APPENDIX N
Geotechnical Assessment

REVISED
GEOTECHNICAL ASSESSMENT REPORT
PROPOSED TENTATIVE TRACT NO. 063022
ROBINSON RANCH DEVELOPMENT
SULFUR SPRINGS, SANTA CLARITA, CALIFORNIA

Prepared for:

KOAR Institutional Advisors, LLC

8447 Wilshire Boulevard, Suite 100
Beverly Hills, California 90211

Project Number 061989-002

December 5, 2006

Leighton and Associates, Inc.

A LEIGHTON GROUP COMPANY

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To: KOAR Institutional Advisors, LLC
8447 Wilshire Boulevard, Suite 100
Beverly Hills, California 90211

Attention: Mr. Bruce H. Rothman

Subject: Revised Geotechnical Assessment Report, Proposed Tentative Tract No. 063022, Robinson Ranch Development, Sulfur Springs, City of Santa Clarita, California.

In accordance with your request and authorization, Leighton and Associates, Inc., (Leighton) performed a geotechnical assessment of a 185-acre residential development that is planned on Tentative Tract 063022, in the Sulfur Springs area of Santa Clarita, California. The assessment was performed in general conformation with Leighton's Proposal Number P06-000-299 dated May 23, 2006.

The purpose of Leighton's work was to assess the geotechnical feasibility of the proposed residential development within Tentative Tract 063022, and to provide preliminary geotechnical recommendations for use in the planning and preliminary design of the proposed development. The investigation consisted of reviewing previous investigations of the site, exploring the subsurface conditions of the subject site, performing a preliminary evaluation of the soil characteristics, and providing preliminary geotechnical recommendations for use in planning and preliminary design of the proposed development.

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If you have any questions regarding this report, please contact our office at (661) 257-7434. We appreciate this opportunity to be of service.

Respectfully submitted,

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Distribution: (6) Addressee

1. INTRODUCTION

1.1 Purpose

This report presents the results of the geotechnical feasibility assessment performed by Leighton and Associates, Inc. (Leighton) for the proposed residential development within Tentative Tract 063022 in Santa Clarita, California. The report also includes preliminary geotechnical recommendations for use in the planning and preliminary design of the development.

1.2 Site Location and Description

The subject site is approximately 185 acres in size and is located on the south side of the Santa Clara River in the City of Santa Clarita, California (Figure 1 – Site Location Map). Site topography consists of a wide canyon bottom with gentle slope gradients trending downward from the southeast to the Santa Clara River on the northwest. Relatively steep-sided ridge lines border the site on the southwest, southeast, and east. Bordering ridges are inclined at gradients ranging from approximately 3:1 (horizontal to vertical) to approximately 1:1. Two bedrock outcrops of approximately 35 and 60 feet in height are located in the western and north-central portions of the property. Site elevations range from approximately 1,550 feet above mean sea level (msl) in the northwest portion of the site to approximately 1,730 feet (msl) in the southeast portion of the site.

An active railroad right-of-way crosses the northern portion of the site and a floodway boundary crosses the southwestern site corner. A gas line easement and an older abandoned railroad right-of-way cross the center of the site from east to west.

1.3 Proposed Development

It is Leighton's understanding that the proposed development will consist of 105 residential lots (Lots 1 to 105). Lots 1 through 100 will be located south of the active railroad right-of-way and Lots 101 to 105 will be located north of the active railroad right-of-way. An open space lot, designated Lot 106, will be located north of the railroad right-of-way and east of Lot 101. The locations of the lots are shown on the attached Geotechnical Map, Plate 1.

It is also Leighton's understanding that the proposed development will comprise one to two-story single family detached wood structures, together with the associated streets and flatwork. Subterranean structures do not appear to be planned at this point; however, it is anticipated that the proposed development will include earth retaining structures.

The proposed development will also include three detention basins: one adjacent to Lot 14 in the southeastern corner of the site, a second between Lots 9 and 10 at the eastern site margin, and a third north of Lot 1 in the northeastern corner of the site.

Access to the site will be from Lost Canyon Road in the northwestern portion of the site and from "E" Street in the southern part of the site. A bridge with a span of approximately 275 feet is planned for Lost Canyon Road, and a second bridge with a span of approximately 160 feet is planned for a future street near its intersection with the northern terminus of "E" Street.

Cut slopes up to 40 feet in height at a gradient of 2:1 (horizontal: vertical) are planned to descend to Lost Canyon Road at the northwest site margin. A cut slope up to 50 feet in height is planned in the southeastern portion of the site behind Lots 15 through 17. Offsite and to the east of the project, two cut slopes are planed: one up to 30 feet in height and descending to Lots 1 through 4, and a second almost 100 feet in height descending to Lots 10 through 13 in the southeastern portion of the site.

A fill slope up to approximately 25 feet in height is planned to ascend from the northern margin of Lots 66 through 68.

1.4 Previous Investigations

Leighton had previously performed several geotechnical investigations at the subject site; including investigations for the previously proposed Tract 34466 (see referenced reports). The relevant information obtained from these investigations was used in preparing this current report.

A brief summary of the scope of work and findings for the prior Leighton geotechnical investigations is as follows:

Leighton, 1985a:

This report was for the preliminary geotechnical investigation for the previously proposed Tentative Tract 34466, Sulphur Springs, Los Angeles, California. The investigation included:

- Excavation of 13 bucket-auger borings (B1 through B13).
- Analyses of the geotechnical conditions and opportunities and constraints for the subject site.
- A conclusion that Tentative Tract 34466 is geotechnically suitable for residential development.
- Conclusions and recommendations for construction at the tract.
- Identification of a liquefaction hazard in portions of the site.

Leighton, 1985b:

- Provided two additional cross-sections and depicted zones of potential liquefaction.

Leighton, 1986a:

- Geotechnical review of the revised Tentative Tract Map 34466 that concluded that the changes in the subject tentative tract plan were minimal, and that the previous geotechnical recommendations remained applicable to the revised tentative tract map.

Leighton, 1986b:

- Provided a response to the County of Los Angeles Soils Engineering and Engineering Geology Review Sheets pertaining to the previously proposed Revised Tentative Tract 34466.

Leighton, 1989a:

- Previous Leighton report and grading plan had been approved by the County of Los Angeles.
- Leighton evaluated the geotechnical conditions pertaining to a revised grading plan by Lind and Hillerud dated September 7, 1988.
- Evaluation included excavation of 10 additional exploratory backhoe trenches.

Leighton, 1986b:

- Provided geotechnical input for the environmental impact report regarding liquefaction potential.
- Concluded that the liquefaction hazard in the southern portion and in bedrock areas is very low to nil.
- Recommended special foundations in the northern portions of the site.

Leighton, 1986b:

- Supplemental Liquefaction Evaluation for Vesting Tentative Tract 34466.
- Included 14 additional borings utilizing a hollow-stem drill rig.
- Concluded that Leighton's previous borings (1985a) were drilled after the unusually heavy rainfall year of 1984. Well records for this period show ground water levels to be within 5 feet of the highest recorded for the area.
- Concluded that residential irrigation of 26 inches per year would correspond to a 5± -foot increase in ground water levels at the subject site.

Leighton, 1990a:

- Supplemental Liquefaction Evaluation; provided analyses and mitigation in accordance with the prevailing standards and practices at that time.

Leighton, 1990b:

- Response to Geotechnical Review by Los Angeles County specific to previously proposed Vesting Tentative Tract 34466.

Leighton, 1990c:

- Review of new tentative tract map 34466; bedrock strength parameter were summarized, and peak strength parameters were utilized for slope stability analyses for seismic loading conditions.

Leighton, 1990d:

- Response to review of Draft Environmental Impact Report.
- Reiterated the previous recommendation for removal and recompaction of the top 5 feet in areas with low potential of liquefaction in addition to utilizing post-tensioned foundations, also recommended an additional 10 to 15 feet of compacted fill in the areas of highest liquefaction potential will reduce liquefaction potential significantly.
- Concluded that other methods of ground preparation and foundation design, such as vibro-flotation, or the use of pile foundations, were not warranted for the proposed project.

1.5 Purpose and Scope of Current Investigation

The purpose of this investigation was to assess the feasibility of Tentative Tract 063022 and to provide preliminary geotechnical recommendations for use in the planning and preliminary design of the proposed development.

Leighton performed the following tasks as part of the current scope of work:

- Reviewed Leighton's pre-existing soils and geology reports conducted for the subject site (see Appendix A - References).

- Assessed geologic hazards as referenced by the following:

  - State of California Alquist Priolo Earthquake Fault Zones Map;
  - State of California Seismic Hazard Zones Map; and,
  - Regional geologic maps contained in Leighton's in house library.

- Assessed historic high groundwater levels as referenced by the following:

  - State of California Seismic Hazard Zones Map; and
  - Groundwater Level Data within Newhall County Water District Pinetree Wells 1 through 3,

- Performed a preliminary site reconnaissance and geologic mapping of surface on-site conditions.

- Produced a Geotechnical Map from Leighton's previous onsite explorations, geologic resources in Leighton's in-house library as well as information gathered during onsite geologic mapping.

- Performed a site reconnaissance to evaluate access to, and to mark, the intended boring locations.

- As required by State law, contacted Underground Service Alert a minimum of two working days prior to fieldwork mobilization such that underground utilities could be located and marked by others.

- Drilled, logged, and sampled two borings to total depths of 61.5 and 51.5 feet (bgs) with a sample interval of no more than every 5 feet.

- Performed laboratory testing on selected samples including:
  - In-situ moisture/density; and
  - Gradation.

- Performed Engineering analysis to assess:
  - Anticipated removal limits;
  - Preliminary slope stability;
  - Liquefaction assessment; and
  - Preliminary foundation recommendations.

- Prepared this report summarizing our findings and conclusions.

2. GEOLOGIC FINDINGS

2.1 Geologic Setting

The subject site is located within the western portion of the Transverse Ranges Geomorphic Province and more specifically within the central portion of the San Gabriel Mountains. The Transverse Ranges are a belt of east/west-trending folds and associated thrusts that formed in response to northeast to north-northeast crustal shortening that initiated in Pliocene time, approximately 4 to 5 million years before the present. The area continues to undergo intense deformation by geological standards. This regional north-south compression causes the bedrock units to become progressively folded and faulted, forming valleys (such as the Santa Clara River Valley, Simi Valley, the Oxnard Plain, and the Ventura and Ojai Valleys), and uplands (including the San Gabriel Mountains, Oakridge-Santa Susanna Mountains, the Santa Monica Mountains, the Simi Hills, Big Mountain, South Mountain, and the Topatopa Mountains), that are generally bounded by reverse faults and/or thrust faults, which generally dip north along the southern range fronts and dip south along the northern range fronts.

The attached Figure 2 (Regional Geologic Map) shows the geologic conditions in the vicinity of site. The bedrock on site exhibits relatively consistent dips to the west and slightly north of west with isolated southwest dips in the northeast portion of the site. Dip angles on site range from approximately 13 degrees to the west on the eastern portion of the site to 35 degrees on the northeastern portion of the site.

2.2 Earth Materials

The majority of the subject site is underlain by Quaternary alluvium, Quaternary Older Alluvium as well as by siltstones, sandstones, and conglomeratic bedrock of the Mint Canyon Formation. Quaternary Terrace deposits have been mapped as capping units throughout the site. A description of each of the geologic units encountered at the site follows:

Artificial Fill – Uncertified (Afu):

Artificial fill soils have been mapped along the trend of the active as well as the abandoned railroad rights-of-way. The active railroad grade has an approximate maximum height of 20 feet and an approximate width of 100 feet. The abandoned railroad grade is approximately 20 feet high at its highest point and is approximately 75 feet wide.

Although not observed during Leighton's field investigation, artificial fill should be anticipated along portions of the adjoining roads. Artificial fill will be present around buried structures and utility lines.

Quaternary Alluvium (Qal):

Alluvial materials consist of stream-channel deposits of silts, sands, and gravels that are transported by surface water, and are restricted to the bottoms of the main canyons and tributary channels. Alluvial deposits along the northern portions of the site in the vicinity of the Santa Clara River have been mapped as Quaternary Alluvium (Qal). Quaternary alluvium encountered in Leighton's borings consists primarily of gray, brown, or slightly orangish brown silts and sands with varying amounts of clay and gravel. The soils range from loose to dense.

Quaternary Older Alluvium (Qoal):

Alluvial materials encountered on the southern portion of the site have been mapped as Quaternary Older Alluvium. The Quaternary Older Alluvium consists of orange-brown to reddish-brown silts and sands with varying amounts of clay and gravel. The soils range from loose to dense with the soils generally becoming denser with depth.

Terrace Deposits (Qt):

Terrace deposits were encountered as capping units overlying Mint Canyon bedrock on the outcrops located on the western and north-central portion of the property. Terrace deposits also were observed as remnants of older eroded surfaces along the northeastern and southeastern portions of the site. The terrace deposits primarily consist of light brown silty sands with occasional subrounded gravelly layers.

Mint Canyon (Tmc):

The Mint Canyon Formation underlies the site and is typically exposed in the areas of higher topographic relief. This formation is Miocene in age and is believed to have been deposited in westward flowing streams and in a valley bottom fresh water lake (Dibblee, 1996). Mint Canyon Formation bedrock onsite consists of interbedded claystones, siltstones, sandstones, and conglomerates that are slightly to moderately friable and slightly to highly weathered.

2.3 Groundwater

Leighton's prior investigations for the subject site have utilized groundwater data provided by the Newhall County Water District (NCWD) (Leighton, 1990a, b, c, d). Predictions of future groundwater conditions were estimated from the prior performance of the site vicinity as shown by the groundwater well data. The influence of irrigation resulting from the residential development was incorporated into this prediction by comparing the historical recharge effect of increased rainfall and correlating this to expected volumes of irrigation water. This future high water level was contoured on the geotechnical map with depth to future high groundwater level contours ranging from 25 to 60 feet below the existing ground surface.

Leighton's current investigation deviated from the prior approach of incorporating the influence of homeowner irrigation resulting from the residential development. It is believed that the historical rainfall levels versus groundwater level data utilized in the prior reports only holds true in the vicinity of the Santa Clara River channel where the data was collected. The drainage basin acting to recharge the groundwater in the vicinity of the Santa Clara river channel is much larger than the drainage basin collecting water introduced by future homeowner irrigation. This larger drainage basin will cause rainfall to have a much larger effect on the groundwater levels in the vicinity of the Santa Clara river channel than on the groundwater levels beneath the subject site. It is also believed that the open, unconfined groundwater basin and the relatively coarse nature of the alluvium underlying the site as well as the presence of the Santa Clara river channel topographically lower than the site will provide a drainage channel preventing a significant rise in groundwater due to homeowner irrigation. Additional data regarding the depth to groundwater and correlations between rainfall and groundwater levels may be collected at a later investigative phase of the project through the installation of piezometers on the subject site.

Groundwater levels vary appreciably across the site. It is anticipated that the depth to groundwater roughly follows topography, with the shallowest groundwater conditions under the northern portion of the site in the Santa Clara River flood plain. Due to this variability of the depth to groundwater across the site, the current investigation has assigned the portion of the site north of the active railroad alignment a different future depth to groundwater than the portion of the site south of the active railroad alignment.

Future depth to groundwater levels for the purposes of this report were estimated utilizing available data from the California Geological Survey (formerly the California Division of Mines and Geology), groundwater monitoring wells and historic rainfall data from the Newhall County Water District as well as the groundwater conditions encountered during Leighton's subsurface investigations.

Historic high groundwater levels have been reported as approximately 10 to 25 feet below the existing ground surface for the portion of the site north of the active railroad alignment (CDMG, 1998). Newhall County Water District groundwater wells Pinetree 1, Pinetree 2 and Pinetree 3 are located approximately 500 feet, 570 feet and 450 feet respectively, north of the proposed development within the Santa Clara River flood plain. The available depth to groundwater data for these wells was reviewed and has been included in Appendix E. The shallowest groundwater recorded in these wells, over the period from 1979 to the present, was at a depth of 15 feet within Pinetree well 1 in April of 1993. The shallowest groundwater encountered in Leighton's subsurface investigations for the portion of the site north of the active railroad alignment was encountered at a depth of 15 feet in B-4 and B-9 (drilled approximately 200 feet and 500 feet respectively, north of the proposed development). In light of this data, a future groundwater high of 10 feet below the existing ground surface has been utilized within this report for portions of the site north of the active railroad alignment.

Historic high groundwater levels documented by CGS are reported as 25 feet below the existing ground surface immediately south of the active railroad alignment and are not documented for the remaining portion of the site south of the active railroad alignment. Historic high groundwater data was not available from Newhall County Water District for the portion the site south of the active railroad alignment. The shallowest depth to groundwater encountered by Leighton's subsurface investigation south of the active railroad alignment was at a depth of 30 feet within B-11. The remainder of Leighton's borings on this portion of the site did not encounter groundwater. A future groundwater high of 25 feet was assumed for the portion of the site south of the active railroad alignment for the purposes of this report.

3. FAULTING AND SEISMICITY

3.1 Faulting

There are several unnamed faults mapped through the site. These faults are well exposed in the railroad right-of-way cut slopes. They offset the Mint Canyon Formation but do not disturb the overlying Pleistocene terrace deposits. The faults do not exhibit signs of recent activity and probably originate under similar post-depositional conditions as the Sulphur Springs fault to the west of the site.

No active faults have been mapped at, or are known to project towards, the project site. The project site does not lie within an Alquist-Priolo Earthquake Fault Zone, (APEFZ): (Hart and Bryant, 1999; State of California, 2000).

For the purposes of providing seismic design for planned construction, active faults in California have been designed as seismic sources and classified designed as Type A, B, or C faults. Type A faults are those that are capable of producing a Maximum Moment Magnitude Earthquake of M>7.0 and have a slip rate of greater than 5 mm/year. Type C faults are those that are only capable of producing an earthquake with a Maximum Moment Magnitude of less than 6.5 and have a slip rate of less than 2 mm/year. Type B faults are those which have a Moment Magnitude and slip rate characteristics in between those of Type A and Type C faults. Seismic source Type C's have not been designated in California because they have been judged not to have a significant impact on seismic design.

The nearest Seismic Source Type A Fault to the site is the San Andreas Fault (1857 rupture) at a distance of approximately 24 km to the northeast of the site (Jennings, 1994; Blake, 1999). The nearest Seismic Source Type B Fault is the Sierra Madre (San Fernando) Fault located approximately 2 km southwest of the project site (Blake, 1999).

3.2 Probabilistic Seismic Hazard Assessment

A probabilistic seismic hazard assessment (PSHA) was performed for the site in accordance with the requirements of the 2002 edition of the County of Los Angeles Building Code (LABC), which states that the design-basis earthquake is the ground motion that has a 10% probability of exceedance in a 50-year time period, that is, a ground motion with an average 475-year return period. In order to estimate this ground motion, a probabilistic seismic hazard analysis was performed for the site using the computer program FRISKSP (Blake, 2000). For the project site, a central representative location of 34.4218°N latitude; 118.4070°W longitude was selected for use in the analyses.

The PSHA considered various magnitudes of earthquakes that major active or potentially active faults within a 100-km radius of the site could produce along their respective fault lengths. The attenuation relationships of Boore, et al. (1997), Campbell (1997, 2000), and Sadigh, et al. (1997) were used in the analyses.

The following table summarizes the design earthquake peak horizontal ground acceleration (PHGA) values, not magnitude weighted and magnitude weighted for Mw = 7.5, for the project site:

Attenuation Relationship	**PHGA** ***(Not Magnitude-Weighted)***	**PHGA** ***(Mw = 7.5)***
Boore et al., (1997), 250 m/s	0.74g	0.54g
Campbell (1997, 2000), alluvium	0.57g	0.44g
Sadigh, et al., (1997), deep soil	0.57g	0.41g
Average Estimated PHGA	**0.63g**	**0.46g**

4. GEOTECHNICAL HAZARDS

4.1 Liquefaction Potential and Seismically-Induced Settlement

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:

1. Ground shaking of sufficient magnitude and duration.
2. A high groundwater level at or above the level of the susceptible soils during the ground shaking.
3. Soils that are susceptible to liquefaction.

Liquefaction of the underlying soil layers may result in settlement of the soils as well as surface manifestation such as sand boils, mud-spouts, surface water seepage, or temporary quicksand like conditions. Studies by Ishihara (1985) indicate that the ground surface at a site will not experience damage due to liquefaction if a sufficient thickness of the non-liquefiable soils overlies the liquefiable soils.

The standard of practice for evaluation of liquefaction and seismically-induced settlement has evolved significantly from the time the last report was issued by Leighton for the site in 1990. Accordingly, the liquefaction potential and seismically induced settlement at the site were re-evaluated as part of the current investigation.

To assess the potential of liquefaction and the settlement that may result from its occurrence, the Computer Program Liquefy Pro by CivilTech Software (2006) was used utilizing the following data:

1. A magnitude weighted 0.46g PHGA resulting from a 7.5 magnitude earthquake per the analyses in Section 3.2 above.

2. A historic high groundwater of 10 feet for portions of the site to the north of the active railroad alignment and 25 feet for portions of the site to the south the active railroad alignment.

3. Leighton's boring logs with their relevant field Standard Penetration Test (SPT) results and laboratory particle size analyses results.

Only the current explorations extended at least 50 feet below the existing grade in accordance with the state-of-the-practice requirements for liquefaction analyses. However, several of the older explorations extended to 40 or 45 feet below the existing grade, and for preliminary evaluation purposes, coupled with the current deeper borings, these were considered to be sufficient for this preliminary assessment. Also, some of the previous borings were terminated in bedrock encountered at relatively shallow depths.

Our analyses considered both no groundwater and an assumed groundwater level of either 10 or 25 feet below the existing ground surface, depending on where the boring was located relative to the existing railroad alignment. Summary plots of the analyses are presented in Appendix D.

Calculated seismically-induced settlements without groundwater ranged upwards to about 1½ inches and were typically between ½ and ¾ inch. With the groundwater level at the assumed historic high levels, the seismically-induced settlements range up to 5 inches in the proposed buildable lot areas.

As indicated above, liquefaction can produce surface manifestations such as sand boils, mud-spouts, surface water seepage, or temporary quicksand like conditions. If there is a sufficient thickness of non-liquefiable soils over the layers of liquefiable soils, surface manifestations of liquefaction are not expected to occur. In the portions of the site where seismically-induced settlements are expected to be less than approximately 2 inches, the thickness of the non-liquefiable soils overlying the liquefiable soils is of sufficient thickness generally to preclude surface manifestations of liquefaction. Where greater seismically-induced settlements are expected, some surface manifestations of liquefaction may occur.

Lateral spreading can occur where the soils are liquefiable. If the groundwater level were to rise to the assumed historic high levels, portions of the site would have soils that could be susceptible to lateral spreading. However, with at least 10 feet of non-liquefiable soils over the site, no open-face slopes towards which to flow, and "islands" where lateral spreading is unlikely to occur and that would function as buttresses against lateral deflection, lateral spreading is not expected to be of sufficient magnitude to adversely affect the proposed development.

4.2 Expansive Soils

Generally speaking, the existing on-site soils are classified as predominantly granular; these types of soils have a very low expansion potential. The degree of expansivity of the few existing on-site cohesive soils is not expected to be more than moderate.

5. STABILITY OF SLOPES

After a review of the geology and the proposed tentative tract plans, three representative cross-sections (LS1 through LS3) were drawn and analyzed for slope stability. The locations of these sections are shown on the Geotechnical Map (Plate 1) while details of our analyses, including the selected strength parameters, our methodology, and the calculated factors of safety are presented in Appendix D.

Global slope stability analyses performed in this investigation utilized shear strength parameters presented in the Seismic Hazard Report for the Mint Canyon Quadrangle (State of California, 1998b), for a similar type of bedrock. Additional field subsurface explorations should be performed, to obtain undisturbed bedrock samples in order to perform direct shear tests to develop site specific shear strength parameters. Additional slope stability analyses, together with additional recommendations, may be required if the new shear strength parameters are significantly different than those assumed in this report.

Section LS1 was constructed to depict the most critical cut slope proposed as a portion of the referenced tentative tract map. The location of LS1 was selected based on the height of the proposed cut slope as well as the adverse geologic structure. The results of the slope stability analyses for this section indicated that the planned slope meets the minimum factor of safety requirements of the County of Los Angeles Building Code (LABC).

Section LS2 was constructed through the natural slopes descending to the tallest cut slope at the margin of the site. The results of the slope stability analyses for this section indicated that the planned slope does not meet the minimum factor of safety requirements of the LABC. Additional analyses were performed and indicated that flattening the proposed slope to at 2½: 1 or flatter would meet the minimum factor of safety requirements of the LABC.

Section LS3 was constructed through the natural slopes descending from offsite to the northeastern portion of the site and extending through the detention basin east of Lot 14. Slope stability analyses as well as rapid drawdown analyses were performed. The results of the slope stability analyses for this section indicated that the planned slope meets the minimum factor of safety required by LABC.

6. CONCLUSIONS

Based upon our evaluation of our field explorations, laboratory testing, and engineering analyses, together with our review of previous investigations performed by Leighton and others, we have developed the following conclusions:

- The proposed development is feasible from a geotechnical point of view provided that the preliminary geotechnical recommendations contained in this report are followed and are incorporated into the planning and design of the project.
- This site is not located within an Alquist-Priolo Earthquake Fault Zone and there is no evidence to suggest that active or potentially active faults exist on, or trend towards, the subject site. Therefore, structural damage resulting from fault rupture is unlikely.
- The on-site alluvial soils range from loose to dense sands, silty sands, and silts with some clays and gravels. Locally, the alluvial soils are underlain by dense materials consisting of Terrace Deposits or bedrock of the Mint Canyon Formation
- Grading involving deep removals may encounter groundwater at some locations; especially in the northern portions of the subject site.
- The on-site soils may be incorporated into structural fills after removing organic and other deleterious materials.
- Proposed manufactured and natural slopes are anticipated to meet the required factors of safety provided that our recommendations are implemented.
- Existing on-site cohesive soils have a medium potential for volumetric change.
- Liquefaction along with seismically-induced settlements of up to 5 inches, surface manifestations such as sand boils, and lateral spreading could occur to varying degrees across the site.
- The potential for structural damage from seismically-induced settlement, liquefaction, or lateral spreading can be reduced by implementing the recommendations presented in this report.
- Due to the possible seismically-induced settlement, the proposed residences should be supported on post-tensioned foundations designed for relatively large vertical displacements.
- The corrosivity and sulfate content of the soils should be assessed during a subsequent investigation phase or during construction.

7. RECOMMENDATIONS

7.1 Review of Plans and Supplementary Investigation

The recommendations included in this preliminary geotechnical report are based on limited field explorations, laboratory testing, and geologic and engineering analyses. The recommendations are necessarily preliminary and intended to address, from a geotechnical prospective, the general features of the proposed Tentative Tract Map. As the features of the project are developed, the plans should be forwarded to Leighton for review. Due to the preliminary nature of our investigation, additional subsurface explorations, laboratory tests, and analyses should be performed to develop final recommendations for use in the design and construction of the proposed project.

The additional explorations should include deep borings and cone penetration test (CPT) soundings to evaluate the areas that would be most susceptible to liquefaction. The borings should be planned extend from 50 to 75 feet below the existing grade, though some of the borings could be terminated at shallow depths where bedrock is encountered. CPT soundings should be planned to extend 75 feet below the existing grade, though many of the soundings should also be expected to encounter refusal at shallower depths. The additional explorations and testing may result in recommendations that could result in economies for construction or better performance of the proposed structures.

In addition the explorations for liquefaction, site-specific data for use in slope stability analyses should be obtained by exploring the slopes and testing of the materials. The data should be used to confirm the analyses performed for this investigation.

7.2 Liquefaction

Portions of the site are susceptible to excessive total seismically-induced settlements and possible surface manifestations of liquefaction. The affected areas should be delineated by the recommended additional explorations.

The extent of potential damage to structures in the areas affected by liquefaction can be mitigated by designing the structures in accordance with the recommendations presented in the Foundations section of this report. However, those recommendations will only mitigate the effects of differential settlement on the structures and will not affect the areal total settlements or the surface manifestations of liquefaction. The non-structural portions of the development should be designed to accommodate the effects or the affected areas should be mitigated. If the liquefaction affected areas are mitigated, it may be possible to use conventional shallow footings or post-tensioned slabs designed for lesser deflections than recommended in this report.

Mitigation of the site for the effects of liquefaction would consist of improving the upper soils to provide a sufficient thickness of non-liquefiable soils to reduce total settlements and suppress surface expressions of liquefaction. The mitigation could consist of overexcavation of the upper soils to locally as deep as 30 feet and replacing them with compacted fill. Other means of improving the upper soils can include stone columns or compaction grouting. Details of the mitigations, if any, should be developed during subsequent investigations of the site.

7.3 Grading

To provide improved support for the proposed development and to decrease the potential for static settlements of the residences, the upper soils to depths of 10 to 15 feet should be overexcavated and recompacted. Recommended preliminary overexcavation depths are shown on the Geotechnical Map, Plate 1.

7.3.1 Site Preparation

Site preparation should include the following:

- Removal of existing vegetation and debris from the site, in addition to removals required to achieve the planned grades.
- Generally, temporary vertical cuts should not exceed 5 feet in height, while temporary slopes should not be steeper than 1: 1.
- Overexcavation should be performed beneath the proposed structures and streets to remove existing uncertified fills (if any) and colluvial and alluvial soils. The depth of overexcavation should be measured from the existing ground surface or the planned finish grade; whichever is lower. For planning purposes, the overexcavation should consist of:

    1. A minimum of 10 feet for lots located north of the easement of the existing active railroad line.
    2. A minimum of 15 feet for lots located between the south easement of the existing active railroad line and north of the old abandoned railroad.
    3. A minimum of 10 feet for lots located south of the old abandoned railroad.

- Overexcavation need not continue into competent terrace deposits or into the Mint Canyon Formation except as required for mitigation of transition lot conditions.

- Transition lots may occur where terrace deposits and/or the Mint Canyon Formation are at or near the proposed finished grade. Overexcavation of affected lots should extend at least 3 feet below the foundations.

- Overexcavation should extend horizontally, beyond the exterior face of the proposed footings a distance equal to thickness of the fill beneath the footings. However, the overexcavation should include the area between the buildings and the backbone utilities that will serve the buildings.

- The recommended depths of removals and overexcavation are preliminary, and may be revised during construction based on the exposed materials by a California Certified Engineering Geologist.

- Exposed materials that have been approved for support of fill by the Geotechnical Consultant should be scarified to depths of approximately 6 to 8 inches, moisture conditioned to between 110% and 120% of optimum moisture content, and compacted to at least 90% of the maximum dry density obtainable using the ASTM D 1557 method of compaction.

- Holes and depressions resulting from the removal of trees, buried obstructions and/or oversize rocks that extend below finished site grades or in zones of overexcavation should be backfilled with compacted fill.

7.3.3 Materials for Fill

- The removed and excavated soils, after deleterious materials have been removed, may be incorporated in the proposed structural fill.

- Materials larger than 8 inches in greatest dimension should not be placed in fills. Oversize materials should be broken down to less than 8 inches in greatest dimension. No more than 25 percent of the fill materials should consist of materials greater than 4 inches in greatest dimension. Gravel and cobbles incorporated into fills should be thoroughly mixed into the soil, and should not be clumped or segregated in heaps.

- Rocks larger that 4 inches in greatest dimension should not be placed in wall backfills or in the top 5 feet beneath finish grade. Gravel and cobbles incorporated into backfills should be thoroughly mixed into the soil, and should not be clumped or segregated in heaps.

- Approximately 20 percent shrinkage of the overexcavated soils when compacted to 90 percent should be expected. Approximately 4 to 5 inches of subsidence of the exposed soils should be expected.

- Import soils, if required, should be similar to the on-site soils. Samples of the soils and the locations of their source areas should be provided to the Geotechnical Consultant at least 48 hours (2 working days) before importing to the site so that appropriate tests can be performed and the materials evaluated for suitability for use at the site.

7.3.4 Compaction

Approved fill materials should be brought to a moisture content of between 110% and 120% of optimum moisture content and thoroughly mixed for uniformity of moisture and materials at the time of compaction. The materials should be placed in generally even horizontal layers not exceeding 8 inches in thickness prior to compaction, and compacted to at least 90% relative compaction.

Slope faces may be compacted by backrolling of the faces of the slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Alternatively, the slopes may be overbuilt and trimmed back to the final design configuration. Upon completion of grading, the relative compaction of the fill out to the slope face should be at least 90%.

7.4 Slopes

7.4.1 General

Preliminary recommendations for the construction of slopes are presented below. More detailed recommendations should be developed during the grading plan review for the project.

7.4.2 Fill Slopes

Fill slopes are proposed at various locations of the site at 2:1 gradients or flatter. The highest fill slope proposed at the site is approximately 45 feet in height and is located west of Lot 102. Fill slopes should be constructed in accordance with the grading provisions of the LABC with regard to setbacks and the locations of drainage terraces. Fill soils placed within the slopes should be benched into competent natural materials. The benches should be approximately 4 feet high, and soils should be compacted to at least 90 percent of the maximum dry density obtainable by ASTM D 1557. Fill slopes should be at least 8 feet wide from front to back.

7.4.3 Cut Slopes

Cut slopes are proposed at various locations of the site at 2:1 gradients or flatter. The highest cut slope proposed at the site is approximately 100 feet high and is located east of Lots 10 through 13. The cut slopes should be provided with drainage terraces in accordance with the grading provisions of the LABC.

If during construction the exposed surfaces of the cut slopes appear to be erodible and/or surficially unstable, they should be temporarily sloped back at no steeper than 1½:1, and reconstructed as a stability fill, per section 7.3.2 above with a sufficient keyway at the toe and subdrains.

7.4.4 Subdrain Installation

Subsurface water should be relieved from the backs of fill slopes by placing subdrains at the benches. Vertical spacing between subdrain lines should not exceed 25 feet, and the subdrains should be provided with outlets at least every 100 feet. The subdrain lines should consist of 4-inch diameter perforated pipe backfilled with at least 3 cubic feet of clean ¾-inch gravel per foot length of pipe. The gravel should be separated from the surrounding soils by a filter fabric such a Mirafi 140N. The pipe should have a fall of at least 2 percent towards the outlets. A land surveyor/civil engineer should survey the subdrains for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys. The outlet lines should consist of solid walled pipe.

7.4.5 Keyways

Buttress and stability fills, as well a fill slopes, should be keyed into bedrock or other competent materials. These keyways should be at least 15 feet wide and 2 feet deep at the toe of the slope and 3 feet deep at the heel. Where keyways are established in alluvial areas, the keyway may need to be deepened; the need for deepening of a keyway should determined during construction. Depending on the final proposed slope gradients, wider keyways may be recommended. A subdrain should be installed at the bottom of the heel. Leighton's geologist should observe the materials exposed in the keyways to determine if additional removals, laterally or vertically, should be performed.

7.4.6 Natural Slopes

Slopes left in their natural condition may be subject to erosion and sloughing. Debris basins and/or debris/slough walls may be required to protect structures and roadways below the slopes. Furthermore, the stability of the slopes should be verified during the rough grading plan review when site-specific shear strengths parameters have been obtained.

7.5 Foundations

Post-tensioned foundations and slabs-on-grade, established in structural fill, should be used for the support of the proposed residences at the subject development. Preliminary parameters for use in design of post-tensioned slabs are presented in the following table:

Post-Tensioned Floor Slab Parameters

Edge Lift-E_m	6 feet
Center Lift-E_m	6 feet
Edge Lift-Y_m	2.5 inches
Center Lift-Y_m	6.0 inches
Minimum Perimeter Footing / Slab Edge Embedment	18 inches
Minimum Interior Footing Embedment	12 inches
Bearing Value	2,000 pounds per square foot

Depending on the results of subsurface explorations and laboratory testing during the rough grading plan review, it may be possible to reduce the Y_m parameters for at least some portions of the site.

Details for the anticipated bridges are not available. However, a separate investigation should be performed for each bridge. Piling will likely be required for support of the bridges. The piling will probably need to be driven, though favorable water conditions could allow for installation of cast-in-drilled-hole (CIDH) piling for the bridge accessing the site from the south.

7.6 Vapor Retarder

Slabs, including post-tensioned slabs, that may receive moisture sensitive floor coverings should be underlain by at least a 10-mil thick vapor retarder. In accordance with current ACI recommendations, a sand layer should not be placed between the vapor retarder and the slab.

7.7 Expansion Potential

The existing on-site soils are predominantly granular, while the few on-site cohesive soils are expected to have low to moderate expansion potential. Therefore, the potential of structural damage resulting from expansion of the existing on-site soils is considered to be remote. Furthermore, in order to mitigate for potential seismically-induced settlements, the proposed residences should be supported on post-tensioned foundations and these would mitigate for expansive soils, should they occur beneath a building.

7.8 Corrosivity and Sulfate Content

The corrosivity of at- and/or near-finish-grade soils should be assessed during construction by testing. The sulfate content of the soils that will be in contact with concrete should also be assessed. Samples for testing should be obtained by the Geotechnical Consultants' representative. Recommendations for mitigation should be developed based on the results of the tests.

7.9 Site Seismic Coefficient

Under the Earthquake Design regulations of Chapter 16, Divisions IV, and V of the 2001 edition of the CBC, the following coefficients and factors apply to lateral-force design for structures at the site:

Seismic Coefficients	
SEISMIC ZONE, Z	0.4
SOIL PROFILE TYPE	S_D
Near-Source Factor N_a	1.3
Near-Source Factor N_v	1.6
Seismic Coefficient C_a	0.57
Seismic Coefficient C_v	1.02
Period, T_o*	0.14
Period, T_s*	0.72
* Use with Figure 16-3 of the LABC.	

7.10 Retaining Walls

The following preliminary recommendations are applicable to the design and construction of retaining walls that do not exceed 12 feet in height:

1. The equivalent fluid pressure at the back of the wall will vary from 35 pounds per square foot per foot depth (pcf) for a level backfill to 50 pcf for a 2:1 ascending slope at the top of the proposed wall.

2. The above mentioned values do not include surcharges generated from traffic and/or any additional loads within the setback zone. Surcharge values should be added to the equivalent fluid pressure if any of the aforementioned loads exist in the setback zone.

3. A 2,000 pounds per square feet (psf) allowable bearing pressure may be used for the design of the footings. The minimum embedment of the footings, in competent native soils and/or structural fill, should not be less than 18 inches below the lowest adjacent grade and should meet the minimum setback requirements set forth in LABC Figure 18A-I-1.

4. For the structural design of the walls, the bulk density of the soils over footing slabs may be taken as 125 pcf.

5. A 300 pound per square foot per foot depth passive earth pressure, starting from one foot below the adjacent proposed grade, along with a 0.35 coefficient of friction, may be used in the design of the subject walls. Where both friction and passive resistance are utilized in the design, one of the values should be reduced by one-third. These values may be assumed to be ultimate values.

6. The hydrostatic pressure should be relieved from the back of the wall by installing a 4-inch diameter perforated pipe, surrounded by a minimum of 1-cubic foot per foot of pipe of free draining ¾-inch gravel. A minimum thickness of 4 inches of gravel should surround the pipe. A geofabric filter, such as Mirafi 140 N should separate the gravel from the adjacent soils.

7. As a substitute for the ¾-inch free draining gravel and the geofabric filter, Class 2 permeable material or equivalent may be used with slotted pipe.

8. An unobstructed outlet should be provided at the lower end of each segment of the subdrain. Outlets should be provided at least every 100 feet.

9. To minimize seepage through the wall, the back of the wall should be waterproofed.

10. Positive surface drainage should be provided and maintained to direct surface water away from the wall and towards suitable collective drainage facilities. A V-ditch should be provided at the top of the wall along with a minimum 12-inch deep freeboard. Surface water should not be allowed to pond adjacent to or flow over the wall surface in an uncontrolled manner.

11. Heavy equipment should not be operated close to the walls when placing backfill unless the walls are braced properly.

12. Granular on-site soils may be used for the backfill behind the walls. Any import materials should be granular. The top 18 inches of the backfill should be relatively impermeable.

13. All relevant CAL-OSHA requirements should be considered during both the design and construction phases.

14. The plans should be submitted to this office for review and approval prior to commencing construction.

15. Footing excavations, subdrain systems, and wall backfill should be observed and approved by a representative of this office.

7.11 Pavement Design

Based on our experience with granular soils similar to those encountered in our borings, an R-value of 35 was assumed for estimating the pavement sections. Based on the design procedures outlined in the current Caltrans Highway Design Manual, and using a design R-value of 78 for aggregate base course, preliminary flexible pavement sections may be designed as follows for the Traffic Indices indicated. Local agency's more conservative minimum thickness requirements will supersede the following recommended sections. Final pavement design should be based on laboratory testing performed near the completion of grading and the Traffic Index determined by the project civil engineer.

Traffic Index	Asphalt Concrete (inches)	Aggregate Base (inches)
4.0	3.5	4.0
5.0	4.0	5.0
6.0	4.0	6.0
7.0	5.0	6.0

7.12 Surface Drainage

Positive surface drainage should be provided and maintained to direct surface water away, through non-erodible drainage devices, from structures and slopes and towards streets or other suitable collective drainage facilities. In no case should surface water be allowed to pond adjacent to buildings or behind the retaining walls or to flow over slope surfaces in an uncontrolled manner.

Inadequate control of runoff water or heavy irrigation may result in shallow groundwater conditions and seepage where, previously, none existed. Maintaining adequate surface drainage, proper disposal of runoff water and control of irrigation will minimize the potential of adverse structural impacts resulting from oversaturated soils.

7.13 Geotechnical Observation

The Consultant's representative should have at least the following duties:

- Observe the excavation so that necessary modifications based on variations in the soil conditions encountered can be made;
- Observe the exposed surfaces in areas to receive fill and in areas where excavation has resulted in the desired finished subgrade. The representative should also observe proof-rolling and delineation of areas requiring overexcavation;
- Evaluate the suitability of on-site and import soils for fill placement; collect and submit soil samples for laboratory testing;
- Observe the fill and backfill for uniformity during placement;
- Test fills and backfills for field density and compaction to determine the percentage of compaction achieved during placement; and,
- Obtain representative samples of the in-place fill soils for laboratory testing of the expansion potential, corrosivity, sulfate content, and R-Value.
- Obtain representative samples of the fill materials used in slopes for laboratory testing of the maximum dry density and optimum moisture content, gradation, and shear strength.

The governmental agencies having jurisdiction over the project should be notified before commencement of grading so that the necessary grading permits can be obtained and arrangements made for required inspection(s). The contractor should be familiar with the inspection requirements of the reviewing agencies.

8. LIMITATIONS

Leighton's work was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional opinions included in this report.

In many projects, conditions revealed in excavations may be at variance with preliminary findings. If this occurs, the changed conditions should be evaluated by the geotechnical consultant and additional recommendations be obtained, as warranted.

The identification and testing of hazardous, toxic, or contaminated materials were outside the scope of Leighton's work. Should such materials be encountered at any time, or their existence be suspected, and all measures stipulated in local, County, State and Federal regulations, as applicable, should be implemented.

This report is issued with the understanding that it is the responsibility of the owner, or of his representative, to ensure that the information and recommendations contained herein are brought to the attention of the necessary design consultants for the project and incorporated into the plans; and that the necessary steps are taken to see that the contractors carry out such recommendations in the field.

The findings of this report are considered valid as of the present date. However, changes in the condition of a property can occur with the passage of time, whether due to natural processes or the work of man on the subject or adjacent properties. In addition, changes in standards of practice may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may at some future time be invalidated wholly or partially by changes outside Leighton's control.

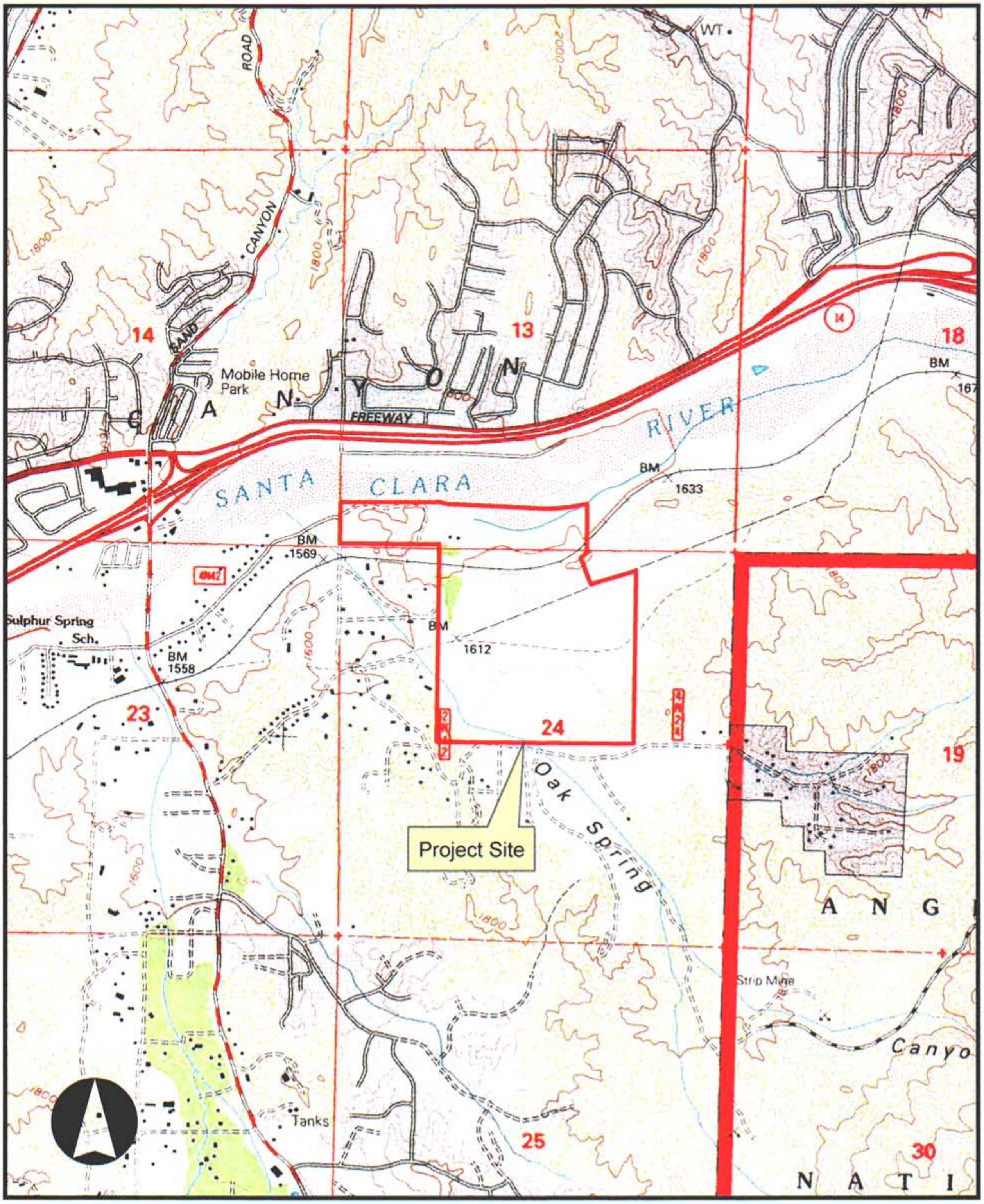
The conclusions and recommendations in this report are based in part upon data that were obtained from a necessarily limited number of observations, site visits, excavations, samples, and tests. Such information can be obtained only with respect to the specific locations explored, and therefore may not completely define all subsurface conditions throughout the site. The nature of many sites is that differing geotechnical or geological conditions can occur within small distances and under varying climatic conditions. Furthermore, changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report can be relied upon only if Leighton has the opportunity to observe the subsurface conditions during grading and construction of the project, in order to verify that our preliminary findings are representative of the site.

This report is intended only for the use of KOAR Institutional Advisors, LLC and its design consultants, and only as related expressly to the subject site and project.

9. CLOSURE

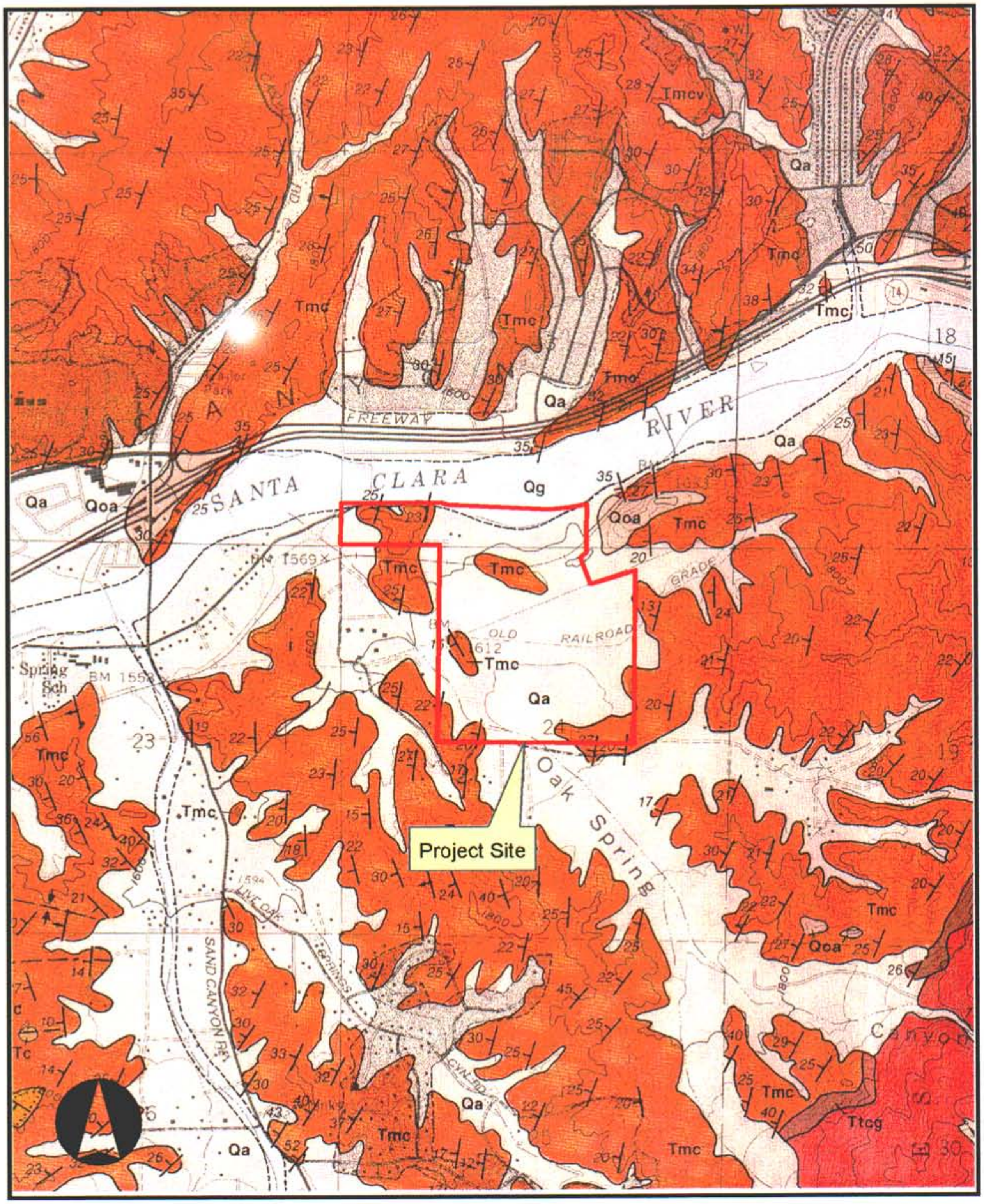
If parties other than Leighton are engaged to provide construction geotechnical services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the findings and recommendations in this report or by providing alternative recommendations.

Any persons using this report for bidding or construction purposes should perform such independent investigations as they deem necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on the subject site.



Base Map: USGS Mint Canyon Quadrangle, State of California, Los Angeles County, 7.5' Series, 1979
Scale: 1" = 2,000'

Robinson Ranch Residential Tract No. 063022 City of Santa Clarita, California	**SITE LOCATION MAP**	Project No. 061989-002 Date December 2006 Figure No. 1



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Robinson Ranch Residential Tract No. 063022 City of Santa Clarita, California	**Regional Geologic Map**	Project No. 061989-002 Date December, 2006 Figure No. 2

APPENDIX A

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APPENDIX A

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APPENDIX B

FIELD EXPLORATIONS

APPENDIX B

FIELD EXPLORATIONS

B-1 General

A reconnaissance of the site was carried out by Leighton's personnel. The locations of the borings were chosen based on the area of the land to be developed and the locations of utilities and existing structures. The logs of the borings drilled for the current subsurface explorations as well as Leighton's previous onsite investigations are presented in this appendix.

B-2 Drilling

Dig Alert was called over 48 hours before drilling, and a visual survey was conducted to verify that the proposed borings would not encounter any subsurface utility lines. No underground lines were encountered during the drilling.

The current subsurface investigation included two, 8-inch-diameter borings using a truck-mounted mud rotary wash drill rig. The borings were drilled to depths of up to approximately 61.5 feet below the existing ground surface. The drilled borings are designated Borings LRW-1 and LRW-2. The approximate locations of the borings are shown on the Geotechnical Map (Plate 1). The borings were backfilled with the native soils.

B-3 Logging

The borings were logged by Leighton personnel, who also supervised the drilling operations and collected the soil samples. Visual observations were made of the materials at each sampling depth. The earth materials were classified visually, in substantial accordance with the Unified Soil Classification System (USCS).

Stratification lines on the logs represent the approximate boundaries between predominant types of materials. Stratification may contain differing materials, with transitions generally occurring gradually.

B-3 Sampling

Relatively undisturbed ring samples were obtained from the borings at the depths indicated on the boring logs. The samples were obtained by driving a Modified California Split-Spoon Sampler into the bottom of the boring as it was being incrementally advanced. The sampler has a 3-inch outside diameter (OD). The sampling rings were 2.41 inches inside diameter (ID) and 1 inch high. The ring samples were placed in plastic cans, labeled, and transported to the laboratory in cushioned containers. The number of blows required to drive the sampler at total of 18 inches (in three 6-inch increments) using a 140 pound hammer dropped 30 inches in general accordance with ASTM Test Method D 3550 is indicated on the boring logs. The samples were transported to our laboratories for further testing.

Standard Penetration Tests (SPTs) were performed using a standard penetration test sampler with a 1⅜-inch ID and 2-inch OD. The sampler was driven 18-inches using a 140 pound hammer dropping 30 inches in general accordance with ASTM Test Method D1586. For each sample, the number of blows required for each 6-inches of drive penetration was recorded and is presented on the boring logs. The number of blows to achieve the last 12-inches of penetration is known as the N Value. The samples were transported to our laboratories for further testing.

FIGURES

Logs of Geotechnical Borings 1 through 13 (reprinted from Leighton, 1985a)
Logs of Geotechnical Borings BB-1 through BB-14 (reprinted from Leighton, 1990a)
Logs of Geotechnical Borings LRW-1 through LRW-2 (current investigation)

GEOTECHNICAL BORING

Date 10/25/84 Drill Hole No. 1 Sheet 1 of 1

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200# - 22' Drop 12 in.

Elevation Top of Hole 1587' Ref. or Datum Lind & Hillerud Plot Plan

Logged by TJ

Sampled by ERR

Depth Feet	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0	OLDER ALLUVIUM					SM	SILTY SAND: medium brown, dry, rooted, loose, pebbles to 1/4" ø
		1					@ 2' - no tube recovery
			7-12"				@ 3' - 3" to 5" cobbles, boulders to 2'
		2					
5		SP3	3-6" 9-6"				@ 5' - 10% pebbles
		4 5	9-9" 17-6"	116.8	3	SP	SAND: medium to coarse grained, poorly graded, brownish-gray, 20% pebbles
		SP6	16-6"				@ 7.5' - slightly moist
10							@ 10' - coarse grained, dark brown, very moist, 20% pebbles
						ML	CLAYEY SILT: sandy, greenish-brown, moist, slightly plastic
		7 8		105.7	22		
						SM	SILTY SAND: fine, dark brown, very moist
		SP9	4-6" 4-6"				
15							
		10					@18' - saturated, medium brown
		SP11	3-6" 4-6"				
20							
		12					Total Depth = 21'
							Caving to 4', saturated zone at 18' No Free Water Boring backfilled
25							

10+15+7+25=57

GEOTECHNICAL BORING

Date 10/25/84 Drill Hole No. 2 Sheet 1 of 1

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200 # - 22' Drop 12 in.

Elevation Top of Hole 1576' Ref. or Datum Lind & Hillerud Plot Plan

Logged by TJ

Sampled by ERR

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0		OLDER ALLUVIUM					SM	SILTY SAND: medium brown, dry, slightly plastic, roots, 5% cobbles
			13					@ 1.5' - 50% cobbles
			14	push	135.9	2		@ 3.0' - slightly moist, 5% cobbles
			SP15	4-6" 3-6"				
5								@ 6' - moderately well sorted, moist, micaceous
			16	push	93.1	18		
			17					
			SP18	2-6" 3-6"			ML	CLAYEY SILT: greenish-brown, moist, micaceous, sandy
10			19	push 1 blow	103.2	21		
			20					
			SP21	3-6" 4-6"				
15			22	push				@ 15' - no tube sample recovery
			SP23	1.5-6" 2.5-6"			SM	SILTY SAND: fine, medium-brown, saturated
20			24	2-6"	123.1	17		
			25					Total Depth = 22' Caving from 15' to 22', standing water to 18' Boring backfilled
25								

GEOTECHNICAL BORING

Date 10/25/84 Drill Hole No. 3 Sheet 1 of 1

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 2200#-23', 1400#-25' Drop 12 in.

Elevation Top of Hole 1617' Ref. or Datum Lind & Hillerud Plot Plan

GEOTECHNICAL DESCRIPTION

Logged by TJ

Sampled by ERR

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	Geotechnical Description
0		OLDER ALLUVIUM					SM	SILTY SAND: light medium-brown, dry, loose, 5% subangular pebbles to 1/2" ø
			26 27	push 1-6"	109.0	2		
			SP28	3.5-6" 2-6"				
5			29 30		113.8	5		@ 5' - light brown, slightly moist, 10% pebbles to 3/4" ø
			SP31	5-6" 6-6"				@ 8' - medium brown, 3% pebbles to 1/4" ø.
10			32 33	1-12"	111.7	3		@ 10' - medium brown, slightly moist, 10% pebbles to 1/4" ø
			SP34	3-6" 3-6"				
								@ 14' - medium to coarse grained, light brown, moist, 10% pebbles to 1/2" ø
15			35 36	2-12"				@ 16' - medium brown, moist, 5% pebbles to 1/4" ø
			SP37	4.5-6" 6-6"				@ 18' - fine to medium grained, medium brown, moist, 10" pebbles to 3/4" ø
20			38 39	3-12"	111.6	7		
			SP40	5-6" 5-6"				
25			41 42	5-12"	124.1	4	SP	SAND: medium grained, grayish-brown, slightly moist, 15% pebbles

Total Depth = 26'
No caving, no free water
Boring backfilled

GEOTECHNICAL BORING

Date 10/26/84 Drill Hole No. 4 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23', 1400#-50' Drop 12 in.

Elevation Top of Hole 1555' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
0		ALLUVIUM					SP	SAND: medium to coarse-grained, light brown, slightly moist, pebbles, cobbles, boulders sub-angular, cohesionless, poorly graded
			43					@ 2' - no tube recovery
			SP44	9-6" 15-6"				
5								@ 6'-coarse grained, med. brown, cobbles, No tube recovery
			45					
			SP46	7-6" 10-6"				
10			47		127.4	8		
			48					
			SP49	8-6" 11-6"				
		OLDER ALLUVIUM					SM	SILTY SAND: fine grained, orangish brown, sub-angular
15			50	12	121.3	13	SP	SAND: coarse grained, med. brown, sub-angular, pebbles, cobbles to 6"Ø, slightly dense
			51					
			SP52	14-6" 17-6"				
20			53		125.7	12		
			54					
			SP55	18-6" 19-6"				
							SW	SAND: well-graded, medium to coarse, reddish-brown
25								@ 25' - no recovery
			56	14-12"				Stopped Standard Penetration Test because of large count
			SP57	35-6" X-6"				@ 28' - very dense Thin, reddish-brown, silt lenses encountered every 1-2 ft., cobbly horizo
30								

GEOTECHNICAL BORING

Date 10/26/84 Drill Hole No. 4 continued Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23',1400#-50' Drop 12 in.

Elevation Top of Hole 1555' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
30			58	30-12"	117.3	13		(continued)
			59					
			SP60	25-6" 20-6"			SP	SAND: medium-fine, poorly graded with gravels and silt, slight reddish-green color
35			61	20-12"	125,6	10		@ 35' - medium coarse-grained, medium brown, sub-angular
			62					
			SP63	38.6" X-6"				
40		OLDER ALLUVIUM	64	5-12"	139.8	12		@ 40' - very dense, med. to fine grained with silt lenses, med. brown 5% cobbles
			65					
			SP66	10-6" 19.6"				@ 43' - very few silts
45								@ 45' - no undisturbed sample recovery
			67	28-12"				
			SP68	15-6" 24-6"				
50			69	50-9"	135.6	11		@ 51' - coarse grained with gravel, medium dense
			70					

Total Depth = 51'

Drilling mud used
Free water at approximately 15'
Boring backfilled

GEOTECHNICAL BORING

Date 10/29/84 Drill Hole No. 5 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23', 1400#-30' Drop 12 in.

Elevation Top of Hole 1633' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by ERR Sampled by ERR
0		ALLUVIUM					SP	SAND: grayish brown, dry, loose, rooted, sub-angular grains, pebbles, poorly graded
				3-6"				@ 2' - slightly moist
			SP71	3-6"				
			72					
5								@ 5' - 3" to 10" cobbles
			73	3-12"	119.7	4		
			74					@ 8' - slightly firm
			SP75	6-6"				
				4-6"				
10		OLDER ALLUVIUM	76	3-12"	118.3	14	ML	SANDY SILT: reddish brown, slightly moist, slightly plastic, caliche stringers, soft
			77					
			78	5-6"				@ 13' - clayey, plastic
				7-6"				
15			79	7-12"	129.2	3	SP	SAND: med.-coarse sand w/gravel, slightly moist, silty, slightly dense
			80					
			SP81	8-6"				
				8-6"				
20			82	4-12"	138.7	4	SM	SILTY SAND: slightly clayey, dark brown, slightly moist, sub-angular, slightly plastic, slightly dense
			83					
				18-6"				
			SP84	16-6"				
							SP	SAND: fine-medium grained, 5% cobbles, med. brown, dry, sub-angular, dense
25			85	6-12"	116.1	18	SM	SANDY SILT: dark brown, moist, med. plasticity, some sand and gravel (5-10%)
			86					
				13-6"				
			SP87	18-6"				
30								(continued)

GEOTECHNICAL BORING

Date 10/29/84 Drill Hole No. 5 continued Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23',1400#-30' Drop 12 in.

Elevation Top of Hole 1633' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by ERR Sampled by ERR
30			88 89	11-12"	126.9	4	SP	SAND: medium-coarse grained with gravel, moist, some silt
								Total Depth = 31'
								No free water Boring backfilled

GEOTECHNICAL BORING

Date 10/29/84 Drill Hole No. 6 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23', 1400#-30' Drop 12 in.

Elevation Top of Hole 1568' Ref. or Datum Lind & Hillerud Plot Plan

Logged by TJ

Sampled by ERR

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0		OLDER ALLUVIUM					ML	SANDY SILT: light brown, dry, soft, 5% sand
			90	push	97.8	6		
			91	1 blow				@ 3' - caliche stringers, slightly moist
			SP92	4-6"				@ 4' - tighter material
				35-6"				
5			93	1-12"	93.0	6		
			94					
			SP95	6-6"				
				7-6"				
10			96	5-12"	112.5	6		
			97					
			SP98	4-6"				
				5-6"				@ 14' - med. brown, moist, 5% sand, slightly plastic
15			99	1-12"	108.9	13		
			100					
			SP101	5-6"				
				9-6"				
20		BEDROCK	102				MH	CLAYEY SILTSTONE: greenish-brown, moist, highly fractured
			103		125.1	14		
							ML	SANDY SILTSTONE: greenish-brown, moist, firm
			SP104	35-4"			MH	CLAYEY SILTSTONE: greenish-brown, less fractured
							ML	SANDY SILTSTONE: greenish-brown, moist, less fractured, firm
25			105	25-10"	121.0	11		
			106					
30								(continued)

GEOTECHNICAL BORING

Date 10/29/84 Drill Hole No. 6 continued Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23',1400#-30' Drop 12 in.

Elevation Top of Hole 1568' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
30			107 108	25-10"	118.6	10		
								Total Depth = 31' No caving, no seeps No free water Boring backfilled

GEOTECHNICAL BORING

Date 10/29/84- 10/30/84 Drill Hole No. 7 Sheet 1 of 1

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 2400#-24', 1450# Drop 12 in.

Elevation Top of Hole 1595' Ref. or Datum Lind and Hillerud Plot Plan

Graphic Log (W–E):

Depth Feet	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by FK/ERR Sampled by FK, TJ, ERR
0	OLDER ALLUVIUM					SM	CLAYEY SAND: light brown, moist, massive, occasional gravel, roots and root hairs
		109 110	1	106.3	4		
5		111 112	1	102.8	6		
							@ 8'3" - gradational contact (color lighter)
						ML	CLAYEY SILT: light brown, moist
10	BEDROCK B-Gen N70W, 42NE	113 114	6	124.4	10		SANDSTONE: medium to coarse sand, light brown moist, massive
							@ 11'3" - fine silty sand, greenish-brown
							@ 13'-16' - joint, caliche coated inter-bedded fine silty sand to coarse grained sand, greenish-brown
15	J N60W, 87NE	115 116	17	127.9	12		@ 16'10" - contact
							SILTSTONE: dark brown, dry, massive, fractured
							@ 19'- contact
							SANDSTONE: light brown
20	B N12W, 39SW	117 118	20-10"	130,5	10		@ 21'- gradational contact, light greenish-brown, massive
25							NOTE: Total Depth = 25', down hole logged to 22' No free water No caving Boring Backfilled

GEOTECHNICAL BORING

Date 10/30/84 Drill Hole No. 8 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 2400#-24', 1450# Drop 12 in.

Elevation Top of Hole 1712 ' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log W I E	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by FK, TJ Sampled by TJ
0		TERRACE DEPOSITS					SM	SILTY SAND: light brown, slightly moist, massive, occasional gravel, rooted, slightly porous, loose
			A	8	122.5	7		
								@ 4'7" - 8' - gravelly horizon
5			B C	6	107.1	6	SP	GRAVELLY SAND: medium to coarse, brown, slightly moist, massive, poorly sorted sub-rounded clasts, friable, dark minerals, slightly loose
								@ 9' - contact
10		BEDROCK B N10W, 19SW	D E	15-10"	124.2	8		SANDSTONE: fine sand, light greenish-brown, moist, massive, weathered, FeO_2 stained @ 9'6" - rooted @ 11'6" - 3/10" bed exhibiting coarse to fine gradation
								@ 14'-14'3" - pebbly coarse sand, brown
15			F	15-8"	127.9	10		SILTY SANDSTONE: light greenish-brown, moist, massive, weathered, rhythmically graded bedding, coarse to fine @ 16'3" - FeO_2 stained
								@ 19'3" - fine grained sand, light orangish green, damp, slightly better induration or cementation
20			G					@ 21'-22' - medium to coarse sand, medium brown, some cementation @ 22'1" - fine grained sand
		J N75E, 72SW						@ 23'7" - MnO_2 stained joint, fairly throughgoing
25			H	23-8"	133.2	8		@ 25'6" - coarse grained sand @ 27'-28' - FeO_2 staining prevalent @ 28'3" - fine grained sand sequence
30								(continued)

GEOTECHNICAL BORING

Date 10/30/84 Drill Hole No. 8 continued Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 24" Drive Weight 2400#-24', 1450# Drop ____ in.

Elevation Top of Hole 1712' Ref. or Datum Lind and Hillerud Plot Plan

Logged by FK, TJ

Sampled by TJ

Depth Feet	Graphic Log W I E	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30								(Continued)
35		BEDROCK	I	37-9"	129.7	9		SILTY SANDSTONE: light green, damp. massive, cemented
			J	Bag				
40		B N56W, 34SW						SANDSTONE: medium grained, light green, damp, less cementation, grading to fine in a 1.5' thick bed /
		B N20W, 33SW						SILTY SANDSTONE: light green, damp, massive, cemented
		Generalized						
45			K	40-7"	132.5	10		
								@ 49' - clay bed, 15' thick, reddish-brown damp to moist, plastic, parallels bedding plane, continuous around hole, mineralized contact at base
50		B N35W, 22SW						
								SANDSTONE: fine to medium sand, light green, damp, massive, cementation
55			L	36-6"				
								NOTE: Total Depth = 60', downhole logged to 58' No Free Water No caving Boring backfilled
60			M	Bag				

GEOTECHNICAL BORING

Date 10/31/84 Drill Hole No. 9 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23' 1400#-48' Drop 12 in.

Elevation Top of Hole 1555' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
0							SP	SAND: poorly graded, gravelly, dry, sub-angular grey-brown, cohesionless
								@ 2' - slightly moist
			SP119	10-6" 10-6"				
5			120 121	6-5"	117.4	3		@ 5' - cobbles, moist, slightly dense
10			122 123	8-12"		12		
			SP124	19-6" 22-6"				@ 13' - fine to coarse grained, slightly moist, gravelly, dense
15			125 126	18-12"	129.1	9		
		ALLUVIUM						@ 18' - fine to coarse grained w/gravel and reddish-brown silt, greyish-brown, well-graded
20			127 128	8-12"	131.5	13		@ 19' - medium to coarse grained, gravelly, occasional cobbles to 5"Ø
			SP129	16-6" 17-6"				@ 23' - medium grained, saturated, pebbles
25			130 131	20-12"	129.5	12		
30								(continued)

GEOTECHNICAL BORING

Date 10/31/84 Drill Hole No. 9 Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23',1400#-48' Drop 12 in.

Elevation Top of Hole 1555' Ref. or Datum Lind & Hillerud Plot Plan

GEOTECHNICAL DESCRIPTION

Logged by TJ

Sampled by ERR

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	Geotechnical Description
								(continued)
30		ALLUVIUM	132 / 133	20-12"	131.2	17		@ 31' - med. to coarse gravelly sand, well-graded, greyish-brown
								material becoming more dense
			SP134	21-6" / 22-6"				
35			135 / 136	30-12"	130.4	13		
		OLDER ALLUVIUM					SM	SILTY SAND: greyish brown w/red hue in silt, dense
							SW	SAND: medium-grained, greyish-brown, dense, well-graded @ 39' - fine to medium grained
40			137 / 138	40-6"	121.8	10	ML	SANDY SILT: greenish brown, dense (lithified)
			SP139	12-6" / 13-6"				
45			140		133.6	12		
			141					
50								Total Depth = 50' Drilling mud used Free water at approximately 15' Boring backfilled

GEOTECHNICAL BORING

Date 11/1/84 Drill Hole No. 10 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23', 1400#-30' Drop 12 in.

Elevation Top of Hole 1603' Ref. or Datum Lind & Hillerud Plot Plan

GEOTECHNICAL DESCRIPTION

Logged by TJ

Sampled by ERR

Depth Feet	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	Geotechnical Description
0	OLDER ALLUVIUM					SM	SILTY SAND: medium brown, dry, porous, rooted, occasional pebbles to 1"Ø, loose
							caved from 18" to 4-1/2', became tighter at 4-12'
		142 143	push	109.4	2		@ 4-1/2' - medium brown, moist, porous, pebble to 1"Ø, rooted
5							
		144 145	3-12"	121.3	3		
10							@ 10' - fine to medium grained, dark brown, moist, caliche stringers
		146 147	2-12"	107.6	8		@ 14' - fine grained, medium dark brown
15							@ 15' - medium-dark brown, moist, slightly plastic, occasional pebbles to 1"Ø
		148 149	2-12"	117.5	8		
20							@ 20' - medium dark brown
		150 151	1-12"	122.9	3	SW	SAND: fine to medium grained, medium brown, moist, loose
25							
		152					
30							

(continued)

GEOTECHNICAL BORING

Date 11/1/84 Drill Hole No. 10 continued Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23', 1400#-30' Drop 12 in.

Elevation Top of Hole 1603' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
								(continued)
30			153	14-12"	111.2	16		@ 31' - medium grained
								Total Depth = 31' No water Boring backfilled

GEOTECHNICAL BORING

Date 11/1/84 Drill Hole No. 11 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23',1400#-30' Drop 12 in.

Elevation Top of Hole 1598' Ref. or Datum Lind & Hillerud Plot Plan

GEOTECHNICAL DESCRIPTION

Logged by TJ

Sampled by ERR

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	Geotechnical Description
0		-					SM	SILTY SAND: medium brown, dry, loose, rooted, pebbles to 1"Ø
								caving @ 2' - 6'
			154 155	1-6"	96.3	3		@ 4' - fine grained, medium brown, slightly moist, pebbles to 1"Ø
5								@ 6' - fine grained, medium brown, moist, slightly plastic
			156 157	1-12"	102.2	6		
10								
		OLDER ALLUVIUM	158 159	2-12"	106.4	18		
15							ML	SILT: medium grown, moist, pebbles to
			160 161	1-12"	111.7	18		
20								
			162 163	1-12"	112.5	11	SM	SILTY SAND: medium brown, moist, loose
25								@ 25' - more cohesion
								@ 26' - fine grained, medium brown, very moist
30	▼		164					@ 30' - saturated (continued)

GEOTECHNICAL BORING

Date 11/1/84 Drill Hole No. 11 continued Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23' 1400#-30' Drop 12 in.

Elevation Top of Hole 1598' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
30			165	push	106.0	25		(Continued)
								Total Depth = 31' Caved 2'-6', free water at 30' Boring backfilled

GEOTECHNICAL BORING

Date 11/1/84 Drill Hole No. 12 Sheet 1 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23',1400#-30' Drop 12 in.

Elevation Top of Hole 1632' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
0						SP	SAND: medium grained, med. brown, slightly moist, loose, pebbles to 1"Ø, rooted @ 1'-1'10" - gravelly horizon, gravel to 1"Ø, rooted
		166 167	push 6" 1-6"		2		@ 3'-3'6" - gravelly horizon, gravel to 2"Ø,rooted
5							@ 5'-6' - cobbly horizon, cobbles to 4"Ø
		168 169	2-12"	116.9	3	SM	SILTY SAND: med. brown, fine grained, slightly moist, slightly plastic, tight, occasional pebbles to 1/4"Ø
10	OLDER ALLUVIUM						
		170 171	push 6" 1-6"	123.2	3		@ 13' - fine to medium grained, red brown, slightly moist, pebbles to 1/4"Ø
15						ML	SILT: medium brown, slightly moist, more cohesive
		172 173	3-12"		3	SP	SAND: medium to coarse grained, medium brown, slightly moist, pebbles to 1/2"Ø, loose
20							@ 22' - fine grained
		174 175	4-12"	129.1	2		@ 23.5' - fine grained, medium brown moist
25						ML	SANDY SILT: med. brown, moist, cohesive, firm
30		176					(continued)

GEOTECHNICAL BORING

Date 11/1/84 Drill Hole No. 12 continued Sheet 2 of 2

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23', 1400#-30' Drop 12 in.

Elevation Top of Hole 1632' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
30			177	5-12"	120.0	7		(Continued)
								Total Depth = 31' Caving throughout, no water Boring backfilled

GEOTECHNICAL BORING

Date 11/1/84 Drill Hole No. 13 Sheet 1 of 1

Project First Financial/Sand Canyon Job No. 3840787-01

Drilling Co. Contractors Drilling Service Type of Rig Bucket Auger

Hole Diameter 18" Drive Weight 2200#-23', 1400#-29' Drop 12 in.

Elevation Top of Hole 1632' Ref. or Datum Lind & Hillerud Plot Plan

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by TJ Sampled by ERR
0		OLDER ALLUVIUM					SM	SILTY SAND: fine grained, med. brown, slightly moist, pebbles & cobbles to 5"Ø, rooted, loose
			178 179	1-12"		2		
5								@ 6' - medium grained, pebbles to 2"Ø
								@ 7-1/2' - medium to coarse grained
			180 181	1-12"	115.7	4		
10								@ 10' - medium brown, slightly moist
			182 183	2-12"	121.4	3	SP	SAND: fine to medium grained, med. brown, moist, pebbles to 1-1/2"Ø, loose
15								@ 17' - medium to coarse grained, cobbles to 6"Ø
			184 185	2-12"	118.7	4		
20								
			186 187	4-12"		3		
25								@ 26' - fine grained, pebbles to 1/4"Ø
			188 189	8-12"	130.0	5	ML	SILT: medium brown, very moist, slightly plastic
30								Total Depth = 30' - caving to 28', no water, Boring backfilled

Date 4/27/89 Drill Hole No. BB-1 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							ML	Alluvium : @ Surface : Brown, loose, fine sandy silt, dry
5		SPT	1	3 5 4 9			SM/ML	@ 5": Brown, loose, Silty fine sand; dry; trace medium sand and trace subangular gravel to 1/2"
10		Cal	1	7 14 17 31	105.4	5.7	SM/ML	@ 10' : Brown, medium dense, Silty fine sand; moist; trace clay and subangular gravel to 1/2"
15		SPT	2	5 7 16 23			SM/ML	@ 15 Same as 10'
20		SPT	3	12 17 7 24			SW	@ 20' Brown, medium to coarse sand, medium dense, moist; trace gravel to 1"
25		SPT	4	2 4 4 8			SM/ML	@ 25' Brown, loose, silty fine sand; moist

Date 4/27/89 Drill Hole No. BB-1 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	5	8 8 13 21			SW	Alluvium: @30': Brown, medium dense, medium to coarse sand, moist; trace fine sand and subangular gravel to 3/4"
35		SPT	6	5 6 6 12			SW/SM	@35': Light brown, medium dense medium coarse sand; trace fine gravel, little silt
40		SPT	7	5 4 7 11				@40': Same as 35' except increasing fine gravel
								Total depth 40' No ground water encountered

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Date 4/27/89 Drill Hole No. BB-2 Sheet 1 of 1

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SW	Alluvium: @Surface: light grey, loose, gravelly fine to coarse sand, dry, cobbles to 4"
5		SPT	1	12 15 29 44			SW	@ 5', light grey, dense, gravelly fine to coarse sand, dry; gravel to 2" @ 6', boulder encountered Stopped drilling Total Depth 6' No water encountered
10								
15								
20								
25								
30								

500A (2/77)

Leighton & Associates

Date 4/27/89 Drill Hole No. BB-3

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Logged by KWB

Sampled by KWB

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
0								Alluvium: @ Surface: Light grey, loose, gravelly fine to coarse sand, gravel to 2"
10		SPT	1	5, 6, 9 — 15			SW	@ 10': Light grey, medium dense, medium sand, moist; trace fine and coarse sand and trace subangular gravel to 1"
15		SPT	2	8, 3, 5 — 8				@ 15': Light brown, loose, fine to coarse sand, moist; trace subangular gravel to 1"
17								@ 17': Boulder encountered, able to continue
20		SPT	3	4, 7, 10 — 17				@ 20': Light brown, medium dense, fine to coarse sand, moist; trace subangular gravel to 1"
25		SPT	4	14, 22, 32 — 54				@ 25': Light brown, very dense, fine to coarse sand, moist; trace subangular gravel to 1". Sampler may have been driven into a boulder or cobble
30								

Date 4/27/89 Drill Hole No. BB-3 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	5	13 17 29 46			SW	@30': Light brown, dense, fine to coarse sand, moist, trace subangular gravel to 1"
35		SPT	6	16 16 18 34			SW	@35': Light brown, dense fine to coarse sand, moist, trace fine gravel
								Total Depth 35' No water encountered

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Date 4/27/89 Drill Hole No. BB-4 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SW	Alluvium: @ Surface: Light grey, loose, fine to coarse sand, dry; trace gravel, cobbles and boulders
5		SPT	1	13 / 7 / 16 — 23			SW	@ 5': Light grey, medium dense, fine to coarse sand, slightly moist, trace subangular gravel to 1"
								@ 7': Boulder encountered while drilling, able to continue
10		SPT	2	8 / 15 / 15 — 30			SW	@ 10': Light grey, medium dense to dense, fine to coarse sand, moist; little subangular gravel to 1"
								@ 13': Boulder encountered while drilling: able to continue
15		SPT	3	5 / 6 / 11 — 17			SW	@ 15': Light brown, medium dense, fine to coarse sand, moist, trace subangular gravel to 1"
20		Cal	1	23 / 22 / 33 — 55			SW	@ 20': Light brown, medium dense to dense, fine to coarse sand, moist some subangular gravel
25		SPT	4	10 / 16 / 18 — 34			SW	@ 25': Same as 20', except little subangular gravel to 1"
30								

Date 4/27/89 Drill Hole No. BB-4 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	5	8 12 19 31			SW	@30': Light brown, medium dense to dense, fine to coarse sand, moist trace subangular gravel to 1" Total Depth 30' No water encountered

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Date 4/27/89 Drill Hole No. BB-5 Sheet 1 of 1

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0								Alluvium:
							SW	@ Surface: Light grey, loose, fine coarse sand, dry, little subangular gravel, cobbles and boulders
5								@ 4': Boulder encountered @ 5': No Sampling performed due to boulder
								@ 5': Stopped drilling due to boulder
10								Total Depth 5' No ground water encountered
15								
20								
25								
30								

Date 4/27/89 Drill Hole No. BB-6 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SW	Alluvium : @ Surface : Light grey, Loose, fine To medium sand, dry; little subangular gravel and cobbles
5		SPT	1	9 20 19 39			SW	@ 5' : Light grey, dense, fine To coarse sand, dry; little Subangular gravel To 1"
								@ 7' : Boulder encountered, able To continue drilling
10		SPT	2	5 16 15 31			SW	@ 10' : Same as 5', except little subangular gravel To 1" and moist
15		Cal	1	15 20 20 40			SW	@ 15' : Light grey, dense fine To coarse sand, moist; trace subangular gravel To 1"
20		SPT	3	9 12 17 29		2.2	SW	@ 20' : Light grey, medium dense, fine To coarse sand, moist, trace subangular gravel To 1"
25		SPT	4	16 15 18 33			SW	@ 25' : Light grey, dense fine To coarse sand, moist, trace Subangular gravel To 1"
30								

Date 4/27/89 Drill Hole No. BB-6 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	5	15 16 26 46			SW	@30': Alluvium, Light grey, dense, fine to coarse sand, moist, Trace subangular gravel To 1" Total Depth: 30' No ground water encountered

Date 4/27/89 Drill Hole No. BB-7 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SM/ML	Alluvium: @ Light brown, loose, silty fine sand, dry;
5		SPT	1	3 3 3 6			SM/ML	@ 5': Light brown, loose, silty fine sand, dry; trace medium sand
10		SPT	2	3 4 5 9			SM/ML	@ 10': Same as 5', except moist
15		SPT	3	3 3 5 8			ML/SM	@ 15': Same as 10'
20		Cal	1	4 7 9 16	107.2	7.9		@ 20': Light brown, medium dense, fine sand, moist, trace silt and medium sand
25		SPT	4	2 2 4 6				@ 25': Light brown, loose, silty fine sand, moist.
30								

Date 4/27/89 Drill Hole No. BB-7 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	5	7 7 7 14			SW	@ 30': Light grey, medium dense, fine to coarse sand, moist; trace subangular gravel to 1"
35		SPT	6	4 2 3 5			SW SM	@ 35': Contact between same material @ 30' and Light brown, loose silty fine sand, moist
40		SPT	7	3 4 8 12			SM SW	@ 40': Brown, medium dense, fine sand, wet; trace silt and medium sand
								Total Depth 40' No water encountered, but sample @ 40' wet

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Date 4/27/89 Drill Hole No. BB-8 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SM SW	Alluvium: @ Surface: Light brown, silty fine sand, dry, trace medium to coarse sand
5		Cal	(1)	14 11 13 24			SW	@ 5': Light brown, medium dense, fine to coarse sand, dry; trace silt
10		SPT	[1]	3 8 6 14			SM	@ 10': Light brown, loose silty fine to coarse sand, slightly moist, trace subangular gravel to 1".
15		SPT	[2]	5 3 3 6			SM	@ 15': Contact between, material @10' and brown, loose silty fine sand, moist.
20		Cal	(2)	9 5 6 11	100.5	7.9	SM	@ 20': Brown, loose to medium dense, silty fine sand, moist.
25		SPT	[3]	3 3 6 9			ML SM	@ 25': Brown, loose, silty fine to medium sand, moist; little coarse sand
30								

Date 4/27/89 Drill Hole No. BB-8

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	4	5 6 8 14			SM ML	@ 30' : Brown, medium dense, silty fine to medium sand, moist, trace clay and coarse sand
35		SPT	5	11 12 13 25			SW	@ 35' : Brown, medium dense, fine to coarse sand, moist, trace subangular gravel to 1"
								Total Depth 35' No ground water encountered.

500A (2/77)

Leighton & Associates

Date 4/28/89 Drill Hole No. BB-9 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SW	Alluvium: @ Surface: Grey, loose, fine to coarse sand, dry, little subangular gravel to 2"
5		SPT	1	4 5 14 19			SW	@ 5': Light brown, medium dense fine to coarse sand, moist, few subangular gravel to 1"
10		SPT	2	6 13 12 25			SW	@ 10': Light brown, medium dense fine to coarse sand, moist, slight trace of fine gravel
		BULK	1					
15		Cal	1	11 11 15 26	111.6	2.9	SW	@ 15': Light brown, medium dense, medium to coarse sand, moist, trace fine sand and fine gravel.
20		SPT	3	6 11 14 25			SW	@ 20': Light brown, medium dense fine to coarse sand, moist, trace subangular gravel to 3/4"
25		SPT	4	8 11 9 20			SW	@ 25': Light brown, medium dense fine to coarse sand, moist, little subangular gravel to 1"
30								

Date 4/28/89 Drill Hole No. BB-9 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	5	6 8 7 15				@30': Light brown, medium dense fine to coarse sand, moist, trace fine subangular gravel.
35		SPT	6	12 24 32 56				@35': Greyish brown, very dense fine to coarse sand, moist, trace fine subangular gravel.
								Total Depth 35' No water encountered

Date 4/28/89 Drill Hole No. BB-10 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SW SM	Alluvium: @ Surface: Light brown, loose, fine to coarse sand, moist, little subangular gravel to 2" trace silt.
5		SPT	1	4 2 3 5			SM	@ 5': Light brown, loose, Silty fine to coarse sand, moist, trace fine subangular gravel.
10		Cal	1	11 13 19 32		2.0	SW	@ 10': Light brown, dense, fine to medium gravelly fine to coarse sand, moist
		BULK 5-15'	1					
15		SPT	2	4 12 6 18			SW	@ 15': Light brown, medium dense, fine to coarse sand, moist, few subangular gravel to 1"
20		SPT	3	4 4 6 10			SW	@ 20': Light brown, loose to medium dense, fine to medium sand, moist, silty, trace coarse gravel.
25		SPT	4	6 12 14 26			SM	@ 25': Light brown, medium dense, silty fine sand, moist, trace medium to coarse sand
30								

Date 4/28/89 Drill Hole No. BB-10 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	5	4 8 8 16			SM	@ 30': Light brown, medium dense, silty fine sand, moist; few medium to coarse sand
35		SPT	6	5 7 6 13			SM	@ 35': Light brown, medium dense, silty fine sand, moist, little medium to coarse sand, trace subangular gravel to 1"
40		SPT	7	3 5 8 13			SM	@ 40': Same as 35'
45		Cal	2	21 27 27 54			SW	@ 45': Light greyish brown, dense, fine to coarse sand, moist, few subangular gravel to 2"
								Total Depth 45' No ground water encountered

Date 4/28/89 Drill Hole No. BB-11 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SM	Alluvium: @ Surface: Brown, loose, silty fine sand, dry, Trace medium To coarse sand
5		SPT	1	3 2 3 5			SM	@ 5': Same as surface, but slightly moist
10		SPT	2	5 6 6 12			SW	@ 10': Light brown, medium dense, silty fine To medium sand, moist, trace coarse sand and fine gravel
15		Cal	1	16 11 9 20			SW	@ 15': Light brown, medium dense, fine To coarse sand, moist, Trace silt, few subangular gravel To 1-1/2"
20		SPT	3	3 6 3 9			SM	@ 20': Light brown, loose, silty fine To medium sand, moist, little coarse sand,
		BULK 0-40'	1					
25		SPT	4	5 9 7 16			SW	@ 25': Light brown, medium dense, fine To medium sand, moist, Trace silt and fine gravel
30								

Date 4/28/89 Drill Hole No. BB-11

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Logged by KWB

Sampled by KWB

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION
30		SPT	5	3 7 6 13			SM / SW	@ 30': Light brown, medium dense silty fine to medium sand, moist, little coarse sand
35		SPT	6	7 8 10 18			SW	@ 35': Light brown, medium dense, fine to medium sand, moist, trace silt and coarse sand
40		SPT	7	6 7 6 13			SW	@ 40': Light brown, medium dense, fine to coarse sand, moist, trace silt and fine subangular gravel.
								Total Depth 40'
								No ground water encountered

Date 4/28/89 Drill Hole No. BB-12 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SM	Alluvium: @ Surface: Light brown, loose silty fine sand, Top soil, dry Trace fine gravel
5		SPT	1	3 4 4 10			SM SW	@ 5': Contact between material (a) Surface and light brown, loose to medium dense, fine to coarse sand, slightly moist, Trace fine subangular gravel @ 7': Boulder encountered, able to continue drilling.
10		Cal	1	18 10 14 24			SW	@ 10': Light brown, medium dense, Fine to coarse sand, slightly moist, little silt, No recovery first 3 rings
		BULK 0-25'	1					
15		SPT	2	3 5 3 8			SW SM	@ 15': Light brown, loose, silty fine sand, moist, Trace medium to coarse sand
20		SPT	3	5 9 8 17			SW	@ 20': Same as 15', except medium dense
25		SPT	4	5 6 7 13			SW	@ 25': Light brown: medium dense, fine to coarse sand, moist, slightly Trace silt.
30								

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Date 4/28/89 Drill Hole No. BB-12 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		Cal	②	11 9 11 20	110.6	7.2	SM	@ 30': Light brown, medium dense silty fine sand; moist, little medium to coarse sand
35		SPT	5	4 4 4 8			SM	@ 35': Light brown, loose, silty fine sand, moist, trace medium to coarse sand
40		SPT	6	4 5 7 12			SM	@ 40': Light brown, medium dense, silty fine sand, slight trace medium to coarse sand
								Total Depth 40' No ground water encountered

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Date 4/2/89 Drill Hole No. BB-13 Sheet 1 of 1

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SM	Alluvium: @ Surface: Light brown, loose silty fine sand Topsoil, slightly moist, Trace medium To coarse sand and fine gravel
5		SPT	1	3 4 4 8			SM SW	@ 5': Contact between material @ Surface and light brown, loose fine To medium sand, moist, slight Trace coarse sand
10		SPT	2	2 3 3 6			SM	@ 10': Light brown, loose, silty fine sand, moist @ 13': Boulder encountered able To continue drilling
15		SPT	3	13 11 9 20			SM	@ 15': Boulder, no soil recovered
20		Cal Bag Sample	① 4	21 29/3" 50+			Tmc	Bedrock: @ 20': Bedrock siltstone, very dense. (TMC - Mint Canyon Formation Bedrock)
25		SPT	5	40/4" 50+			Tmc	@ 25': Same as 20' Total Depth 25' No ground water encountered
30								

Date 4/2/89 Drill Hole No. BB-14 Sheet 1 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
0							SM	Alluvium: @ Surface: Light brown, loose, silty fine sand topsoil, moist, trace medium to coarse sand and fine gravel
5		SPT	1	2 3 2 5			SM	@ 5': Light brown, loose, silty fine sand, moist, slight trace medium to coarse sand
10		Cal	1	11 6 8 14	91.2	10.2	SW/SM	@ 10': Light brown, medium dense fine sandy silt, moist, little silt
15		SPT	2	3 2 2 4			SW/SM	@ 15': Same as 10', except trace fine gravel
20		SPT	3	5 6 6 12			SW	@ 20': Light brown, medium dense fine to medium sand, moist, few coarse sand, trace subangular gravel to 3/4"
25		Cal	2	6 5 7 12			SW	@ 25': Same as 20'
30								

Date 4/28/89 Drill Hole No. BB-14 Sheet 2 of 2

Project American Beauty Job No. 7840787-05

Drilling Co. A & R Type of Rig CME 75

Hole Diameter 6" Drive Weight 140 lbs Drop 30 in.

Elevation Top of Hole Ref. or Datum See Geotechnical Map

Depth Feet	Graphic Log	Attitudes	Tube Sample No.	Blows Per Foot	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	GEOTECHNICAL DESCRIPTION Logged by KWB Sampled by KWB
30		SPT	4	3 4 12 16			SM	Alluvium: @ 30': Contact between light brown silty fine sand, moist, slight trace medium sand and light brown medium dense, fine to coarse clean sand; moist with slight trace fine subangular gravel.
							SW	
35		SPT	5	2 4 6 10			SM	@ 35': Light brown, loose to medium dense, silty fine to medium sand, moist, slight trace coarse sand and fine gravel
40		SPT	6	5 4 6 10			SM	@ 40': Light brown, loose to medium dense; silty fine sand moist
45		SPT	7	4 5 7 12			SM	@ 45': Same as 40' but silt content increased to roughly 30%
								Total Depth 45' No ground water encountered

GEOTECHNICAL BORING LOG RW-1

Date 6-6-06 **Sheet** 1 **of** 3
Project Robinson Ranch Development (TT 063022) **Project No.** 061989-001
Drilling Co. Valley Well Drilling **Type of Rig** Rotary Wash
Hole Diameter 8" **Drive Weight** 140 lbs **Drop** 30"
Elevation Top of Hole ~1598' **Location** See Geotechnical Map (Plate 1)

Logged By MEK
Sampled By MEK

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								**ALLUVIUM (Qal):** SANDY SILT, light grayish brown, dry, loose	
				SPT-1	9 9 9			SP	SAND, brown, slightly moist, medium dense, fine to medium grained, trace gravel	
	5			R-1	4 5 10	111	11.4	ML	SANDY SILT, dark brown, moist, stiff	
				SPT-2	7 8 12			SM	Interbedded SILTY SAND/ SANDY SILT, brown, moist, loose to medium dense, medium to coarse grained	
	10			R-2	4 10 20	117	11.5			
				SPT-3	2 4 4					
	15			R-3	8 8 9	114	14.8	SM	SANDY SILT, brown, moist, medium dense, fine to coarse grained	
	20			SPT-4	2 5 5			SM	SILTY GRAVELLY SAND, brown, moist, loose, fine to coarse grained	
	25			SPT-5	7 9 13			ML	SANDY SILT, brown, moist, stiff, contains minor gravel	
	30									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG RW-1

Date 6-6-06
Project Robinson Ranch Development (TT 063022) **Project No.** 061989-001
Drilling Co. Valley Well Drilling **Type of Rig** Rotary Wash
Hole Diameter 8" **Drive Weight** 140 lbs **Drop** 30"
Elevation Top of Hole ~1598' **Location** See Geotechnical Map (Plate 1)

Logged By MEK
Sampled By MEK

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			SPT-6	2 3 5			SM/ML	Interbedded GRAVELLY SILTY SAND/ SANDY SILT, brown, moist, loose to medium dense or medium stiff.	
	35			SPT-7	6 14 21			SP/SM	SILTY SAND, moist, brown, dense, fine to coarse grained	
	40			SPT-8	5 12 21			SM	SILTY SAND, moist, brown, dense, fine to coarse grained, increased silt content	
	45			SPT-9	21 50/2"			SM	SILTY SAND, dark brown, moist, very dense, fine to coarse grained	
	50			SPT-10	12 31 50/4"			SP-SM	SILTY GRAVELLY SAND, medium gray, moist, dense, medium to coarse grained SILTY SAND, dark brown, moist, very dense, fine to coarse grained, contains trace gravel	
	55			SPT-11	34 50/6"			SP	GRAVELLY SAND, gray to brown,very dense, coarse grained with fine gravel, well graded	
	60				9					

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG RW-1

Date 6-6-06 **Sheet** 3 **of** 3
Project Robinson Ranch Development (TT 063022) **Project No.** 061989-001
Drilling Co. Valley Well Drilling **Type of Rig** Rotary Wash
Hole Diameter 8" **Drive Weight** 140 lbs **Drop** 30"
Elevation Top of Hole ~1598' **Location** See Geotechnical Map (Plate 1)

Logged By MEK
Sampled By MEK

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	60			SPT-12	28 46			SP	GRAVELLY SAND, gray to brown,very dense, coarse grained with fine gravel, well graded	
	65								**Drilled to 60'** **Sampled to 61.5'** **Boring backfilled with cuttings and bentonite chips**	
	70									
	75									
	80									
	85									
	90									

SAMPLE TYPES:
- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:
- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG RW-2

Date 6-6-06
Project Robinson Ranch Development (TT 063022)
Project No. 061989-001
Drilling Co. Valley Well Drilling
Type of Rig Rotary Wash
Hole Diameter 8"
Drive Weight 140 lbs
Drop 30"
Elevation Top of Hole ~1605'
Location See Geotechnical Map (Plate 1)

Logged By JBW
Sampled By JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	0								**ALLUVIUM (Qal)** Interbedded SANDY SILT/SANDY SAND, medium brown to dark brown, dry to moist, loose, contains minor gravels	
				R-1	3 4 6	109	6.1	ML/SM		
	5			SPT-1	1 1 2			ML/SM		
				R-2	3 4 8	112	15.9			
	10			SPT-2	3 4 6					
				R-3	7 10 13	118	14.4	SM	Interbedded SILTY SAND/ GRAVELLY SILTY SAND, medium gray to medium brown, moist, medium dense, coarse grained	
	15			SPT-3	6 6 7					
	20			SPT-4	8 8 9					
	25			SPT-5	3 4 7			SM	SILTY SAND, medium brown, moist, loose to medium dense, fine to medium grained contains minor gravel	
	30									

SAMPLE TYPES:
S SPLIT SPOON
R RING SAMPLE
B BULK SAMPLE
T TUBE SAMPLE
G GRAB SAMPLE
C CORE SAMPLE

TYPE OF TESTS:
DS DIRECT SHEAR
MD MAXIMUM DENSITY
CN CONSOLIDATION
CR CORROSION
HCO HYDRO COLLAPSE
SA SIEVE ANALYSIS
AL ATTERBERG LIMITS
EI EXPANSION INDEX
RV R-VALUE
PR PERCOLATION

GEOTECHNICAL BORING LOG RW-2

Date	6-6-06	Project No.	061989-001
Project	Robinson Ranch Development (TT 063022)	Type of Rig	Rotary Wash
Drilling Co.	Valley Well Drilling	Drop	30"
Hole Diameter	8"	Drive Weight	140 lbs
Elevation Top of Hole	~1605'	Location	See Geotechnical Map (Plate 1)

Logged By: JBW
Sampled By: JBW

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	DESCRIPTION	Type of Tests
	30			SPT-6	5 7 14			SM	SILTY SAND, medium brown, moist, medium dense, fine to medium grained with trace coarse sand	
	35			SPT-7	8 20 36				becomes dense	
	40			SPT-8	25 50/5"			SP	GRAVELLY SAND, medium gray, moist, very dense, fine to coarse grained with little fines	
	45			SPT-9	20 50/6"					
	50			SPT-10	26 50/6"			SPG		
	55								**Drilled to 50' Sampled to 51.5' Boring backfilled with cuttings and bentonite chips**	
	60									

SAMPLE TYPES:

- S SPLIT SPOON
- R RING SAMPLE
- B BULK SAMPLE
- T TUBE SAMPLE
- G GRAB SAMPLE
- C CORE SAMPLE

TYPE OF TESTS:

- DS DIRECT SHEAR
- MD MAXIMUM DENSITY
- CN CONSOLIDATION
- CR CORROSION
- HCO HYDRO COLLAPSE
- SA SIEVE ANALYSIS
- AL ATTERBERG LIMITS
- EI EXPANSION INDEX
- RV R-VALUE
- PR PERCOLATION

APPENDIX C

LABORATORY TEST RESULTS

APPENDIX C

LABORATORY TEST RESULTS

C-1 General

The laboratory test program consisted of testing selected representative specimens, prepared from representative samples of the earth materials to obtain the following properties and characteristics: in-situ moisture content and dry density; particle size distribution; consolidation, hydro-collapse, and maximum dry density and optimum moisture content.

The laboratory tests were performed in substantial accordance with the applicable procedures of: American Society for Testing and Materials (ASTM), and California Building Code Standards (CBC Standard), as relevant.

C-2 Soil Classification: Visual Method (ASTM D2488)

Classifying soils in accordance with standardized methods enables their properties and characteristics to be evaluated in a broad-based manner, and to correlate soils found on various sites. Visual classifications made in the field are often refined after more detailed observations of the materials are made in the laboratory, and after subsequent laboratory testing.

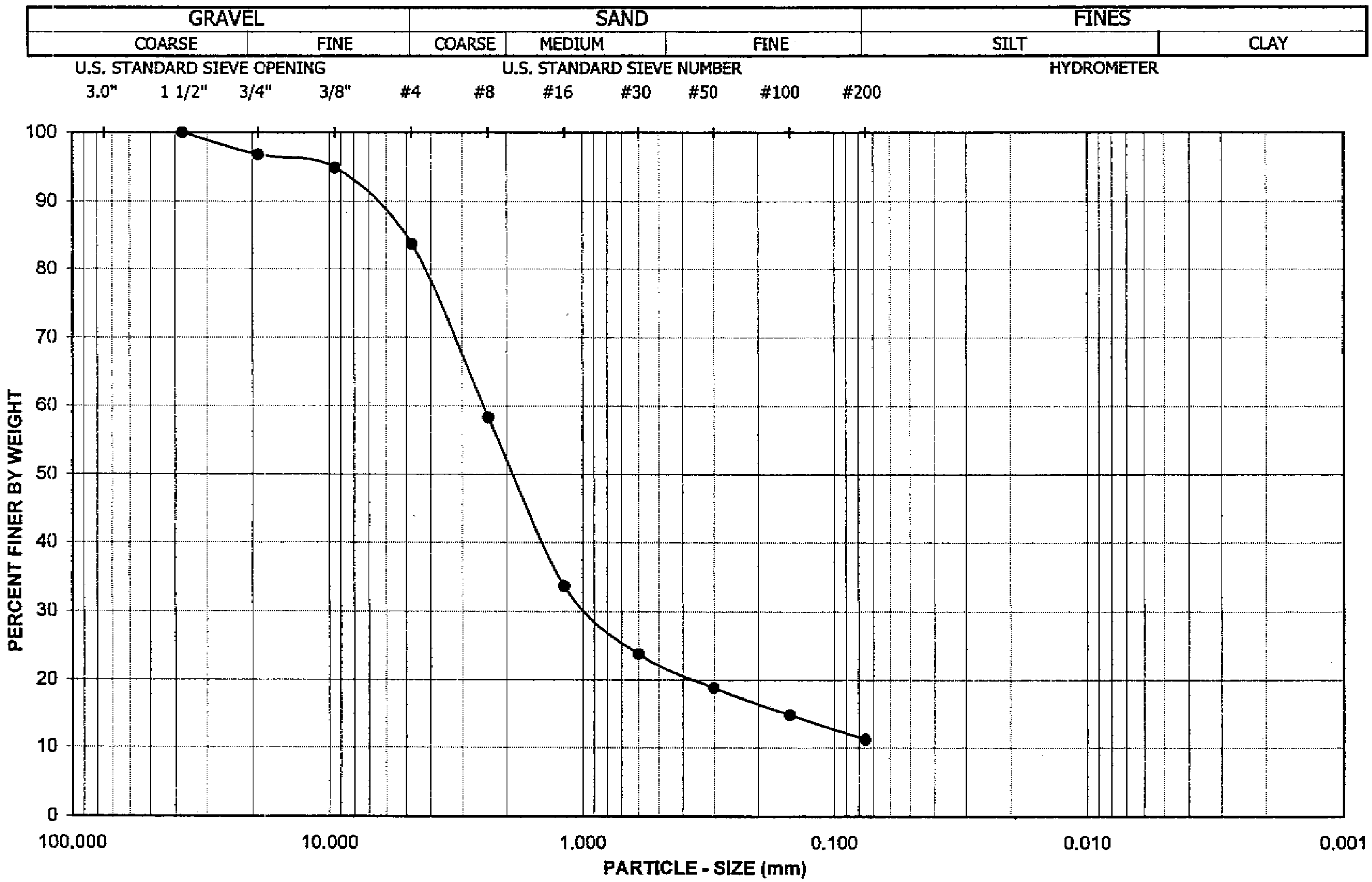
The classifications made in respect of selected soil samples are shown on the Logs of Borings in Appendix B. The classifications of specific specimens that were tested are indicated with the respective test results in this appendix. Because the types of in-situ materials may change abruptly, there may be apparent discrepancies between the classifications as indicated on the logs and in the test-result documentation.

C-3 In-Situ Dry Density and Moisture Content (ASTM D 2937, 2216)

The in-situ dry density (in pcf) and moisture content (as a percentage of dry weight of soil) were determined for relatively undisturbed specimens. The test results are presented on the Logs of Borings (Appendix B).

C-4 Particle-Size Analysis (ASTM D 422)

A particle –size analysis test establishes the distribution, within a specimen of the soil, of soil particles of given sizes. A total of 23 specimens were tested. Graphs of the gradations, in terms of the weights of the material passing sieves of specified sizes, are presented in this Appendix.



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1 Sample No.: SPT-4

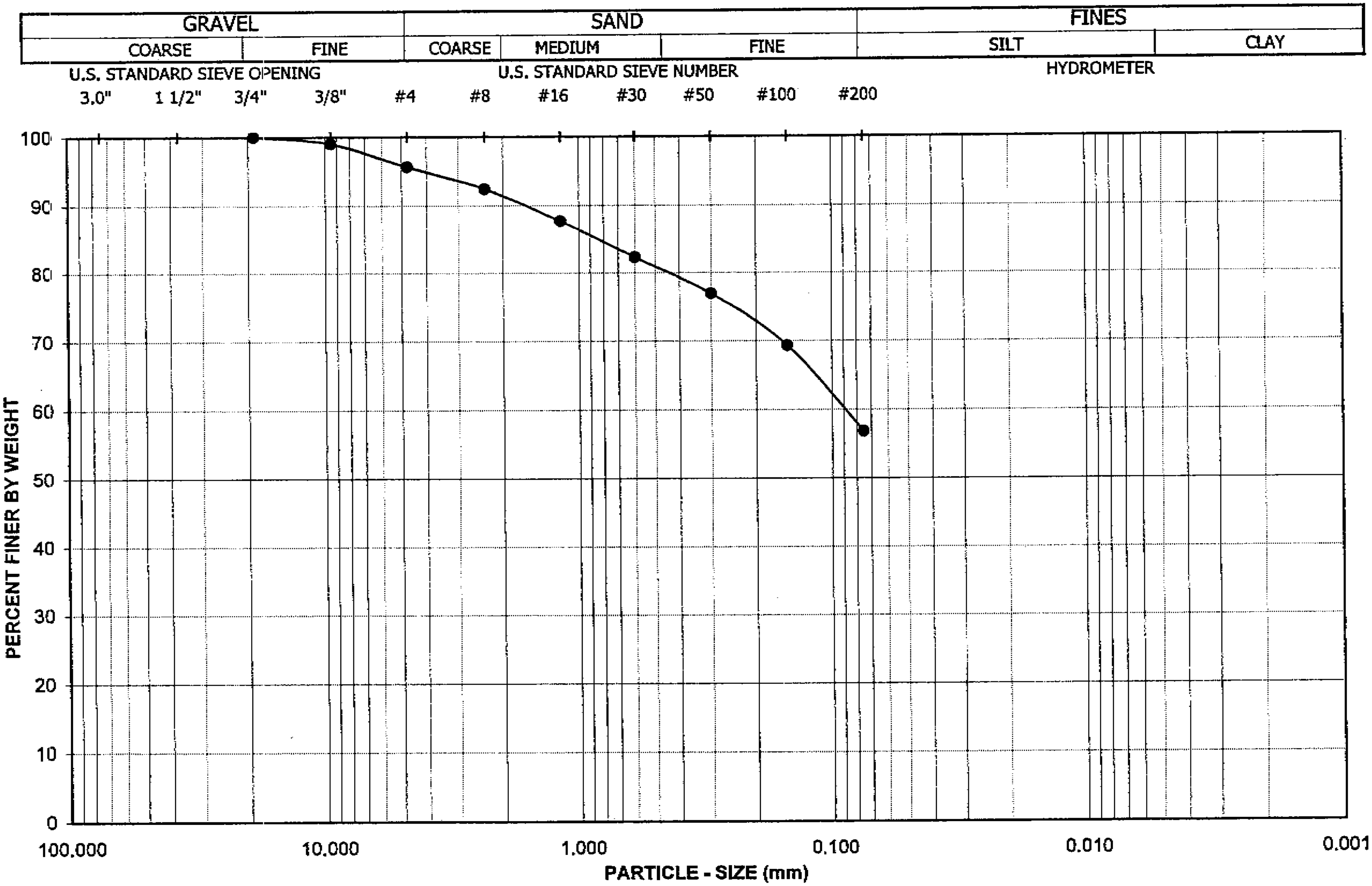
Depth (feet): 20.0 Soil Type : (SP-SM)g

Soil Identification: Light brown poorly graded sand with silt and gravel (SP-SM)g

GR:SA:FI : (%) 16 : 73 : 11

Jun-06

SA LRW-1 SPT-4



Project Name: Robinson Ranch

Project No.: 061989-001

Exploration No.: LRW-1

Sample No.: SPT-5

Depth (feet): 25.0

Soil Type : s(ML)

Soil Identification: Light brown sandy silt s(ML)

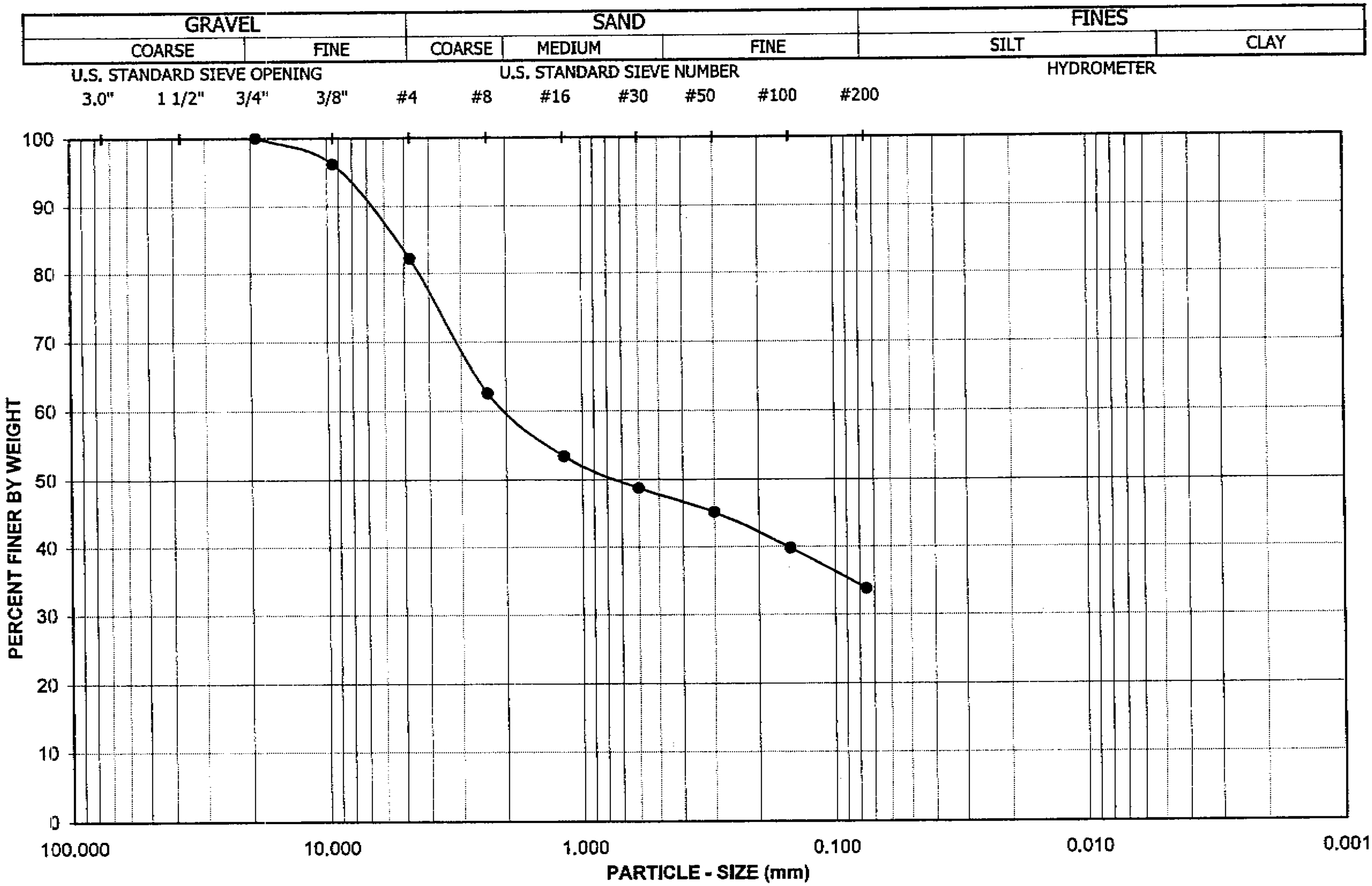
Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 4 : 39 : 57

Jun-06

SA LRW-1 SPT-5



Project Name: Robinson Ranch

Project No.: 061989-001

Exploration No.: LRW-1

Sample No.: SPT-6

Depth (feet): 30.0

Soil Type : (SM)g

Soil Identification: Light brown silty sand with gravel (SM)g

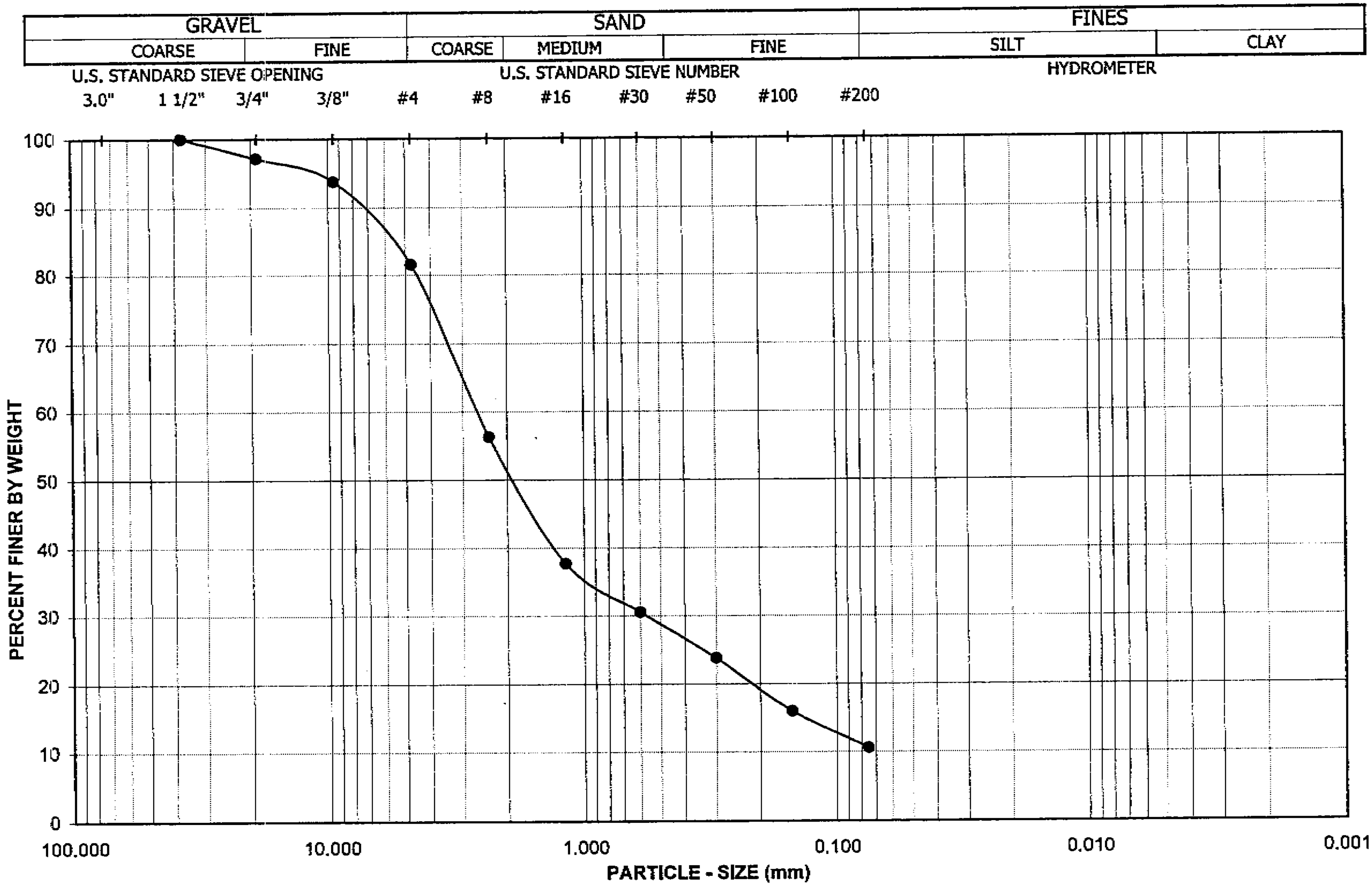
Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 18 : 48 : 34

Jun-06

SA LRW-1 SPT-6



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1 Sample No.: SPT-7

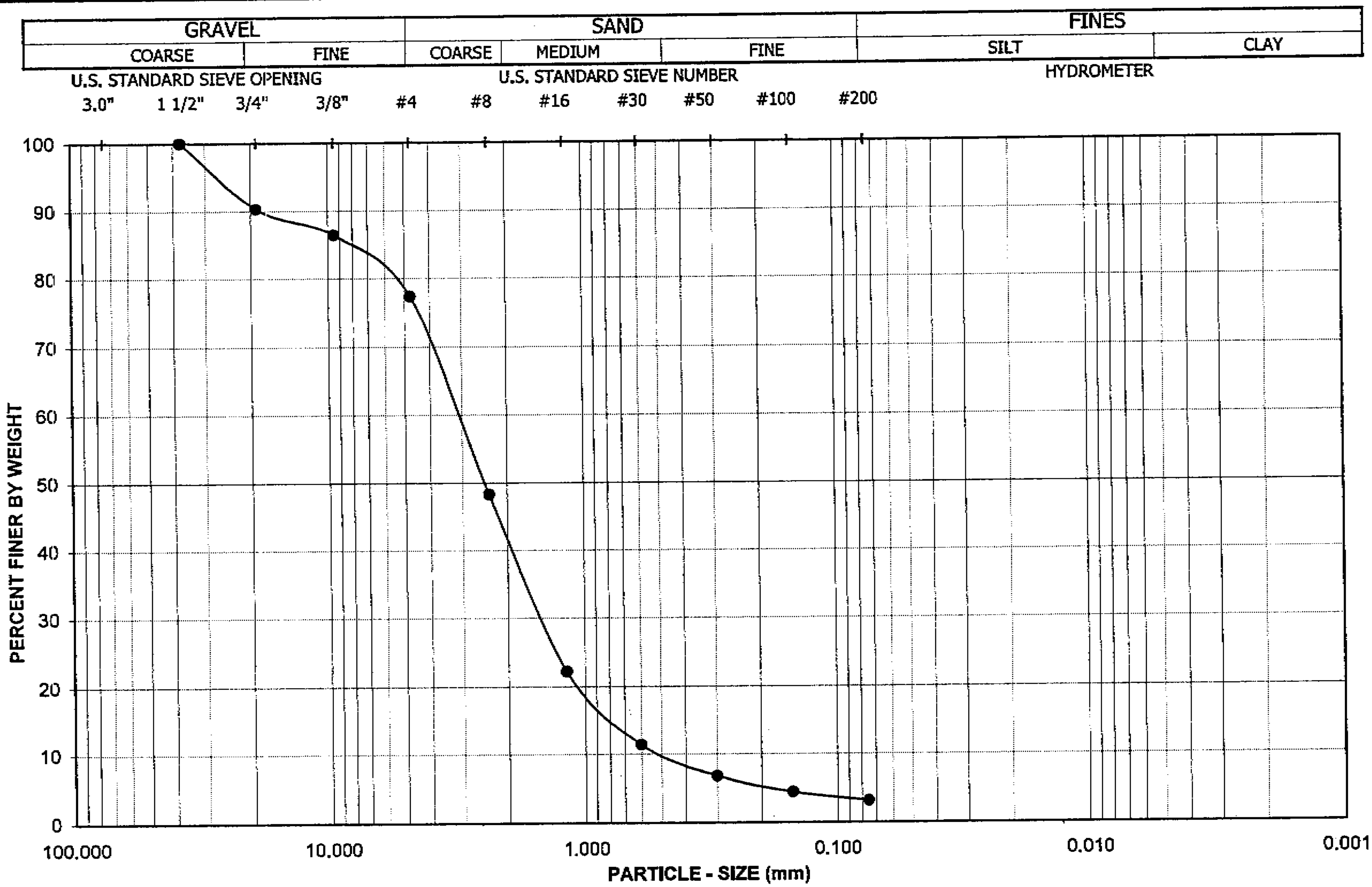
Depth (feet): 36.0 Soil Type : (SW-SM)g

Soil Identification: Olive gray well-graded sand with silt and gravel (SW-SM)g

GR:SA:FI : (%) 18 : 71 : 11

Jun-06

SA LRW-1 SPT-7



Project Name: Robinson Ranch

Project No.: 061989-001

Exploration No.: LRW-1 Sample No.: R-2

Depth (feet): 10.0 Soil Type : (SP)g

Soil Identification: Dark grayish brown poorly graded sand with gravel (SP)g

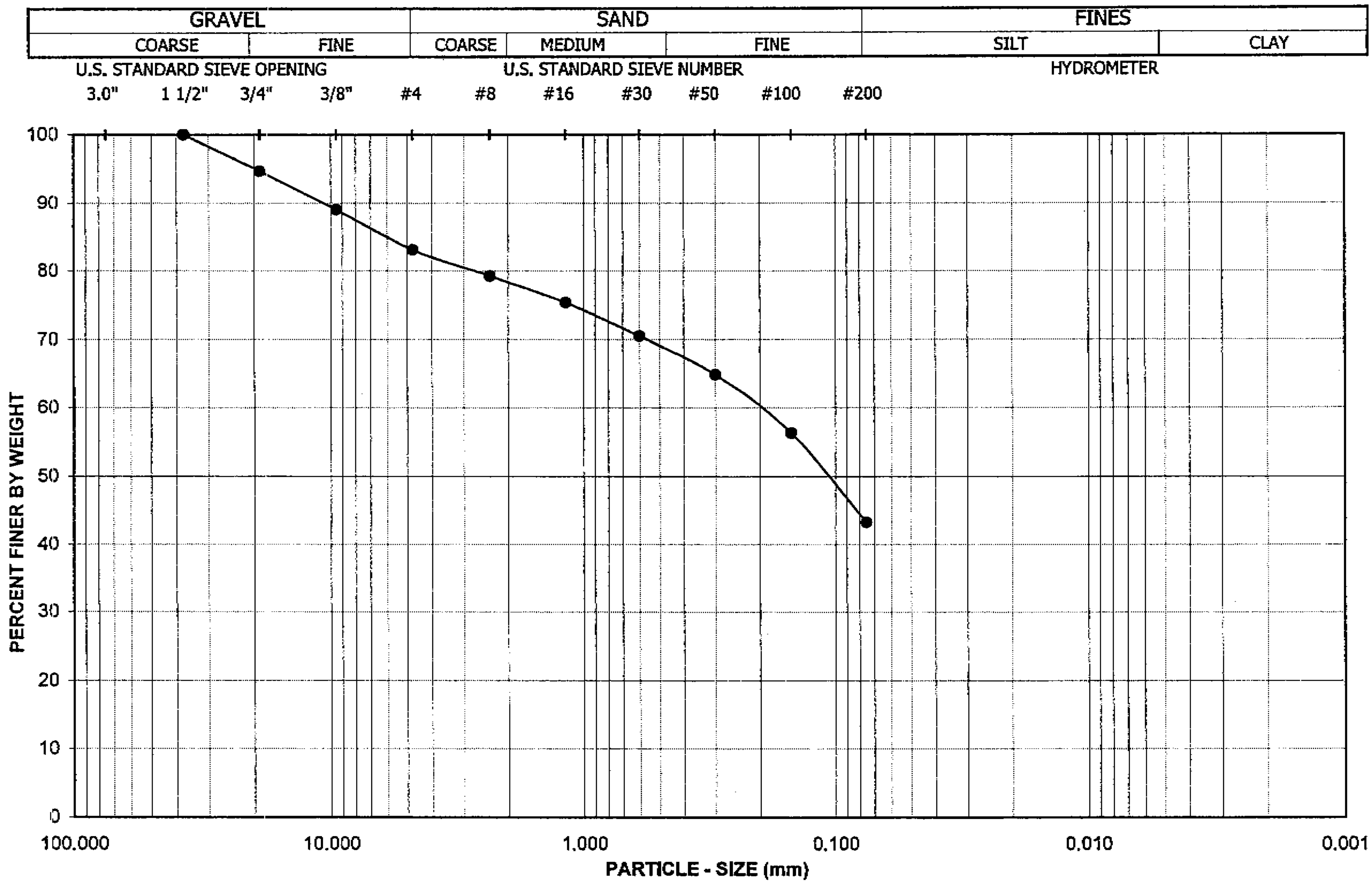
Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

GR:SA:FI : (%) 23 : 74 : 3

Jun-06

SA LRW-1 R-2



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1

Sample No.: R-3

Depth (feet): 15.0

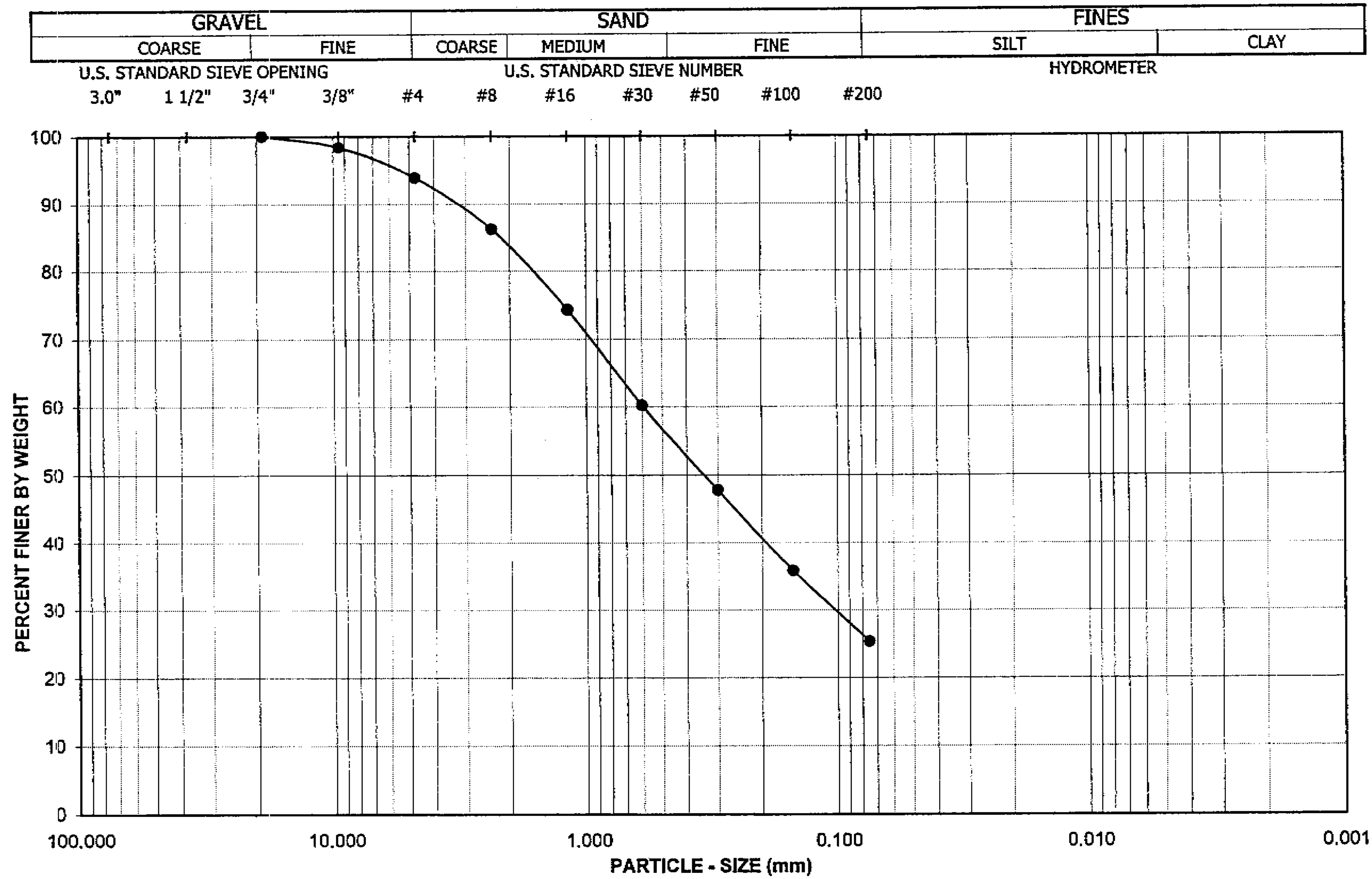
Soil Type : (SM)g

Soil Identification: Brown silty sand with gravel (SM)g

GR:SA:FI : (%) 17 : 40 : 43

Jun-06

SA LRW-1 R-3



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1

Sample No.: SPT-2A

Depth (feet): 7.5

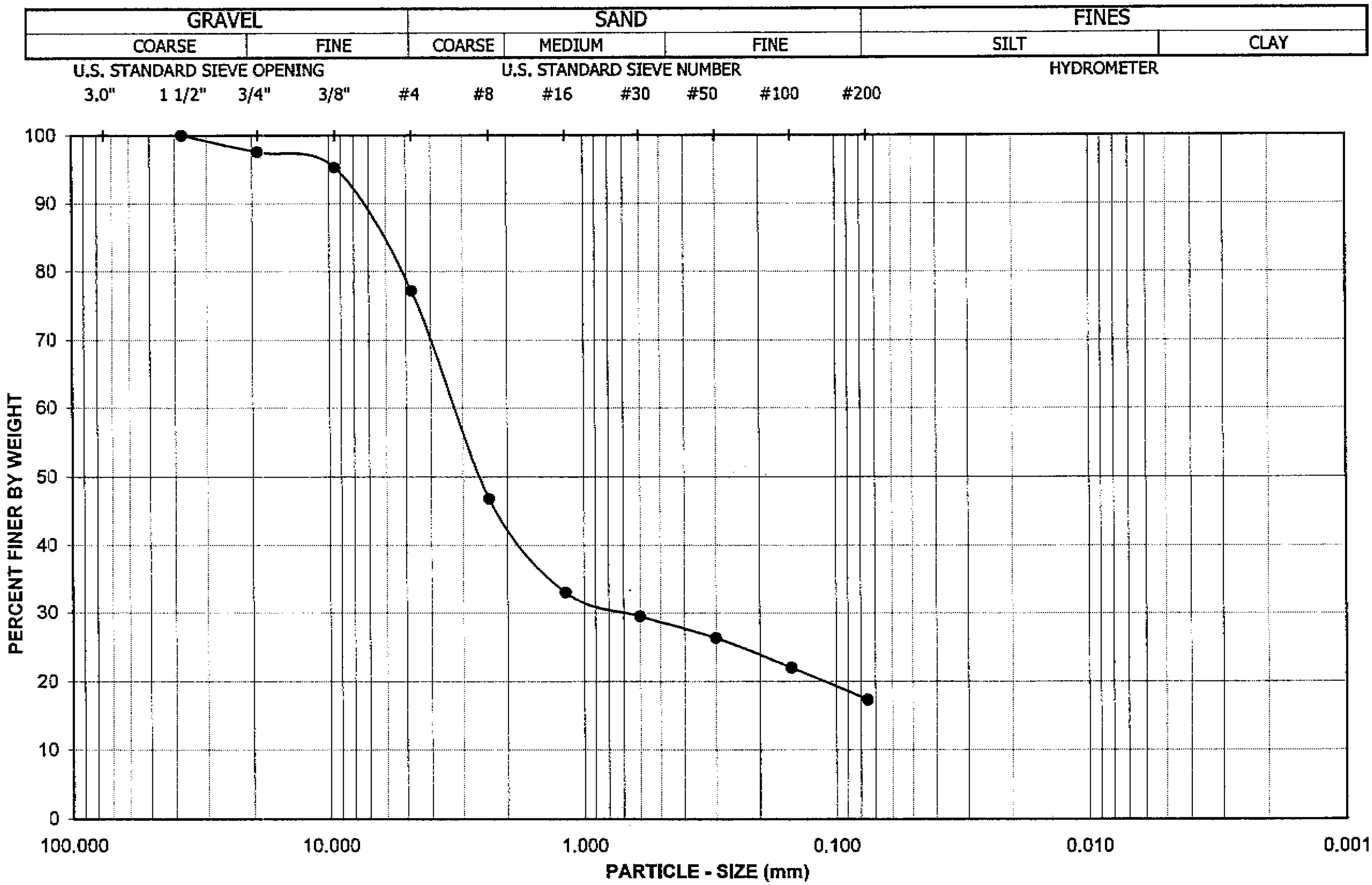
Soil Type : SM

Soil Identification: Light brown silty sand (SM)

GR:SA:FI : (%) 6 : 69 : 25

Jun-06

SA LRW-1 SPT-2A



Project Name: Robinson Ranch
Project No.: 061989-001

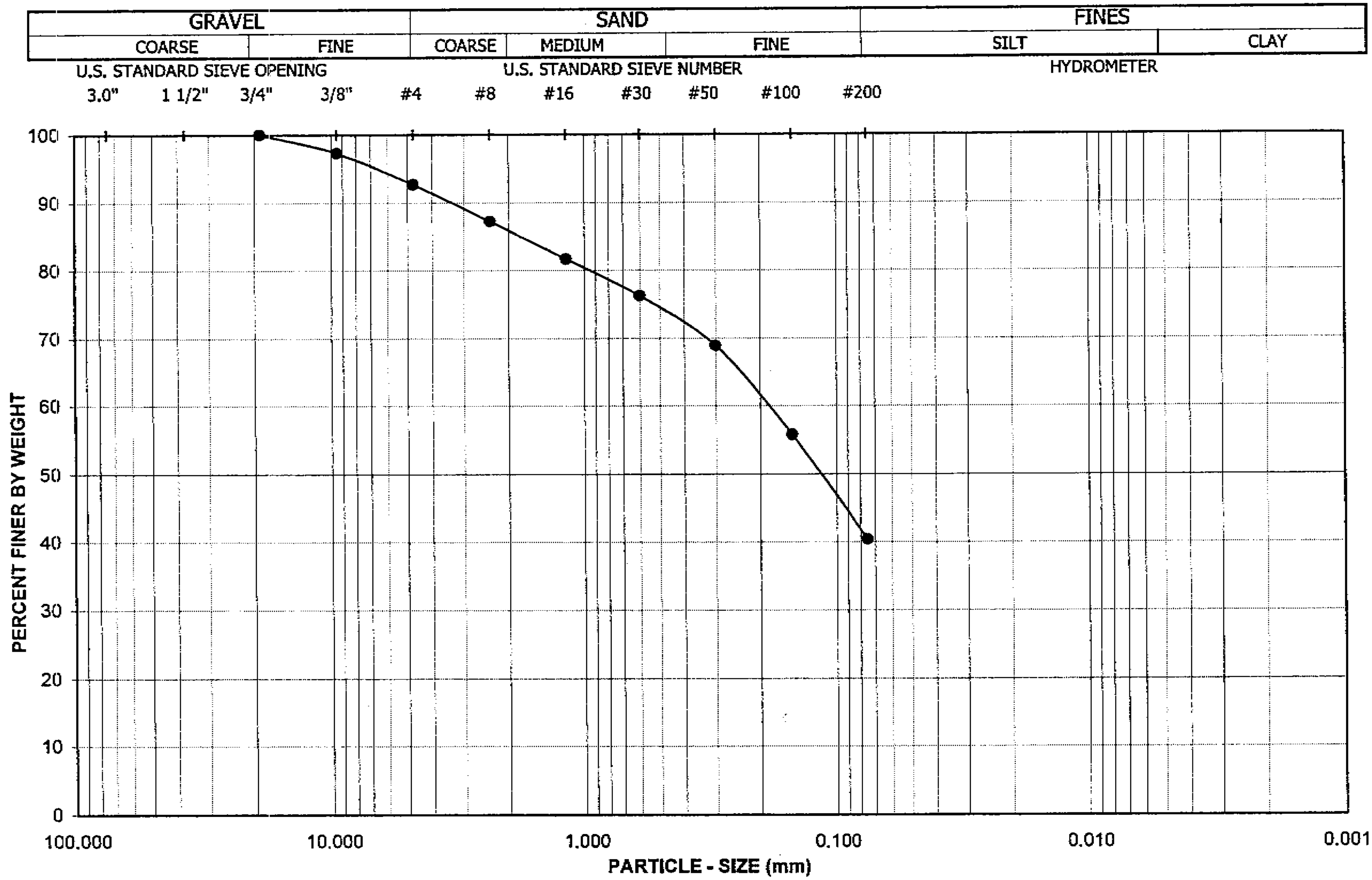
Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1   Sample No.: SPT-8
Depth (feet): 40.0   Soil Type : (SM)g
Soil Identification: Olive gray silty sand with gravel (SM)g
GR:SA:FI : (%)   23 : 60 : 17

Jun-06

SA LRW-1 SPT-8



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1

Sample No.: SPT-9A

Depth (feet): 45.0

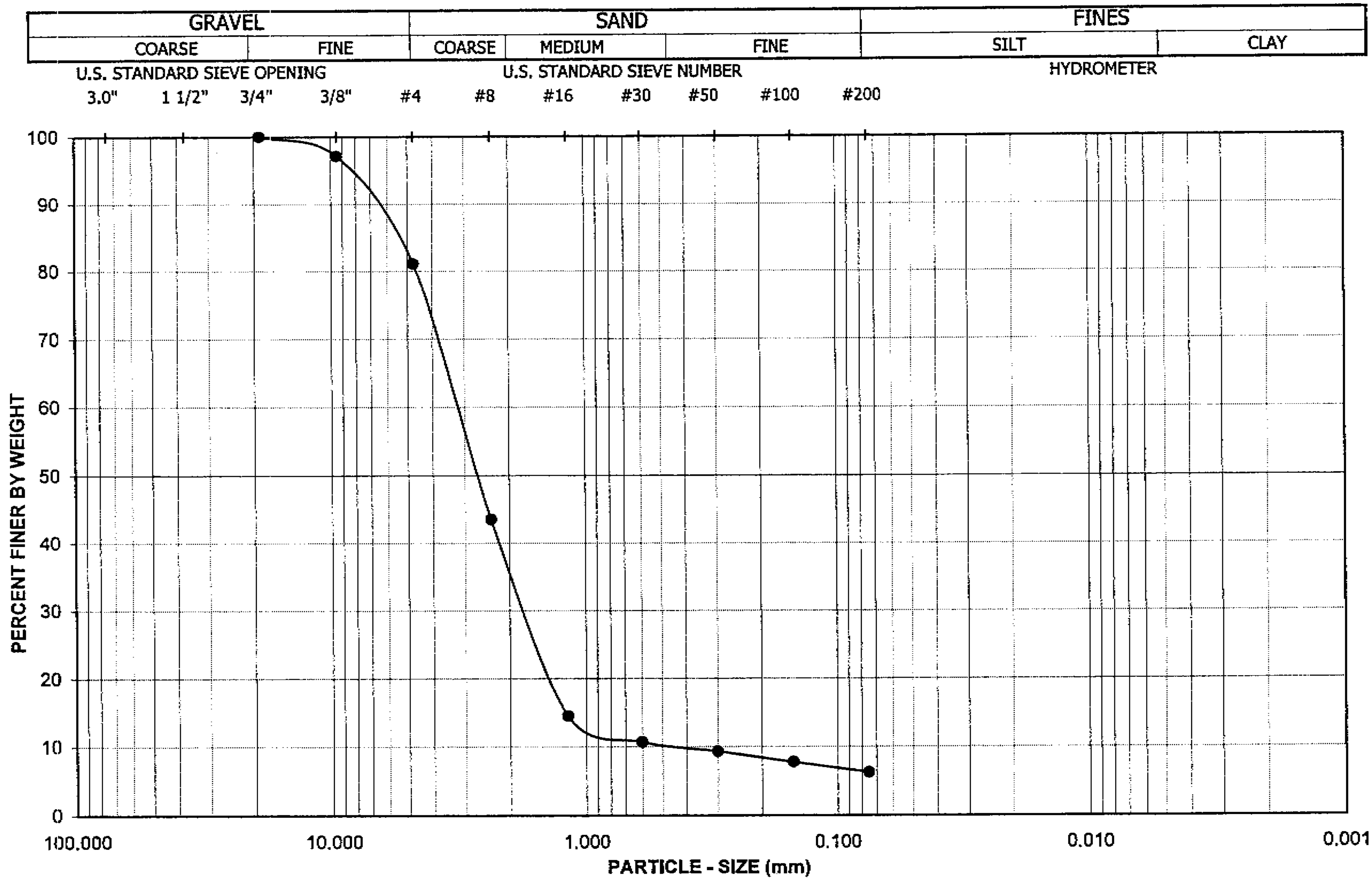
Soil Type : SM

Soil Identification: Olive gray silty sand (SM)

GR:SA:FI : (%) 7 : 53 : 40

Jun-06

SA LRW-1 SPT-9A



Project Name: Robinson Ranch
Project No.: 061989-001

Leighton

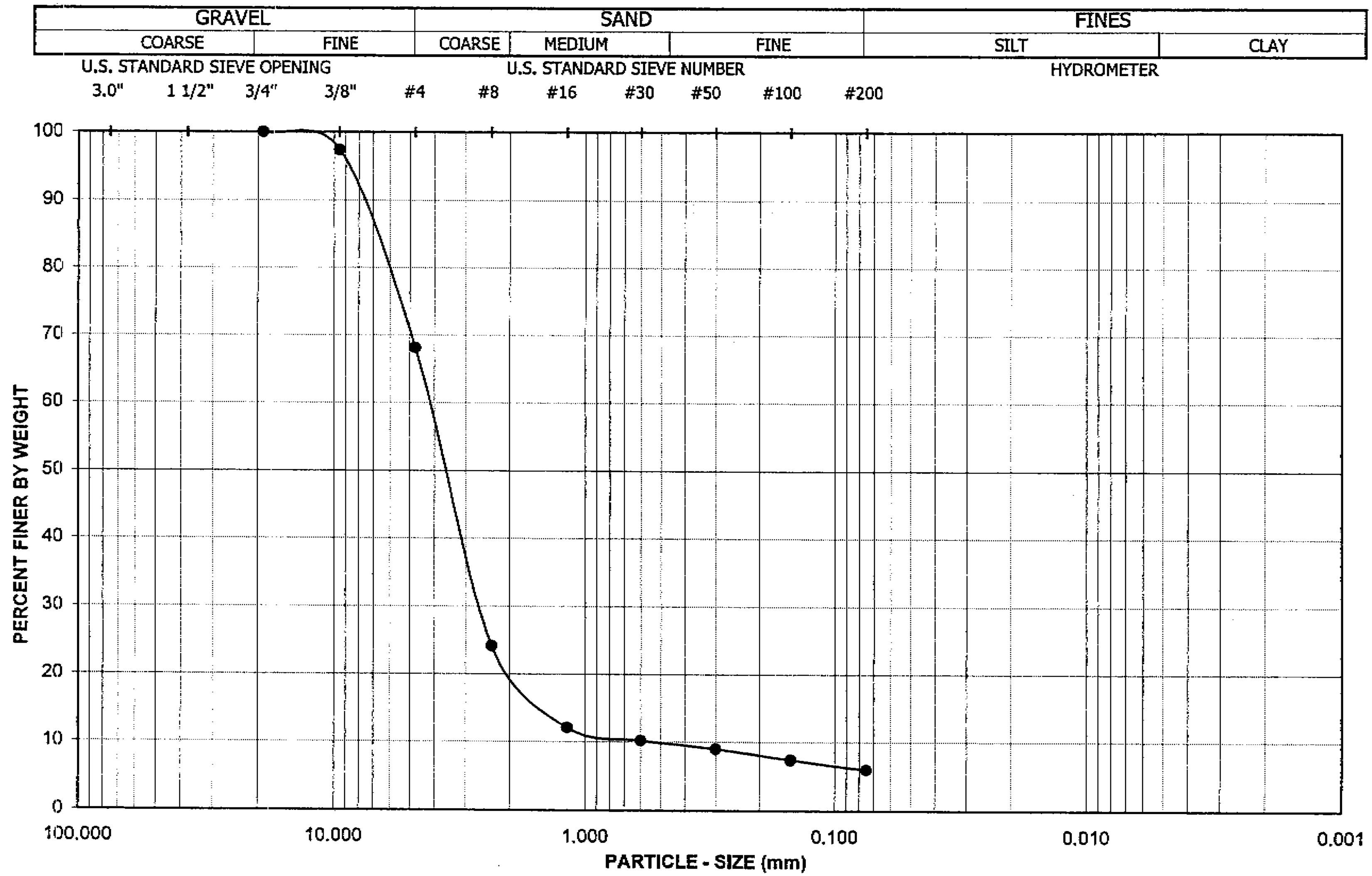
PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1 Sample No.: SPT-9B
Depth (feet): 46.0 Soil Type : (SW-SM)g
Soil Identification: Olive gray well-graded sand with silt and gravel (SW-SM)g

GR:SA:FI : (%) 19 : 75 : 6

Jun-06

SA LRW-1 SPT-9B



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-1 Sample No.: SPT-10A

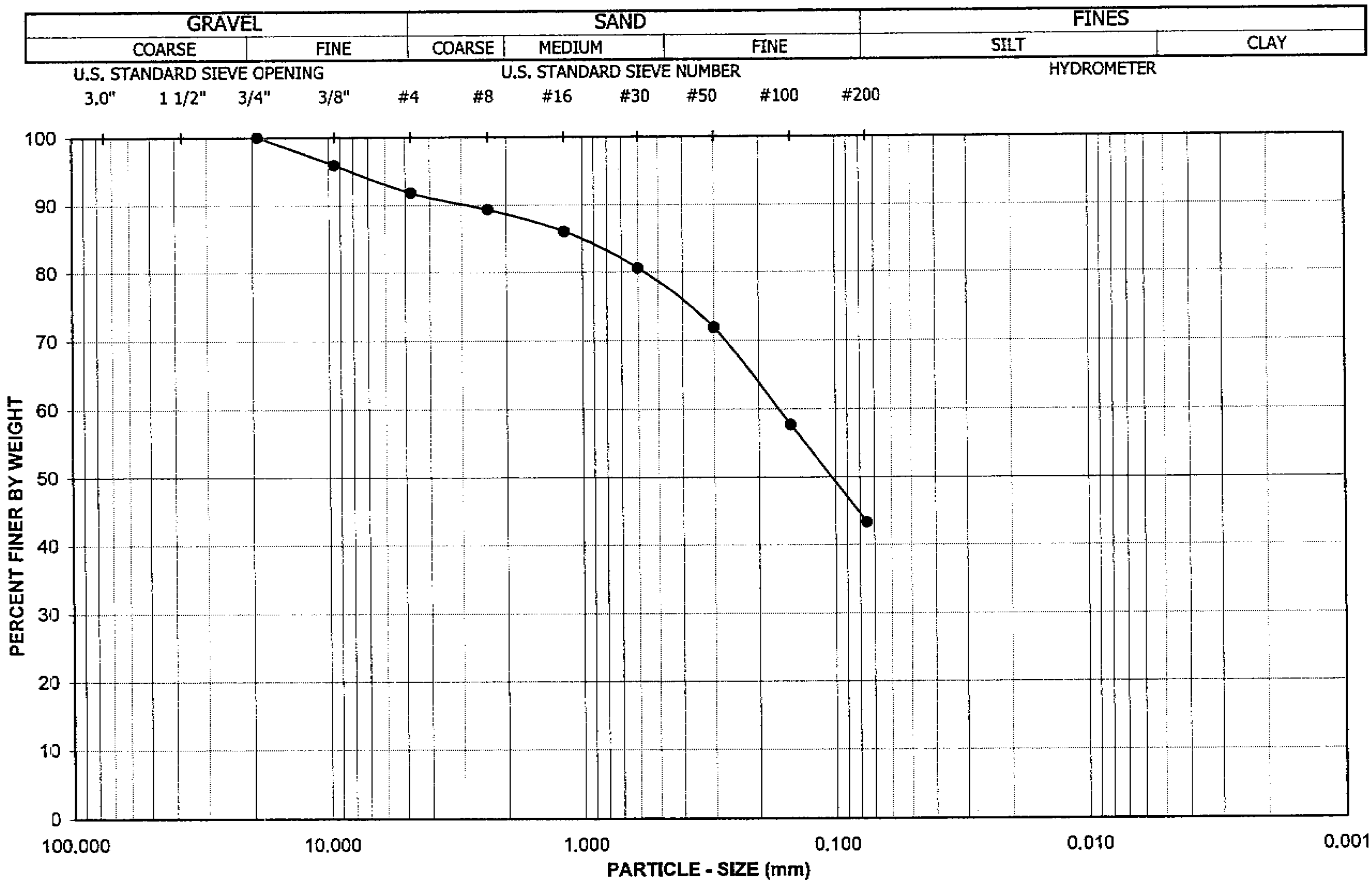
Depth (feet): 50.0 Soil Type : (SW-SM)g

Soil Identification: Olive gray well-graded sand with silt and gravel (SW-SM)g

GR:SA:FI : (%) **32 : 62 : 6**

Jun-06

SA LRW-1 SPT-10A



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION
ASTM D 422

Exploration No.: LRW-1 Sample No.: SPT-10B

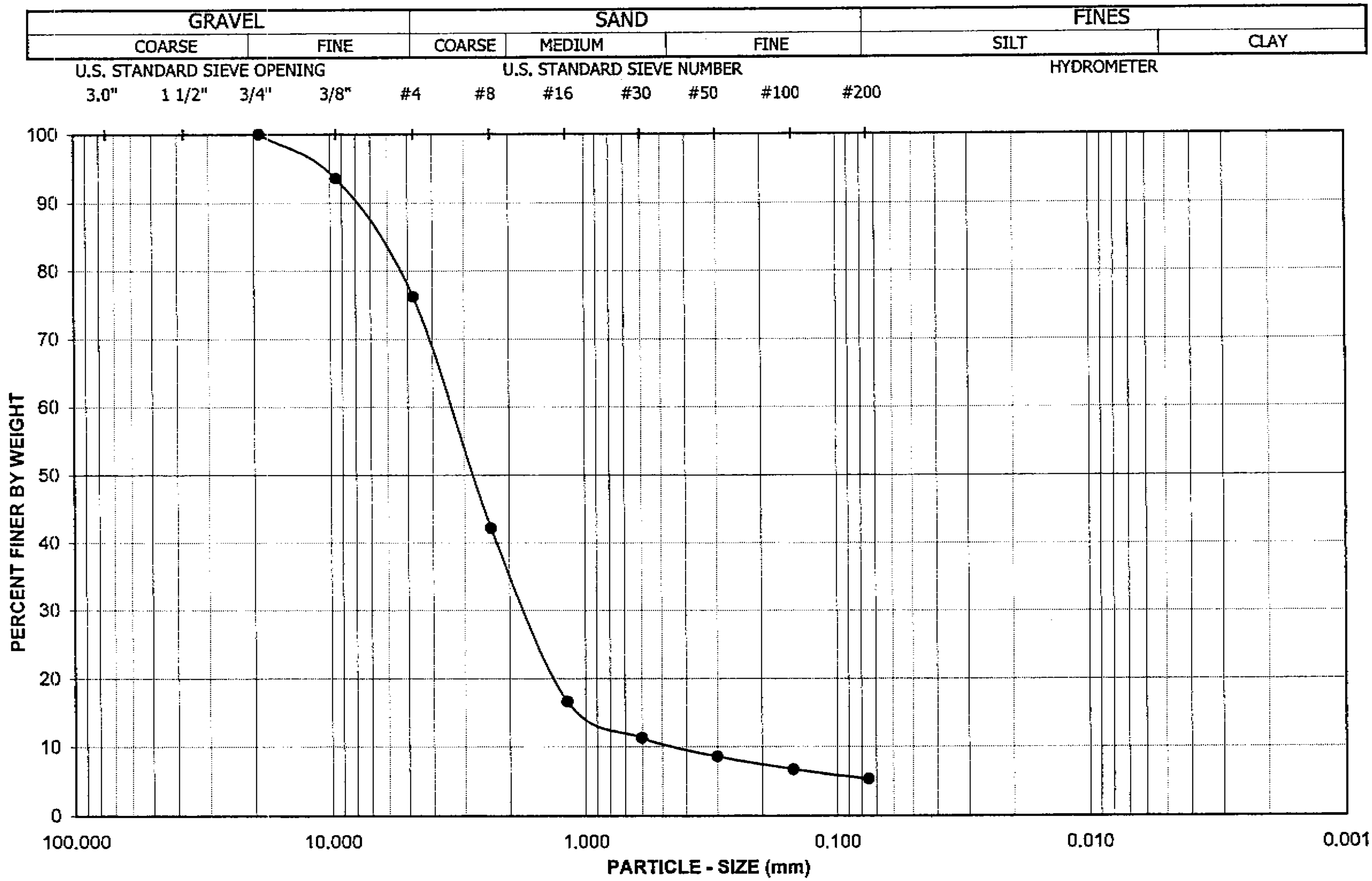
Depth (feet): 51.0 Soil Type : SM

Soil Identification: Olive gray silty sand (SM)

GR:SA:FI : (%) 8 : 49 : 43

Jun-06

SA LRW-1 SPT-10B



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION
ASTM D 422

Exploration No.: LRW-1 Sample No.: SPT-11

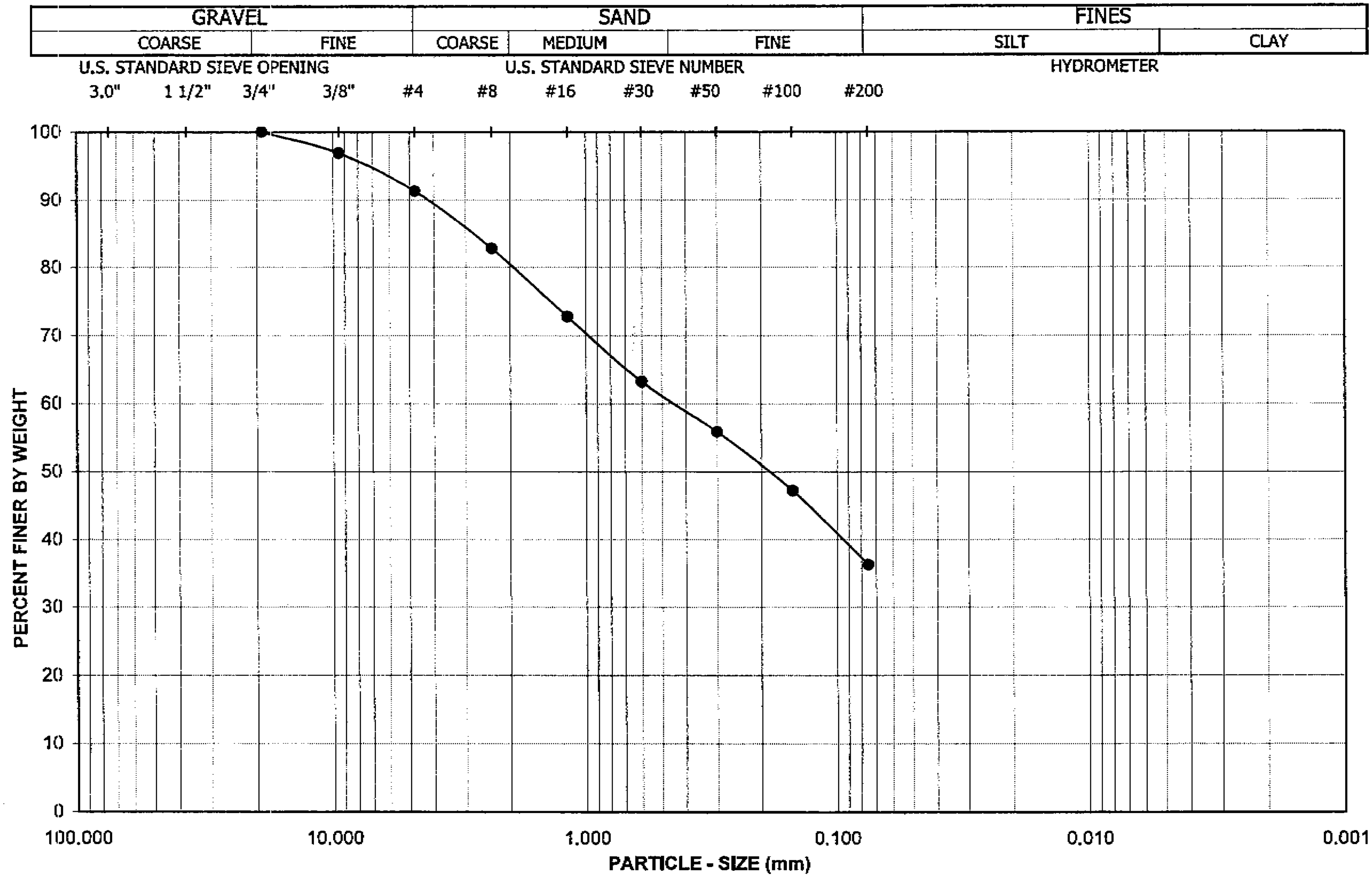
Depth (feet): 55.0 Soil Type : (SW-SM)g

Soil Identification: Olive gray well-graded sand with silt and gravel (SW-SM)g

GR:SA:FI : (%) 24 : 71 : 5

Jun-06

SA LRW-1 SPT-11



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-2 Sample No.: R-3

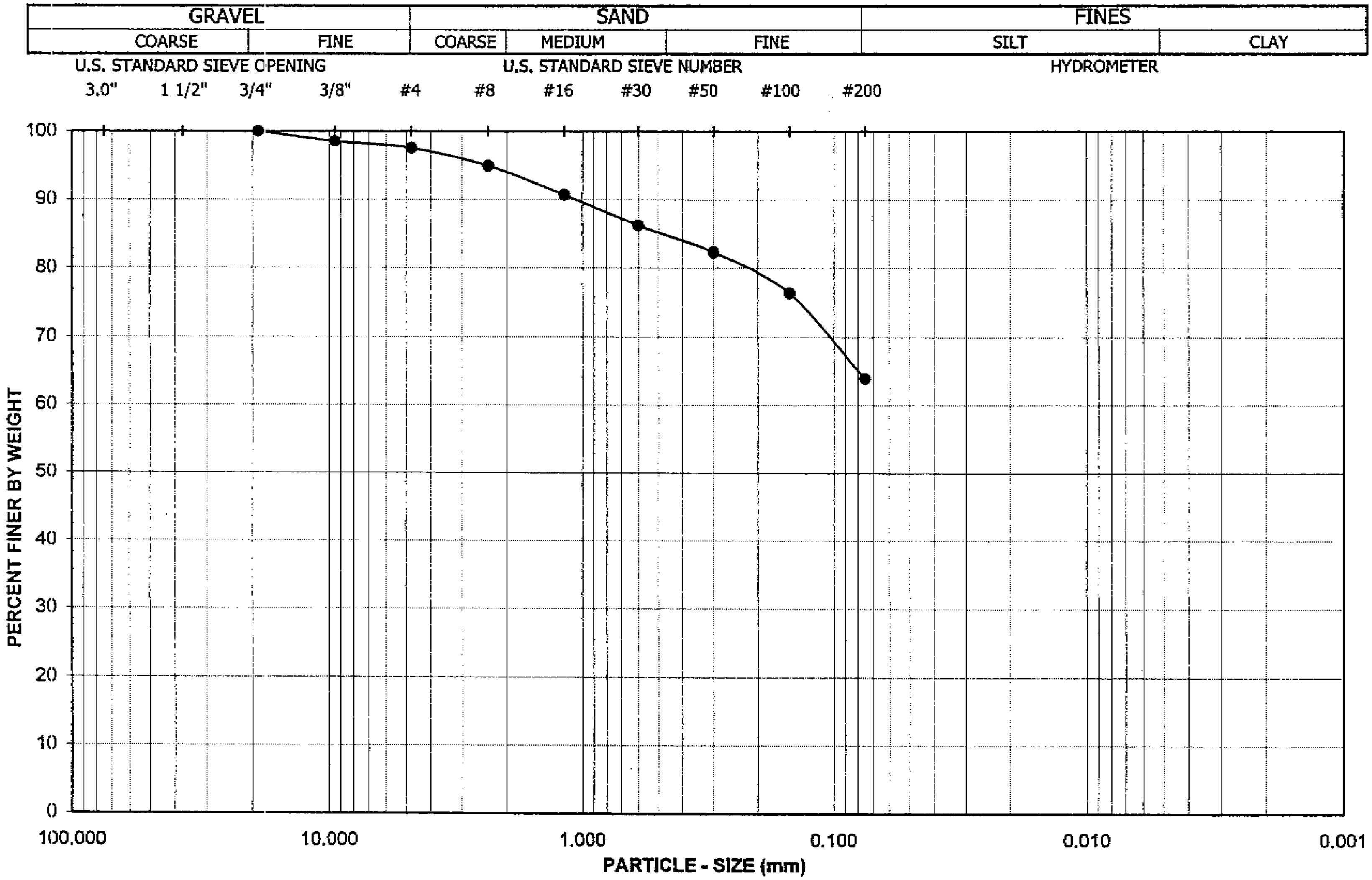
Depth (feet): 12.5 Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 9 : 55 : 36

Jun-06

SA LRW-2 R-3



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-2 Sample No.: SPT-1

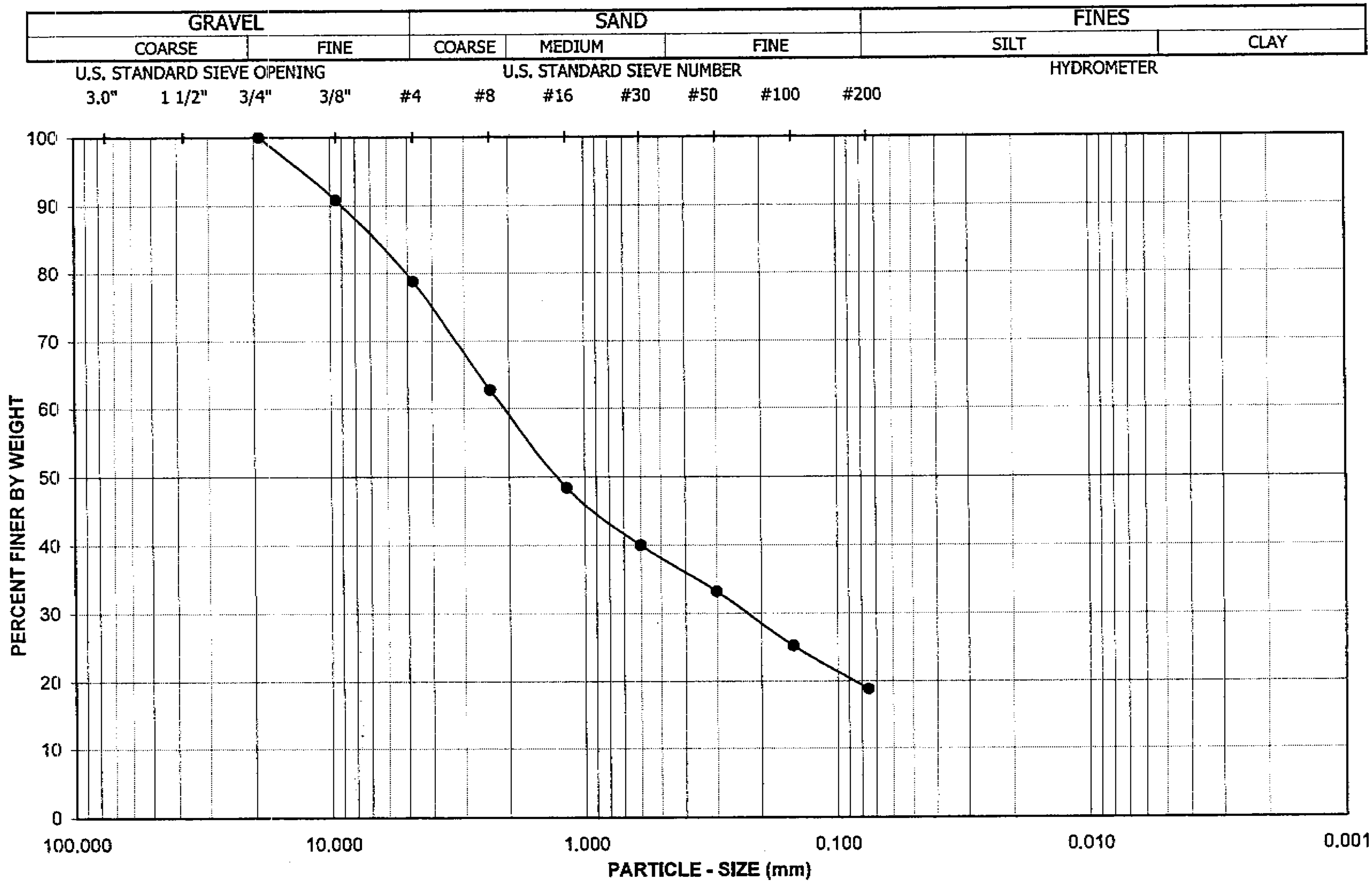
Depth (feet): 5.0 Soil Type : s(ML)

Soil Identification: Light brown sandy silt s(ML)

GR:SA:FI : (%) 3 : 33 : 64

Jun-06

SA LRW-2 SPT-1



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-2

Sample No.: SPT-4

Depth (feet): 20.0

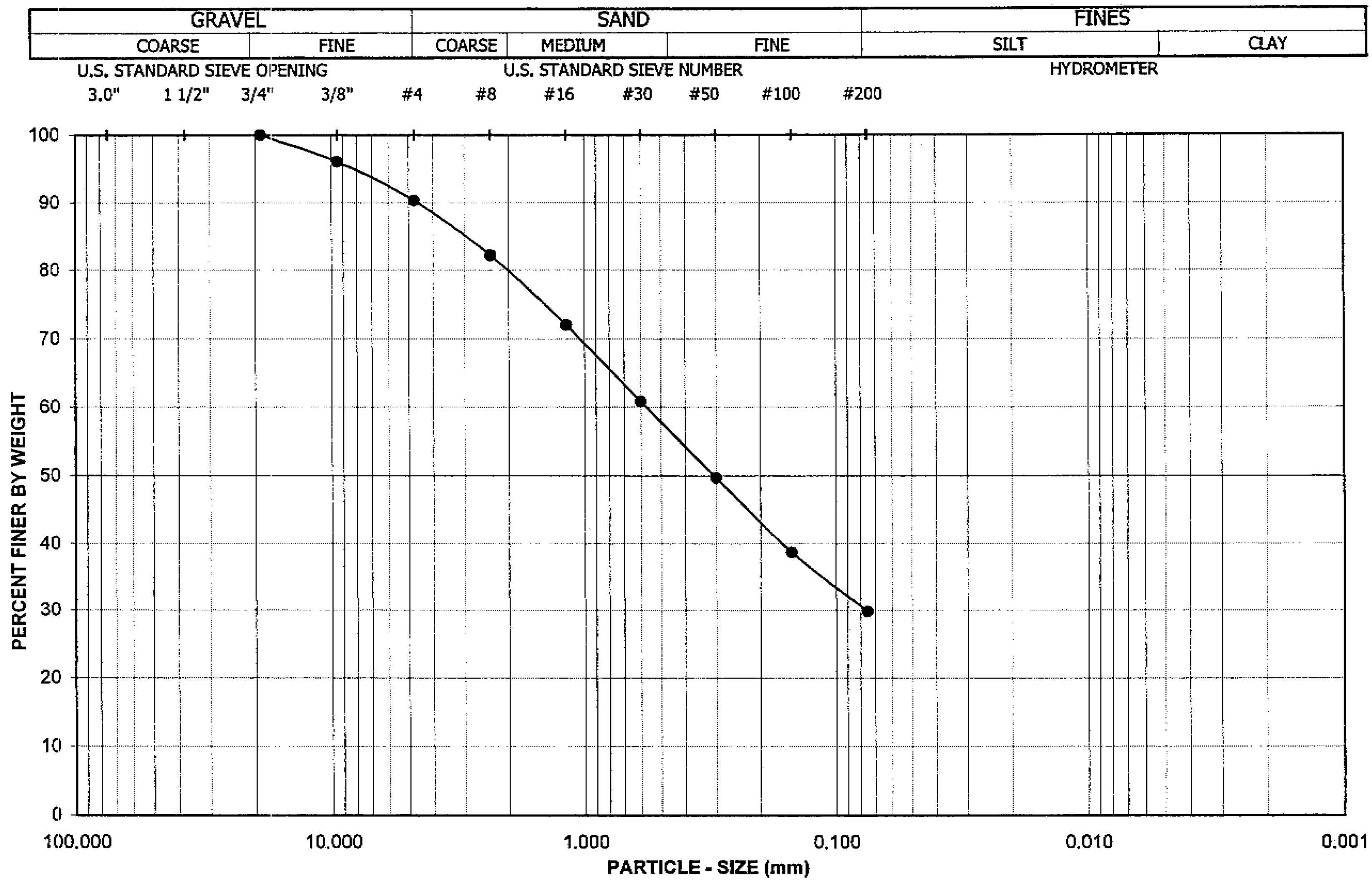
Soil Type : (SM)g

Soil Identification: Brown silty sand with gravel (SM)g

GR:SA:FI : (%) 21 : 60 : 19

Jun-06

SA LRW-2 SPT-4



Project Name: Robinson Ranch

Project No.: 061989-001

Exploration No.: LRW-2
Sample No.: SPT-2

Depth (feet): 10.0
Soil Type : SM

Soil Identification: Olive gray silty sand (SM)

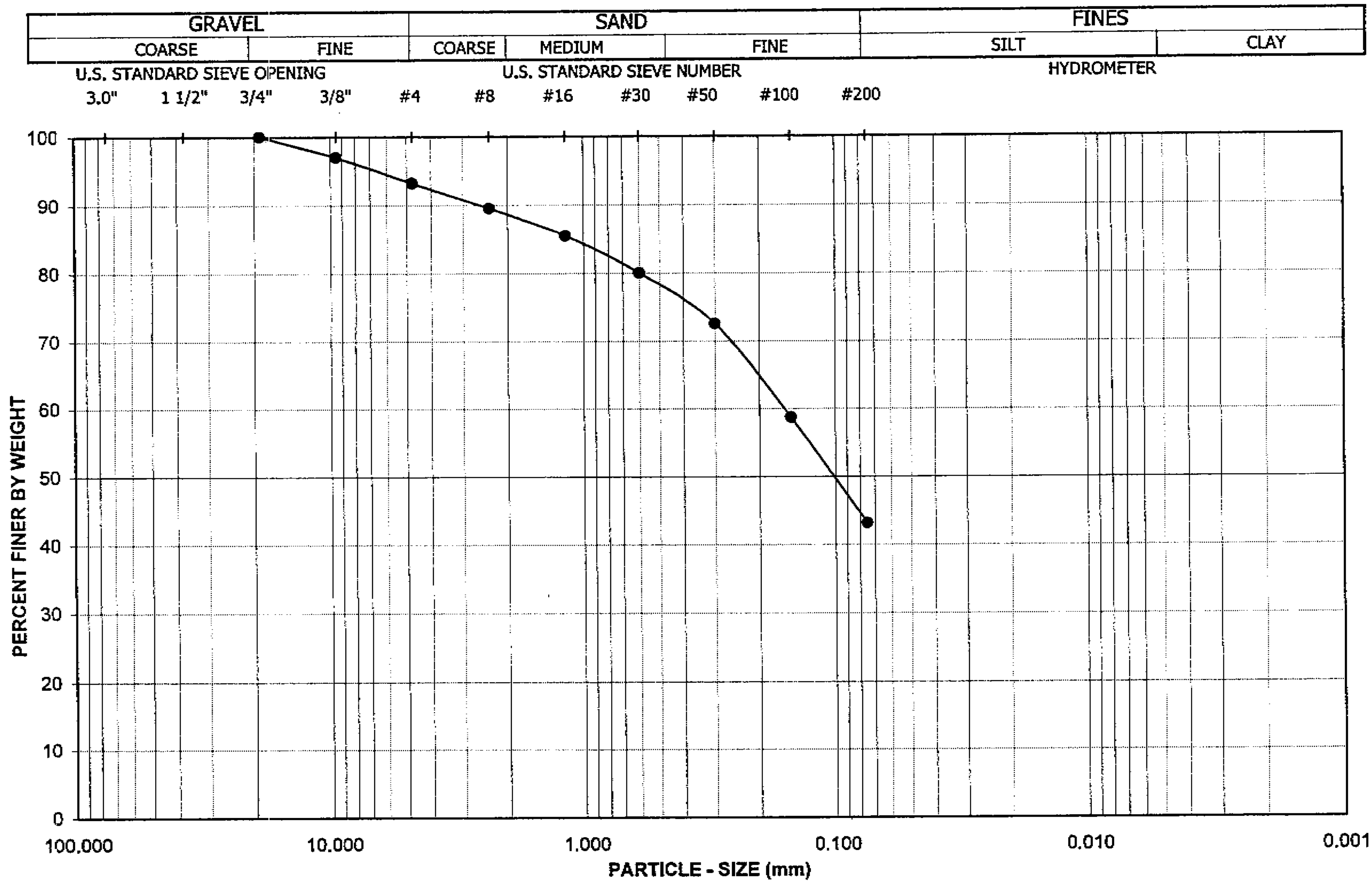
GR:SA:FI : (%) 10 : 60 : 30

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-06

SA LRW-2 SPT-2



Project Name: Robinson Ranch

Project No.: 061989-001

Exploration No.: LRW-2

Sample No.: SPT-5

Depth (feet): 25.0

Soil Type : SM

Soil Identification: Light brown silty sand (SM)

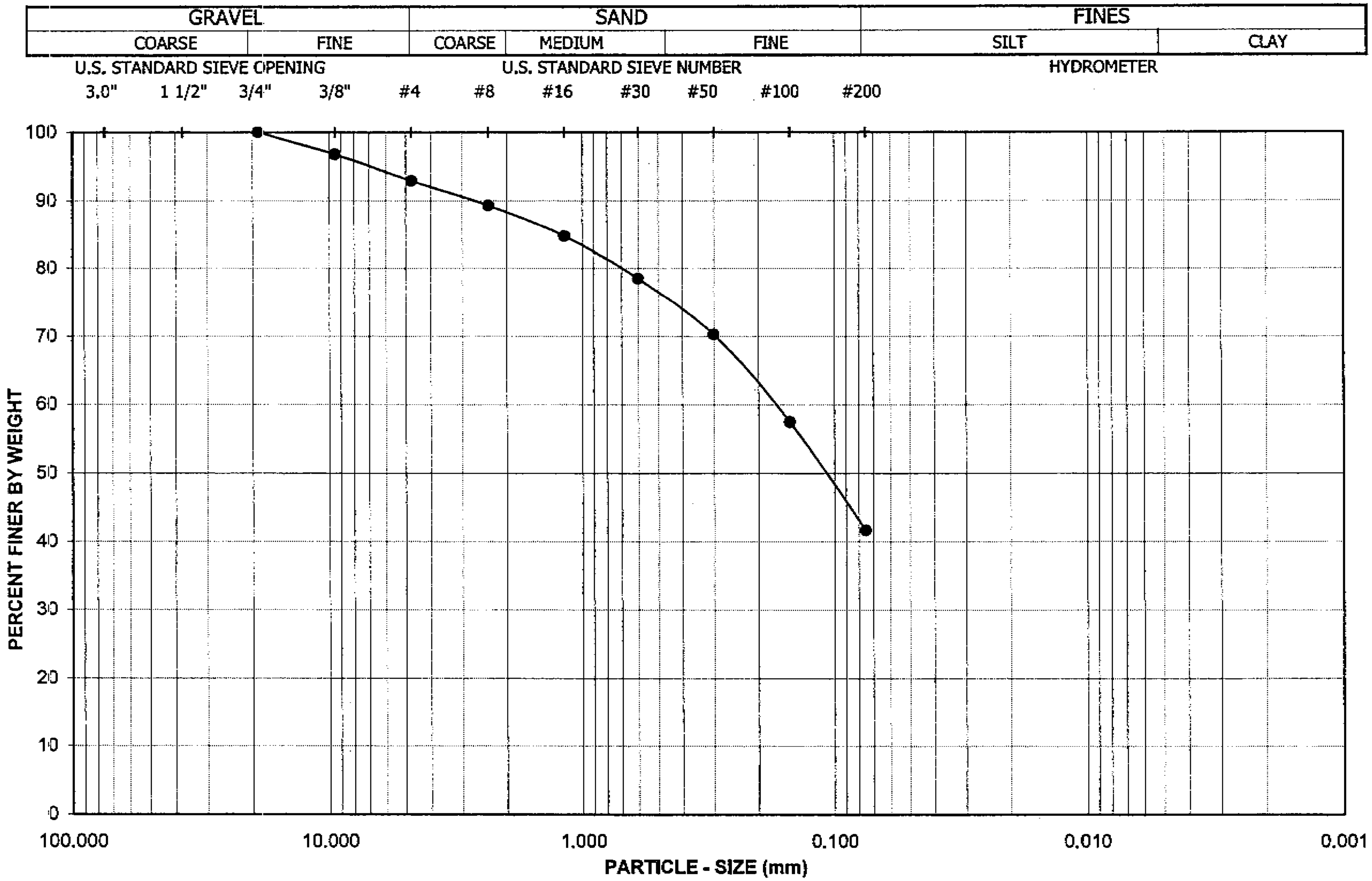
GR:SA:FI : (%) 7 : 50 : 43

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-06

SA LRW-2 SPT-5



Project Name: Robinson Ranch

Project No.: 061989-001

Exploration No.: LRW-2 | Sample No.: SPT-6

Depth (feet): 30.0 | Soil Type : SM

Soil Identification: Olive silty sand (SM)

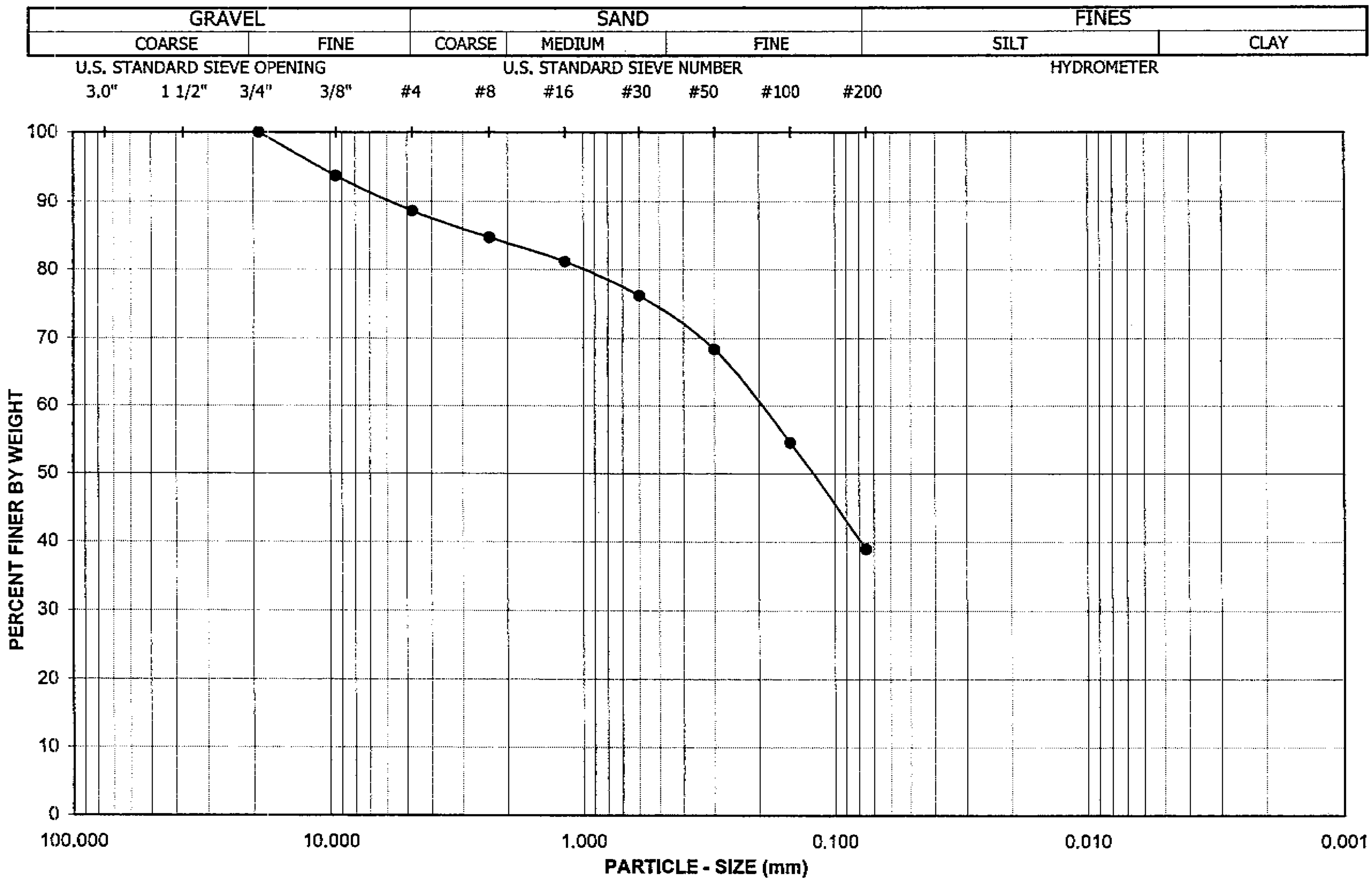
GR:SA:FI : (%) 7 : 51 : 42

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Jun-06

SA LRW-2 SPT-6



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION
ASTM D 422

Exploration No.: LRW-2 Sample No.: SPT-7

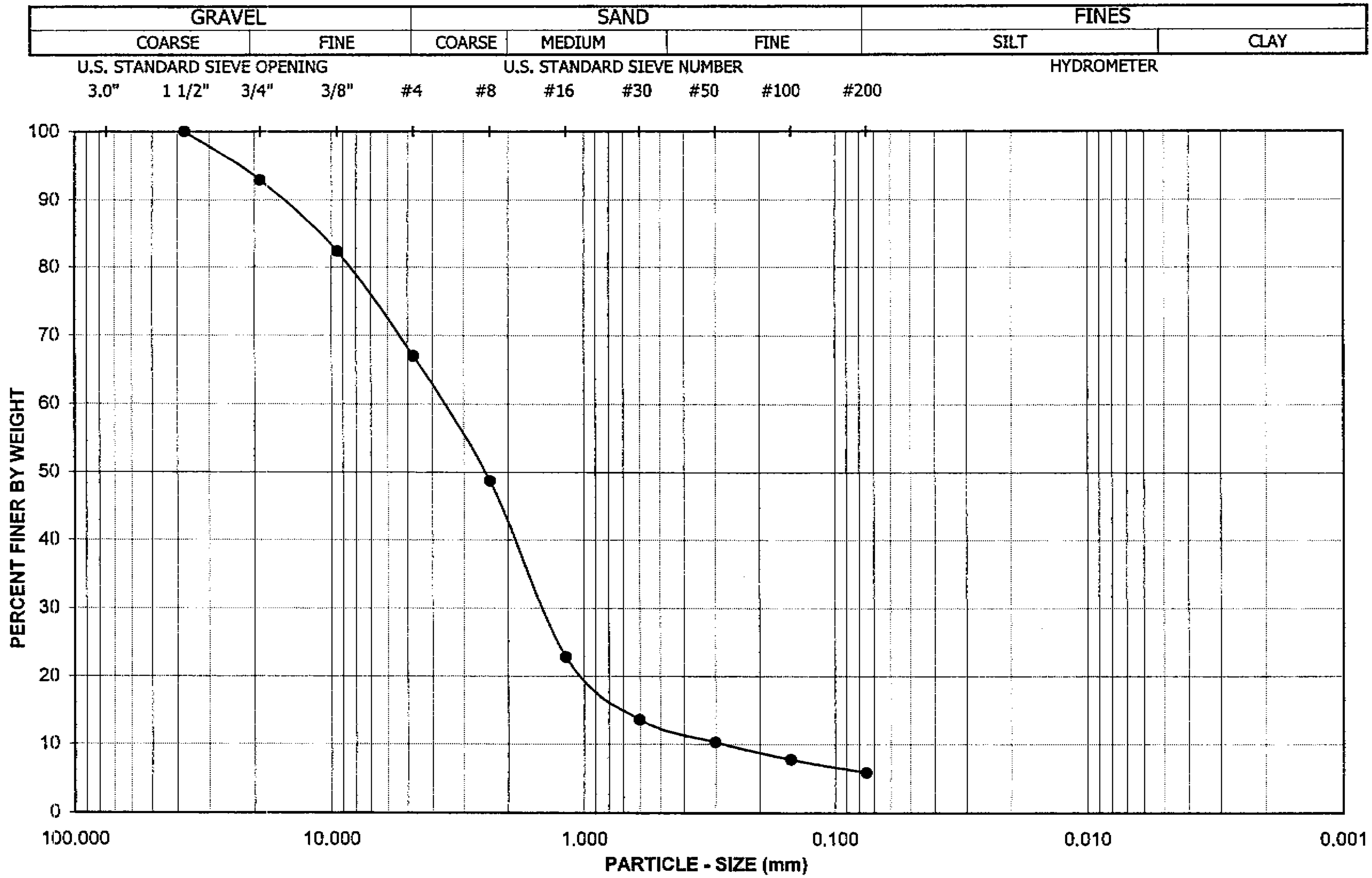
Depth (feet): 35.0 Soil Type : SM

Soil Identification: Olive gray silty sand (SM)

GR:SA:FI : (%) 11 : 50 : 39

Jun-06

SA LRW-2 SPT-7



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-2 Sample No.: SPT-8

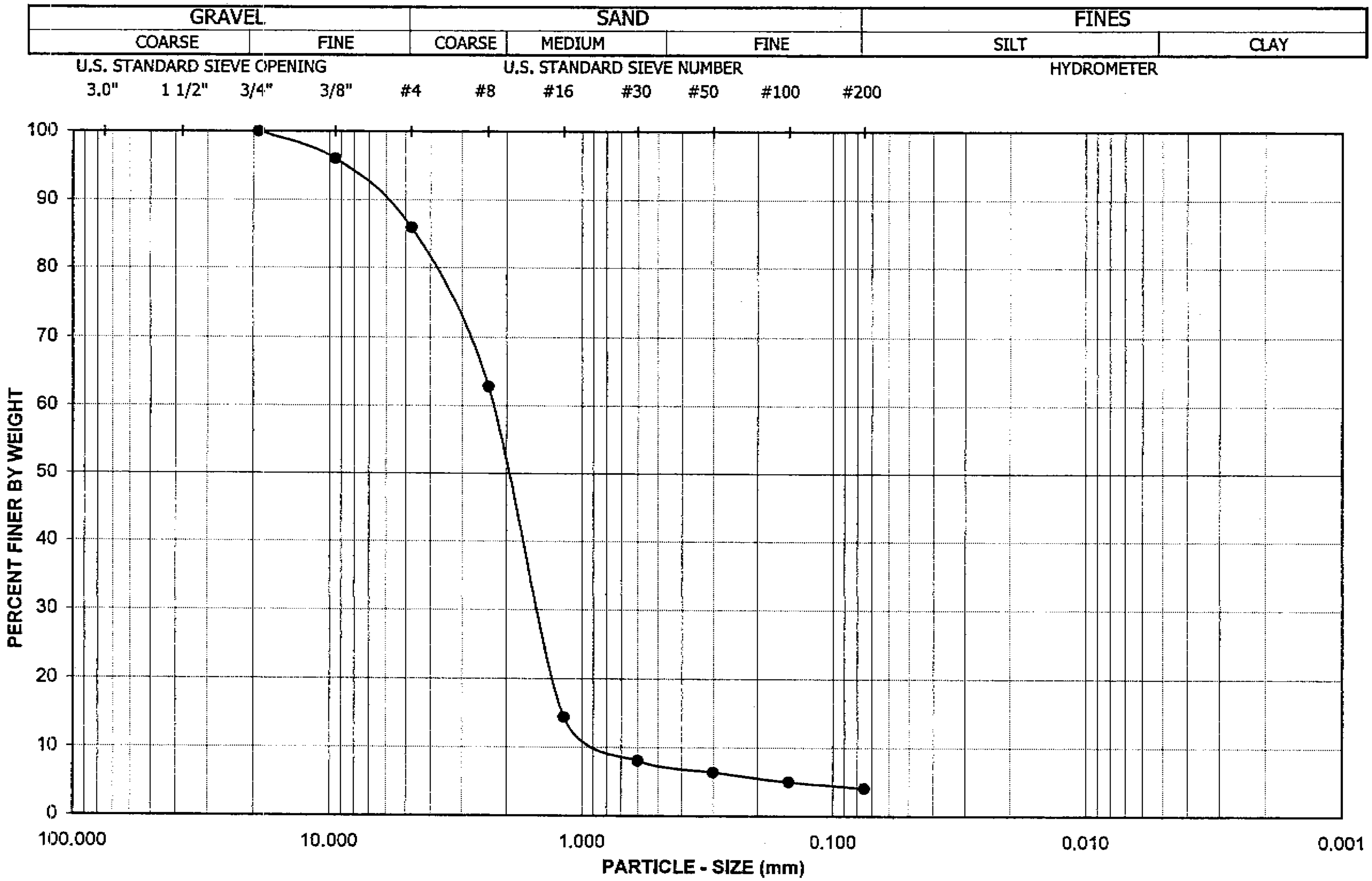
Depth (feet): 40.0 Soil Type : (SW-SM)g

Soil Identification: Olive gray well-graded sand with silt and gravel (SW-SM)g

GR:SA:FI : (%) **33 : 61 : 6**

Jun-06

SA LRW-2 SPT-8



Project Name: Robinson Ranch

Project No.: 061989-001

Exploration No.: LRW-2 | Sample No.: SPT-9

Depth (feet): 45.0 | Soil Type : SP

Soil Identification: Olive gray poorly graded sand (SP)

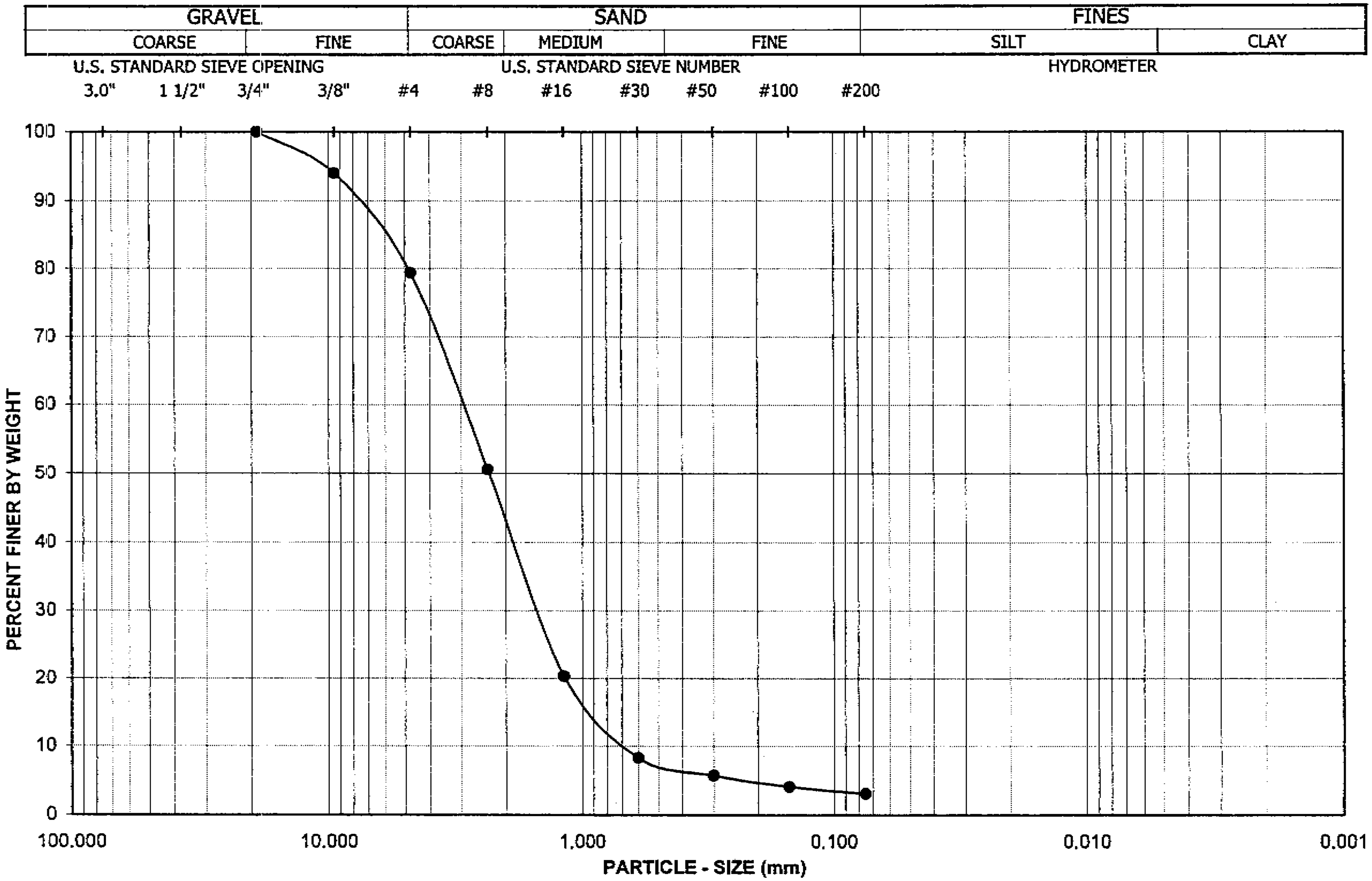
GR:SA:FI : (%) 14 : 82 : 4

Leighton

PARTICLE - SIZE DISTRIBUTION
ASTM D 422

Jun-06

SA LRW-2 SPT-9



Project Name: Robinson Ranch

Project No.: 061989-001

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

Exploration No.: LRW-2 Sample No.: SPT-10

Depth (feet): 50.0 Soil Type : (SP)g

Soil Identification: Olive gray poorly graded sand with gravel (SP)g

GR:SA:FI : (%) 21 : 76 : 3

Jun-06

SA LRW-2 SPT-10

APPENDIX D

LIQUEFACTION AND SLOPE STABILITY ANALYSES

APPENDIX D

LIQUEFACTION AND SLOPE STABILITY ANALYSES

D-1 Liquefaction Analyses

Liquefaction analyses were performed using the computer program LiquefyPro version 5.3c. The settlement calculations utilize the filed Standard Penetration Tests (SPT) blow counts data and/or blow counts recorded during Modified California Drive sampling (approximately two third of the blow counts were assumed equivalent to SPT blow counts), and other physical engineering characteristics of the subsurface soils (determined from laboratory tests). In this analysis, the design basis ground motion of 0.46g and a maximum moment magnitude of 7.5Mw were used. Plots of the calculations are presented in this appendix.

D-2 Slope Stability Analyses

Global slope stability analyses, for static and pseudostatic conditions, were performed on three sections; LS1, LS2 and LS3 using the computer program GSTABL7 with STEDwin version 2. The Simplified Janbu's Method was used. A coefficient of horizontal acceleration of 0.15g was used for pseudostatic stability analyses.

Surficial stability of a generic manufactured slopes at the site was evaluated assuming that seepage is parallel to the slope face.

The shear strength parameters presented in the Seismic Hazard Report for the Mint Canyon Quadrangle (State of California, 1998b) for similar types of bedrock were utilized in the analyses. The parameters are presented in Table D-1 below.

TABLE D-1

Design Shear Strength Parameters for Slope Stability Analyses

Soil Type	Cohesion (psf)	Angle of Internal Friction (Degrees)
Mint Canyon Formation (Tmc) (Adverse bedding)	400	24
Mint Canyon Formation (Tmc) (Favorable bedding)	300	31
Artificial Fill (af)	225	25

The slope stability analyses are presented in the attached figures. The results are summarized in Table D-2.

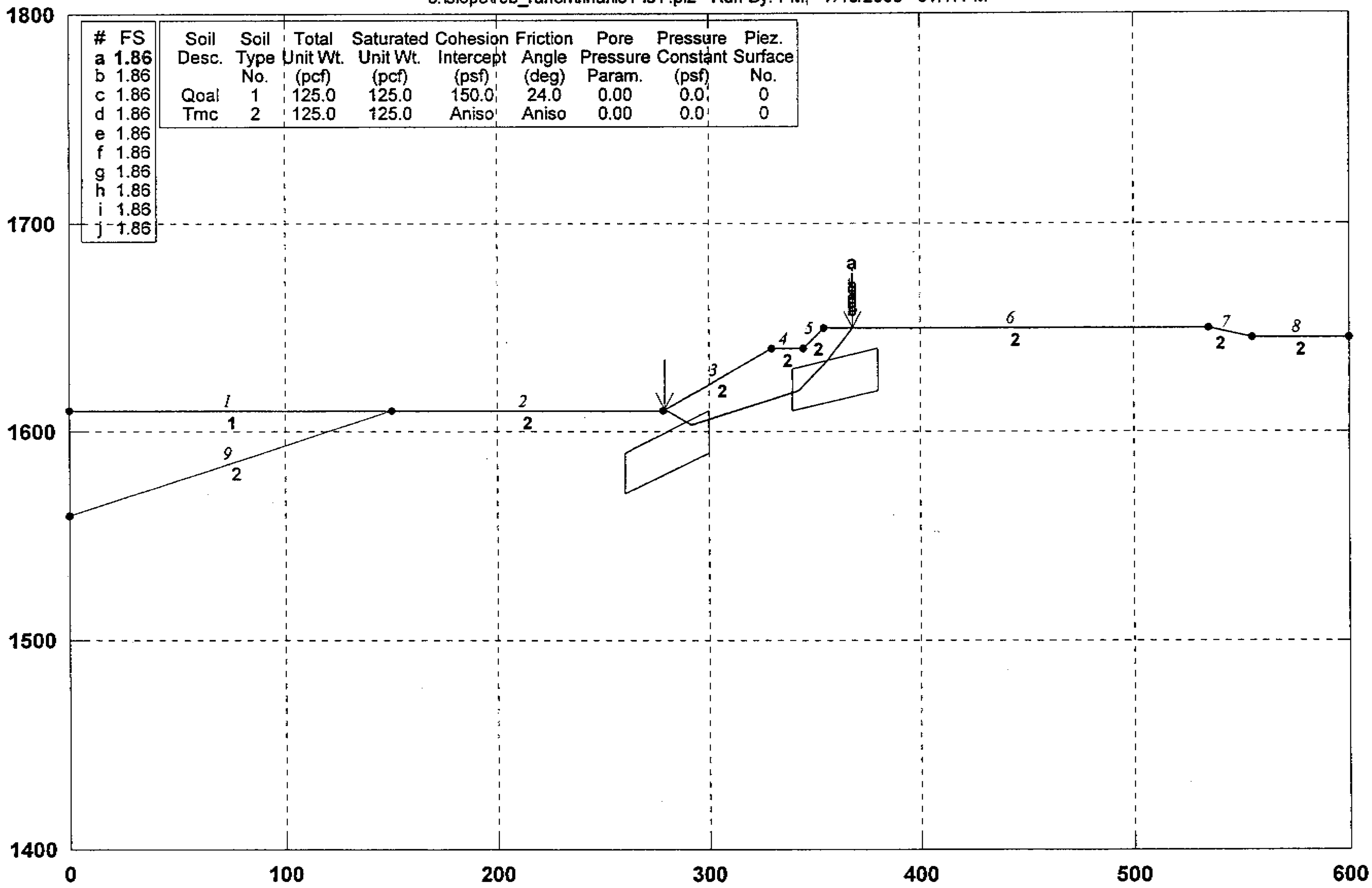
TABLE D-2

Summary of Slope Stability Analyses

No	Cross Section	Reference	Condition	Factor of Safety	Remarks
1	LS1	Figure D-1 (Sets)	Global Stability Static Most Critical Failure Surface	1.86	Simplified Janbu Method
2	LS1	Figure D-2 (Sets)	Pseudostatic	1.33	Simplified Janbu Method
3	LS2	Figure D-3 (Sets)	Global Stability Static Most Critical Failure Surface	1.61	Simplified Janbu Method
4	LS2	Figure D-4 (Sets)	Pseudostatic	1.12	Simplified Janbu Method
5	LS3	Figure D-5 (Sets)	Global Stability Static Most Critical Failure Surface	1.64	Simplified Janbu Method
5	LS3	Figure D-6 (Sets)	Pseudostatic	1.11	Simplified Janbu Method
5	LS3	Figure D-7 (Sets)	Rapid Drawdown	1.58	Simplified Janbu Method
5	LS3	Figure D-7 (Sets)	Pseudostatic	1.10	Simplified Janbu Method

Robinson Ranch 061989-001 LS1-LS1' , Static

c:\slope\rob_ranch\final\ls1-ls1'.pl2 Run By: PM, 7/18/2006 01:17PM



GSTABL7 v.2 FSmin=1.86

Safety Factors Are Calculated By The Simplified Janbu Method

Fig D-1

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **

****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 7/18/2006
Time of Run: 01:17PM
Run By: PM,
Input Data Filename: C:\SLOPE\ROB_ranch\Final\ls1-ls1'.in
Output Filename: C:\SLOPE\ROB_ranch\Final\ls1-ls1'.OUT
Unit System: English
Plotted Output Filename: C:\SLOPE\ROB_ranch\Final\ls1-ls1'.PLT
PROBLEM DESCRIPTION: Robinson Ranch 061989-001 LS1-LS1'
, Static

BOUNDARY COORDINATES
8 Top Boundaries
9 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	1610.00	150.00	1610.00	1
2	150.00	1610.00	278.00	1610.00	2
3	278.00	1610.00	330.00	1640.00	2
4	330.00	1640.00	345.00	1640.00	2
5	345.00	1640.00	355.00	1650.00	2
6	355.00	1650.00	535.00	1650.00	2
7	535.00	1650.00	555.00	1645.00	2
8	555.00	1645.00	600.00	1645.00	2
9	0.00	1560.00	150.00	1610.00	2

User Specified Y-Origin = 1400.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	150.0	24.0	0.00	0.0	0
2	125.0	125.0	300.0	31.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	16.0	300.00	31.00
2	20.0	400.00	24.00
3	90.0	300.00	31.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 20.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	260.00	1580.00	300.00	1600.00	20.00
2	340.00	1620.00	380.00	1630.00	20.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 5.620 FS Min = 1.856 FS Ave = 2.717
Standard Deviation = 0.518 Coefficient of Variation = 19.08 %

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	279.174	1610.677
2	291.580	1603.518
3	342.419	1619.730
4	356.449	1633.983
5	368.303	1650.000

Factor of Safety
*** 1.856 ***

Individual data on the 7 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	12.4	11100.4	0.0	0.0	0.	0.	0.0	0.0	0.0
2	38.4	92562.3	0.0	0.0	0.	0.	0.0	0.0	0.0
3	12.4	34542.3	0.0	0.0	0.	0.	0.0	0.0	0.0
4	2.6	6115.6	0.0	0.0	0.	0.	0.0	0.0	0.0
5	10.0	21961.4	0.0	0.0	0.	0.	0.0	0.0	0.0
6	1.4	3035.3	0.0	0.0	0.	0.	0.0	0.0	0.0
7	11.9	11866.4	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 5 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	279.174	1610.677
2	291.580	1603.518
3	342.419	1619.730
4	356.449	1633.983
5	368.303	1650.000

Factor of Safety
*** 1.856 ***

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5	368.303	1650.000

Factor of Safety

*** 1.856 ***

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*** 1.856 ***

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Factor of Safety
*** 1.856 ***

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5	368.303	1650.000

Factor of Safety
*** 1.856 ***

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Point No.	X-Surf (ft)	Y-Surf (ft)
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3	342.419	1619.730
4	356.449	1633.983
5	368.303	1650.000

Factor of Safety
*** 1.856 ***

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Point No.	X-Surf (ft)	Y-Surf (ft)
1	279.174	1610.677
2	291.580	1603.518
3	342.419	1619.730
4	356.449	1633.983
5	368.303	1650.000

Factor of Safety
*** 1.856 ***

Failure Surface Specified By 5 Coordinate Points

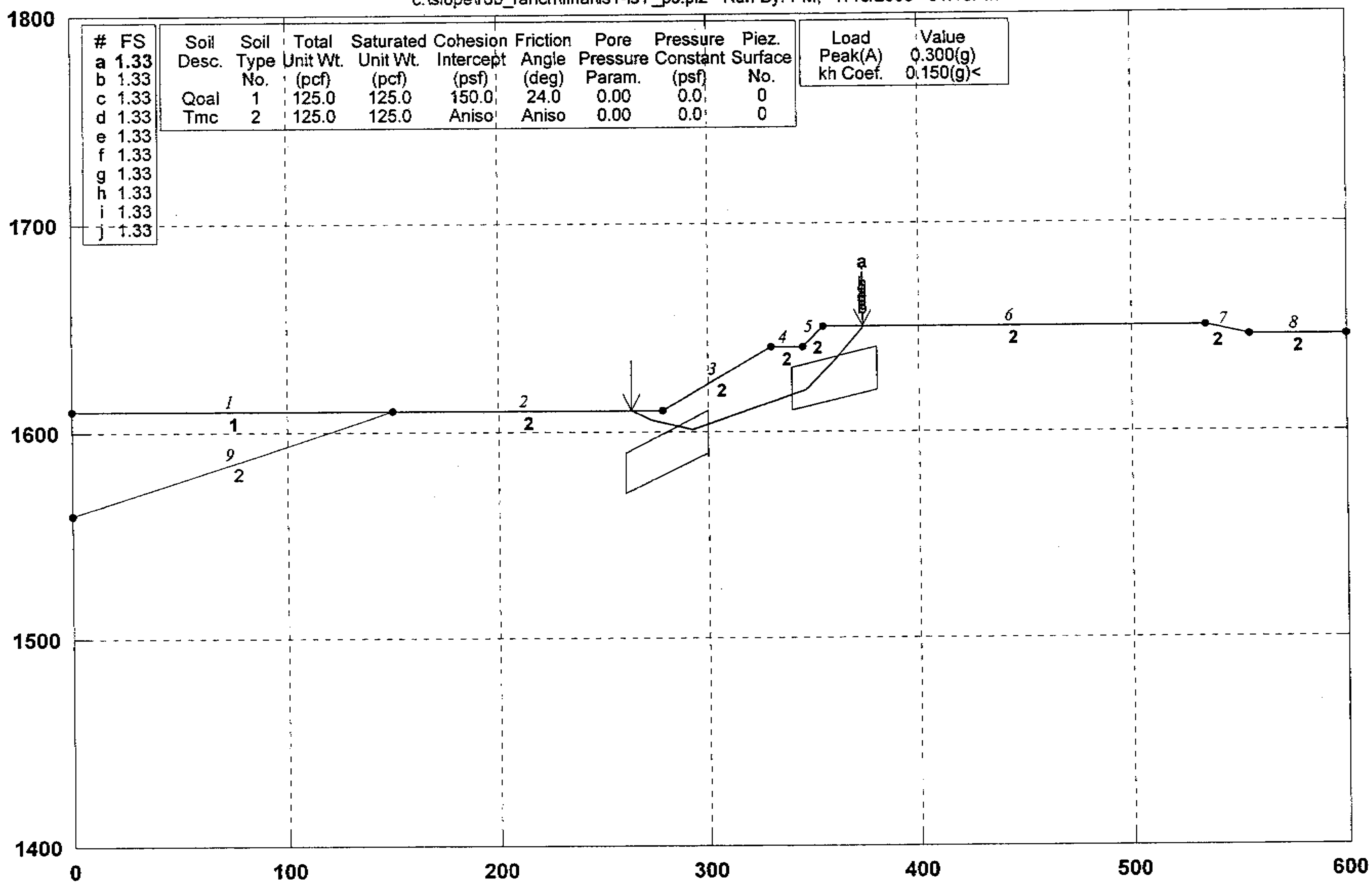
Point No.	X-Surf (ft)	Y-Surf (ft)
1	279.174	1610.677
2	291.580	1603.518
3	342.419	1619.730
4	356.449	1633.983
5	368.303	1650.000

Factor of Safety
*** 1.856 ***

**** END OF GSTABL7 OUTPUT ****

Robinson Ranch 061989-001 LS1-LS1' , PStatic

c:\slope\rob_ranch\final\ls1-ls1'_ps.pl2 Run By: PM, 7/18/2006 01:18PM



GSTABL7 v.2 FSmin=1.33

Safety Factors Are Calculated By The Simplified Janbu Method

FIG. D-2

```
                         ***  GSTABL7  ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
 ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
             (All Rights Reserved-Unauthorized Use Prohibited)
*****************************************************************************
                   SLOPE STABILITY ANALYSIS SYSTEM
      Modified Bishop, Simplified Janbu, or GLE Method of Slices.
      (Includes Spencer & Morgenstern-Price Type Analysis)
      Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
      Nonlinear Undrained Shear Strength, Curved Phi Envelope,
      Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
      Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
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Time of Run:                01:18PM
Run By:                     PM,
Input Data Filename:        C:\SLOPE\ROB_ranch\Final\ls1-ls1'_ps.in
Output Filename:            C:\SLOPE\ROB_ranch\Final\ls1-ls1'_ps.OUT
Unit System:                English
Plotted Output Filename:    C:\SLOPE\ROB_ranch\Final\ls1-ls1'_ps.PLT
PROBLEM DESCRIPTION:  Robinson Ranch 061989-001 LS1-LS1'
                     , PStatic
BOUNDARY COORDINATES
    8 Top   Boundaries
    9 Total Boundaries
Boundary     X-Left      Y-Left      X-Right     Y-Right    Soil Type
  No.         (ft)        (ft)        (ft)        (ft)      Below Bnd
   1           0.00     1610.00      150.00     1610.00        1
   2         150.00     1610.00      278.00     1610.00        2
   3         278.00     1610.00      330.00     1640.00        2
   4         330.00     1640.00      345.00     1640.00        2
   5         345.00     1640.00      355.00     1650.00        2
   6         355.00     1650.00      535.00     1650.00        2
   7         535.00     1650.00      555.00     1645.00        2
   8         555.00     1645.00      600.00     1645.00        2
   9           0.00     1560.00      150.00     1610.00        2
 User Specified Y-Origin =       1400.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  2 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure   Piez.
 Type Unit Wt. Unit Wt.  Intercept  Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)    (deg)    Param.   (psf)     No.
   1   125.0    125.0     150.0    24.0     0.00      0.0      0
   2   125.0    125.0     300.0    31.0     0.00      0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  2 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction     Counterclockwise      Cohesion       Friction
   Range        Direction Limit      Intercept        Angle
    No.             (deg)              (psf)          (deg)
     1              16.0              300.00          31.00
     2              20.0              400.00          24.00
     3              90.0              300.00          31.00
 ANISOTROPIC SOIL NOTES:
   (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
   (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
   (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
 Specified Peak Ground Acceleration Coefficient (A) =   0.300(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 5000 Trial Surfaces Have Been Generated.
 2 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  20.0
 Box         X-Left      Y-Left      X-Right     Y-Right      Height
 No.          (ft)        (ft)        (ft)        (ft)         (ft)
  1          260.00     1580.00      300.00     1600.00       20.00
  2          340.00     1620.00      380.00     1630.00       20.00
 Following Are Displayed The Ten Most Critical Of The Trial
      Failure Surfaces Evaluated. They Are
      Ordered - Most Critical First.
      * * Safety Factors Are Calculated By The Simplified Janbu Method * *
      Total Number of Trial Surfaces Attempted =  5000
      Number of Trial Surfaces With Valid FS = 5000
      Statistical Data On All Valid FS Values:
         FS Max =    2.723   FS Min =    1.327   FS Ave =    1.842
         Standard Deviation =    0.263   Coefficient of Variation =   14.27 %
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
           Individual data on the    10  slices
                        Water   Water      Tie      Tie     Earthquake
                        Force   Force     Force    Force       Force   Surcharge
Slice  Width   Weight    Top     Bot      Norm      Tan     Hor     Ver     Load
 No.   (ft)    (lbs)    (lbs)   (lbs)     (lbs)    (lbs)   (lbs)   (lbs)   (lbs)
  1     9.9    2914.4    0.0     0.0        0.       0.    437.2    0.0     0.0
  2     5.0    3301.7    0.0     0.0        0.       0.    495.2    0.0     0.0
  3    14.5   21374.0    0.0     0.0        0.       0.   3206.1    0.0     0.0
  4    37.5  103057.8    0.0     0.0        0.       0.  15458.7    0.0     0.0
  5    15.0   44322.3    0.0     0.0        0.       0.   6648.3    0.0     0.0
  6     1.5    4117.8    0.0     0.0        0.       0.    617.7    0.0     0.0
  7     8.5   23287.2    0.0     0.0        0.       0.   3493.1    0.0     0.0
  8     5.6   13488.3    0.0     0.0        0.       0.   2023.2    0.0     0.0
  9    12.7   13601.2    0.0     0.0        0.       0.   2040.2    0.0     0.0
 10     0.3      13.8    0.0     0.0        0.       0.      2.1    0.0     0.0
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
```
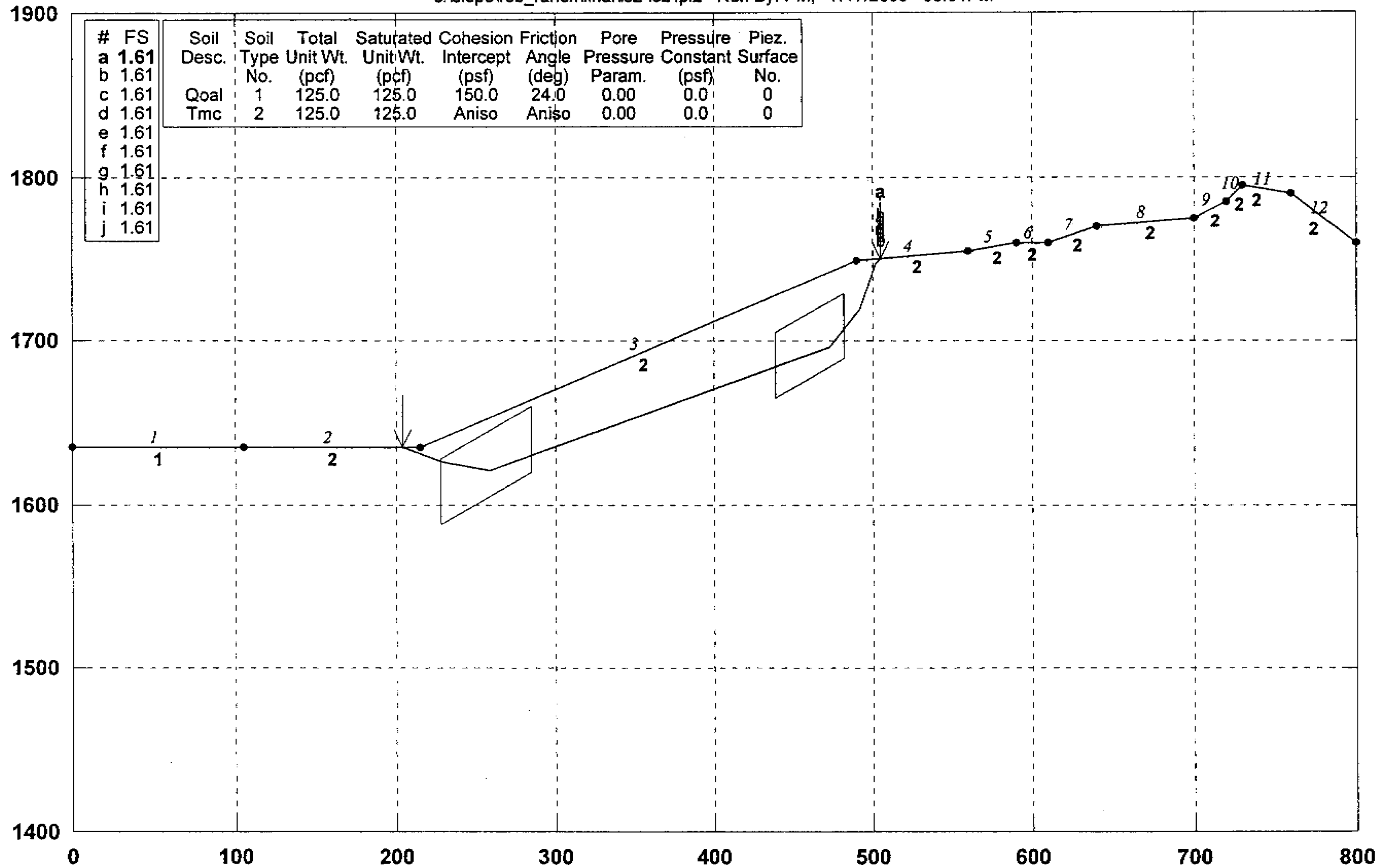



```
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
      Failure Surface Specified By  7 Coordinate Points
        Point      X-Surf       Y-Surf
         No.        (ft)         (ft)
          1        263.156      1610.000
          2        273.029      1605.277
          3        292.488      1600.657
          4        346.531      1619.512
          5        360.637      1633.690
          6        373.322      1649.153
          7        373.583      1650.000
             Factor of Safety
            ***    1.327    ***
          **** END OF GSTABL7 OUTPUT ****
```

Robinson Ranch, 061989-001, Sec LS2-LS2', Static

c:\slope\rob_ranch\final\ls2-ls2'.pl2 Run By: PM, 7/17/2006 03:31PM



GSTABL7 v.2 FSmin=1.61

Safety Factors Are Calculated By The Simplified Janbu Method

FIG D-3

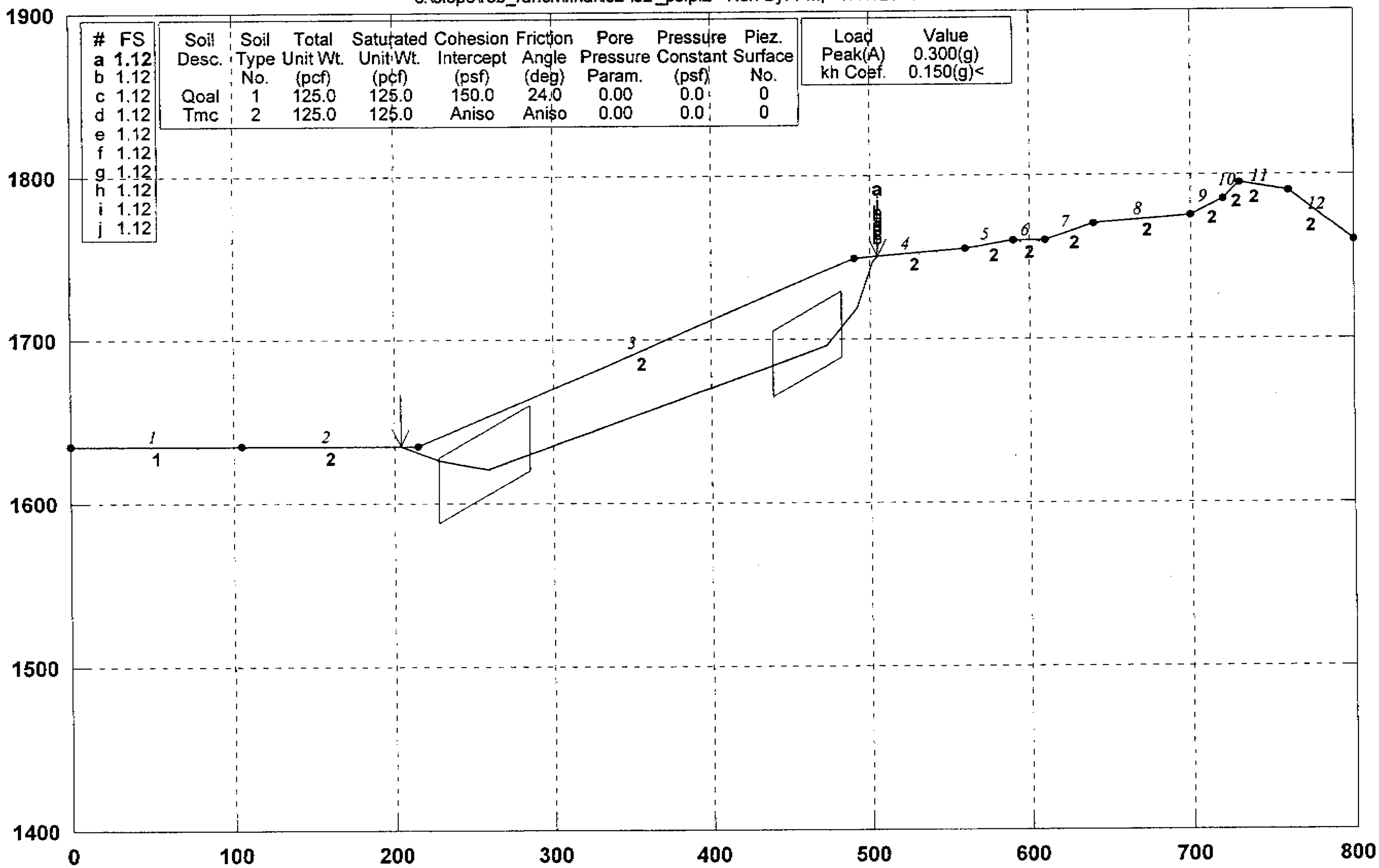
```
                         *** GSTABL7 ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
  ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
            (All Rights Reserved-Unauthorized Use Prohibited)
*********************************************************************************
                   SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*********************************************************************************
Analysis Run Date:        7/17/2006
Time of Run:              03:31PM
Run By:                   PM,
Input Data Filename:      C:\SLOPE\ROB_ranch\Final\ls2-ls2'.in
Output Filename:          C:\SLOPE\ROB_ranch\Final\ls2-ls2'.OUT
Unit System:              English
Plotted Output Filename:  C:\SLOPE\ROB_ranch\Final\ls2-ls2'.PLT
PROBLEM DESCRIPTION:  Robinson Ranch, 061989-001, Sec LS2-LS2'
                    , Static
BOUNDARY COORDINATES
   12 Top   Boundaries
   12 Total Boundaries
Boundary     X-Left     Y-Left     X-Right    Y-Right    Soil Type
  No.         (ft)       (ft)       (ft)       (ft)      Below Bnd
   1           0.00    1635.00     105.00    1635.00        1
   2         105.00    1635.00     215.00    1635.00        2
   3         215.00    1635.00     490.00    1749.00        2
   4         490.00    1749.00     560.00    1755.00        2
   5         560.00    1755.00     590.00    1760.00        2
   6         590.00    1760.00     610.00    1760.00        2
   7         610.00    1760.00     640.00    1770.00        2
   8         640.00    1770.00     700.00    1775.00        2
   9         700.00    1775.00     720.00    1785.00        2
  10         720.00    1785.00     730.00    1795.00        2
  11         730.00    1795.00     760.00    1790.00        2
  12         760.00    1790.00     800.00    1760.00        2
 User Specified Y-Origin =      1400.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  2 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore   Pressure  Piez.
 Type Unit Wt. Unit Wt. Intercept  Angle  Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)    (deg)   Param.   (psf)     No.
  1   125.0    125.0     150.0     24.0    0.00      0.0      0
  2   125.0    125.0     300.0     31.0    0.00      0.0      0
ANISOTROPIC STRENGTH PARAMETERS
    1 soil type(s)
 Soil Type  2 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion      Friction
   Range       Direction Limit     Intercept       Angle
    No.           (deg)              (psf)         (deg)
     1             16.0             300.00         31.00
     2             20.0             400.00         24.00
     3             90.0             300.00         31.00
 ANISOTROPIC SOIL NOTES:
    (1) An input value of 0.01 for C and/or Phi will cause Aniso
        C and/or Phi to be ignored in that range.
    (2) An input value of 0.02 for Phi will set both Phi and
        C equal to zero, with no water weight in the tension crack.
    (3) An input value of 0.03 for Phi will set both Phi and
        C equal to zero, with water weight in the tension crack.
 Specified Peak Ground Acceleration Coefficient (A) =   0.300(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
 EARTHQUAKE DATA HAS BEEN SUPPRESSED
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 5000 Trial Surfaces Have Been Generated.
 2 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  30.0
 Box        X-Left      Y-Left     X-Right     Y-Right       Height
 No.         (ft)        (ft)        (ft)        (ft)         (ft)
  1         228.00     1608.00     265.00     1640.00        40.00
  2         439.00     1685.00     482.00     1709.00        40.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  5000
       Number of Trial Surfaces With Valid FS = 5000
       Statistical Data On All Valid FS Values:
          FS Max =   3.027   FS Min =   1.611   FS Ave =   1.943
          Standard Deviation =    0.214   Coefficient of Variation =   10.80 %
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
            Individual data on the     8  slices
                             Water  Water        Tie      Tie      Earthquake
                             Force  Force       Force    Force       Force   Surcharge
Slice  Width    Weight       Top    Bot         Norm      Tan     Hor     Ver     Load
 No.   (ft)     (lbs)       (lbs)  (lbs)       (lbs)     (lbs)   (lbs)   (lbs)   (lbs)
  1    10.6    2610.4        0.0    0.0         0.        0.      0.0     0.0     0.0
  2    14.0   16520.2        0.0    0.0         0.        0.      0.0     0.0     0.0
  3    29.5   87510.1        0.0    0.0         0.        0.      0.0     0.0     0.0
  4   214.1 1042002.0        0.0    0.0         0.        0.      0.0     0.0     0.0
  5    17.4   84838.9        0.0    0.0         0.        0.      0.0     0.0     0.0
  6     2.2    8465.4        0.0    0.0         0.        0.      0.0     0.0     0.0
  7    10.1   20710.8        0.0    0.0         0.        0.      0.0     0.0     0.0
  8     2.6     452.8        0.0    0.0         0.        0.      0.0     0.0     0.0
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
```



```
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
       Failure Surface Specified By  7 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         204.433     1635.000
           2         228.969     1625.822
           3         258.514     1620.617
           4         472.581     1696.318
           5         492.163     1719.045
           6         502.240     1747.302
           7         504.877     1750.275
              Factor of Safety
             ***    1.611    ***
           **** END OF GSTABL7 OUTPUT ****
```

Robinson Ranch, 061989-001, Sec LS2-LS2', Pseudostatic

c:\slope\rob_ranch\final\ls2-ls2'_ps.pl2 Run By: PM, 7/17/2006 03:32PM



GSTABL7 v.2 FSmin=1.12
Safety Factors Are Calculated By The Simplified Janbu Method

FIG D-4

*** GSTABL7 ***
** GSTABL7 by Garry H. Gregory, P.E. **
** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **

****

SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
****

Analysis Run Date: 7/17/2006
Time of Run: 03:32PM
Run By: PM,
Input Data Filename: C:\SLOPE\ROB_ranch\Final\ls2-ls2'_ps.in
Output Filename: C:\SLOPE\ROB_ranch\Final\ls2-ls2'_ps.OUT
Unit System: English
Plotted Output Filename: C:\SLOPE\ROB_ranch\Final\ls2-ls2'_ps.PLT
PROBLEM DESCRIPTION: Robinson Ranch, 061989-001, Sec LS2-LS2' , Pseudostatic

BOUNDARY COORDINATES
12 Top Boundaries
12 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	1635.00	105.00	1635.00	1
2	105.00	1635.00	215.00	1635.00	2
3	215.00	1635.00	490.00	1749.00	2
4	490.00	1749.00	560.00	1755.00	2
5	560.00	1755.00	590.00	1760.00	2
6	590.00	1760.00	610.00	1760.00	2
7	610.00	1760.00	640.00	1770.00	2
8	640.00	1770.00	700.00	1775.00	2
9	700.00	1775.00	720.00	1785.00	2
10	720.00	1785.00	730.00	1795.00	2
11	730.00	1795.00	760.00	1790.00	2
12	760.00	1790.00	800.00	1760.00	2

User Specified Y-Origin = 1400.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	150.0	24.0	0.00	0.0	0
2	125.0	125.0	300.0	31.0	0.00	0.0	0

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 2 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	16.0	300.00	31.00
2	20.0	400.00	24.00
3	90.0	300.00	31.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

Specified Peak Ground Acceleration Coefficient (A) = 0.300(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 30.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	226.00	1608.00	285.00	1640.00	40.00
2	439.00	1685.00	482.00	1709.00	40.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 1.652 FS Min = 1.117 FS Ave = 1.379
Standard Deviation = 0.133 Coefficient of Variation = 9.62 %

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Individual data on the 8 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	10.6	2610.4	0.0	0.0	0.	0.	391.6	0.0	0.0
2	14.0	16520.2	0.0	0.0	0.	0.	2478.0	0.0	0.0
3	29.5	87510.1	0.0	0.0	0.	0.	13126.5	0.0	0.0
4	214.1	1042002.0	0.0	0.0	0.	0.	*******	0.0	0.0
5	17.4	84838.9	0.0	0.0	0.	0.	12725.8	0.0	0.0
6	2.2	8465.4	0.0	0.0	0.	0.	1269.8	0.0	0.0
7	10.1	20710.8	0.0	0.0	0.	0.	3106.6	0.0	0.0
8	2.6	452.8	0.0	0.0	0.	0.	67.9	0.0	0.0

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302

Point No.	X-Surf (ft)	Y-Surf (ft)
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

Failure Surface Specified By 7 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	204.433	1635.000
2	228.969	1625.822
3	258.514	1620.617
4	472.581	1696.318
5	492.163	1719.045
6	502.240	1747.302
7	504.877	1750.275

Factor of Safety
*** 1.117 ***

**** END OF GSTABL7 OUTPUT ****

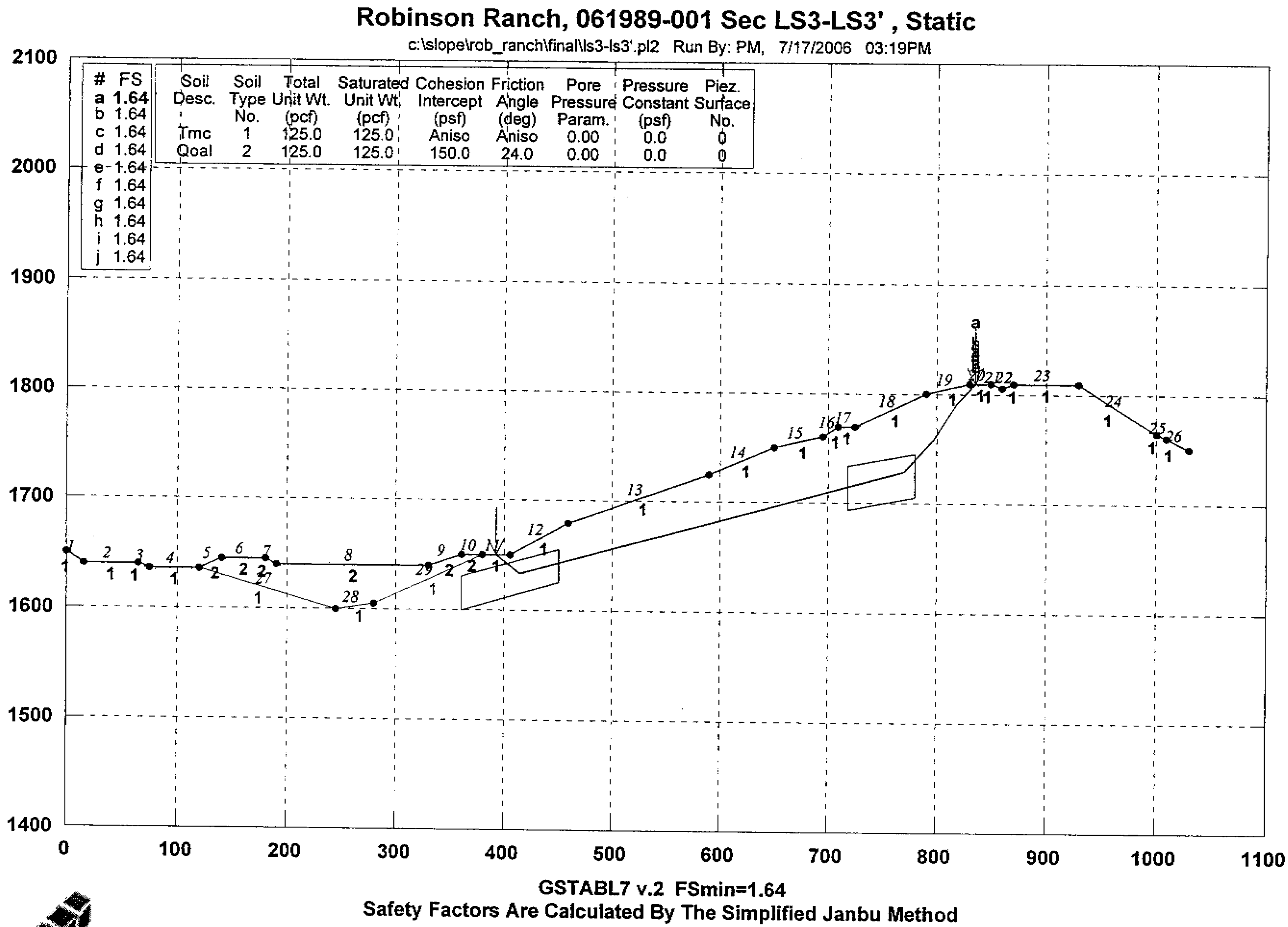

Robinson Ranch, 061989-001 Sec LS3-LS3' , Static
c:\slope\rob_ranch\final\ls3-ls3'.pl2 Run By: PM, 7/17/2006 03:19PM
FS
a 1.64
b 1.64
c 1.64
d 1.64
e 1.64
f 1.64
g 1.64
h 1.64
i 1.64
j 1.64
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Tmc 1 125.0 125.0 Aniso Aniso 0.00 0.0 0
Qoal 2 125.0 125.0 150.0 24.0 0.00 0.0 0
2100
2000
1900
1800
1700
1600
1500
1400
0
100
200
300
400
500
600
700
800
900
1000
1100
GSTABL7 v.2 FSmin=1.64
Safety Factors Are Calculated By The Simplified Janbu Method

FIG D-5

```
                        ***  GSTABL7  ***
              ** GSTABL7 by Garry H. Gregory, P.E. **
  ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
            (All Rights Reserved-Unauthorized Use Prohibited)
*********************************************************************************
                  SLOPE STABILITY ANALYSIS SYSTEM
      Modified Bishop, Simplified Janbu, or GLE Method of Slices.
      (Includes Spencer & Morgenstern-Price Type Analysis)
      Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
      Nonlinear Undrained Shear Strength, Curved Phi Envelope,
      Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
      Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*********************************************************************************
Analysis Run Date:          7/17/2006
Time of Run:                03:19PM
Run By:                     PM,
Input Data Filename:        C:\SLOPE\ROB_ranch\Final\ls3-ls3'.in
Output Filename:            C:\SLOPE\ROB_ranch\Final\ls3-ls3'.OUT
Unit System:                English
Plotted Output Filename:    C:\SLOPE\ROB_ranch\Final\ls3-ls3'.PLT
PROBLEM DESCRIPTION:  Robinson Ranch, D61989-001 Sec LS3-LS3'
                    , Static
BOUNDARY COORDINATES
   26 Top   Boundaries
   29 Total Boundaries
Boundary     X-Left      Y-Left      X-Right     Y-Right     Soil Type
   No.        (ft)        (ft)        (ft)        (ft)       Below Bnd
    1          0.00     1650.00       15.00     1640.00          1
    2         15.00     1640.00       65.00     1640.00          1
    3         65.00     1640.00       75.00     1635.00          1
    4         75.00     1635.00      120.00     1635.00          1
    5        120.00     1635.00      140.00     1645.00          2
    6        140.00     1645.00      180.00     1645.00          2
    7        180.00     1645.00      190.00     1640.00          2
    8        190.00     1640.00      330.00     1640.00          2
    9        330.00     1640.00      360.00     1650.00          2
   10        360.00     1650.00      380.00     1650.00          2
   11        380.00     1650.00      405.00     1650.00          1
   12        405.00     1650.00      460.00     1680.00          1
   13        460.00     1680.00      590.00     1725.00          1
   14        590.00     1725.00      650.00     1750.00          1
   15        650.00     1750.00      695.00     1760.00          1
   16        695.00     1760.00      710.00     1770.00          1
   17        710.00     1770.00      725.00     1770.00          1
   18        725.00     1770.00      790.00     1800.00          1
   19        790.00     1800.00      830.00     1810.00          1
   20        830.00     1810.00      850.00     1810.00          1
   21        850.00     1810.00      860.00     1805.00          1
   22        860.00     1805.00      870.00     1810.00          1
   23        870.00     1810.00      930.00     1810.00          1
   24        930.00     1810.00     1000.00     1765.00          1
   25       1000.00     1765.00     1010.00     1760.00          1
   26       1010.00     1760.00     1030.00     1750.00          1
   27        120.00     1635.00      245.00     1600.00          1
   28        245.00     1600.00      280.00     1605.00          1
   29        280.00     1605.00      380.00     1650.00          1
 User Specified Y-Origin =      1400.00(ft)
 Default X-Plus Value = 0.00(ft)
 Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
  2 Type(s) of Soil
 Soil  Total  Saturated  Cohesion Friction   Pore    Pressure   Piez.
 Type Unit Wt. Unit Wt. Intercept  Angle   Pressure Constant Surface
  No.  (pcf)    (pcf)     (psf)    (deg)    Param.    (psf)     No.
  1    125.0    125.0     300.0    31.0     0.00       0.0      0
  2    125.0    125.0     150.0    24.0     0.00       0.0      0
ANISOTROPIC STRENGTH PARAMETERS
     1 soil type(s)
 Soil Type  1 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion      Friction
   Range      Direction Limit      Intercept       Angle
    No.            (deg)             (psf)         (deg)
     1             13.0             300.00         31.00
     2             17.0             400.00         24.00
     3             90.0             300.00         31.00
 ANISOTROPIC SOIL NOTES:
   (1) An input value of 0.01 for C and/or Phi will cause Aniso
       C and/or Phi to be ignored in that range.
   (2) An input value of 0.02 for Phi will set both Phi and
       C equal to zero, with no water weight in the tension crack.
   (3) An input value of 0.03 for Phi will set both Phi and
       C equal to zero, with water weight in the tension crack.
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 9000 Trial Surfaces Have Been Generated.
 2 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  40.0
 Box        X-Left      Y-Left     X-Right     Y-Right      Height
 No.         (ft)        (ft)        (ft)        (ft)        (ft)
  1         360.00     1615.00     450.00     1640.00       30.00
  2         718.00     1713.00     780.00     1725.00       40.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  9000
       Number of Trial Failure Surfaces is Greater Than 5000.
       Statistical Data on FS Values Are Not Generated.
       To Generate Stastical Data, Reduce Number of Trial
       Failure Surfaces to 5000 or less.
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
           Individual data on the    14  slices
                        Water   Water     Tie      Tie     Earthquake
                        Force   Force    Force    Force       Force   Surcharge
Slice  Width   Weight    Top     Bot     Norm      Tan     Hor     Ver    Load
 No.   (ft)    (lbs)    (lbs)   (lbs)    (lbs)    (lbs)   (lbs)   (lbs)   (lbs)
  1    12.2    7314.3    0.0     0.0       0.       0.     0.0     0.0     0.0
  2     9.8   19843.2    0.0     0.0       0.       0.     0.0     0.0     0.0
  3    45.2  163621.4    0.0     0.0       0.       0.     0.0     0.0     0.0
  4   130.0  653570.6    0.0     0.0       0.       0.     0.0     0.0     0.0
  5    60.0  372398.1    0.0     0.0       0.       0.     0.0     0.0     0.0
```



```
  6    45.0  298260.3    0.0     0.0       0.       0.     0.0     0.0     0.0
  7    15.0  103031.8    0.0     0.0       0.       0.     0.0     0.0     0.0
  8    15.0  104837.7    0.0     0.0       0.       0.     0.0     0.0     0.0
  9    44.8  325784.2    0.0     0.0       0.       0.     0.0     0.0     0.0
 10    20.2  141221.0    0.0     0.0       0.       0.     0.0     0.0     0.0
 11     6.4   37389.6    0.0     0.0       0.       0.     0.0     0.0     0.0
 12    22.8   85472.2    0.0     0.0       0.       0.     0.0     0.0     0.0
 13    10.8   15273.6    0.0     0.0       0.       0.     0.0     0.0     0.0
 14     5.2    2007.4    0.0     0.0       0.       0.     0.0     0.0     0.0
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
       Failure Surface Specified By  6 Coordinate Points
         Point        X-Surf       Y-Surf
          No.          (ft)         (ft)
           1         392.830     1650.000
           2         414.816     1632.627
           3         769.779     1728.156
           4         796.442     1757.974
           5         819.206     1790.864
           6         835.178     1810.000
              Factor of Safety
            ***     1.640   ***
                **** END OF GSTABL7 OUTPUT ****
```

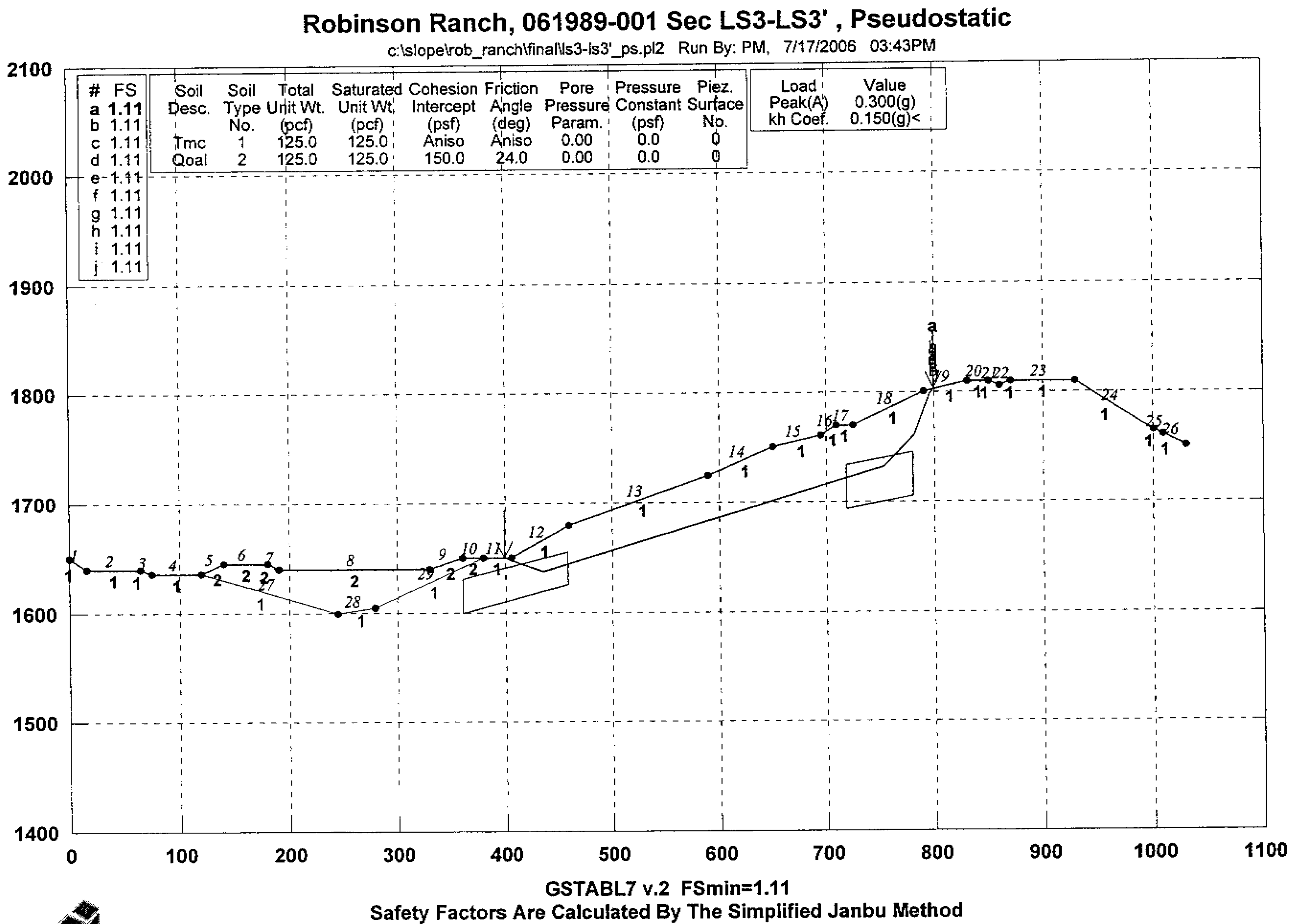

Robinson Ranch, 061989-001 Sec LS3-LS3' , Pseudostatic
c:\slope\rob_ranch\final\ls3-ls3'_ps.pl2 Run By: PM, 7/17/2006 03:43PM
FS
a 1.11
b 1.11
c 1.11
d 1.11
e 1.11
f 1.11
g 1.11
h 1.11
i 1.11
j 1.11
Soil Desc. | Soil Type No. | Total Unit Wt. (pcf) | Saturated Unit Wt. (pcf) | Cohesion Intercept (psf) | Friction Angle (deg) | Pore Pressure Param. | Pressure Constant (psf) | Piez. Surface No.
Tmc 1 125.0 125.0 Aniso Aniso 0.00 0.0 0
Qoal 2 125.0 125.0 150.0 24.0 0.00 0.0 0
Load Value
Peak(A) 0.300(g)
kh Coef. 0.150(g)<
2100
2000
1900
1800
1700
1600
1500
1400
0
100
200
300
400
500
600
700
800
900
1000
1100
GSTABL7 v.2 FSmin=1.11
Safety Factors Are Calculated By The Simplified Janbu Method

FIG D-6

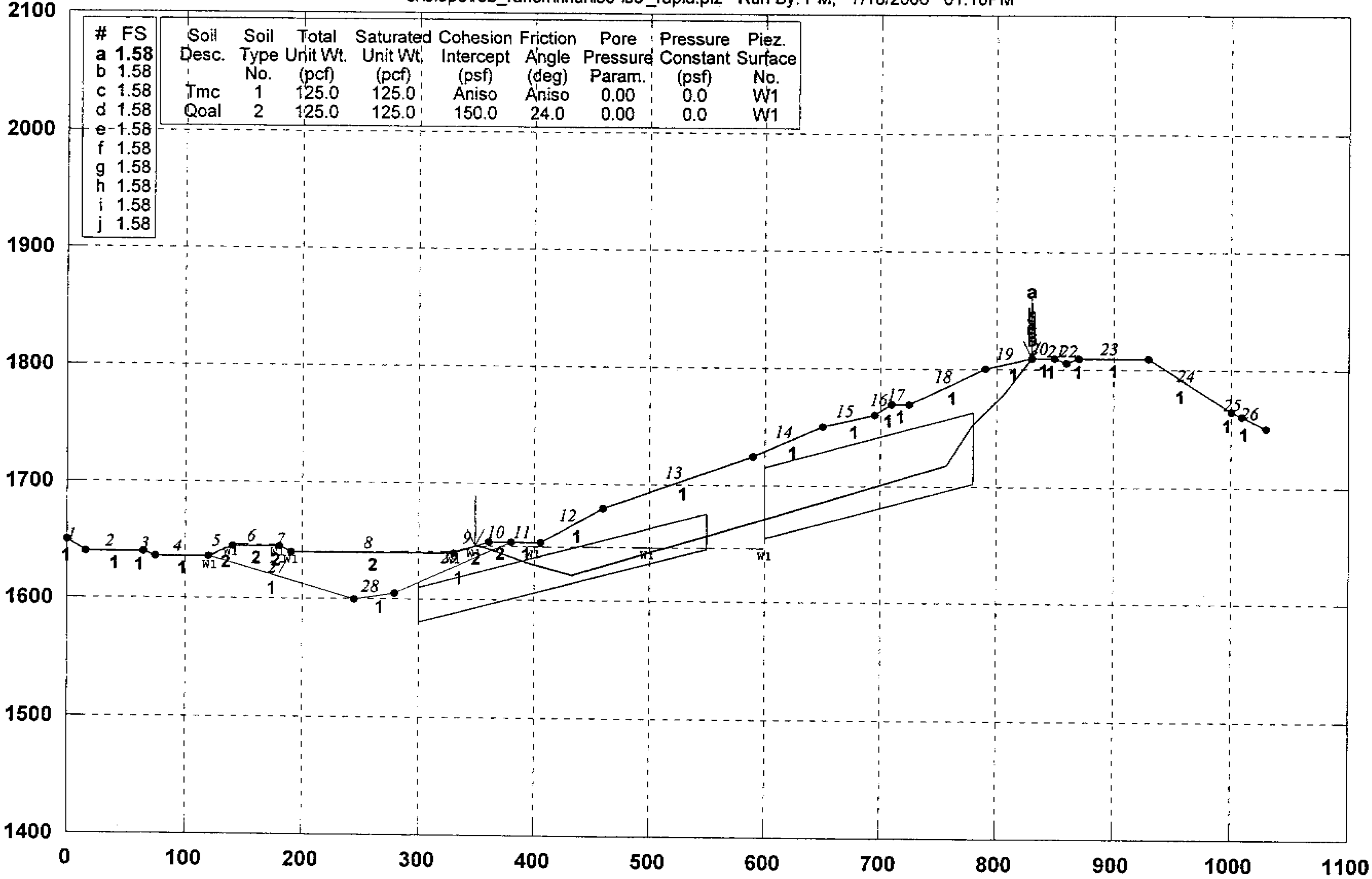
```
                         ***  GSTABL7  ***
               ** GSTABL7 by Garry H. Gregory, P.E. **
    ** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **
                (All Rights Reserved-Unauthorized Use Prohibited)
*********************************************************************************
                   SLOPE STABILITY ANALYSIS SYSTEM
        Modified Bishop, Simplified Janbu, or GLE Method of Slices.
        (Includes Spencer & Morgenstern-Price Type Analysis)
        Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
        Nonlinear Undrained Shear Strength, Curved Phi Envelope,
        Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
        Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.
*********************************************************************************
Analysis Run Date:          7/17/2006
Time of Run:                03:43PM
Run By:                     PM,
Input Data Filename:        C:\SLOPE\ROB_ranch\Final\ls3-ls3'_ps.in
Output Filename:            C:\SLOPE\ROB_ranch\Final\ls3-ls3'_ps.OUT
Unit System:                English
Plotted Output Filename:    C:\SLOPE\ROB_ranch\Final\ls3-ls3'_ps.PLT
PROBLEM DESCRIPTION:  Robinson Ranch, 061989-001 Sec LS3-LS3'
                    , Pseudostatic
BOUNDARY COORDINATES
   26 Top   Boundaries
   29 Total Boundaries
Boundary     X-Left      Y-Left      X-Right     Y-Right     Soil Type
  No.         (ft)        (ft)        (ft)        (ft)       Below Bnd
   1          0.00     1650.00       15.00     1640.00          1
   2         15.00     1640.00       65.00     1640.00          1
   3         65.00     1640.00       75.00     1635.00          1
   4         75.00     1635.00      120.00     1635.00          1
   5        120.00     1635.00      140.00     1645.00          2
   6        140.00     1645.00      180.00     1645.00          2
   7        180.00     1645.00      190.00     1640.00          2
   8        190.00     1640.00      330.00     1640.00          2
   9        330.00     1640.00      360.00     1650.00          2
  10        360.00     1650.00      380.00     1650.00          2
  11        380.00     1650.00      405.00     1650.00          1
  12        405.00     1650.00      460.00     1680.00          1
  13        460.00     1680.00      590.00     1725.00          1
  14        590.00     1725.00      650.00     1750.00          1
  15        650.00     1750.00      695.00     1760.00          1
  16        695.00     1760.00      710.00     1770.00          1
  17        710.00     1770.00      725.00     1770.00          1
  18        725.00     1770.00      790.00     1800.00          1
  19        790.00     1800.00      830.00     1810.00          1
  20        830.00     1810.00      850.00     1810.00          1
  21        850.00     1810.00      860.00     1805.00          1
  22        860.00     1805.00      870.00     1810.00          1
  23        870.00     1810.00      930.00     1810.00          1
  24        930.00     1810.00     1000.00     1765.00          1
  25       1000.00     1765.00     1010.00     1760.00          1
  26       1010.00     1760.00     1030.00     1750.00          1
  27        120.00     1635.00      245.00     1600.00          1
  28        245.00     1600.00      280.00     1605.00          1
  29        280.00     1605.00      380.00     1650.00          1
User Specified Y-Origin =      1400.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)
ISOTROPIC SOIL PARAMETERS
 2 Type(s) of Soil
Soil  Total  Saturated  Cohesion Friction   Pore    Pressure   Piez.
Type Unit Wt. Unit Wt.  Intercept  Angle  Pressure Constant  Surface
 No.  (pcf)    (pcf)     (psf)    (deg)    Param.    (psf)      No.
  1   125.0    125.0     300.0     31.0     0.00      0.0        0
  2   125.0    125.0     150.0     24.0     0.00      0.0        0
ANISOTROPIC STRENGTH PARAMETERS
    1 soil type(s)
 Soil Type  1 Is Anisotropic
 Number Of Direction Ranges Specified =  3
 Direction    Counterclockwise     Cohesion      Friction
   Range       Direction Limit     Intercept       Angle
    No.            (deg)             (psf)         (deg)
     1              13.0            300.00         31.00
     2              17.0            400.00         24.00
     3              90.0            300.00         31.00
 ANISOTROPIC SOIL NOTES:
   (1) An input value of 0.01 for C and/or Phi will cause Aniso
       C and/or Phi to be ignored in that range.
   (2) An input value of 0.02 for Phi will set both Phi and
       C equal to zero, with no water weight in the tension crack.
   (3) An input value of 0.03 for Phi will set both Phi and
       C equal to zero, with water weight in the tension crack.
 Specified Peak Ground Acceleration Coefficient (A) =   0.300(g)
 Specified Horizontal Earthquake Coefficient (kh) =   0.150(g)
 Specified Vertical Earthquake Coefficient (kv) =   0.000(g)
 Specified Seismic Pore-Pressure Factor =   0.000
 A Critical Failure Surface Searching Method, Using A Random
 Technique For Generating Sliding Block Surfaces, Has Been
 Specified.
 9000 Trial Surfaces Have Been Generated.
 2 Boxes Specified For Generation Of Central Block Base
 Length Of Line Segments For Active And Passive Portions Of
 Sliding Block Is  40.0
 Box        X-Left      Y-Left      X-Right     Y-Right      Height
 No.         (ft)        (ft)        (ft)        (ft)         (ft)
  1        360.00     1615.00      458.00     1640.00        30.00
  2        718.00     1713.00      780.00     1725.00        40.00
 Following Are Displayed The Ten Most Critical Of The Trial
       Failure Surfaces Evaluated. They Are
       Ordered - Most Critical First.
       * * Safety Factors Are Calculated By The Simplified Janbu Method * *
       Total Number of Trial Surfaces Attempted =  9000
       Number of Trial Failure Surfaces is Greater Than 5000.
       Statistical Data on FS Values are Not Generated.
       To Generate Stastical Data, Reduce Number of Trial
       Failure Surfaces to 5000 or less.
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
           Individual data on the     13  slices
                        Water   Water       Tie       Tie       Earthquake
                        Force   Force      Force     Force        Force    Surcharge
Slice  Width   Weight    Top     Bot       Norm       Tan      Hor      Ver      Load
 No.    (ft)    (lbs)   (lbs)   (lbs)      (lbs)     (lbs)    (lbs)    (lbs)    (lbs)
  1      5.8    811.0    0.0     0.0         0.         0.    121.7     0.0      0.0
```



```
  2     29.7   59109.6    0.0     0.0        0.         0.   8866.4     0.0      0.0
  3     25.3  103695.2    0.0     0.0        0.         0.  15554.3     0.0      0.0
  4    130.0  628993.2    0.0     0.0        0.         0.  94349.0     0.0      0.0
  5     60.0  337702.3    0.0     0.0        0.         0.  50655.4     0.0      0.0
  6     45.0  262559.5    0.0     0.0        0.         0.  39383.9     0.0      0.0
  7     15.0   89288.2    0.0     0.0        0.         0.  13393.2     0.0      0.0
  8     15.0   90172.4    0.0     0.0        0.         0.  13525.9     0.0      0.0
  9     28.3  170361.0    0.0     0.0        0.         0.  25554.2     0.0      0.0
 10     28.2  150505.2    0.0     0.0        0.         0.  22575.8     0.0      0.0
 11      8.5   27761.0    0.0     0.0        0.         0.   4164.1     0.0      0.0
 12      6.3    8156.3    0.0     0.0        0.         0.   1223.4     0.0      0.0
 13      3.2     665.2    0.0     0.0        0.         0.     99.8     0.0      0.0
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
       Failure Surface Specified By  6 Coordinate Points
         Point       X-Surf       Y-Surf
          No.         (ft)         (ft)
           1        399.153     1650.000
           2        434.666     1636.521
           3        753.340     1732.728
           4        781.550     1761.087
           5        796.264     1798.283
           6        799.505     1802.376
              Factor of Safety
            ***     1.113    ***
           **** END OF GSTABL7 OUTPUT ****
```

Robinson Ranch 061989-001 LS3 - LS3' , Static Rapid Drawdown

c:\slope\rob_ranch\final\ls3-ls3'_rapid.pl2 Run By: PM, 7/18/2006 01:10PM



GSTABL7 v.2 FSmin=1.58

Safety Factors Are Calculated By The Simplified Janbu Method

FIG D-7

*** GSTABL7 ***
** GSTABL7 by Garry H. Gregory, P.E. **
** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **

****

SLOPE STABILITY ANALYSIS SYSTEM
Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 7/18/2006
Time of Run: 01:10PM
Run By: PH,
Input Data Filename: C:\SLOPE\ROB_ranch\Final\ls3-ls3'_rapid.in
Output Filename: C:\SLOPE\ROB_ranch\Final\ls3-ls3'_rapid.OUT
Unit System: English
Plotted Output Filename: C:\SLOPE\ROB_ranch\Final\ls3-ls3'_rapid.PLT
PROBLEM DESCRIPTION: Robinson Ranch 061989-001 LS3 - LS3'
, Static Rapid Drawdown

BOUNDARY COORDINATES
26 Top Boundaries
29 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	1650.00	15.00	1640.00	1
2	15.00	1640.00	65.00	1640.00	1
3	65.00	1640.00	75.00	1635.00	1
4	75.00	1635.00	120.00	1635.00	1
5	120.00	1635.00	140.00	1645.00	2
6	140.00	1645.00	180.00	1645.00	2
7	180.00	1645.00	190.00	1640.00	2
8	190.00	1640.00	330.00	1640.00	2
9	330.00	1640.00	360.00	1650.00	2
10	360.00	1650.00	380.00	1650.00	2
11	380.00	1650.00	405.00	1650.00	1
12	405.00	1650.00	460.00	1680.00	1
13	460.00	1680.00	590.00	1725.00	1
14	590.00	1725.00	650.00	1750.00	1
15	650.00	1750.00	695.00	1760.00	1
16	695.00	1760.00	710.00	1770.00	1
17	710.00	1770.00	725.00	1770.00	1
18	725.00	1770.00	790.00	1800.00	1
19	790.00	1800.00	830.00	1810.00	1
20	830.00	1810.00	850.00	1810.00	1
21	850.00	1810.00	860.00	1805.00	1
22	860.00	1805.00	870.00	1810.00	1
23	870.00	1810.00	930.00	1810.00	1
24	930.00	1810.00	1000.00	1765.00	1
25	1000.00	1765.00	1010.00	1760.00	1
26	1010.00	1760.00	1030.00	1750.00	1
27	120.00	1635.00	245.00	1600.00	1
28	245.00	1600.00	280.00	1605.00	1
29	280.00	1605.00	380.00	1650.00	1

User Specified Y-Origin = 1400.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	300.0	31.0	0.00	0.0	1
2	125.0	125.0	150.0	24.0	0.00	0.0	1

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 1 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	13.0	300.00	31.00
2	17.0	400.00	24.00
3	90.0	300.00	31.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

1 PIEZOMETRIC SURFACE(S) SPECIFIED
Unit Weight of Water = 62.40 (pcf)
Piezometric Surface No. 1 Specified by 9 Coordinate Points
Pore Pressure Inclination Factor = 0.50

Point No.	X-Water (ft)	Y-Water (ft)
1	120.74	1634.24
2	138.79	1645.45
3	178.75	1645.45
4	190.35	1639.85
5	329.57	1641.25
6	347.62	1645.45
7	399.18	1645.45
8	498.44	1645.45
9	600.00	1645.45

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 40.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	300.00	1595.00	550.00	1660.00	30.00
2	600.00	1685.00	780.00	1733.06	60.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 6.813 FS Min = 1.582 FS Ave = 2.173
Standard Deviation = 0.425 Coefficient of Variation = 19.55 %

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281

Point No.	X-Surf (ft)	Y-Surf (ft)
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.582 ***

Individual data on the 24 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.3	673.0	0.0	0.0	0.	0.	0.0	0.0	0.0
2	2.8	1132.1	0.0	59.3	0.	0.	0.0	0.0	0.0
3	3.4	2249.8	0.0	290.8	0.	0.	0.0	0.0	0.0
4	3.2	2769.1	0.0	515.6	0.	0.	0.0	0.0	0.0
5	6.7	7390.0	0.0	1889.3	0.	0.	0.0	0.0	0.0
6	10.1	14918.5	0.0	4861.9	0.	0.	0.0	0.0	0.0
7	14.2	28764.8	0.0	10961.6	0.	0.	0.0	0.0	0.0
8	4.9	11987.3	0.0	4742.5	0.	0.	0.0	0.0	0.0
9	5.8	15157.0	0.0	6124.5	0.	0.	0.0	0.0	0.0
10	27.9	114791.7	0.0	37475.1	0.	0.	0.0	0.0	0.0
11	27.1	161602.5	0.0	36228.7	0.	0.	0.0	0.0	0.0
12	38.4	249023.0	0.0	26607.9	0.	0.	0.0	0.0	0.0
13	16.1	106798.8	0.0	2540.2	0.	0.	0.0	0.0	0.0
14	75.5	520125.7	0.0	0.0	0.	0.	0.0	0.0	0.0
15	60.0	452499.4	0.0	0.0	0.	0.	0.0	0.0	0.0
16	45.0	348997.2	0.0	0.0	0.	0.	0.0	0.0	0.0
17	15.0	118165.3	0.0	0.0	0.	0.	0.0	0.0	0.0
18	15.0	119081.7	0.0	0.0	0.	0.	0.0	0.0	0.0
19	31.7	253167.9	0.0	0.0	0.	0.	0.0	0.0	0.0
20	22.7	156410.0	0.0	0.0	0.	0.	0.0	0.0	0.0
21	10.6	53954.3	0.0	0.0	0.	0.	0.0	0.0	0.0
22	17.2	66998.8	0.0	0.0	0.	0.	0.0	0.0	0.0
23	22.8	35723.6	0.0	0.0	0.	0.	0.0	0.0	0.0
24	0.6	30.5	0.0	0.0	0.	0.	0.0	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.582 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.582 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.582 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.582 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.582 ***

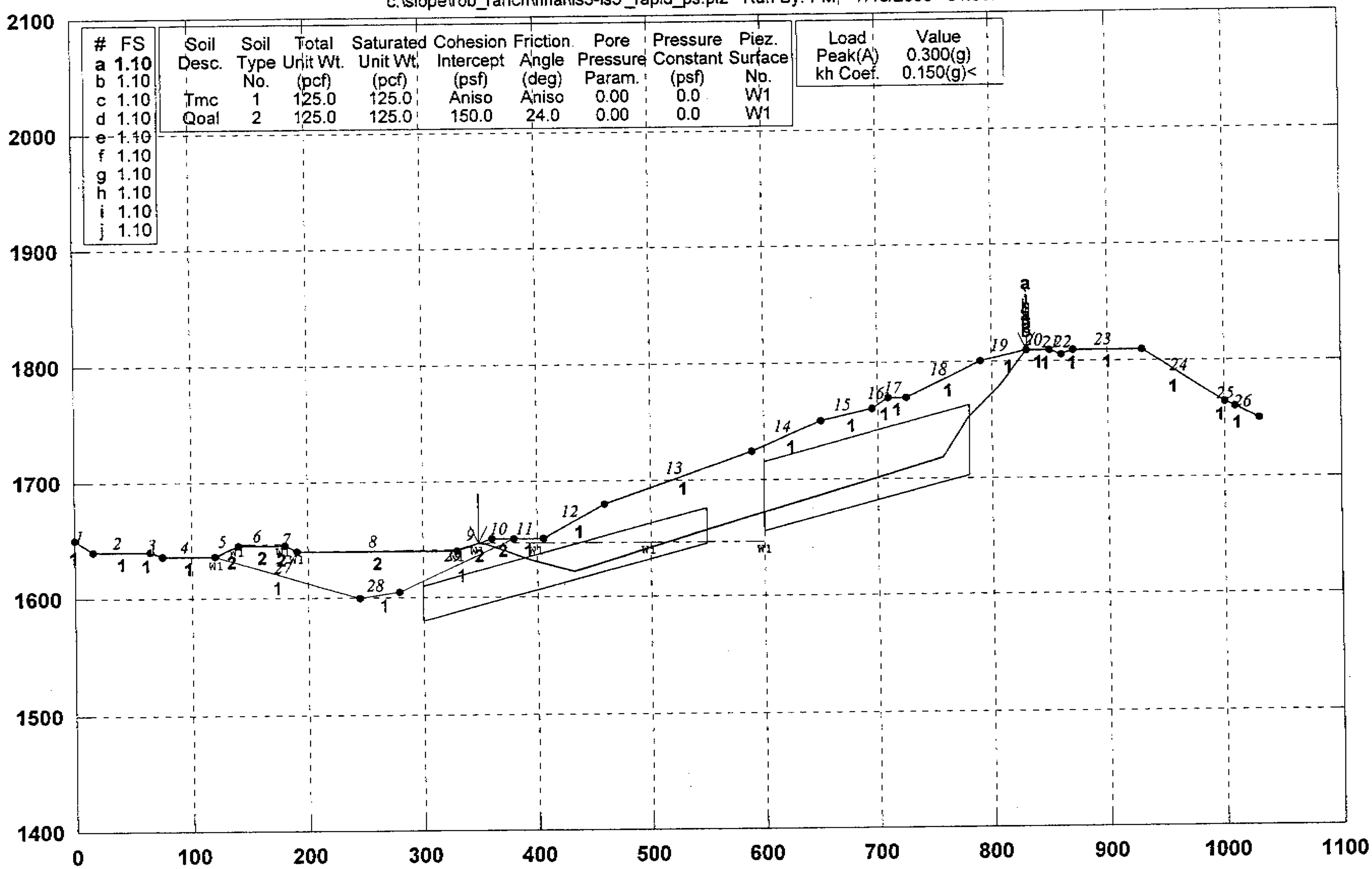
Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986

```
     8         830.616      1810.000
          Factor of Safety
        ***     1.582    ***
Failure Surface Specified By  8 Coordinate Points
   Point       X-Surf       Y-Surf
    No.         (ft)         (ft)
     1         349.500      1646.500
     2         356.580      1644.781
     3         394.233      1631.281
     4         432.858      1620.884
     5         756.742      1718.292
     6         779.440      1751.228
     7         807.242      1779.986
     8         830.616      1810.000
          Factor of Safety
        ***     1.582    ***
Failure Surface Specified By  8 Coordinate Points
   Point       X-Surf       Y-Surf
    No.         (ft)         (ft)
     1         349.500      1646.500
     2         356.580      1644.781
     3         394.233      1631.281
     4         432.858      1620.884
     5         756.742      1718.292
     6         779.440      1751.228
     7         807.242      1779.986
     8         830.616      1810.000
          Factor of Safety
        ***     1.582    ***
            **** END OF GSTABL7 OUTPUT ****
```

Robinson Ranch 061989-001 LS3 - LS3', PStatic Rapid Drawdown

c:\slope\rob_ranch\final\ls3-ls3'_rapid_ps.pl2 Run By: PM, 7/18/2006 01:30PM



GSTABL7 v.2 FSmin=1.10

Safety Factors Are Calculated By The Simplified Janbu Method

FIG D-8

*** GSTABL7 ***

** GSTABL7 by Garry H. Gregory, P.E. **

** Original Version 1.0, January 1996; Current Version 2.004, June 2003 **

****

SLOPE STABILITY ANALYSIS SYSTEM

Modified Bishop, Simplified Janbu, or GLE Method of Slices.
(Includes Spencer & Morgenstern-Price Type Analysis)
Including Pier/Pile, Reinforcement, Soil Nail, Tieback,
Nonlinear Undrained Shear Strength, Curved Phi Envelope,
Anisotropic Soil, Fiber-Reinforced Soil, Boundary Loads, Water
Surfaces, Pseudo-Static & Newmark Earthquake, and Applied Forces.

****

Analysis Run Date: 7/18/2006
Time of Run: 01:30PM
Run By: PH,
Input Data Filename: c:\SLOPE\ROB_ranch\Final\ls3-ls3'_rapid_ps.in
Output Filename: c:\SLOPE\ROB_ranch\Final\ls3-ls3'_rapid_ps.OUT
Unit System: English
Plotted Output Filename: c:\SLOPE\ROB_ranch\Final\ls3-ls3'_rapid_ps.PLT
PROBLEM DESCRIPTION: Robinson Ranch 061989-001 LS3 - LS3'
, PStatic Rapid Drawdown

BOUNDARY COORDINATES
26 Top Boundaries
29 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	1650.00	15.00	1640.00	1
2	15.00	1640.00	65.00	1640.00	1
3	65.00	1640.00	75.00	1635.00	1
4	75.00	1635.00	120.00	1635.00	1
5	120.00	1635.00	140.00	1645.00	2
6	140.00	1645.00	180.00	1645.00	2
7	180.00	1645.00	190.00	1640.00	2
8	190.00	1640.00	330.00	1640.00	2
9	330.00	1640.00	360.00	1650.00	2
10	360.00	1650.00	380.00	1650.00	2
11	380.00	1650.00	405.00	1650.00	1
12	405.00	1650.00	460.00	1680.00	1
13	460.00	1680.00	590.00	1725.00	1
14	590.00	1725.00	650.00	1750.00	1
15	650.00	1750.00	695.00	1760.00	1
16	695.00	1760.00	710.00	1770.00	1
17	710.00	1770.00	725.00	1770.00	1
18	725.00	1770.00	790.00	1800.00	1
19	790.00	1800.00	830.00	1810.00	1
20	830.00	1810.00	850.00	1810.00	1
21	850.00	1810.00	860.00	1805.00	1
22	860.00	1805.00	870.00	1810.00	1
23	870.00	1810.00	930.00	1810.00	1
24	930.00	1810.00	1000.00	1765.00	1
25	1000.00	1765.00	1010.00	1760.00	1
26	1010.00	1760.00	1030.00	1750.00	1
27	120.00	1635.00	245.00	1600.00	1
28	245.00	1600.00	280.00	1605.00	1
29	280.00	1605.00	380.00	1650.00	1

User Specified Y-Origin = 1400.00(ft)
Default X-Plus Value = 0.00(ft)
Default Y-Plus Value = 0.00(ft)

ISOTROPIC SOIL PARAMETERS
2 Type(s) of Soil

Soil Type No.	Total Unit Wt. (pcf)	Saturated Unit Wt. (pcf)	Cohesion Intercept (psf)	Friction Angle (deg)	Pore Pressure Param.	Pressure Constant (psf)	Piez. Surface No.
1	125.0	125.0	350.0	33.0	0.00	0.0	1
2	125.0	125.0	150.0	24.0	0.00	0.0	1

ANISOTROPIC STRENGTH PARAMETERS
1 soil type(s)
Soil Type 1 Is Anisotropic
Number Of Direction Ranges Specified = 3

Direction Range No.	Counterclockwise Direction Limit (deg)	Cohesion Intercept (psf)	Friction Angle (deg)
1	13.0	350.00	33.00
2	17.0	450.00	24.00
3	90.0	350.00	33.00

ANISOTROPIC SOIL NOTES:
(1) An input value of 0.01 for C and/or Phi will cause Aniso C and/or Phi to be ignored in that range.
(2) An input value of 0.02 for Phi will set both Phi and C equal to zero, with no water weight in the tension crack.
(3) An input value of 0.03 for Phi will set both Phi and C equal to zero, with water weight in the tension crack.

1 PIEZOMETRIC SURFACE(S) SPECIFIED
Unit Weight of Water = 62.40 (pcf)
Piezometric Surface No. 1 Specified by 9 Coordinate Points
Pore Pressure Inclination Factor = 0.50

Point No.	X-Water (ft)	Y-Water (ft)
1	120.74	1634.24
2	138.79	1645.45
3	178.75	1645.45
4	190.35	1639.85
5	329.57	1641.25
6	347.62	1645.45
7	399.18	1645.45
8	498.44	1645.45
9	600.00	1645.45

Specified Peak Ground Acceleration Coefficient (A) = 0.300(g)
Specified Horizontal Earthquake Coefficient (kh) = 0.150(g)
Specified Vertical Earthquake Coefficient (kv) = 0.000(g)
Specified Seismic Pore-Pressure Factor = 0.000
A Critical Failure Surface Searching Method, Using A Random Technique For Generating Sliding Block Surfaces, Has Been Specified.
5000 Trial Surfaces Have Been Generated.
2 Boxes Specified For Generation Of Central Block Base
Length Of Line Segments For Active And Passive Portions Of Sliding Block Is 40.0

Box No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Height (ft)
1	300.00	1595.00	550.00	1660.00	30.00
2	600.00	1685.00	780.00	1733.06	60.00

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Evaluated. They Are Ordered - Most Critical First.
* * Safety Factors Are Calculated By The Simplified Janbu Method * *
Total Number of Trial Surfaces Attempted = 5000
Number of Trial Surfaces With Valid FS = 5000
Statistical Data On All Valid FS Values:
FS Max = 3.222 FS Min = 1.103 FS Ave = 1.544
Standard Deviation = 0.268 Coefficient of Variation = 17.37 %

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

Individual data on the 24 slices

Slice No.	Width (ft)	Weight (lbs)	Water Force Top (lbs)	Water Force Bot (lbs)	Tie Force Norm (lbs)	Tie Force Tan (lbs)	Earthquake Force Hor (lbs)	Earthquake Force Ver (lbs)	Surcharge Load (lbs)
1	4.3	673.0	0.0	0.0	0.	0.	101.0	0.0	0.0
2	2.8	1132.1	0.0	59.3	0.	0.	169.8	0.0	0.0
3	3.4	2249.6	0.0	290.8	0.	0.	337.5	0.0	0.0
4	3.2	2769.1	0.0	515.6	0.	0.	415.4	0.0	0.0
5	6.7	7390.0	0.0	1889.3	0.	0.	1108.5	0.0	0.0
6	10.1	14918.5	0.0	4861.9	0.	0.	2237.8	0.0	0.0
7	14.2	28764.8	0.0	10961.6	0.	0.	4314.7	0.0	0.0
8	4.9	11987.3	0.0	4742.5	0.	0.	1798.1	0.0	0.0
9	5.8	15157.0	0.0	6124.5	0.	0.	2273.6	0.0	0.0
10	27.9	114791.7	0.0	37475.1	0.	0.	17218.8	0.0	0.0
11	27.1	161602.5	0.0	36228.7	0.	0.	24240.4	0.0	0.0
12	38.4	249023.0	0.0	26607.9	0.	0.	37353.5	0.0	0.0
13	16.1	106798.8	0.0	2540.2	0.	0.	16019.8	0.0	0.0
14	75.5	520125.7	0.0	0.0	0.	0.	78018.9	0.0	0.0
15	60.0	452499.4	0.0	0.0	0.	0.	67874.9	0.0	0.0
16	45.0	348997.2	0.0	0.0	0.	0.	52349.6	0.0	0.0
17	15.0	118165.3	0.0	0.0	0.	0.	17724.8	0.0	0.0
18	15.0	119081.7	0.0	0.0	0.	0.	17862.3	0.0	0.0
19	31.7	253167.9	0.0	0.0	0.	0.	37975.2	0.0	0.0
20	22.7	156410.0	0.0	0.0	0.	0.	23461.5	0.0	0.0
21	10.6	53954.3	0.0	0.0	0.	0.	8093.1	0.0	0.0
22	17.2	66998.8	0.0	0.0	0.	0.	10049.8	0.0	0.0
23	22.8	35723.6	0.0	0.0	0.	0.	5358.5	0.0	0.0
24	0.6	30.5	0.0	0.0	0.	.0.	4.6	0.0	0.0

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
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5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
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5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
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Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
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6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
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5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281

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5	756.742	1718.292
6	779.440	1751.228
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Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
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5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

Failure Surface Specified By 8 Coordinate Points

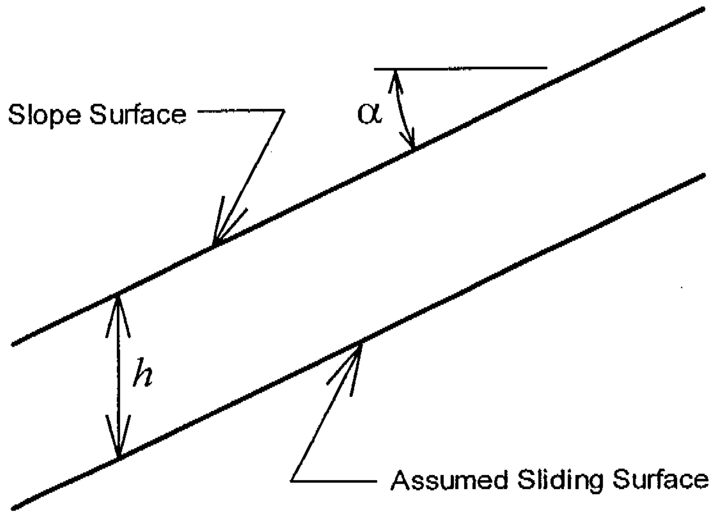
Point No.	X-Surf (ft)	Y-Surf (ft)
1	349.500	1646.500
2	356.580	1644.781
3	394.233	1631.281
4	432.858	1620.884
5	756.742	1718.292
6	779.440	1751.228
7	807.242	1779.986
8	830.616	1810.000

Factor of Safety
*** 1.103 ***

**** END OF GSTABL7 OUTPUT ****

Client: KOAR Institutional Advisors, LLC
Job Name: Robinson Ranch, Santa Clarita, California.
Job No.: 06-1989-001
By: NHA
Date: 07/18/06 Time: 13:12:54

Subject: Surficial Slope Stability



$$f.s. = \frac{C + h\left(\gamma_t - \gamma_w\right)\left(\cos^2 \alpha\right)\left(\tan \phi\right)}{\gamma_t h \left(\sin \alpha\right)\left(\cos \alpha\right)}$$

α =	26.6 degrees	0.464 radians	γ =	125 pcf (total)
C =	225 psf		γ =	62.4 pcf (water)
ϕ =	25.0 degrees	0.436 radians		

	Depth of Saturation h (feet)	Factor of Safety $f.s.$	
	1	4.96	
	2	2.71	
	3	1.96	
>>>>>>	4	1.59	<<<<<<
	5	1.37	

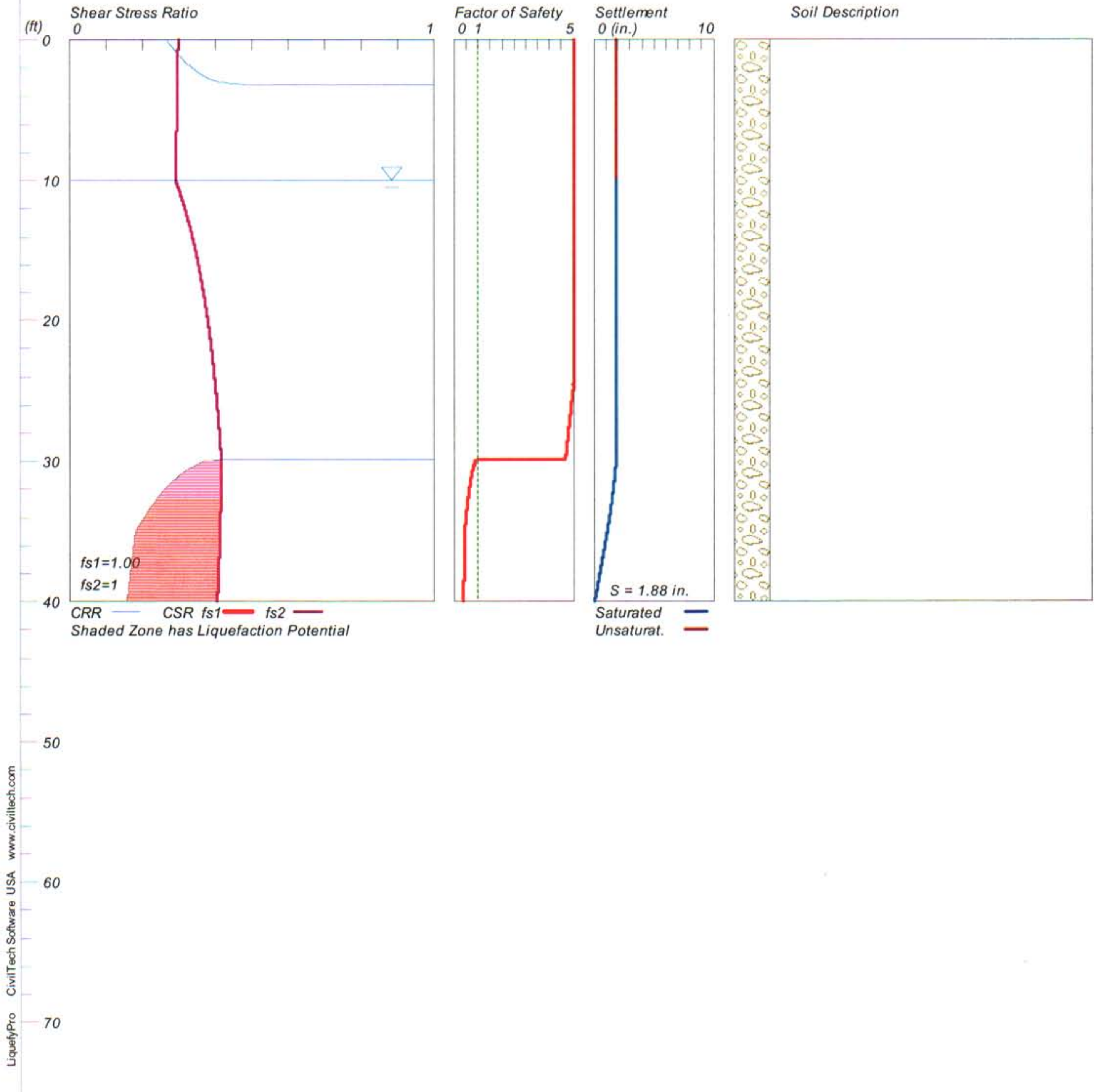
LEIGHTON AND ASSOCIATES, INC.

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-1 Water Depth=10 ft

Magnitude=7.5
Acceleration=0.46g



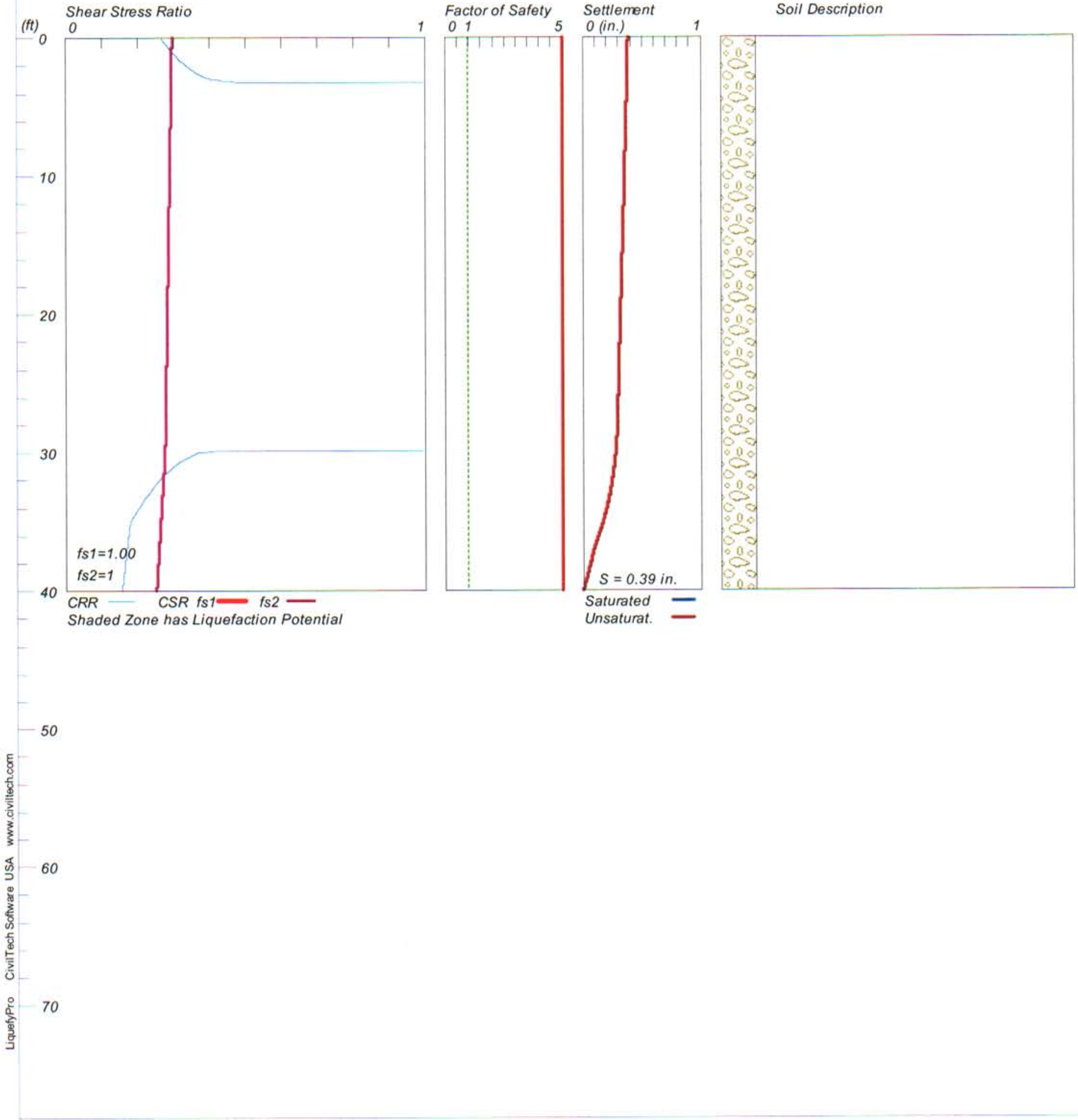
Leighton 061989-002 Plate D-1

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-1 Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g



Leighton

061989-002

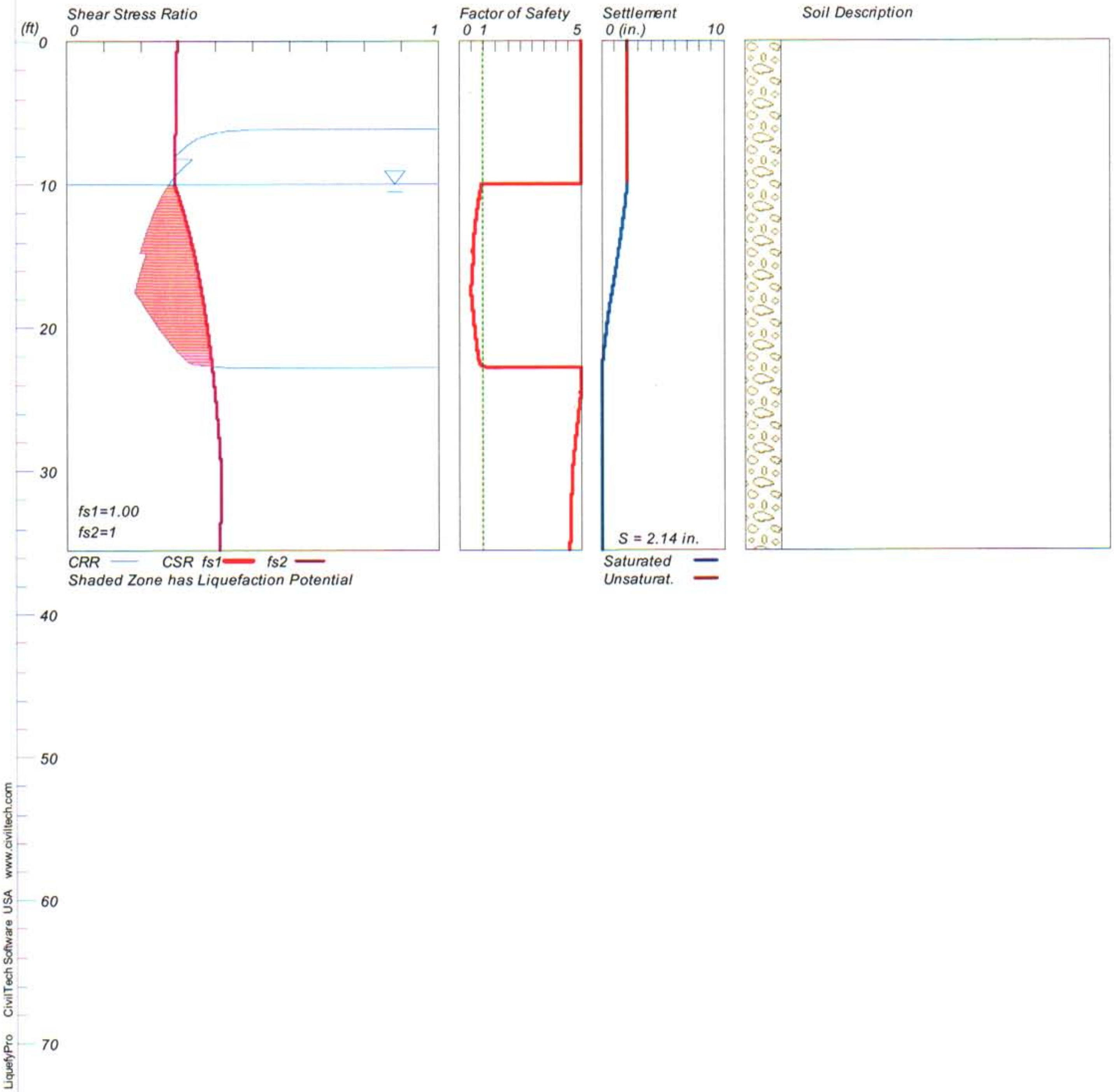
Plate D-2

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-3   Water Depth=10 ft

Magnitude=7.5
Acceleration=0.46g



Leighton

061989-002

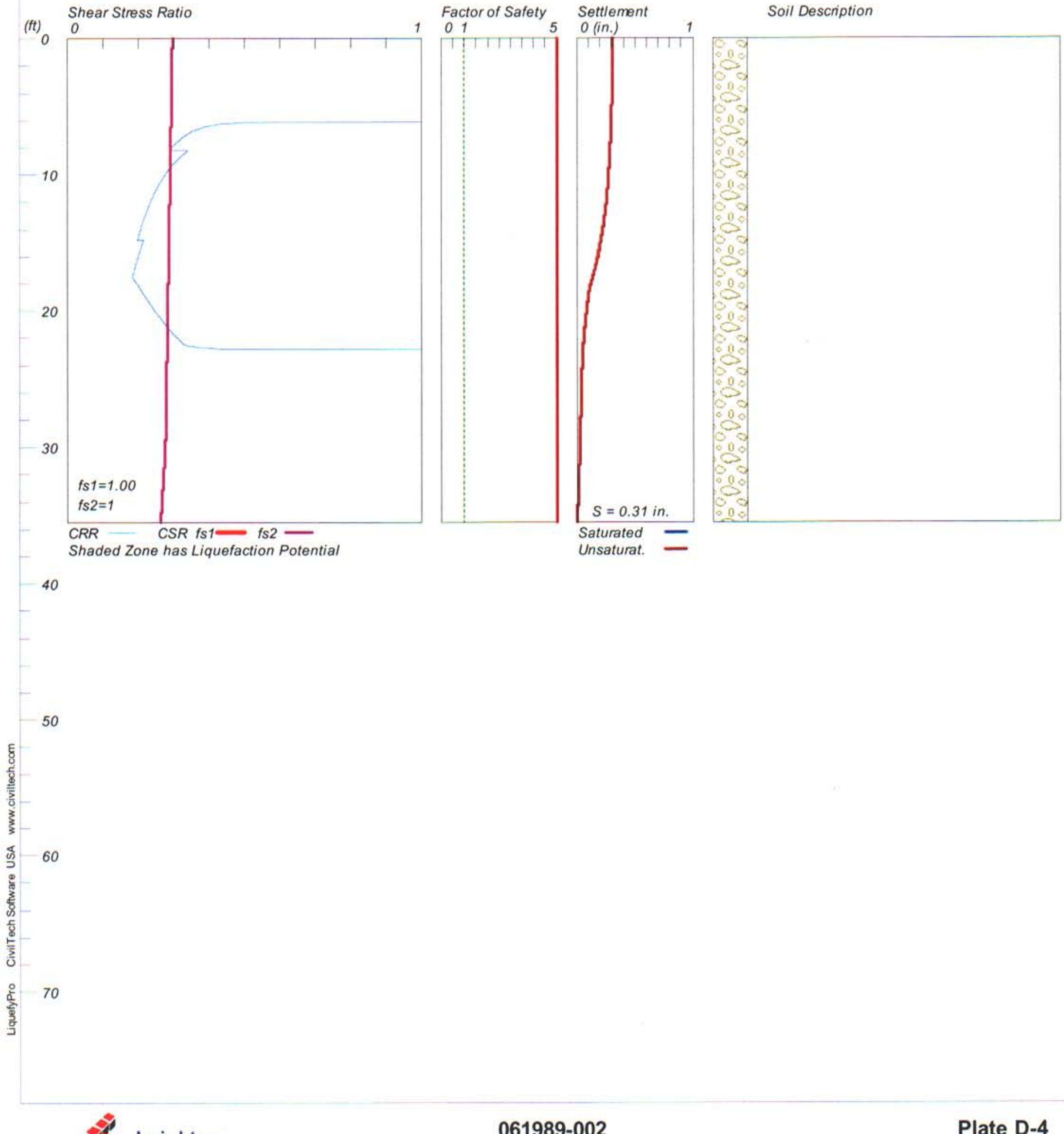
Plate D-3

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-3   Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g



Leighton

061989-002

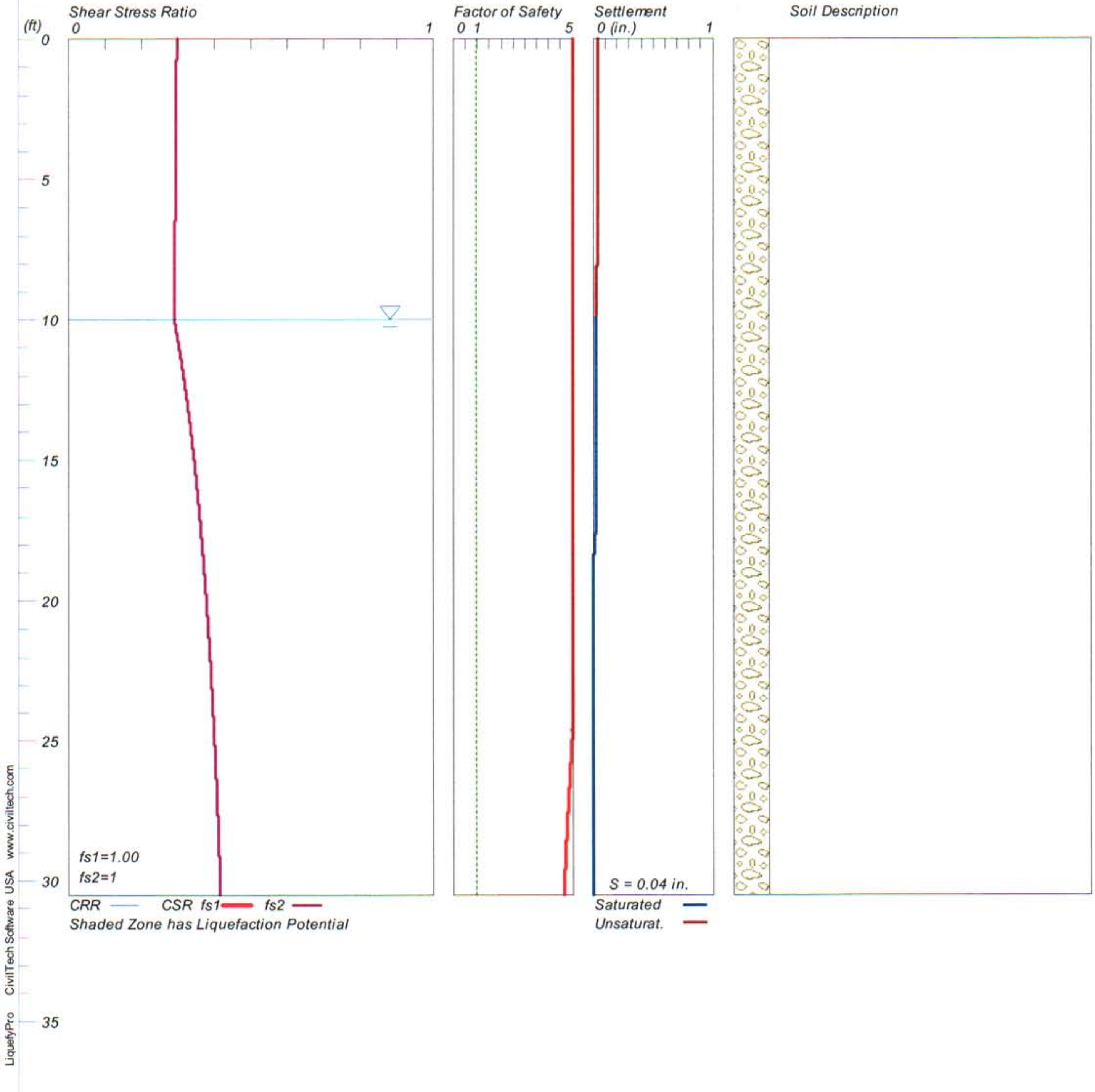
Plate D-4

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-4 Water Depth=10 ft

Magnitude=7.5
Acceleration=0.46g

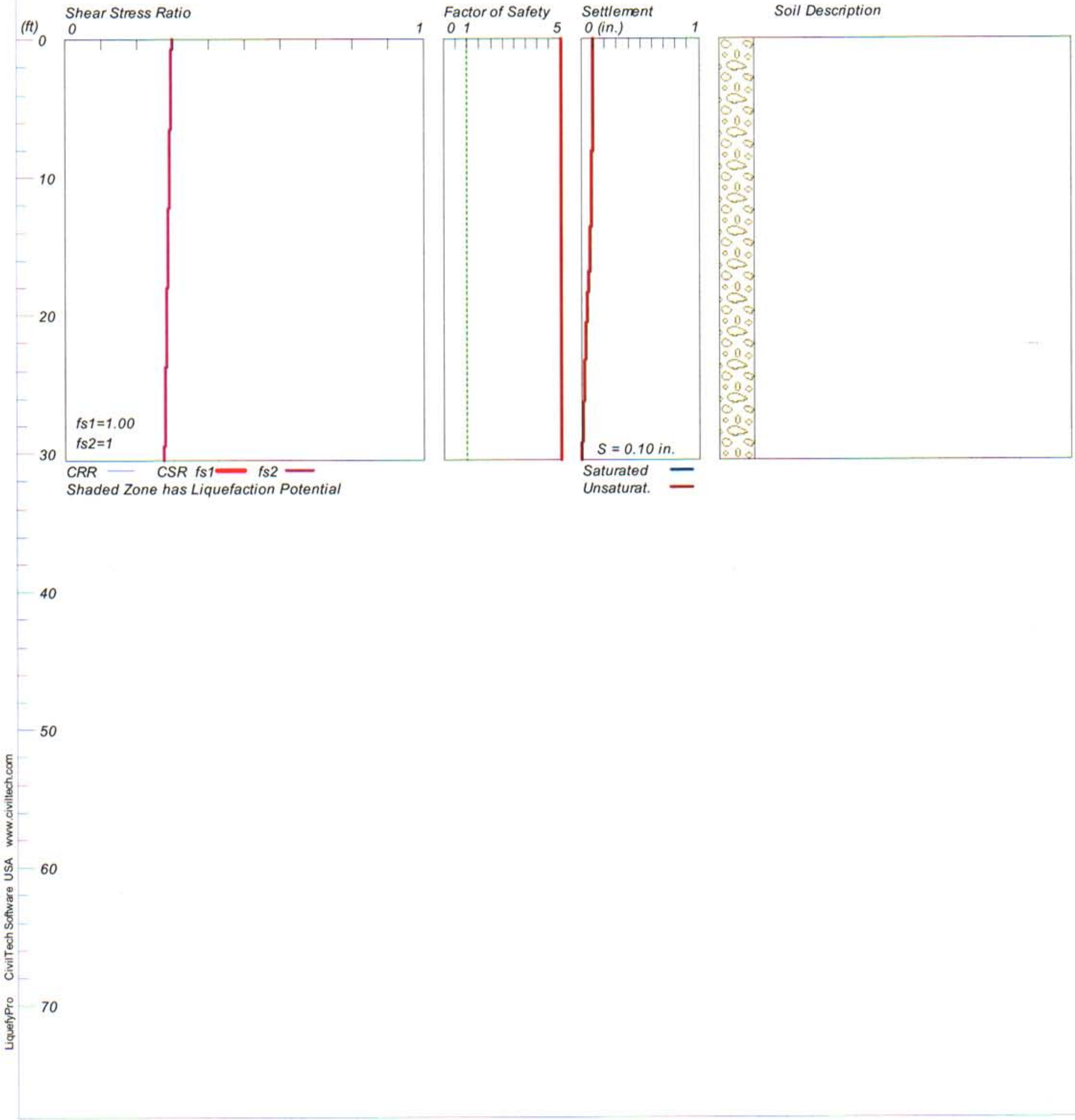


LIQUEFACTION ANALYSIS

Robinson Ranch

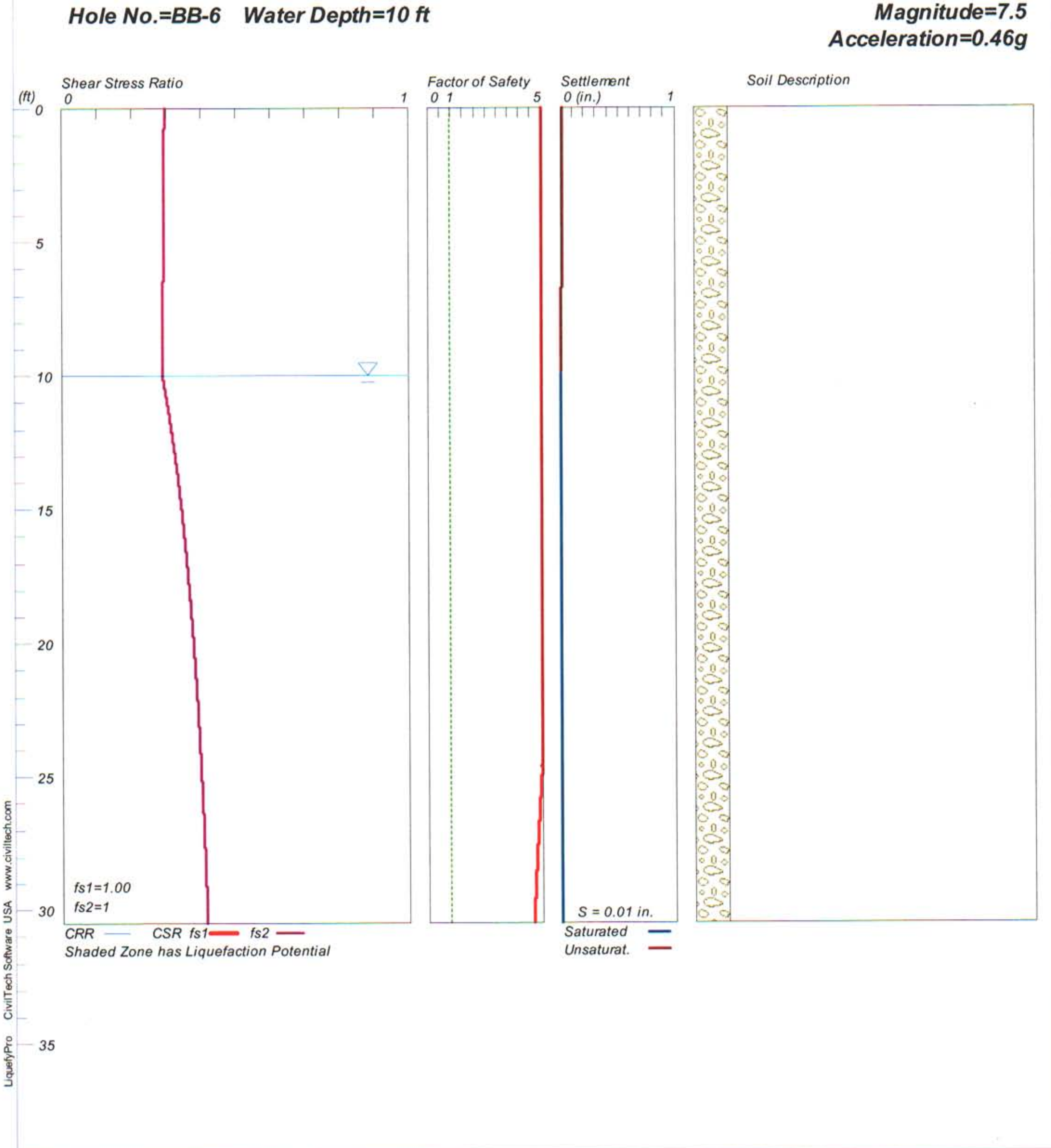
Hole No.=BB-4 Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g



LIQUEFACTION ANALYSIS

Robinson Ranch



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061989-002

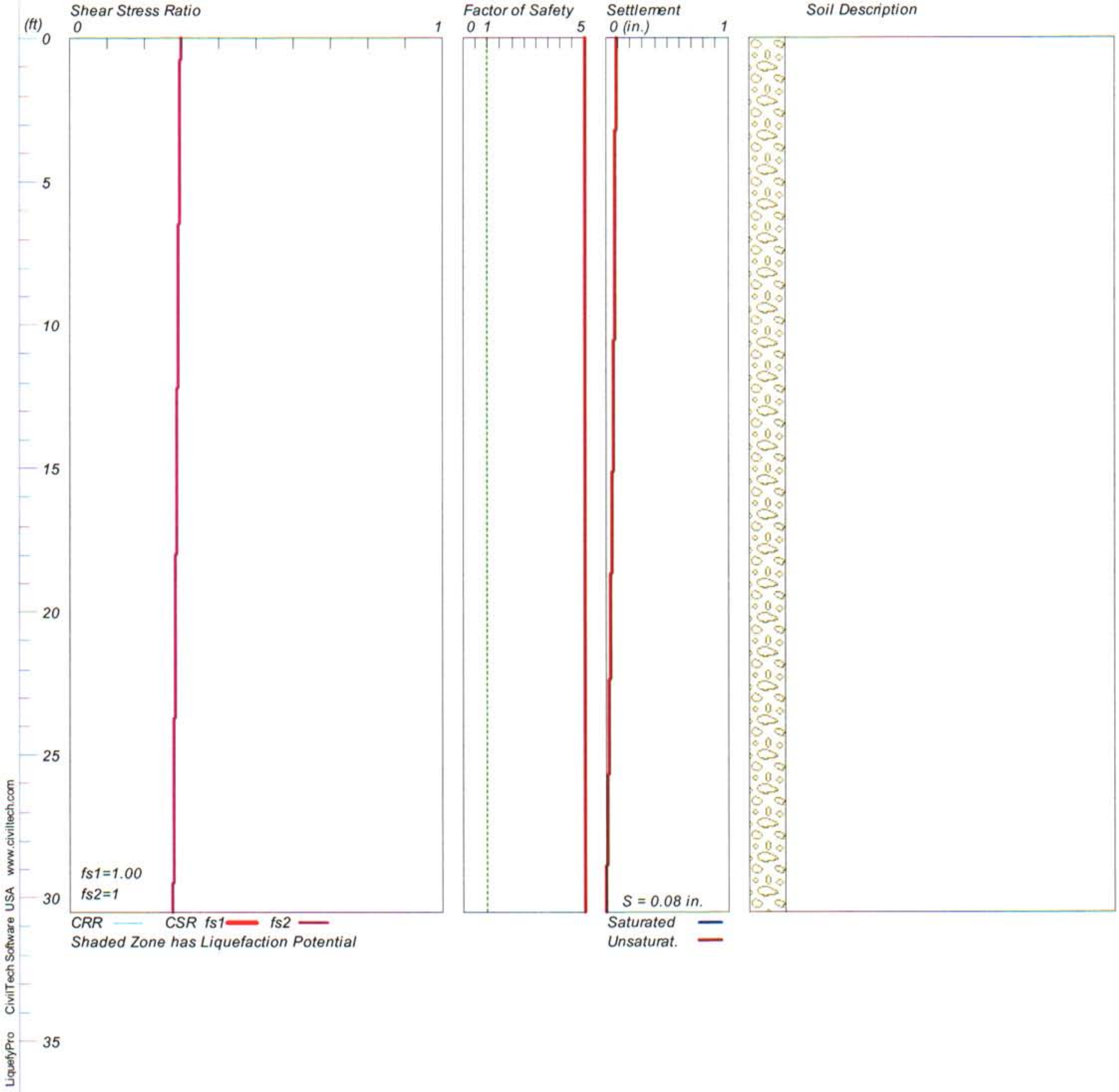
Plate D-7

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-6 Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g

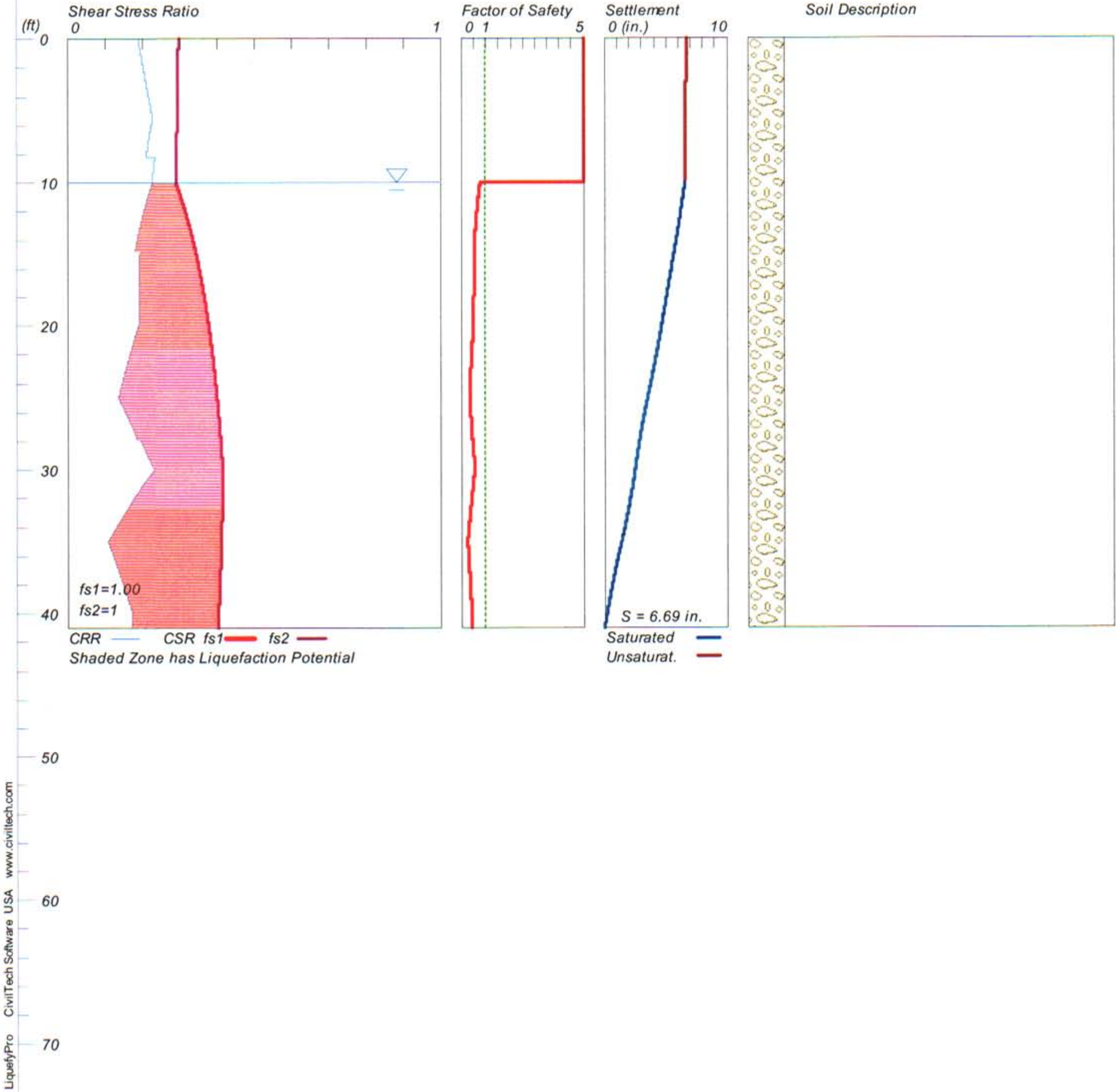


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-7 Water Depth=10 ft

Magnitude=7.5
Acceleration=0.46g

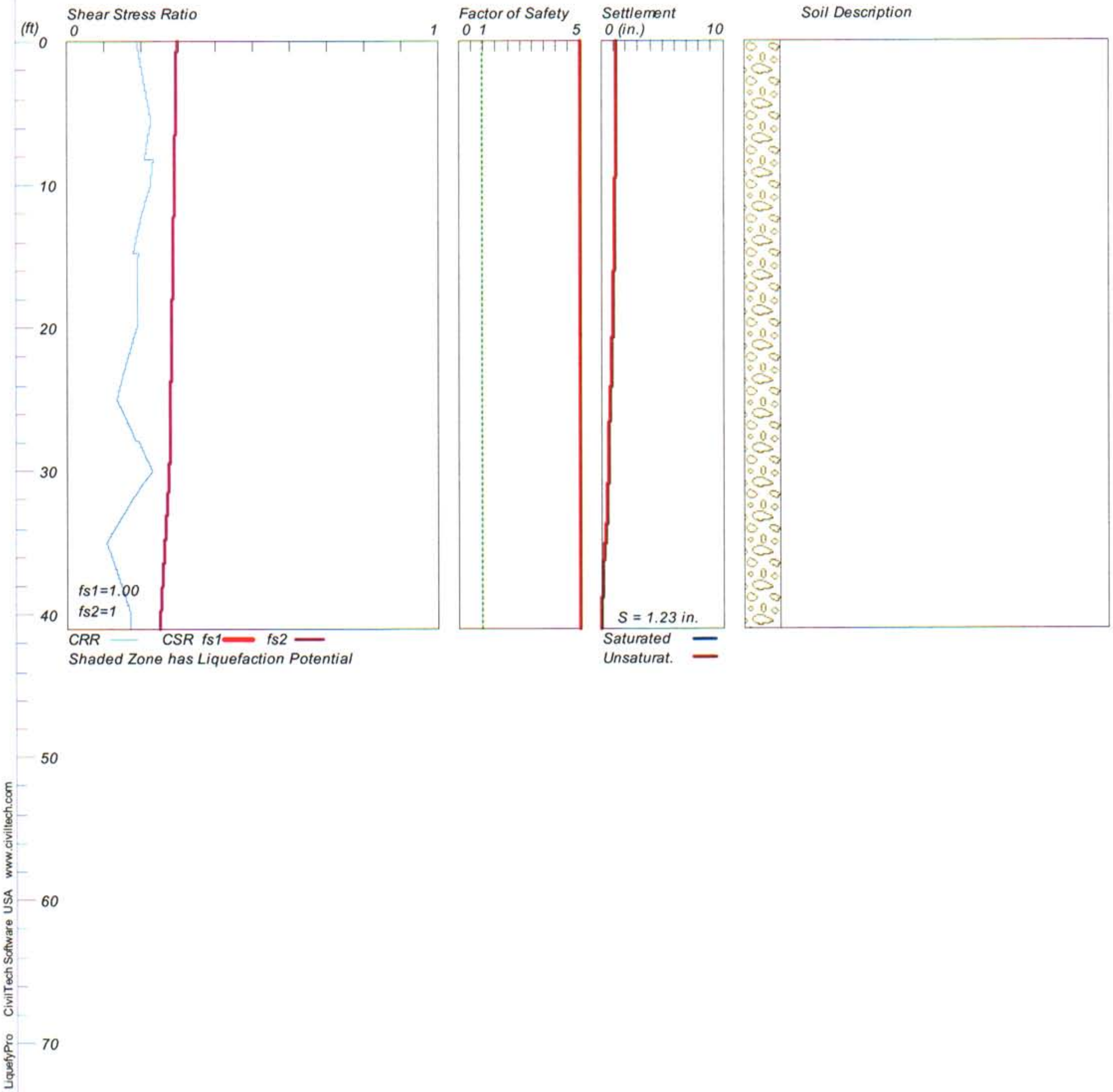


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-7   Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g



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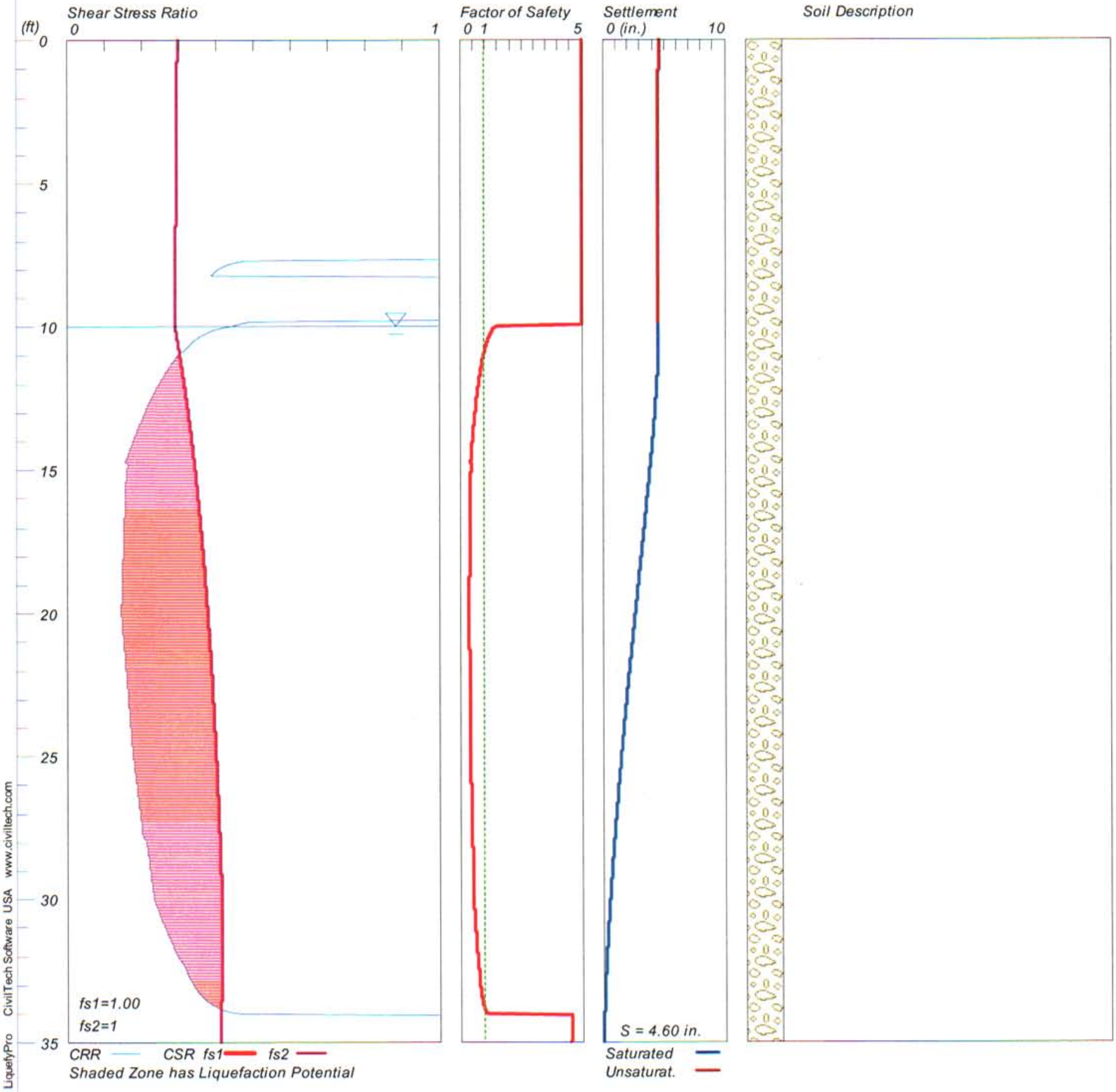
061989-002

Plate D-10

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-8 Water Depth=10 ft *Magnitude=7.5*
Acceleration=0.46g



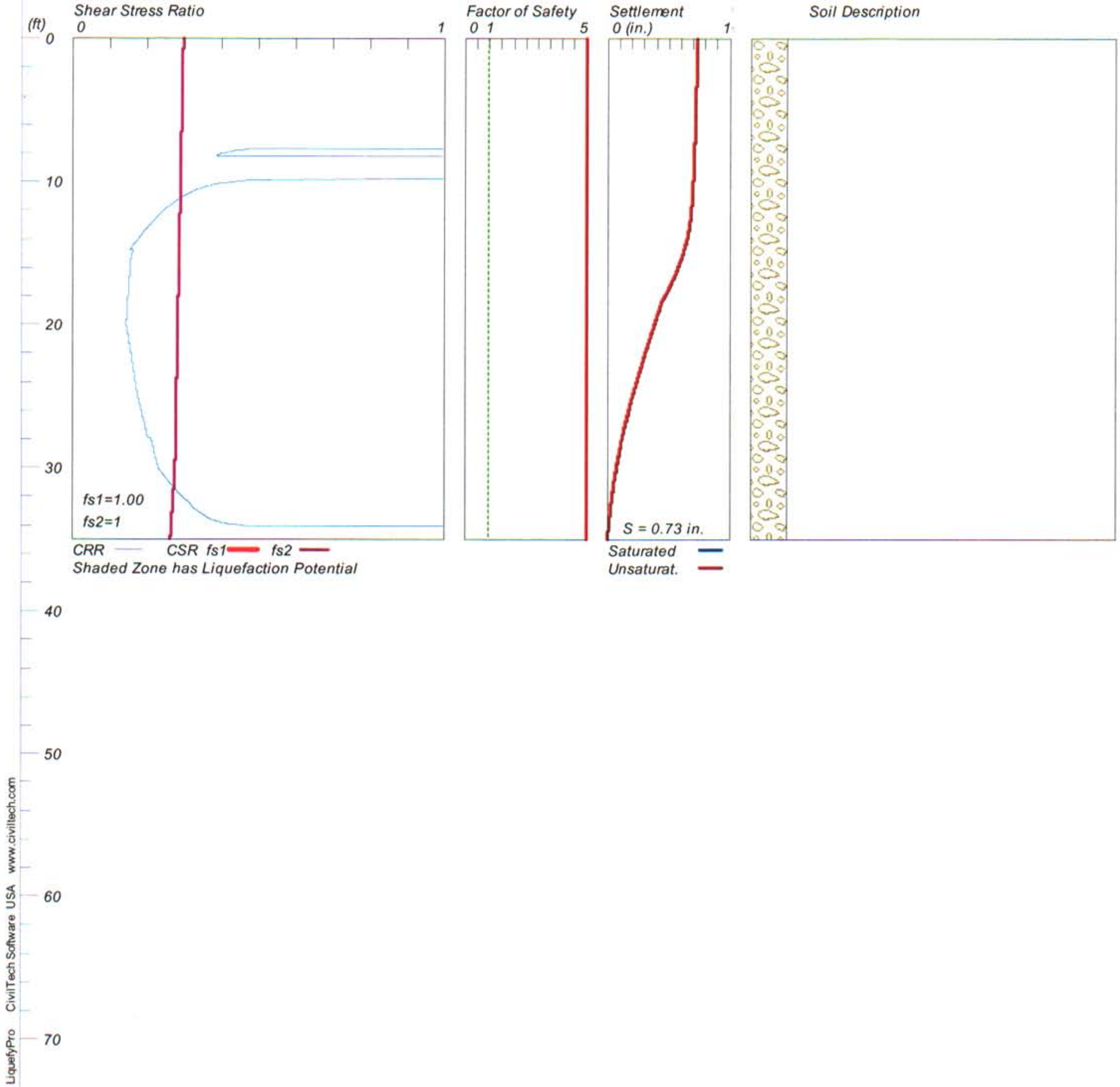
Leighton 061989-002 Plate D-11

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-8   Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g



Leighton

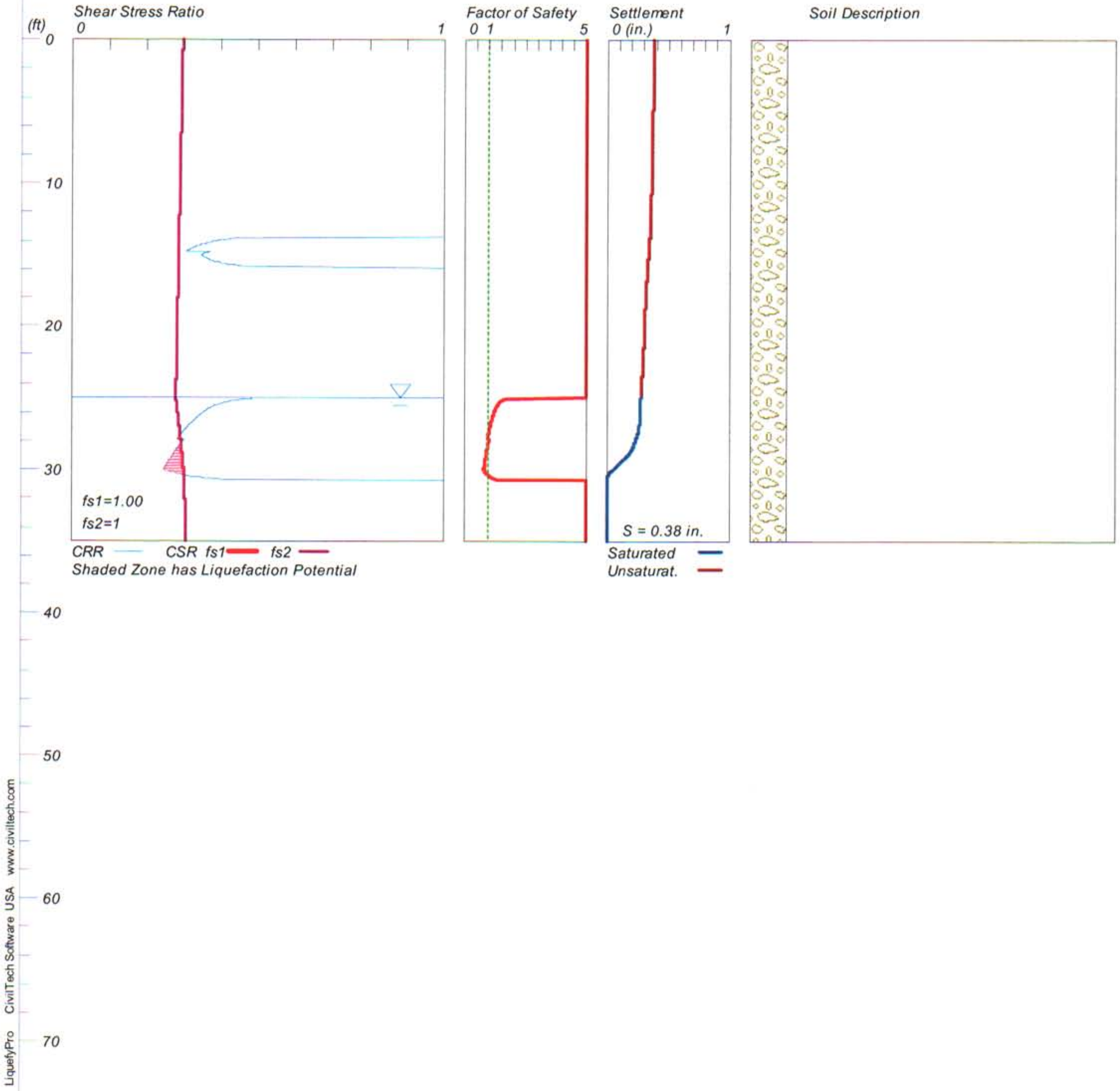
061989-002

Plate D-12

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-9 Water Depth=25 ft ***Magnitude=7.5***
Acceleration=0.46g

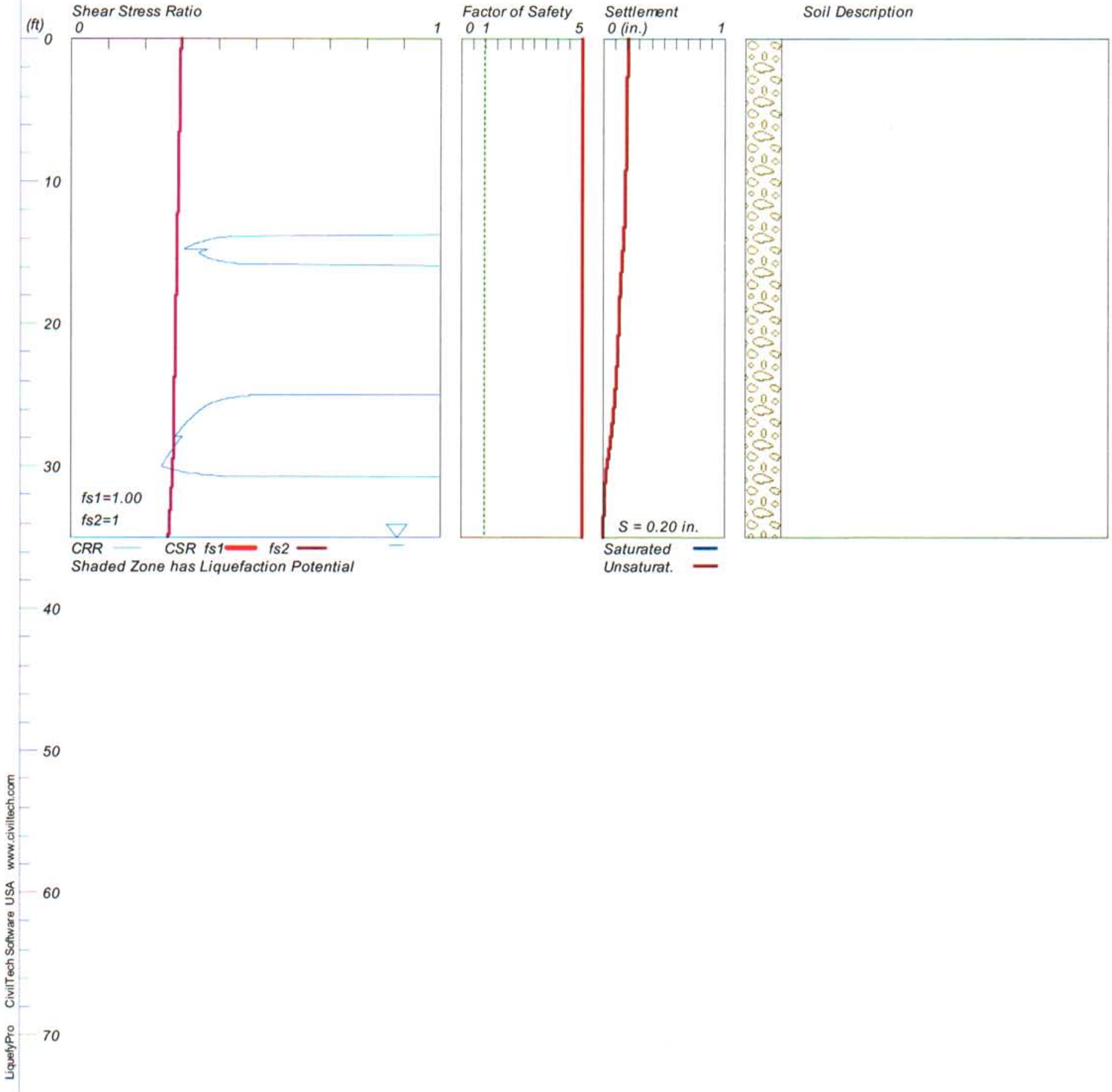


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-9 Water Depth=35 ft

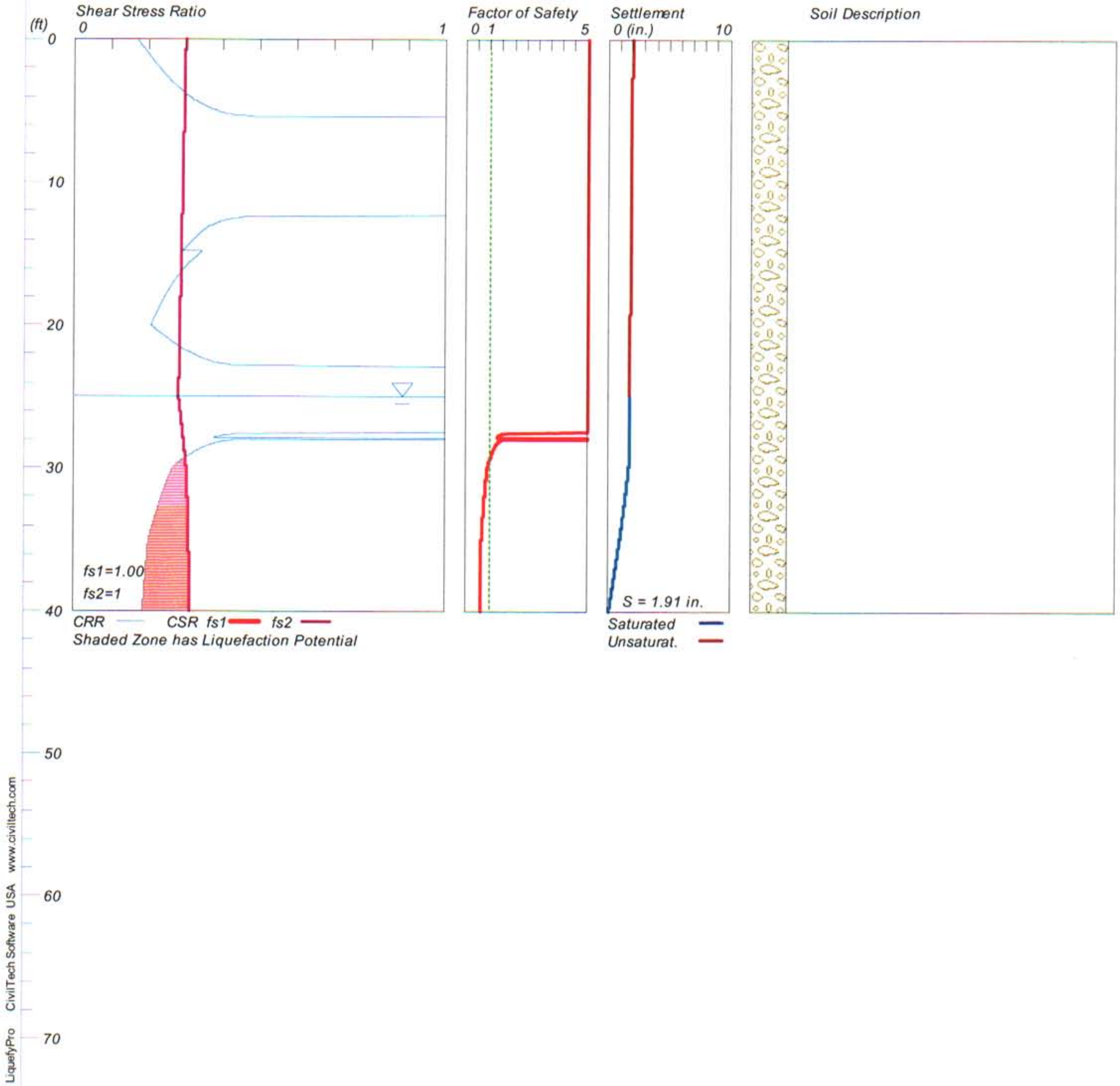
Magnitude=7.5
Acceleration=0.46g



LIQUEFACTION ANALYSIS
Robinson Ranch

Hole No.=BB-10 Water Depth=25 ft

Magnitude=7.5
Acceleration=0.46g



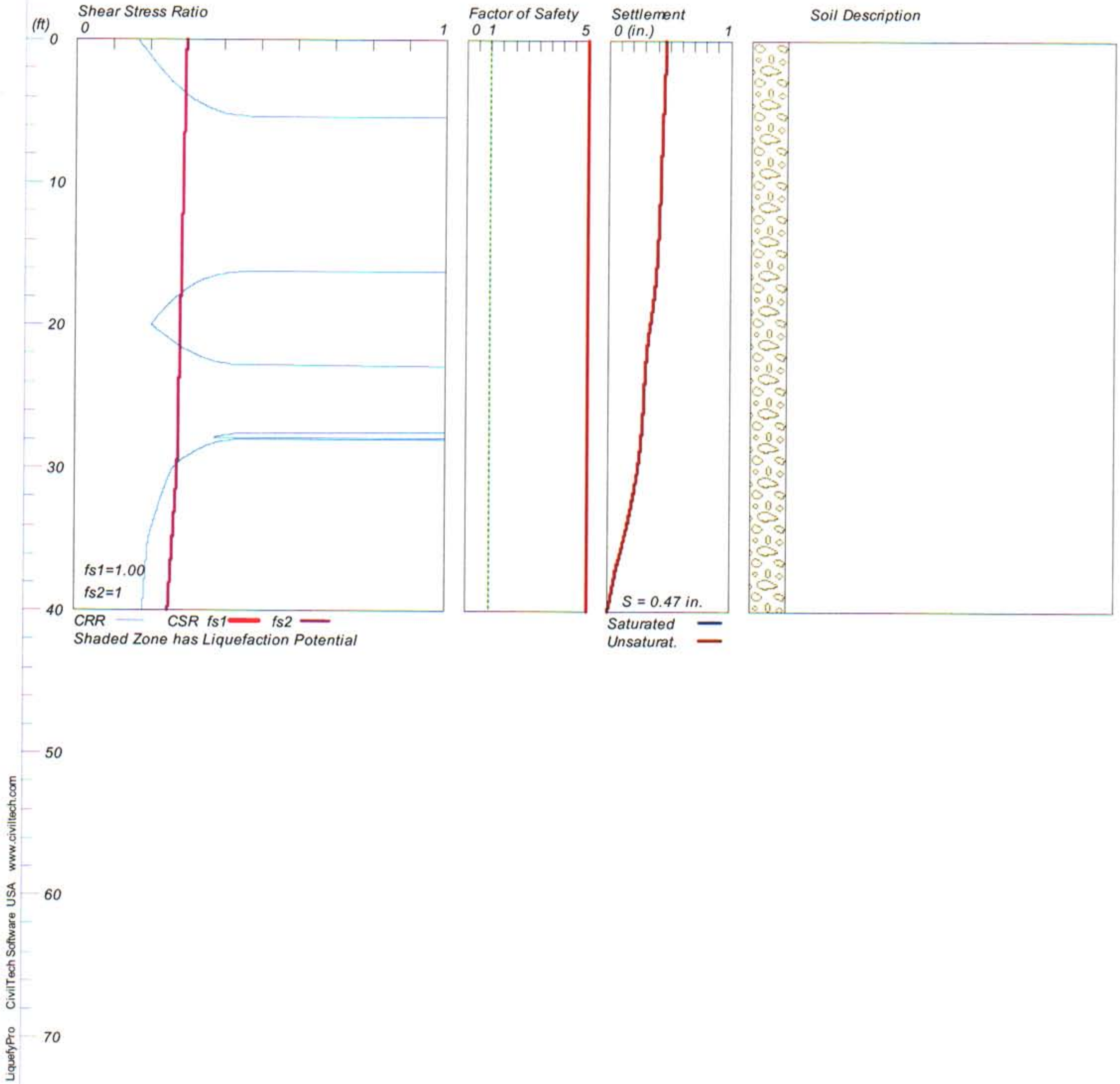
Leighton 061989-002 Plate D-15

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-10   Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g

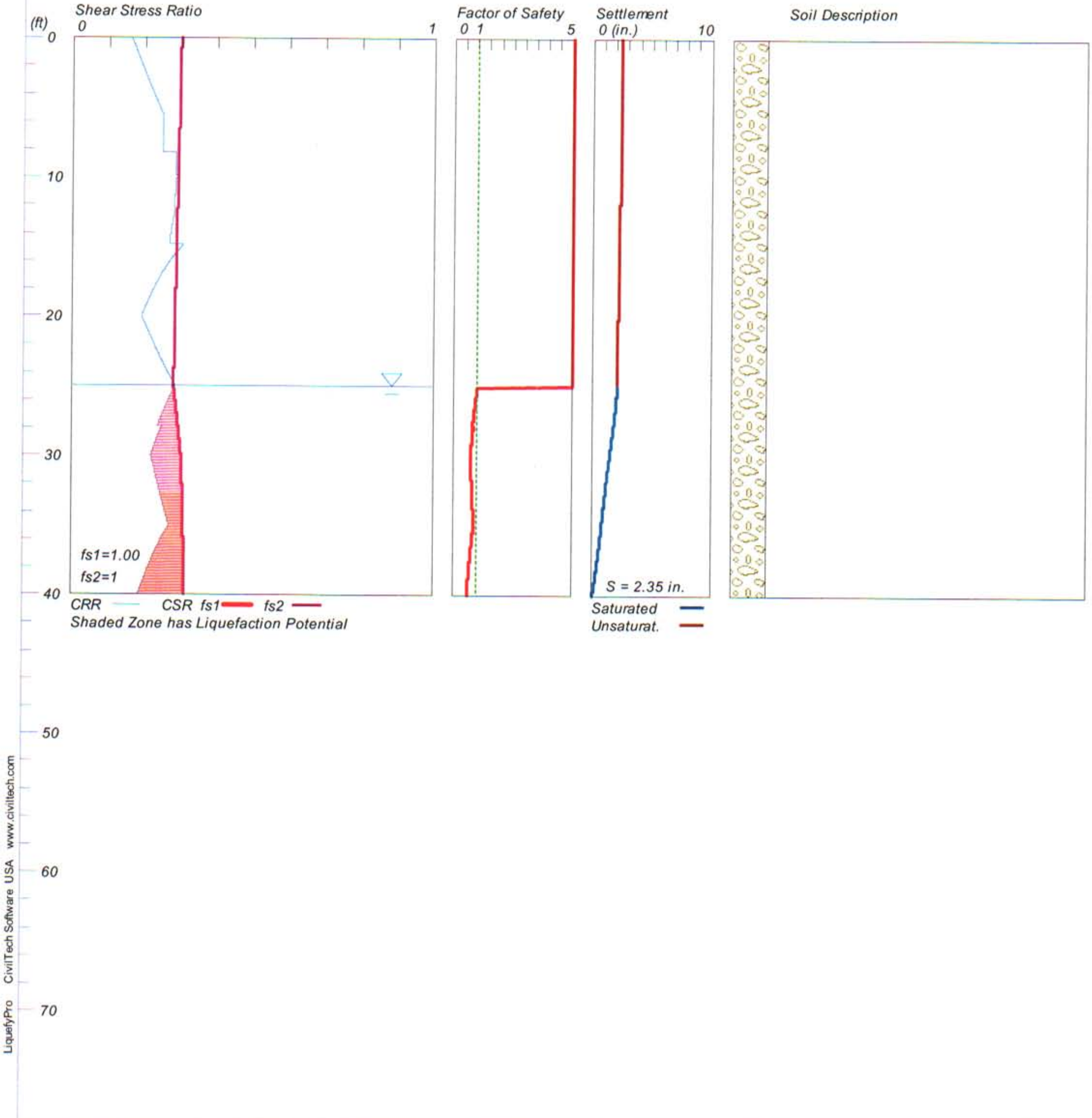


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-11 Water Depth=25 ft

Magnitude=7.5
Acceleration=0.46g



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061989-002

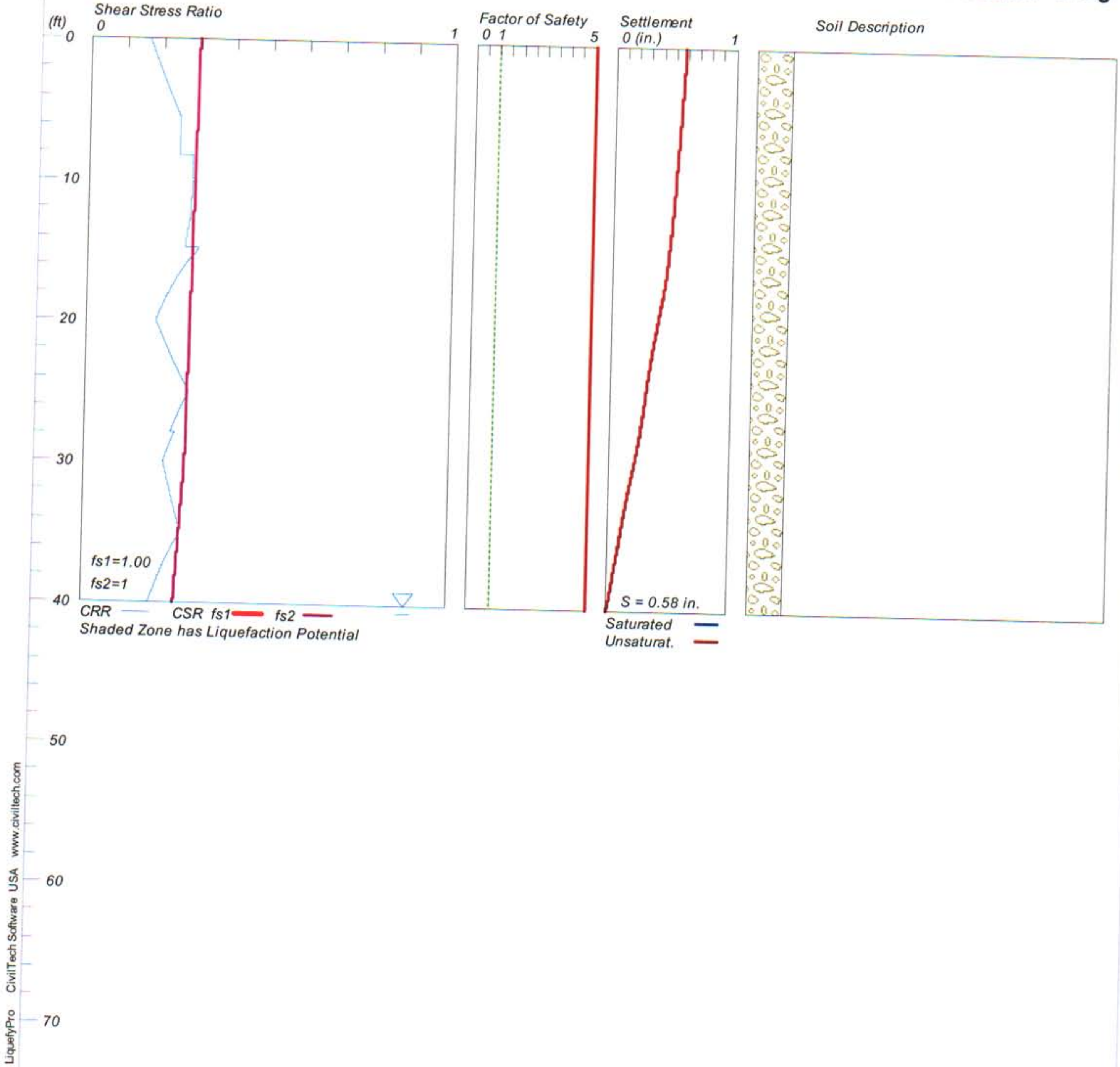
Plate D-17

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-11 Water Depth=40 ft

Magnitude=7.5
Acceleration=0.46g

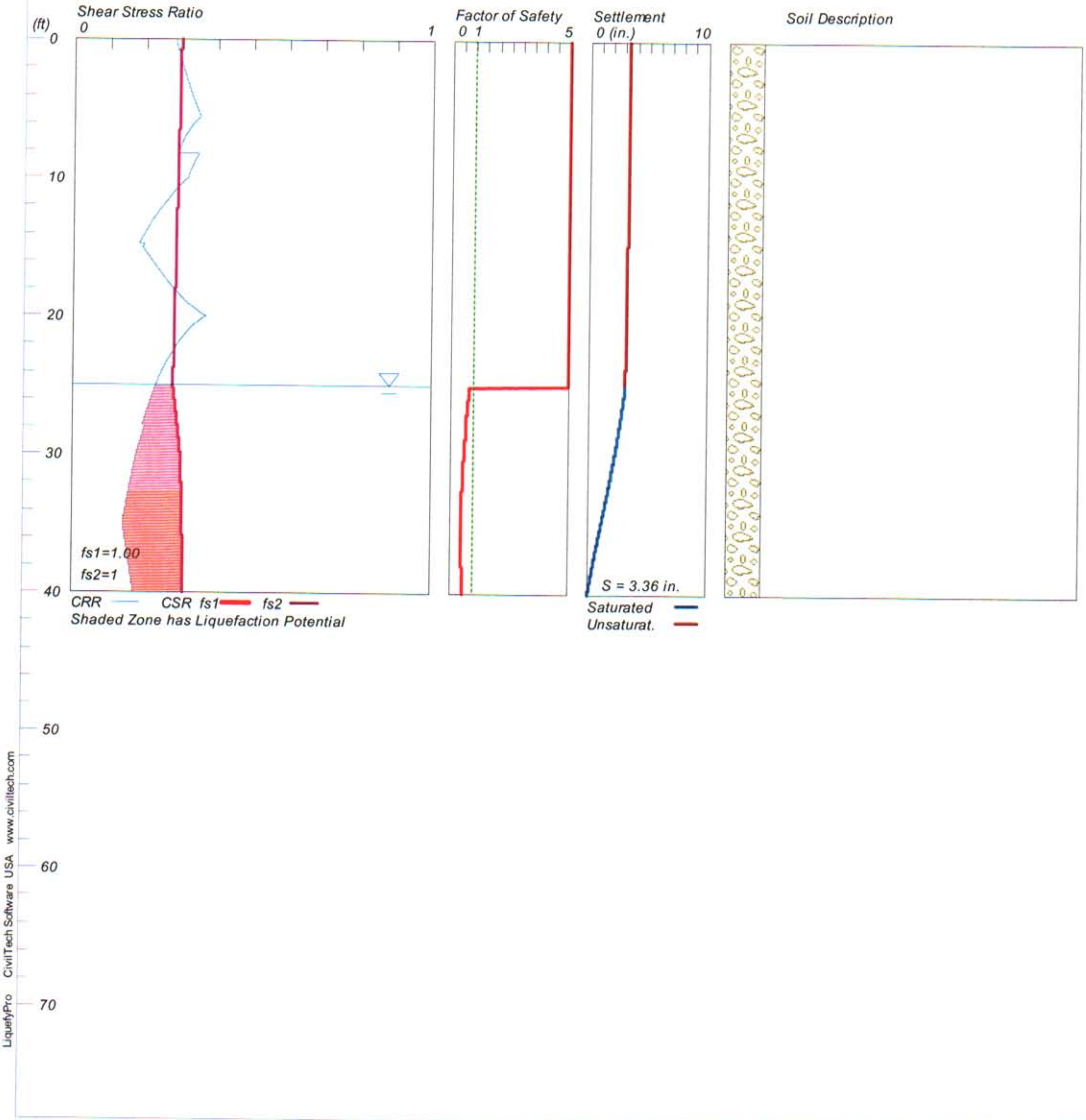


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-12 Water Depth=25 ft

Magnitude=7.5
Acceleration=0.46g



Leighton

061989-002

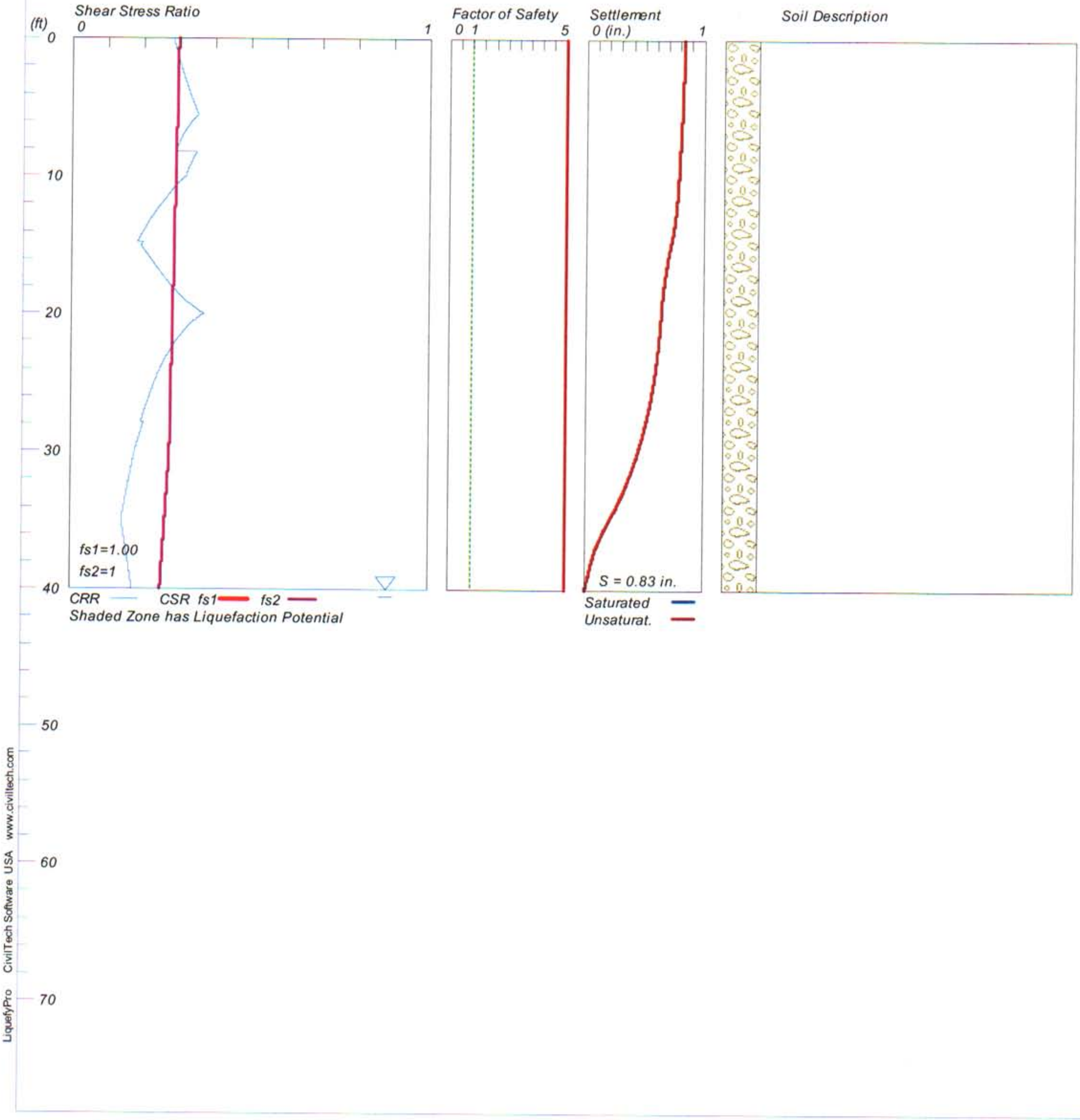
Plate D-19

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-12 Water Depth=40 ft

Magnitude=7.5
Acceleration=0.46g



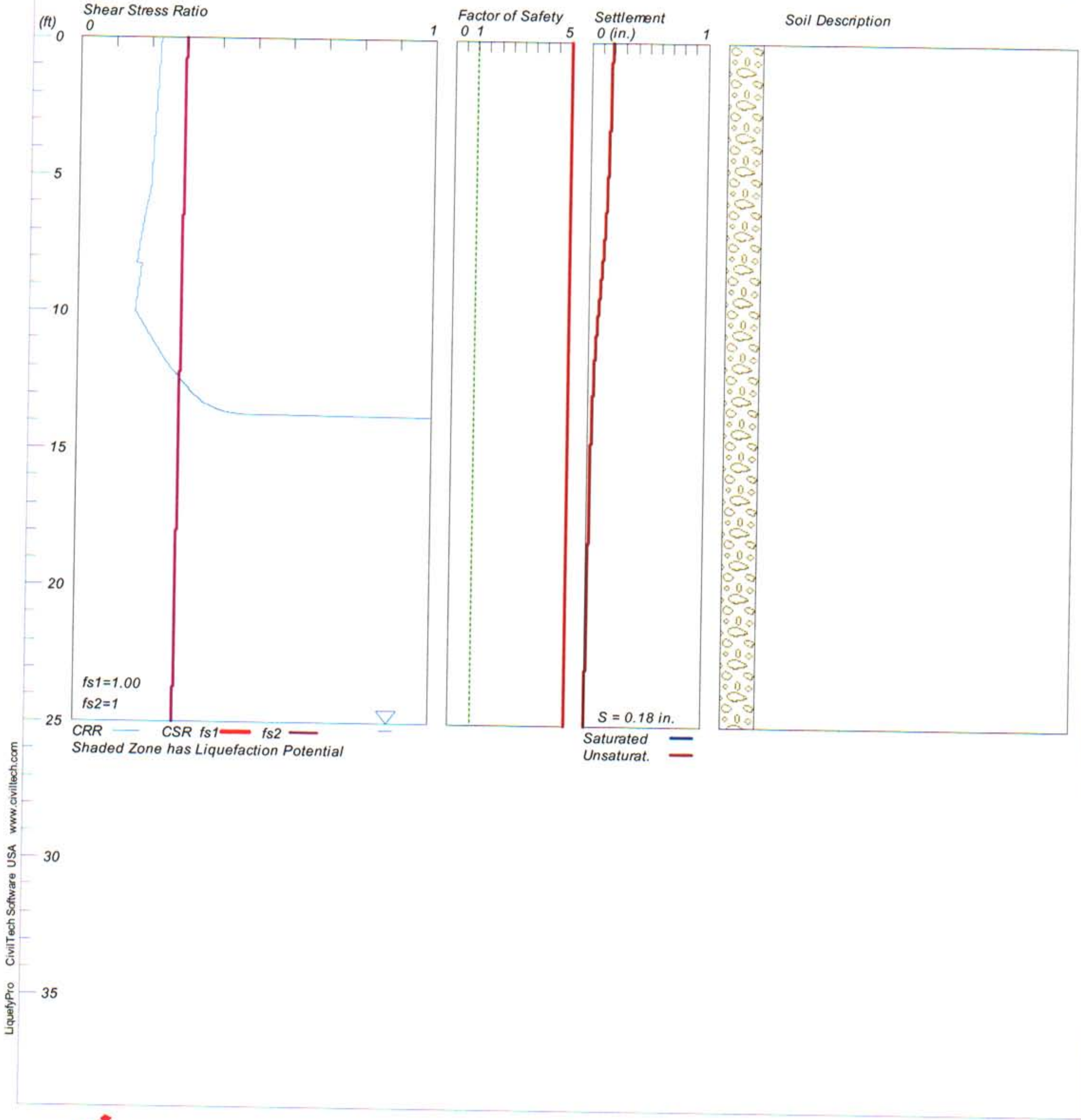
Leighton 061989-002 Plate D-20

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-13 Water Depth=25 ft

Magnitude=7.5
Acceleration=0.46g



Leighton

061989-002

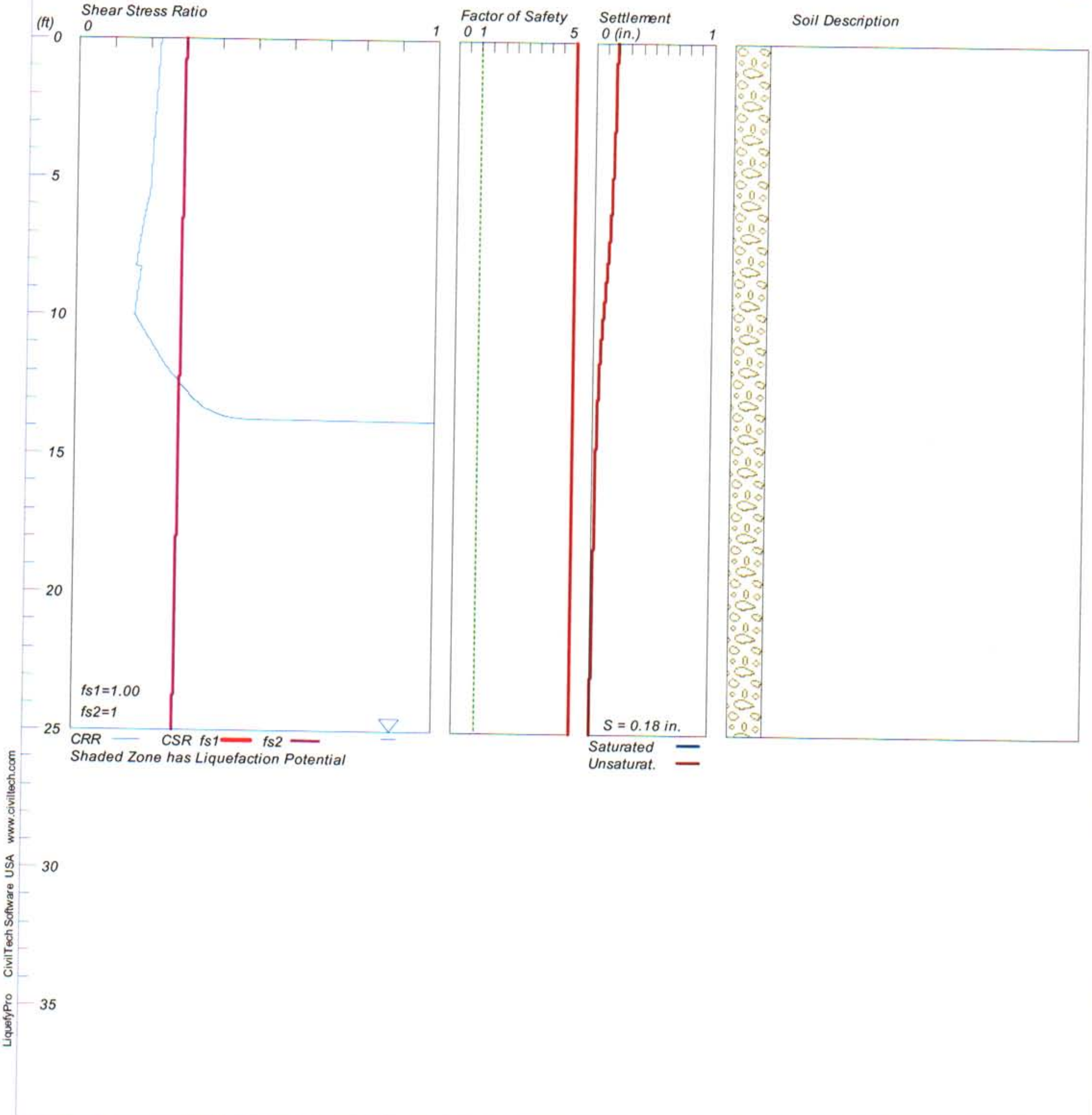
Plate D-21

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-13 Water Depth=25 ft

Magnitude=7.5
Acceleration=0.46g

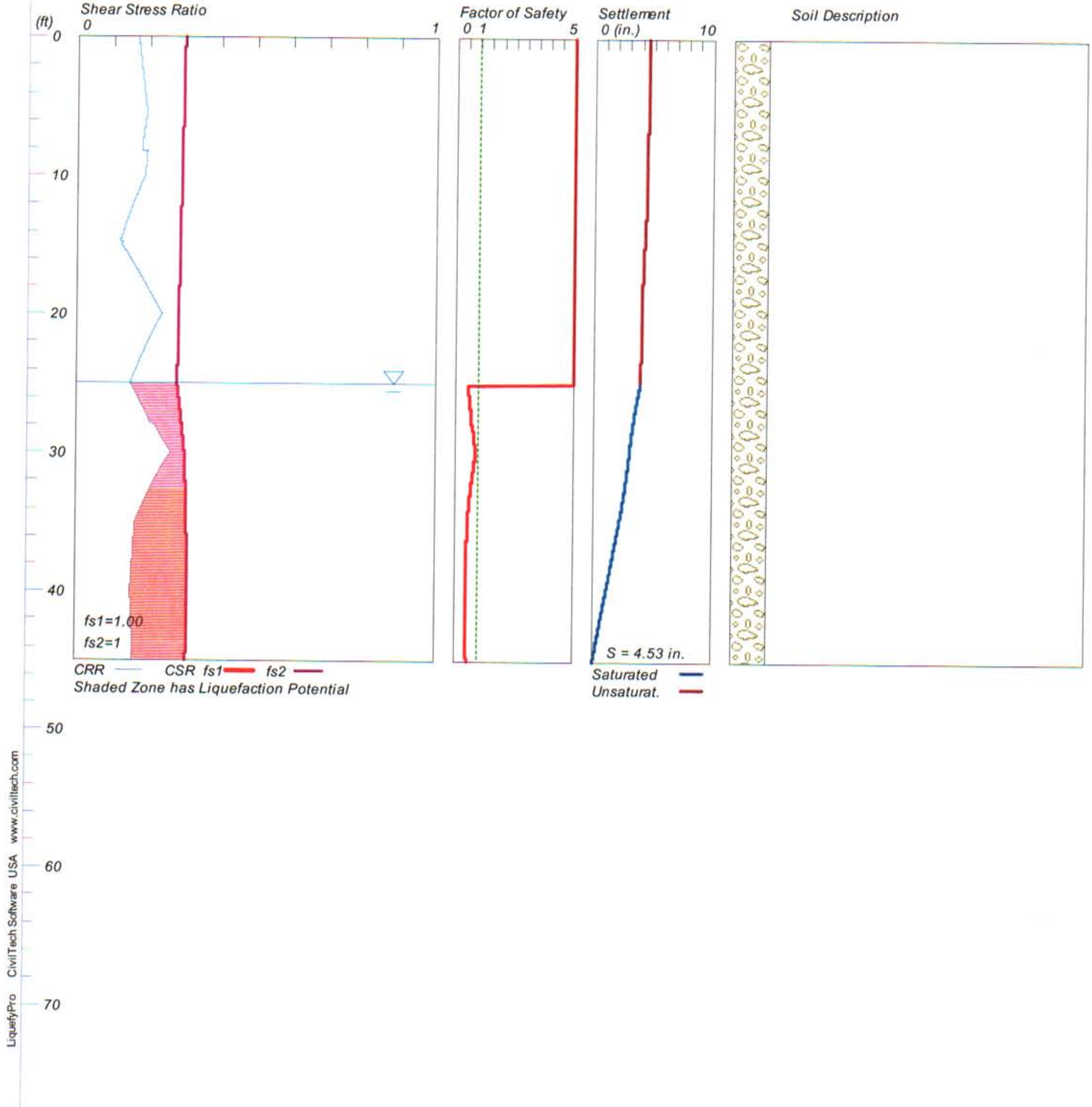


Leighton 061989-002 Plate D-22

LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-14 *Water Depth=25 ft* *Magnitude=7.5*
Acceleration=0.46g

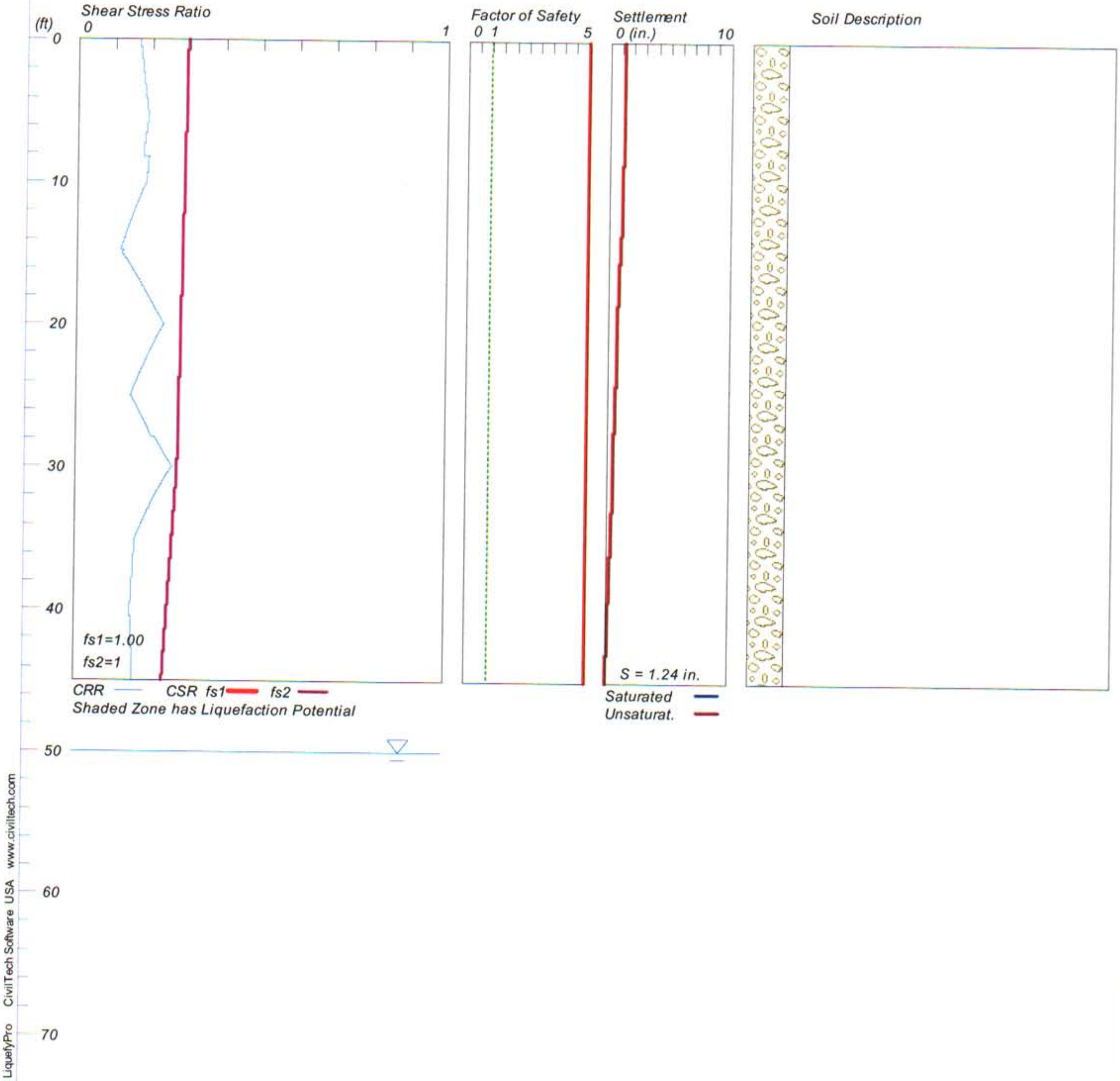


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=BB-14 Water Depth=50 ft

Magnitude=7.5
Acceleration=0.46g

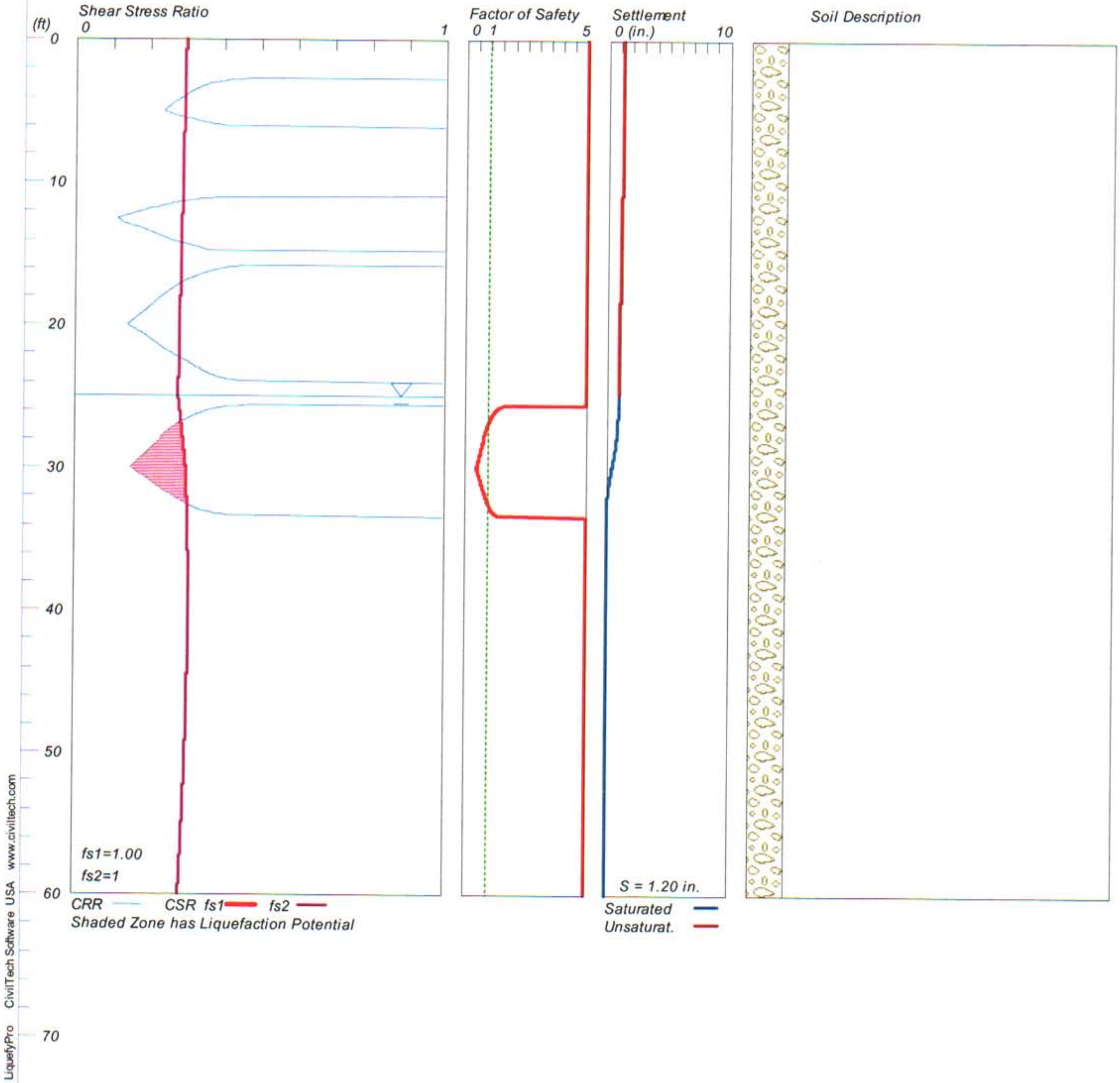


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=LRW-1   Water Depth=25 ft

Magnitude=7.5
Acceleration=0.46g

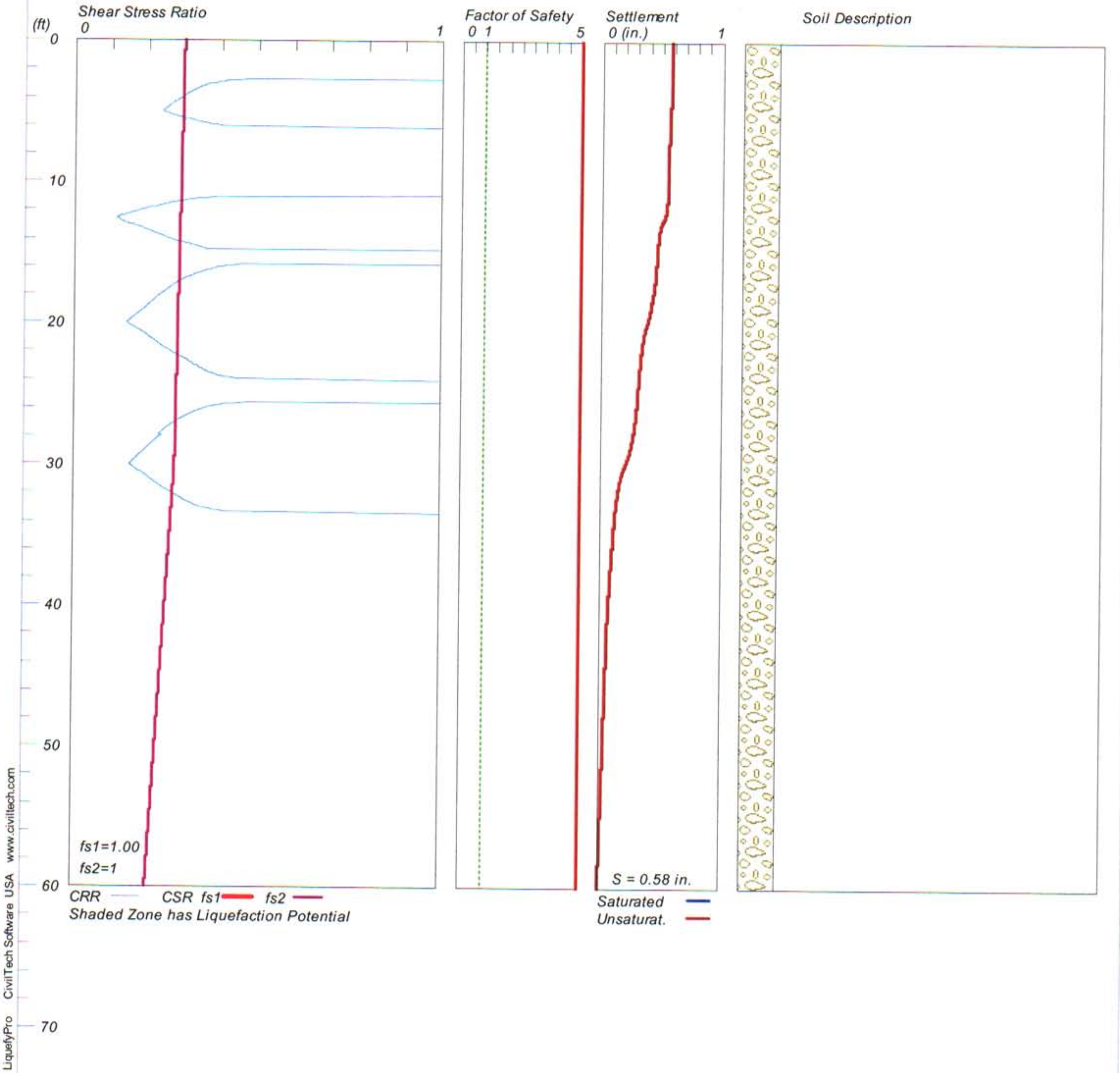


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=LRW-1 Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g

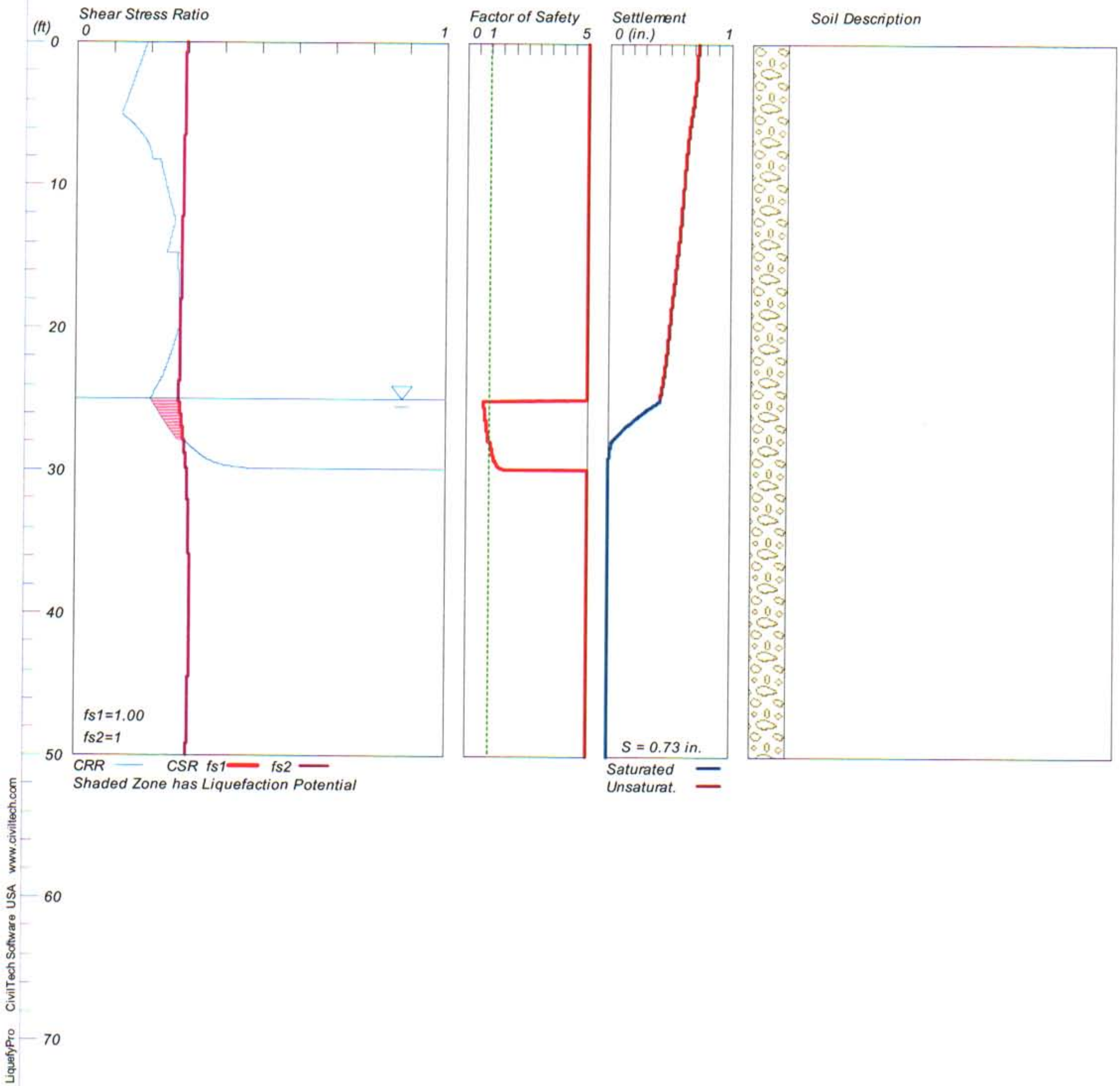


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=LRW-2 Water Depth=25 ft

Magnitude=7.5
Acceleration=0.46g

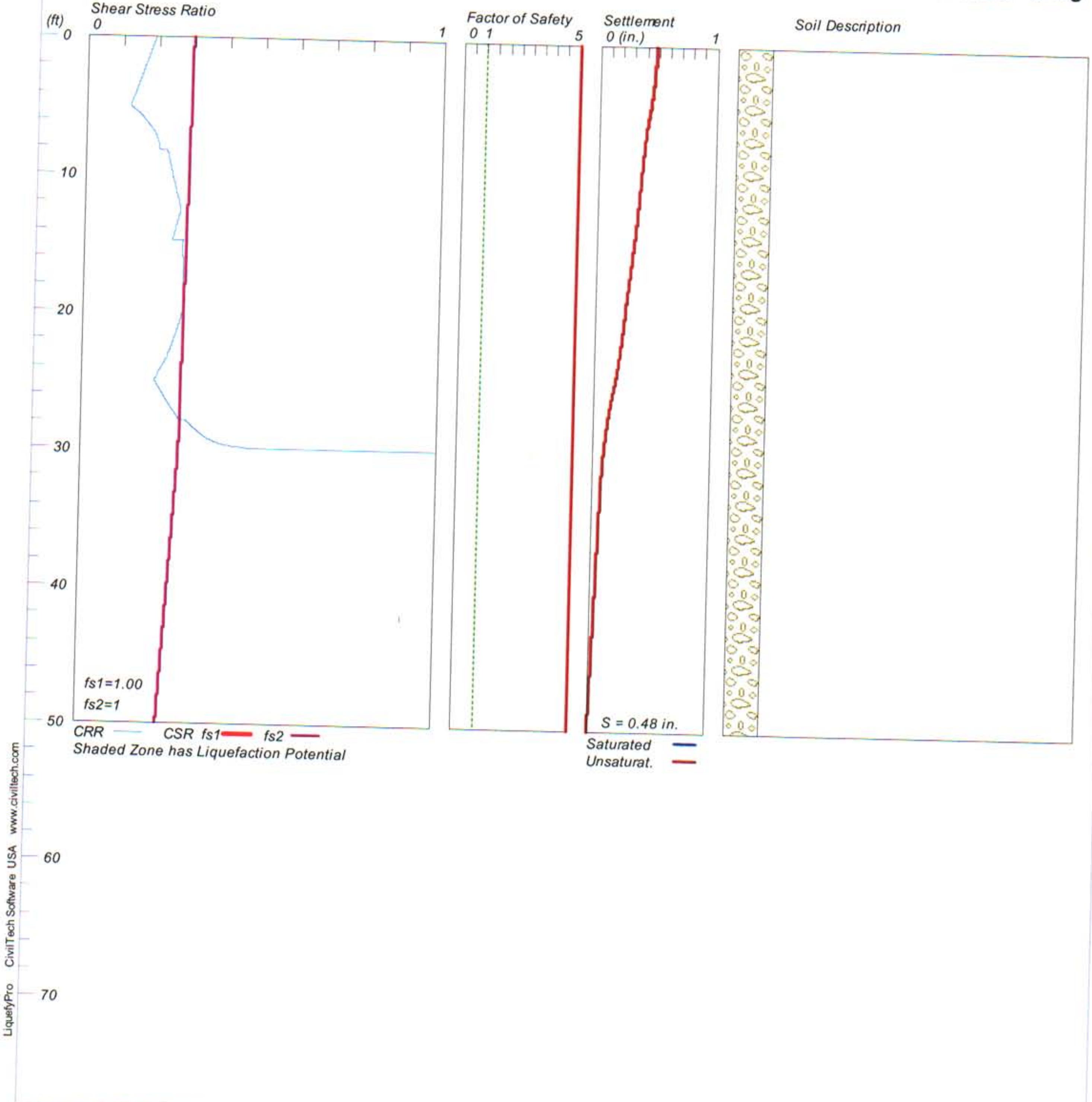


LIQUEFACTION ANALYSIS

Robinson Ranch

Hole No.=LRW-2 Water Depth=100 ft

Magnitude=7.5
Acceleration=0.46g



Leighton

061989-002

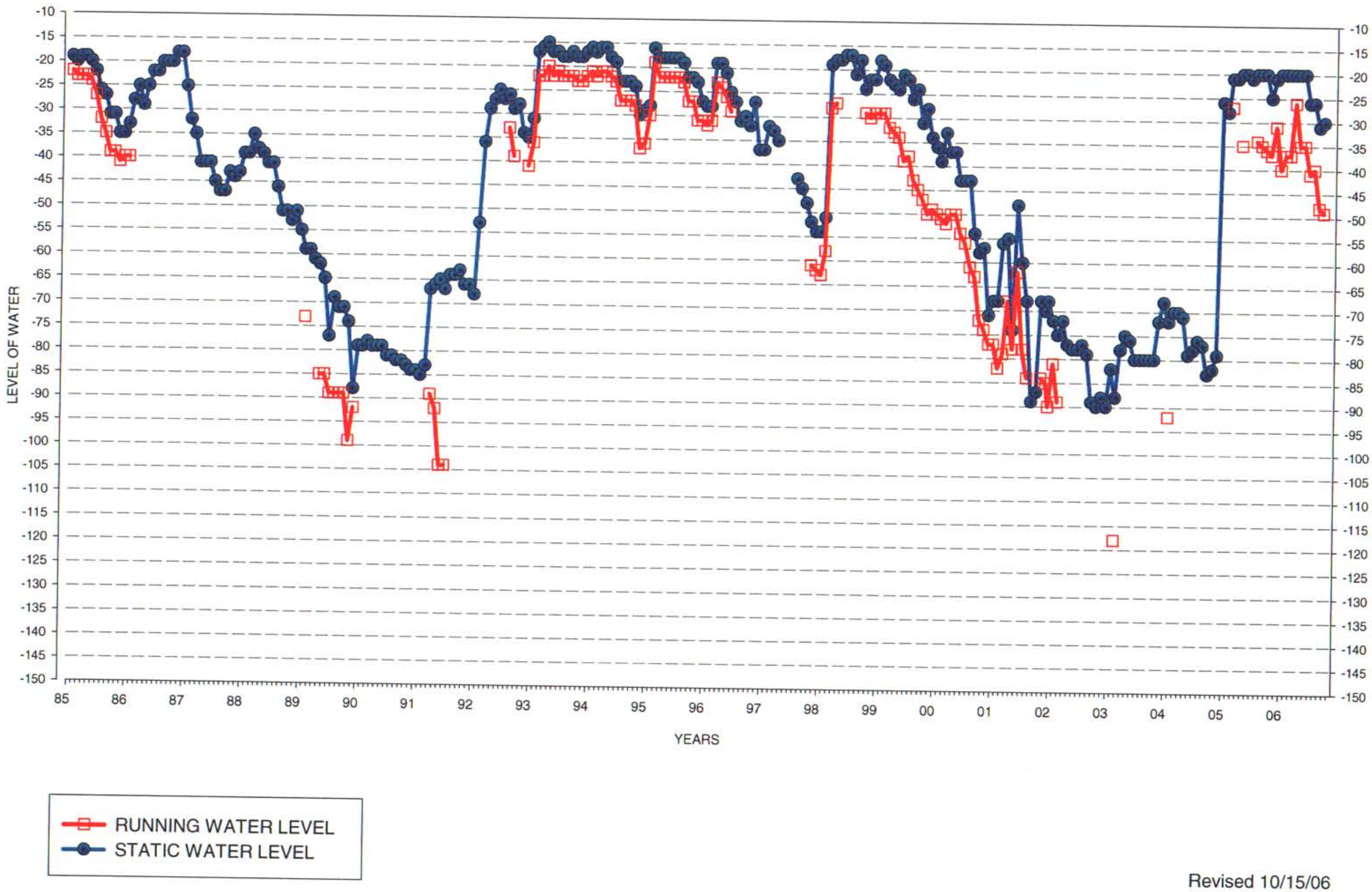
Plate D-28

APPENDIX E

NEWHALL COUNTY WATER DISTRICT PINETREE WELLS 1 THROUGH 3

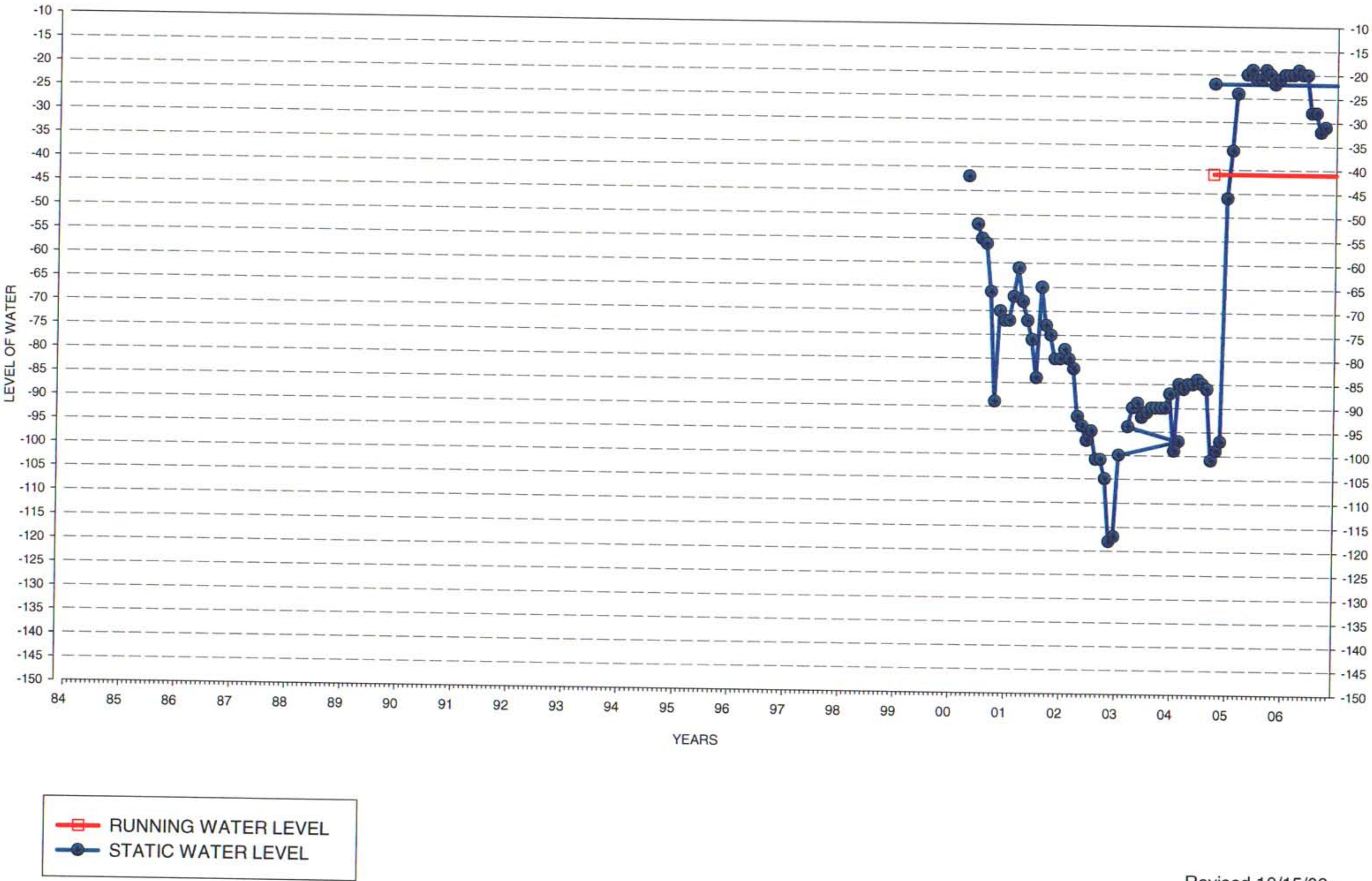
PINETREE WELL # 1

WATER LEVEL GRAPH



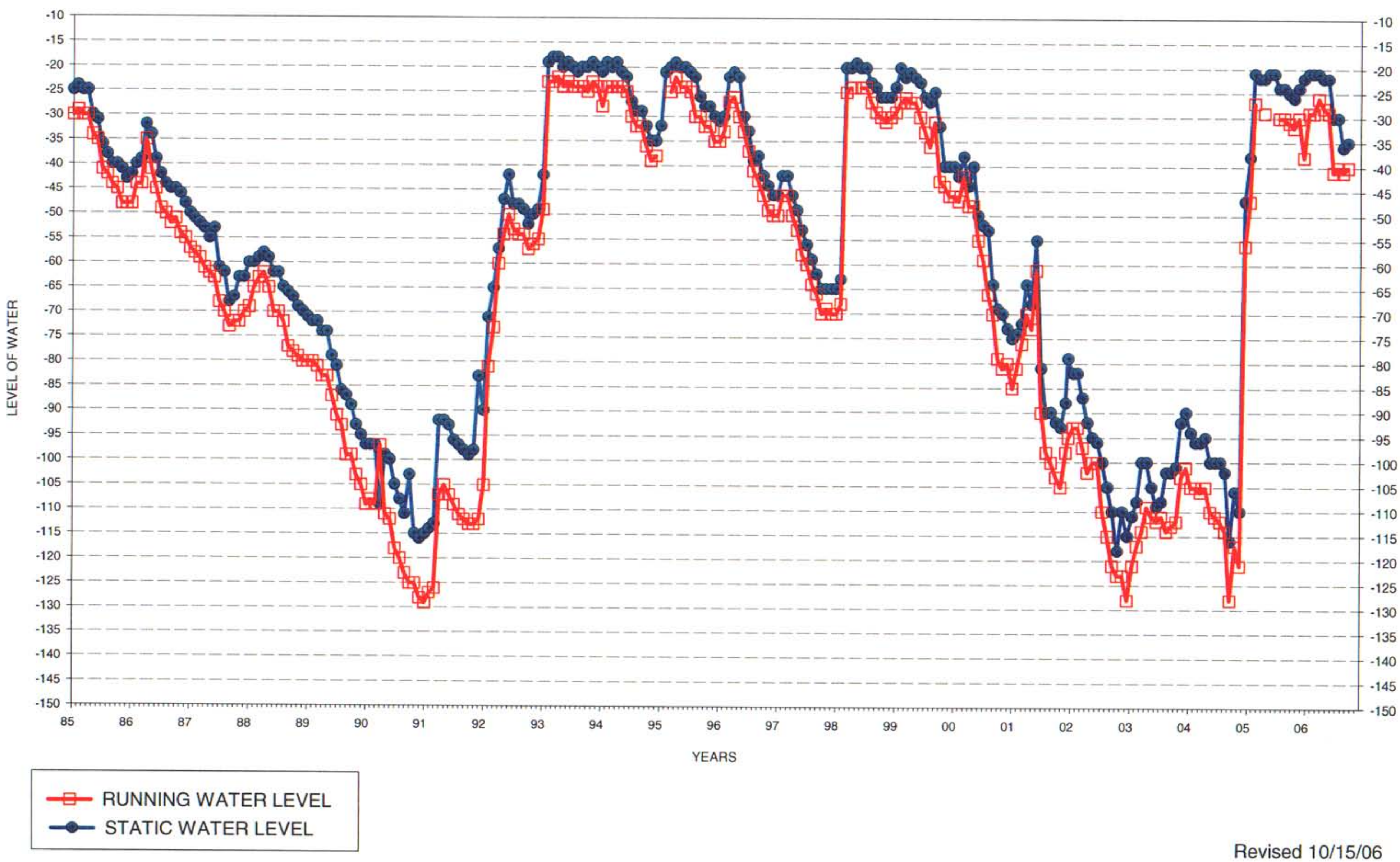
Revised 10/15/06

PINETREE WELL # 2
WATER LEVEL GRAPH



Revised 10/15/06

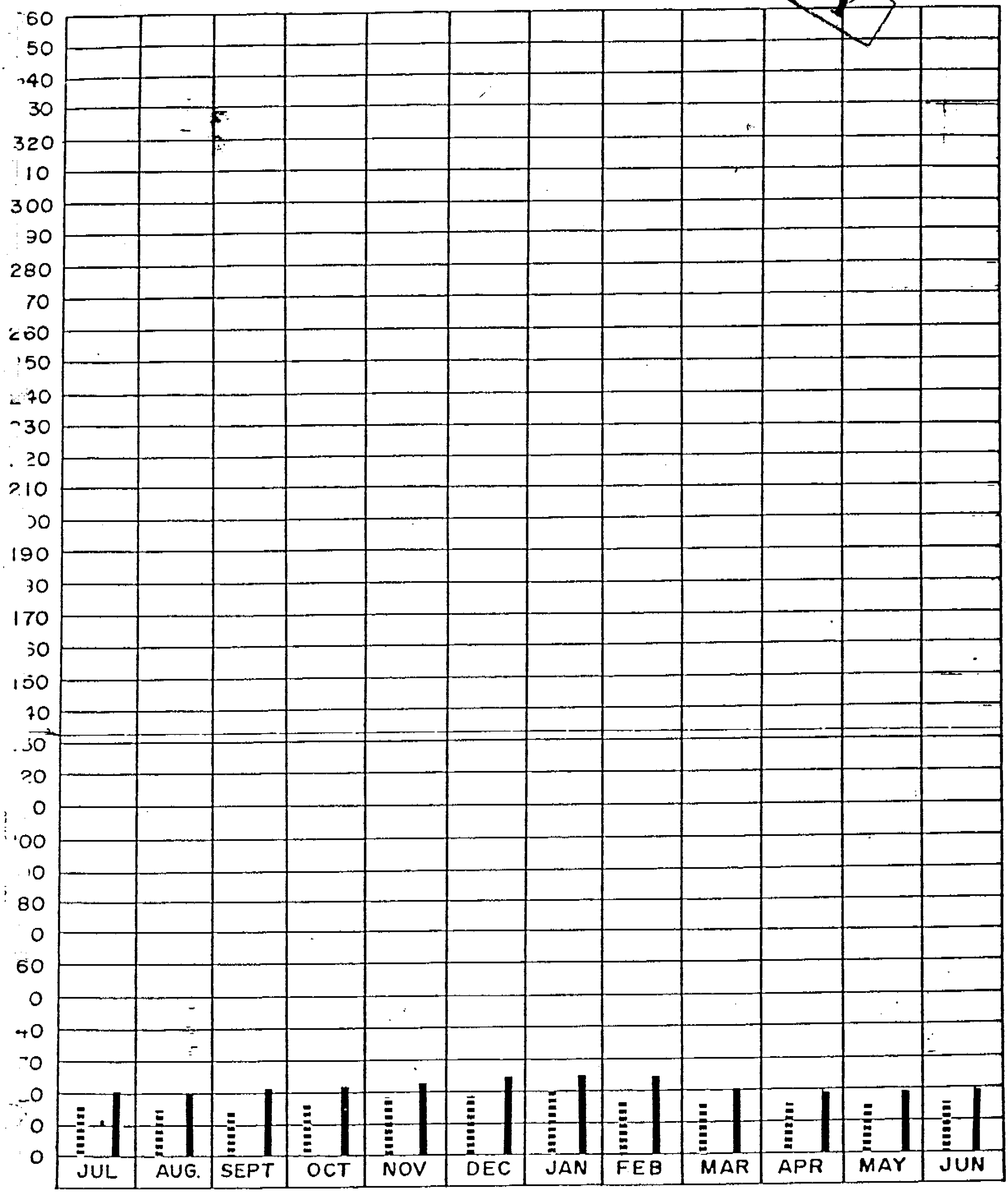
PINETREE WELL #3
WATER LEVEL GRAPH



Revised 10/15/06

PUMPING LEVELS

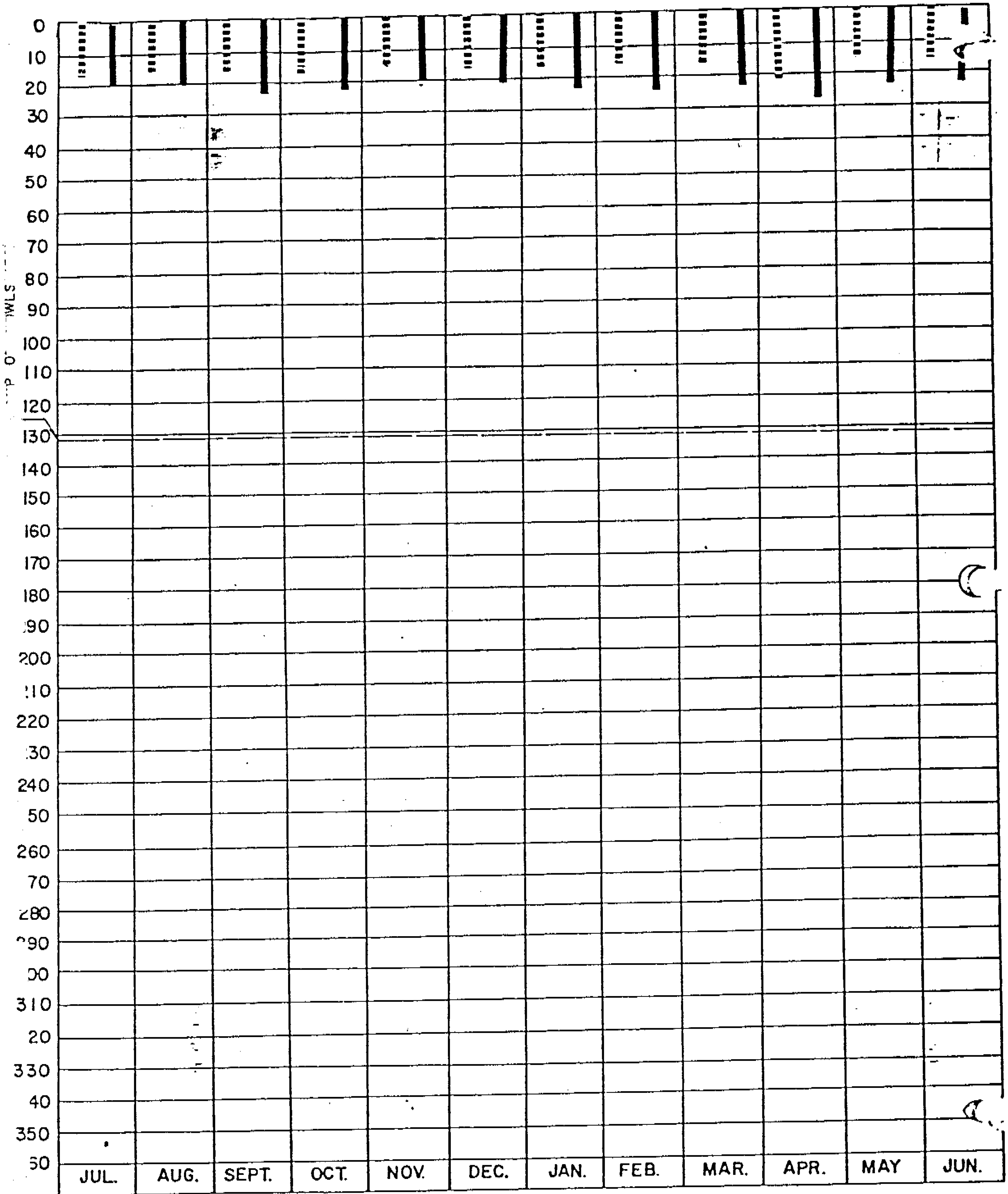
COPY



STATIC
PUMPING

PINE. 1979·80 WELL NO. 1

PUMPING LEVELS

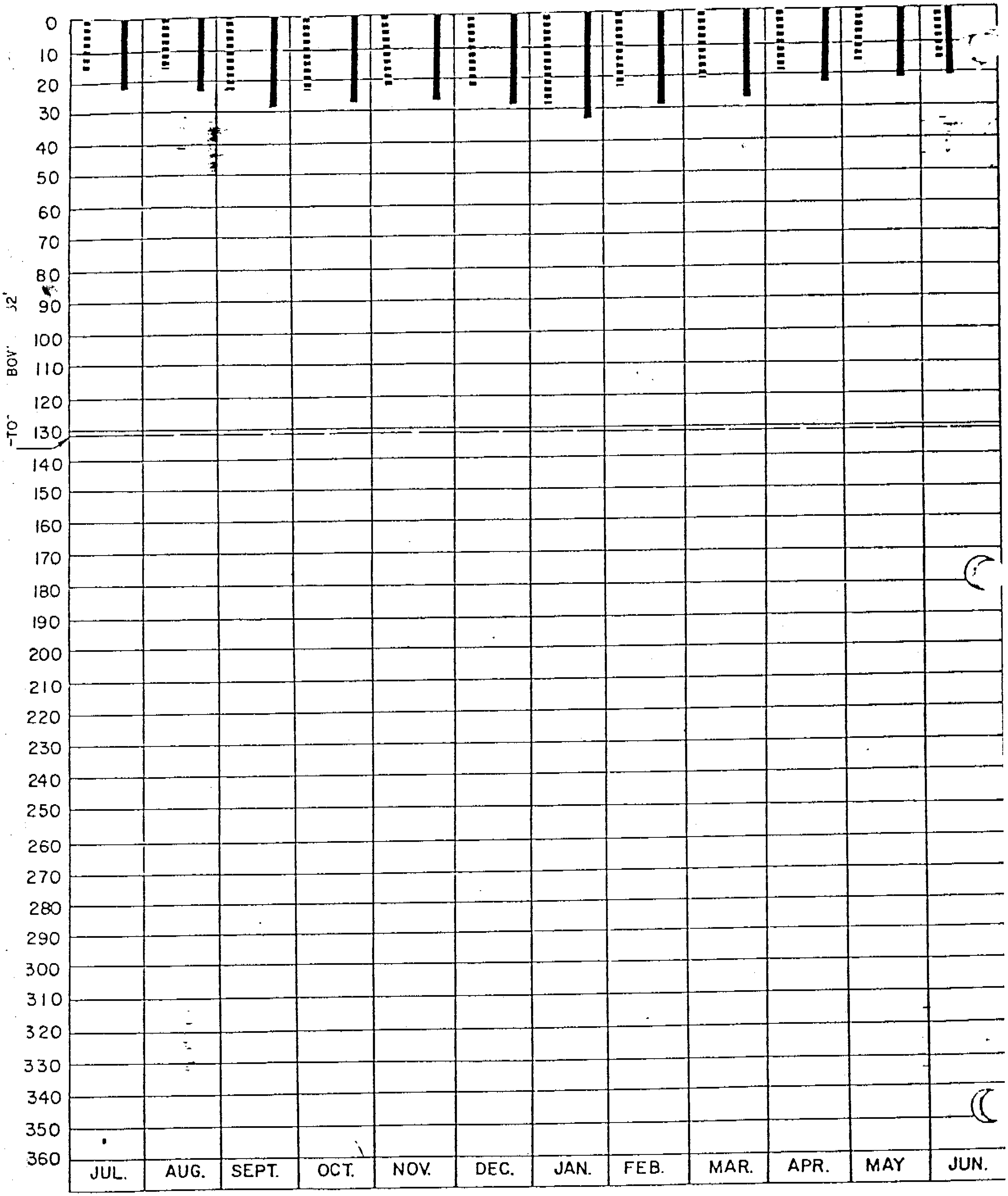


STATIC

PUMPING

PINETREE 1980-81 WELL NO. 1

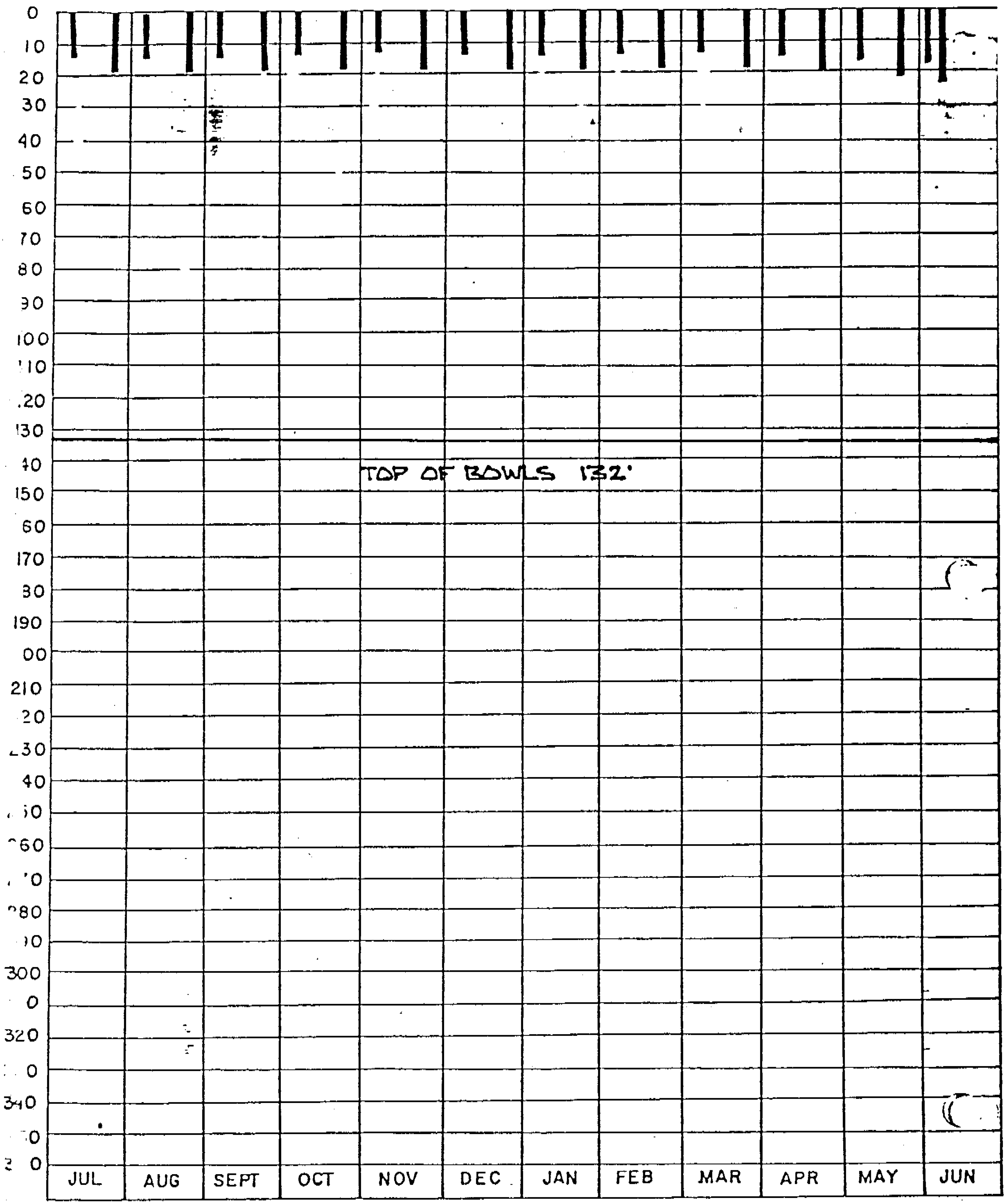
PUMPING LEVELS



STATIC
PUMPING

PINETREE 1981-82 WELL NO. 1

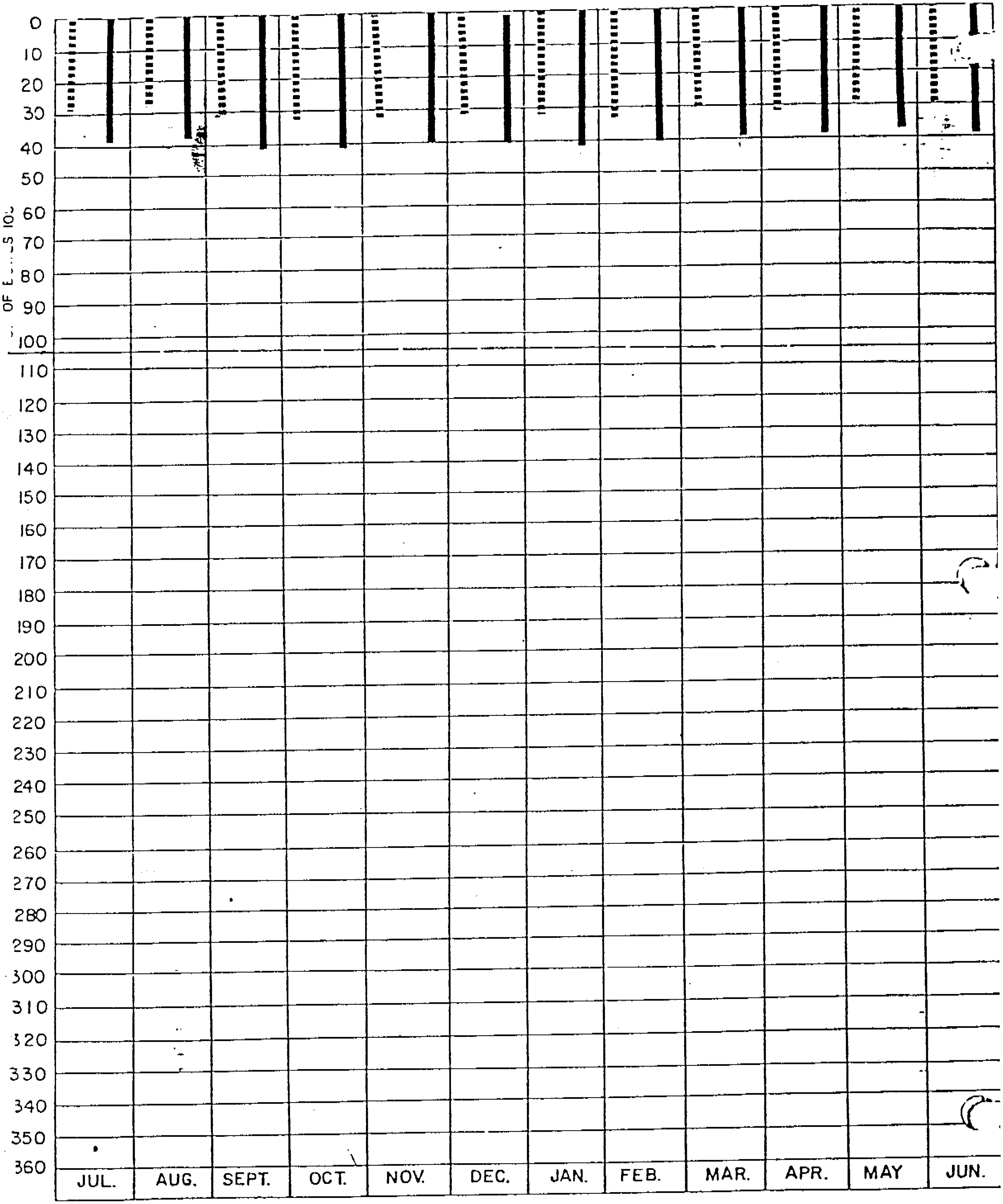
PUMPING LEVELS



STATIC

E - 4 1983 1984 WELL NO. 1

PUMPING LEVELS

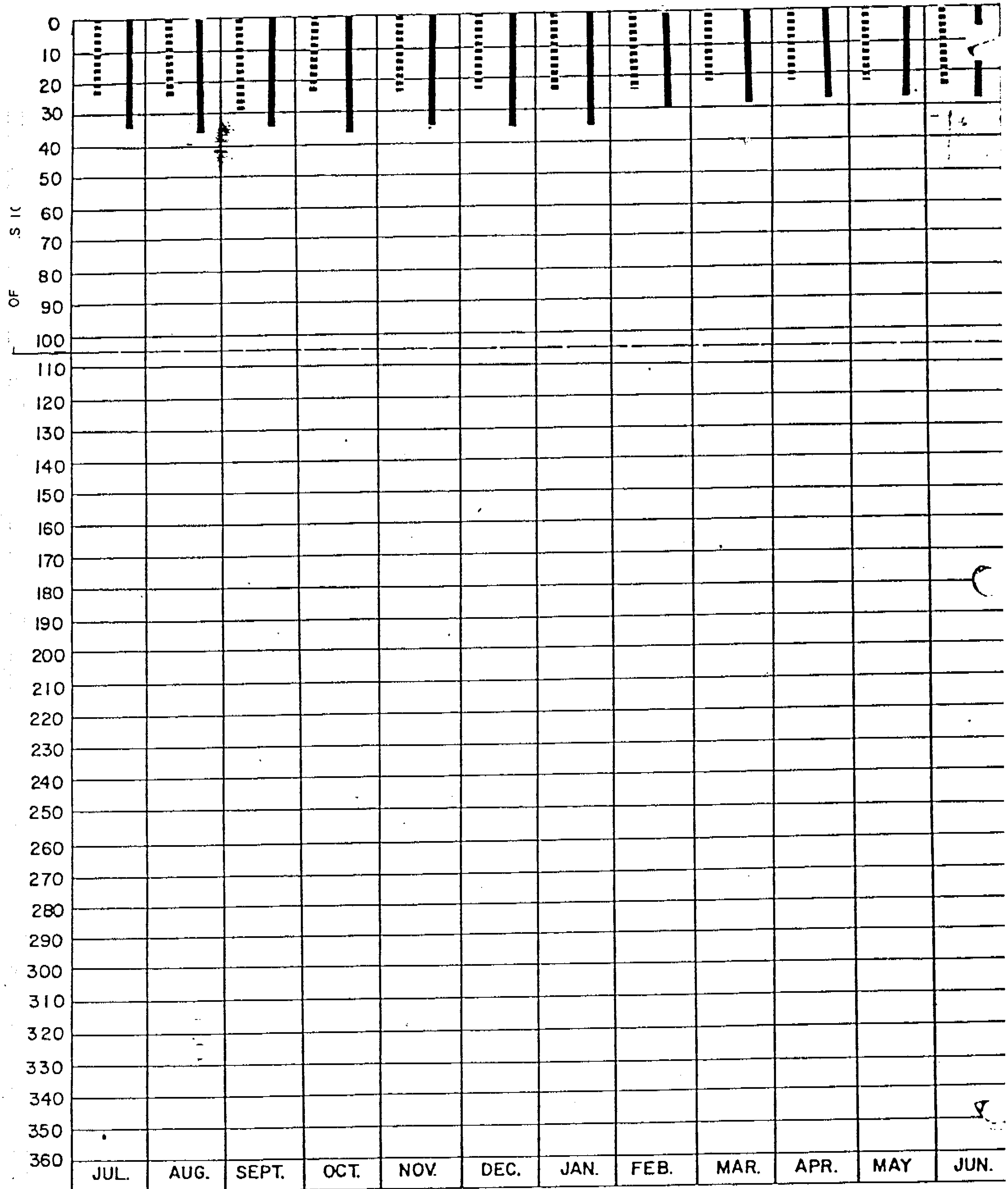


STATIC ▪▪▪▪▪▪▪▪
PUMPING ▬▬▬

PINETREE

1981-82 WELL NO. 2

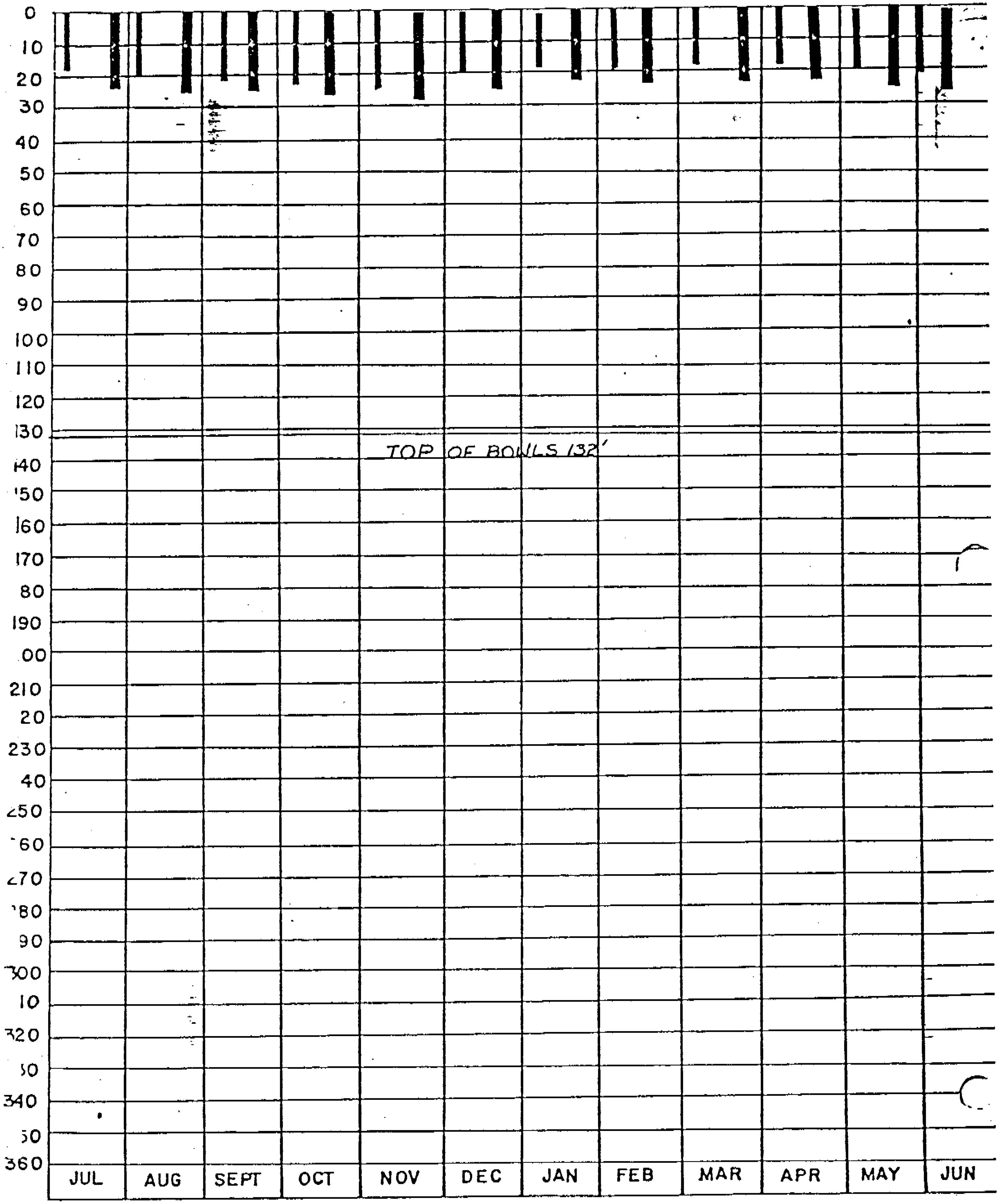
PUMPING LEVELS



STATIC
PUMPING

PINETREE 1980-81 WELL NO. 2

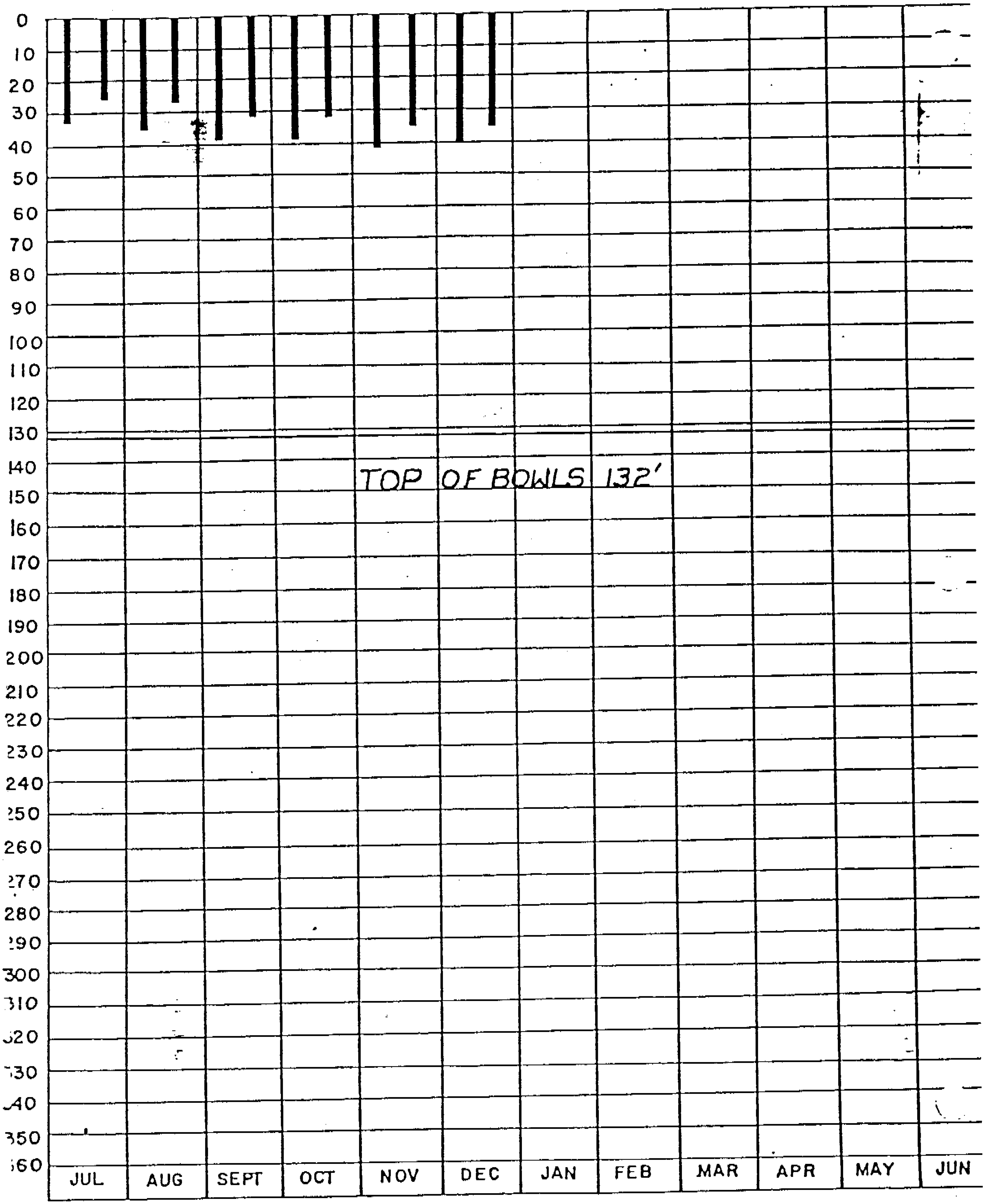
PUMPING LEVELS



STATIC

19 84 1985 WELL NO. 1

PUMPING LEVELS



STATIC ▬
PUMPING ▬

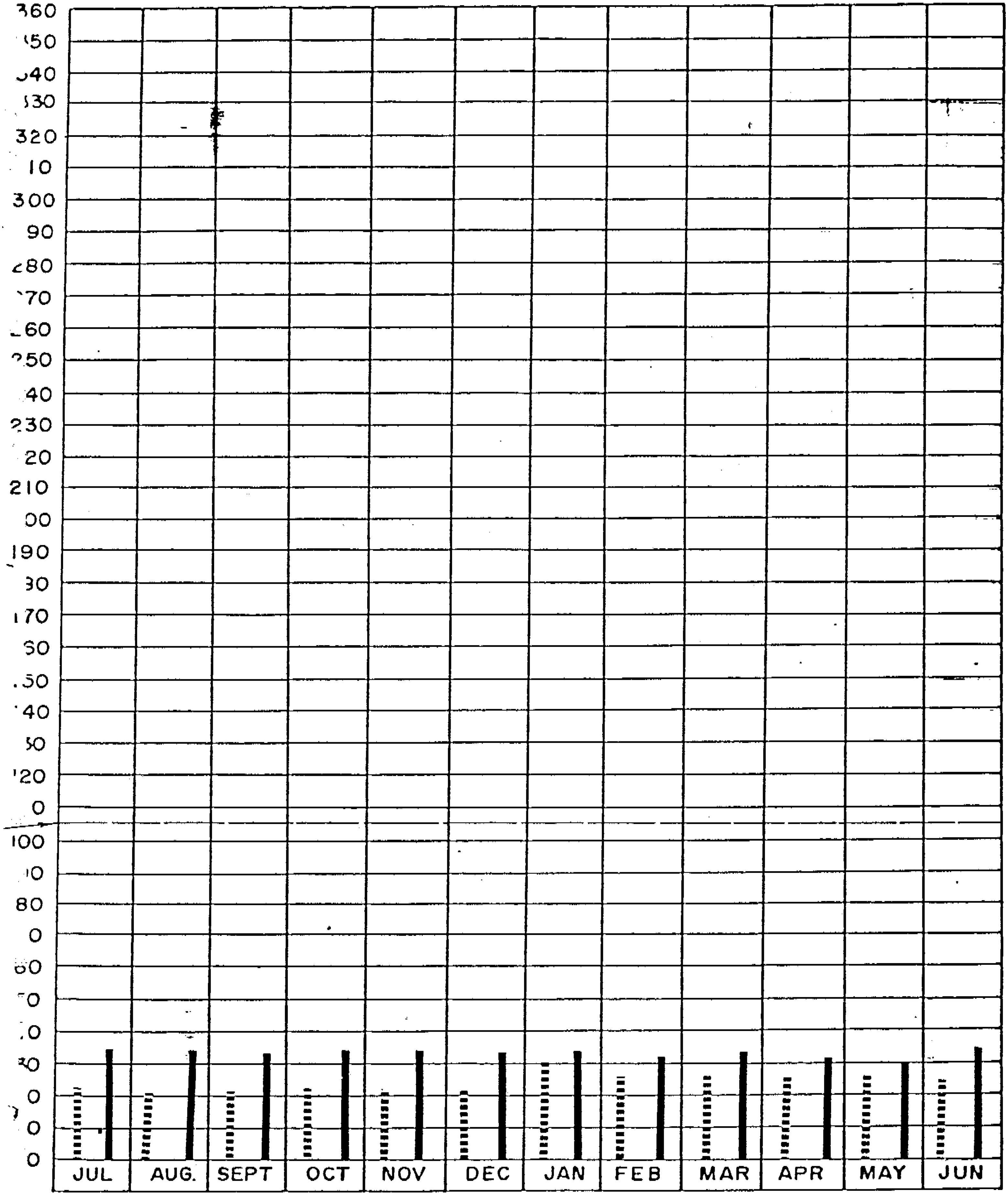
PINETREE

E - 8

1985 1986

WELL NO. 1

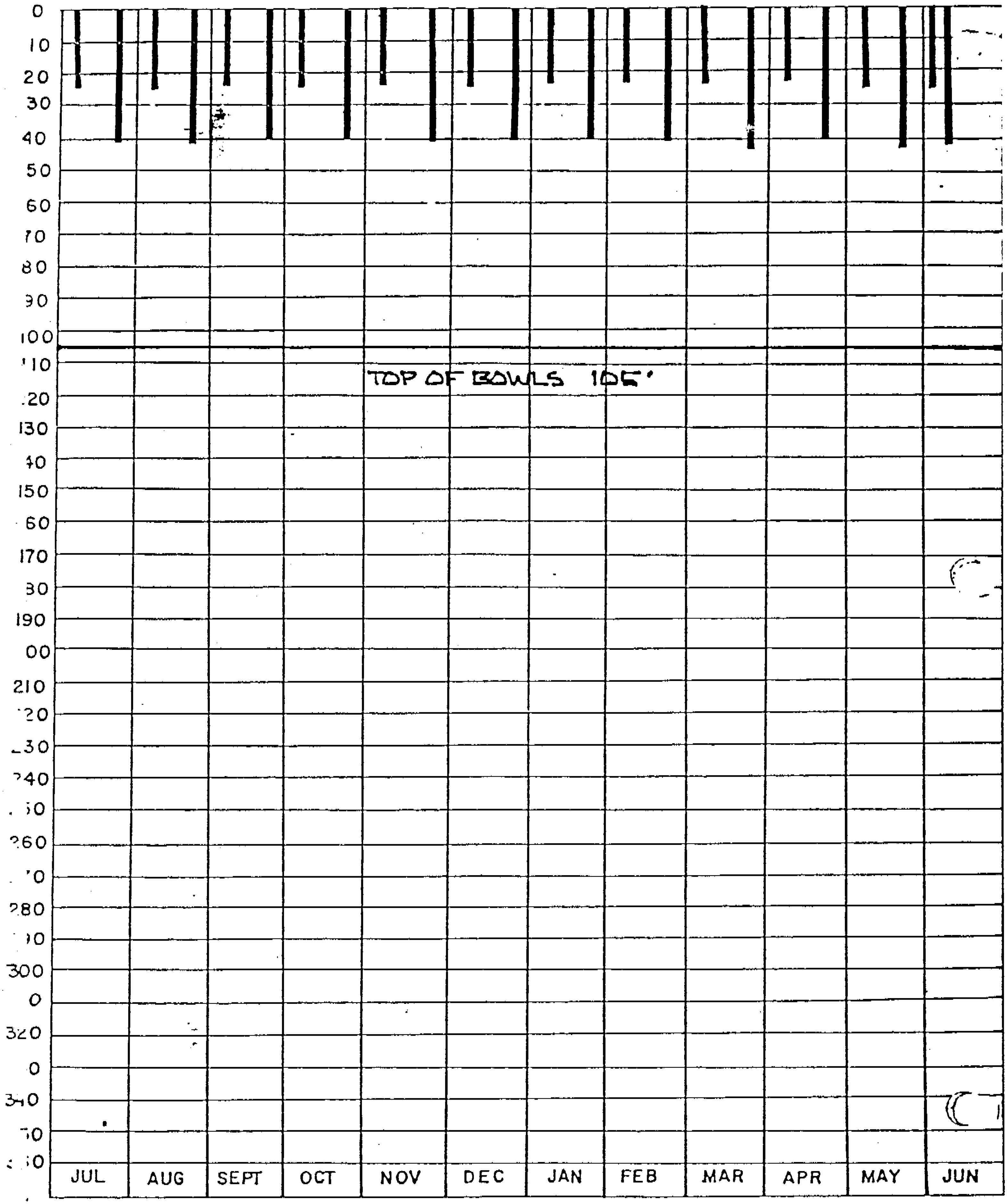
PUMPING LEVELS



STATIC
PUMPING

PINE. E - 9 1979-80 WELL NO. 2

PUMPING LEVELS

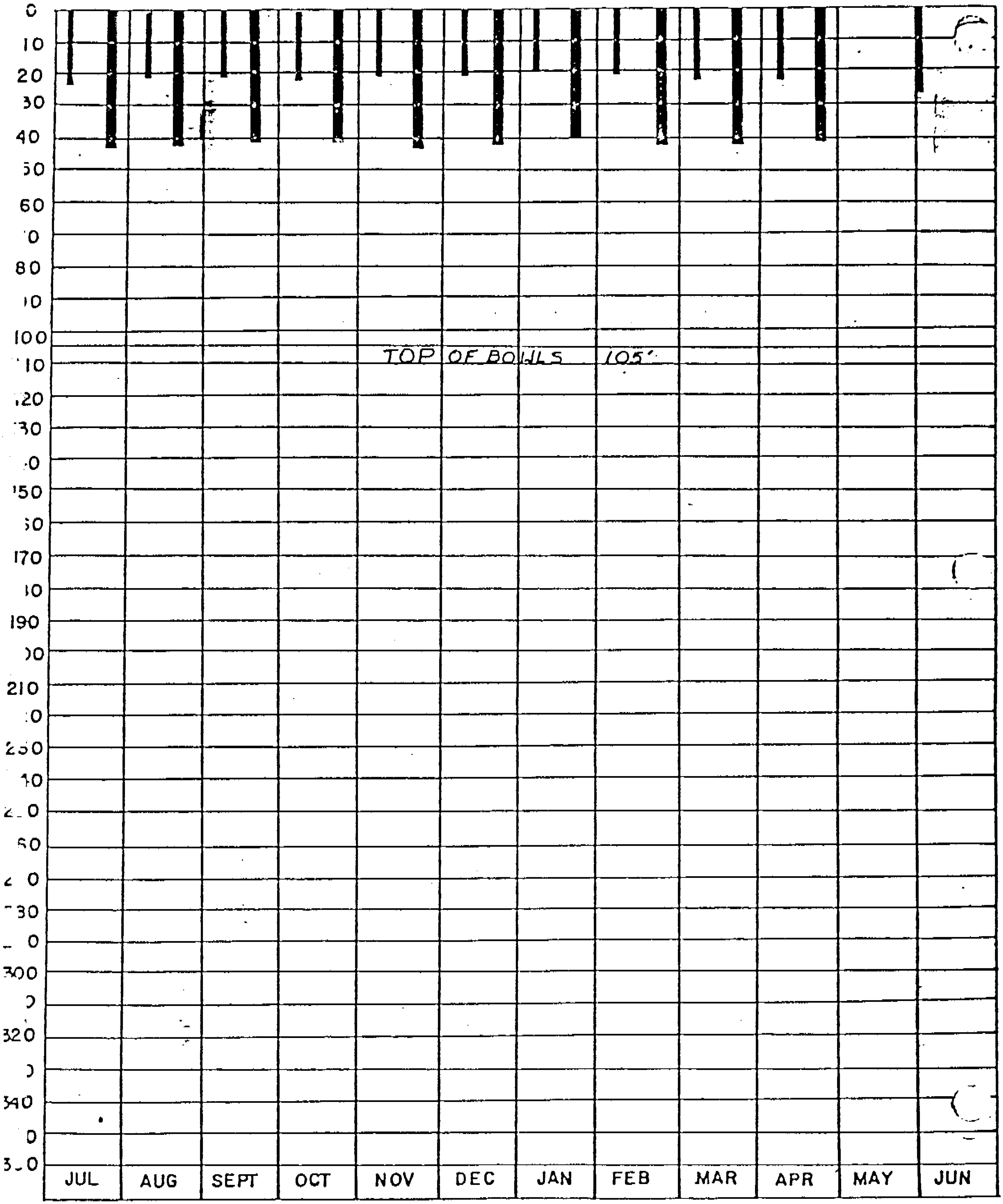


STATIC ▬▬▬

PUMPING ▬▬▬

E - 10 19**83** 19**84** WELL NO. **2**

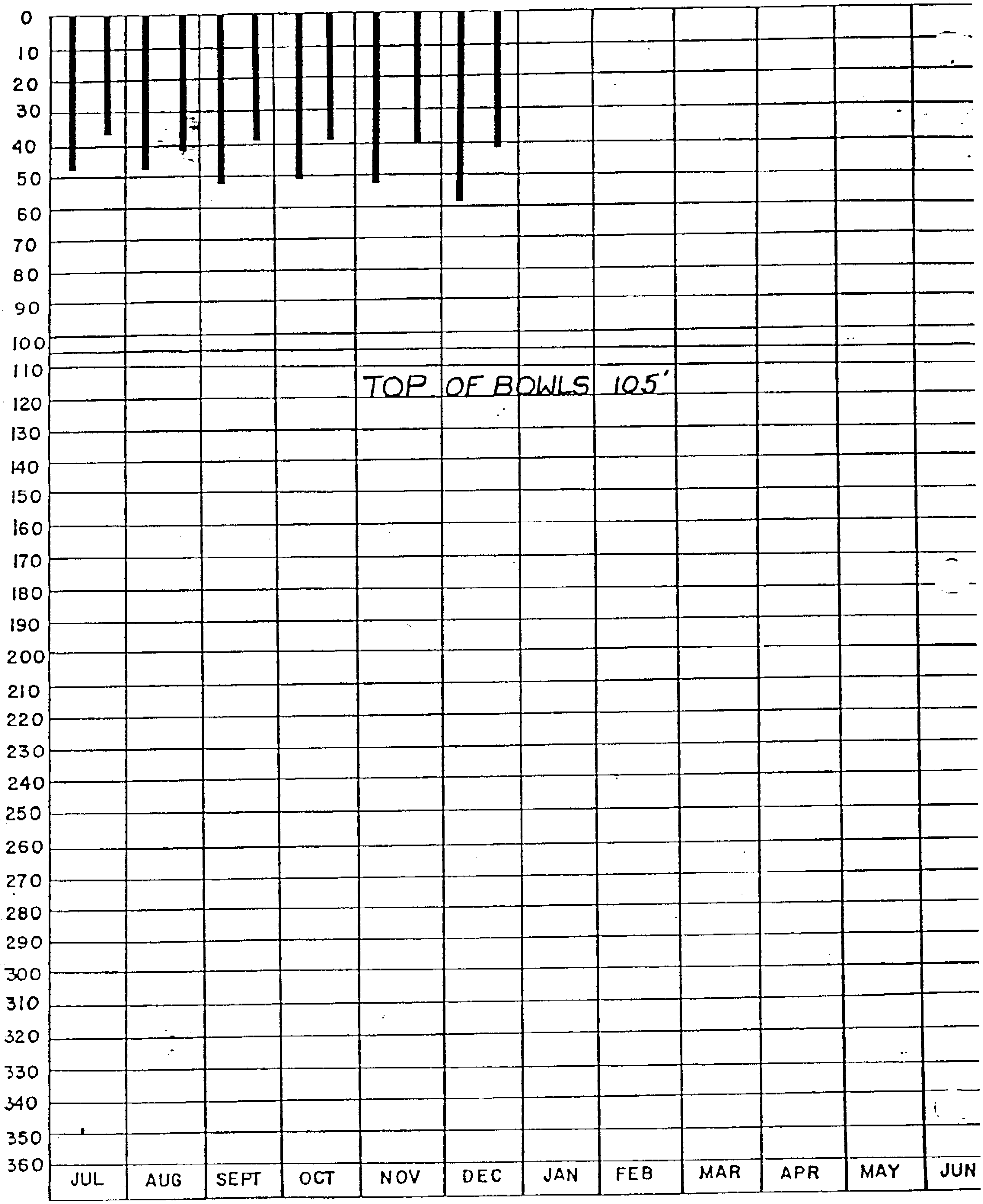
PUMPING LEVELS



STATIC

19 84 1985 WELL NO. 2

PUMPING LEVELS

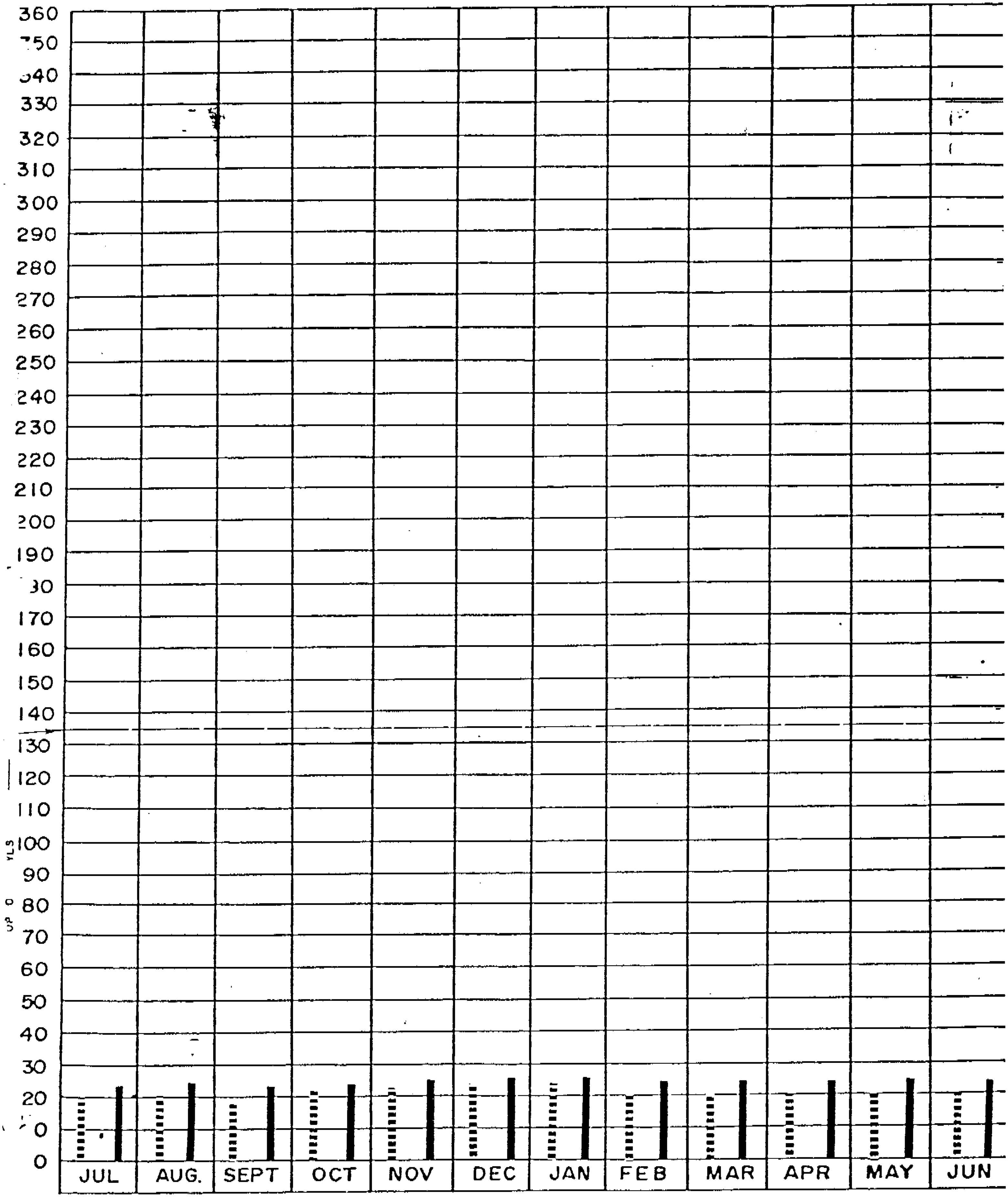


STATIC
PUMPING

PINE TREE

E - 12 1985 1986 WELL NO. 2

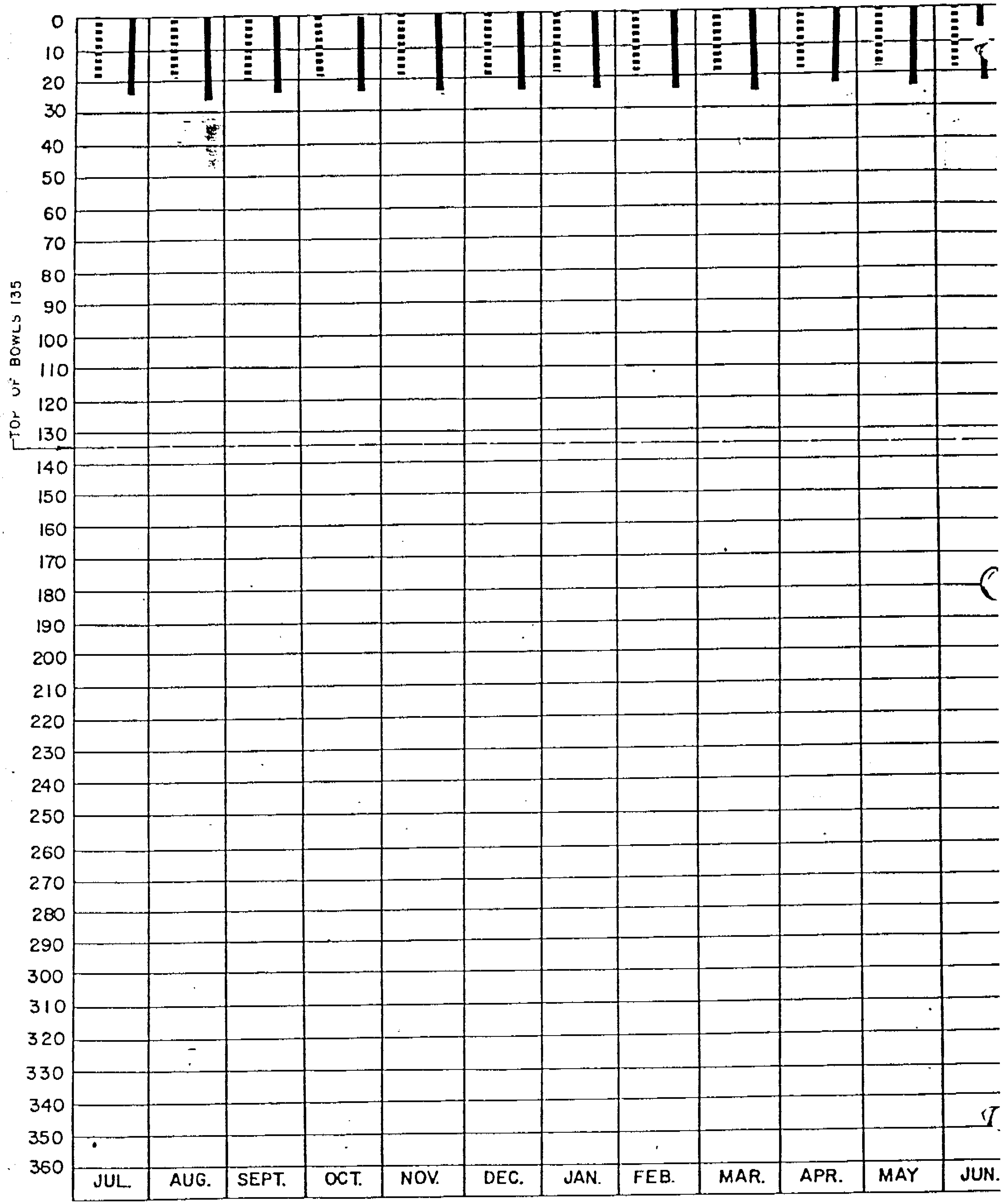
PUMPING LEVELS



STATIC
PUMPING

PINE. 1979-80 WELL NO. 3

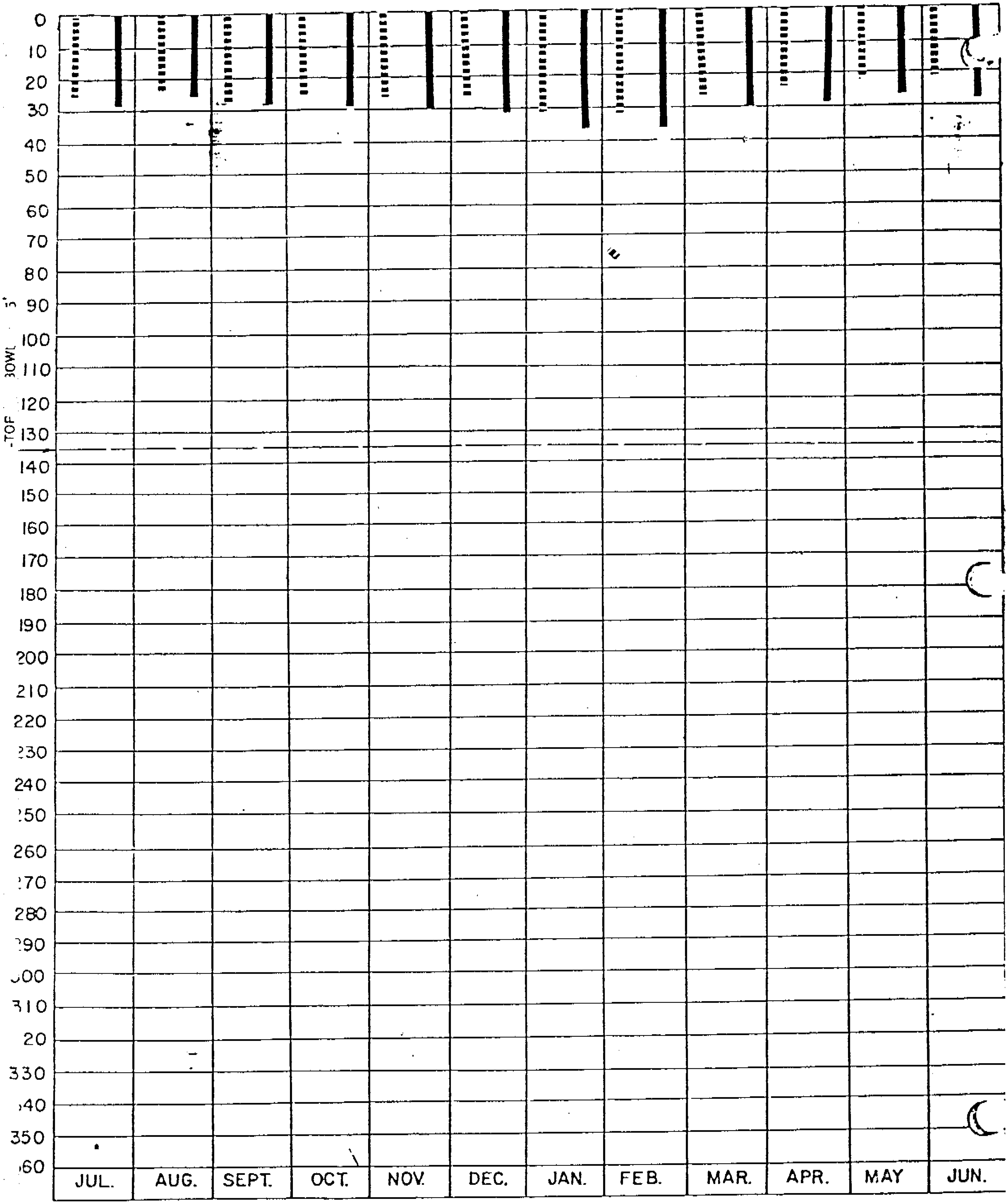
PUMPING LEVELS



STATIC ▪▪▪▪▪▪▪▪
PUMPING ▬▬▬

PINETREE 1980-81 WELL NO. 3

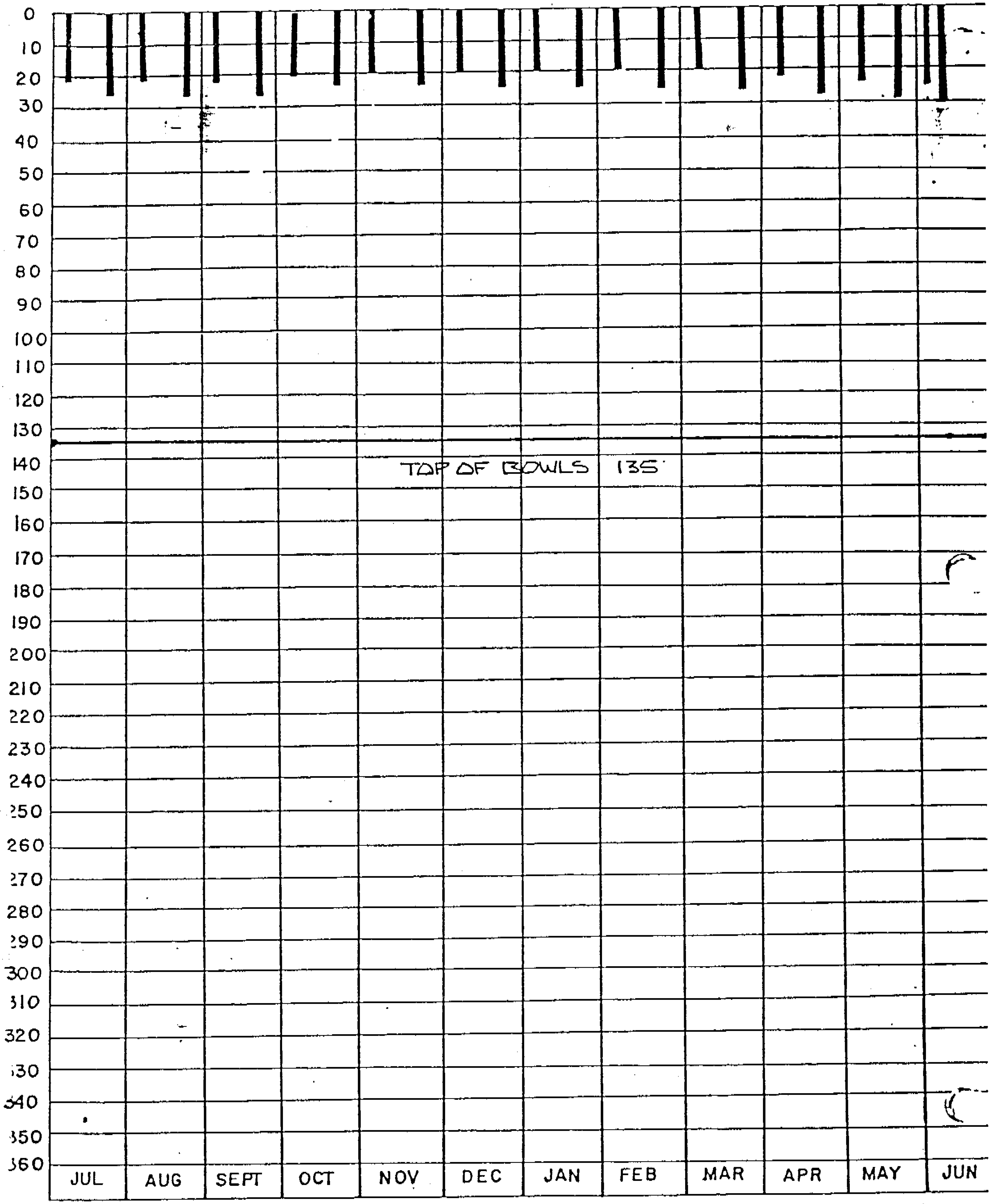
PUMPING LEVELS



STATIC
PUMPING

PINETREE 1981-82 WELL NO. 3

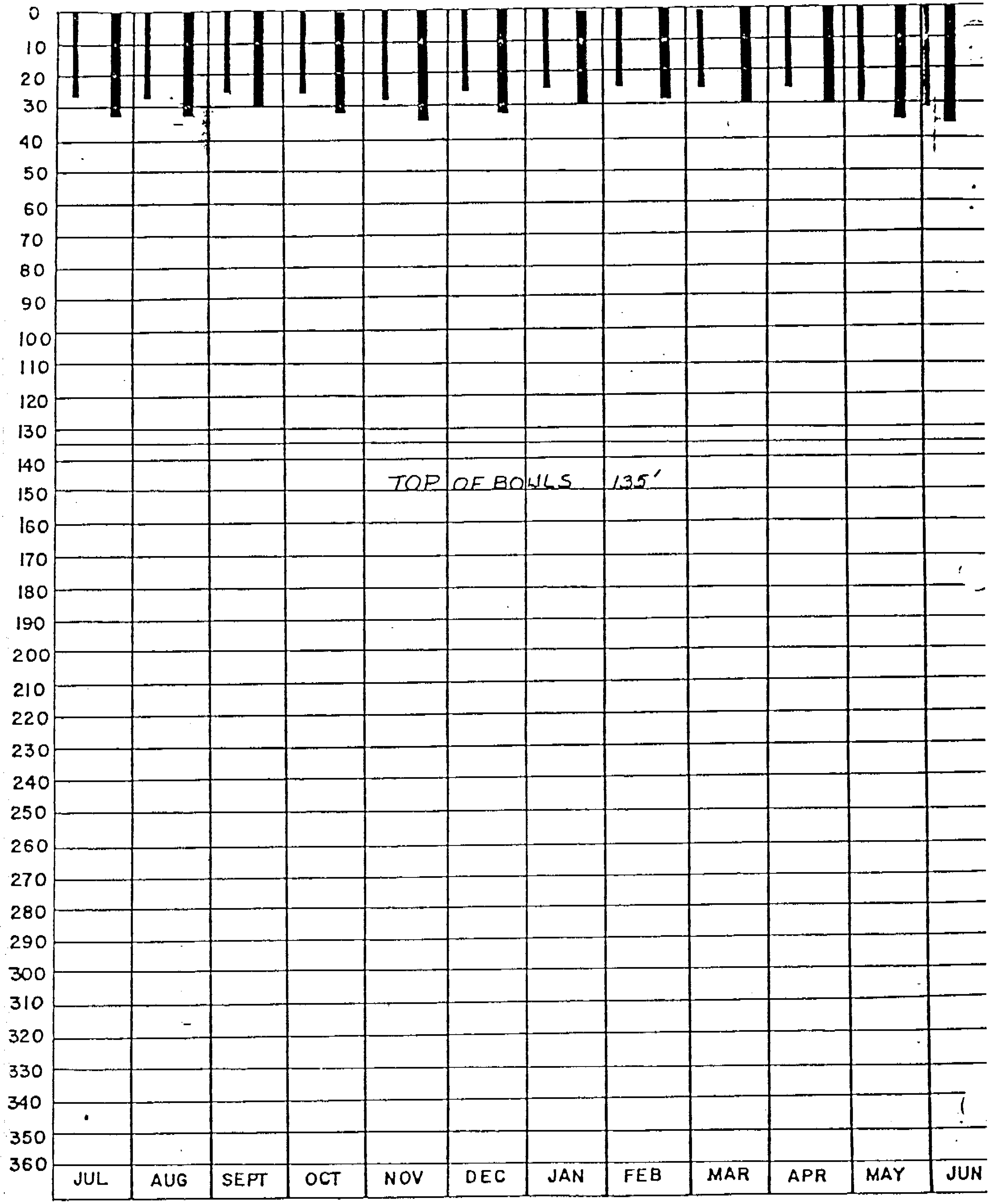
PUMPING LEVELS



STATIC

19 83 19 84 WELL NO. 3

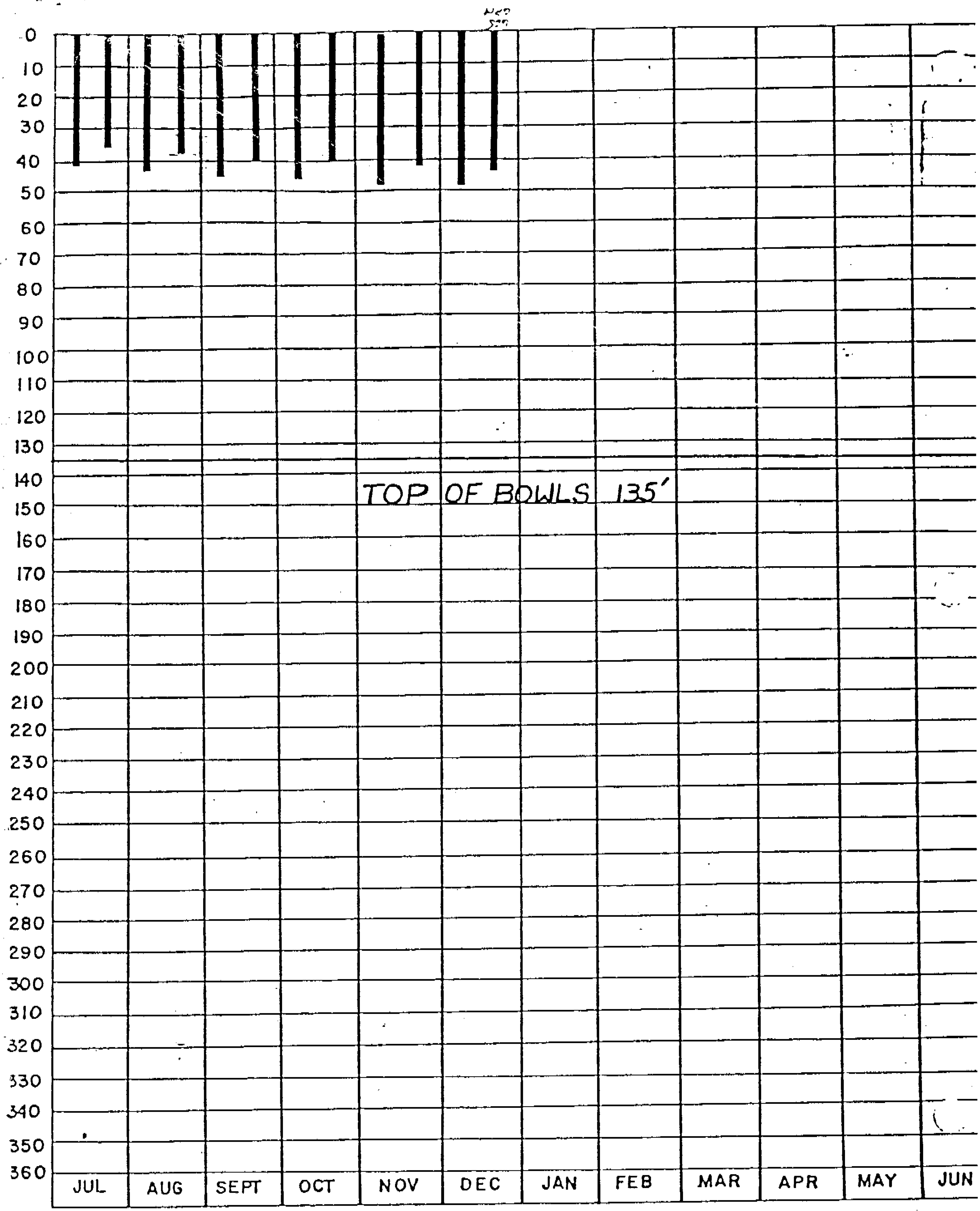
PUMPING LEVELS



STATIC ▬▬

19 84 19 85 WELL NO. 3

PUMPING LEVELS



STATIC ▬▬
PUMPING ▬▬

PINETREE

E - 18 1985 1986 WELL NO. 3


Qal
Qoal
Tmc
Qt
af
Qt
Tmc
Qoal
af
RL
RVL
LS1
LS1'
LS2
LS2'
LS3
LS3'
10'
15'
CITY OF SANTA CLARITA
COUNTY OF LOS ANGELES
B-4 AND B-9 ARE OFF THE MAP
LEGEND
EARTH UNITS
Af ARTIFICIAL FILL
Qal ALLUVIUM
Qoal OLDER ALLUVIUM
Qt TERRACE DEPOSITS
Tmc MINT CANYON FORMATION
SYMBOLS
LRW-2 APPROXIMATE LOCATION OF MUD ROTARY WASH BORING
LB-13 APPROXIMATE LOCATION OF EXPLORATORY BORING
BB-14 APPROXIMATE LOCATION OF HOLLOW STEM AUGER BORING
WELL 3 NEWHALL WATER DISTRICT WELL LOCATION
GEOLOGIC CONTACT
FAULT LOCATION (DOTTED WHERE BURIED, QUERIED WHERE UNCERTAIN)
BEDDING ATITUDE (DASHED WHERE BURIED)
GENERAL BEDDING ATTITUDE (DASHED WHERE BURIED)
JOINT ATTITUDE (DASHED WHERE BURIED)
FAULT ATTITUDE (DASHED WHERE BURIED)
T-10 APPROXIMATE LOCATION OF EXPLORATION TRENCH (TEST PIT)
GT-3 LOCATION OF GEOLOGIC TRAVERSE
LS3 LS3' APPROXIMATE LOCATION OF GEOTECHNICAL CROSS-SECTION, (LEIGHTON, 2006)
T-2 APPROXIMATE LOCATION OF TRENCH
15' ESTIMATED DEPTH OF REMOVAL
N
0 100 200
SCALE FEET
PLATE 1
GEOTECHNICAL MAP
TENTATIVE TRACT 063022, ROBINSON RANCH
SANTA CLARITA, CALIFORNIA
Proj: 061989-002
Scale: 1"=100'
Date: 12/06
Eng/Geol: NHA/JBW
Drafted By: VMN
CP By: BQT
Leighton and Associates, Inc.
A LEIGHTON GROUP COMPANY
P:\DRAFTING\061989\002\OF_06-12-06\PLATE1.DWG (12-06-06 10:24:03AM) Plotted by: btran

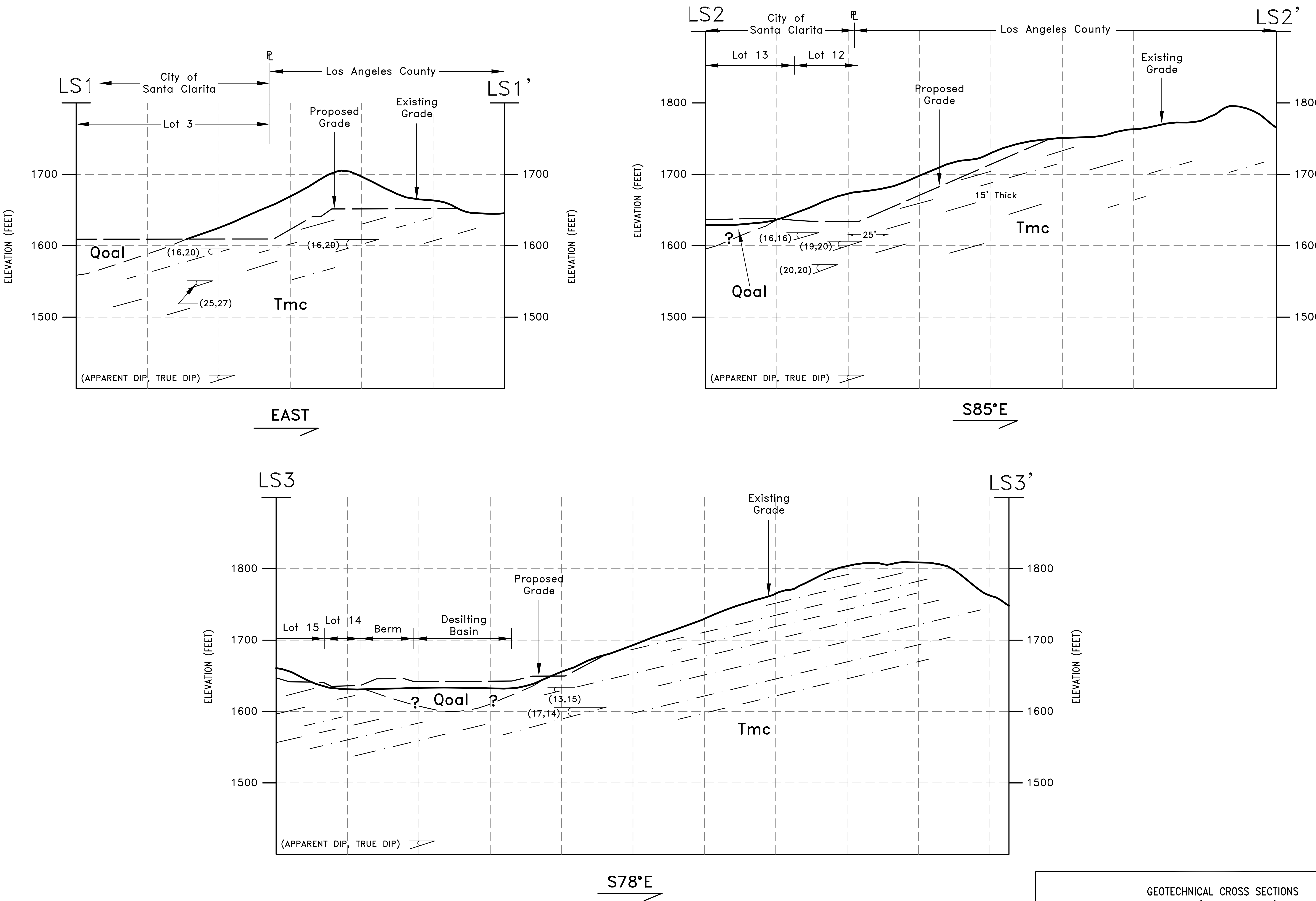


PLATE 2

GEOTECHNICAL CROSS SECTIONS
LS1-LS1' THROUGH LS3-LS3'
ROBINSON RANCH

Leighton and Associates, Inc. A LEIGHTON GROUP COMPANY	Proj: 061989-002	Scale: 1"=40'	Date: 12/06
	Eng/Geol: NHA/JBW	Drafted By: BQT	CP By: BQT
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Revised
Geotechnical Assessment Report
Proposed Tentative Tract No. 063022,
Robinson Ranch Development

Prepared by Leighton and Associates, Inc.

November 2008

1. INTRODUCTION

1.1 Purpose

This report presents the results of the geotechnical feasibility assessment performed by Leighton and Associates, Inc, (Leighton) for the proposed residential development within Tentative Tract 063022 in Santa Clarita, California. The report also includes preliminary geotechnical recommendations for use in the planning and preliminary design of the development.

1.2 Site Location and Description

The subject site is approximately 185 acres in size and is located on the south side of the Santa Clara River in the City of Santa Clarita California (Figure 1 - Site Location Map). Site topography consists of a wide canyon bottom with gentle slope gradients trending downward from the southeast to the Santa Clara River on the northwest. Relatively steep-sided ridge lines border the site on the southwest, southeast, and east. Bordering ridges are inclined at gradients ranging from approximately 3:1 (horizontal to vertical) to approximately 1:1. Two bedrock outcrops of approximately 25 and 40 feet in height are located in the western and north-central portions of the property. Site elevations range from approximately 1,550 feet above mean sea level (msl) in the northwest portion of the site to approximately 1,730 feet (msl) in the southeast portion of the site.

An active railroad grade crosses the northern portion of the site and a floodway boundary crosses the southwestern site comer. Two gas line easements and an older abandoned railroad grade cross the center of the site from east to west.

1.3 Proposed Development

It is Leighton's understanding that the proposed development will consist of 105 residential lots (Lots 1 to 105). Lots 1 through 100 will be located south of the railroad right-of-way and Lots 101 to 105 will be located north of the active railroad right-of-way. An open space lot, designated Lot 106, will be located north of the railroad right-of-way and east of Lot 101. The locations of the lots are shown on the Geotechnical Map, Plate 1.

It is also Leighton's understanding that the proposed development will comprise one to two-story single family detached wood structures, together with the associated streets and flatwork. Subterranean structures do not appear to be planned at this point; however, it is anticipated that the proposed development will include earth retaining structures.

The proposed development will also include three detention basins: one adjacent to Lot 14 in the southeastern comer of the site, a second between Lots 9 and 10 at the eastern site margin, and a third north of Lot 1 in the northeastern comer of the site.

Access to the site will be from Lost Canyon Road in the northwestern portion of the site and from "E" Street in the southern part of the site. A bridge with a span of approximately 275 feet is planned for Lost Canyon Road, and a second bridge with a span of approximately 160 feet is planned for a future street near its intersection with the northern terminus of "E" Street.

Cut slopes up to 40 feet in height and a gradient of 2: 1 (horizontal: vertical) are planned to descend to Lost Canyon Road at the northwest site margin. A cut slope up to 50 feet in height is planned in the southeastern portion of the site, behind Lots 15 through 17. Offsite and to the east of the project, two cut slopes are planed: one up to 30 feet in height and descending to Lots 1 through 4, and a second almost 100 feet in height descending to Lots 10 through 13 in the southeastern portion of the site.

A fill slope up to approximately 25 feet in height is planned from the northern margin of Lots 66 through 68.

1.4 Previous Investigations

Leighton had previously performed several geotechnical investigations at the subject site; including investigations for the previously proposed Tract 34466 (see referenced reports). The information obtained from these investigations was used in preparing this current report where relevant.

A brief summary of the scope of work and findings for the prior Leighton geotechnical investigations is as follows:

Leighton, 1985a:

This report was for the preliminary geotechnical investigation for the previously proposed Tentative Tract 34466, Sulphur Springs, Los Angeles, California. The investigation included:

- Excavation of 13 bucket-auger borings (Bl through B13).
- Analyses of the geotechnical conditions and opportunities and constraints for the subject site.
- Concluded that Tentative Tract 34466 is geotechnically suitable for residential development.
- Conclusions and recommendations for construction at the tract. . Identified a liquefaction hazard in portions of the site.

Leighton, 1985b:

- Provided two additional cross-sections and depicted zones of potential liquefaction.

Leighton, 1986a:

- Geotechnical review of the revised Tentative Tract Map 34466 that concluded that the changes in the subject tentative tract plan were minimal, and that the previous geotechnical recommendations remained applicable to the revised tentative tract map.

Leighton, 1986b:

- Provided a response to the County of Los Angeles Soils Engineering and Engineering Geology Review Sheets pertaining to the previously proposed Revised Tentative Tract 34466.

Leighton, 1989a:

- Previous Leighton report and grading plan had been approved by the County of Los Angeles.
- Leighton evaluated the geotechnical conditions pertaining to a revised grading

plan by Lind and Hillerud dated September 7, 1988.
- Evaluation included excavation of 10 additional exploratory backhoe trenches.

Leighton, 1986b:

- Provided geotechnical input for the environmental impact report regarding liquefaction potential.
- Concluded that the liquefaction hazard in the southern portion and in bedrock areas is very low to nil.
- Recommended special foundations in the northern portions of the site.

Leighton, 1986b:

- Supplemental Liquefaction Evaluation for Vesting Tentative Tract 34466.
- Included 14 additional borings utilizing a hollow-stem drill rig.
- Concluded that Leighton's previous borings (1985a) were drilled after the unusually heavy rainfall year of 1984. Well records for this period show ground water levels to be within 5 feet of the highest recorded for the area.
- Concluded that residential irrigation of 26 inches per year would correspond to a 5:1: -foot increase in ground water levels at the subject site.

Leighton, 1990a:

- Supplemental Liquefaction Evaluation; provided analyses and mitigation in accordance with the prevailing standards and practices at that time.

Leighton, 1990b:

- Response to Geotechnical Review by Los Angeles County specific to previously proposed Vesting Tentative Tract 34466.

Leighton, 1990c:

- Review of new tentative tract map 34466; bedrock strength parameter were summarized, and peak strength parameters were utilized for slope stability analyses for seismic loading conditions.

Leighton, 1990d:

- Response to review of Draft Environmental Impact Report.
- Reiterated the previous recommendation for removal and recompaction of the top 5 feet in areas with low potential of liquefaction in addition to utilizing posttensioned foundations, also recommended an additional 10 to 15 feet of compacted fill in the areas of highest liquefaction potential will reduce liquefaction potential significantly.
- Concluded that other methods of ground preparation and foundation design, such as vibro-flotation, or the use of pile foundations, were not warranted for the proposed project.

1.5 Purpose and Scope of Current Investigation

The purpose of this investigation was to assess the feasibility of Tentative Tract 063022 and to provide preliminary geotechnical recommendations for use in the planning and preliminary design of the proposed development.

Leighton performed the following tasks as part of the current scope of work:

- Reviewed Leighton's pre-existing soils and geology reports conducted for the subject site, (see Appendix A - References).

- Assessed geologic hazards as referenced by the following:

  - State of California Alquist Priolo Earthquake Fault Zones Map;
  - State of California Seismic Hazard Zones Map; and,
  - Regional geologic maps contained in Leighton's in house library.

- Performed a preliminary site reconnaissance and geologic mapping of surface on-site conditions.

- Produced a Geotechnical Map from Leighton's previous onsite explorations, geologic resources in Leighton's in-house library as well as information gathered during onsite geologic mapping.

- Performed a preliminary assessment of the stability of the proposed slopes.

- Performed a site reconnaissance to evaluate access to, and to mark, the intended boring locations.

- As required by State law, contacted Underground Service Alert a minimum of two working days prior to fieldwork mobilization such that underground utilities could be located and marked by others.

- Drilled, logged, and sampled two borings to total depths of 61.5 and 51.5 feet (bgs) with a sample interval of no more than every 5 feet.

- Performed laboratory testing on selected samples including:
  - In-situ moisture/density; and
  - Gradation.

- Performed Engineering analysis to assess:
  - Anticipated removal limits;
  - Preliminary slope stability;
  - Liquefaction assessment; and
  - Allowable bearing pressure.

- Prepared this report summarizing our findings and conclusions.

2. GEOLOGIC FINDINGS

2.1 Geologic Setting

The subject site is located within the western portion of the Transverse Ranges Geomorphic Province and more specifically within the central portion of the San Gabriel Mountains. The Transverse Ranges are a belt of east/west-trending folds and associated thrusts that formed in response to northeast to north-northeast crustal shortening that initiated in Pliocene time, approximately 4 to 5 million years before the present. The area continues to undergo intense deformation by geological standards. This regional northsouth compression causes the bedrock units to become progressively folded and faulted, forming valleys (such as the Santa Clara River Valley, Simi Valley, the Oxnard Plain, and the Ventura and Ojai Valleys), and uplands (including the San Gabriel Mountains, Oakridge-Santa Susanna Mountains, the Santa Monica Mountains, the Simi Hills, Big Mountain, South Mountain, and the Topatopa Mountains), that are generally bounded by reverse faults and/or thrust faults, which generally dip north along the southern range fronts and dip south along the northern range fronts.

The attached Figure 2 (Regional Geologic Map) shows the geologic conditions in the vicinity of site. The bedrock on site exhibits relatively consistent dips to the west and slightly north of west with isolated southwest dips in the northeast portion of the site. Dip angles on site range from approximately 13 degrees to the west on the western portion of the site to 35 degrees on the northwest portion of the site.

2.2 Earth Materials

The earth materials underlying the site consist of artificial fill, surficial alluvial soils, terrace deposits and recent landslide debris underlain by Tertiary sedimentary bedrock assigned to the Miocene age Mint Canyon Formation. A description of each of the geologic units encountered at the site follows:

The majority of the subject site is underlain by Quaternary alluvium, Quaternary Older Alluvium as well as by siltstones, sandstones, and conglomeratic bedrock of the Mint Canyon Formation. Quaternary Terrace deposits have been mapped

Artificial Fill - Uncertified (Afu):

Artificial fill soils have been mapped along the trend of the active as well as the abandoned railroad grade. The active railroad grade has an approximate maximum height of 27 feet and an approximate width of 205 feet. The abandoned railroad grade is approximately 14 feet high at its highest point and is approximately 100 feet wide.

Although not observed during Leighton's field investigation, artificial fill should be anticipated along portions of the adjoining roads.

Ouaternary Alluvium (QoL):

Alluvial materials consist of stream-channel deposits of silts, sands, and gravels that are transported by surface water, and are restricted to the bottoms of the main canyons and tributary channels. Alluvial deposits along the northern portions of the site in the vicinity of the Santa Clara River have been mapped as Quaternary Alluvium (Qal). Quaternary Alluvium encountered in Leighton's borings consists primarily of gray, brown, or slightly orangish brown silts and sands with varying amounts of clay and gravel.

Quaternary Older Alluvium (Qoal):

Alluvial materials encountered on the southern portion of the site have been mapped as Quaternary Older Alluvium. The Quaternary Older Alluvium consists of orange-brown to reddish-brown silts and sands with varying amounts of clay and gravel.

Terrace Deposits (Ot):

Terrace deposits were encountered as capping units overlying Mint Canyon bedrock on the outcrops located on the western and north-central portion of the property. Terrace deposits also were observed as remnants of older eroded surfaces along the northeastern portion of the site. The terrace deposits primarily consist of light brown silty sands with occasional subrounded gravelly layers.

Mint Canyon (Tmc):

The Mint Canyon Formation underlies the site and is exposed in the areas of higher topographic relief. This formation is Miocene in age and is believed to have been deposited in westward flowing streams and in a valley bottom fresh water lake (Dibblee, 1996). Mint Canyon Formation bedrock onsite consists of interbedded claystones, siltstones, sandstones, and conglomerates which are slightly to moderately friable and slightly to highly weathered.

2.3 Groundwater

The shallowest groundwater encountered in Leighton's borings was observed at a depth of 15 feet (bgs) in Boring 4 on October 26, 1984, and in Boring 9 on October 31, 1984. The historic high groundwater depths in the vicinity of the northern portion of the site (north of the active railroad grade) are reported as 5 to 25 feet (bgs) and as 25 feet (bgs) or not evaluated south of the active railroad grade (State of California, 1998b). The groundwater flow direction beneath the site is assumed to the northwest, generally following topography.

3. FAULTING AND SEISMICITY

3.1 Faulting

There are several unnamed faults mapped through the site. These faults are well exposed in the railroad cut slopes. They offset the Mint Canyon Formation but do not disturb the overlying Pleistocene terrace deposits. The faults do not exhibit signs of recent activity and probably originate under similar post-depositional conditions as the Sulphur Springs fault to the west of the site.

No active faults have been mapped at, or are known to project towards, the project site. The project site does not lie within an Alquist-Priolo Earthquake Fault Zone, (APEFZ): (Hart, E. W., and Bryant, W. A., 1999; State of California, 2000).

For the purposes of providing seismic design for planned construction, active faults in California have been designed as seismic sources and classified designed as Type A, B, or C faults. Type A faults are those that are capable of producing a Maximum Moment Magnitude Earthquake of M>7.0 and have a slip rate of greater than 5 mm/year. Type C faults are those that are only capable of producing an Earthquake with a Maximum Moment Magnitude of less than 6.5 and have a slip rate of less than mm/year. Type B faults are those which have a Moment Magnitude and slip rate characteristics in between those of Type A and Type C faults. Seismic source Type C's have not been designated in California because they have been judged not to have a significant impact on seismic design.

The nearest Seismic Source Type A Fault to the site is the San Andreas Fault (1857 rupture) (Jennings, C. W., 1994), at a distance of approximately 7 km to the southwest of the site. The nearest Seismic Source Type B Fault is the Sierra Madre (San Fernando) Fault located approximately 2 km southwest of the project site (Jennings, C. W., 1994).

3.2 Probabilistic Seismic Hazard Assessment

A probabilistic seismic hazard assessment (PSHA) was performed for the site in accordance with the requirements of the 2002 edition of the County of Los Angeles Building Code (LABC), which states that the design-basis earthquake is the ground motion that has a 10% probability of exceedance in a 50-year time period, that is, a ground motion with an average 475-year return period. In order to estimate this ground motion, a probabilistic seismic hazard analysis was performed for the site using the computer program FRISKSP (Blake, 2000). For the project site, a central representative location of 34.4218°N latitude; 118.4070oW longitude was selected for use in the analyses.

The PSHA considered various magnitudes of earthquakes that major active or potentially active faults within a 100-km radius of the site could produce along their respective fault lengths. The attenuation relationships of Boore, et al. (1997), Campbell (1997, 2000), and Sadigh, et al. (1997) were used in the analyses.

The following table summarizes the design earthquake peak horizontal ground acceleration (PHGA) values, not magnitude weighted and magnitude weighted for Mw = 7.5, for the project site:

Attenuation Relationship	PHGA (Not Magnitude-Weighted)	PHGA (Mw = 7.5)
Score et al., (1997), 250 mjs	0.74g	0.54g
Campbell (1997, 2002), alluvium	0.57g	0.44g
Sadigh, et aI., (1997), deep soil	0.57g	0.41g
Average Estimated PHGA	O.63g	O.46g

3.3 Liquefaction Potential and Dry Sand Settlement

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:

1. Ground shaking of sufficient magnitude and duration.
2. A high ground water level at or above the level of the susceptible soils during the ground shaking.
3. Soils that are susceptible to liquefaction.

Liquefaction of the underlying soil layers may result in settlement of the soils as well as surface manifestation such as sand boils, mud-spouts, surface water seepage, or quicksand like conditions. Studies by Ishihara (1985) indicate that the ground surface at a site will not experience damage due to liquefaction if a sufficient thickness of the nonliquefiable soils overlies the liquefiable soils.

The standard of practice for evaluation of liquefaction and seismically-induced settlement has evolved significantly from the time the last report was issued by Leighton for the site in 1990. Accordingly, the liquefaction potential and seismically induced settlement at the site were re-evaluated as part of the current investigation.

To assess the potential of liquefaction and the damages that may result from its occurrence for the subject development, the Computer Program LIQUEFY -2 by Blake was used by utilizing the following data:

1. The average O.46g PHGA resulting from a 7.5 magnitude weighted earthquake per the analyses in Section 3.2 above.
2. A historic high groundwater of 25 feet (State of California, 1998b).
3. Leighton's boring logs with their relevant field Standard Penetration Test (SPT) results and laboratory particle size analyses results.

Based on our analyses, it appears that some of the subsurface alluvial layers, located at some 25 feet below the existing ground surface north of the old abandoned railroad right-of-way, may liquefy if underground water rises to the historic high levels and the design basis earthquake occurs simultaneously in the area. The liquefaction-induced settlement in the aforementioned area was estimated, utilizing the Tokimatsu and Seed method, to range from 1 to 3 inches. Areas with liquefaction-induced settlements larger than 2 inches may be susceptible to the aforementioned surface manifestations of liquefaction.

Soils above the historic high groundwater elevation may also be susceptible to dynamic settlement due to a relatively strong ground shaking. This settlement of the soils above the groundwater level was assessed using the Tokimatsu and Seed method and utilizing the same data as above. Accordingly, it is estimated that this settlement will be less than 1 inch for the area south of the old abandoned railroad right-of-way, less than 1 ~ inch in the area north of the existing active railroad right-of-way, and less than 2 inches in the area between the two rights-of-way.

4. GEOTECHNICAL FINDINGS

4.1 Subsurface Conditions

Artificial fill soils were not encountered at the locations of our two current borings; however, fill soils were observed within the proximity of the railroad right-of-way and at or near-surface utility lines. Fill soils may also be encountered in other locations such as abandoned buried structures or utility lines. Native soils were classified as sandy silt and silty sand with varying amounts of gravel.

Per the Standard penetration Tests (SPT) performed during drilling, the soils in the top 30 to 40 feet below the existing grade were classified as loose to medium dense and not suitable to support the proposed structures. The soils beneath the top 40 feet were relatively more competent and may be used for support of structural fill.

The shallowest groundwater encountered during Leighton's subsurface explorations was at 15 feet (bgs) in Boring No.4 on October 26, 1984, and in Boring No.9 on October 31, 1984. The historic high groundwater depths in the vicinity of the northern portion of the site (north of the active railroad grade) are reported as 5 to 25 feet (bgs) and as 25 feet (bgs) or not evaluated south of the active railroad grade (State of California, 1998b).

Grading that will involve deep removals may encounter groundwater at some locations; especially the northern portions of the subject project. Shallow groundwater may also result in structural damage from liquefaction or seismically-induced settlement, when accompanied by a design basis earthquake occurring near the subject site, if the recommendations presented in this report are not implemented.

4.2 Expansivity Potential

Generally speaking, the existing on-site soils are classified as predominantly granular; these types of soils have a very low expansion potential. The degree of expansivity of the few existing on-site cohesive soils is not expected to be more than moderate. It is Leighton's opinion that the potential for structural damage resulting from existing on-site soils expansivity is considered unlikely. Additional testing should be performed during grading to better evaluate the finish grade soils.

Relevant chemical tests should be performed on bulk samples obtained from on-site soils during construction to assess the potential for structural damage as a result of soils corrosivity. Mitigation and recommendations should be provided.

5. STABILITY OF SLOPES

After a review of the geology and the proposed tentative tract plans, three representative cross-sections (LS 1 through LS3) were drawn and analyzed for slope stability. The locations of these sections are shown on the Geologic Map (Plate 1) while details of our analyses, including the selected strength parameters, our methodology, and the calculated factors of safety are presented in Appendix D.

Global Slope stability analyses performed in this investigation utilized shear strength parameters presented in the Seismic Hazard Report for the Mint Canyon Quadrangle (State of California, 1998b), for a similar type of bedrock. Additional field subsurface explorations should be performed, to obtain undisturbed bedrock samples in order to perform direct shear tests to develop site specific shear strength parameters. Additional slope stability analyses, together with additional recommendations, may be required if the new shear strength parameters are significantly different than those assumed in this report.

Section LS I was constructed to depict the most critical cut slope proposed as a portion of the referenced tentative tract map. The location of LS 1 was selected based on the height of the proposed cut slope as well as the adverse geologic structure. The results of the slope stability analyses for this section indicated that the planned slope meets the minimum factor of safety requirements of the County of Los Angeles Building Code (LABC).

Section LS2 was constructed through the natural slopes descending to the tallest cut slope at the margin of the site. The results of the slope stability analyses for this section indicated that the planned slope does not meet the minimum factor of safety requirements by the County of Los Angeles Building Code (LABC). Additional analyses were performed and indicated that flattening the proposed slope to at 2~: I or flatter will meet the minimum factor of safety requirements of LABC.

Section LS3 was constructed through the natural slopes descending from offsite to the northeastern portion of the site and extending through the detention basin east of Lot 14. Slope stability analyses as well as rapid drawdown analyses were performed. The result of the slope stability analyses for this section indicated that the planned slope meets the minimum factor of safety required by LABC.

Also for the surficial slope stability, shear strength parameters were conservatively utilized from those presented in the Seismic Hazard Report, for a similar type of bedrock, the Mint Canyon Quadrangle (State of California, 1998b). It is necessary to obtain undisturbed ring samples during grading from the exterior faces of fill slopes, to perform the relevant direct shear tests, and to verify the surficial stability.

6. CONCLUSIONS

- Based upon our evaluation, the proposed development is feasible from a geotechnical point of view provided that the preliminary geotechnical recommendations contained in this report are followed and are incorporated into the planning and design of the project.

- Approximately, the upper 10 to 40 feet of on-site soils, except where competent native soils (Terrace Deposits or the Mint Canyon Formation) are encountered, are not considered suitable for the support of the proposed structures and/or structural fill and; therefore, should be removed and/or mitigated at the locations of the proposed structures. However, the removed soils may be incorporated into the structural fill after removing organic and other deleterious materials.

- Grading that will involve deep removals may encounter groundwater at some locations; especially in the northern portions of the subject site.

- Proposed manufactured and natural slopes are anticipated to be relatively stable provided that our recommendations are implemented.

- Structural damage resulting from dynamic settlement, liquefaction and/or dry sand, may be reduced if the recommendations presented in this report are implemented.

- This site is not located within an Alquist-Priolo Earthquake Fault Zone and there is no evidence to suggest that active or potentially active faults exist on, or trend towards, the subject site. Therefore, structural damage resulting from fault ruputre is unlikely.

- Existing on-site cohesive soils have a medium potential for volumetric change.

- Post-tensioned foundations, designed for high volumetric change conditions, should be used for the support of the proposed residences.

- The corrosivity of the soils should be assessed during construction.

7. RECOMMENDATIONS

7.1 Review of Plans and Supplementary Investigation

The recommendations included in this preliminary geotechnical report are based on limited field explorations, laboratory testing, and geologic and engineering analyses. The recommendations are necessarily preliminary and intended to address, from a geotechnical prospective, the general features of the proposed Tentative Tract Map. As the features of the project are developed, the plans should be forwarded to Leighton for review. Due to the preliminary nature of this report, additional subsurface exploration and recommendations may be required for use in the design and construction of the proposed project.

7.2 Grading

Grading is anticipated to consist mainly of overexcavating and compacting the upper 10 to 15 feet of existing on-site soils to provide a relatively uniform blanket of fill beneath the proposed footings. The depth of overexcavation should be measured from the existing ground surface or the planned finish grade; whichever is lower.

7.2.1 Site Preparation

Site preparation should include the following:

- Removal of existing vegetation and debris from the site, in addition to removals required to achieve the planned grade.

- Generally, temporary vertical cuts should not exceed 5 feet in height, while temporary slopes should not be steeper than 1: 1.

- Overexcavation should be performed, in the locations of the proposed structures, to remove existing uncertified fills (if any) and colluvial and alluvial soils, the recommended depth of overexcavation is to reduce the amount of the potential settlement induced by relatively strong ground shaking. The overexcavation should consist of:

    1. A minimum of 10 feet for lots located north of the easement of the existing functional railroad.

    2. A minimum of 15 feet for lots located between the south easement of the existing functional railroad and north of the old abandoned railroad.

    3. A minimum of 10 feet for lots located south of the old abandoned railroad.

- Overexcavation need not extend deeper than required to place a 15-foot thick blanket of engineered fill below the proposed buildings or into competent terrace deposits and/or Mint Canyon Formation are encountered.

- Overexcavation should extend horizontally, beyond the exterior face of the proposed footings a distance equal to thickness of the fill beneath the footings.

- Overexcavation of the terrace deposits and/or Mint Canyon Formation should extend at least 3 feet below foundations where required to mitigate transitional lots.

- The recommended depths of removals and overexcavation are preliminary, and may be revised during construction based on the exposed materials by a California Certified Engineering Geologist.

- Exposed materials that have been approved for support of fill by the Geotechnical Consultant should be scarified to depths of approximately 6 to 8 inches, moisture conditioned to between 110% and 120% of optimum moisture content, and compacted to at least 90% of the maximum dry density obtainable using the ASTM D 1557 method of compaction.

- Holes and depressions resulting from the removal of trees, buried obstructions and/or oversize rocks that extend below finished site grades or in zones of overexcavation should be backfilled with compacted fill.

- For planned streets and hardscape, a minimum overexcavation of 3 feet is recommended with a minimum horizontal extension of 3 feet beyond the planned edge of pavement or hardscape.

7.2.2 Materials for Fill

- The removed and excavated soils, after deleterious materials have been removed, may be incorporated in the proposed structural fill.

- Rocks larger that 4 inches in greatest dimension should not be placed in wall backfills or in the top 5 feet beneath finish grade. Gravel and cobbles incorporated into fills should be thoroughly mixed into the soil, and should not be clumped or segregated in heaps; and,

- Approximately 20% shrinkage of the overexcavated soils when compacted to 90% should be expected. Approximately 4 to 5 inches of subsidence of the exposed soils should be expected.

- If import soils, if required, should be similar to the on-site soils samples of the soils and the locations of their source areas should be provided to the Geotechnical Consultant at least 48 hours (2 working days) before importing to the site so that appropriate tests can be performed and the materials evaluated for suitability for use at the site.

7.2.3 Oversize Materials

Oversize material, defined as rock or other irreducible material with a maximum dimension greater than 8 inches should not be buried or placed in fill unless the locations, materials, and placement methods are specifically accepted by the Geotechnical Consultant. Placement operations should be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted fill. Oversize material should not be placed within 10 vertical feet of finish grade, 15 feet from the face of a slope, or within 5 feet of future utilities or underground construction.

7.2.4 Compaction

Approved fill materials should be moisture conditioned to between 110% to 120% of optimum moisture content and thoroughly mixed for uniformity of moisture and materials at the time of compaction. The materials should be placed in generally even horizontal layers not exceeding 8 inches in thickness prior to compaction, and compacted to at least 90% relative compaction.

Compaction of slopes faces may be accomplished by backrolling of the faces of the slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Alternatively, the slopes may be overbuilt and trimmed back to the final design configuration. Upon completion of grading, the relative compaction of the fill out to the slope face should be at least 90%.

7.3 Slopes

7.3.1 General

General geotechnical recommendations for the construction of slopes such as keying and benching, testing, subdrains, etc., are included in the attached Appendix E. Specific geotechnical recommendations for the construction of manufactured slopes at the site are provided in this section. Manufactured slopes should be constructed in compliance with the requirements of Appendix Chapter 33 of LABC.

7.3.2 Fill Slopes

Fill slopes are proposed at various locations of the site at 2: 1 gradients or flatter. The highest fill slope proposed at the site is approximately 45 feet and is approximately located west of Lot 102.

Relatively cohesive on-site soils should be used in the outer 15 feet of the fill slopes. The reason is to reduce the erosion potential of materials on the slope face, and to maintain an adequate factor of safety against surficial type of failure.

The toes of the planned fill slopes should have a minimum setback of 6 feet from the tops of the existing natural or cut slopes as per section 3314 of the LABC. These new fill slopes should be established by benching into existing older structural fill and/or competent native soils.

As discussed in Section 4.2 above, for undisturbed ring and bulk samples should be obtained during grading for shear tests to verify the shear strength parameters used during the investigation phase.

7.3.3 Cut Slopes

Cut slopes are proposed at various locations of the site at 2: 1 gradients or flatter. The highest cut slope proposed at the site is approximately 100 feet high and is approximately located east of Lots 10 through 13.

If during construction the exposed surfaces of the cut slopes appear to be erodible and/or surficially unstable, they should be temporarily slopes back at no steeper than 1 K 1, and reconstructed as a stability fill, per section 7.3.2 above with a sufficient keyway at the toe and subdrains.

Leighton provides guidelines and recommendations for temporary excavations, taking into consideration that under the existing geotechnical/geologic, and groundwater conditions, backcut excavations should maintain a minimum factor of safety for temporary slope stability equal to or greater than 1.25. With that in mind, alternative excavation scenarios may be suggested by the grading contractor for our evaluation. Ultimately, it is the grading contractor's responsibility to provide safe and stable temporary backcut excavations.

7.3.4 Subdrain Installation

Surface drainage systems should be established on all cut and fill slopes per the requirements of Section 3315 of LABC. Subsurface water should be relieved from the back of fill slopes by placing subdrains at the bedrock benches. Vertical spacing between subdrain lines should not exceed 25 feet, and the subdrains should be provided with outlets at no more than 50 feet horizontally. Subdrains should consist of 4-inch diameter, at a minimum, schedule 40, PVC pipe, with two rows of staggered perforations backfilled with at least 3 cubic feet of gravel per foot length of pipe. The gravel should not be greater than o/.t-inch in size and should be separated from the surrounding soils by a filter fabric such a Mirafi 140N to reduce the chances of siltation. A land surveyor/civil engineer should survey the sub drains for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

7.3.5 Keyways

Buttress and stability fills, as well a fill slopes, should be keyed into bedrock or other competent materials. These keyways should be at least 15 feet wide and 2 feet deep at the toe of the slope and 3 feet deep at the heel. Depending on the final proposed slope gradients, wider keyways may be recommended. A subdrain should be installed at the bottom of the heel per the detail in Appendix E. Leighton's geologist should observe the materials exposed in the keyways to determine if additional removals, laterally or vertically, should be performed.

7.3.6 Natural Slopes

Depending on the conditions observed during construction, the geotechnical consultant may revise or supplement the recommendations presented in this report. The construction of a debris walls may be recommended at the toe to intercept slough and debris before they reach the proposed road.

7.4 Foundations

7.4.1 Post-Tension Slab

Post-tensioned foundations and slabs-on-grade, established in structural fill, should be used for the support *of* the proposed residences at the subject development. These foundations should be designed to accommodate the following settlements; combined static and dynamic:

1. Up to 4 inches of total settlement with 2 inches of differential settlement beneath structures located between the south limit of the existing railroad right-of-way and the north limit of the abandoned railroad right-of-way.
2. Up to 2 inches total settlement with 1 inch of differential settlement beneath structures located north of the existing railroad right-of-way.
3. Up to 1 inch total settlement with Y2 inch differential settlement beneath structures located south of the old abandoned railroad right-of-way.

The west part of the area addressed in 1 above may be susceptible to surface manifestation induced by liquefaction, which may require special types of foundations and/or deeper removals. Therefore, once the grading plans are finalized, Leighton recommends a one-day

Cone Penetration Tests (CPT) program be performed in the field to assess, liquefaction potential wise, the site generally and that particular area specifically.

Slabs with moisture sensitive floor coverings should be underlain by at least a 10-mil vapor retarder. A sand layer should not be placed between the vapor retarder and the slab.

7.5 Expansion Potential

Existing On-site soils are predominantly granular, while the few on-site cohesive soils are expected to have low to moderate expansion potential. Therefore, the potential of structural damage resulting from expansion of the existing on-site soils is considered to be remote. However, further testing should be performed during grading to re-assess the expansion potential of the soils at finished grade.

7.6 Chemical Features

The corrosivity of at- and/or near-finish-grade soils should be assessed during construction by testing. Samples for testing should be obtained by the Geotechnical Consultants' representative. Recommendations for mitigation should be developed based on the results of the tests.

7.7 Site Seismic Coefficient

Under the Earthquake Design regulations of Chapter 16, Divisions IV, and V of the 200 I edition of the CBC, the following coefficients and factors apply to lateral-force design for structures at the site:

Seismic Coefficients	
SEISMIC ZONE Z	0.4
SOIL PROALE TIPE	SD
Near-Source Factor *Na*	1.3
Near-Source Factor *Nv*	1.6
Seismic Coefficient *Ca*	0.57
Seismic Coefficient *Cv*	1.02
Period, *To* *	0.143
Period, *Ts**	0.716
* Use with Figure 16-3 of the LASC.	

7.8 Retaining Walls

The following recommendations are applicable to the design and construction of retaining walls that do not exceed 12 feet in height:

1. The equivalent fluid pressure at the back of the wall will vary from 35 pounds per square foot per foot depth (pct) for a level backfill to 45 pef for a 2: 1 ascending slope at the top of the subject proposed wall.

2. The above mentioned values do not include surcharges generated from traffic and/or any additional loads within the setback zone. Thus, surcharge values should be added to the equivalent fluid pressure if any of the aforementioned loads exist in the setback zone.

3. A 2,000 pounds per square feet (pst) allowable bearing pressure may be used for the design of the footings. The minimum embedment of the footings, in competent native soils and/or structural fill, should not be less than 18 inches below the lowest adjacent grade and should meet the minimum setback requirements set forth in LABC Figure 18-1-1.

4. For the structural design of the walls, the bulk density of the soils over footing slabs may be taken as 125 pef.

5. A 300 pound per square foot per foot depth passive earth pressure, starting from one foot below the adjacent proposed grade, along with a 0.35 coefficient of friction, may be used in the design of the subject walls. Where both friction and passive resistance are utilized in the design, one of the values should be reduced by one-third. These values may be assumed to be ultimate values.

6. The hydrostatic pressure should be relieved from the back of the wall by installing a Schedule 40, 4-inch diameter PVC pipe, with two rows of staggered perforations, at the bottom of the back of the wall, surrounded by a minimum of I-cubic foot per foot of pipe of free draining %-inch maximum-size gravel. A minimum thickness of 4 inches of gravel. A geofabric filter, such as Mirafi 140 N should separate the gravel from the adjacent soils.

7. As a substitute for the %-inch tree draining gravel and the geofabric filter, Class 2 permeable material or equivalent may be used with slotted pipe.

8. An unobstructed outlet should be provided at the lower end of each segment of the subdrain. This outlet should drain into a suitable collective drainage facility.

9. To minimize seepage through the wall, the back of the wall should be waterproofed.

10. Positive surface drainage should be provided and maintained to direct surface water away from the wall and towards suitable collective drainage facilities. A Vditch should be provided at the top of the wall along with a minimum I2-inch deep freeboard. Surface water should not be allowed to pond adjacent to or flow over the wall surface in an uncontrolled manner.

11. Heavy equipment should not be operated close to the walls when placing backfill unless the walls are braced properly.

12. Granular on-site soils may be used for the backfill behind the walls. Any import materials should be granular. The top 18 inches of the backfill should be relatively impermeable.

13. All relevant CAL-OSHA requirements should be considered during both the design and construction phases.

14. The plans should be submitted to this office for review and approval prior to commencing construction.

15. Footing excavations, sub drain systems, and wall backfill should be observed and approved by a representative of this office.

7.9 Pavement Design

Based on our experience with granular soils similar to those encountered in our borings, an R-value of 35 was assumed for estimating the pavement sections. Based on the design procedures outlined in the current Caltrans Highway Design Manual, and using a design R-value of 78 for aggregate base course, preliminary flexible pavement sections may be designed as follows for the Traffic Indices indicated. Local agency's more conservative minimum thickness requirements will supersede the following recommended sections. Final pavement design should be based on laboratory testing performed near the completion of grading and the Traffic Index determined by the project civil engineer.

Traffic Index	Asphalt Concrete (inches)	Aggregate Base (inches)
4.0	3.5	4.0
5.0	4.0	5.0
6.0	4.0	6.0
7.0	5.0	6.0

7.10 Utilities Trench Backfill

In general, the requirements for bedding and backfill as presented in the Standard Specifications for Public Works Construction (The "Greenbook") may be used. Bedding material should consist of granular soils with a sand equivalent (SE) of not less than 30 and should provide a minimum cover of 12 inches above the pipe. Bedding material should be compacted manually; however, jetting may be permitted depending on the type of soils exposed in the sides of the trenches.

Existing on-site soils may be used for trench backfill to be placed over the granular bedding layer, provided they are free of organic materials and rocks over 6 inches in greatest dimension. Fill material should be placed in 6 to 8-inch thick loose lifts and should be compacted to at least 90 percent relative compaction by mechanical means only. Care should be taken not to damage utility lines.

Trenches should be located so as not to impair the bearing capacity or cause settlement under or adjacent to foundations. As a guide, trenches subparallel to foundations should not extend below a 1: 1 plane extending down from adjacent foundations.

All work associated with trench excavation should conform to the State of California Safety Code (OSHA).

7.11 Surface Drainage

Positive surface drainage should be provided and maintained to direct surface water away, through nonerodible drainage devices, ITom structures and slopes and towards the street or other suitable collective drainage facilities at all times. In no case should surface water be allowed to pond adjacent to buildings or behind the retaining walls or to flow over slope surfaces in an uncontrolled manner.

Inadequate control of runoff water or heavy irrigation may result in shallow groundwater conditions and seepage where, previously, none existed. Maintaining adequate surface drainage, proper disposal of runoff water and control of irrigation will minimize the potential of adverse structural impacts resulting from oversaturated soils.

7.12 Preventive Slope Maintenance

Hillside properties are typically subject to potential geotechnical hazards including mudslides, spalling of slopes, erosion, and concentrated flows. Responsible maintenance of these slopes and the property in general, by the owner, using proper methods, can reduce the risk of these hazards significantly. The property owner should implement a program of slope maintenance. This program should include annual cleanout of drains, elimination of gophers and earth burrowing rodents, and maintaining low water consumptive, fire retardant, deep-rooted ground cover with proper irrigation.

7.13 Geotechnical Observation

The Consultant's representative should have at least the following duties:

- Observe the excavation so that necessary modifications based on variations in the soil conditions encountered can be made;

- Observe the exposed surfaces in areas to receive fill and in areas where excavation has resulted in the desired finished subgrade. The representative should also observe proof-rolling and delineation of areas requiring overexcavation;

- Evaluate the suitability of on-site and import soils for fill placement; collect and submit soil samples for laboratory testing;

- Observe the fill and backfill for uniformity during placement;

- Test fills and backfills for field density and compaction to determine the percentage of compaction achieved during placement; and,

- Obtain representative samples of the in-place fill soils for laboratory testing of the expansion potential, corrosivity, sulfate content, and R-Value.

The governmental agencies having jurisdiction over the project should be notified before commencement of grading so that the necessary grading permits can be obtained and arrangements made for required inspection(s). The contractor should be familiar with the inspection requirements of the reviewing agencies.