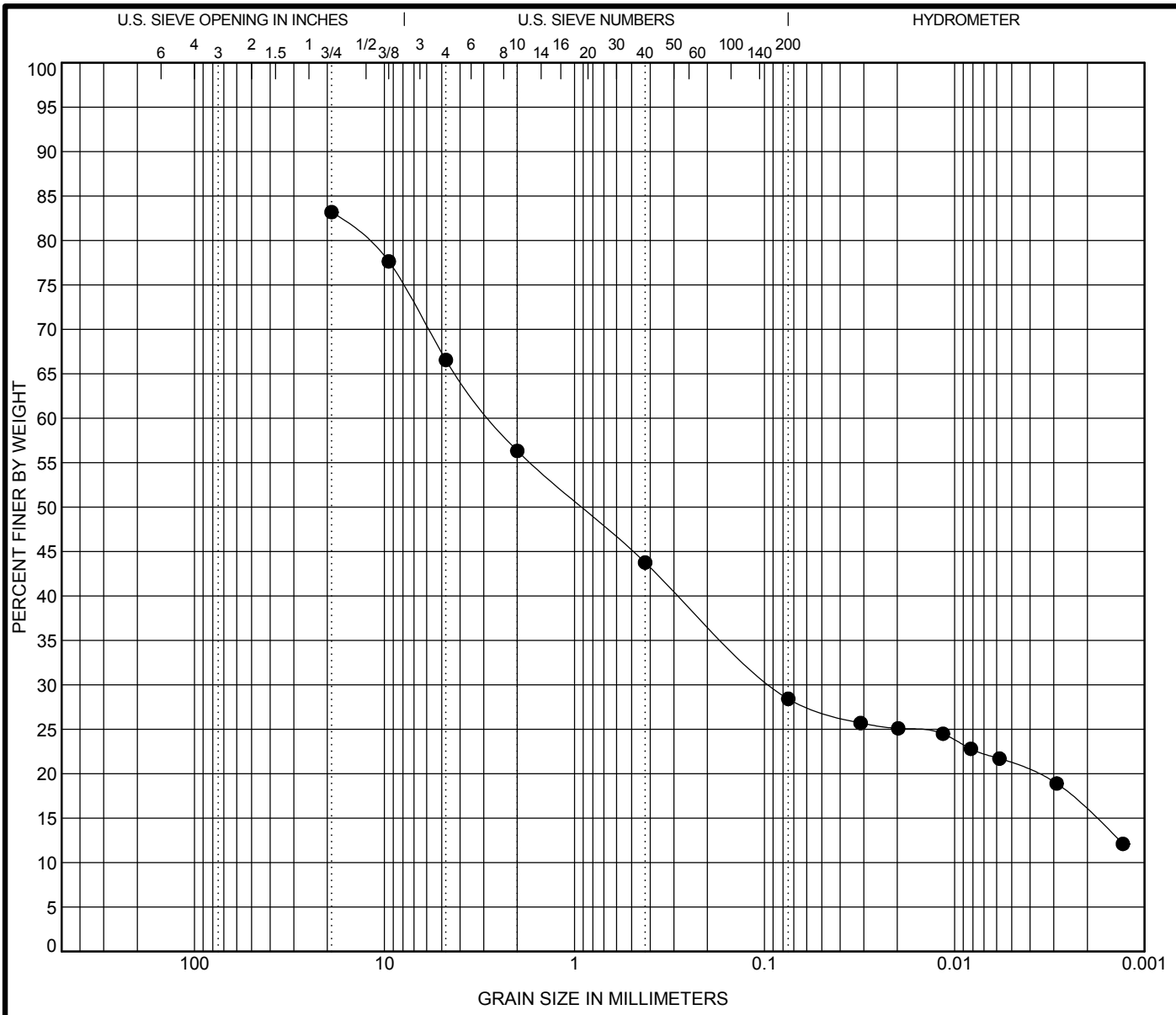
GRAIN SIZE DISTRIBUTION

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**B-2-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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GRAIN SIZE DISTRIBUTION

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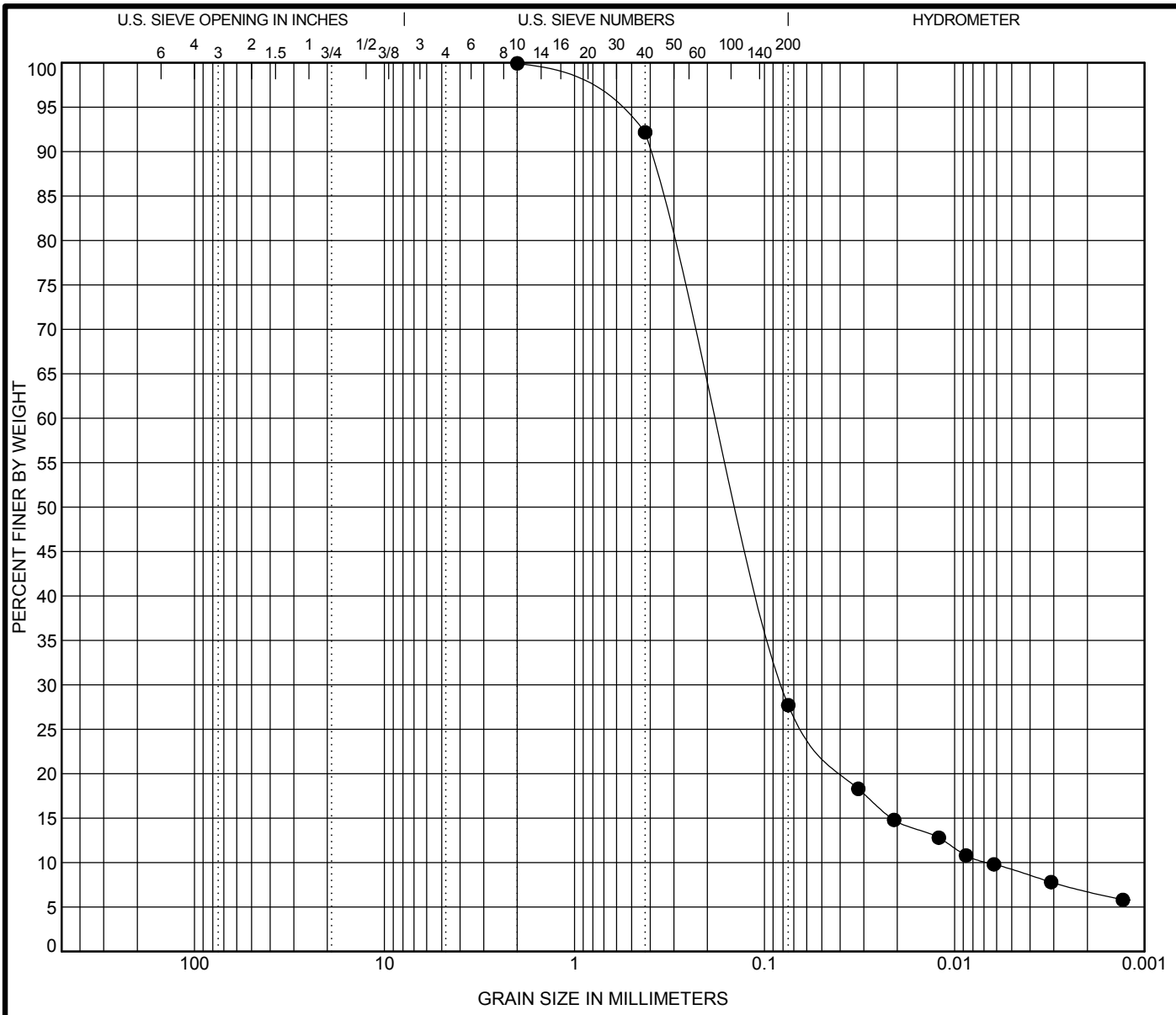
REPORT DATED: 01-19-2011

RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**B-3-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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GRAIN SIZE DISTRIBUTION

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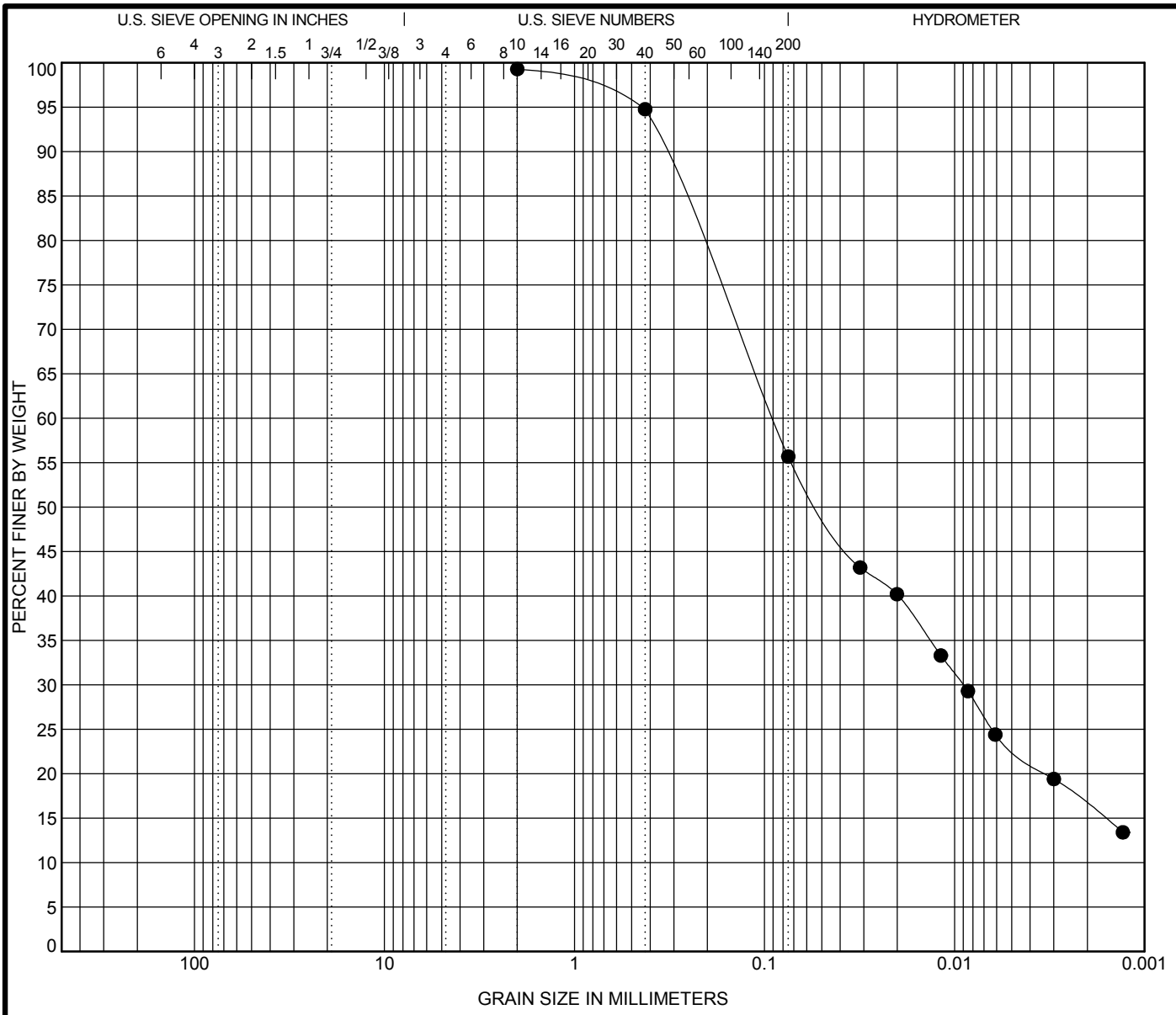
RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**B-8-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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GRAIN SIZE DISTRIBUTION

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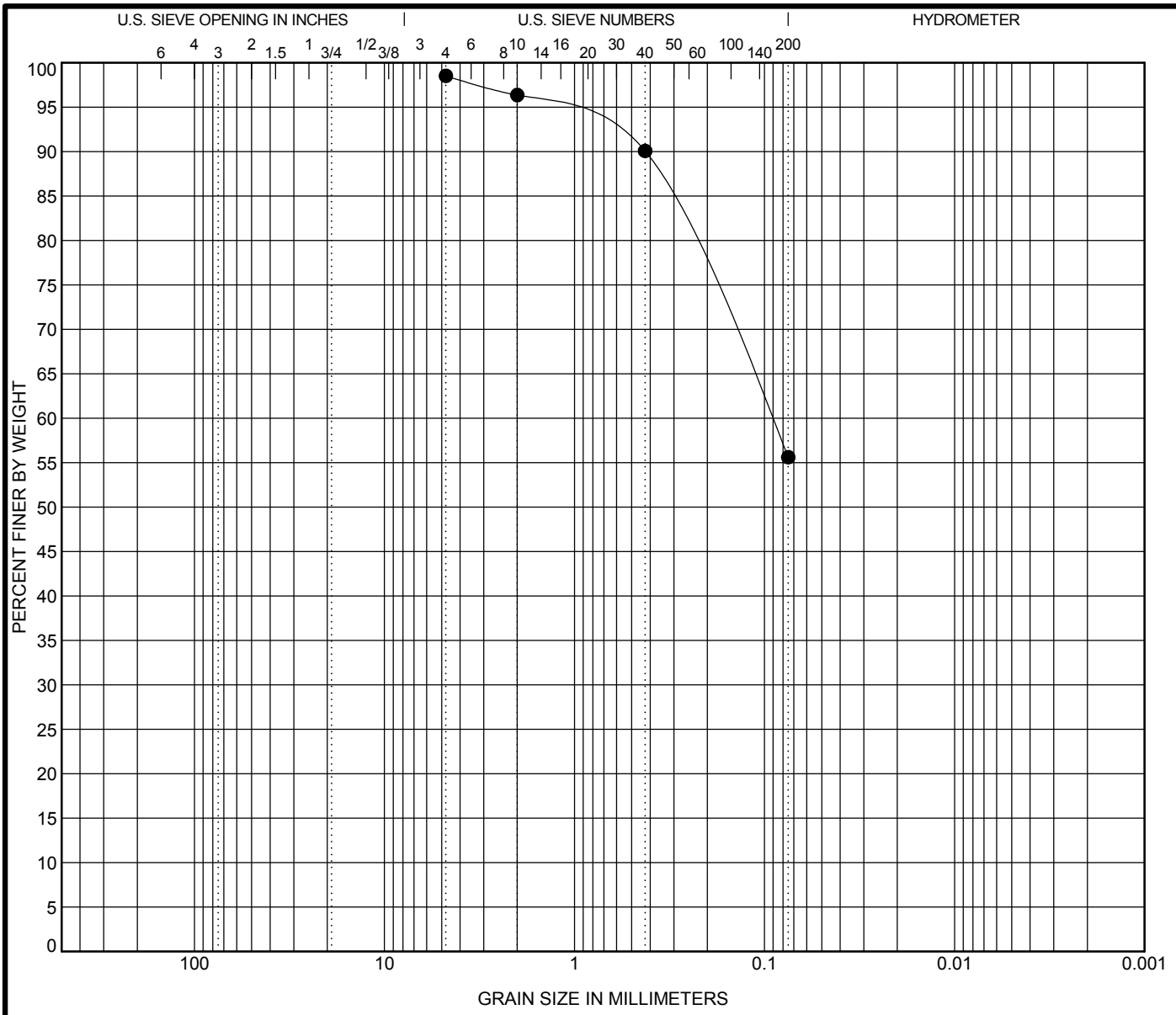
RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**HS-1-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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GRAIN SIZE DISTRIBUTION

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RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

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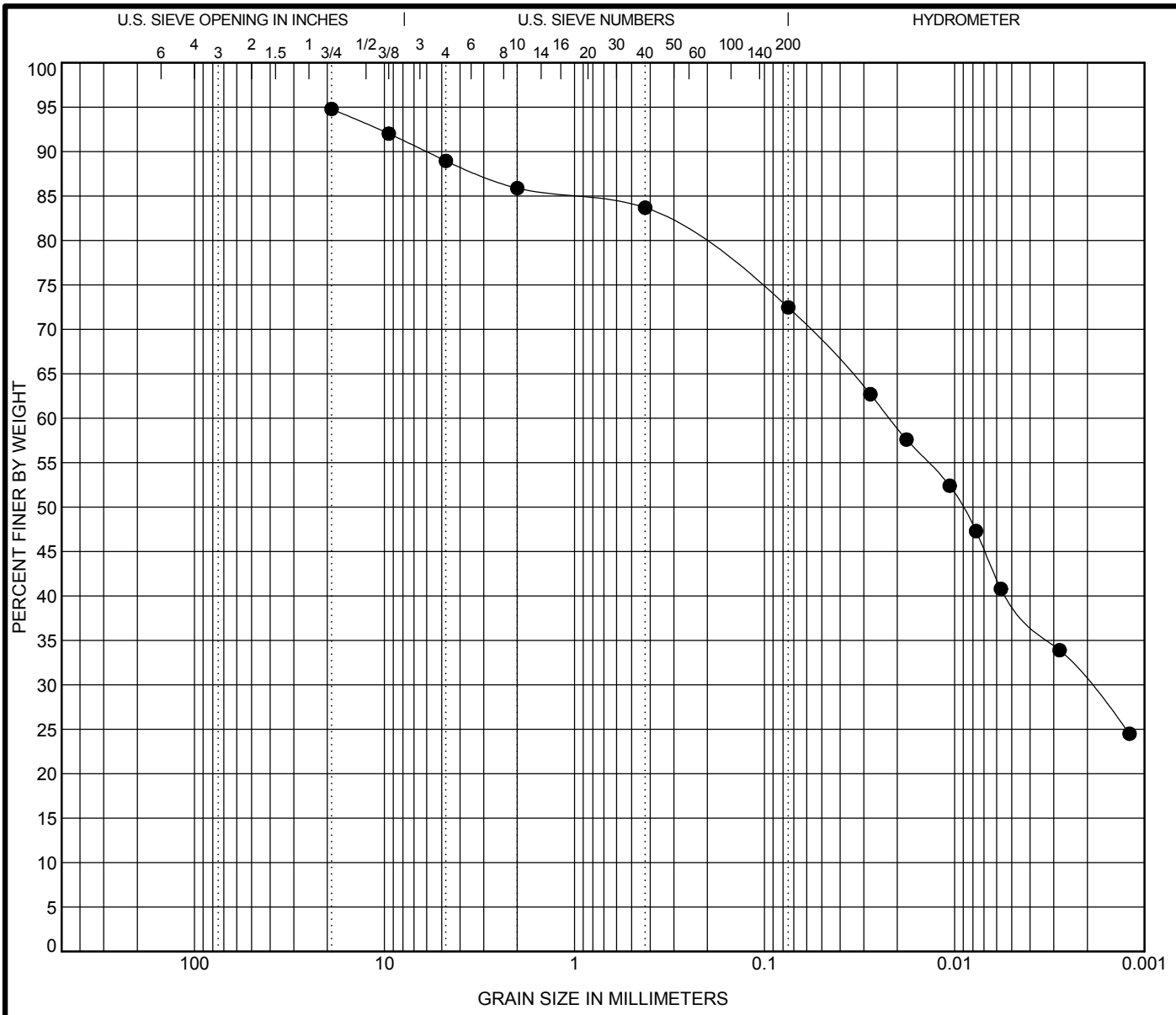

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**HS-2-10**	**LEAN CLAY with SAND(CL)**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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GRAIN SIZE DISTRIBUTION

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RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

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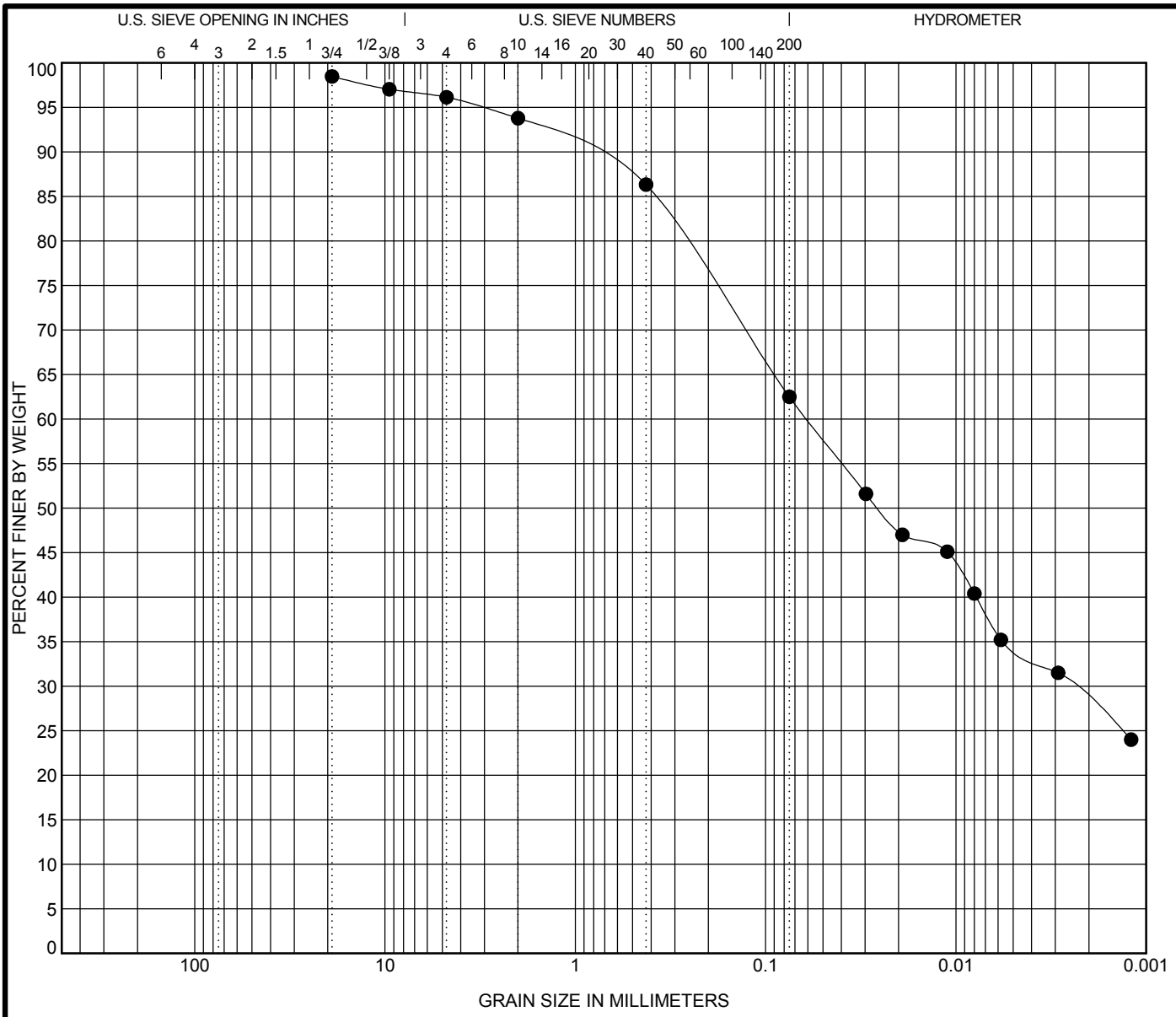

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**HS-2-10**	**SANDY LEAN CLAY(CL)**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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GRAIN SIZE DISTRIBUTION

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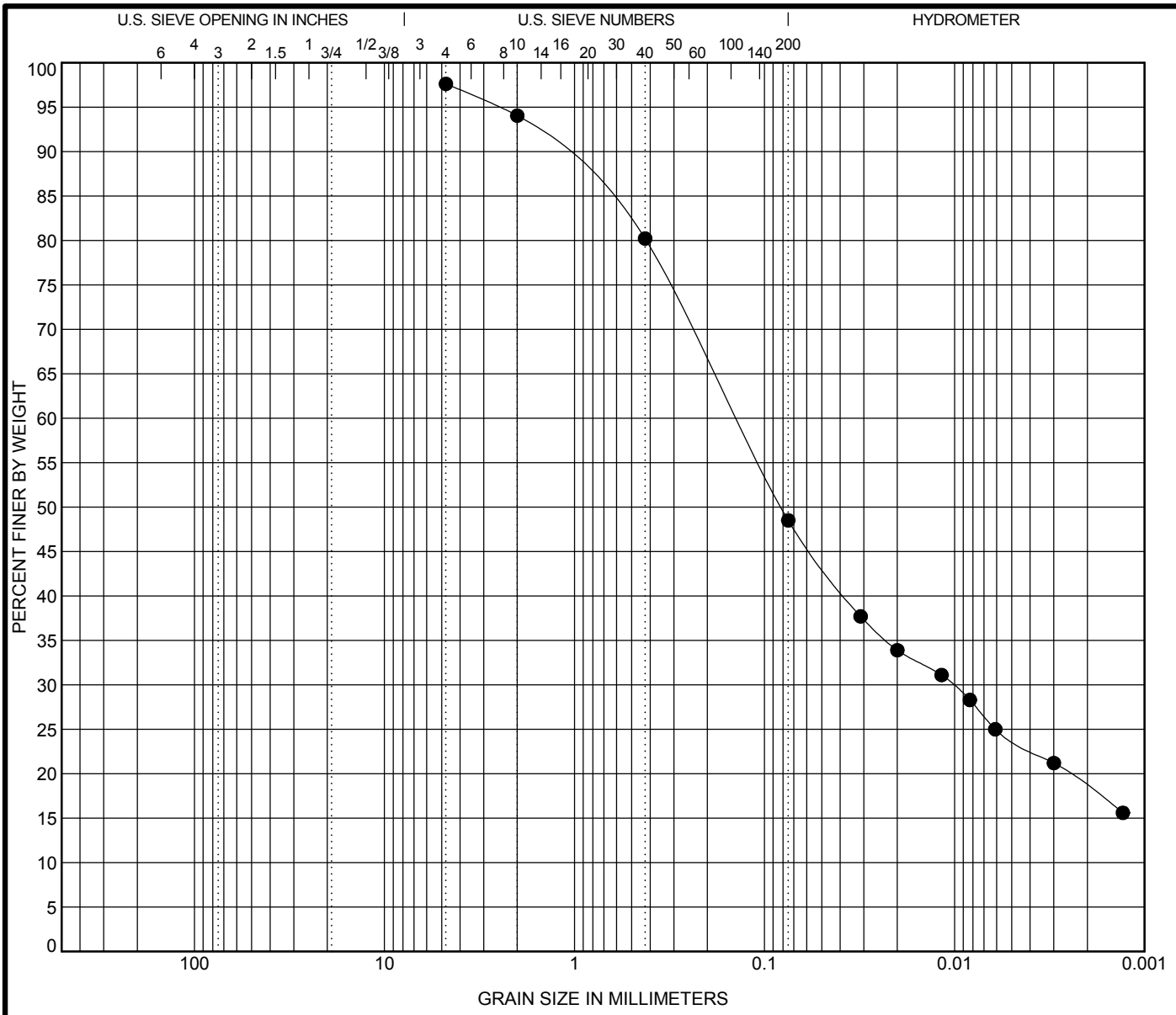

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**HS-3-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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GRAIN SIZE DISTRIBUTION

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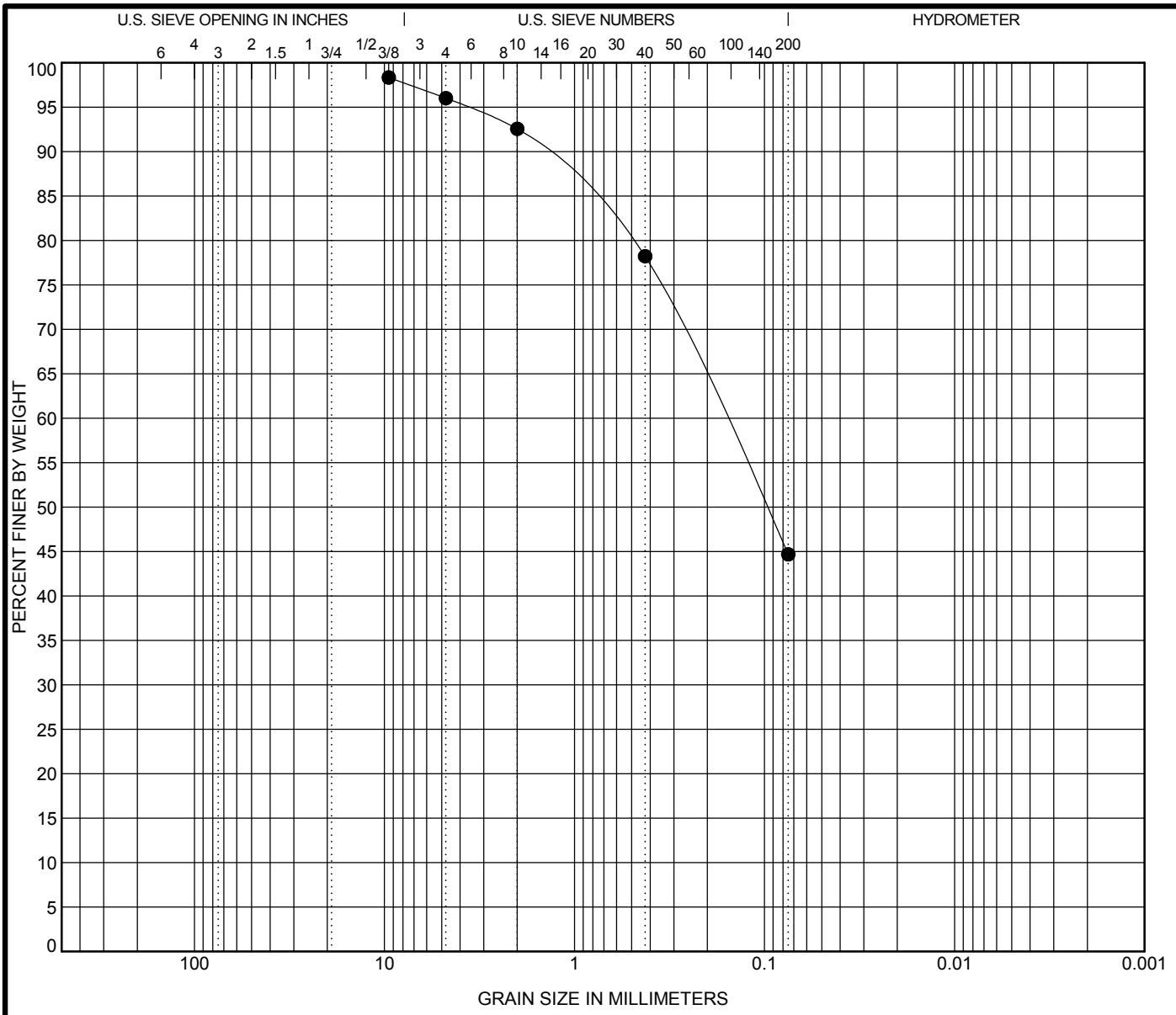
RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**HS-3-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

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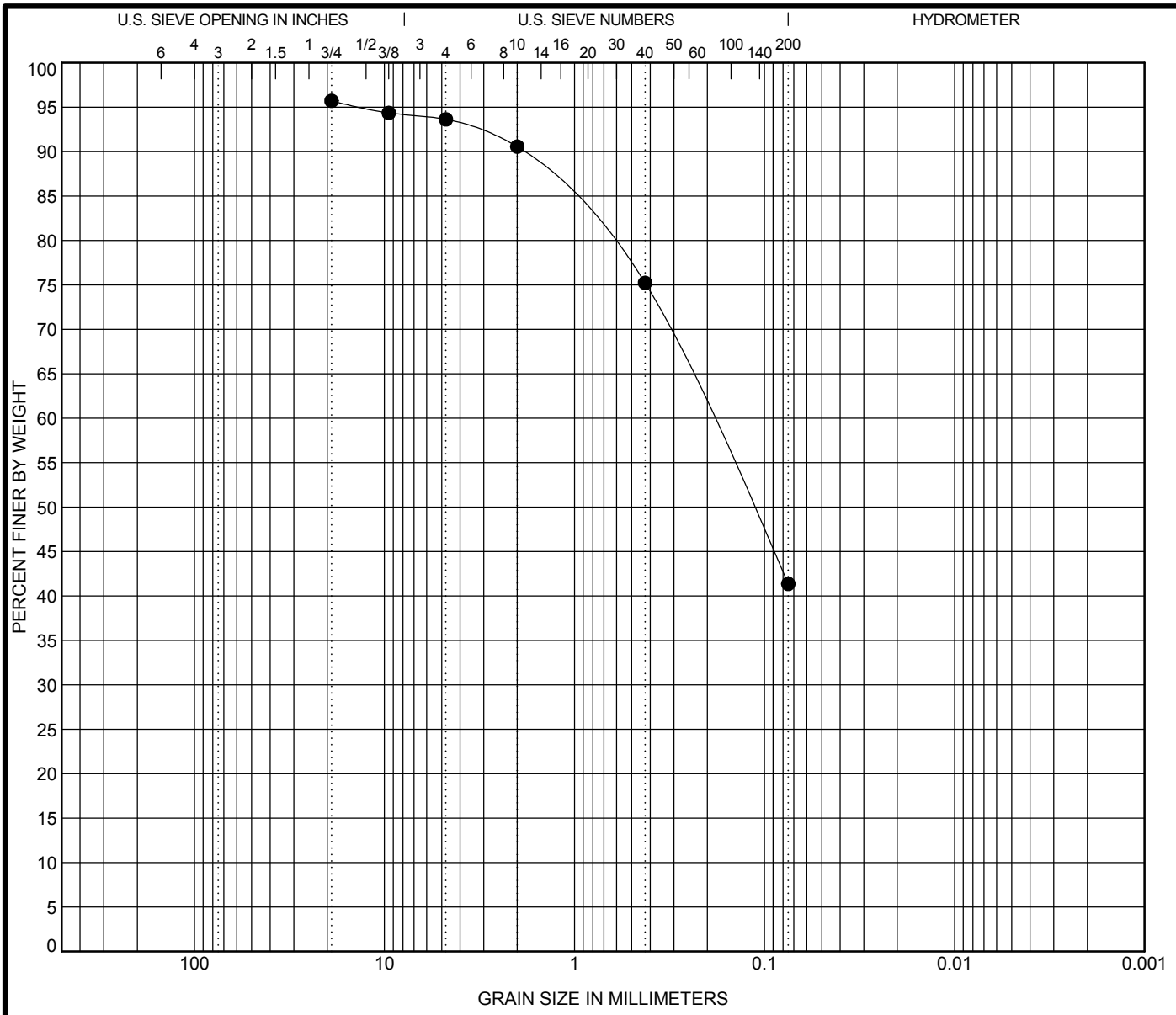


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**HS-3-10**						

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
Telephone: (818) 531-1501
Fax: (818) 531-1511

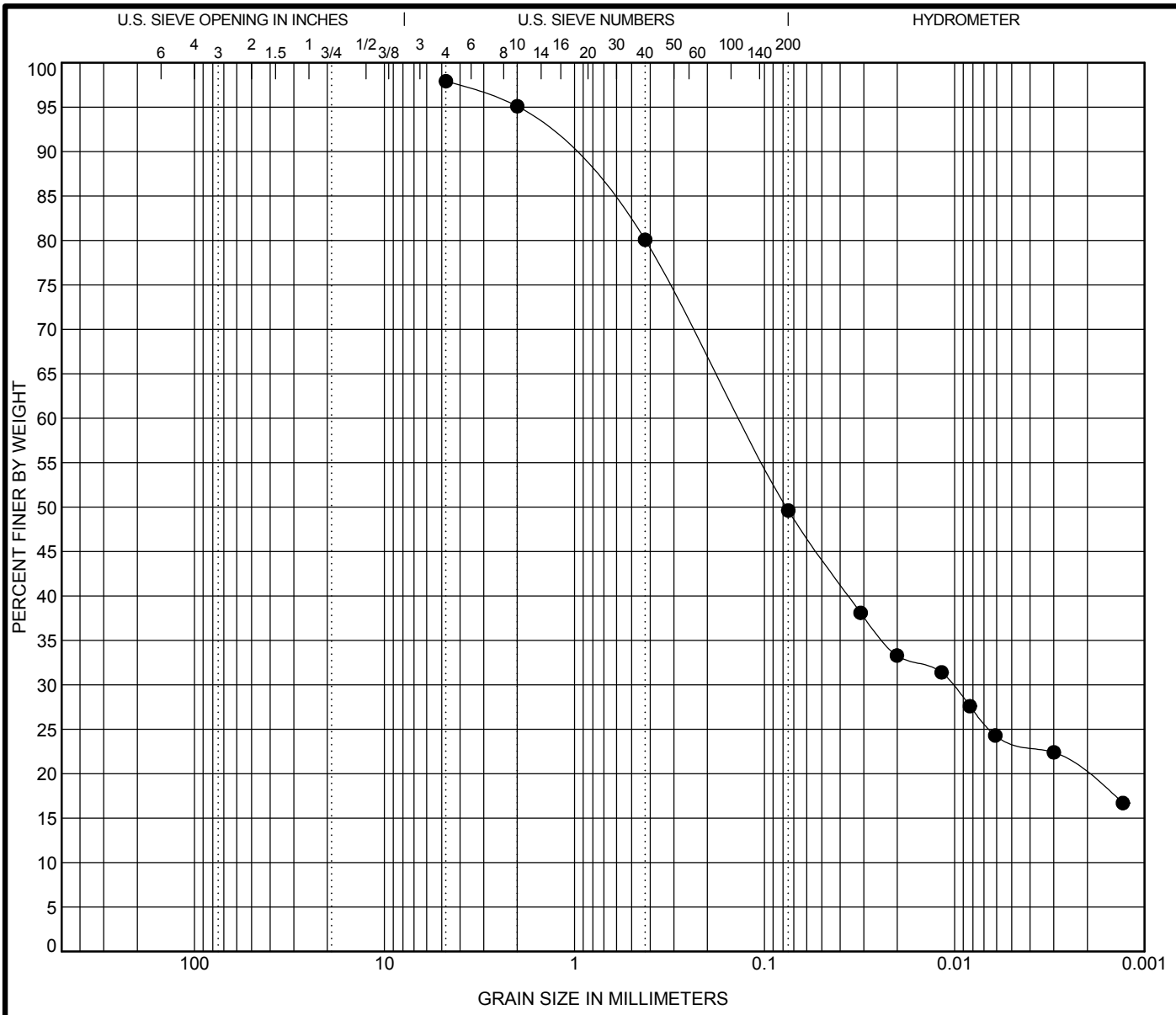
GRAIN SIZE DISTRIBUTION

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification	Classification	LL	PL	PI	Cc	Cu
●	**HS-4-10**	**CLAYEY SAND(SC)**					

Specimen Identification	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay

R. T. Frankian & Associates
1329 Scott Road
Burbank, Ca 91504
Telephone: (818) 531-1501
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GRAIN SIZE DISTRIBUTION

JOB NUMBER: 2002-036-004

REPORT DATED: 01-19-2011

RTF GRAIN SIZE 2002-036-004-7-24-2010.GPJ FRANKIAN.GDT 1/28/11

FOR USE WITH RTF&A 2002-036-004 REPORT DATED 1-27-2012

Chiquita Canyon Landfill
January 27, 2012
2002-036-004

APPENDIX D

SLOPE STABILITY CALCULATIONS

RTF&A
GEOTECHNICAL ENGINEERING & ENGINEERING GEOLOGY

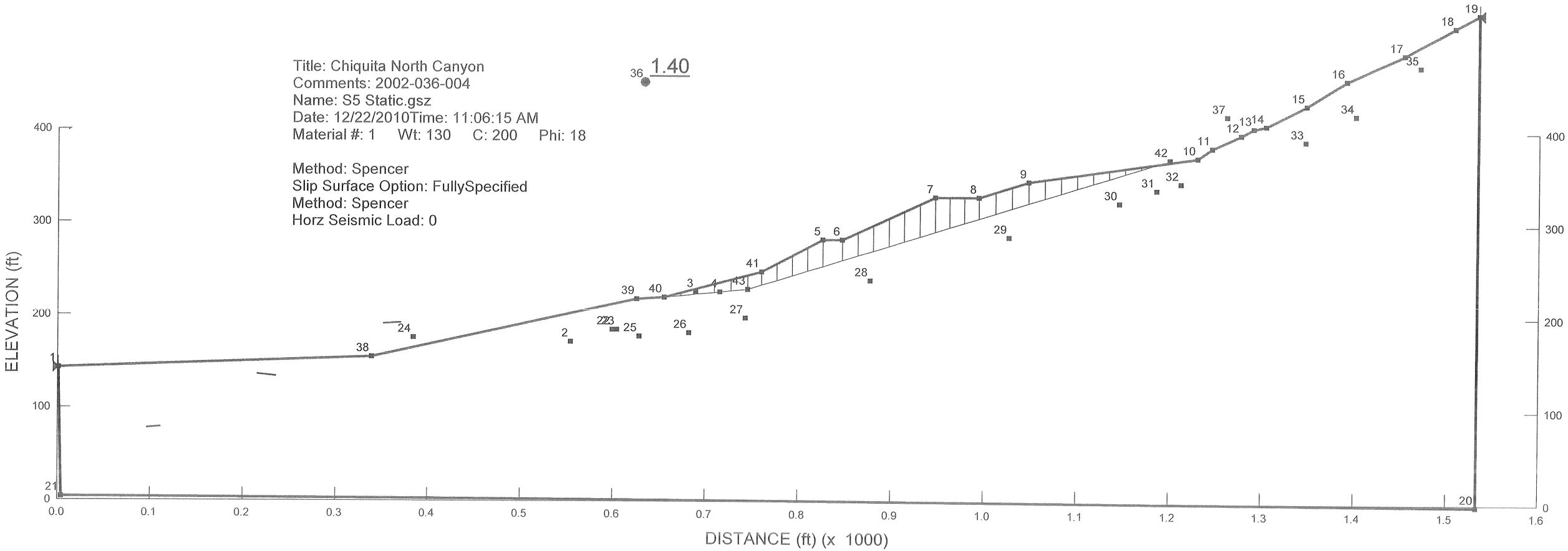
Summary of Slope Stability Calculations

Section	Case	File	Factor of Safety	Condition
S5	Static	S5 Static.gsz	1.4	Bedding through 1st bench
S5	Static	S5 Static.gsz	1.43	Bedding between toe & 1st bench
S11	Static	S11 Static.gsz	1.63	Tp Cross Bedding Failure
S11	Seismic	S11 Seismic.gsz	1.16	Tp Cross Bedding Failure
S15	Static	S15 Static.gsz	2.35	Failure along bedding
S17	Static	S17 Static.gsz	1.31	Bedding above first bench
S17	Static	S17 Static.gsz	1.41	Bedding near toe
S17	Static	S17 Static.gsz	1.42	Bedding below 1st bench
S19	Static	Section S19 Static.gsz	1.58	Bedding above first bench
S19	Static	Section S19 Static.gsz	1.32	Bedding between 1st and 2nd bench
S19	Static	Section S19 Static.gsz	1.29	Bedding above 2nd Bench
S20	Static	S20 Static.gsz	1.34	Bedding near toe
S23	Static	S23 Static.gsz	1.5	Bedding near toe
S25	Static	S25 Static.gsz	1.25	Bedding below 2nd bench
N/A	Static	130' Fill Slope Static.gsz	1.56	130' High 2:1 Slope
N/A	Seismic	130' Fill Slope Static.gsz	1.14	130' High 2:1 Slope

Title: Chiquita North Canyon
Comments: 2002-036-004
Name: S5 Static.gsz
Date: 12/22/2010Time: 11:06:15 AM
Material #: 1 Wt: 130 C: 200 Phi: 18

Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0

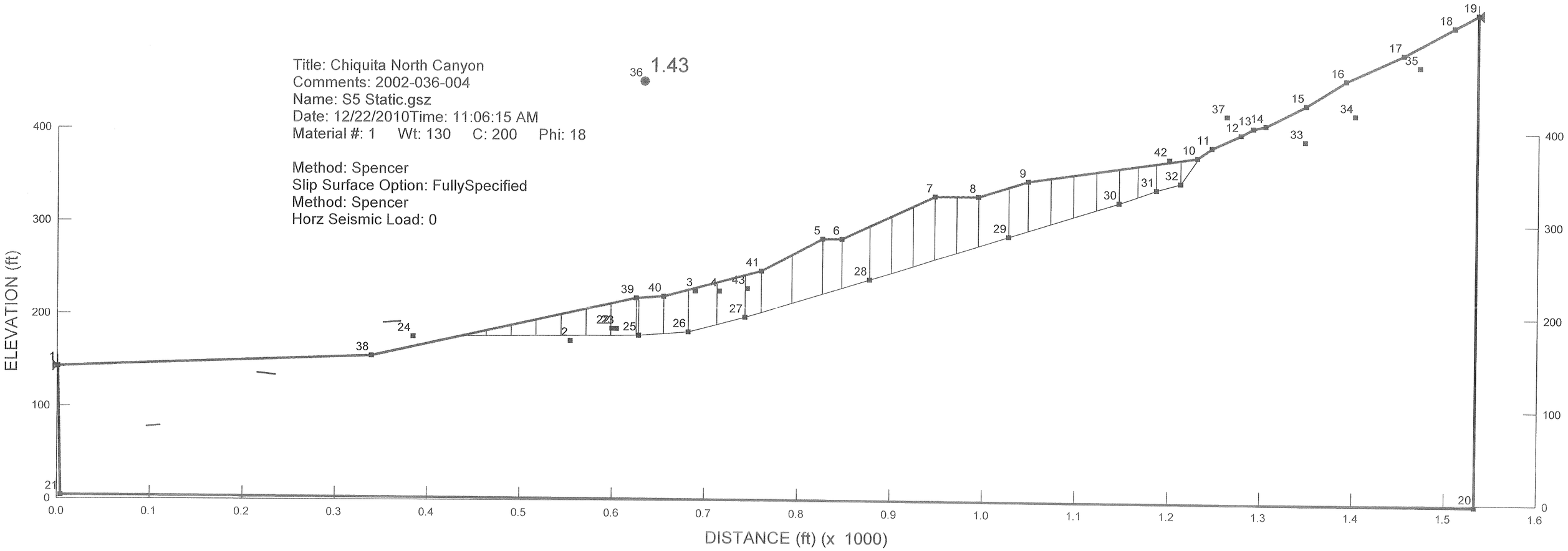
36 1.40

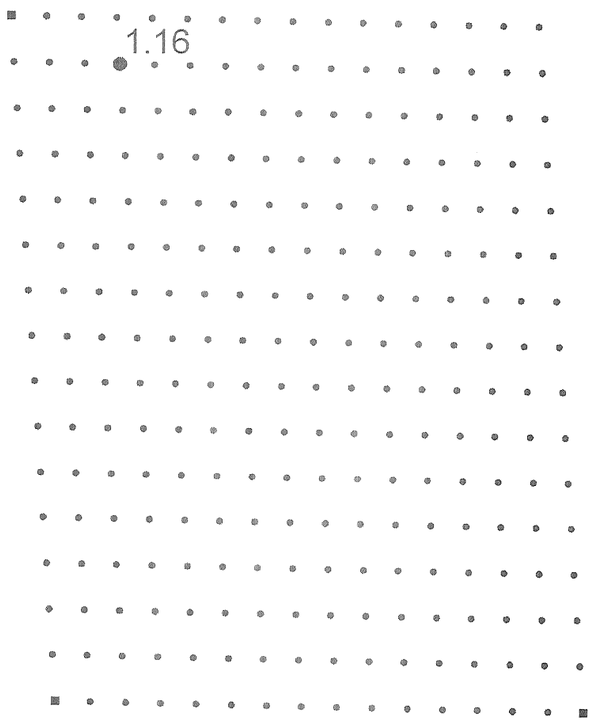


Title: Chiquita North Canyon
Comments: 2002-036-004
Name: S5 Static.gsz
Date: 12/22/2010Time: 11:06:15 AM
Material #: 1 Wt: 130 C: 200 Phi: 18

Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0

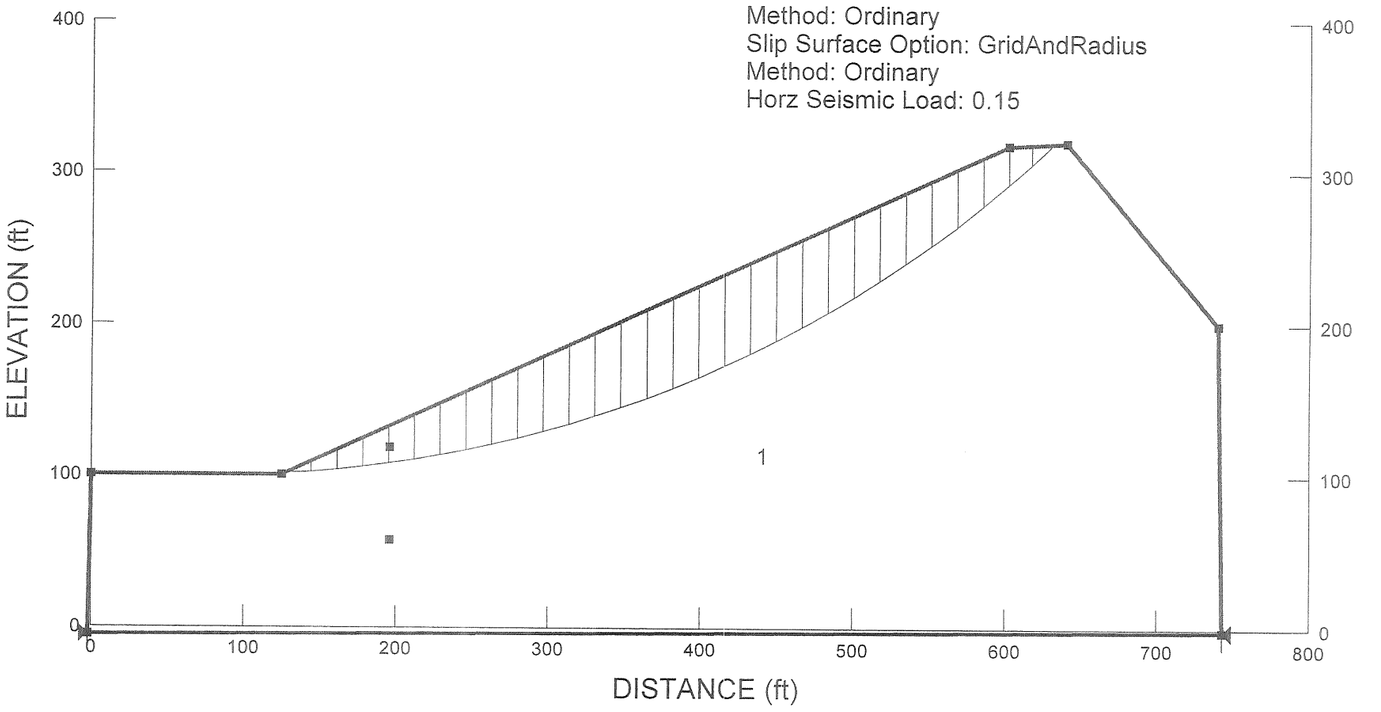
36 1.43

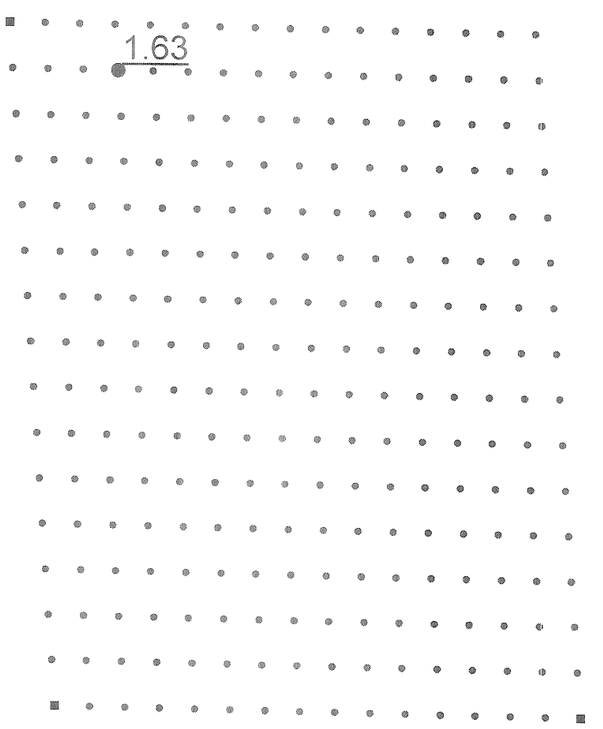




Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S11 Seismic.gsz
Date: 1/18/2011Time: 10:21:32 AM
Material #: 1 Wt: 130 C: 500 Phi: 30 Model: MohrCoulomb

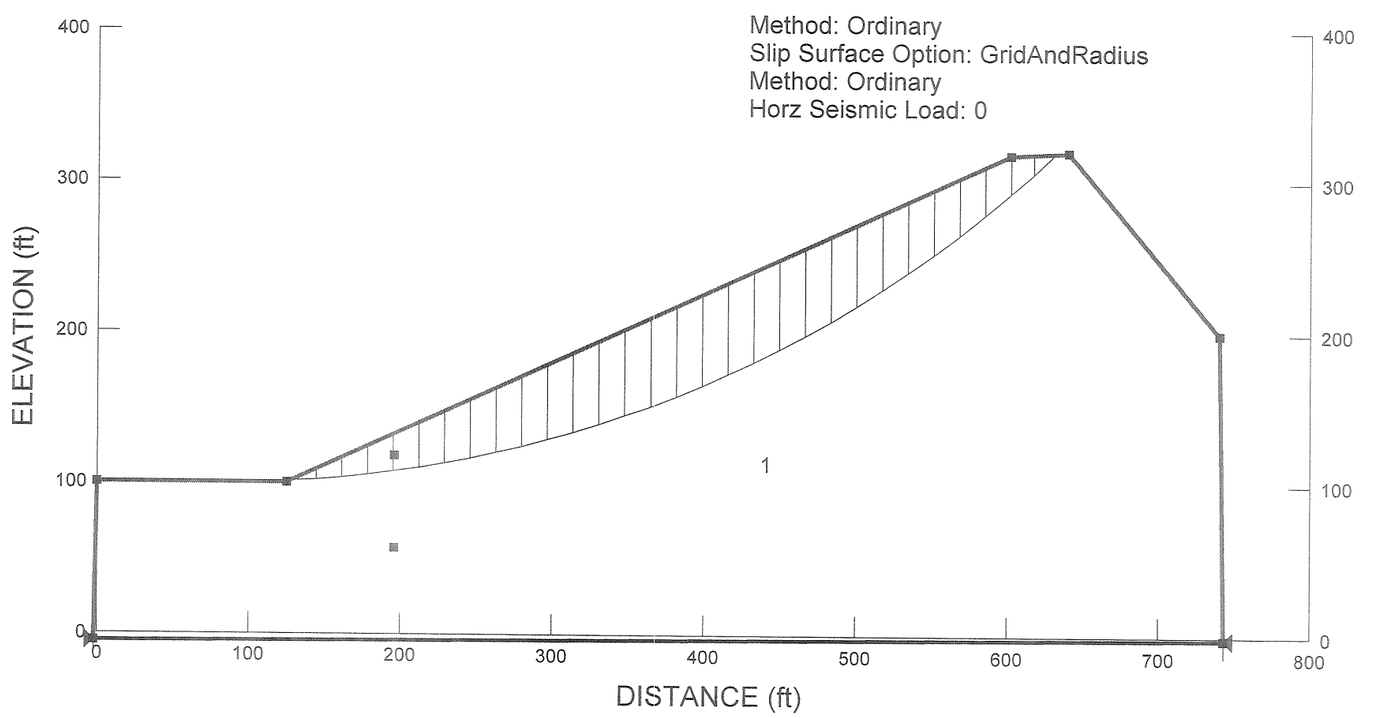
Method: Ordinary
Slip Surface Option: GridAndRadius
Method: Ordinary
Horz Seismic Load: 0.15





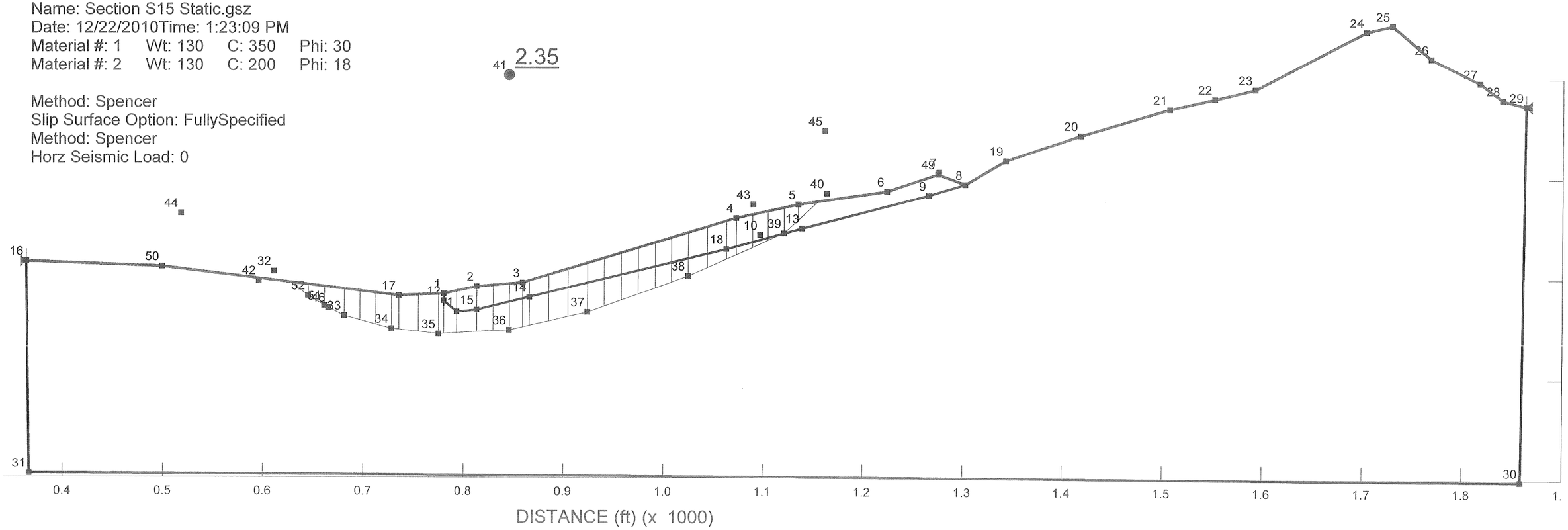
Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S11 Static.gsz
Date: 1/18/2011Time: 9:37:43 AM
Material #: 1 Wt: 130 C: 500 Phi: 30 Model: MohrCoulomb

Method: Ordinary
Slip Surface Option: GridAndRadius
Method: Ordinary
Horz Seismic Load: 0



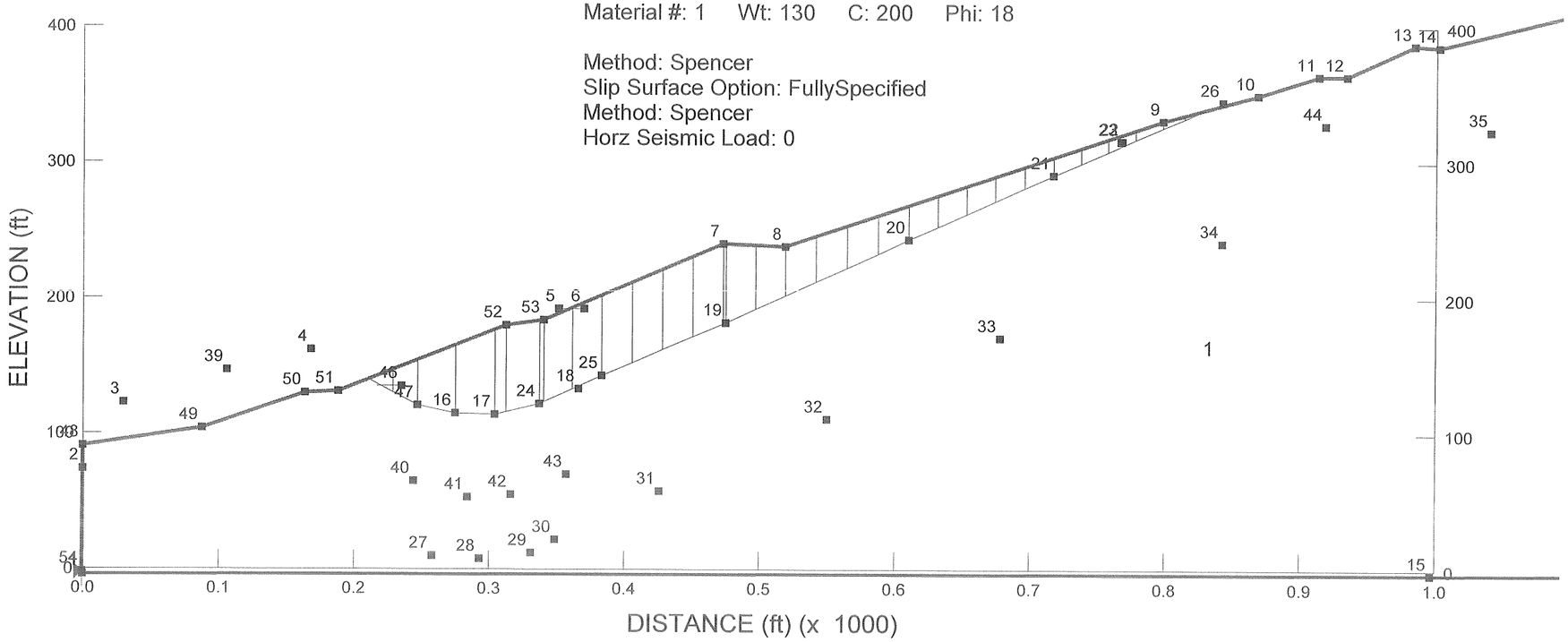
Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S15 Static.gsz
Date: 12/22/2010Time: 1:23:09 PM
Material #: 1 Wt: 130 C: 350 Phi: 30
Material #: 2 Wt: 130 C: 200 Phi: 18

Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0



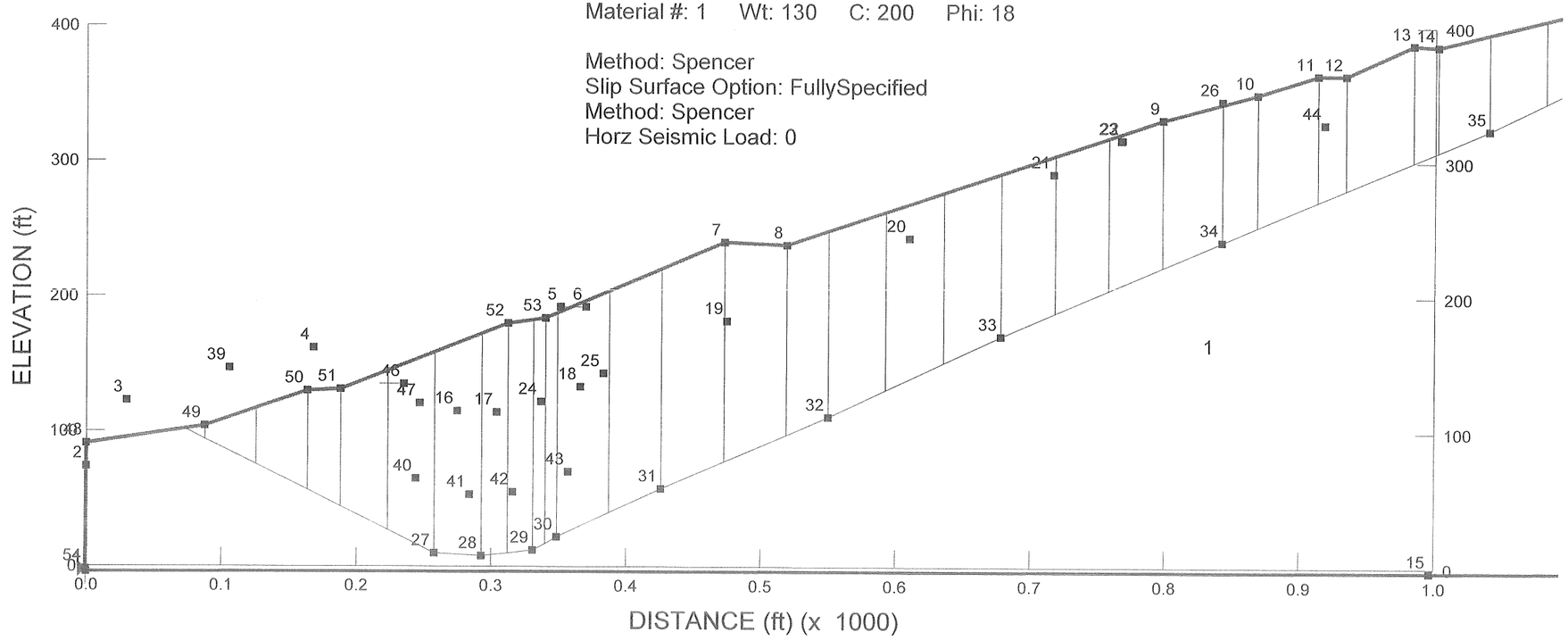
Title: Chiquita North Canyon
Comments: SECTION S17 Bedding
Name: S17 Static.gsz
Date: 12/22/2010Time: 1:47:19 PM
Material #: 1 Wt: 130 C: 200 Phi: 18

Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0



Title: Chiquita North Canyon
Comments: SECTION S17 Bedding
Name: S17 Static.gsz
Date: 12/22/2010Time: 1:47:19 PM
Material #: 1 Wt: 130 C: 200 Phi: 18

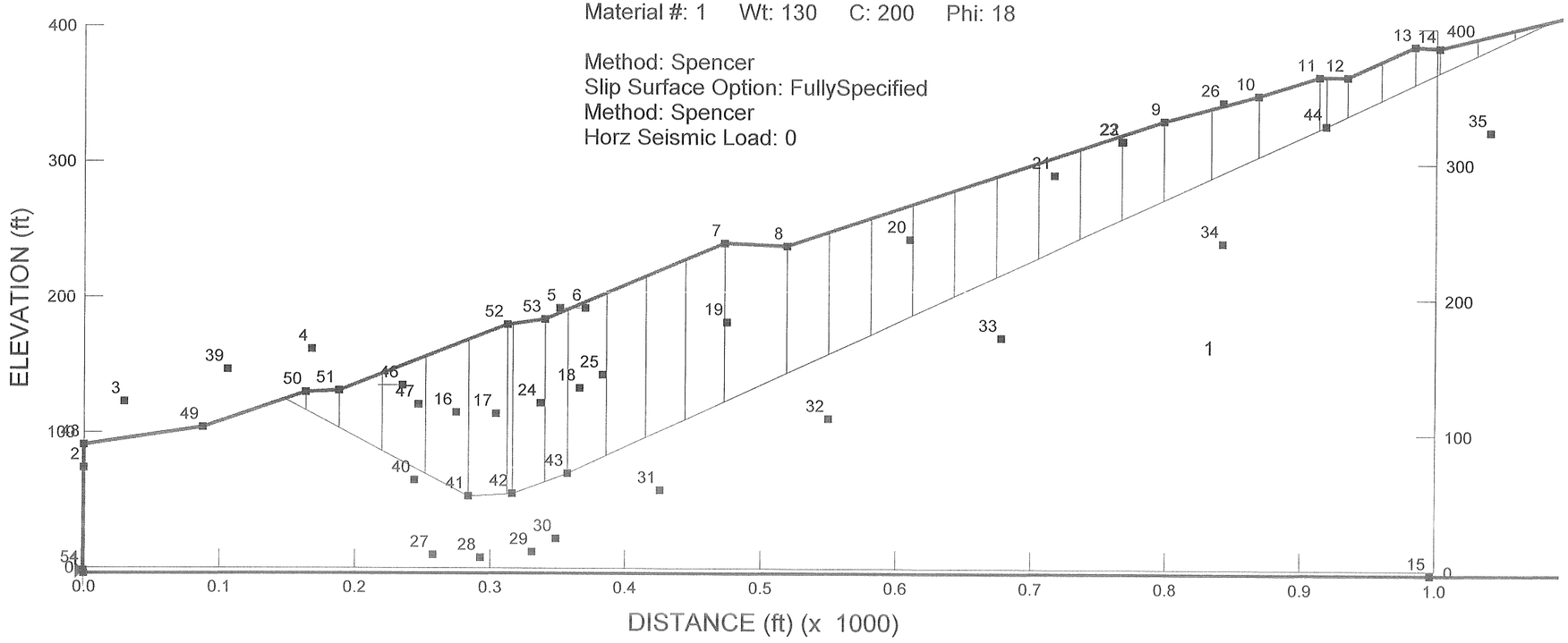
Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0



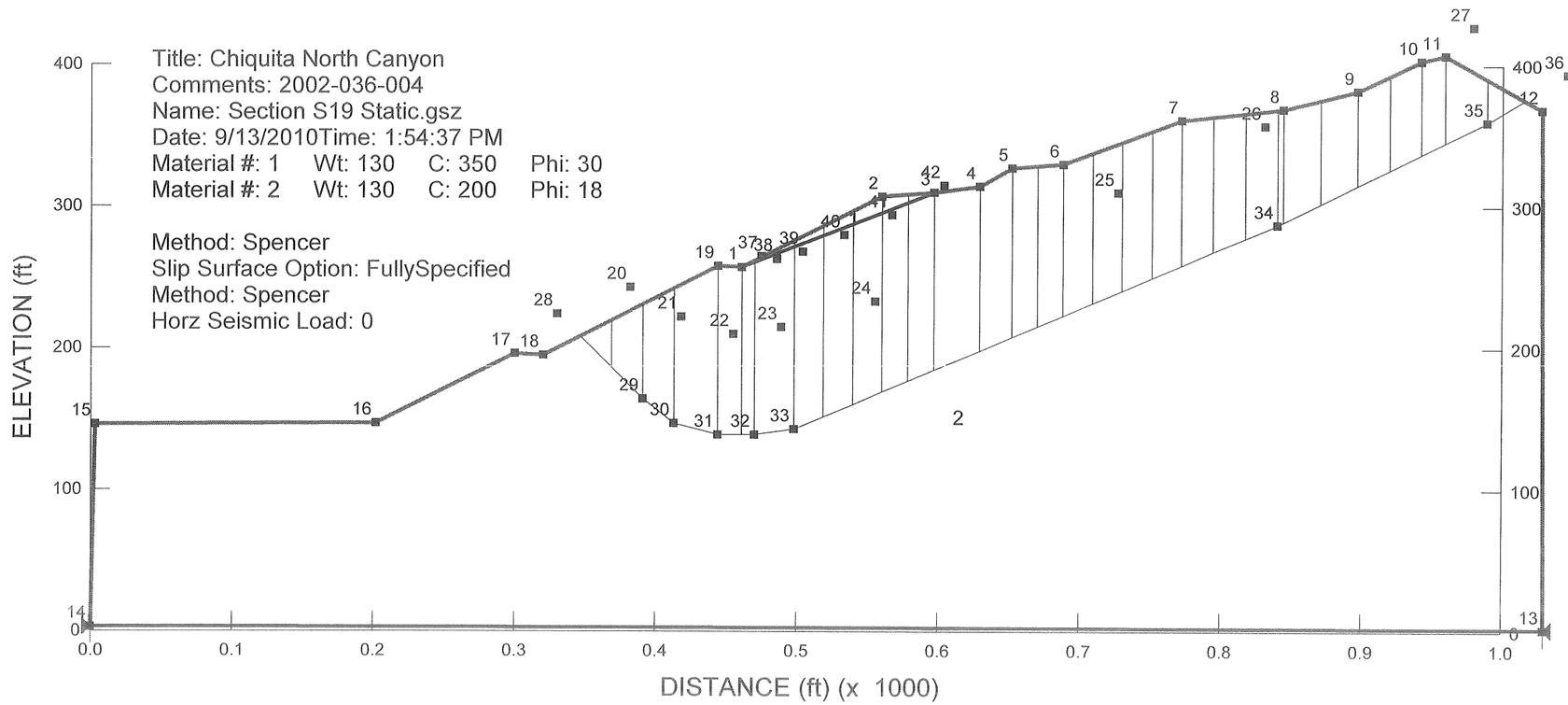
1.42

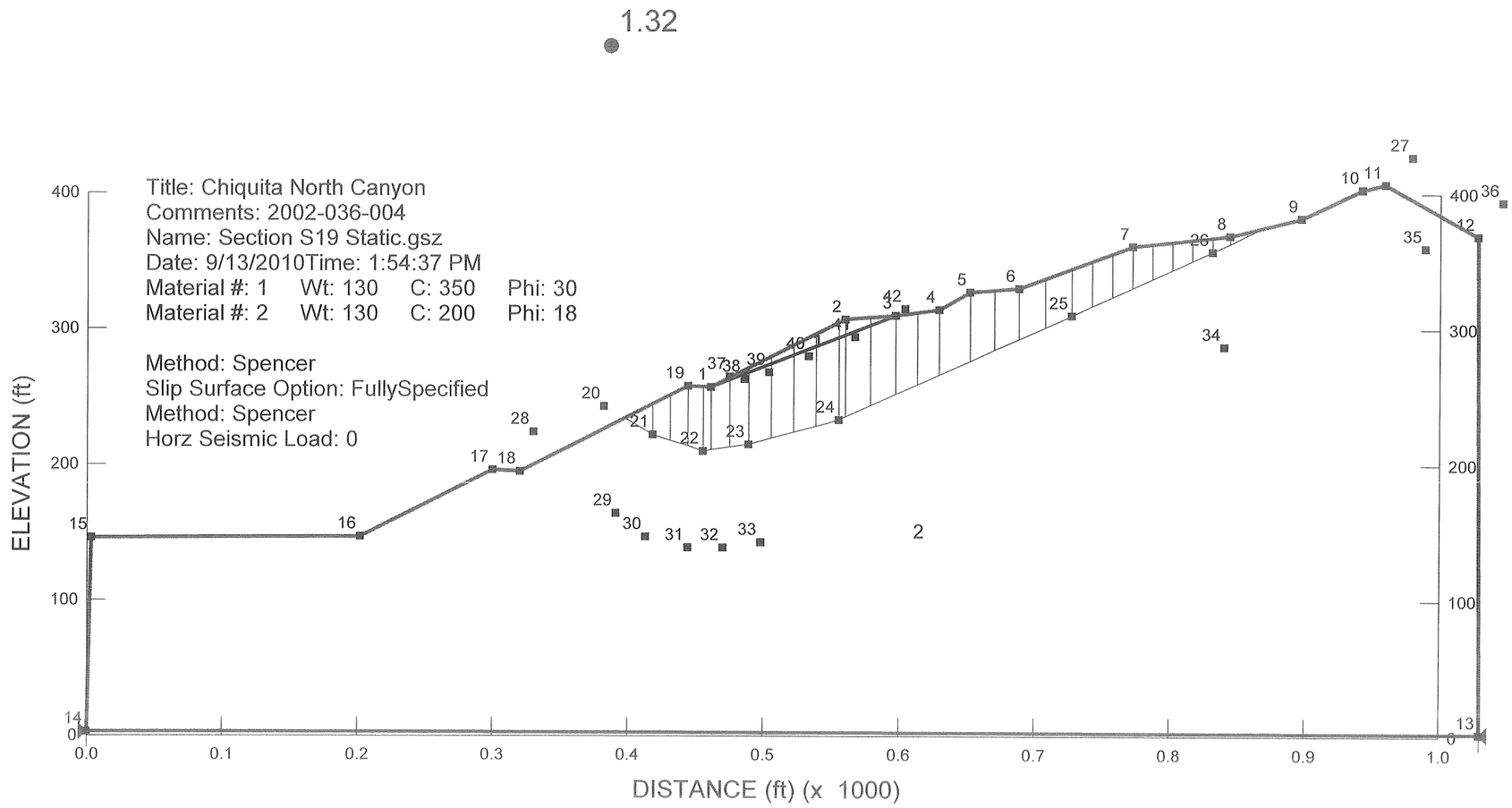
Title: Chiquita North Canyon
Comments: SECTION S17 Bedding
Name: S17 Static.gsz
Date: 12/22/2010Time: 1:47:19 PM
Material #: 1 Wt: 130 C: 200 Phi: 18

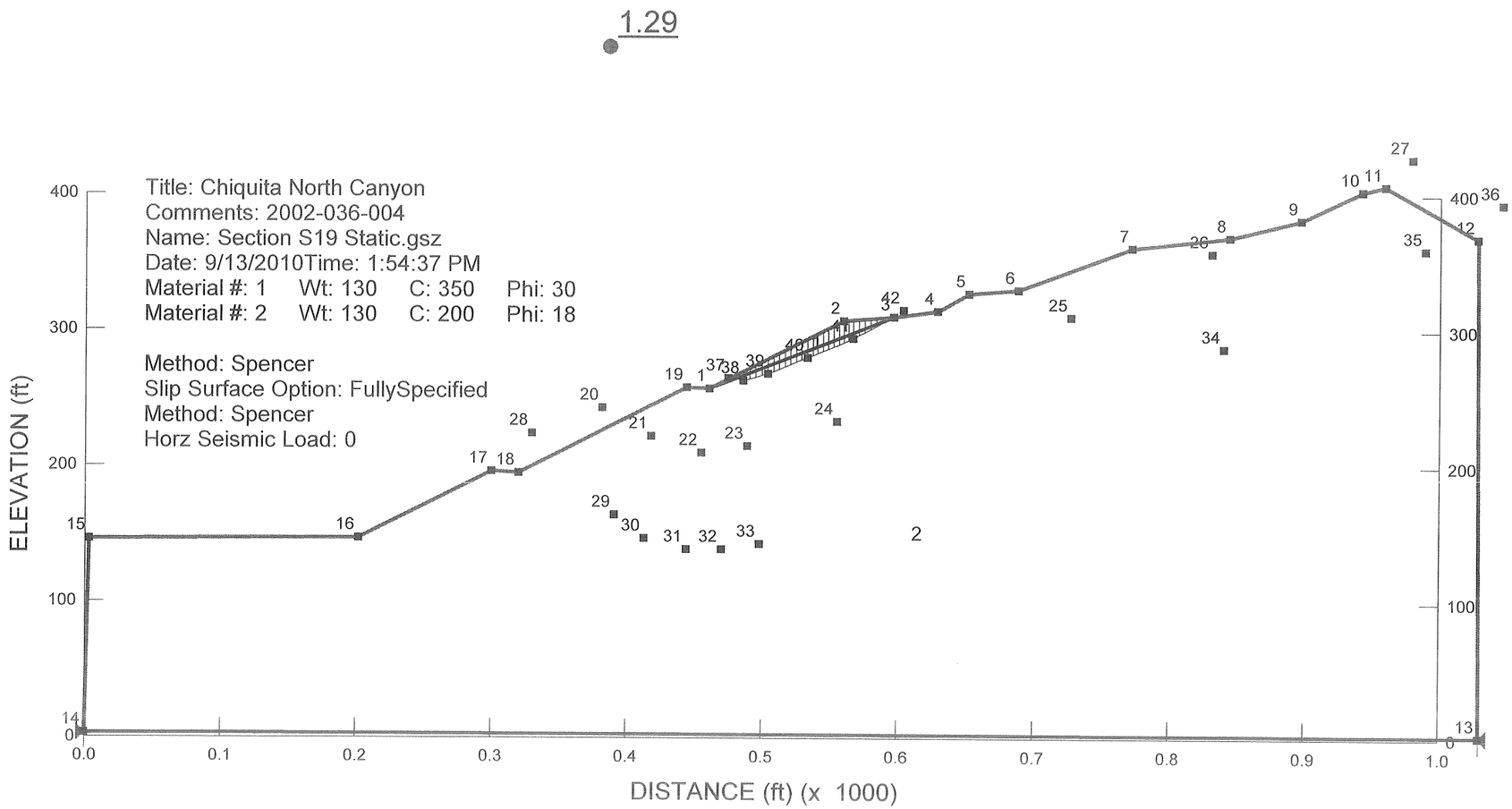
Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0



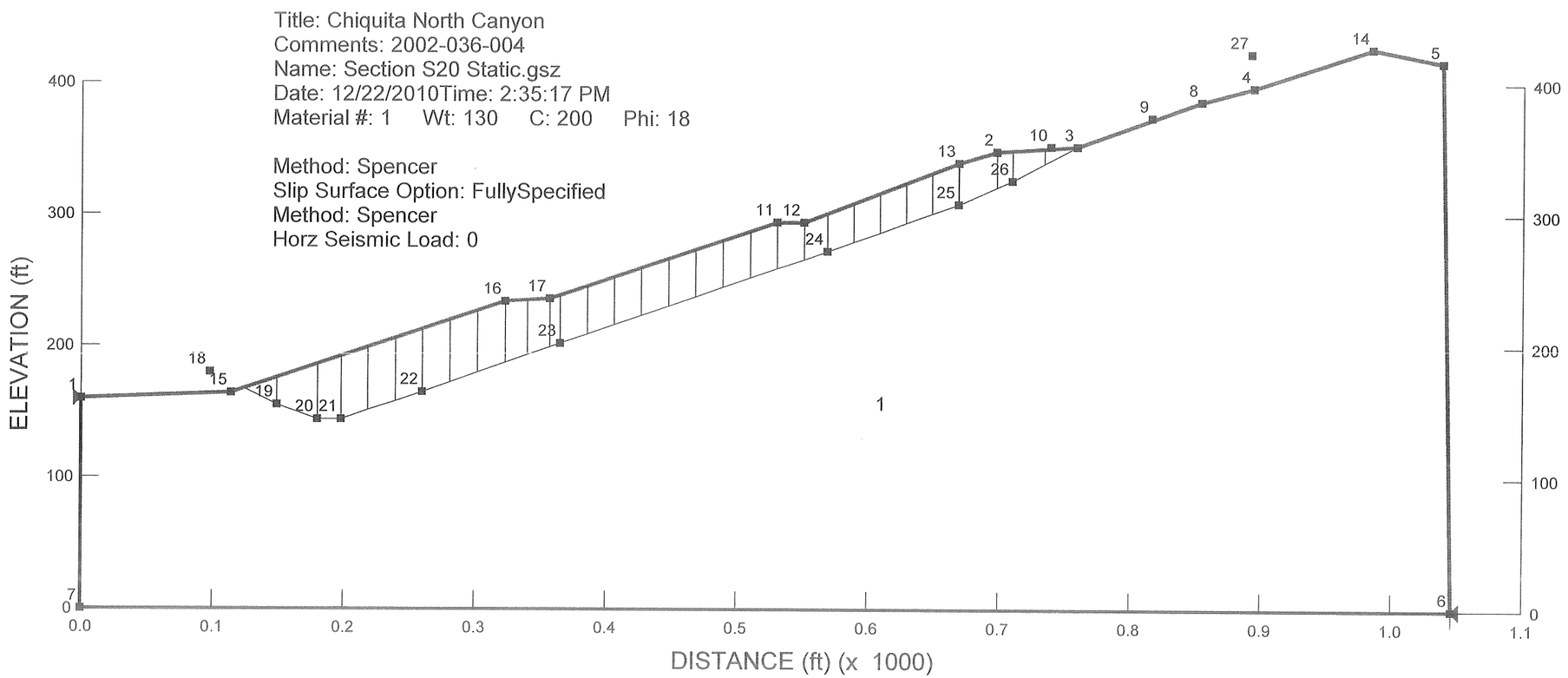
1.58


Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S19 Static.gsz
Date: 9/13/2010Time: 1:54:37 PM
Material #: 1 Wt: 130 C: 350 Phi: 30
Material #: 2 Wt: 130 C: 200 Phi: 18
Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0
ELEVATION (ft)
DISTANCE (ft) (x 1000)
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
2


1.32
Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S19 Static.gsz
Date: 9/13/2010Time: 1:54:37 PM
Material #: 1 Wt: 130 C: 350 Phi: 30
Material #: 2 Wt: 130 C: 200 Phi: 18
Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0
ELEVATION (ft)
DISTANCE (ft) (x 1000)
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
2

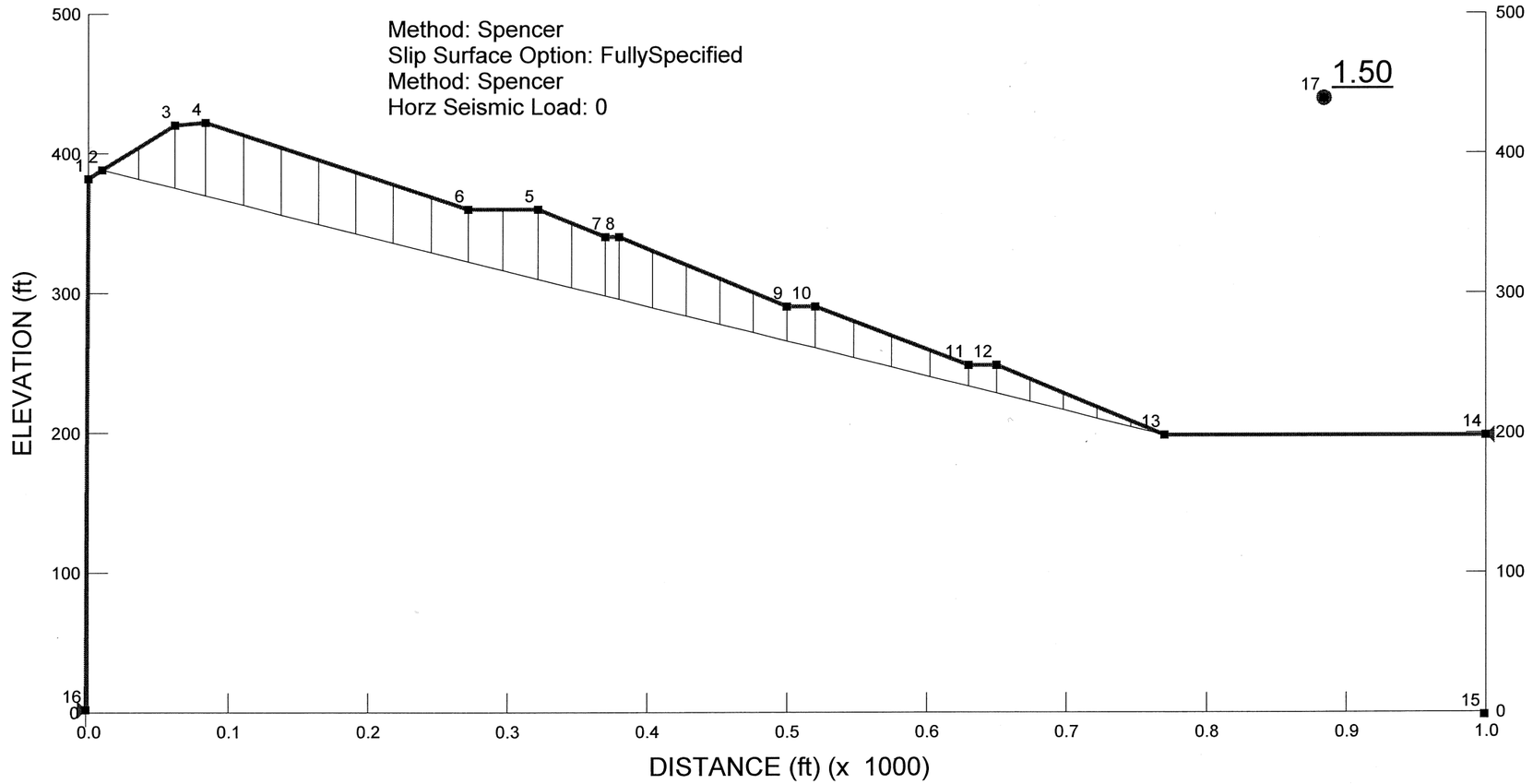

1.29
Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S19 Static.gsz
Date: 9/13/2010Time: 1:54:37 PM
Material #: 1 Wt: 130 C: 350 Phi: 30
Material #: 2 Wt: 130 C: 200 Phi: 18
Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0
ELEVATION (ft)
DISTANCE (ft) (x 1000)
400
300
200
100
0
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0

1.34


Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S20 Static.gsz
Date: 12/22/2010Time: 2:35:17 PM
Material #: 1 Wt: 130 C: 200 Phi: 18
Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0
ELEVATION (ft)
DISTANCE (ft) (x 1000)
0
100
200
300
400
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
1.1

Title: Chiquita
Comments: 2002-036-004
Name: S23 Static.gsz
Date: 11/23/2011Time: 12:21:28 PM
Material #: 1 Wt: 130 C: 200 Phi: 18

Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0



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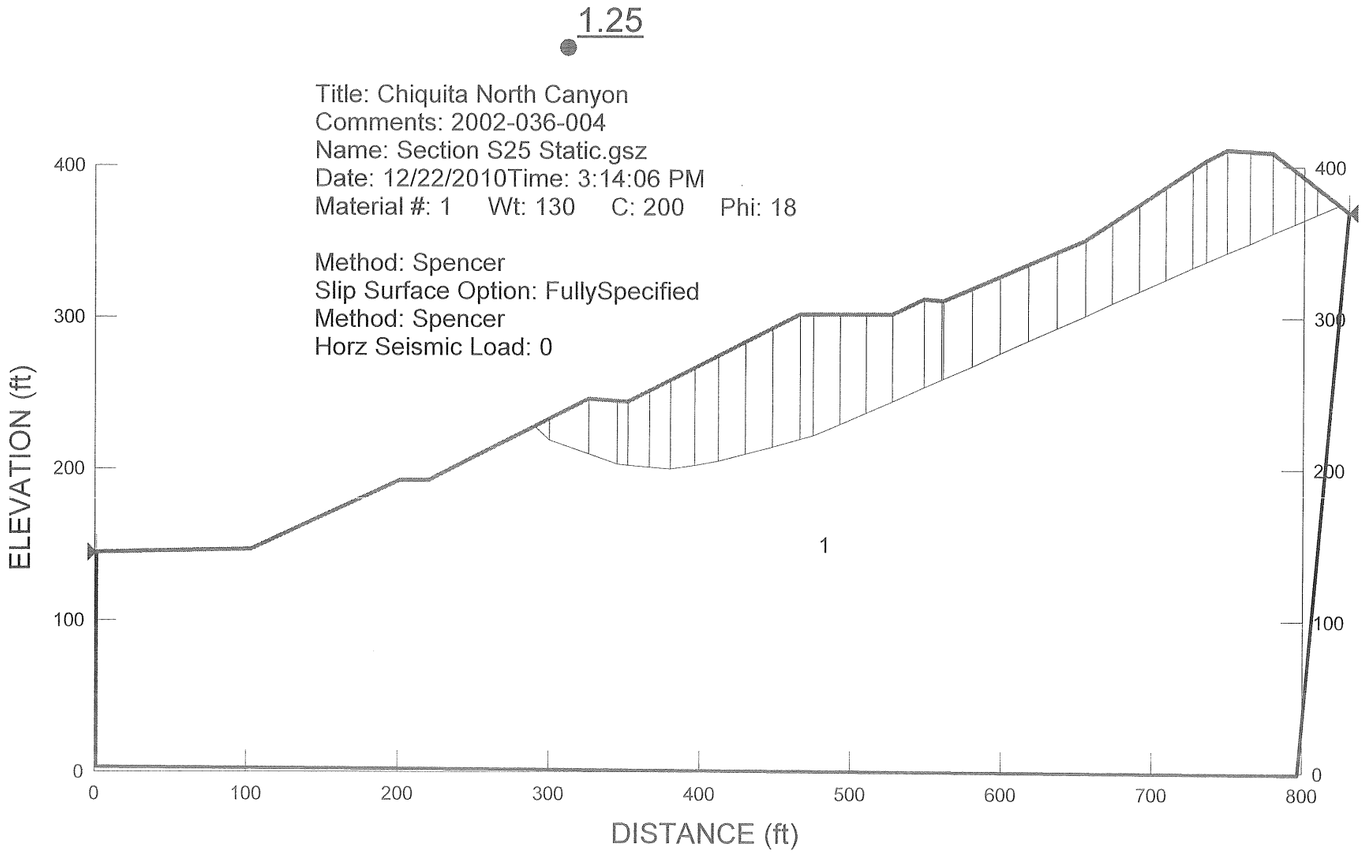
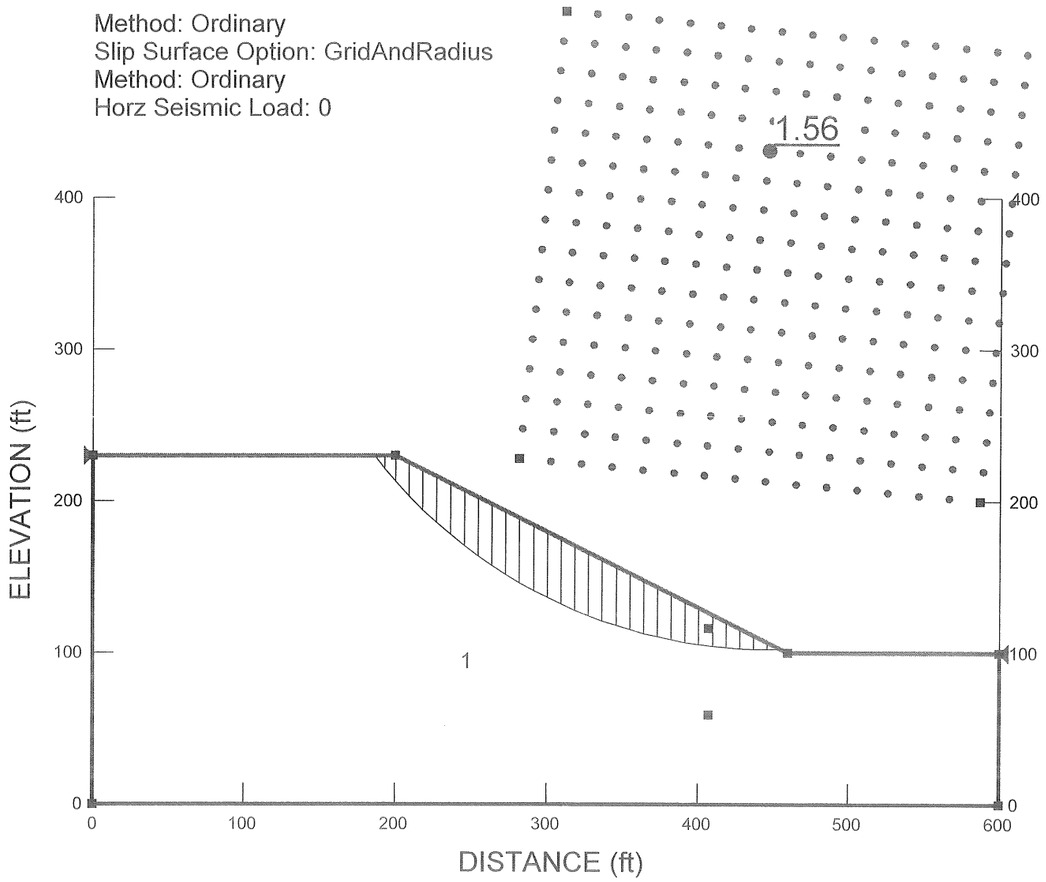

1.25
Title: Chiquita North Canyon
Comments: 2002-036-004
Name: Section S25 Static.gsz
Date: 12/22/2010Time: 3:14:06 PM
Material #: 1 Wt: 130 C: 200 Phi: 18
Method: Spencer
Slip Surface Option: FullySpecified
Method: Spencer
Horz Seismic Load: 0
1
ELEVATION (ft)
DISTANCE (ft)
0
100
200
300
400
500
600
700
800

Title: Chiquita North Canyon
Comments: 130' High, 2:1 Compacted Fill Slope
Name: 130' Fill Slope Static.gsz
Date: 1/18/2011Time: 10:15:23 AM
Material #: 1 Wt: 130 C: 350 Phi: 30 Model: MohrCoulomb

Method: Ordinary
Slip Surface Option: GridAndRadius
Method: Ordinary
Horz Seismic Load: 0



Title: Chiquita North Canyon
Comments: 130' High, 2:1 Compacted Fill Slope
Name: 130' Fill Slope Seismic.gsz
Date: 1/18/2011Time: 10:14:07 AM
Material #: 1 Wt: 130 C: 350 Phi: 30 Model: MohrCoulomb

Method: Ordinary
Slip Surface Option: GridAndRadius
Method: Ordinary
Horz Seismic Load: 0.15