APPENDIX C: GEOTECHNICAL REPORT

PRELIMINARY
GEOTECHNICAL EXPLORATION

EAST GARRISON, FORT ORD – PHASE I

MONTEREY, CALIFORNIA

SUBMITTED

TO

URBAN COMMUNITY PARTNERS, LLC

MONTEREY, CALIFORNIA

PREPARED

BY

ENGEO INCORPORATED

PROJECT NO. 5866.3.001.01

JULY 22, 2003

Project No.
5866.3.001.01

July 22, 2003

Mr. Keith McCoy
Urban Community Partners, LLC
c/o Woodman Development
24571 Silver Cloud Court, Suite 101
Monterey, CA 93940

Subject: East Garrison, Fort Ord – Phase I
Monterey, California

PRELIMINARY GEOTECHNICAL EXPLORATION

Dear Mr. McCoy:

With your authorization, we have performed a preliminary geotechnical exploration and fault study for the proposed development at East Garrison, Fort Ord – Phase I, in Monterey, California. This study provides geotechnical/geologic constraints and general development guidelines for the subject property. A fault study was concurrently performed to address the potentially active King City fault which was mapped within the Phase I development area by Kilborne and Mualchin (1980).

The accompanying report contains our exploration data, conclusions, and preliminary recommendations for grading, drainage, and suitable foundation systems for the project. It is our opinion that the proposed development is feasible from a geotechnical and geologic standpoint provided the recommendations included in this report are followed.

We are pleased to be of service to you on this project and will continue to consult with you and your design team as project planning progresses.

Very truly yours,

ENGEO INCORPORATED

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INTRODUCTION

Purpose and Scope

The purpose of this geotechnical exploration is to provide information regarding potential geotechnical hazards and preparation of general grading and drainage recommendations for use in developing the site grading plans, including preliminary pavement design. Site-specific information for foundation design of the residential and commercial facilities are not included herein; however, discussion regarding types of foundation systems deemed suitable at the site and subgrade soil treatment for such systems are presented and generally discussed. Detailed design information will be prepared once grading plans and building layouts are determined, and may require additional field work to provide specific design information for the community center, post office, police sub-station, and fire station, as a minimum.

A geologic site assessment was performed by an ENGEO Incorporated engineering geologist and included a field reconnaissance, literature search, and aerial photography research. The findings from that assessment regarding geologic hazard mitigation for the site are incorporated herein. Additional reviews and studies will be performed as development of the site proceeds to confirm that the geologic hazards at the project do not impact the development.

The scope of services for our geotechnical exploration, as presented in our proposal dated March 11, 2003, includes the following:

- Physical properties of the typical soil material encountered in the subject area.
- Preparation of a preliminary geologic map.
- Discussion of the King City fault trench findings, including conclusions related to the activity of the fault, as appropriate.
- Preliminary discussion of geotechnical constraints such as loose surface soils, soft soils, expansive soils, existing bluff slope, and liquefiable soils, as necessary.

- Preliminary grading recommendations including cut/fill design criteria, fill compaction recommendations, and drainage considerations for estimating purposes.
- Seismic considerations from nearby faults and 1997 UBC seismic design criteria.
- Preliminary discussion of feasible foundation types for the proposed development, including general guidelines for cost estimating.
- Preliminary pavement design based on two Resistance Value samples.
- Recommendations for further design-level study.

This report was prepared for the exclusive use of Urban Community Partners, LLC, and its design team consultants. In the event that any changes are made in the character, design, or layout of the development, the conclusions and recommendations contained in this report should be reviewed by ENGEO to determine whether modifications to the report are necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without the express written consent of ENGEO.

Site Location and Description

According to available plans and maps, the property is situated within the inactive Fort Ord military base, south and east of Reservation Road off the intersection of Reservation Road and Inter-Garrison Road in East Garrison, California (Figure 1). Our specific study area is described as Parcel 1, totaling 244 acres, and is situated within the greater East Garrison site of 800 acres.

Topographic maps and reconnaissance of the area indicate that the site is situated on top of a steeply sloping bluff for the eastern portion and at the base of a depression for the western portion. Elevations range from about 25 feet above mean sea level (msl) at the base of the bluff slope along the eastern boundary to about 225 feet above msl along the western and southwestern boundaries (Figure 2A). The interior portions form three gently sloping plateaus at elevations of roughly 150, 175, and 200 feet above msl within the eastern, southern, and northern areas, respectively. Moderately steep interior slopes to create the elevation differences are located between the plateaus.

The site is occupied by old military buildings, including officers' quarters, mess halls, ammunition buildings, a chapel, a theatre, a battle simulation building, an abandoned wastewater treatment facility, a small above-ground water tank, latrines, open-space exercise ranges, random additional buildings, and numerous concrete slabs where former buildings were sited (Figure 2A). A few perimeter retaining walls are also found along the top of slope along the eastern bluff up to 8 feet in exposed height. Internal paved roads, parking areas, and dirt roads are situated within the site, as well as numerous trees and ground covering.

Select overhead and underground utilities are present on site which, we anticipate, will be abandoned and relocated as applicable.

Proposed Development

We understand that our current study area includes about 244 acres of development with 1,400 homes at build-out. The total project includes redevelopment of about 800 acres with up to 3,100 homes at build-out.

As indicated on the Conceptual Development Plan (Figure 2B), the homes will be a mixture of single family, townhomes, lofts, live/work, and apartments. A Town Center with a public square, an artist district, parks, open spaces, and commercial development including a community center, post office, police sub-station, and fire station are also included in the first phase of development.

From the plan provided for our use, it appears that grading consisting of maximum cut and fill thicknesses of approximately 30 feet may be required to create relatively level, drainable building pads. We anticipate that the proposed residential structures will be of wood-frame construction; therefore, the building loads are expected to be light to moderate.

GEOLOGIC AND SEISMIC SETTING

Site Geology

Regional geologic mapping by Wagner et al. (2002) indicates that the site is underlain by late Pleistocene older dune sand (Qod) deposits (Figure 3). Dibblee (1973) similarly maps the site as being underlain by Pleistocene older dune deposits and Plio-Pleistocene Aromas Sand (older dune deposits). Bedding in the region, as mapped by Dibblee, dips to the northeast at inclinations of 3 to 5 degrees.

Landsliding

Landsliding was not identified on published geologic maps reviewed. The lower portion of the natural bluff area to the east was observed to have numerous shallow earthflows/slumps during our site reconnaissance. The headscarp for two more recent earthflow/slump areas were roughly 25 feet below the top of slope elevations, approximately 100 feet wide and roughly the thickness of the residual soil materials (about 2 to 4 feet). Other shallow earthflow/slump areas identified were older and well vegetated. Accumulations of landslide debris and slope wash on the lower portion of the bluff probably range up to about 10 feet thick. Vegetation on the slope, including thick stands of oak trees suggests that the accumulation of landslide debris and slope wash is a gradual process that has occurred over a long period of time.

Site Seismicity

The site is not located within a State of California Earthquake Fault Hazard Zone and no active faults are mapped on the site by Wagner et al. (2002) or Dibblee (1973).

The San Andreas and Calaveras faults are located approximately 17 miles and 23 miles, respectively, to the northeast of the site (Jennings, 1994). The Palo Colorado fault is located about 15 miles to the southwest. Each of these faults is considered a major active fault. The maximum earthquake for the region can be expected from the San Andreas Fault, the major active fault within the Bay Area. Figure 4 shows the site in relation to the faults in the region.

The northward extension of the Rinconada fault is mapped by Jennings (1994) approximately ½ mile to the northeast of the site. The Rinconada fault is classified as potentially active by Jennings. The northern segment of the Rinconada fault, the Espinosa segment, is not zoned as active by the State of California (Hart et al., 1986) since the fault lacks geomorphic evidence of Holocene displacement. It should be noted, however, that UBC (1997) includes the Rinconada fault as an earthquake source with an estimated maximum moment magnitude of 7.3.

King City Fault. Kilborne and Mualchin (1980) map the King City fault in a northwest orientation across the central portion of the site (Figure 5). The King City fault is mapped by Kilborne and Mualchin as a concealed fault with a relative upward sense of movement on the southwestern side of the fault; that report describes the King City fault as being associated with the Rinconada fault system and is potentially active. A published map showing recency of faulting prepared by Jennings (1994) does not show the King City fault mapped by Kilborne and Mualchin as active or potentially active. To address this feature, a fault trench study was performed by ENGEO as discussed below.

FAULT EXPLORATION

Aerial Photograph Review

Aerial photographs of the site (Pacific Aerial Surveys, 1992) were examined to evaluate geomorphic features that could be associated with the fault mapped by Kilborne and Mualchin (1980). A vegetation lineation was noted on the aerial photographs in the northwestern portion of the site that is roughly coincident with the fault trace mapped by Kilborne and Mualchin. The vegetation lineation is about 800 feet long and is expressed by oak scrub forest on the southwest and a grassy meadow on the northeast. No other geomorphic features that could be indicative of faulting were observed.

Site Reconnaissance

A reconnaissance of the bluff on the northeast and east side of the site was performed to look for features that could be related to faulting. Where the older dune sands are clearly exposed on the bluff face, no features indicative of faulting were observed. The portion of the bluff where the fault is mapped by Kilborne and Mualchin (1980) is vegetated with grass and brush and a clear exposure of the older dune sand was not present. No springs or other features that could be indicative of faulting in this area were observed.

Fault Exploration

As noted above, the King City fault is mapped by Kilborne and Mualchin (1980) crossing the central portion of the site (Figure 5). However, a map showing recency of faulting, prepared by Jennings (1994), does not show the fault mapped by Kilborne and Mualchin as active or potentially active, and the site is not located within an Earthquake Fault Hazard Zone as defined by the State of California for active faults. To address the mapping presented by Kilborne and Mualchin (1980), ENGEO performed a fault trench excavation.

Exploratory Trench T-1 was excavated across the fault trace mapped by Kilborne and Mualchin (1980). The trench was located at the southeast end of the vegetation lineament described in the site reconnaissance (Figures 2A and 2B). The trench was approximately 320 feet long and typically about 6 to 7 feet deep. The southeast wall of the trench was cleaned with picking tools and the trench was logged by an ENGEO geologist under the direction of an ENGEO certified engineering geologist. The exploratory fault trench log is included in Appendix A as Figure A1.

Subsurface Conditions

In Trench T-1, residual soils ranging from about ½ to 2½ feet thick were encountered overlying older dune sand. Regional geologic mapping by Dibblee (1973) and Wagner et al., (2002) indicates that the older dune sands are late Pleistocene age deposits. Weathering of the older dune sand decreased with depth and cementation of the dune sand increased with depth. Discontinuous light and dark bedding features were mapped within the older dune sand. The bedding features are undulating but generally horizontal in orientation. No shear features, clay gouge, or other features that would be indicative of faulting were encountered in the exploratory trench. Although the light and dark sand layers appear to be discontinuous, overlapping of the layers indicates continuity of the stratigraphy in the trench exposure.

Based on the findings of Trench T-1, no indications of faulting were encountered in deposits classified as late Pleistocene age where the King City fault is mapped by Kilborne and Mualchin (1980). This fault exploration also indicates that the vegetation lineament coinciding with the mapped fault trace is not fault related. Since no other faults are mapped on the site and no other geomorphic expressions of possible faulting were identified in the study area, it is our conclusion that there appear to be no active faults crossing the site. Our geologic map of the site, therefore, does not show mapping of the concealed fault presented by Kilborne and Mualchin (1980).

The mapping by Kilborne and Mualchin indicates that the King City fault is concealed by the older dune sand. If the King City fault exists in bedrock beneath the older dune sand, the fault would appear to be no younger than early Pleistocene age (probably 500,000 or more years old).

GEOTECHNICAL EXPLORATION

Field Exploration

The geotechnical field exploration for this study was conducted on April 2, 3, and 4, 2003, and consisted of drilling 13 borings and excavating 17 test pits distributed across the site to characterize subsurface conditions (Figures 2A and 2B). Geologic field mapping was undertaken concurrently, and is presented on Figures 2A and 2B.

Test Borings. A CME-750X all-terrain balloon-tired drill rig equipped with 8-inch-diameter hollow stem augers was used to drill the boreholes to a maximum depth of 71.5 feet. The borings were approximately located by pacing from existing features and by the site topographic map provided by the project civil engineer (Figure 2A).

Our engineer logged the borings and took samples during drilling for soil identification and laboratory testing using either a 3-inch O.D. California-type split-spoon sampler or a 2-inch O.D. Standard Penetration Test (SPT) split-spoon sampler. The penetration of the sampler into the native materials was field recorded as the number of blows needed by the 140-pound auto trip, hydraulic slide hammer with a 30-inch drop to advance the sampler 18 inches in 6-inch increments. Drill rods were used as applicable to keep the slide hammer near the surface of the borehole.

The reported blow counts represent the field blow counts to achieve that last 12 inches of penetration for the drive sampler used at the depth identified and have not been corrected to represent SPT values. All borings were backfilled on the day of drilling.

Test Pits. A backhoe equipped with a 24-inch-wide bucket was used to excavate the test pits to a maximum depth of 16 feet. The pit locations were approximated by pacing from existing features and were located in areas of suspected residual soil thickening (colluvium) and pre-existing undocumented fill (Figure 2A). The test pits were logged by a geologist, and the test pits were loosely backfilled with trench spoils prior to moving to the next test pit location.

The field logs were used to develop the report borelogs and the test pit logs (Appendix A). The logs depict subsurface conditions within the boreholes and test pits on the date of exploration; however, subsurface conditions may vary with time.

Laboratory Testing

Representative samples of on-site soils were selected for laboratory testing to determine the following soil characteristics:

Soil Characteristic	Test Method	Location in Report
Natural Unit Weights	ASTM D-2216	Appendix A - Borelogs
Natural Moisture Contents	ASTM D-2216	Appendix A - Borelogs
Plasticity Index	ASTM D-4318	Appendix B
Grain Size Distribution	ASTM D-2217	Appendix B
Direct Shear Test	ASTM D-3080	Appendix B

Laboratory test results are presented on the borelogs with individual test results provided in Appendix B.

Subsurface Stratigraphy

The older dune sand deposits on site were generally found to be capped with a relatively thin layer of either residual soil or colluvium. At least four areas of pre-existing undocumented fills were encountered at or near our exploration locations. Refer to Figure 2A for mapping of the units described below.

Residual Soil. The residual soil encountered in our borings and test pits was up to 4.5 feet in thickness within Borings B-1, B-2, B-3, B-4, B-5, and B-10. Residual soil develops essentially in-place from weathering of the underlying parent material, older dune sand (Qod) deposits for the subject site. The site residual soil typically found was dark brown to brown silty sand or sand with silt and was generally slightly moist to moist and loose to medium dense. Trace roots were also encountered in a few locations.

Selected samples of residual soil materials encountered were tested for grain size distribution and yielded a range of 17 to 38 percent passing the No. 200 sieve. One sample was tested for Plasticity Index (PI) and yielded a non-plastic (NP) PI.

Colluvium (Qc). The surface soil materials encountered above the older dune deposits in Borings B-6, B-7, B-8, B-9, B-11, B-12, and B-13 has been mapped as colluvium. The thickness of colluvium found in our exploratory borings and test pits was up to roughly 7 feet in thickness within some areas of the site. The dark brown silty sand and sand with silt colluvial materials are similar to the residual soil materials in description, but are found in low-lying swale areas or depressions. These materials are accumulated by a combination of processes, including slopewash and soil creep, and were identified as dry to moist, and very loose to medium dense.

Select samples of the colluvial materials encountered were tested for grain size distribution and yielded a range of 3.2 to 45 percent passing the No. 200 sieve. Additionally, three samples were submitted for Plasticity Index (PI) and yielded PIs of non-plastic and 2 for the samples selected. This indicates that the representative residual and older soils tested have very low to low expansion potential.

Existing Fill Materials (Qaf). A layer of pre-existing undocumented fill was found in Borings B-7 and B-8 over the colluvial materials, and in Test Pit TP-16 over older dune deposits. The fill was roughly 3.5 feet thick in Boring B-7, roughly 8 feet thick at Boring B-8, and roughly 6 feet thick at Test Pit TP-16. The fill was likely placed to create the relatively flat area in a depressed/swale area or water tank pad when the military base was active. Based upon blow counts, the fill material is characterized as very loose to medium dense silty sand and sand with silt. Minor roots and trace gravels were also encountered in the fill material.

A sample of this material was tested for grain size distribution and yielded 17 percent passing the No. 200 sieve.

Several other areas of minor undocumented fill are expected around the existing structures. These minor fills were created during minor grading operations to create the relatively flat pads for the military buildings. It is anticipated that the fills are generally 6 feet or less in thickness, such as at the water tank near Test Pit TP-16 off Watkins Gate Road, but may reach up to 8 feet in some undetermined areas, such as behind the retaining wall located near Boring B-2, which was constructed to extend the flat area toward the bluff.

Older Dune Sand (Qod). The older dune sand materials were generally medium dense to very dense and slightly moist to very moist. Select samples of the dune sand materials were tested for grain size distribution and yielded a range of 4 to 28 percent passing the No. 200 sieve.

Groundwater

No springs or other manifestations of shallow groundwater were observed during our reconnaissance of the site. In addition, groundwater was not encountered in the test pits or borings drilled as a part of this study. Groundwater levels should be expected to vary depending on weather conditions, the time of year, irrigation practices, drainage patterns, and the proposed development.

DISCUSSION AND CONCLUSIONS

Seismic Hazards

Potential seismic hazards resulting from a nearby moderate to major earthquake may include primary ground rupture, ground shaking, lurching, liquefaction, lateral spreading, and earthquake-induced densification and landsliding. These potential hazards are discussed below.

Risks from seiches, tsunamis, and inundation due to embankment failure are considered low at the site based on the elevated topographic setting and the absence of large reservoirs in the vicinity.

Ground Rupture. The site is not within a State of California Earthquake Fault Hazard Zone and no active faults cross the site. Additionally, as discussed above, no indications of faulting were found in exploratory trenching where Kilborne and Mualchin (1980) map the King City fault in the central portion of the site. Therefore, based on these findings, the potential for fault rupture at the site is considered low.

Ground Shaking. An earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the site, similar to that which has occurred in the past. This hazard is not unique to this project and affects all properties in the region. To mitigate the shaking effects, all structures should be designed using sound engineering judgment and the latest Uniform Building Code (UBC) requirements as a minimum.

Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead-and-live loads. The prescribed lateral forces are generally considered to be substantially smaller than the actual peak forces that would be associated with a major earthquake. Consequently, structures should be able to (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

Lurching. Ground lurching is a result of the rolling motion imparted to the ground surface during energy released by an earthquake. Such rolling motion can cause ground cracks to form. The potential for the formation of these cracks is considered greater in poorly consolidated colluvial and alluvial deposits or at the contact of surface materials with bedrock. Due to the relatively consistent older dune deposits, lurching is expected to be low to negligible.

Within the loose residual, colluvial, and undocumented fill areas, overexcavation of these materials and construction of engineered fills underlying all developed portions of the project is intended to mitigate this hazard.

Liquefaction. Soil liquefaction is a phenomenon under which saturated, cohesionless, loose soils experience a temporary loss of shear strength when subjected to the cyclic shear stresses caused by earthquake ground shaking. Maps showing liquefaction potential by Dupre and Tinsley (1980) indicate that the site has a low susceptibility for liquefaction.

Based on our exploration, near-surface zones of very loose to loose silty sands (residual soils, colluvium, and undocumented fill) were encountered in a few locations. However, groundwater was not encountered in any exploratory locations, which extended up to 71 feet below existing grade. Based on these findings, in conjunction with general earthwork activities to create a stable foundation soil, it is our opinion that the soils encountered on site are not susceptible to liquefaction.

Lateral Spreading. Lateral spreading is a failure within weaker soil material that causes the soil mass to move towards a free face or down a gentle slope. Since surficial soils (residual soils, colluvium, and undocumented fill) situated above the older dune deposits will likely be removed as a part of earthwork operations, the potential for lateral spreading is considered low.

Appropriate setbacks from the existing top of slope for the perimeter bluff areas for permanent improvements and structures will be provided and discussed below. Proposed fill slopes will be adequately keyed into competent older dune deposits and subdrained.

Seismically Induced Densification. Densification of loose to medium dense sand above and below the groundwater level during earthquake shaking could cause settlement. As previously stated, the liquefaction potential of the on-site soil is considered very low; however, there are areas of very loose to loose surface soils. Therefore, densification induced by earthquake shaking is probable for these areas unless mitigated. Mitigation measures will be recommended for developable areas as final plans are available and would likely include subexcavation of near-surface materials to encounter firm older dune deposit and placement of engineered materials that are compacted to a minimum specified relative compaction.

Seismically Induced Landsliding. As for all of the San Francisco Bay area, the risk of instability is greater during major earthquakes than during other time periods. Also, as with most hillside developments, landslides and slope stability are important issues for the project. The relatively flat interior terrain at the site does not appear to be subject to seismically induced landsliding; however, the natural bluff areas and internal slopes to remain could be impacted by landsliding. However, although seismically induced landsliding can be a significant hazard, it can generally be mitigated through proper grading procedures and slope stability analysis of existing and proposed conditions.

Mitigation measures with regards to seismically induced landsliding for this project include establishment of setbacks for structures and other improvements from the natural bluff in the eastern portion of the site that is to remain, based upon slope stability analysis (static and pseudo-static) of existing materials. For interior slopes to remain and proposed slopes, additional stability analysis will be performed and mitigation measures will be developed based upon the results of the analysis. This analysis will be performed during our review of 40-scale grading plans. In general, future graded slopes should be constructed in conformance with our recommendations in an effort to minimize the risks associated with seismically induced landsliding.

Existing Perimeter Bluff

The existing perimeter bluff along the northeastern and eastern portion of the site is typically inclined at a slope gradient of 1:1 (horizontal:vertical) or flatter, with some localized sections of near-vertical to 0.75:1 inclinations. The bluff slope ranges from 25 feet in height to 125 feet in height. Minor recent earthflow/slumps were also noted on portions of the slope at the time of our site reconnaissance, along with some areas of active erosion and evidence of older earthflow/slumps along the lower portion of the bluff slope. Additional erosion and surficial slumps of the bluff slope should be anticipated due to the presence of weakly cemented residual soils and dune deposits and the steep inclination of the slope.

The bluff along the north and east sides of East Garrison is situated on the south margin of the Salinas River Valley. The bluff formed over a period of several thousand years as streams meandered across the Salinas Valley and eroded the base of the hills along the margin of the valley. The processes that formed the bluff are very different than the processes that can be observed along the Pacific coast. Along the Pacific coast, storms and wave action continue to cause erosion and the formation of sea cliffs. Sea cliff retreat can be a relatively rapid geologic process that can average up to one-foot per year is some locations.

Through channel stabilization and flood control measures, streams and rivers no longer meander across the Salinas Valley and, therefore, will no longer erode the East Garrison bluff. Vegetation of the bluff at East Garrison consisting of oak trees, brush and grasses suggests that stream erosion along the toe of the bluff has not occurred within a few hundred years. Without stream erosion at the toe of the bluff, the processes of erosion and landsliding along the bluff have slowed substantially allowing vegetation to develop on portions of the slope. Some steep portions of the slope are bare of vegetation and continue to ravel and erode at a slower rate than has occurred in the past.

The bluff on the east side of the site appears to be experiencing the most rapid erosion of the bluffs on the perimeter of the site, although considered very slow in comparison to coastal bluffs. The east facing bluff is also the highest and steepest bluff on the site. The north-facing and south-facing bluffs are more highly vegetated and appear to be experiencing erosion at a much slower rate.

To evaluate the rate that the bluff is regressing from erosion, an aerial photograph taken in 1941 was compared to current conditions. Using the locations of buildings that are common to both the 1941 photograph and the current topographic base map as reference points, the photograph was enlarged to a scale of 1"= 100'. The crest of the steep bluff is clearly visible on the aerial photograph as a line between the grass-covered slope and the bare near-vertical scarp. This line representing the top of the bluff in 1941 is plotted on the current topographic base map, Figure 2C.

The location of the existing crest of the steep bluff was also plotted on the current topographic base map (Figure 2C) by tape measuring from the existing edge of pavement and from existing power poles. Comparison of the bluff location in 1941 with the current location indicates that the bluff has regressed no more that about 5 feet over a period of 62 years. This translates to an average estimate rate of regression of about 0.08 feet per year.

In conjunction with development of the site, storm drain runoff will be controlled and less runoff will be directed over the bluff, which is anticipated to be the main cause of the erosion noted above over the last 62 years. Where erosion problems occur on the bluff, it is anticipated that maintenance measures will be taken to reduce the potential for adverse impacts to the planned improvements. We therefore anticipate that erosion of the bluff face in the future will generally be less than the erosion that has occurred in the recent past.

To estimate the amount of bluff regression from erosion that could occur over the next 75- to 100-year period, we have based our calculations on the erosion rate that was estimate for the last 62 years. This is considered a conservative estimate since the rate of erosion of the bluff face following development is expected to be less than the erosion rate that has occurred in the recent past. On this basis, bluff regression from raveling and erosion over the next 75 and 100 years is not expected to exceed 6 to 8 feet. The estimated bluff regression from erosion is substantially less than the setbacks that have been recommended to mitigate the potential for slope instability associated with landsliding that are discussed in a later section of this report and as shown on Figure 2C. In our opinion, therefore, the potential for landsliding on the bluff is the overriding concern for establishing setbacks from the East Garrison bluff.

Mitigation measures to reduce the occurrence of surficial erosion and slope instability will be developed. Additionally, since improvements and development are proposed in close proximity to the top of slope, appropriate setbacks for improvements and structures will be required. Slope stability analysis (static and seismic) will help assess the stability of the current bluff and help establish recommended set back distances for habitable and non-habitable improvements.

Existing Fill Materials

The undocumented fill materials encountered in Borings B-7 and B-8 and Test Pit TP-16 contained trace amounts of organics, and extended to approximately 8 feet below existing grade (Figure 2A).

The placement and quality of this fill material is unknown, but nearby piles of organic debris and the condition of the surficial material indicates that unsuitable debris could have been placed within the fill material. This would not lend itself well to receiving additional fill materials as proposed. Therefore, recommendations to remove all existing fill to a competent native base prior to additional placement of fill are presented in a subsequent section of this report.

Given the historic use of the site, there appear to be numerous smaller fill areas associated with building foundations, pipelines, and roadways. The extent of these localized fills should be evaluated during grading operations, and the fills should be removed and replaced with engineered fill and discussed in the recommendations section of this report.

Expansive Soils

Potentially expansive soils are a minor concern on this site within the upper residual soil layer. Although the results of our laboratory testing showed that the soils tested contain very low to low expansion potentials, some zones of silty or clayey materials may be encountered.

Expansive soils shrink and swell as a result of moisture changes. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Building damage due to volume changes associated with expansive soils can be reduced by deepening the foundations to below the zone of significant moisture fluctuation or by using structural mat foundations which are designed to resist the deflections associated with the expansive soils.

Successful construction on expansive soils requires special attention during grading. It is imperative to keep exposed soils moist by occasional sprinkling. If the soils dry, it is extremely difficult to remoisturize the silty soils without excavation, moisture conditioning, and recompaction.

Slope Stability Analyses

Slope stability is the primary geotechnical concern at the site. To evaluate the stability of the existing slopes and develop proposed mitigation meaures, drained direct shear testing was performed on in-situ older dune sand material along the bluff area as well on a remolded sample of site materials to determine strength parameters for use in effective stress slope stability analyses.

The test was performed at a very slow rate of strain; 0.006 mm/min, which assures that pore pressures are not developed and the drained condition is modeled correctly. These tests are performed to determine the effective peak and fully-softened parameters (cohesion-c' and friction angle-Ø'). The effective peak strength parameters (c_p' and $Ø_p$') correspond to the highest values attained during the test. These parameters are appropriate to use for intact soils and rocks such as sands, sandstone, and compacted fills. The effective fully-softened strength parameters (c_s' and $Ø_s$') correspond to a condition in which the soil has been strained beyond the peak strength and weakened as a result of the "softening." Use of the fully-softened parameters is appropriate for moderately cemented soils and fissured claystone, siltstone, and shale that have not undergone large mass movements (landsliding). Effective residual strength parameters (c_r' and $Ø_r$') correspond to the values obtained when samples are sheared with large displacements and were not determined during this study since residual strength parameters are appropriate for modeling existing slide planes and slide debris, of which we did not identify suspect zones during our site reconnaissance or exploratory borings and test pits. Laboratory test results of direct shear strength are presented in Appendix B.

A summary of the peak strength parameters recommended for use in slope stability analyses are presented below. In general, a relatively conservative approach was utilized in selecting the strength parameters for use in stability analyses. Therefore, we expect that actual factors of safety are somewhat higher than demonstrated in our analyses.

Material (depth below grade)	Soil Strength Parameters			
	Static		Seismic	
	Friction Angle	Cohesion (psf)	Friction Angle	Cohesion (psf)
Residual Soil/Colluvium (upper 5 feet)	25	0	25	0
Older Dune Sands (Qod) – weakly cemented (5 to 15 feet)	34	150	34	150
Older Dune Sands (Qod) – strongly cemented (15 to 35 feet)	39	0	39	0

Material (depth below grade)	Soil Strength Parameters			
	Static		Seismic	
	Friction Angle	Cohesion (psf)	Friction Angle	Cohesion (psf)
Older Dune Sands (Qod) w/ silt – weakly cemented (35 to 45 feet)	26	800	26	800
Older Dune Sands (Qod) – strongly cemented (below 45 feet)	39	0	39	0

Slope stability analyses of the existing bluff slope was conducted as a part of this study to develop appropriate setback distances, as discussed later in this report. This analysis included the use of peak strengths provided above from the direct shear testing and the computer aided program GSLOPE.

The locations of cross-sections along the bluff area are identified in plan view on Figure 2A, and and a representative profile is presented on Figure 6. Appendix C presents the preliminary stability analysis performed along the six cross-section locations shown on Figure 2A. As is common practice, the analyses were conducted with a goal of achieving a factor of safety of 1.5 for static conditions. To model seismic loading, a pseudo-static seismic coefficient of 0.15 was used with a goal of achieving a factor of safety of 1.1 (Seed, 1979 and CDMG, 1997).

Preliminary slope stability at each cross section was analyzed using the computer program GSLOPE. The results indicate that the existing bluff area slope does not have factors of safety that satisfy standard practice values of 1.5 and 1.1 for static loads and seismic loads at its natural state, respectively, as presented in the attached stability analysis printouts in Appendix C.

From a geotechnical standpoint and based upon our preliminary stability analysis, the stability of the bluff slopes when adhering to a non-habitable structure setback that satisfies a 2:1 line of projection extending up from the toe of the bluff slope into the site and a habitable structure setback that satisfies a 2.5:1 line of projection extending up from the toe of the bluff slope is recommended for the existing conditions. These set back lines are shown on Figures 2A and 2B.

Additional slope stability analysis will be performed once 40-scale grading plans are developed; remolded samples for additional shear tests may be performed as needed. Based on the slope stability analyses, the required size of keyways and the extent of slide excavation will be determined to obtain a static factor of safety of 1.5 and a seismic factor of safety of 1.1. Geologic review during remedial grading activities will also be performed, and additional mitigation may be required if adverse conditions are present.

Building Code Seismic Information

Based on the subsurface soil conditions encountered and local seismic sources, the site may be characterized for design based on Chapter 16 of the 1997 UBC using the following information.

Categorization/Coefficient	Design Value
Soil Profile Type (Table 16-J)	S_D
Seismic Zone (Figure 16A-2)	4
Seismic Zone Factor, Z (Table 16-I)	0.4
Seismic Source Type (Table 16-U)*	A
Near Source Factor N_a (Table 16-S)	1.5
Near Source Factor N_v (Table 16-T)	2.0
Seismic Coefficient C_a (Table 16-Q)	0.66
Seismic Coefficient C_v (Table 16-R)	1.28

*Rinconada fault located within 2 km from the site.

Slopes and Creep

Experience has shown that slopes tend to creep outward causing damage to buildings located in close proximity to the top of slope. Creep is the slow, nearly continuous downhill movement of the soil mantle; this is induced by gravity and may be a potential precursor to landsliding. Creep can result from shrinking and swelling of the soil due to seasonal moisture variations on a slope.

One indicator of soil creep is the presence of shrinkage cracks. When a shrinkage crack annually closes as a result of swelling from absorption of moisture, there can be a downhill component of movement. This movement, induced by gravity, has a progressive effect with a preferential downslope component that can reach a downhill movement rate of approximately 0.25 inch per year.

The conceptual site plan shows cutting of ridges and slopes and filling low-lying areas. Mitigation techniques during grading will be necessary to address the potential adverse effects of soil creep on slope areas that are adjacent to residential structures. These may include overexcavation as necessary to create benches during fill placement as shown on Figure 7.

<u>Cut Slopes</u>

The soil formations within the development area consist of a relatively thin layer (10 feet of less) of residual soils, colluvium, and/or undocumented fill over older dune deposits. Cut slopes made in these areas will be particularly susceptible to erosion.

To mitigate the damage of erosion on the proposed development, the majority of the cut slopes will be rebuilt as engineered fill if they exceed slope height and gradient requirements provided in a subsequent section of this report. If lots abut open space slopes, especially cut slopes, supplemental mitigation measures may be recommended, such as providing a debris bench (usually at least 20 feet wide) with a drainage ditch (Figure 7). The purpose of this bench is to intercept erosion or slope debris from the uphill area. Access to this bench should be provided for maintenance purposes. As grading plans are developed, these potential areas will be identified.

Soil Erosion and Terraces

In the design of slopes, consideration has to be given to surface drainage and the potential for slope degradation by erosion. Common practice has been to provide benches at regular intervals on steeply graded slopes (steeper than 3:1 horizontal:vertical) that are higher than 30 feet for control of surface drainage. Typical requirements are included in Section 7012 of the Uniform Building Code (UBC).

On 3:1 or flatter slopes, grasses and other vegetation take hold more easily and shallow surface mudflows and debris flows are infrequent as compared to slopes that are steeper than 3:1. The 3:1 graded slopes, particularly if rounded to match landforms, have a more natural appearance. Experience has shown that since maintenance and cleaning of ditches is often irregular or nonexistent, concentrated overflow can result in localized severe erosion or sloughing. Therefore, techniques to minimize ditch construction are often desirable. It is our opinion that with proper erosion protection, drainage ditches are not necessary on 3:1 (horizontal to vertical) or flatter slopes.

Graded slopes and localized sections of natural slopes may require erosion control protection by means of jute matting or other synthetic products until mature vegetation occurs. Recommendations for erosion control protection can be prepared once detailed plans progress and based upon actual conditions encountered pre- and post-construction.

Long-Term Site Maintenance

A hillside project such as East Garrison, Fort Ord – Phase One will have some geologic/geotechnical maintenance requirements. Maintenance items which the homeowners should anticipate include the following:

1. Maintenance of drainage facilities and periodic removal of soil accumulation, if any, from debris bench catchment areas should be anticipated. These 20-foot-wide catchment areas will be provided within the buffer zones for lots abutting uphill slopes to collect soil detritus and to provide an area to disc for fire safety reasons.

2. All subdrain outlets and cleanouts require periodic observation to confirm proper function and assess the need for maintenance.

Cut-Fill Transition Lots

For the given site conditions and terrain, it is likely that some lots will be traversed by a cut-fill transition. We anticipate that variations in material properties may occur in the areas of cut-and-fill daylighting. This may cause differential swelling and shrinking of the surface soils under the building foundation, which can be detrimental to shallow foundations and building performance. Recommendations are provided in a subsequent section of this report to mitigate the effect on structures caused by differential subgrade performance over the cut-fill transition zones.

Cut Lots

Lots located entirely in cut may be subjected to differential vertical movement if a significant variation in soil types occurs at the proposed ground surface as a result of grading. This may cause differential swelling/shrinking of the foundation soils, similar to the cut-fill transition zone described above. Recommendations for this condition are also provided in a subsequent portion of this report.

Differential Fill Thickness

A differential in fill thickness across individual building footprints may occur at the site, pending the final grading layout. Differential building movements may become apparent for a differential fill thickness that exceeds 10 to 15 feet under individual buildings. Recommendations to reduce the effects of differential settlement across a building pad are provided in the Recommendations section of the report.

Densification

Densification of deep fills (over 15 feet in thickness) may be significant. A differential movement under structures is the primary concern. Expansion of the deep fills may result from swelling of the silty components in the fill materials if moisture contents increase due to irrigation or natural conditions, but is expected to be relatively low. Settlement at the site could be generated from (1) densification of unmitigated residual soils, colluvium, and undocumented fills in the low lying areas where fills will be placed, (2) compression of the deep fills due to their own weight, and (3) compression of soils beneath foundations due to building loads. For the proposed one- or two-story wood-frame residences, settlements due to the building loads are expected to be minor. The recommendations provided later in this report regarding removal of very loose and loose soils and moisture conditioning of fills should reduce potential settlements to tolerable levels.

Compressible Materials

Thicker colluvial materials were encountered within topographic depressions and swale areas of the site. According to the grading plans for the northern and central neighborhood, some of these areas may receive more than 25 feet of fill to reach finished pad grade. The increased amount of overburden pressure that will be applied on the underlying colluvial materials from the proposed fill could result in settlement of this material if not mitigated during grading. Subsequent sections of this report provide recommendations for such mitigation.

Corrosion Potential

Corrosion testing was not a part of this study; however, some soils on site could have a potential for corrosion to concrete and uncoated steel. We recommend that corrosivity tests be conducted on subgrade soils following grading and prior to foundation and utility construction.

Conclusions

Based on the findings of our geotechnical exploration, we conclude that the proposed development is feasible from a geotechnical standpoint. The recommendations included in this report should be incorporated in the design and construction of the project. Additional geotechnical studies will be necessary to develop specific foundation design criteria for the residential and commercial areas. Additional exploration may be required for commercial areas, such as the police station and fire station, to develop specific finished grading and foundation recommendations.

RECOMMENDATIONS

Grading

The grading recommendations provided in this report are appropriate for planning purposes for the entire site, pending additional review and field studies to provide site-specific foundation design and grading information. Development of the grading plans should be coordinated with the Geotechnical Engineer and Engineering Geologist in order to tailor the plans to accommodate known soil and geologic hazards and to improve the overall stability of the site. The final 40-scale grading plans for the project should be reviewed by ENGEO. Detailed locations of keyways, subdrains, debris benches, and subexcavation areas will be outlined on these plans during our review, as applicable.

ENGEO should be notified at least 48 hours prior to grading in order to coordinate its schedule with the grading contractor. Grading operations should meet the requirements of the Guide Contract Specifications included at the end of this report and should be performed under the observation of ENGEO personnel.

Ponding of storm water must not be allowed at the site during winter periods in areas other than those proposed, such as desilting basins. If water is allowed to pond on the building pads, additional pad preparation may be required prior to foundation construction. Before the grading is halted by rain, we recommend that positive slopes be provided to carry surface runoff water in a controlled manner.

Demolition and Stripping

Site development will commence with demolition of existing structures and the excavation and removal of buried structures including any utilities to be removed or relocated. Underground structures, which could act as water traps or could deteriorate, should also be removed from the project site.

All site vegetation and topsoil, as well as any soft compressible materials located in areas to be graded, should be removed as necessary for project requirements. Based on the borings and trench excavations, we expect that the site top soil stripping will average about 4 inches in depth. Removal of approved trees and shrubs should also occur at this time. Root balls could be up to 3 feet in depth. The actual depth of removal of unsuitable materials will be verified by the Geotechnical Engineer in the field at the time of grading but may reach upwards of 8 feet in localized areas of residual soils, colluvium, and undocumented fill.

It is important that the test pit and trench locations be shown on the grading plans and then field-staked prior to the onset of grading. For test pits and the trench excavation located within proposed fill or shallow cut areas, it is important that the loosely-compacted backfill material and any desiccated or sloughing soil be removed to a competent native base and backfilled as engineered fill.

All excavations below design grades resulting from demolition and stripping operations should be cleaned to a firm undisturbed soil surface determined by the Geotechnical Engineer. This surface should then be scarified to a depth of at least 12 inches, moisture conditioned and backfilled with compacted, engineered fill. The requirements for backfill materials and placement operations are the same as for engineered fill. No loose or uncontrolled backfilling of depressions is permitted.

Selection of Materials

With the exception of organically contaminated soils (those exceeding 3 percent organics) and soils contaminated with construction debris, it is our opinion that the site soils are suitable for use as engineered fill. The Geotechnical Engineer should be informed when import materials are planned for the site. A sample of such material should be submitted to the Geotechnical Engineer for evaluation prior to being brought on the site and should adhere to the guidelines provided in the attached Guide Contract Specifications.

We recommend that a layer of site strippings, topsoil, or other organic soil no more than 6 inches in thickness, be trackwalked onto all graded slopes (cut or fill) following rough grading to promote the growth of vegetation. Subject to approval by the Landscape Architect, organically contaminated soil material may also be utilized in landscape areas. These materials should be stockpiled in an approved area that is unaffected by grading operations until their future use.

As discussed previously, although the soils tested had a very low to low PI, some of the site soils within in the upper soil mantle may have a moderate shrink/swell potential. During grading plan development, selective grading schemes can be developed to reduce the presence of highly expansive soil within the upper lot areas by placing the highly expansive materials as engineered fill within deeper fills, or by selectively placing such materials outside building envelopes.

Graded Slopes

It is recommended that graded cut and fill slopes up to 20 feet in height be no steeper than 2:1 (horizontal:vertical). For slopes between 20 and 30 feet in height, we recommended a 2.5:1 or flatter slope gradient be provided, while for slopes exceeding these height guidelines, a maximum slope gradient of 3:1 is recommended. If steeper and/or higher slopes are desired, guidelines for geotextile slope reinforcement may be developed.

Cut slopes should be observed by an ENGEO Engineering Geologist during grading to determine whether any adverse geologic conditions are encountered on the exposed slope. If adverse conditions are noted, additional mitigation measures, possibly including slope reconstruction, may be recommended. Additional recommendations to reduce the need for cut slope reconstruction can be provided by ENGEO during grading plan development.

All fill slopes should be adequately keyed into firm natural materials unaffected by shrinkage cracks.

We recommend that fill slopes be overbuilt and cut back to finished grades; trackwalking of slopes is not sufficient. As described previously, finished slopes should receive approximately 4 inches (no more than 6 inches) of topsoil to improve erosion protection and promote the growth of vegetation. Final slope construction may require erosion control protection by means of jute matting or other synthetic products until mature vegetation occurs.

Subdrained Keyways

In order to develop the relatively level, drainable building pads, we anticipate some interior and perimeter slopes. Construction of subdrained keyway systems will be recommended for most fill slopes in order to support the slopes and reduce the risk of lot damage due to slope failures. A detailed keyway layout will be shown on the final grading plans. Based upon the final layout, buffers may also be provided between open space or graded slopes and building pad areas. This will be accomplished by constructing a debris bench supported on an engineered buttress keyway. Figure 7 presents typical keyway details. Buttress details will be prepared during the time of our grading plan review if the situation warrants their construction.

We anticipate that typical keyway designs will consist of minimum 18-foot-wide keyways constructed to a minimum depth of 5 feet, or extending at least 3 feet into competent native materials, whichever is deeper. Actual subsurface mitigation configurations (size and depths) will be shown on the final 40-scale drawings and after detailed slope stability analyses have been performed. These will be further revised as warranted in the field by an ENGEO representative during grading. Fill slopes and rebuilt cut slopes, if any, should be adequately benched into competent native soil upon backfilling.

Subdrainage systems should be provided at the base of each keyway along the rear edge of the excavation. The subdrain should consist of a 6-inch-diameter perforated pipe embedded in either free-draining gravel wrapped in a synthetic filter fabric, or Caltrans Class 2 permeable material, as presented on Figure 8. The drain blanket should be at least 18 inches thick and should extend to about 5 feet below finished grades. As an alternative to a granular drain blanket and the conventional pipe wrapped in granular material, prefabricated synthetic composite drain panels and approved prefabricated strip drain materials may be installed against the rear slope of the excavation and the rear base of the excavation, respectively. The subdrain should collect subsurface water and discharge via a closed conduit, into an outlet approved by the Civil Engineer. Pipe and synthetic filter fabric specifications should meet the minimum requirements provided in the Guide Contract Specifications.

Compressible Materials

We recommend that all soft/compressible materials (such as residual soil, colluvium, and undocumented fill) be removed and replaced with engineered fill. This will provide a more stable base material for the proposed overlying fill. It appears as though some swales and depressed areas may contain compressible surface materials. We anticipate that the general depth of removal of unsuitable materials in developable areas may be around 2 to 3 feet in thickness, with isolated identified areas that may require up to an additional 3 to 6 feet of additional subexcavation to achieve a competent base. Anticipated areas of mitigation for compressible materials that extend beyond common grading activities are identified on the geologic site map (Figure 2A) as Qc and Qaf, and will be refined during our 40-scale plan review. Actual depths will be determined in the field by an ENGEO representative at the time of grading.

Swale Treatment

According to the site topography, grading activities may encroach into and fill some existing swale areas. For this condition, all unsuitable material, including all soft and compressible soils, should be removed from the existing drainage swales prior to filling. The actual depth of removal should be determined by the Geotechnical Engineer’s field representative at the time of grading.

Following removal of soil from swale areas, a subdrainage system will likely be recommended along the base of the swale excavation. A typical swale treatment detail appropriate for the anticipated development is provided in Figure 9. The swale drain should consist of a 6-inch-diameter perforated pipe encapsulated in either Caltrans Class 2 permeable material, or free-draining gravel wrapped in a synthetic filter fabric as shown on Figure 8. Pipe and backfill material specifications are provided in the Guide Contract Specifications at the end of this report. The swale subdrain should discharge into an outlet approved by the Civil Engineer. Prior to swale drain installation, desiccated or cracked surface clays and slumping soils located along slopes should be removed.

Cut Lots

As previously described, there is a potential for varying subgrade soils for lots located entirely in cut if the cut occurs on previously sloping terrain. To mitigate the effects of differential shrink/swell characteristics of subgrade soils exposed at cut lots, we recommend that the upper 1 foot of subgrade soils be scarified, mixed, and recompacted as engineered fill in accordance with the requirements for near-surface materials provided in the Fill Placement section. The purpose of this reworking is to provide a uniform stable, non-yielding surface on which to construct improvements. Figure 10 presents a general guideline for surficial soil treatment of cut areas containing variable subgrade materials. If a highly variable subgrade material is encountered at the time of cutting, the depth of subexcavation may be increased to 24 inches. This increase will depend upon review and approval at the time of grading by an ENGEO engineer or geologist based on the swell potential of the surface materials.

Fill Lots

For fill lots, once overlying compressible materials are removed, we recommend that the upper 12 inches of native material be scarified, moisture conditioned, and recompacted as engineered fill (Figure 10). The processed native material and overlying fill should be placed in accordance with the recommendations for near-surface fill provided herein to create a uniform layer of engineered fill.

The upper 2 feet of the fill area should be placed in accordance with the recommendations for near-surface fill provided in a subsequent section of this report. Engineered fill placed below this layer should follow the general fill placement specifications.

Cut-Fill Transition Lots

Due to the variation in material properties and particularly shrink/swell characteristics that may occur across a cut to fill daylight, we recommend that the subgrade materials be made more uniform. For building pads located across a cut-fill transition, this can be accomplished by subexcavating the native materials 1 foot below finished subgrade (Figure 10). The bottom of the subexcavation should then be scarified, moisture conditioned, and replaced as a uniform 2-foot-thick layer of engineered fill. If the material characteristics in the cut area and proposed fill materials are similar, a reduction to 12 inches may be appropriate at the time of grading. The moisture and compaction requirements for the upper 2 feet of cut-fill transition lots are provided in the Fill Placement section of this report.

Differential Fill Thickness

For the potentially expansive fill materials encountered at the site, we recommend that the differential in fill thickness under individual buildings be limited to approximately 10 feet. Local subexcavation of soil material and replacement with engineered fill may be necessary to achieve this limitation. A detailed review of fill thicknesses will be performed during the preparation of the final 40-scale grading, and fill performance testing on remolded samples of engineered fill materials will be provided during grading.

Fill Placement

After a firm, undisturbed, non-yielding surface is exposed, general fill areas (those areas receiving at least 2 feet of fill) should be scarified to a minimum depth of 12 inches, moisture conditioned, and recompacted to provide adequate bonding with the initial lift of fill. Cut and shallow fill areas (those areas receiving less than 2 feet of fill) should be scarified to a minimum depth of 12 inches. All fills should be placed in thin lifts, with the lift thickness not to exceed the depth of penetration of the compaction equipment used.

Backfill material for keyways should be placed in accordance with the following compaction control requirements:

Test Procedures:	ASTM D-1557.
Required Moisture Content:	Not less than 2 percent above optimum moisture content.
Minimum Relative Compaction:	Not less than 95 percent.

For general fill areas, the following compaction control requirements should be used:

Test Procedures:	ASTM D-1557.
Required Moisture Content:	Not less than 2 percent above optimum moisture content.
Minimum Relative Compaction:	Not less than 92 percent.

Since excessive compaction of surface materials may produce an undesirable environment for the zone of significant seasonal moisture variation, special requirements for placement of soils are recommended for the foundation zone of building areas. As a result, for soils placed within the upper 2 feet for fill and cut-fill transition lots, the upper 1 foot of cut lots, or the minimum depth provided in previous sections and in Figure 10, are proposed.

Test Procedure:	ASTM D-1557.
Required Moisture Content:	At least 2 percent above optimum moisture content.
Relative Compaction:	Not less than 90 percent and not more than 95 percent.

It is important that all site preparation, including demolition and stripping, be done under the observation of the Geotechnical Engineer's field representative and should be carried out according to the requirements contained in the attached Guide Contract Specifications.

The final grading plans should be submitted to the Geotechnical Engineer for review.

Structure Setback Distance

According to the Uniform Building Code, in general, habitable and non-habitable structures should be set back from the top of slope a distance of at least one-half the vertical height of the slope, or 30 feet maximum. For habitable and non-habitable structures located near the toe of slope, a setback distance of one-third the vertical height, or 40 feet maximum, should be observed. If these criteria cannot be achieved, retaining walls may be introduced to create an appropriate setback, the structure may be designed to resist lateral movement of the upper soil mantle, or the structure may be constructed with deepened foundation elements in these locations to extend below the upper soil mantle.

For the perimeter bluff slope located along the northeastern and eastern portion of the study area, following UBC setback criteria is not deemed sufficient. As a result, recommended habitable and non-habitable structure setback distances have been established based upon geologic and geotechnical review of actual soil conditions, laboratory testing from samples collected, and performing preliminary slope stability analysis of existing slope conditions using the computer aided program GSLOPE. Based upon our review and analysis, we recommend a non-habitable structure setback that satisfies a 2:1 line of projection extending up from the toe of the bluff slope into the site and a habitable structure setback that satisfies a 2.5:1 line of projection extending up from the toe of the bluff slope. These surface setback projections are shown on Figure 2B.

Preliminary Foundation Alternatives

In order to reduce the effects of the potentially expansive soils, the foundations should be sufficiently stiff to move as rigid units with minimum differential movements. This can be accomplished by a deepened foundation system such as drilled piers connected by well-reinforced grade beams or deepened perimeter footings with raised or slab-on-grade flooring, or construction of relatively rigid mat foundations, such as post-tensioned or conventionally reinforced structural mats.

Residential Structures. Provided that all building pads are prepared in accordance with the recommendations provided above, it is our opinion that structural mat foundations (post-tensioned or conventionally-reinforced) or deepened perimeter footings would be feasible and likely most cost effective to support the proposed one- or two-story residential structures. We anticipate that structural mats constructed on swelling soils will move differentially. Structural mats may require stiffening to reduce differential movements due to swelling/shrinkage to a value compatible with the type of structure that will be constructed.

Preliminary foundation design can utilize the following information, which will be confirmed at the time of grading based upon sampling and testing of actual foundation soils:

Center Lift Condition:

Edge Moisture Variation Distance, e_m = 4.5 feet
Differential Soil Movement, y_m = 1.4 inches

Edge Lift Condition:

Edge Moisture Variation Distance, e_m = 3.5 feet
Differential Soil Movement, y_m =0.53 inches

The above parameters are applicable for the design methodology provided in the 1996 (Second Edition) Post-Tensioning Institute, "Design and Construction of Post-Tensioned Slabs-On-Ground" manual. If other procedures are utilized for design, the parameters provided above should be reviewed for suitability.

A minimum post-tensioned mat thickness of 8 inches would appear feasible for the existing conditions encountered. The perimeter should be thickened by 2 inches.

Apartment Building and Commercial Structures. Provided that the building pads for commercial areas are prepared in accordance with the recommendations provided herein, and those to be developed based upon further study, it is our opinion that deepened perimeter footings with slab-on-grade would likely be feasible and most cost effective to support the proposed one- or two-story wood-framed or concrete tilt up commercial structures. Structural mat foundations would also be considered suitable.

For a footing foundation system, we anticipate a minimum footing width of 10 inches and a minimum footing embedment of 18 inches below lowest adjacent soil subgrade elevation. An allowable bearing value of 2,500 pounds per square foot (psf) with a sliding coefficient of friction of 0.35 can also be used for preliminary foundation design purposes. The soil bearing value may be increased by 1/3 for total loads including wind and seismic. A minimum concrete floor slab thickness of 5 inches reinforced with No. 4 bars spaced 18 inches on-center each way over 5 inches of clean crushed rock should also be anticipated. To inhibit the transmission of moisture vapor, the concrete slab should be placed directly on a minimum of 2 layers of vapor retarder, each layer having a minimum thickness of 10 mil.

If the proposed buildings are more then 3 stories in height or if underground parking is expected, additional subsurface information may be beneficial to determine the adequacy of these foundation systems of if drilled piers or driven piles would be better suited to support the structure loads.

Further discussion about proposed building loads and layouts should occur prior to preparation of foundation design information for the residential and commercial facilities.

Secondary Slab-on-Grade Construction

Secondary slabs-on-grade, such as driveways, patios, porches, steps, and walkways, should be constructed as units that are structurally independent of the foundation system, unless incorporated as part of the structural mat or foundation system. This allows the slabs to move with minimum distress to the slabs or the foundation.

It is an accepted practice to design conventional secondary slabs-on-grade with a minimum concrete thickness of 4 inches over a 4-inch-thick layer of clean, crushed rock or gravel. Secondary slabs-on-grade should be constructed with thickened edges extending at least to pad subgrade to minimize water infiltration. In addition, the slabs should slope away from the foundation of the structure to prevent water from flowing toward the structure.

Secondary slabs-on-grade should be designed specifically for their intended use and loading requirements. Slabs-on-grade should be reinforced for control of cracking and should be designed by the Structural Engineer. As a minimum, slab reinforcement should consist of No. 3 bars spaced 16 inches on-center each way. Frequent joints should be provided in the slabs at a spacing determined by the Structural Engineer.

Minor cracking should be expected in the future due to concrete shrinkage and soil uplift forces. It is important that the subgrade materials not be allowed to desiccate at any time prior to the placement of concrete.

Retaining Walls

Unrestrained drained retaining walls less than 10 feet in vertical height and constructed on level ground may be designed for active lateral fluid pressures determined as follows:

Backfill Slope Condition	Active Pressure (pcf)
Level	45
4:1	50
3:1	55
2:1	60

Restrained retaining walls with a level backfill may be designed for an at-rest equivalent fluid weight of 70 pcf.

Passive pressures acting on foundations or keyways may be assumed as 250 pcf for native soil or fill provided that the area in front of the retaining wall is level for a distance of at least 10 feet or three times the depth of foundation or keyway, whichever is greater.

The friction factor for sliding resistance may be assumed as 0.35. It is recommended that retaining wall footings be designed using an allowable bearing pressure of 2,500 psf in native firm materials or fill. Appropriate safety factors against overturning and sliding should be incorporated into the design calculations. The Geotechnical Engineer should be consulted on design values where surcharge loads, such as from automobiles, are expected or where a downhill slope exists below a proposed wall.

All retaining walls should be provided with drainage facilities to prevent the build-up of hydrostatic pressures behind the walls. Wall drainage may be provided using a 4-inch-diameter perforated pipe embedded in either Class 2 permeable material, or free-draining gravel surrounded by synthetic filter fabric. The width of the drain blanket should be at least 12 inches and should extend to about one foot below the finished grades. As an alternative, prefabricated synthetic wall drain panels can be used. The upper one foot of wall backfill should consist of on-site clayey soils. Drainage should be collected by perforated pipes and directed to an outlet approved by the Civil Engineer. Synthetic filter fabric should meet the minimum requirement as listed in the Guide Contract Specifications.

All backfill should be placed in accordance with the recommendations provided earlier for engineered fill. Light equipment should be used during backfill compaction to minimize possible overstressing of the walls.

Infiltration Ponds

Estimated Percolation Rates. We understand that construction of infiltration ponds for storm water is desired for the subject property. At this time, the number, location, and size of ponds are still at the preliminary design stage, but there were five locations identified to us for initial review. Based on our exploration and test data collected regarding the grain size distribution of the site soils, the infiltration/percolation rate will be controlled by the quantity of fine-grained soils within the overall matrix of the generally sandy soils and the depth to the underlying cemented materials.

In general, for the cleaner sands encountered (those containing less than 10 percent fines passing the No. 200 sieve), a permeability rate of roughly 10^{-2} centimeters per second (cm/sec) should be expected. For sands with silt (between 10 and 30 percent fines passing the No. 200 sieve) or moderately cemented sands, the permeability rate may yield roughly 10^{-4} cm/sec.

Site-specific permeability testing was performed at four of the five readily accessible proposed infiltration pond locations. Our field testing was performed on July 14, 2003, consisted of excavating two pits within four of the five pond locations for a total of 8 test pits (Figures 2A and 2B).

In general, the tests were conducted in accordance with the Method for Determining Soil Suitability for Individual Sewage Disposal Systems. The test pits were excavated to 2 feet below existing grade using a 12-inch backhoe bucket with development of a 1 cubic foot excavation in the lower 12 inches. A 6-inch I. D. perforated pipe was set within the 1 foot cube and the test holes were prepared and presoaked for a minimum of 4 hours due to the granular nature of the materials encountered.

Percolation tests were conducted after presoaking the eight pit locations. Collected field data and calculated percolation rates are presented in tabular worksheets within Appendix E for each pit location. The worksheets present the field reported measurements as well as incorporate correction factors to model a "standard" percolation pit size, and associated percolation rates in centimeters per second (cm/s).

Our field exploration and analysis yielded average percolation rates between 1.5 and 2.8×10^{-3} cm/s at possible Ponds 1, 2 and 5, while a percolation rate of 6.5×10^{-4} was calculated at Pond 3. One of the test pits in the Pond 3 location yielded only a 0.5 inch drop over roughly 9 hours of presoaking, after which time, the pit was eliminated from the percolation test program due to a suspect anomaly.

Additional percolation testing should be performed once the pond locations are finalized and the bottom elevation of the pond is known.

Impact on Bluff Stability. Based upon our preliminary stability analysis described above to determine habitable and non-habitable setback distances from the existing top of bluff slope, and the estimated rate of infiltration of the site soils, the proposed infiltration ponds had a negligible effect on the stability analysis due to their distance from the existing top of slope for the bluff area. Prior to finalizing the pond locations, we should review the potential impact to slope stability.

Preliminary Pavement Design

Two near-surface bulk samples of existing site soils were collected as a part of our field exploration and submitted to Resistance Value (R-Value) testing. The laboratory testing yielded R-Values of 61 and 65.

The following preliminary pavement section designs have been determined for Traffic Indices of 4.5, 5, 6, and 7, an assigned R-value of 60, and in accordance with the methods contained in Topic 608 of the Highway Design Manual by Caltrans.

TRAFFIC INDEX	R-VALUE	PAVEMENT SECTION	
		AC (in.)	AB (in.)
4.5	60	2.5	2.5
5.0	60	3.0	2.0
6.0	60	3.5	3.5
7.0	60	4.0	4.5

Notes: AC is asphalt concrete
AB is aggregate base Class 2 Material with minimum R = 78

We understand that permeable pavements are being considered to minimize storm water discharge. From a geotechnical standpoint, permeable pavements are feasible in non-heavy traffic loaded areas, such as alley ways and parking lots. At this time, utilization of permeable pavers in heavy traffic loaded areas, such as main residential streets and around the Town Center is not recommended.

The above pavement sections are provided for estimation purposes only. The actual subgrade material should be tested for R-value when graded, and the Traffic Index should be confirmed by the Civil Engineer and local public agency. Minimum pavement sections provided by the local agency may govern in the case of high R-values and/or low Traffic Indices, and will be utilized when applicable, after actual subgrade conditions are tested.

Pavement construction and all materials should conform to the specifications and requirements of the Standard Specifications by the Division of Highways, Department of Public Works, State of California, latest edition, City requirements, and the following minimum requirements.

- All pavement subgrades should be scarified to a depth of 12 inches below finished subgrade elevation, moisture conditioned to at least optimum moisture content, and compacted to at least 95 percent relative compaction and in accordance with city requirements. (ASTM Test Methods).

- Subgrade soils should be in a stable, non-pumping condition at the time aggregate baserock materials are placed and compacted.

- Adequate provisions must be made such that the subgrade soils and aggregate baserock materials are not allowed to become saturated.

- Aggregate baserock materials should meet current Caltrans specifications for Class 2 aggregate baserock and should be compacted to at least 95 percent of maximum dry density at a moisture content of at least optimum (ASTM Test Methods).

- Asphalt paving materials should meet current Caltrans specifications for asphalt concrete.

- Concrete curbs separating pavement and irrigated landscaped areas should extend to the subgrade and at least to the bottom of adjacent aggregate baserock materials. For irrigated median areas, we recommend that concrete curbs extend into the subgrade and below the bottom of adjacent aggregate baserock materials. As an alternative, a back of curb subdrain facility would be appropriate that is installed 6 inches below the street subgrade elevation.

Surface Drainage

The property must be positively graded at all times to provide for rapid removal of surface water runoff from the foundation systems and to prevent ponding of water under floors or seepage toward the foundation systems at any time during or after construction. Ponded water will cause undesirable soil swell and loss of strength. As a minimum requirement, finished grades should have slopes of at least 3 to 5 percent within 5 feet from the exterior walls and at right angles to them to allow surface water to drain positively away from the structure. The slope gradient away from the foundation may be reduced to 2 percent for paved areas.

All surface water should be collected and discharged into outlets approved by the Civil Engineer. Landscape mounds must not interfere with this requirement. In addition, each lot should drain individually by providing positive drainage or sufficient area drains around the buildings to remove excessive surface water.

All roof storm water should be collected and directed to downspouts. Storm water from roof downspouts should not be allowed to discharge directly onto the ground surface. Rather, storm water from roof downspouts should be directed to a solid pipe that discharges into the street or to an outlet approved by the Civil Engineer.

Subsurface Drainage

The occurrence of surface water infiltrating, ponding, and saturating the foundation soils can cause loss of soil strength and undesirable shrinking/swelling of the foundation soils.

If a footing foundation system or deep foundation consisting of drilled piers or driven piles is the selected system, installation of a perimeter subdrain may be recommended. If a raised floor is constructed, an underfloor drainage system may also be recommended.

For post-tensioned mat foundation systems, if at any time adequate drainage away from the foundation cannot be achieved, then additional measures to hinder saturation of foundation soils must be provided. This may be accomplished by installing a perimeter subdrain system.

Figure 11 provides a typical detail for perimeter and crawlspace drainage. Under no circumstance should the subdrain facilities be connected into the surface water collection system.

Requirements for Landscaping Irrigation

Vegetation should not be planted immediately adjacent to a structure. If planting adjacent to a building occurs, watertight planter boxes with controlled discharges or plants that require little moisture should be installed.

Sprinkler systems should not be installed where they may cause ponding or saturation of foundation soils within 5 feet of the walls or under a structure. Ponding or saturation of foundation soils may cause soil swell, consequent loss of strength, and movements of the foundation and slabs.

Irrigation of landscaped areas should be strictly limited to that necessary to sustain vegetation. Excessive irrigation could result in saturating, weakening, and possible swelling of foundation soils. The Landscape Architect and prospective owners should be informed of the surface drainage requirements included in this report.

Utilities

It is recommended that utility trench backfilling be done under the observation of a Geotechnical Engineer. Pipe zone backfill (i.e. material beneath and immediately surrounding the pipe) may consist of a well-graded import or native material less than ¾ inch in maximum dimension compacted in accordance with recommendations provided above for engineered fill. Trench zone backfill (i.e. material placed between the pipe zone backfill and the ground surface) may consist of native soil compacted in accordance with recommendations for engineered fill.

Where import material is used for pipe zone backfill, we recommend it consist of fine- to medium-grained sand or a well-graded mixture of sand and gravel and that this material not be used within 2 feet of finish grades. In general, uniformly graded gravel should not be used for pipe or trench zone backfill due to the potential for migration of (1) soil into the relatively large void spaces present in this type of material and (2) water along trenches backfilled with this type of material.

Import trench backfill should be compacted using approved techniques to a minimum of 90 percent compaction with a moisture content at or exceeding the optimum moisture. The import material should be placed in lift thicknesses that do not to exceed the depth of penetration of the compaction equipment used (typically 12 inches maximum) and will be tested by ENGEO. Compaction of pipe zone or trench zone backfill by jetting should not be allowed at this site. Utility trenches in areas to be paved should be constructed in accordance with local agency requirements.

All utility trenches entering buildings and paved areas should be backfilled entirely with native materials or concrete, where the trenches pass under the building perimeter and curb lines. The length of the backfill zone should extend at least 3 feet to either side of the crossing and should replace both the pipe zone (bedding and shading) and trench zone. This is to prevent surface water percolation into the import trench backfill materials under foundations and pavements where such water would remain trapped in a perched condition.

Care should be exercised where utility trenches are located beside foundation areas. Utility trenches constructed parallel to foundations should be located entirely above a plane extending down from the lower edge of the footing at an angle of 45 degrees. Utility companies and the Landscape Architect should be made aware of this information.

Construction of utility trenches is the responsibility of the contractor. All excavation work shall be performed in compliance with appropriate Cal/OSHA regulations. The contractor is responsible for determining safe slope inclinations for open trenches and all needs and requirements for shoring, as appropriate. The Contractor shall provide a "Competent Person" as defined by CAL/OSHA to identify existing or predictable hazards in the surroundings or working conditions which are hazardous or dangerous to employees.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report is issued with the understanding that it is the responsibility of the owner/developer to transmit the information and recommendations of this report to developers/owners, buyers, architects, engineers, and designers for the project so that the necessary steps can be taken by the contractors and subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this report are solely professional opinions.

The professional staff of ENGEO Incorporated strives to perform its services in a proper and professional manner with reasonable care and competence but is not infallible. There are risks of earth movement and property damages inherent in land development. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our work.

This report is based upon field and other conditions discovered at the time of preparation of ENGEO's work. This document must not be subject to unauthorized reuse, that is, reuse without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time. If actual field or other conditions necessitate clarifications, adjustments, modifications or other changes to ENGEO's work, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications or other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

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The Following Figures and Appendices to ENGEO's Geotechnical Report Are Available for Review at the Monterey County Planning and Building Inspection Department:

List of Figures:	Figures
Appendix A:	Log of Borings, Test Pits, and Test Trench
Appendix B:	Laboratory Tests - Purpose, Laboratory Test Results
Appendix C:	Select Slope Stability Analysis Results
Appendix D:	Guide Contract Specifications
Appendix E:	Percolation Test Field Data and Calculated Rates

LIST OF FIGURES

BASE MAP SOURCE: THOMAS BROTHERS

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

SITE VICINITY MAP
EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: 5866.3.001.01	
DATE: JULY 2003	
DRAWN BY: DLB	CHECKED BY: DB

FIGURE NO. 1

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GEOLOGIC MAP
EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: 5866.3.001.01
DATE: JULY 2003
DRAWN BY: CLL
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FIGURE NO. 2A

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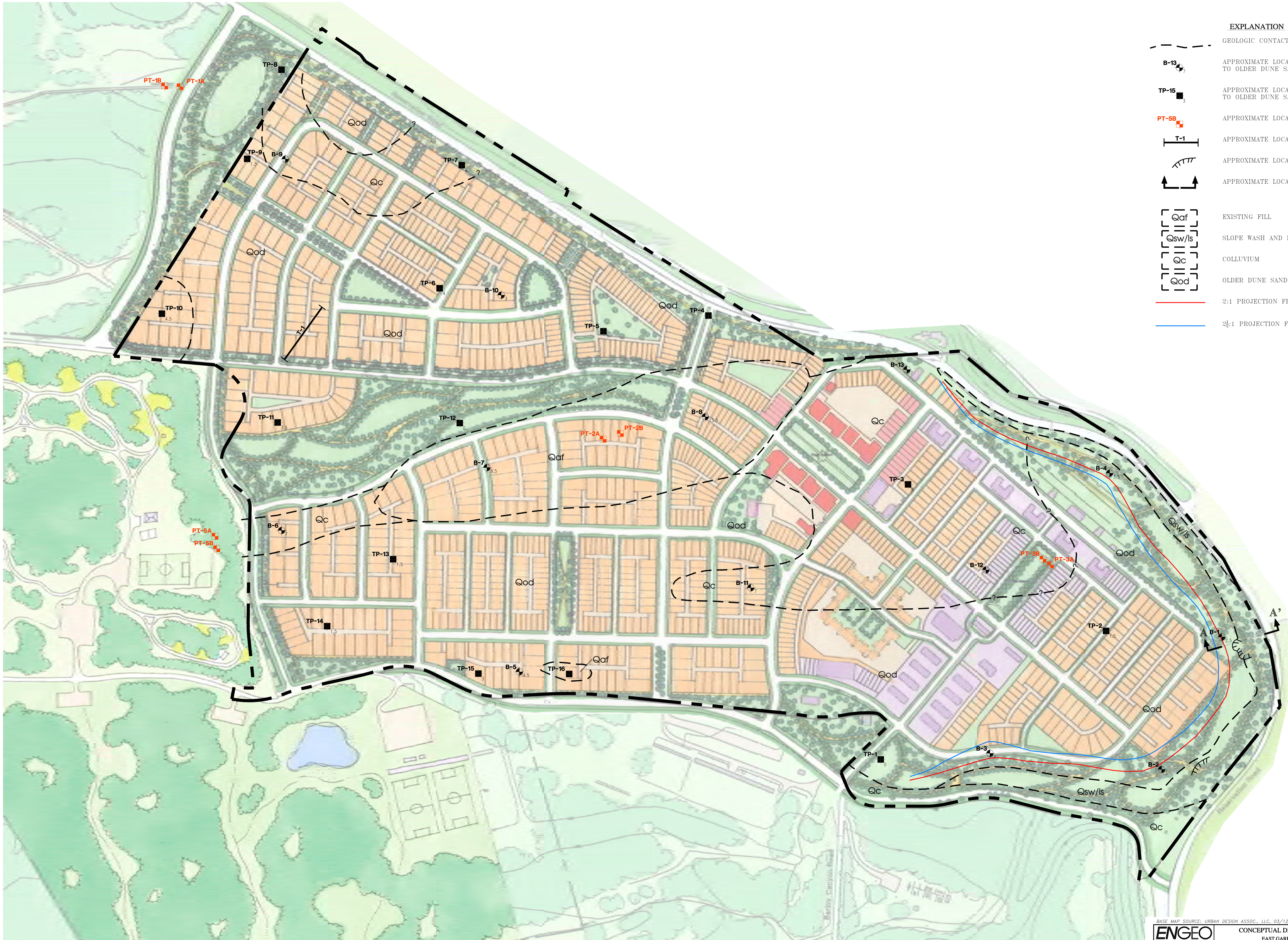

EXPLANATION

- GEOLOGIC CONTACT, APPROXIMATE
- B-13 — APPROXIMATE LOCATION OF BOREHOLE SHOWING DEPTH TO OLDER DUNE SAND IN FEET
- TP-15 — APPROXIMATE LOCATION OF TEST PIT SHOWING DEPTH TO OLDER DUNE SAND IN FEET
- PT-5B — APPROXIMATE LOCATION OF PERCOLATION TEST PITS
- T-1 — APPROXIMATE LOCATION OF TRENCH
- APPROXIMATE LOCATION OF RECENT SCARP
- APPROXIMATE LOCATION GEOLOGIC OF CROSS SECTION
- Qaf — EXISTING FILL
- Qsw/ls — SLOPE WASH AND LANDSLIDE DEBRIS
- Qc — COLLUVIUM
- Qod — OLDER DUNE SAND
- 2:1 PROJECTION FROM TOE OF BLUFF
- $2\frac{1}{2}$:1 PROJECTION FROM TOE OF BLUFF

BASE MAP SOURCE: URBAN DESIGN ASSOC., LLC, 03/12/03

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	CONCEPTUAL DEVELOPMENT PLAN EAST GARRISON - PHASE I MONTEREY COUNTY, CALIFORNIA	PROJECT NO.: 5866.3.001.01 DATE: JULY 2003 DRAWN BY: CLL CHECKED BY: DB	FIGURE NO. 2B

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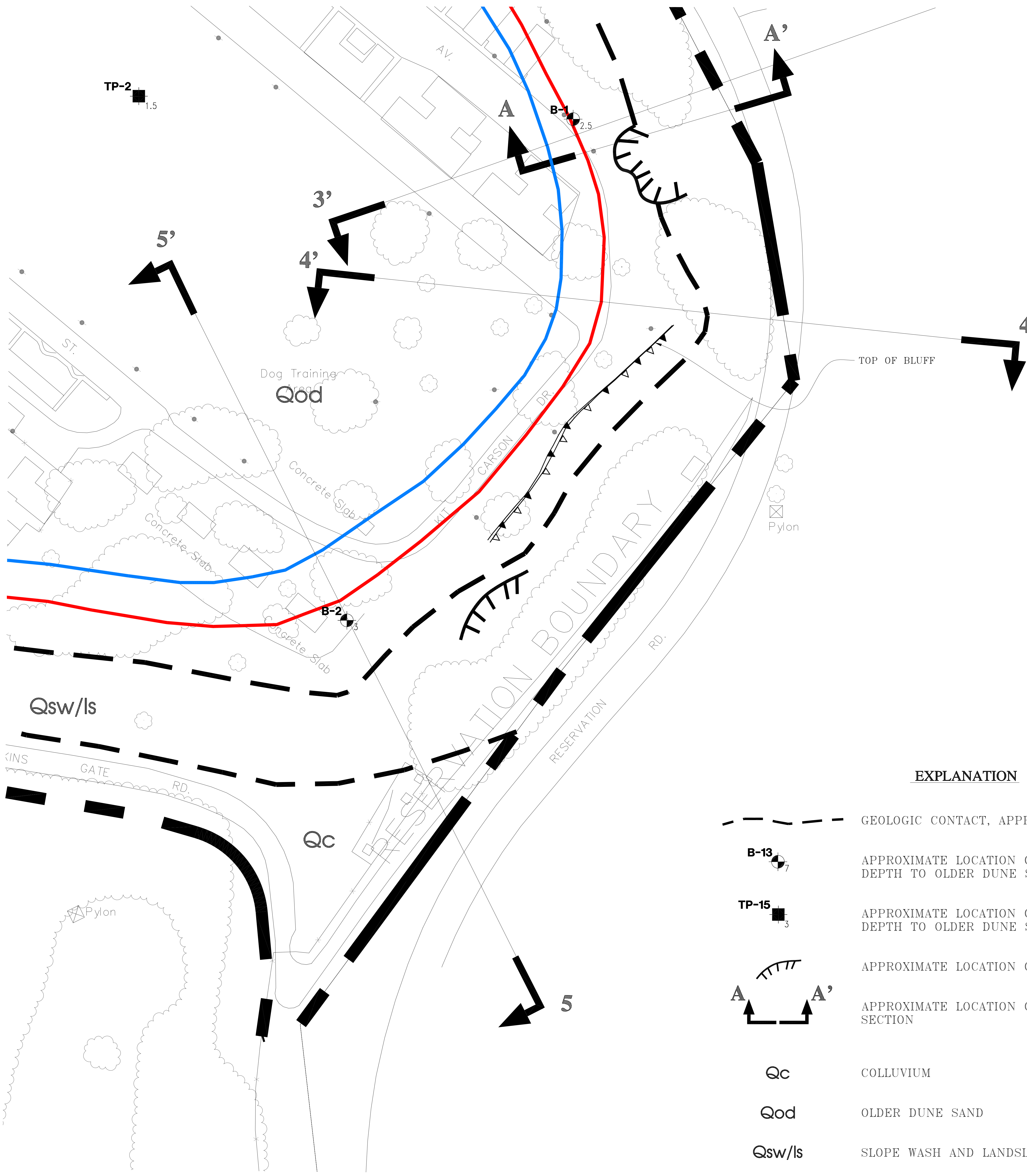
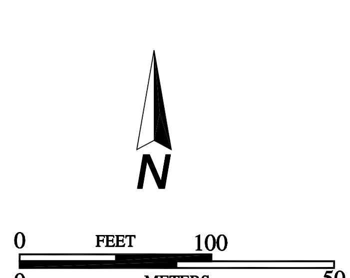


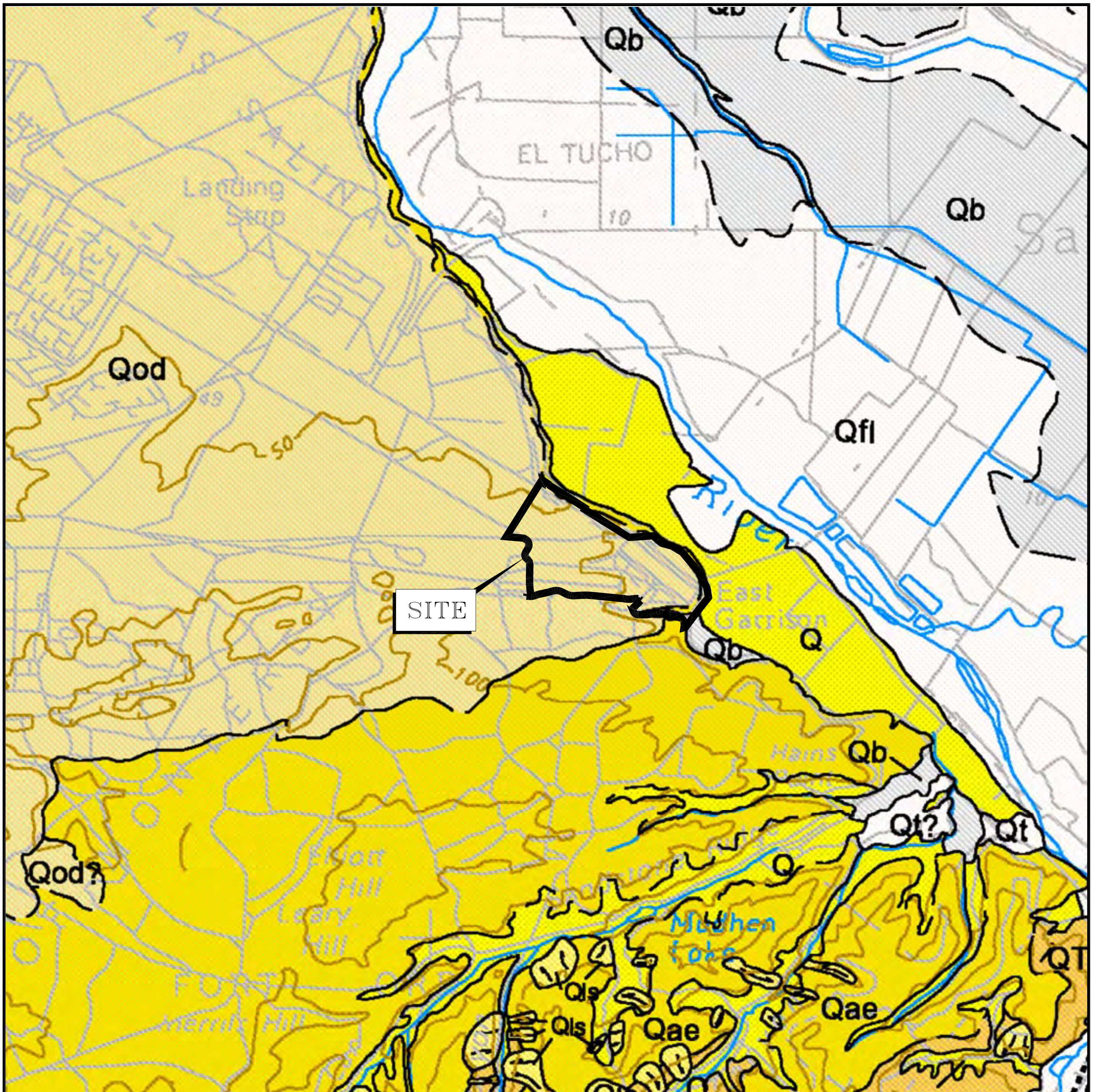
EXPLANATION

(dashed line)	GEOLOGIC CONTACT, APPROXIMATE
B-13 (7)	APPROXIMATE LOCATION OF BOREHOLE SHOWING DEPTH TO OLDER DUNE SAND IN FEET
TP-15 (3)	APPROXIMATE LOCATION OF TEST PIT SHOWING DEPTH TO OLDER DUNE SAND IN FEET
(scarp symbol)	APPROXIMATE LOCATION OF RECENT SCARP
A — A'	APPROXIMATE LOCATION GEOLOGIC OF CROSS SECTION
Qc	COLLUVIUM
Qod	OLDER DUNE SAND
Qsw/ls	SLOPE WASH AND LANDSLIDE DEBRIS
(red line)	2:1 PROJECTION FROM TOE OF BLUFF
(blue line)	2½:1 PROJECTION FROM TOE OF BLUFF
6 — 6'	APPROXIMATE LOCATION OF STABILITY ANALYSIS CROSS SECTION (SEE APPENDIX C)
(line with filled triangles)	TOP OF BLUFF 2003
(line with open triangles)	TOP OF BLUFF 1941



BASE MAP SOURCE: URBAN DESIGN ASSOC., LLC, 03/12/03

ENGEO INCORPORATED — EXCELLENT SERVICE SINCE 1971	SITE PLAN-EAST BLUFF EAST GARRISON-PHASEI MONTEREY COUNTY, CALIFORNIA	PROJECT NO.: 5866.3.001.01 DATE: JULY 2003 DRAWN BY: SRP CHECKED BY: DB	FIGURE NO. 2C



EXPLANATION

Q ALLUVIUM

Qfl FLOOD PLAIN DEPOSITS

Qb BASIN DEPOSITS

Qod OLDER DUNE SAND

Qae AROMAS EOLIAN FACIES

N

0 FEET 4000

0 METERS 2000

BASE MAP SOURCE: WAGNER, ET AL, 2002

ENGEO INCORPORATED
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REGIONAL GEOLOGIC MAP
EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: 5866.3.001.01	
DATE: JULY 2003	
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FIGURE NO. 3

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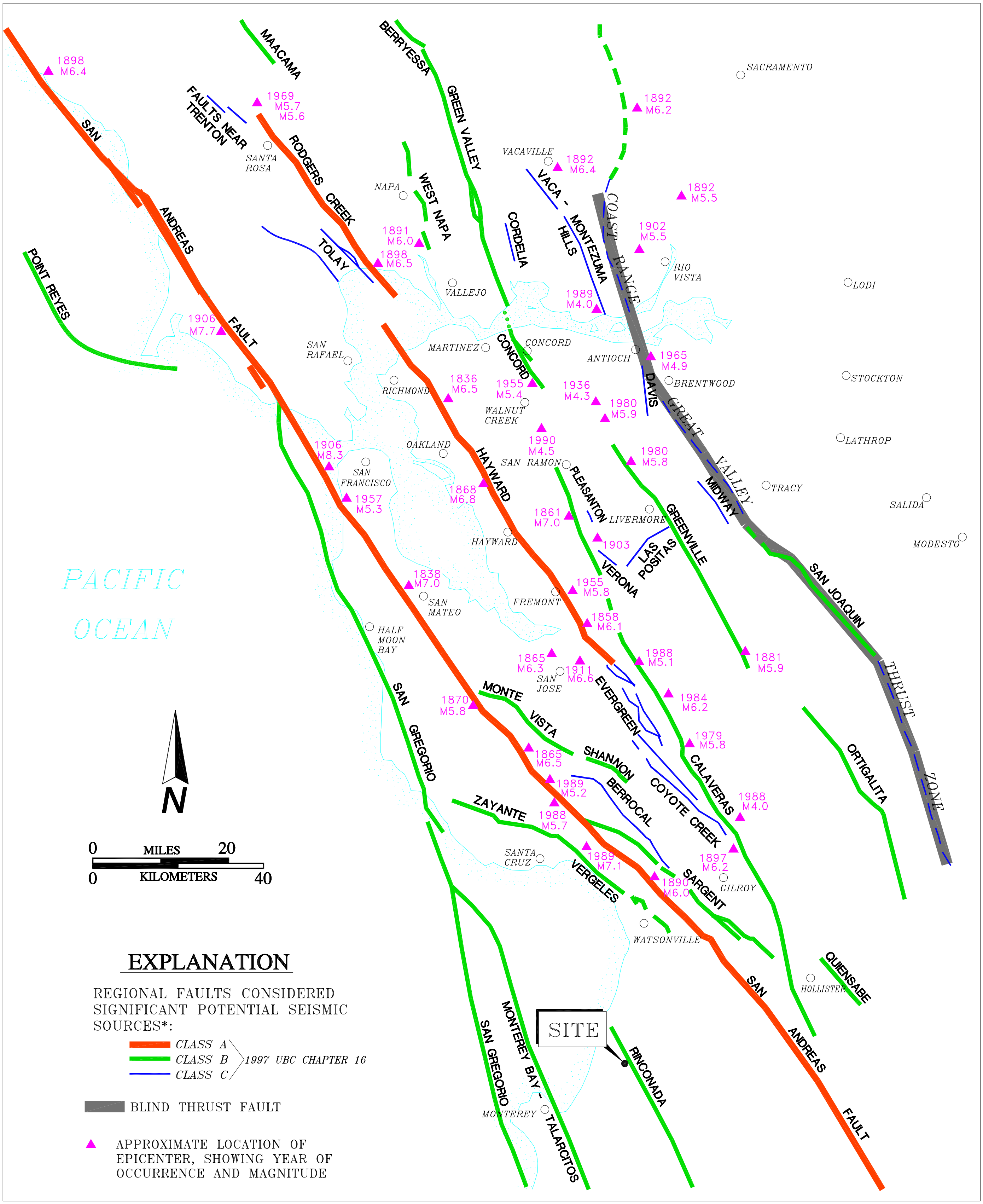

EXPLANATION

REGIONAL FAULTS CONSIDERED SIGNIFICANT POTENTIAL SEISMIC SOURCES*:

- CLASS A
- CLASS B — 1997 UBC CHAPTER 16
- CLASS C

BLIND THRUST FAULT

▲ APPROXIMATE LOCATION OF EPICENTER, SHOWING YEAR OF OCCURRENCE AND MAGNITUDE

*BASED ON USGS OPEN FILE 96-706

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REGIONAL FAULTING AND SEISMICITY

EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: 5866.3.001.01	FIGURE NO. 4
DATE: JULY 2003	
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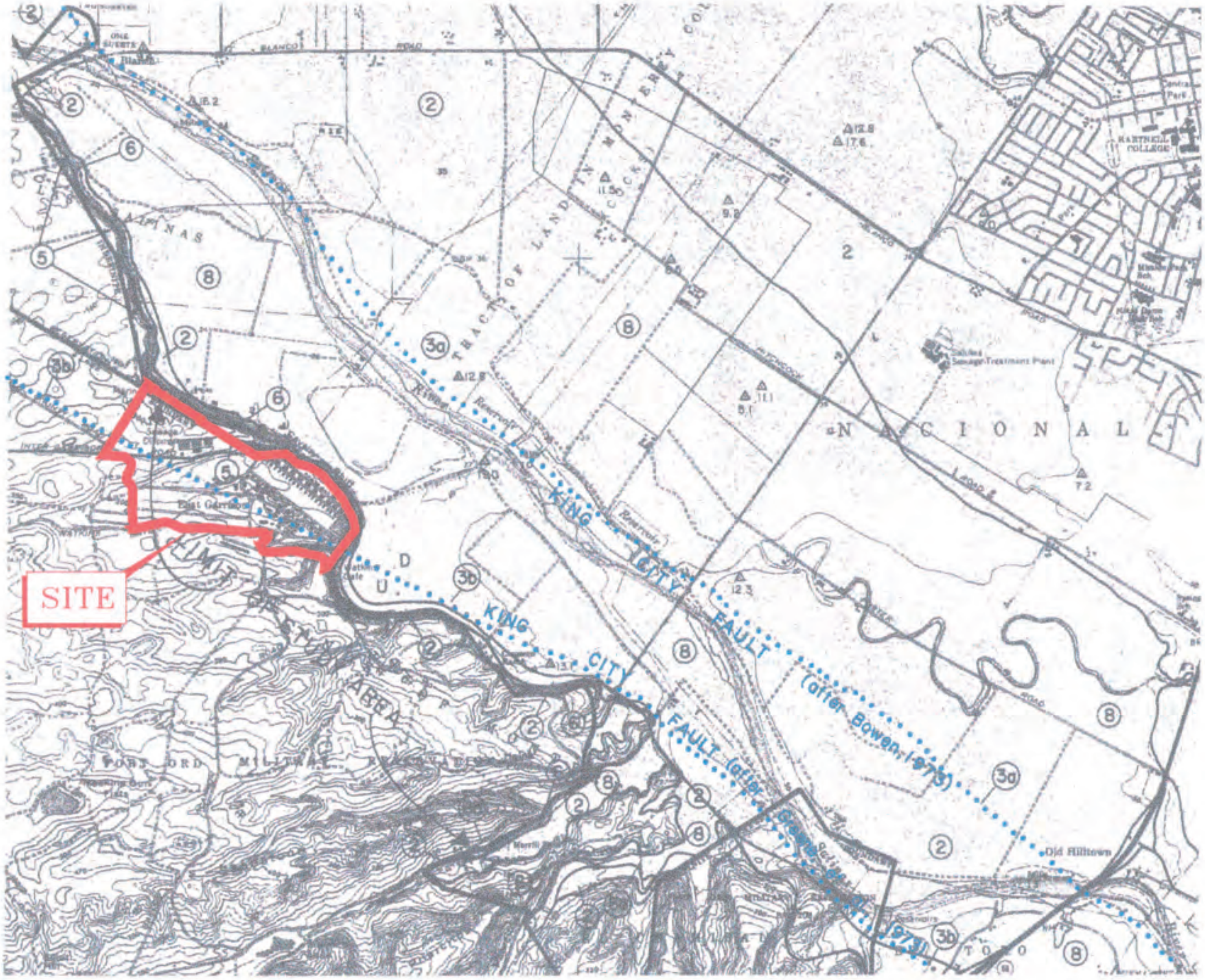

EXPLANATION

•••••• CONCEALED FAULT

N

0 FEET 4000
0 METERS 2000

BASE MAP SOURCE: KILBORNE AND MUALCHIN, 1980

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	KING CITY FAULT MAP EAST GARRISON - PHASE I MONTEREY COUNTY, CALIFORNIA	PROJECT NO.: 5866.3.001.01 DATE: JULY 2003 DRAWN BY: DLB CHECKED BY: DB	FIGURE NO. 5

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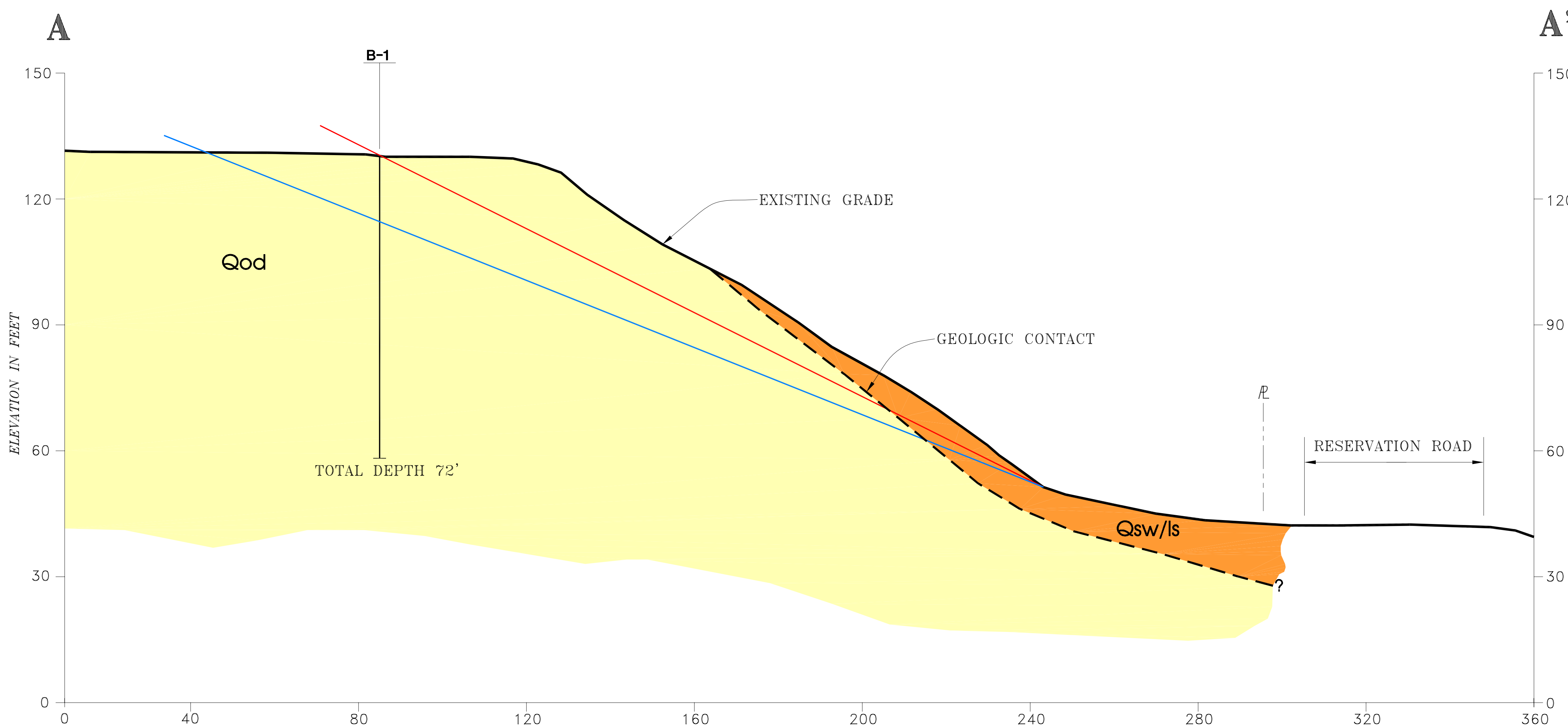

EXPLANATION

Qsw/ls	SLOPE WASH AND LANDSLIDE DEBRIS
Qod	OLDER DUNE SAND
(red line)	2:1 PROJECTION FROM TOE OF BLUFF
(blue line)	2½:1 PROJECTION FROM TOE OF BLUFF

SCALE: 1"=30'

ENGEO INCORPORATED
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CROSS SECTION A-A'
EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: 5866.3.001.01	FIGURE NO. 6
DATE: JULY 2003	
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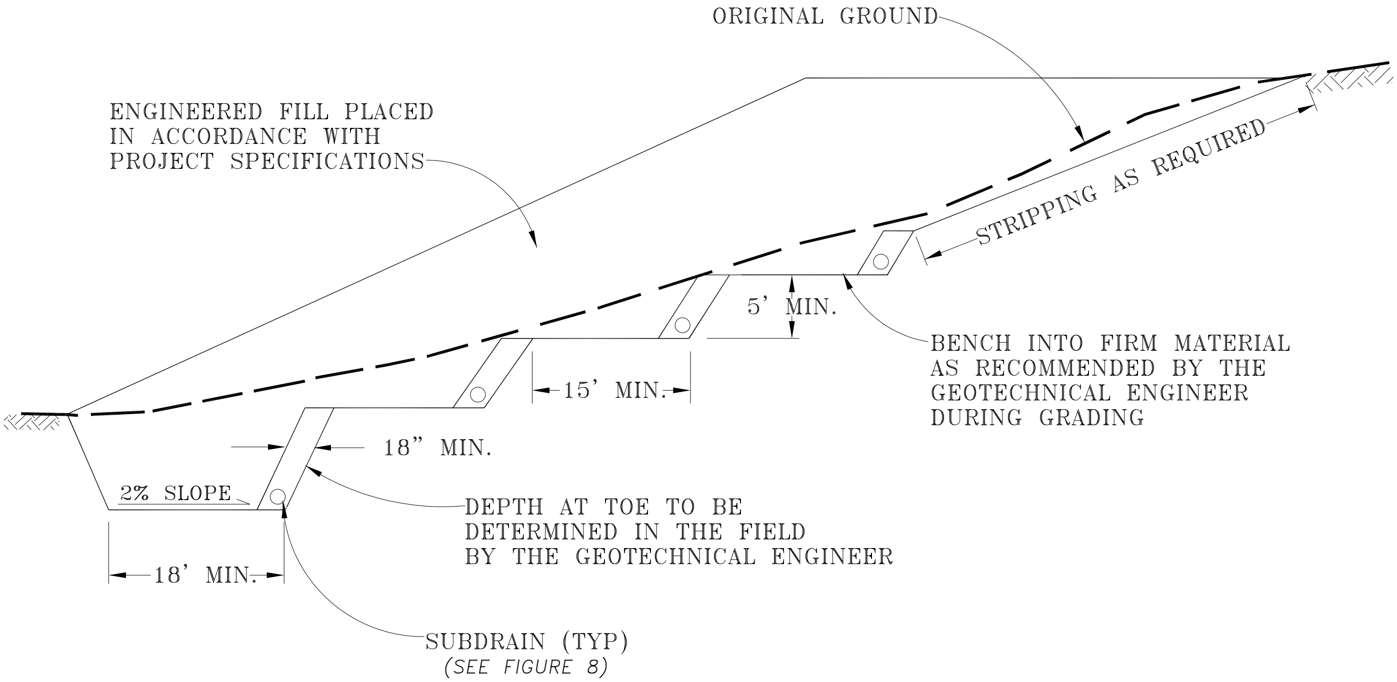
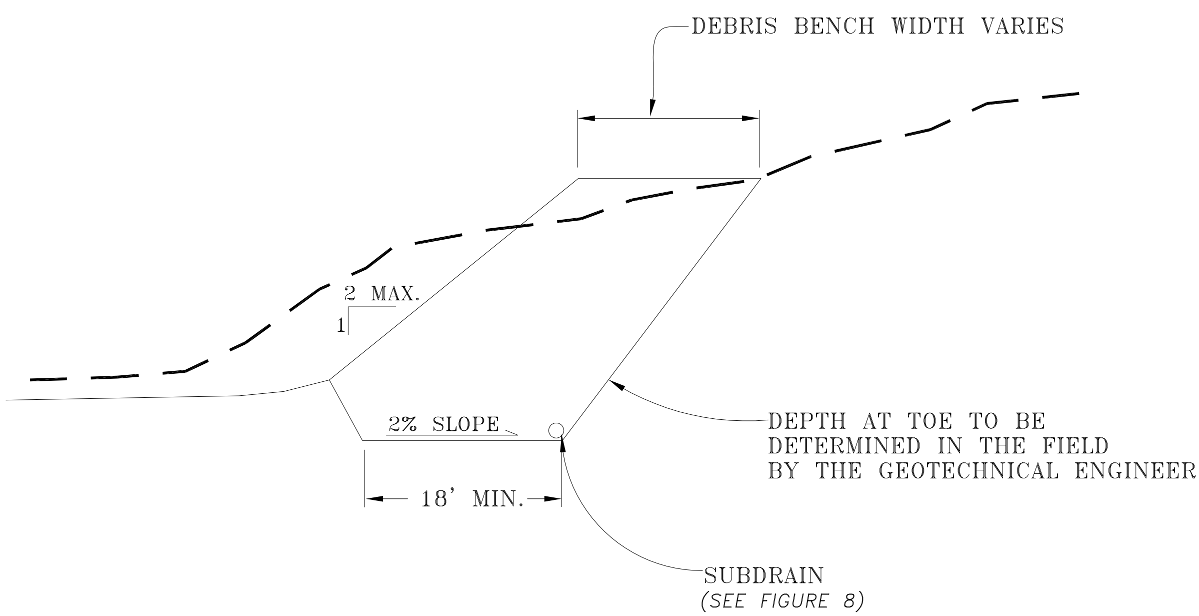


FILL SLOPE KEYWAY



DEBRIS BENCH BUTTRESS KEYWAY

NO SCALE

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

TYPICAL KEYWAY DETAILS
EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: 5866.3.001.01
DATE: JULY 2003
DRAWN BY: DLB
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FIGURE NO. 7

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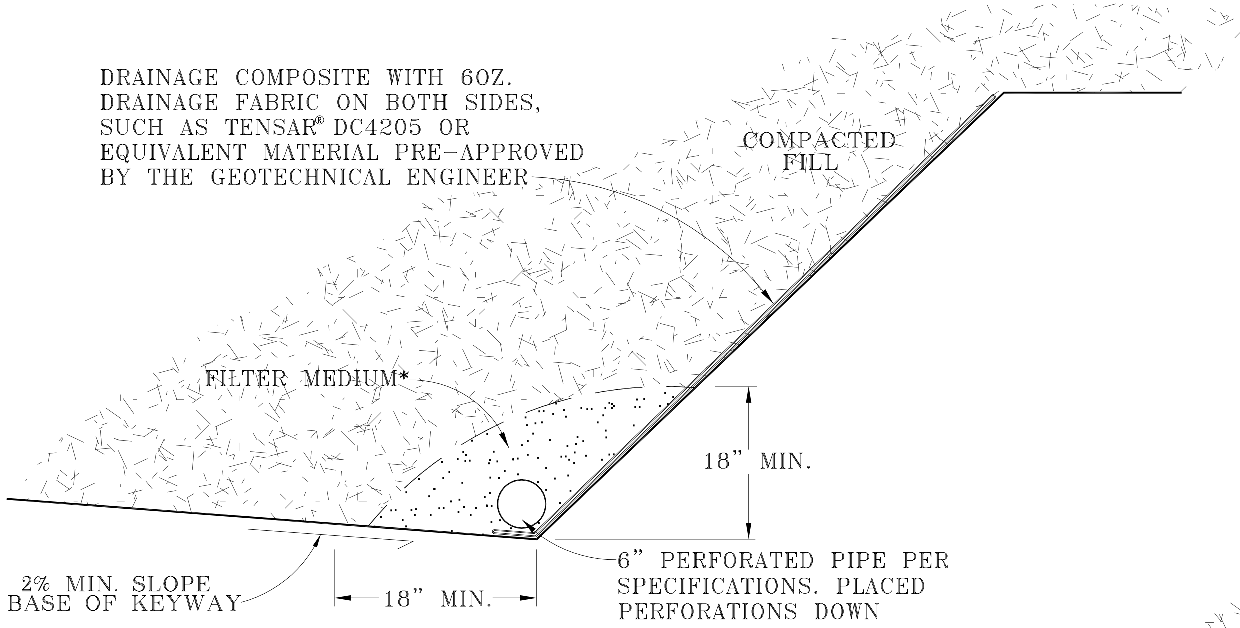
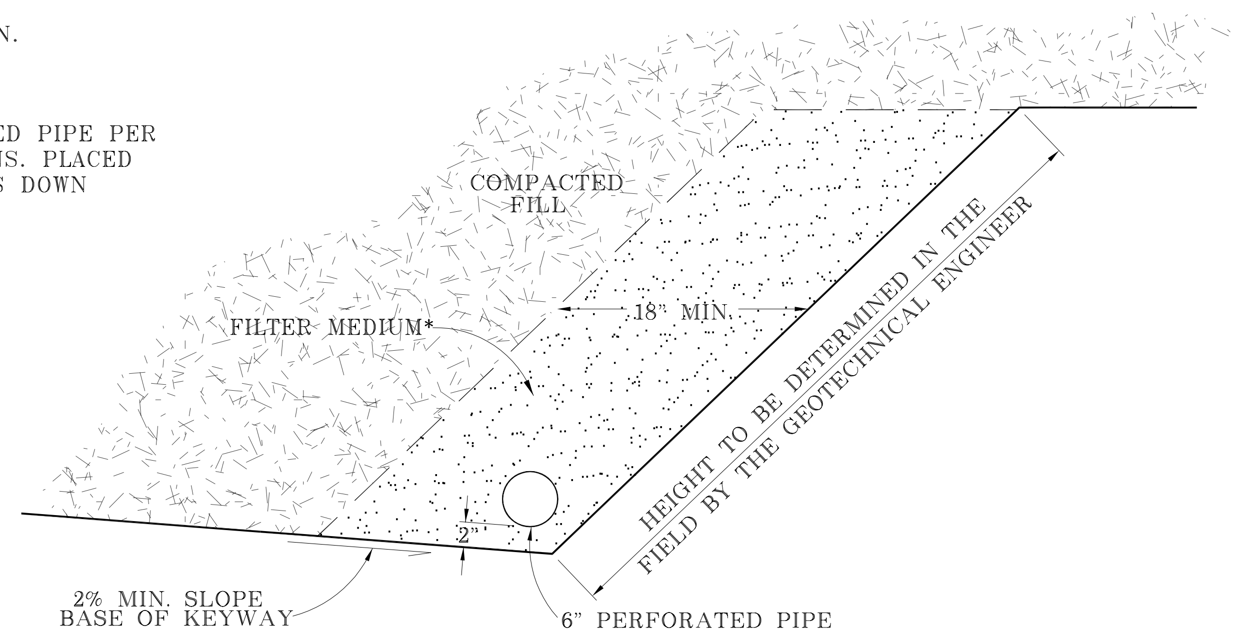
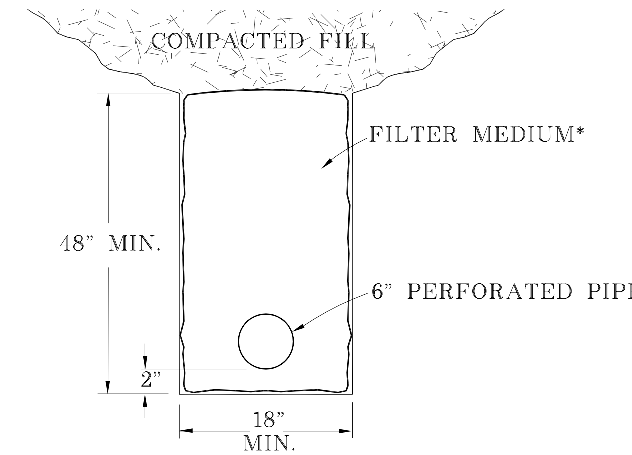


KEYWAY SUBDRAIN - OPTION 1



KEYWAY SUBDRAIN - OPTION 2



SWALE SUBDRAIN

*FILTER MEDIUM

ALTERNATIVE A

CLASS 2 PERMEABLE MATERIAL

MATERIAL SHALL CONSIST OF CLEAN, COARSE SAND AND GRAVEL OR CRUSHED STONE, CONFORMING TO THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING SIEVE
1"	100
3/4"	90–100
3/8"	40–100
#4	25–40
#8	18–33
#30	5–15
#50	0–7
#200	0–3

ALTERNATIVE B

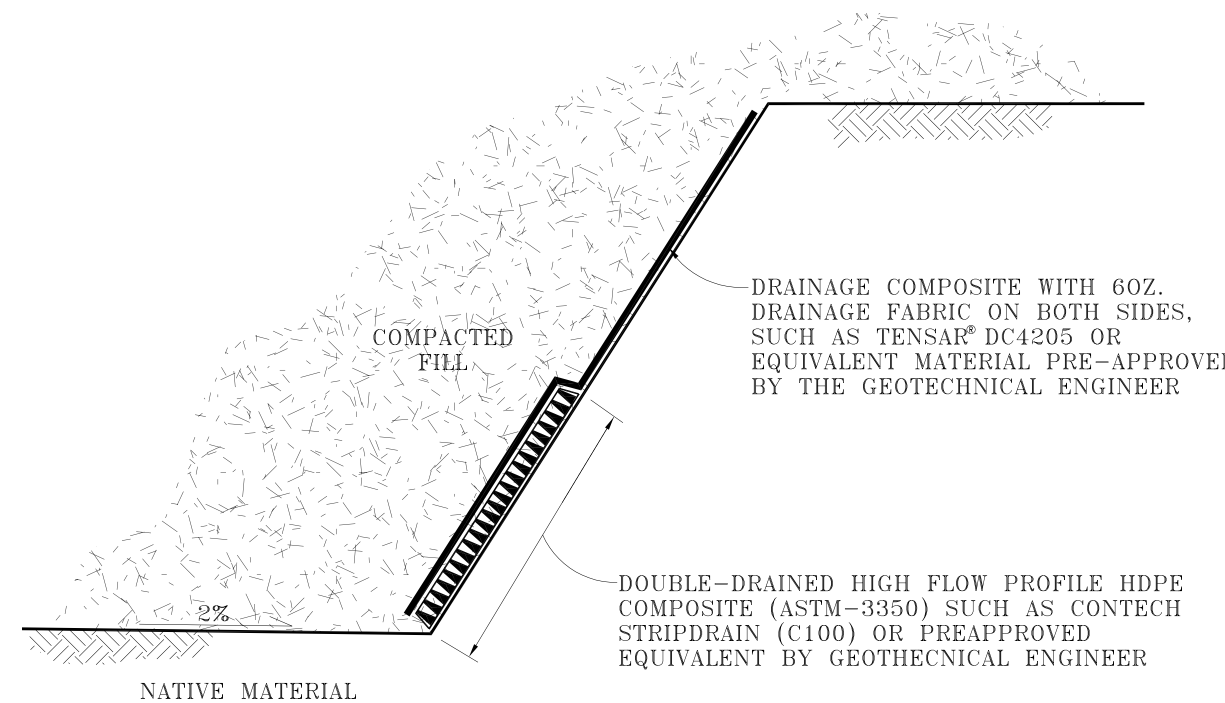
CLEAN CRUSHED ROCK OR GRAVEL WRAPPED IN FILTER FABRIC

ALL FILTER FABRIC SHALL MEET THE FOLLOWING MINIMUM AVERAGE ROLL VALUES UNLESS OTHERWISE SPECIFIED BY ENGEO:

GRAB STRENGTH (ASTM D-4632) ________ 180 lbs
MASS PER UNIT AREA (ASTM D-4751) ________ 6 oz/yd^2
APPARENT OPENING SIZE (ASTM D-4751) ________ 70-100 U.S. STD. SIEVE
FLOW RATE (ASTM D-4491) ________ 80 gal/min/ft
PUNCTURE STRENGTH (ASTM D-4833) ________ 80 lbs

NOTES:

1. *ALL PIPE JOINTS SHALL BE GLUED*
2. *ALL PERFORATED PIPE PLACED PERFORATIONS DOWN*
3. *1% FALL (MINIMUM) ON ALL TRENCHES AND DRAIN LINES*



ALTERNATE KEYWAY SUBDRAIN - OPTION 3
(FOR DEPTHS LESS THAN 30 FEET)

NO SCALE

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	TYPICAL SUBDRAIN DETAILS EAST GARRISON - PHASE I MONTEREY COUNTY, CALIFORNIA	PROJECT NO.: 5866.3.001.01 DATE: JULY 2003 DRAWN BY: DLB / CHECKED BY: DB	FIGURE NO. 8

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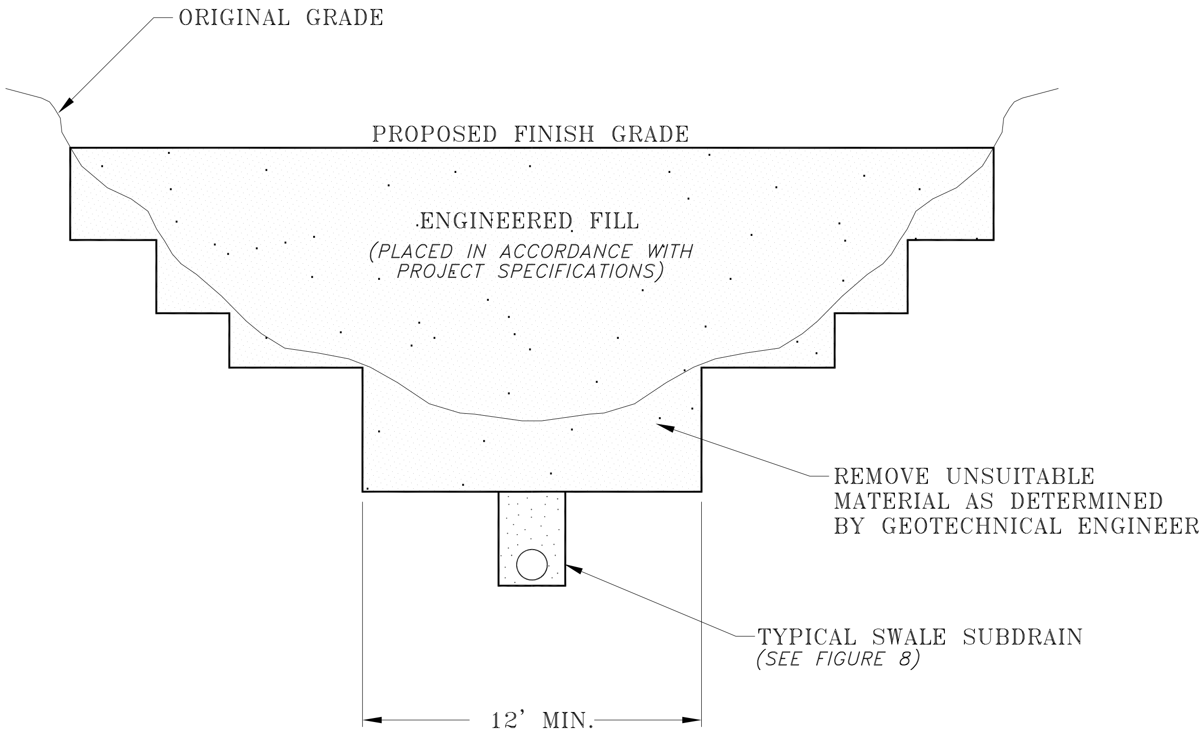

NO SCALE

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

SWALE TREATMENT
EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: 5866.3.001.01	FIGURE NO. 9
DATE: JULY 2003	
DRAWN BY: DLB	CHECKED BY: DB

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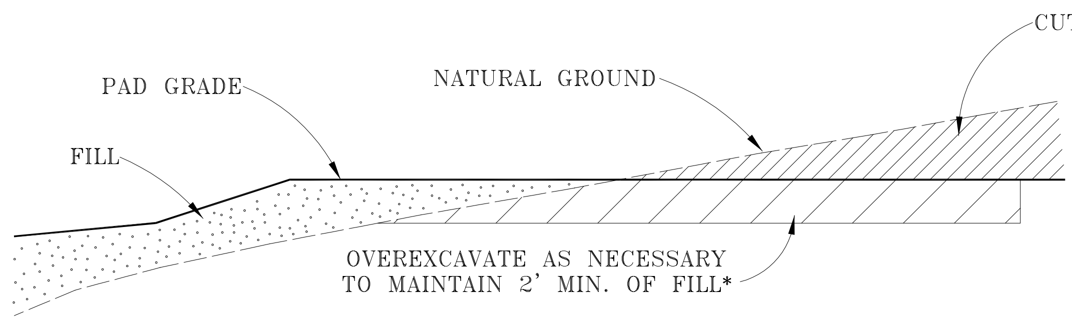
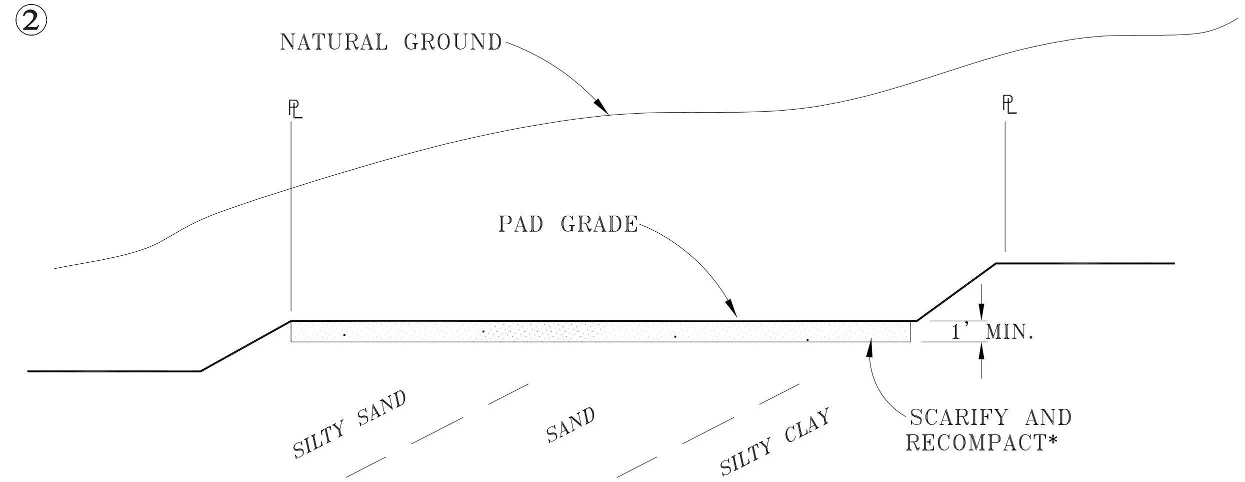
1



WHERE LOTS ARE PARTIALLY IN FILL, AND PARTIALLY IN CUT, THE CUT PORTION MUST BE OVEREXCAVATED AS SHOWN.

CUT/FILL LOT

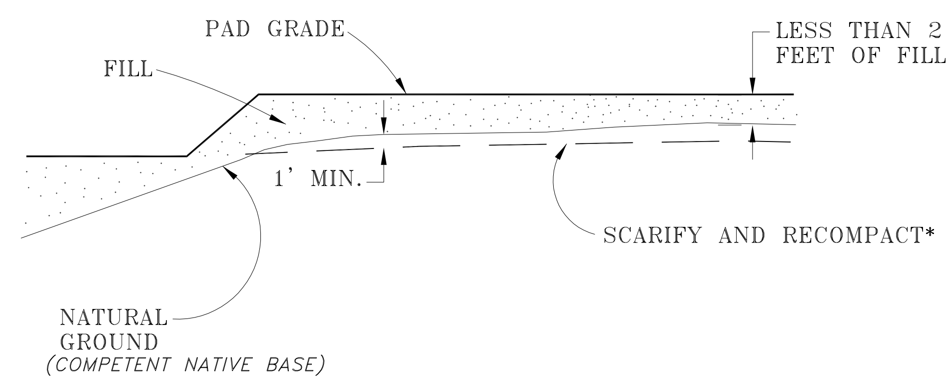
2



WHERE LOTS ARE COMPLETELY IN CUT, THE UPPER 1' SHOULD BE SCARIFY AND RECOMPACTED AS SHOWN

CUT LOT

3



WHERE LOTS ARE IN FILL AREAS, THE UPPER 1 FOOT OF NATIVE MATERIAL SHOULD BE SCARIFIED AND RECOMPACTED AS SHOWN PRIOR TO PLACEMENT OF ADDITIONAL FILL.

FILL LOT

**NOTE: THE SURFICIAL SOIL ZONE INDICATED HEREIN SHOULD BE COMPACTED TO NOT LESS THAN 92 PERCENT RELATIVE COMPACTION AT A MOISTURE CONTENT OF AT LEAST 2 PERCENT ABOVE OPTIMUM MOISTURE.*

NO SCALE

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	SURFICIAL SOIL TREATMENT EAST GARRISON - PHASE I MONTEREY COUNTY, CALIFORNIA	PROJECT NO.: 5866.3.001.01 DATE: JULY 2003 DRAWN BY: DLB	CHECKED BY: DB	FIGURE NO. 10

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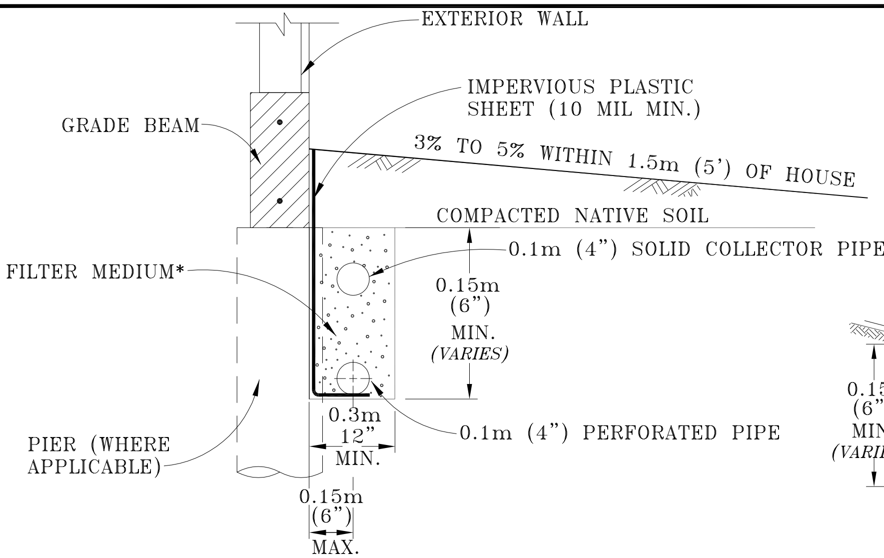
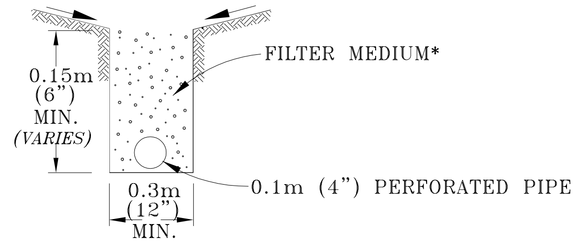
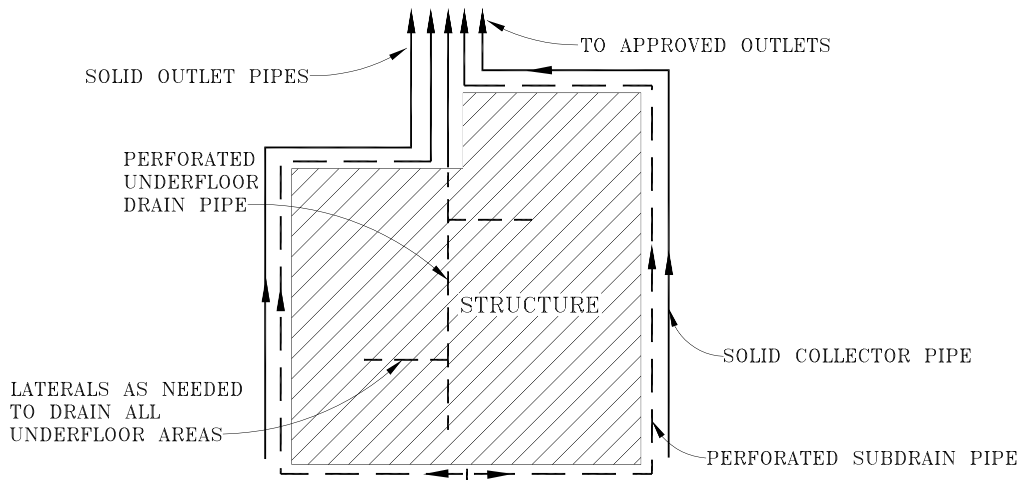


COMBINED SUBDRAIN AND PERIMETER DRAIN



UNDERFLOOR DRAIN



TYPICAL FOUNDATION SUBDRAIN PLAN

NOTES:

1. *ALL PIPE JOINTS SHALL BE GLUED*
2. *ALL PERFORATED PIPE PLACED PERFORATIONS DOWN*
3. *1% FALL (MINIMUM) ON ALL TRENCHES AND DRAIN LINES*
4. *THE CLOSED COLLECTOR AND THE PERIMETER SUBDRAIN CAN BE CONSTRUCTED IN A SINGLE TRENCH, IF DESIRED. HOWEVER, THE CLOSED COLLECTOR PIPE MUST BE PLACED ABOVE THE SUBDRAIN PIPE, AND IN NO CASE SHOULD THE TWO SYSTEMS BE INTERCONNECTED*

*FILTER MEDIUM

ALTERNATIVE A

CLASS 2 PERMEABLE MATERIAL

MATERIAL SHALL CONSIST OF CLEAN, COARSE SAND AND GRAVEL OR CRUSHED STONE, CONFORMING TO THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING SIEVE
1"	100
3/4"	90–100
3/8"	40–100
#4	25–40
#8	18–33
#30	5–15
#50	0–7
#200	0–3

ALTERNATIVE B

CLEAN CRUSHED ROCK OR GRAVEL WRAPPED IN FILTER FABRIC

ALL FILTER FABRIC SHALL MEET THE FOLLOWING MINIMUM AVERAGE ROLL VALUES UNLESS OTHERWISE SPECIFIED BY ENGEO:

GRAB STRENGTH (ASTM D-4632)	180 lbs
MASS PER UNIT AREA (ASTM D-4751)	6 oz/yd^2
APPARENT OPENING SIZE (ASTM D-4751)	70–100 U.S. STD. SIEVE
FLOW RATE (ASTM D-4491)	80 gal/min/ft
PUNCTURE STRENGTH (ASTM D-4833)	80 lbs

NO SCALE

ENGEO INCORPORATED
EXCELLENT SERVICE SINCE 1971

TYPICAL PERIMETER SUBDRAIN DETAILS FOR RAISED FLOORS
EAST GARRISON - PHASE I
MONTEREY COUNTY, CALIFORNIA

PROJECT NO.: **5866.3.001.01**
DATE: **JULY 2003**
DRAWN BY: DLB
CHECKED BY: DB
FIGURE NO. **11**

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APPENDIX A

Log of Borings, Test Pits, and Test Trench

KEY TO BORING LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW - Well graded gravels or gravel-sand mixtures
			GP - Poorly graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES	GM - Silty gravels, gravel-sand and silt mixtures
			GC - Clayey gravels, gravel-sand and clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LITTLE OR NO FINES	SW - Well graded sands, or gravelly sand mixtures
			SP - Poorly graded sands or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES	SM - Silty sand, sand-silt mixtures
			SC - Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS		ML - Inorganic silt with low to medium plasticity
			CL - Inorganic clay with low to medium plasticity
			OL - Low plasticity organic silts and clays
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %		MH - Inorganic silt with high plasticity
			CH - Inorganic clay with high plasticity
			OH - Highly plastic organic silts and clays
	HIGHLY ORGANIC SOILS		PT - Peat and other highly organic soils

GRAIN SIZES

U.S. STANDARD SERIES SIEVE SIZE: 200, 40, 10, 4 — CLEAR SQUARE SIEVE OPENINGS: 3/4 ", 3", 12"

SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*	BLOWS/FOOT (S.P.T.)
VERY SOFT	0-1/4	0-2
SOFT	1/4-1/2	2-4
MEDIUM STIFF	1/2-1	4-8
STIFF	1-2	8-15
VERY STIFF	2-4	15-30
HARD	OVER 4	OVER 30

MOISTURE CONDITION

DRY	Absence of moisture, dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater
SATURATED	Below the water table

MINOR CONSTITUENT QUANTITIES (BY WEIGHT)

TRACE	Particles are present, but estimated to the less than 5%
SOME	5 to 15%
WITH	15 to 30%
........Y	30 to 50%

SAMPLER SYMBOLS

- Modified California (3" O.D.) sampler
- California (2.5" O.D.) sampler
- S.P.T. - Split spoon sampler
- Shelby Tube
- Continuous Core
- Bag Samples
- NR No Recovery

LINE TYPES

- Solid - Layer Break
- Dashed - Gradational or approximate layer break

GROUND-WATER SYMBOLS

- Groundwater level during drilling
- Stabilized groundwater level

ENGEO INCORPORATED
1971-2001 * 30 YEARS OF EXCELLENCE

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

DATE OF BORING: April 2, 2003

SURFACE ELEVATION: Approx. 125 feet (38 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				SILTY SAND (SM), brown, very fine grained, very dense, dry.				
		1-1			51		121	3.0
	1			SAND (SP), light brown, dense, dry, very fine grained, trace to some silt.				
5		1-2			38			
	2	1-3		SILTY SAND (SM), very light brown, dense, dry, very fine grained. Percent Passing No. 200 Sieve = 28.5	44		114	1.6
		1-4		SAND (SP), brown, slightly moist, dense, fine grained, trace silt.	47			
10	3	1-5		SAND (SP), brown to yellowish brown, dense, moderately cemented, fine grained, slightly moist. DS: phi = 34, c=171 psf	46		106	4.8
	4							
15	5	1-6		SAND (SP), yellowish brown, slightly moist, very dense, fine to medium grained.	86			
20	6	1-7		SAND (SP), yellowish brown, slightly moist, very dense, medium to fine grained.	50/5"			
	7							
25	8	1-8		SAND (SP), yellowish brown, slightly moist, very dense, medium to coarse grained.	65			
30	9	1-9		SAND (SP), yellowish brown, slightly moist, very dense, medium to fine grained, with silt. Percent Passing No. 200 Sieve = 4.3	60		74	3.4
	10							
35	11	1-10		Same as above.	77			
	12							

ENGEO INCORPORATED

1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-1

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-1

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 2, 2003 SURFACE ELEVATION: Approx. 125 feet (38 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
40	13	1-11		SAND (SP), yellowish brown, slightly moist, very dense, fine grained, with silt.	50/5"			
45	14	1-12		Same as above.	62			
50	15, 16	1-13		Same as above. Percent Passing No. 200 Sieve = 5.8	94		101	5.2
55	17	1-14		SAND (SP), yellowish brown, slightly moist, very dense, fine grained.	93			
60	18, 19	1-15		SAND (SP), yellowish brown, slightly moist, very dense, fine grained.	50/5"		105	4.1
65	20	1-16		SAND (SP), yellowish brown, slightly moist, very dense, fine to medium grained.	50/5"			
70	21, 22	1-17		SAND (SP), yellowish brown, slightly moist, very dense, fine to medium grained.	50/3"			
75	23, 24			Bottom of boring at approximately 71 $^{1}/_{2}$ feet. Groundwater not encountered during drilling. DS = Direct Shear				

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-1

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-1

ENGEO_BORELOG 5866300101_EASTGARRISON-PHASE1.GPJ 4/14/03

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 3, 2003 SURFACE ELEVATION: Approx. 150 feet (46 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0				(8 feet high stone wall - 20 feet away from it)				
		2-1		SILTY SAND (SM), dark brown, slightly moist, loose, very fine grained, trace roots. Percent Passing No. 200 Sieve = 30.4	9		112	5.8
	1	2-2		SAND (SP), brown, slightly moist, loose, fine grained, trace silt.	8			
5	2	2-3		SAND (SP), yellowish brown, medium dense, dry, fine grained.	21			
		2-4		SILTY SAND (SM), yellowish brown, slightly moist, dense, fine grained, cemented. Percent Passing No. 200 Sieve = 12.2	39		112	4.9
10	3	2-5		SAND (SP), yellowish brown, dense, dry, fine grained.	40			
	4							
15	5	2-6		SAND (SP), yellowish brown, dense, dry, fine grained, moderately cemented, trace silt.	54			
20	6	2-7		SAND (SP), yellowish brown to dark brown, slightly moist, dense, fine grained, trace silt, moderately cemented.	62			
	7							
25	8	2-8		Same as above, with silt. Percent Passing No. 200 Sieve = 6.5	60		102	5.3
30	9	2-9		SAND (SP), yellowish brown, very dense, dry, fine grained.	75			
	10							
35				Same as above.				
	11	2-10		SAND (SP), brown, slightly moist, very dense, fine grained, trace silt.	67			
	12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-2

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-2

ENGEO_BORELOG 586630010l_EASTGARRISON-PHASE1.GPJ 4/14/03

DATE OF BORING: April 3, 2003

SURFACE ELEVATION: Approx. 150 feet (46 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
40		2-11	SILTY SAND (SM), brown, slightly moist, very dense, fine grained, high degree of cementation, trace silt. DS: phi = 26, c= 853 psf	52		117	8.3
	13	2-12	SAND (SP), yellowish brown, dense, dry, fine grained, with silt.	30			
45	14	2-13	Same as above. Percent Passing No. 200 Sieve = 8.4	60		106	6.7
50	15	2-14	Grades to medium grained, slightly moist.	91			
55	16, 17	2-15	SAND (SP), yellowish brown, slightly moist, very dense, fine grained.	90			
60	18, 19	2-16	SAND (SP), yellowish brown, slightly moist, very dense, fine grained.	50/5"			
65	20	2-17	Same as above.	50/5"			
70	21	2-18	SAND (SP), yellowish brown, slightly moist, very dense, fine grained.	50/6"		96	5.7
75	22, 23, 24		Bottom of boring at approximately 71 feet. Groundwater not encountered during drilling. DS = Direct Shear				

ENGEO INCORPORATED

1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-2

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-2

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 3, 2003 SURFACE ELEVATION: Approx. 155 feet (47 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
		3-1		SILTY SAND (SM), dark brown, slightly moist, loose, fine grained, trace roots. Percent Passing No. 200 Sieve = 22.7	6		109	5.9
	1							
		3-2		SILTY SAND (SM), dark brown, slightly moist, loose, fine grained.	4			
5								
		3-3		SAND (SP), yellowish brown to dark brown, slightly moist, medium dense, fine grained.	16			
	2							
		3-4		SAND (SP), yellowish brown, slightly moist, medium dense, fine grained.	28		105	4.8
10	3							
		3-5		SAND (SP), yellowish brown, slightly moist, dense, fine grained, cemented.	35			
	4							
15								
	5	3-6		Same as above, very dense.	85			
20	6							
		3-7		SAND (SP), brown, slightly moist, very dense, fine grained, high cementation.	83			
	7							
25								
	8	3-8		Same as above.	74			
	9							
30								
		3-9		SAND (SP), yellowish brown, slightly moist, very dense, fine to medium grained, with silt. Percent Passing No.200 Sieve = 4.0	64		105	4.6
	10							
35								
	11	3-10		SAND (SP), brown, slightly moist, very dense, fine grained, moderate cementation, trace silt.	84			
	12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-3

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-3

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 3, 2003 SURFACE ELEVATION: Approx. 155 feet (47 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
40	13	3-11		SAND (SP), brown, slightly moist, fine grained, high cementation, trace silt.	59			
				Bottom of boring at approximately 41 1/2 feet. Groundwater not encountered during drilling.				

Depth scale (feet): 40, 45, 50, 55, 60, 65, 70, 75
Depth scale (meters): 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24

DATE OF BORING: April 3, 2003

SURFACE ELEVATION: Approx. 105 feet (32 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0							
	1	4-1	SILTY SAND (SM), dark brown, slightly moist, medium dense, fine grained, trace roots. Percent Passing No. 200 Sieve = 38.1	16		105	3.6
5		4-2	SILTY SAND (SM), light brown, very dense, dry, fine grained, cemented.	50/6"			
	2	4-3	SILTY SAND (SM), dark yellowish brown, dense, dry, fine grained. Percent Passing No. 200 Sieve = 29.3	46		112	6.5
		4-4	Same as above.	53			
10	3	4-5	Same as above, very dense.	84			
	4						
15	5	4-6	SAND (SP), brown to yellowish brown, with white nodules, very dense, dry, highly cemented, fine grained, trace silt. (Very hard drilling)	50/6"		110	8.6
20	6	4-7	Same as above. Percent Passing No. 200 Sieve = 7.5	50/6"			
	7	4-8	Same as above. (Hard drilling from 23 to 25 feet)	68			
25	8	4-9	SAND (SP), dark yellowish brown to brown, very dense, fine grained, high cementation, trace silt. (Very hard drilling from 26 to 28 feet)	50/4"			
30	9	4-10	SAND (SP), yellowish brown, very dense, dry, fine grained. DS: phi = 39, c= 0 psf	81		103	2.0
	10						
35	11	4-11	SAND (SP), yellowish brown, very dense, dry, fine grained.	50/6"			
	12		Bottom of boring at approximately 36 feet. Groundwater not encountered during drilling. DS = Direct Shear				

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-4

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-4

DATE OF BORING: April 3, 2003

SURFACE ELEVATION: Approx. 225 feet (69 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0							
		5-1	SILTY SAND (SM), dark brown, moist, medium dense, fine grained, trace gravel.	12		118	6.0
	1	5-2	Same as above.	8			
5		5-3	SAND (SP), brown, slightly moist to moist, loose, fine grained.	9			
	2	5-4	SAND (SP), yellowish brown, slightly moist, medium dense, fine grained, with silt. Percent Passing No. 200 Sieve = 10.8	19		101	5.5
10	3	5-5	Same as above.	29			
	4						
15	5	5-6	SAND (SP), yellowish brown, slightly moist, dense, fine grained.	52			
20	6	5-7	SAND (SP), yellowish brown to dark brown, slightly moist, very dense, fine grained.	68			
	7						
25	8	5-8	SAND (SP), dark yellowish brown, very moist, very dense, fine to medium grained, trace silt. Percent Passing No. 200 Sieve = 11.2	89		112	10.2
30	9	5-9	(Very moist to wet at 30 feet) SAND (SP), yellowish brown, slightly moist, very dense, fine grained.	88			
	10						
35	11	5-10	SAND (SP), yellowish brown, slightly moist, very dense.	80			
	12		Bottom of boring at approximately 36 $^1/_2$ feet. Groundwater not encountered during drilling.				

ENGEO INCORPORATED

1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-5

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-5

DATE OF BORING: April 3, 2003

SURFACE ELEVATION: Approx. 175 feet (53 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			SILTY SAND (SM), dark brown, moist, loose, fine grained, trace roots.				
		6-1		9			
	1		SILTY SAND (SM), dark yellowish brown, moist, loose. Percent Passing No. 200 Sieve = 22.4				
		6-2		7		112	7.5
5			SAND (SP), dark brown, moist, medium dense, fine grained, trace silt.				
	2	6-3		18			
			SAND (SP), yellowish brown, moist, medium dense, fine grained.				
		6-4		21			
10	3		Same as above.				
		6-5		18		105	3.7
	4						
15			Same as above, dense.				
	5	6-6		30			
			Bottom of boring at approximately 16 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6						
	7						
25	8						
30	9						
	10						
35	11						
	12						

ENGEO INCORPORATED

1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-6

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-6

ENGEO_BORELOG 5866300101_EASTGARRISON-PHASE1.GPJ 4/14/03

DATE OF BORING: April 3, 2003

SURFACE ELEVATION: Approx. 165 feet (50 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
		7-1		SAND (SP), dark brown, slightly moist, medium dense, fine grained, trace roots. (FILL)	12		109	7.5
	1	7-2		SAND (SP), brown, slightly moist, loose, fine grained, trace roots.	6			
5	2	7-3		SILTY SAND (SM), brown, slightly moist, loose, fine grained. Percent Passing No. 200 Sieve = 18.1	7		113	8.7
		7-4		SAND (SP), brown, medium dense, dry, fine grained, trace silt, trace roots.	13			
10	3	7-5		SAND (SP), light brown, dense, dry, fine grained, trace silt, moderate cementation.	48			
	4							
15	5	7-6		SAND (SP), brown, slightly moist, medium dense, fine grained, moderate cementation.	23		108	9.2
20	6	7-7		SAND (SP), brown, slightly moist, dense, fine grained.	44			
	7			Bottom of boring at approximately 21 $^1/_2$ feet. Groundwater not encountered during drilling.				
25	8							
30	9							
	10							
35	11							
	12							

ENGEO INCORPORATED

1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-7

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-7

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 3, 2003 SURFACE ELEVATION: Approx. 150 feet (46 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
	1	8-1		SILTY SAND (SM), grayish brown, slightly moist, medium dense, fine grained, trace gravel, trace roots. (FILL)	20		111	7.1
5		8-2		SILTY SAND (SM), grayish brown, slightly moist, very loose, fine grained. (FILL) Percent Passing No. 200 Sieve 17.3	3		107	8.2
	2	8-3		SAND (SP), yellowish brown, slightly moist, very loose, trace silt, fine grained. (FILL)	3		103	14.7
		8-4		SILTY SAND (SM), dark brown, slightly moist, very loose, fine grained.	3			
10	3	8-5		SILTY SAND (SM), dark brown, very moist, very loose, fine grained. Percent Passing No. 200 Sieve = 34.2	2			
	4							
15	5	8-6		SAND (SP), yellowish brown with dark brown, moist, medium dense, fine grained.	15			
		8-7		SAND (SP), yellowish brown, very moist, medium dense, fine grained.	11			
20	6	8-8		SAND (SP), yellowish brown with brown, moist, dense, fine grained, moderate cementation.	43		112	9.6
	7							
25	8	8-9		SAND (SP), yellowish brown with brown, moist, very dense, fine grained, moderate cementation.	69			
				Bottom of boring at approximately 26 1/2 feet. Groundwater not encountered during drilling.				
30	9							
	10							
35	11							
	12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-8

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-8

ENGEO_BORELOG 5866300101_EASTGARRISON-PHASE1.GPJ 4/14/03

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 4, 2003 SURFACE ELEVATION: Approx. 190 feet (58 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
		9-1		SAND (SP), dark brown, slightly moist, very loose, fine grained, trace roots. Percent Passing No. 200 Sieve = 3.2	4		94	3.9
	1	9-2		Same as above, dry.	3			
5	2	9-3		SAND (SP), yellowish brown, slightly moist, medium dense, with silt.	13		103	4.6
		9-4		Same as above.	22			
10	3	9-5		SAND (SP), yellowish brown, slightly moist, dense, fine grained, with silt.	33			
15	5	9-6		SAND (SP), yellowish brown, slightly moist, dense, fine grained, with silt.	49		99	3.8
				Bottom of boring at approximately 16 $^{1}/_{2}$ feet. Groundwater not encountered during drilling.				
20	6							
25	7, 8							
30	9, 10							
35	11, 12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-9

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-9

ENGEO_BORELOG 5866300101_EASTGARRISON-PHASE1.GPJ 4/14/03

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 4, 2003 SURFACE ELEVATION: Approx. 210 feet (64 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0		10-A		Bulk sample.				
		10-1		SILTY SAND (SM), dark yellowish brown, slightly moist, loose, fine grained. Percent Passing No. 200 Sieve = 17.4	5		105	6.7
	1	10-2		SAND (SP), brown with yellowish brown, slightly moist, loose, fine-grained.	7			
5	2	10-3		Same as above, medium dense.	19			9.5
		10-4		SAND (SP), yellowish brown to brown, slightly moist, medium dense, fine grained, with silt. Percent Passing No. 200 Sieve = 6.1	19			
10	3	10-5		Same as above.	9			
15	4, 5	10-6		SAND (SP), yellowish brown, slightly moist, medium dense, fine grained.	21		102	6.1
20	6	10-7		SAND (SP), yellowish brown, slightly moist, dense, fine grained.	35			
	7			Bottom of boring at approximately 20 1/2 feet. Groundwater not encountered during drilling.				
25	8							
30	9, 10							
35	11, 12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-10

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-10

ENGEO_BORELOG 5866300101_EASTGARRISON-PHASE1.GPJ 4/14/03

DATE OF BORING: April 3, 2003

SURFACE ELEVATION: Approx. 150 feet (46 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0							
		11-1	SILTY SAND (SM), dark brown, slightly moist, very loose, fine grained, trace roots. Percent Passing No. 200 Sieve = 45.3	3		104	11.1
	1		SAND (SP), brown, very moist, medium dense, trace silt.				
5		11-2		16			
			Same as above, slightly moist.				
	2	11-3		15			
			SAND (SP), grayish brown, slightly moist, medium dense, fine grained.				
		11-4		12		106	7.6
10	3		Same as above.				
		11-5		27			
	4						
15			SAND (SP), grayish brown, slightly moist, dense, fine grained.				
	5	11-6		31			
			Bottom of boring at approximately 16 1/2 feet. Groundwater not encountered during drilling.				
20	6						
	7						
25	8						
30	9						
	10						
35	11						
	12						

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-11

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-11

ENGEO_BORELOG 5866300101_EASTGARRISON-PHASE1.GPJ 4/14/03

DATE OF BORING: April 4, 2003

SURFACE ELEVATION: Approx. 130 feet (40 meters)

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0			(2 inches of asphalt concrete over approximately 6 inches of aggregate base) SILTY SAND (SM), dark brown, slightly moist, medium dense, fine grained.				
		12-1		38			
	1		SILTY SAND (SM), dark brown, moist, loose, fine grained. Percent Passing No. 200 Sieve = 33.6				
		12-2		7		112	8.1
5			Same as above, medium dense.				
	2	12-3		14			
			SAND (SP), yellowish brown, moist, medium dense, fine grained, with silt.				
		12-4		21		113	10.2
10	3		SAND (SP), yellowish brown, moist, dense, fine grained.				
		12-5		33			
	4						
15			SAND (SP), yellowish brown, slightly moist, dense, with silt.				
	5	12-6		34		112	11.6
			Bottom of boring at approximately 16 1/2 feet. Groundwater not encountered during drilling.				
20	6						
	7						
25	8						
30	9						
	10						
35	11						
	12						

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-12

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-12

ENGEO_BORELOG 586630010l_EASTGARRISON-PHASE1.GPJ 4/14/03

DEPTH (FEET)	DEPTH (METERS)	SAMPLE NUMBER	LOG, LOCATION AND TYPE OF SAMPLE	DATE OF BORING: April 3, 2003 SURFACE ELEVATION: Approx. 125 feet (38 meters) DESCRIPTION	BLOWS/FT.	qu UNCON STRENGTH (TSF) *FIELD PENET. APPROX.	IN PLACE DRY UNIT WEIGHT (PCF)	IN PLACE MOIST. CONTENT % DRY WEIGHT
0								
		13-1		SILTY SAND (SM), dark brown, slightly moist, dense, fine grained, moderate cementation. Percent Passing No. 200 Sieve = 23.5	34		116	7.4
	1	13-2		SAND (SP), dark brown, slightly moist, medium dense, high cementation.	27			
5		13-3		SAND (SP), dark brown, moist, dense, fine grained, high cementation.	45			
	2	13-4		SAND (SP), grayish brown, slightly moist, medium dense, fine grained.	26		107	4.6
10	3	13-5		SAND (SP), grayish brown, slightly moist, dense, fine grained, moderate cementation.	42			
	4							
15	5	13-6		SAND (SP), yellowish brown, slightly moist, dense, fine grained, high cementation.	57			
		13-7		SAND (SP), yellowish brown, slightly moist, very dense, fine grained, cemented.	50/5"			
20	6			Bottom of boring at approximately 19 1/2 feet. Groundwater not encountered during drilling.				
	7							
25	8							
30	9							
	10							
35	11							
	12							

ENGEO INCORPORATED
1971 - 2001 * 30 YEARS OF EXCELLENCE

EAST GARRISON - PHASE I

MONTEREY, CALIFORNIA

BORING NO.: B-13

LOGGED BY: K. Naphade

PROJ. NO.: 5866.3.001.01

CHECKED BY JAM

FIGURE NO. A-13

ENGEO_BORELOG 586630010l_EASTGARRISON-PHASE1.GPJ 4/14/03

TEST PIT LOGS

Test Pit Number	Depth (Feet)	Description
TP-1	0 – 4	SAND, light brown, medium dense, moist, very fine to fine grained, roots abundant to 4” (Qod).
	4 - 8	SAND, light brown and brown, medium dense, moist, sub-rounded, spherical, poorly cemented, abundant quartz and feldspar (Qod).
		Bottom of test pit at 8 feet. No free ground water encountered.
TP-2	0 – 1.5	SAND with some silt, dark brown, medium dense to dense, moist, very fine to medium-grained, some roots (residual soil).
	1.5 - 8	SAND, light brown, medium dense, dry to slightly moist, sub-rounded, spherical (Qod).
	8 - 16	SAND, light brown and yellowish brown, medium dense to dense, moist, sub-rounded, poorly cemented. Weathering and moisture decreasing with depth. Density and cementation increasing with depth (Qod).
		Bottom of test pit at 16 feet. No free ground water encountered.
TP-3	0 – 2”	ASPHALT CONCRETE
	2”-8”	AGGREGATE BASE ROCK, blue-green
	8”-8’	SAND, brown, medium dense to dense, moist, (Qc).
	8-10	SAND, yellowish brown, medium dense to dense, moist (Qod).
		Bottom of test pit at 10 feet. No free groundwater encountered.

TEST PIT LOGS (cont.)

Test Pit Number	Depth (Feet)	Description
TP-4	0 – 1.5	SILTY SAND, dark brown, medium dense to dense, moist, roots (residual soil).
	1.5 – 6	SAND with some silt, brown, medium dense to dense, moist (Qod).
	6 – 7.5	SAND, light brown and light yellowish brown, medium dense to dense, moist, poorly cemented (Qod).
		Bottom of test pit at 7.5 feet. No free groundwater encountered.
TP-5	0 – 1	SILTY SAND, dark brown, medium dense to dense, moist, roots (residual soil).
	1 – 6	SAND with some silt, brown, medium dense, moist, fine grained (Qod)
	6 – 15	SAND, light yellowish brown and brown, medium dense to dense, dry to moist, fine grained, well sorted (Qod).
		Bottom of test pit at 15 feet. No free groundwater encountered.
TP-6	0 – 4	SILTY SAND, brown, medium dense to dense, moist, roots (residual soil).
	4 – 10	SAND, light yellowish brown and brown, medium dense to dense, well sorted, sub-rounded (Qod).
		Bottom of test pit at 10 feet. No free groundwater encountered.

TEST PIT LOGS (cont.)

Test Pit Number	Depth (Feet)	Description
TP-7	0 – 6	SILTY SAND, dark brown, medium dense, moist, fine grained (colluvium).
	6 - 8	SILTY SAND, brown, medium dense to dense, highly weathered, moderately cemented (Qod).
		Bottom of test pit at 8 feet. No free ground water encountered.
TP-8	0-5	SILTY SAND, dark brown, medium dense, moist (colluvium).
	5-9	SAND, light yellowish brown, medium dense to dense, sub-rounded, spherical, slightly weathered, poorly cemented (Qod)
		Bottom of test pit at 9 feet. No free ground water encountered.
TP-9	0-1.5	SILTY SAND, dark brown, medium dense, moist (residual soil).
	1.5-5	SAND, brown, medium dense to medium dense, poorly cemented (Qod).
	5-8	SAND, light yellowish brown and brown, medium dense, poorly cemented, slightly weathered (Qod).
		Bottom of test pit at 8 feet. No free groundwater encountered.

TEST PIT LOGS (cont.)

Test Pit Number	Depth (Feet)	Description
TP-10	0 – 4.5	SILTY SAND, dark brown, medium dense, moist, some roots (colluvium).
	4.5-7	SAND, dark yellowish brown, medium dense, poorly cemented (Qod)
		Bottom of test pit at 7 feet. No free groundwater encountered.
TP-11	0 – 3.5	SILTY SAND, dark brown, medium dense, moist, some roots (residual soil).
	3.5-6.5	SAND, dark yellowish brown, medium dense, poorly cemented (Qod)
		Bottom of test pit at 6.5 feet. No free groundwater encountered.
TP-12	0 – 6	SAND, dark yellowish brown, medium dense to dense, poorly cemented (Qod)
		Bottom of test pit at 6 feet. No free groundwater encountered.
TP-13	0 – 1.5	SILTY SAND, brown, medium dense, moist, concrete debris at surface (residual soil)
	1.5 – 10	SAND, brown, medium dense, moist (Qod)
	10-12	SAND, dark yellowish brown, medium dense to dense, poorly cemented (Qod)
		Bottom of test pit at 12 feet. No free groundwater encountered.

TEST PIT LOGS (cont.)

Test Pit Number	Depth (Feet)	Description
TP-14	0 – 1.5	SILTY SAND, dark brown, medium dense to dense, moist, roots (residual soil).
	1.5 – 6	SAND, brown, medium dense to dense, moist, poorly sorted, poorly cemented (Qod)
		Bottom of test pit at 6 feet. No free groundwater encountered.
TP-15	0 – 3	SAND with some silt, brown, medium dense to dense, moist (residual soil).
	3 - 6	SAND, light yellowish brown, medium dense to dense, poorly cemented (Qod).
		Bottom of test pit at 6 feet. No free groundwater encountered.
TP-16	0 – 6	SAND, alternating layers of dark brown and light yellowish brown, medium dense, moist (FILL)
	6 – 8.5	SAND, dark yellowish brown, medium dense to dense, poorly cemented (Qod)
		Bottom of test pit at 8.5 feet. No free groundwater encountered.

TEST PIT LOGS (cont.)

Test Pit Number	Depth (Feet)	Description
TP-17	0 – 1.5	SILTY SAND, dark brown, medium dense, moist, some roots (residual soil).
	1.5 – 4	SAND, brown, medium dense, moist, fine grained (Qod)
	4 – 6.5	SAND, dark yellowish brown, medium dense to medium dense, poorly cemented (Qod)
		Bottom of test pit at 6.5 feet. No free groundwater encountered.

TRENCH T-1

SOUTHEAST WALL
TRENCH N30°E

EXPLANATION

① SILTY SAND, DARK BROWN MOTTLED, LOOSE TO MEDIUM DENSE, ABUNDANT ROOTS, MOIST (RESIDUAL SOIL)

② ALTERNATING LAYERS OF BROWN TO DARKER BROWN SAND, MEDIUM DENSE, MOIST, ROOTS, SLIGHTLY WEATHERED (OLDER DUNE SAND, Qod)

③ ALTERNATING LAYERS OF BROWN AND LIGHT YELLOWISH BROWN SAND, MEDIUM DENSE TO DENSE, POORLY CEMENTED FINE SAND, SLIGHTLY MOIST, WEATHERED (OLDER DUNE SAND, Qod)

SCALE: 1=5' HORIZONTAL & VERTICAL

ENGEO INCORPORATED EXCELLENT SERVICE SINCE 1971	TRENCH LOG T-1 EAST GARRISON - PHASE I MONTEREY COUNTY, CALIFORNIA	PROJECT NO.: 5866.3.001.01 DATE: APRIL 2003 DRAWN BY: SRP — CHECKED BY: DB	FIGURE NO. A1

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APPENDIX B

Laboratory Tests – Purpose

Laboratory Test Results

LABORATORY TESTS - PURPOSE

1. Natural Unit Weight and Moisture Content (ASTM D-2216)

   Provides in-place density and percentage moisture by dry weight. These aid in characterizing existing and previous ground-water conditions, soil compressibility, and degree of saturation.

2. Atterberg Limits (ASTM D-4318)

   Performed primarily on cohesive soils. Includes the Liquid Limit and the Plastic Limit. From these, a Plasticity Index can be computed which allows classification of the soil and is an indirect measure of its expansion characteristics.

3. Direct Shear (ASTM D-3080)

   Provides shear strength parameters including cohesion c, and angle of internal friction ϕ, which are used in foundation design and slope stability analyses.

4. Unconfined Compressive Strength (ASTM D-2166)

   Determined usually on cohesive (clay) materials to establish allowable design foundation bearing capacity or estimated shear strength for slope stability studies.

5. Expansion Index (UBC 29-2)

   Determines an "Expansion Index" number derived from a measurement of swell for a remolded soil sample under relatively light loads and prescribed initial density and moisture level.

6. Swell Potential (ASTM D-4546)

   Determines the swell pressure developed by a confined soil when subjected to increased moisture. Also measures volume change due to heave for various initial moisture levels.

7. Consolidation (ASTM D-2435)

Performed on compressible soils. Provides data for computation of consolidation characteristics. Parameters which can be estimated include Preconsolidation Pressure, P_c and Compressions Index, C_c. These are used to estimate foundation and fill settlements.

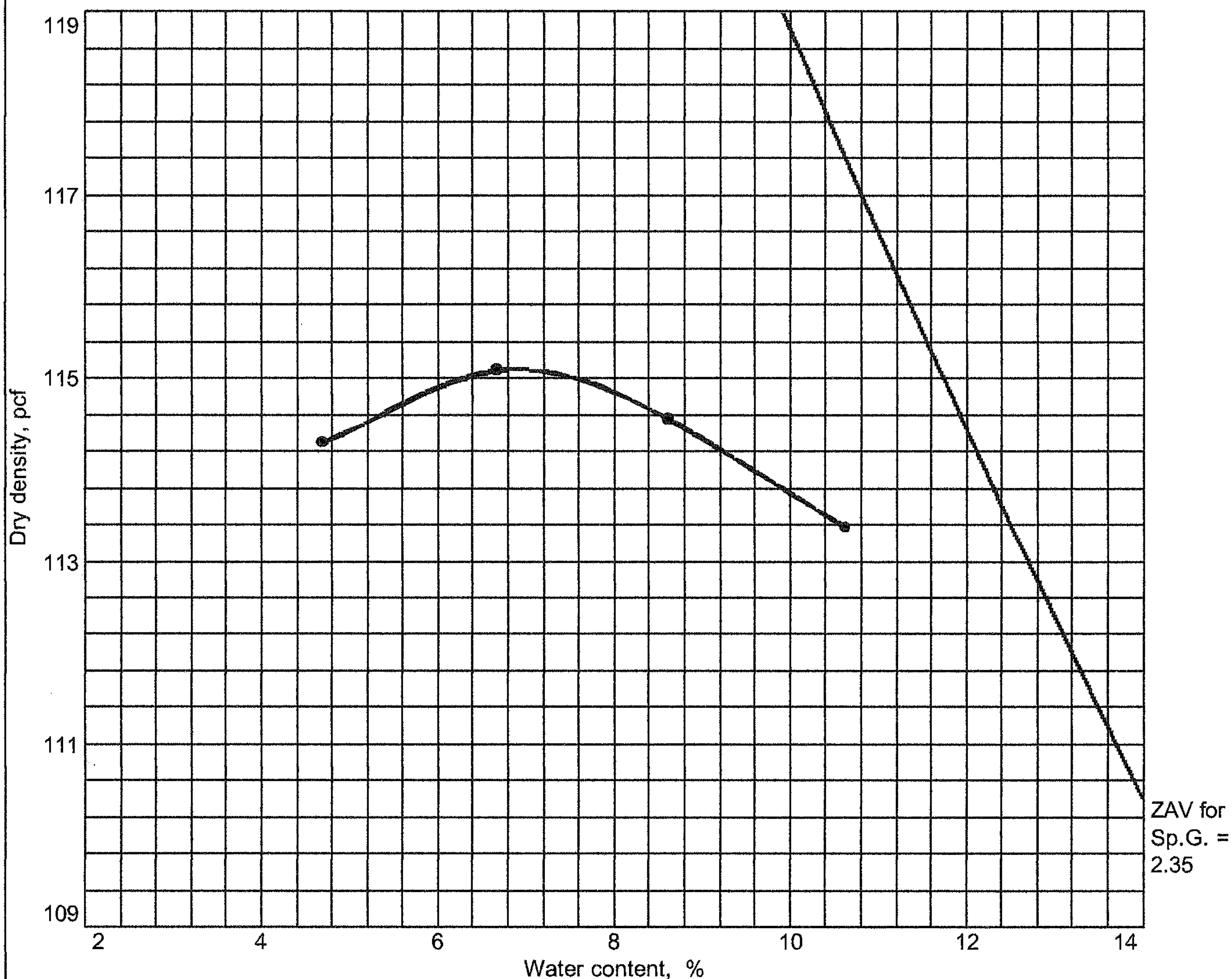
8. Compaction (ASTM D-1557)

Generates a "Compaction Curve" (unit weight vs. moisture content) from which maximum unit weight and optimum moisture content may be estimated. These are used for field testing of engineered fill, and for approximating shrinkage factors in preliminary quantity estimates for grading.

9. R-Value (ASTM D-2844)

Performed on subgrade soils to compute the resistance (R) value which is used in design of roadway pavement sections.

COMPACTION TEST REPORT



Test specification: ASTM D 1557-78 Method A Modified

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Maximum dry density = 115.1 pcf Optimum moisture = 6.9 %	Yellowish brown silty Sand

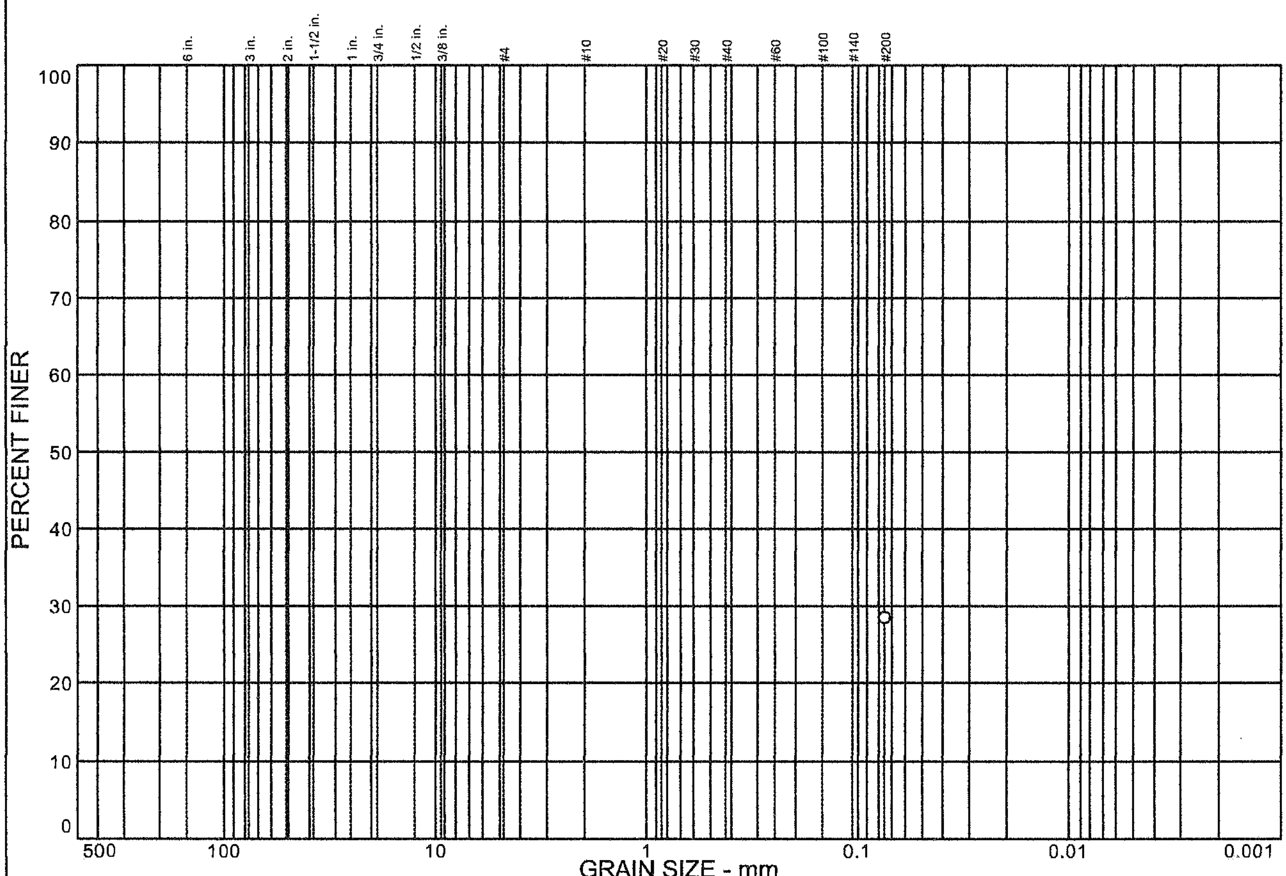
Project No. 5866.3.001.01 **Client:**
Project: East Garrison - Phase I

● **Source:** Curve **Sample No.:** T-1

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Remarks:

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			28.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	28.5		

* (no specification provided)

Soil Description

Very pale brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

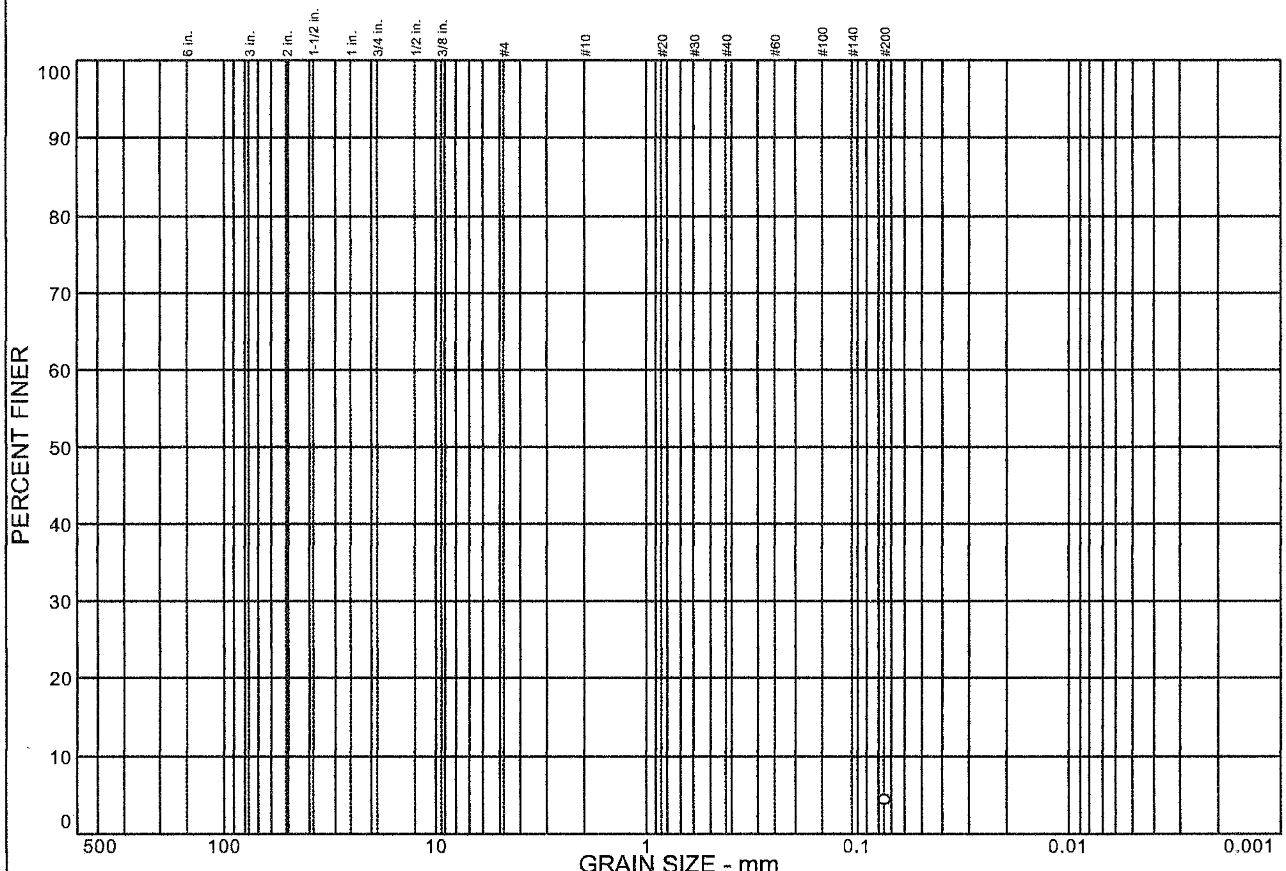
Remarks

Sample No.: 1-3 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 6 to 6.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			4.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	4.3		

* (no specification provided)

Soil Description

Brownish yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

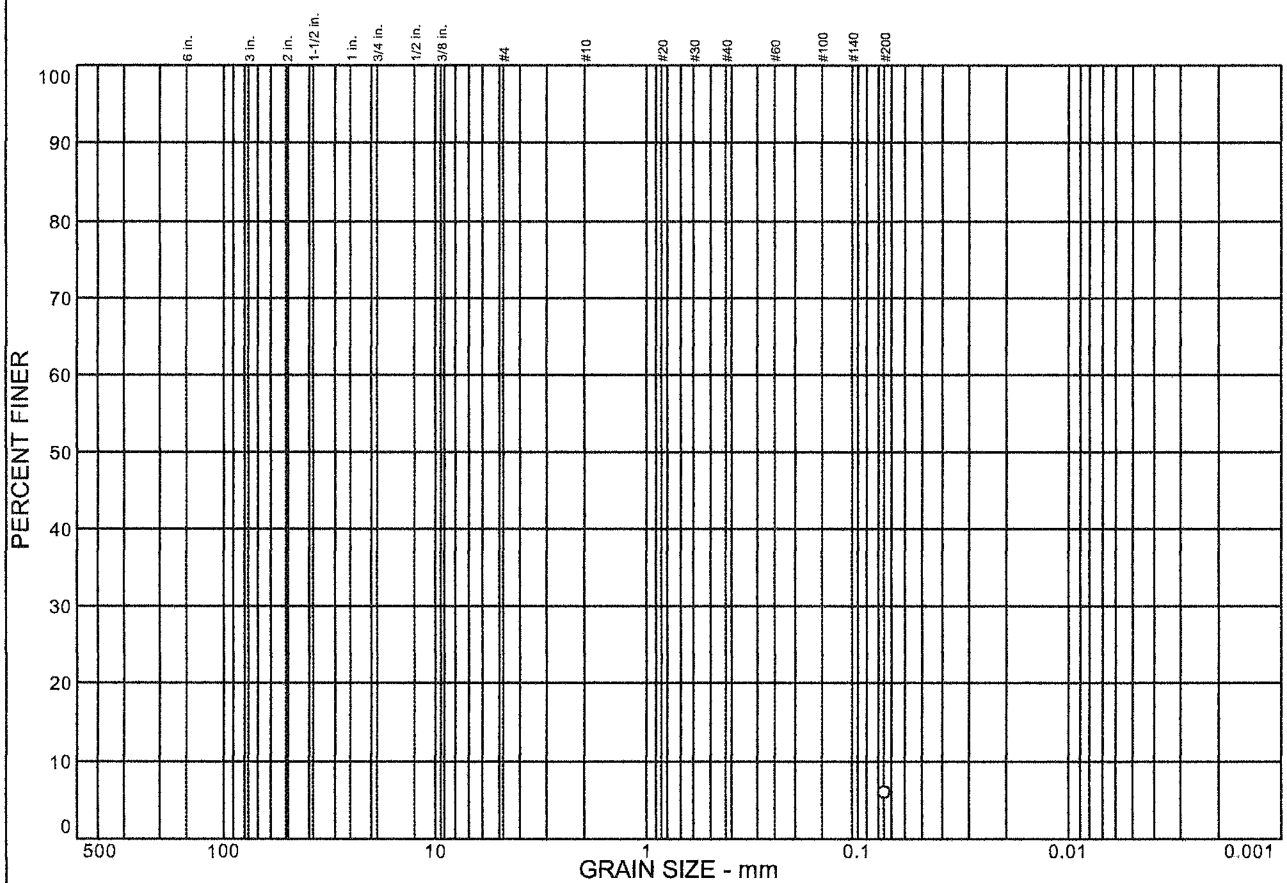
Remarks

Sample No.: 1-9 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 31 to 31.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			5.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	5.8		

* (no specification provided)

Soil Description

Brownish yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

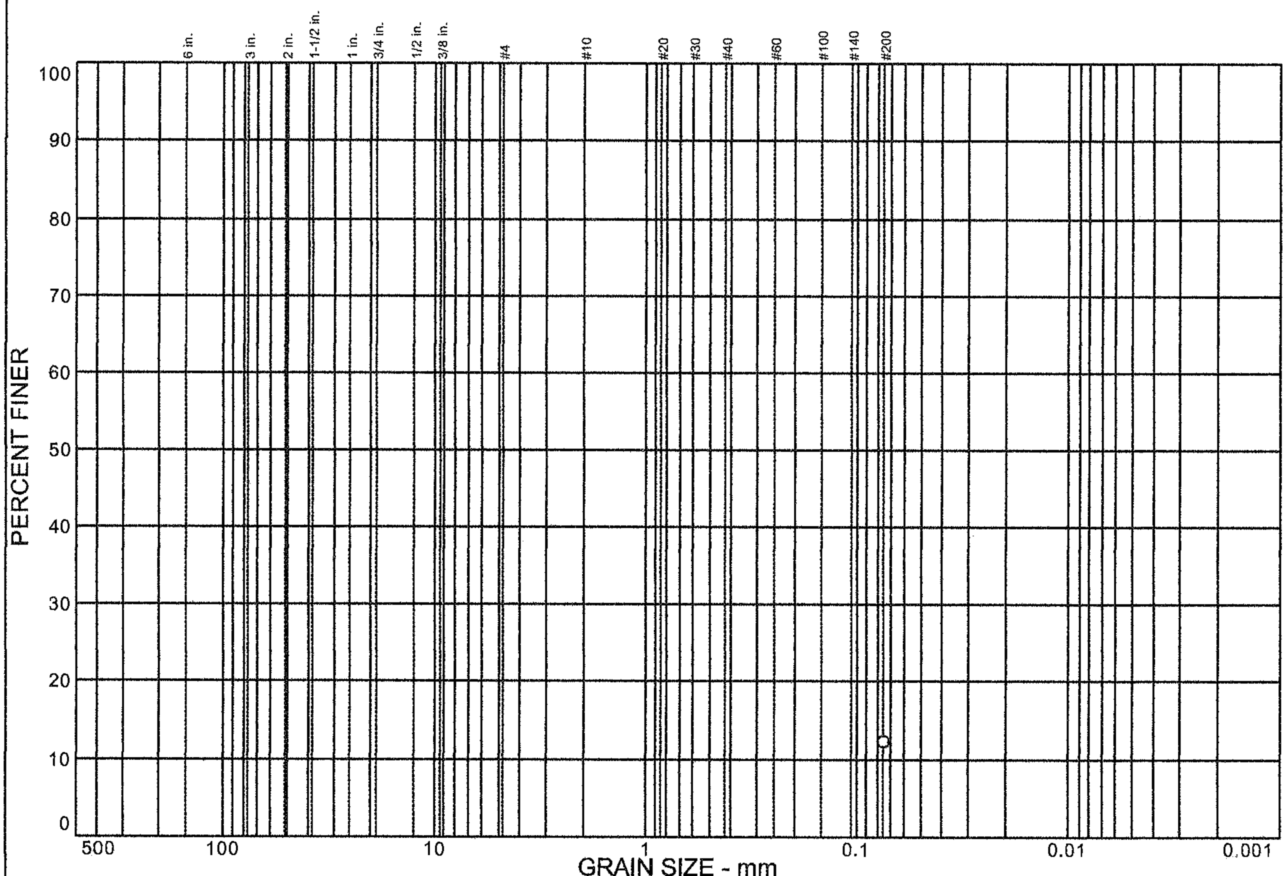
Remarks

Sample No.: 1-13 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 51 to 51.5 ft.

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			12.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	12.2		

* (no specification provided)

Soil Description

Yellow brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

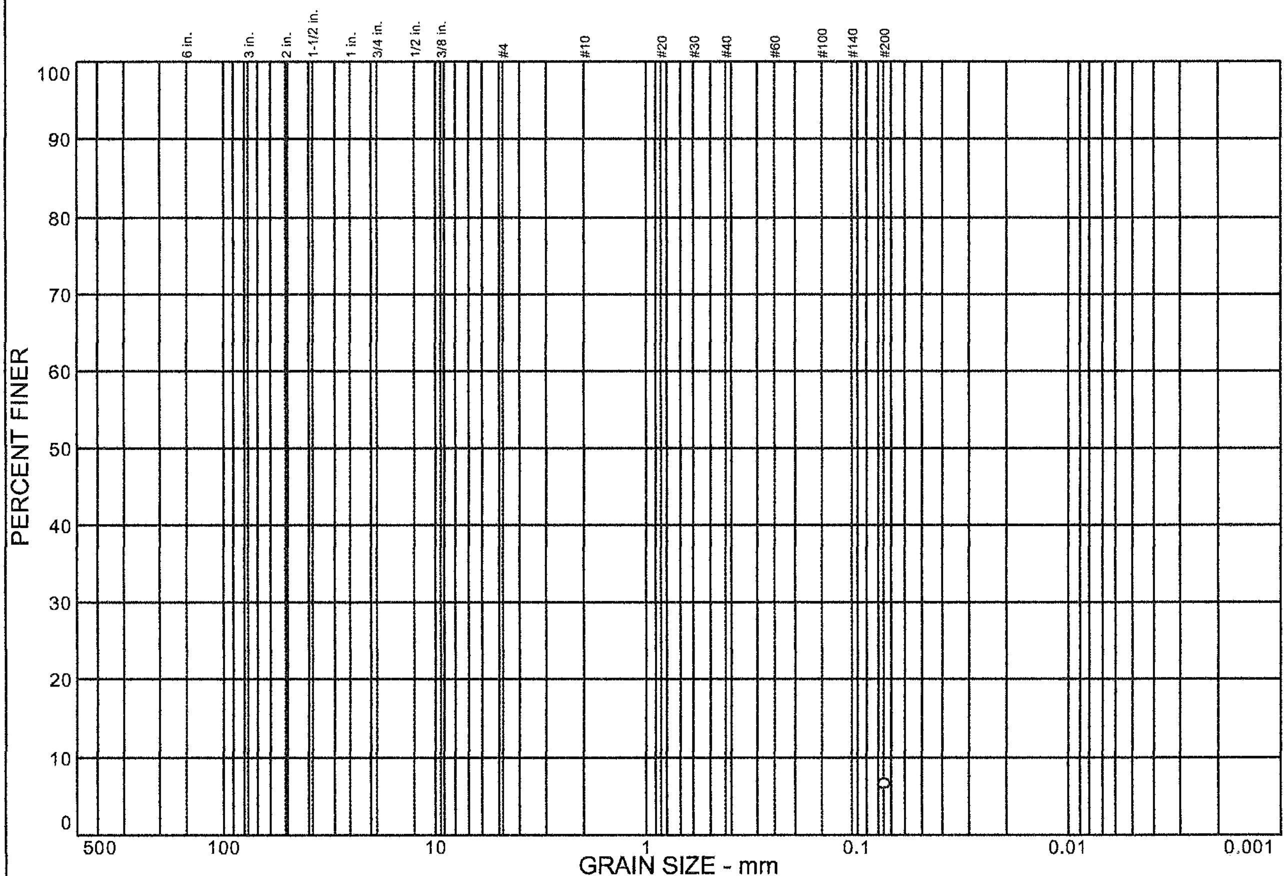
Sample No.: 2-4 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 8 to 8.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: East Garrison - Phase I

Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			6.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	6.5		

* (no specification provided)

Soil Description

Brownish yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

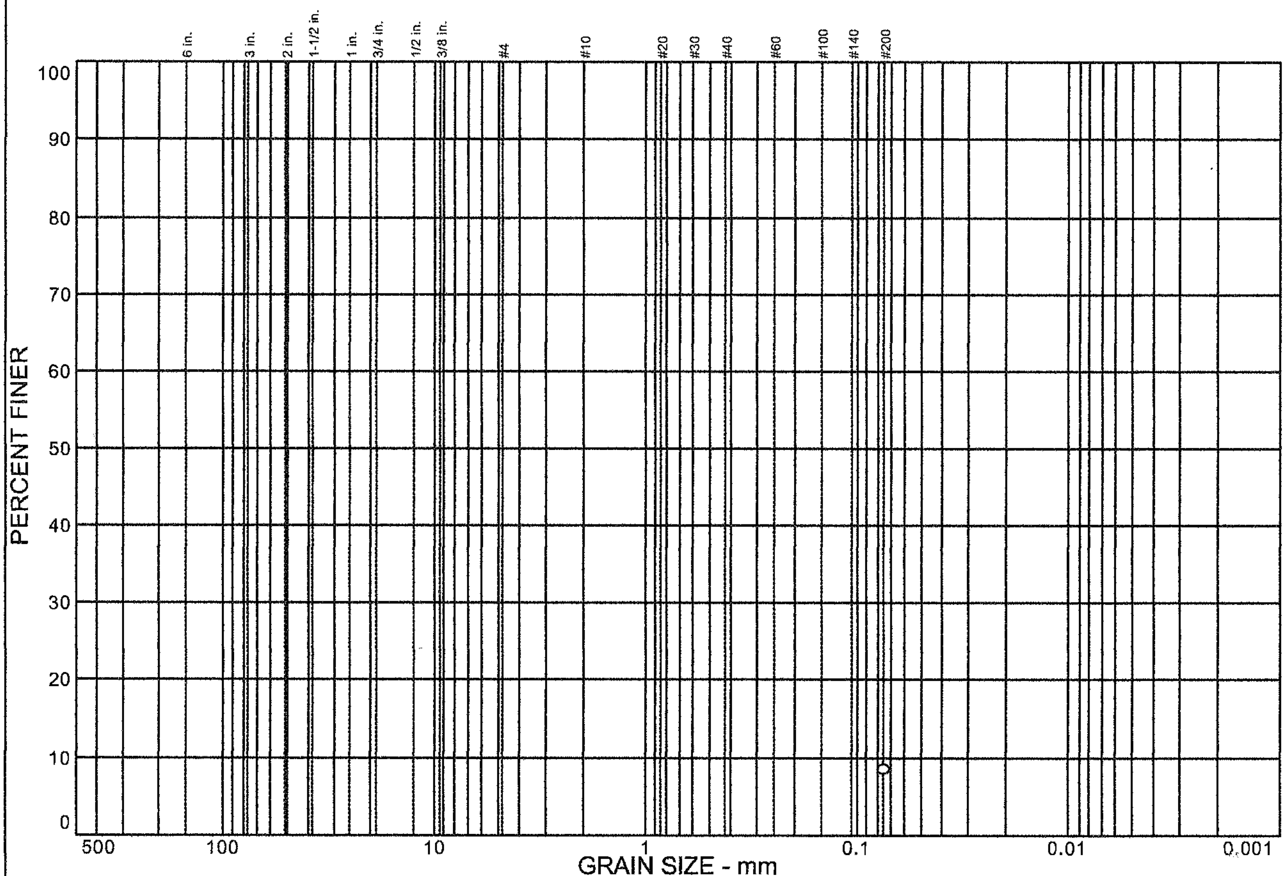
Remarks

Sample No.: 2-8 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 26 to 26.5 ft.

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			8.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	8.4		

* (no specification provided)

Soil Description

Brownish yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

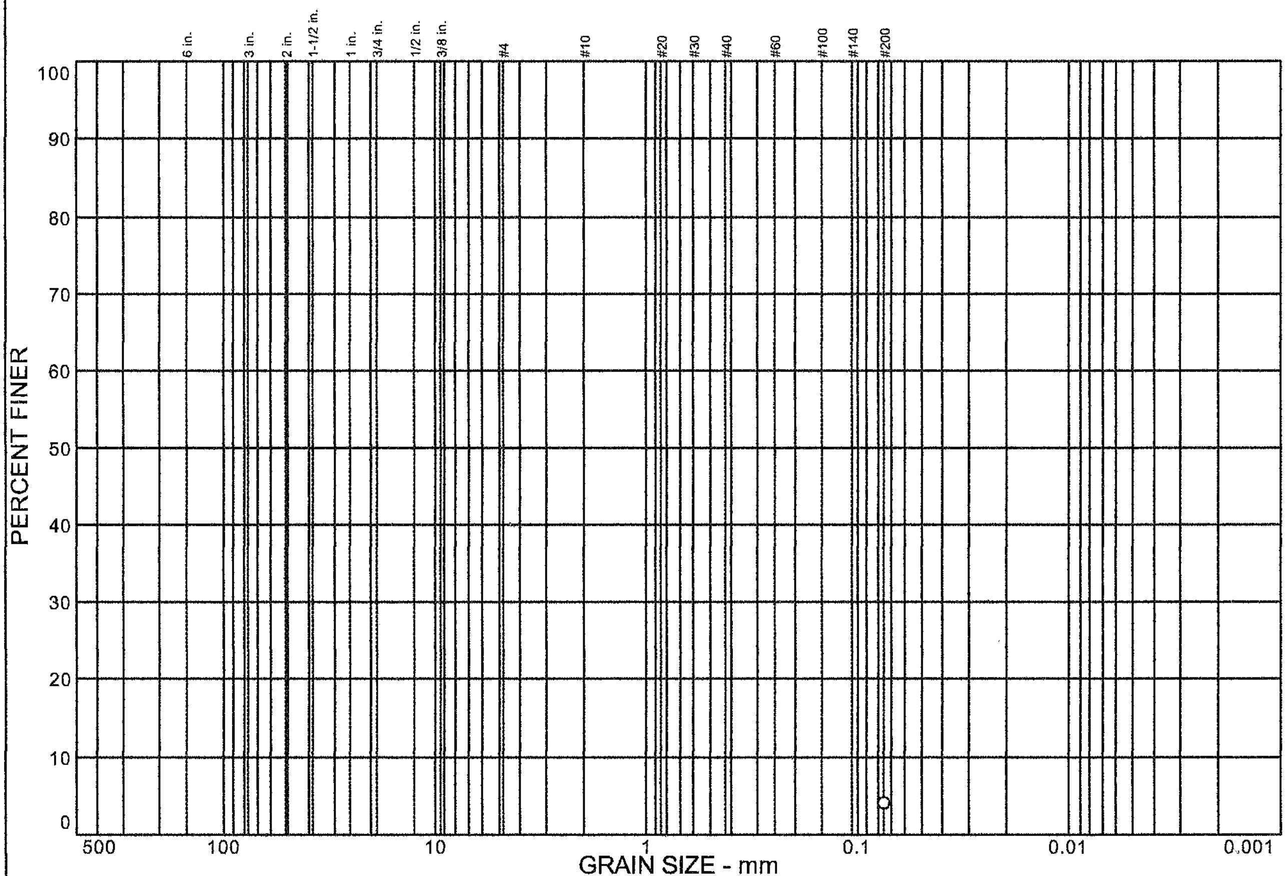
Sample No.: 2-13 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 46 to 46.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I

Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			4.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	4.0		

* (no specification provided)

Soil Description

Brownish yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

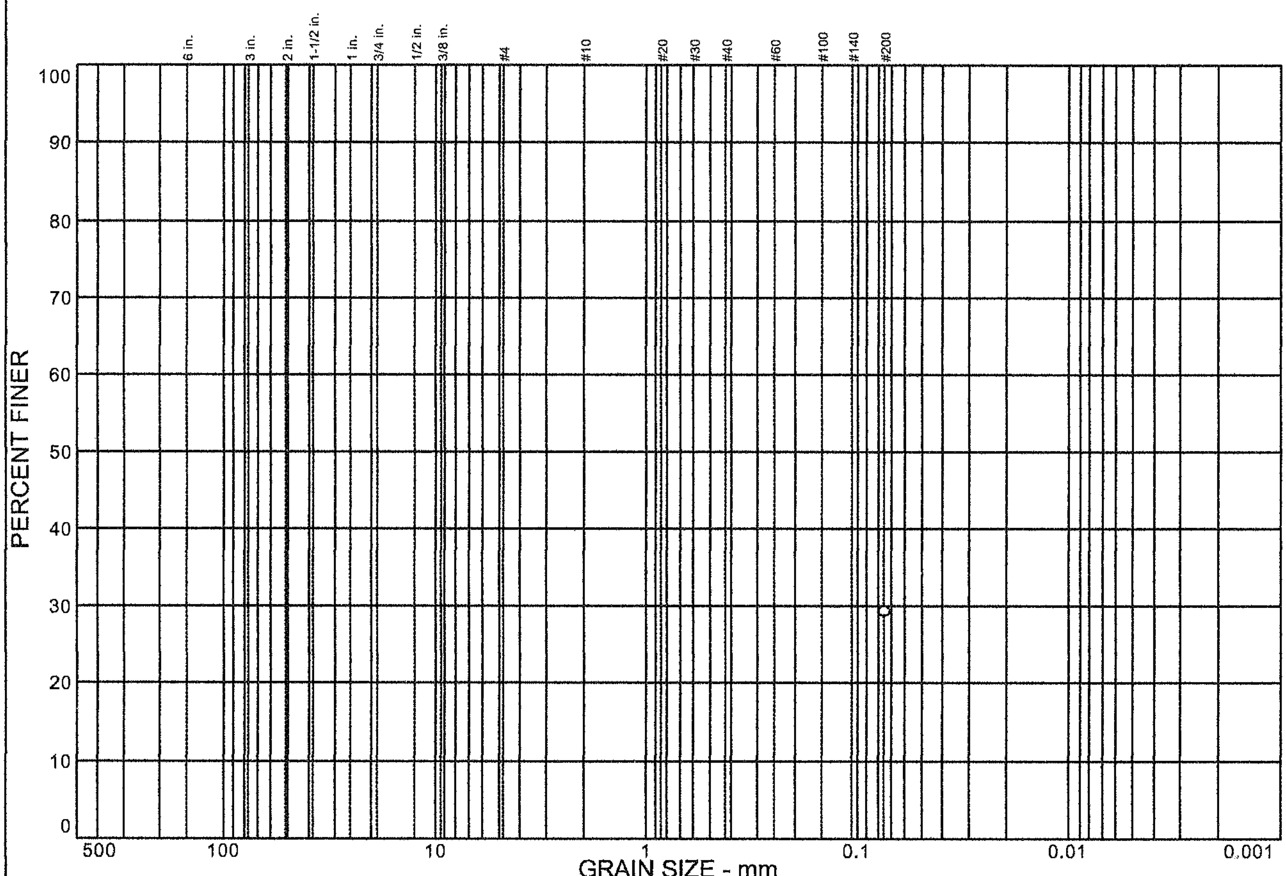
Remarks

Sample No.: 3-9 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 31 to 31.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			29.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	29.3		

* (no specification provided)

Soil Description

Mottled light gray and dark yellowish brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

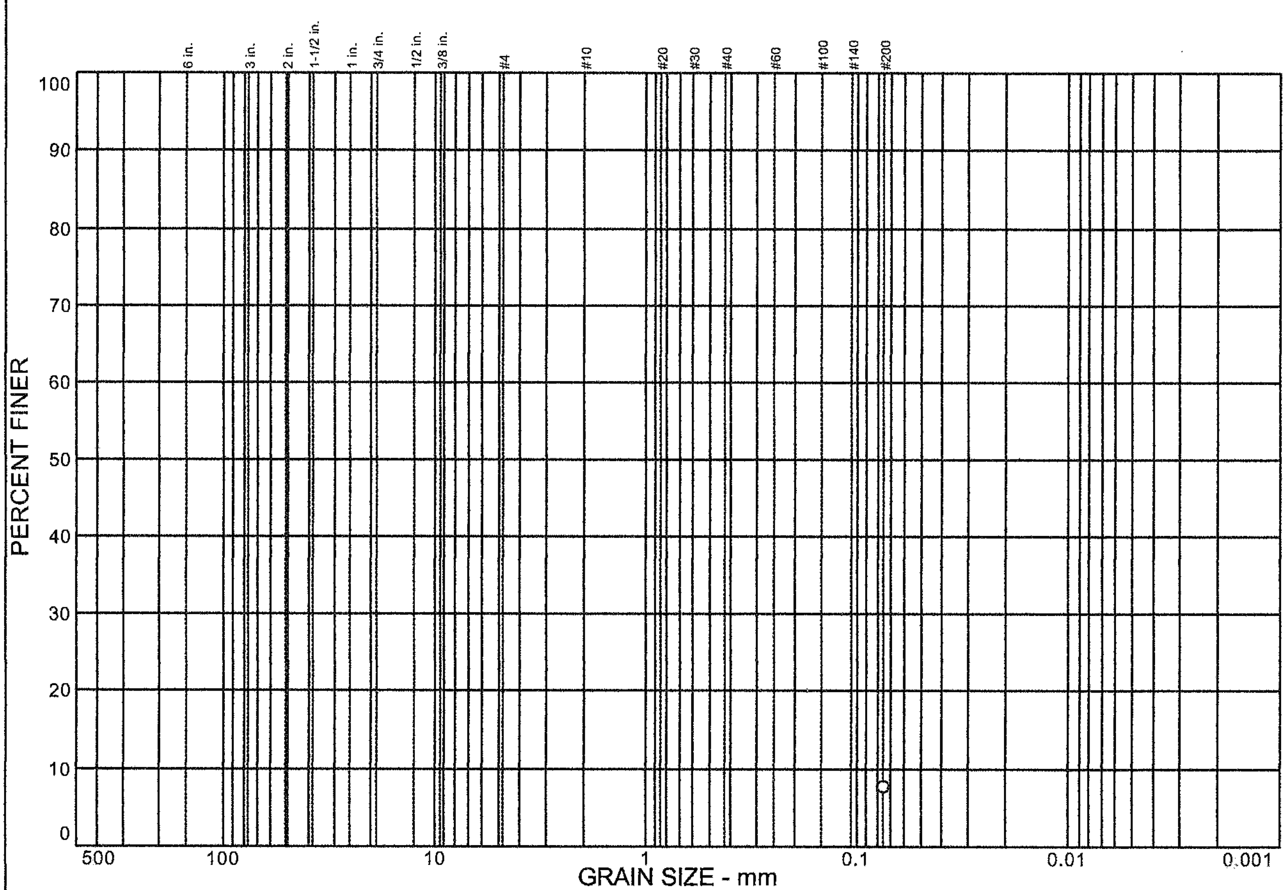
Remarks

Sample No.: 4-3 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 7 to 7.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			7.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	7.5		

* (no specification provided)

Soil Description

Brownish yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

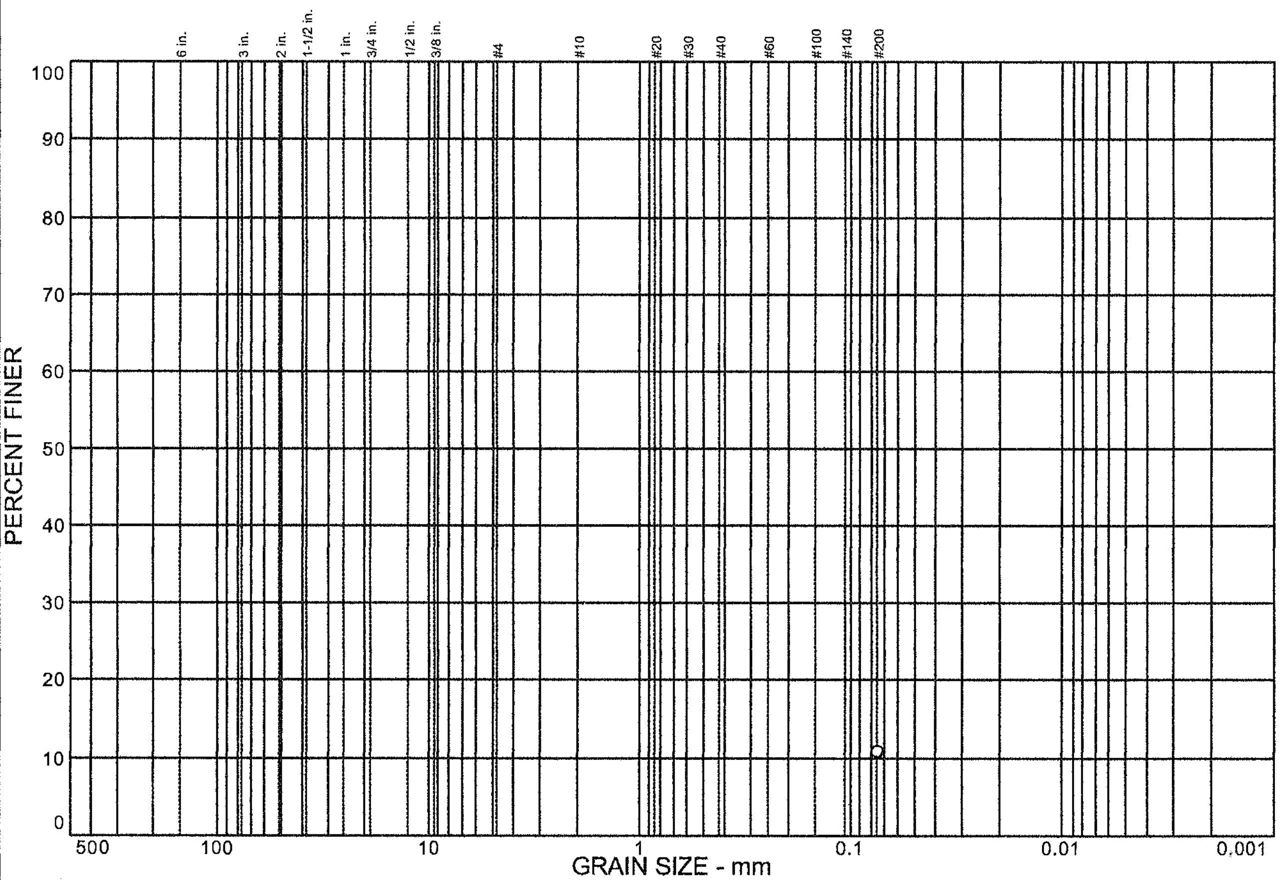
Remarks

Sample No.: 4-7 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 20.5 to 21 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			10.8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	10.8		

* (no specification provided)

Soil Description

Pale yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

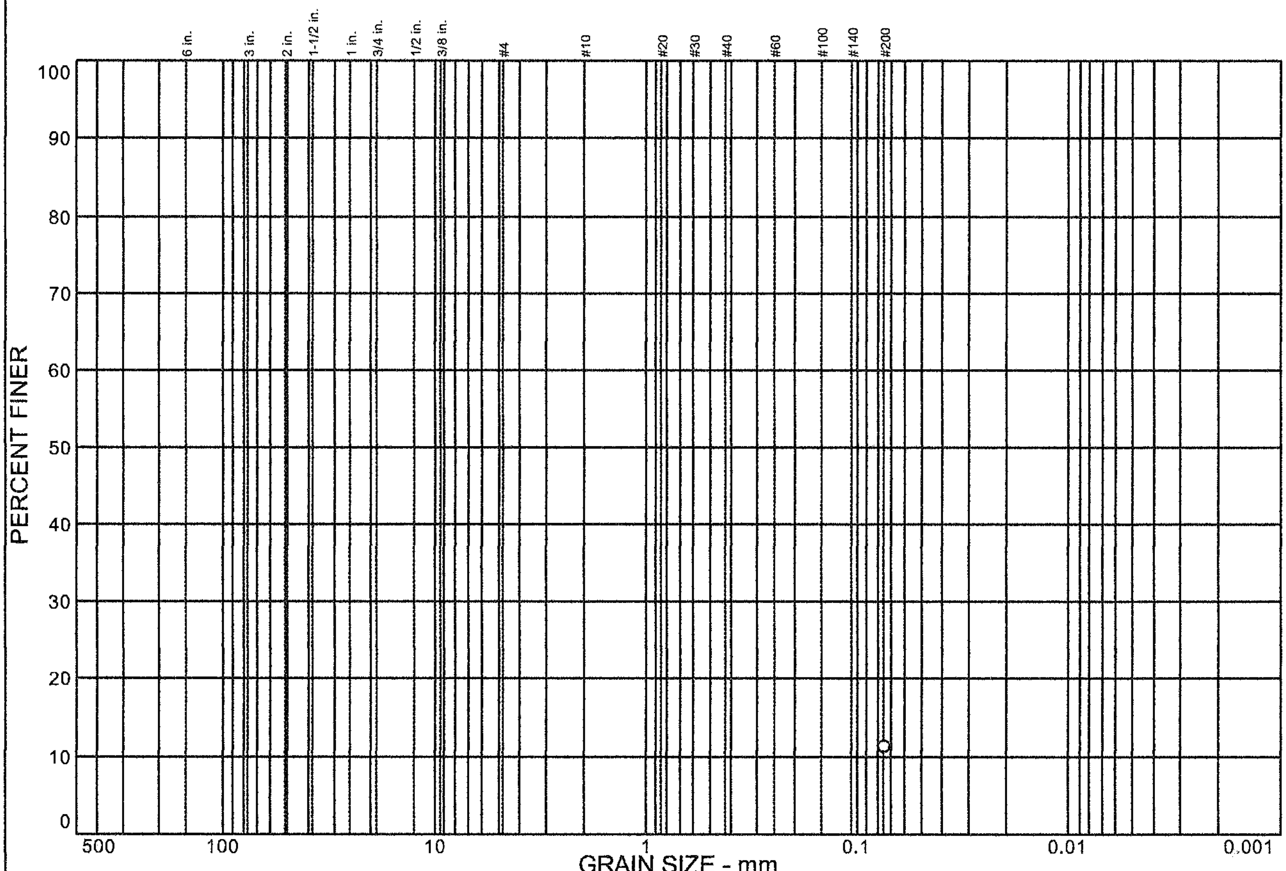
Remarks

Sample No.: 5-4 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 8 to 8.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS
MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			11.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	11.2		

* (no specification provided)

Soil Description

Dark yellowish brown poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

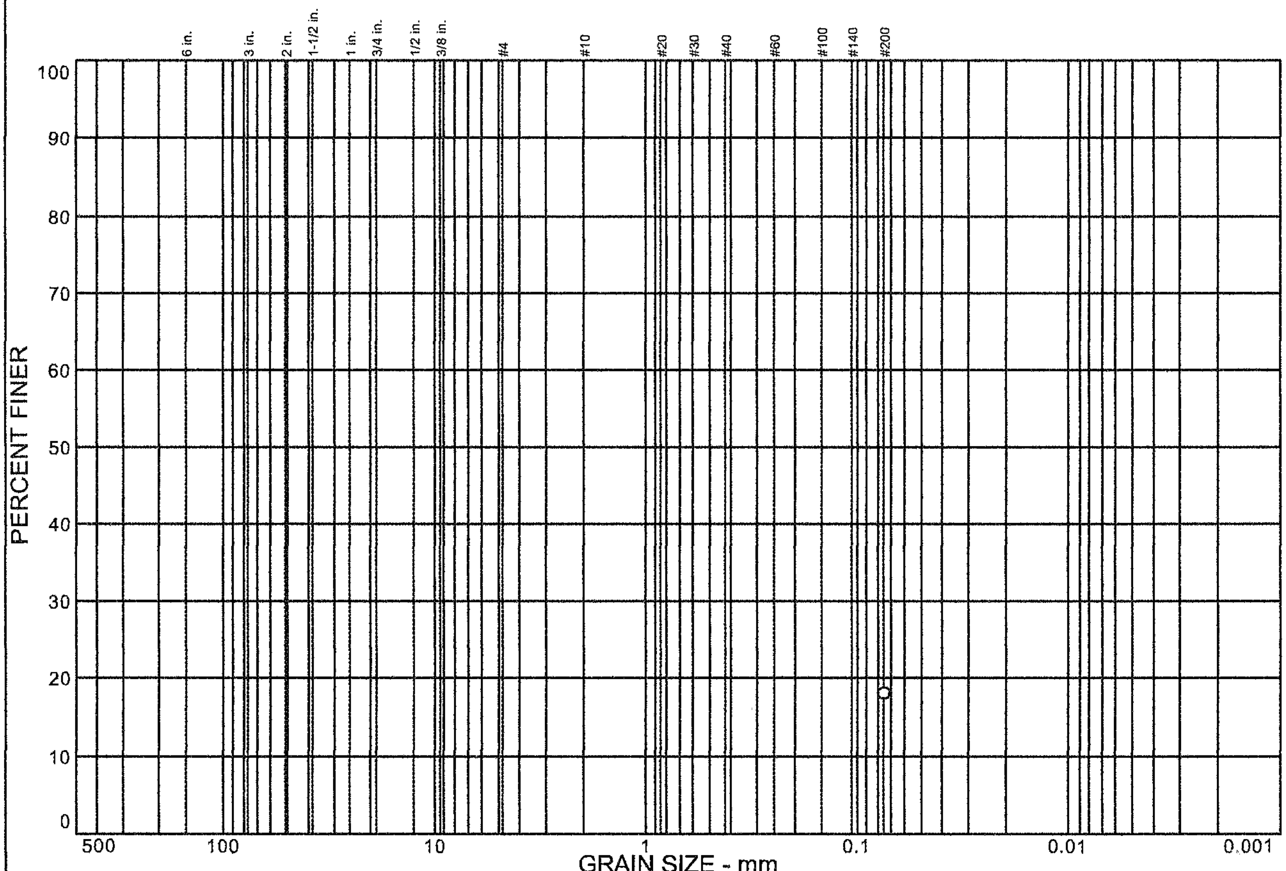
Remarks

Sample No.: 5-8 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 26 to 26.5 ft.

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			18.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	18.1		

* (no specification provided)

Soil Description

Dark brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

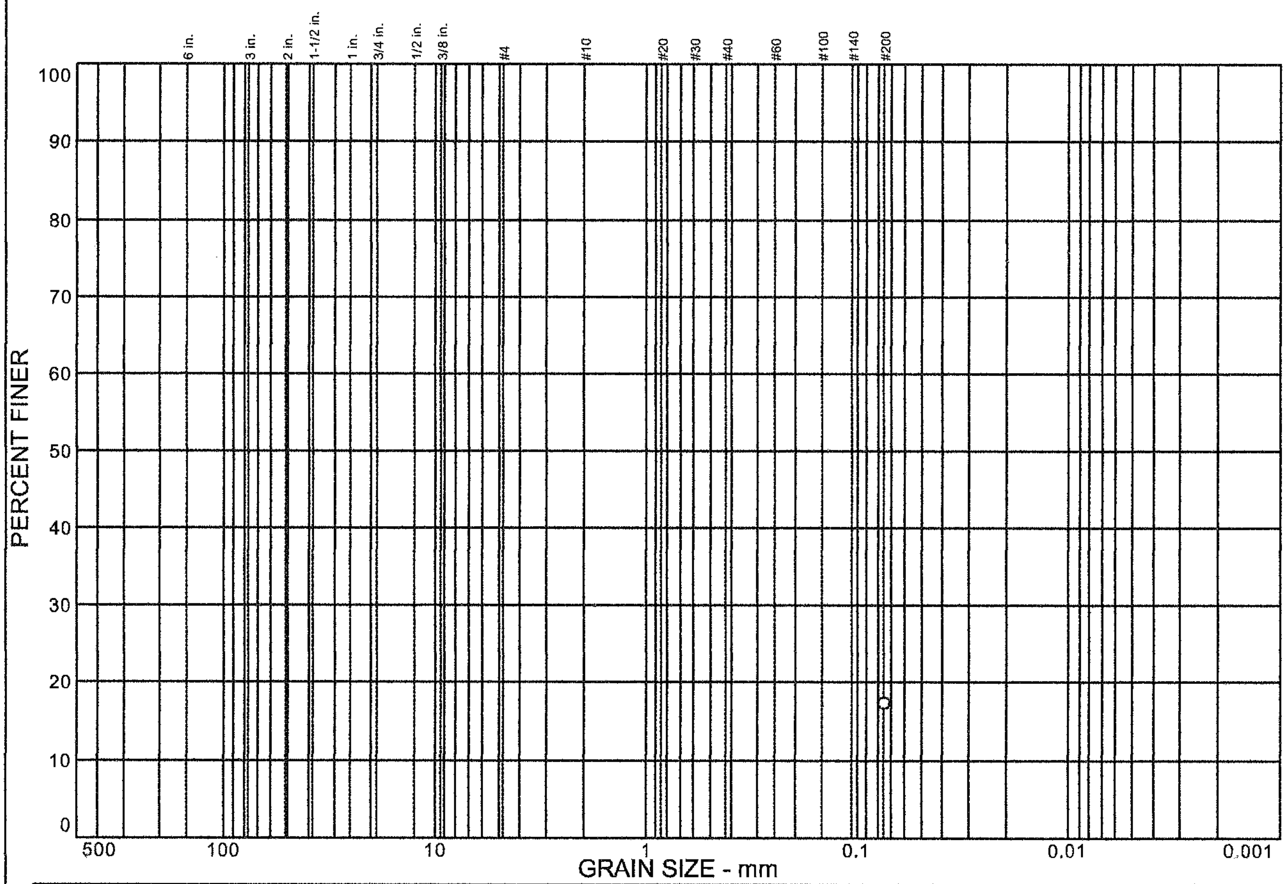
Remarks

Sample No.: 7-3 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 6 to 6.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			17.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	17.3		

* (no specification provided)

Soil Description

Light grayish brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

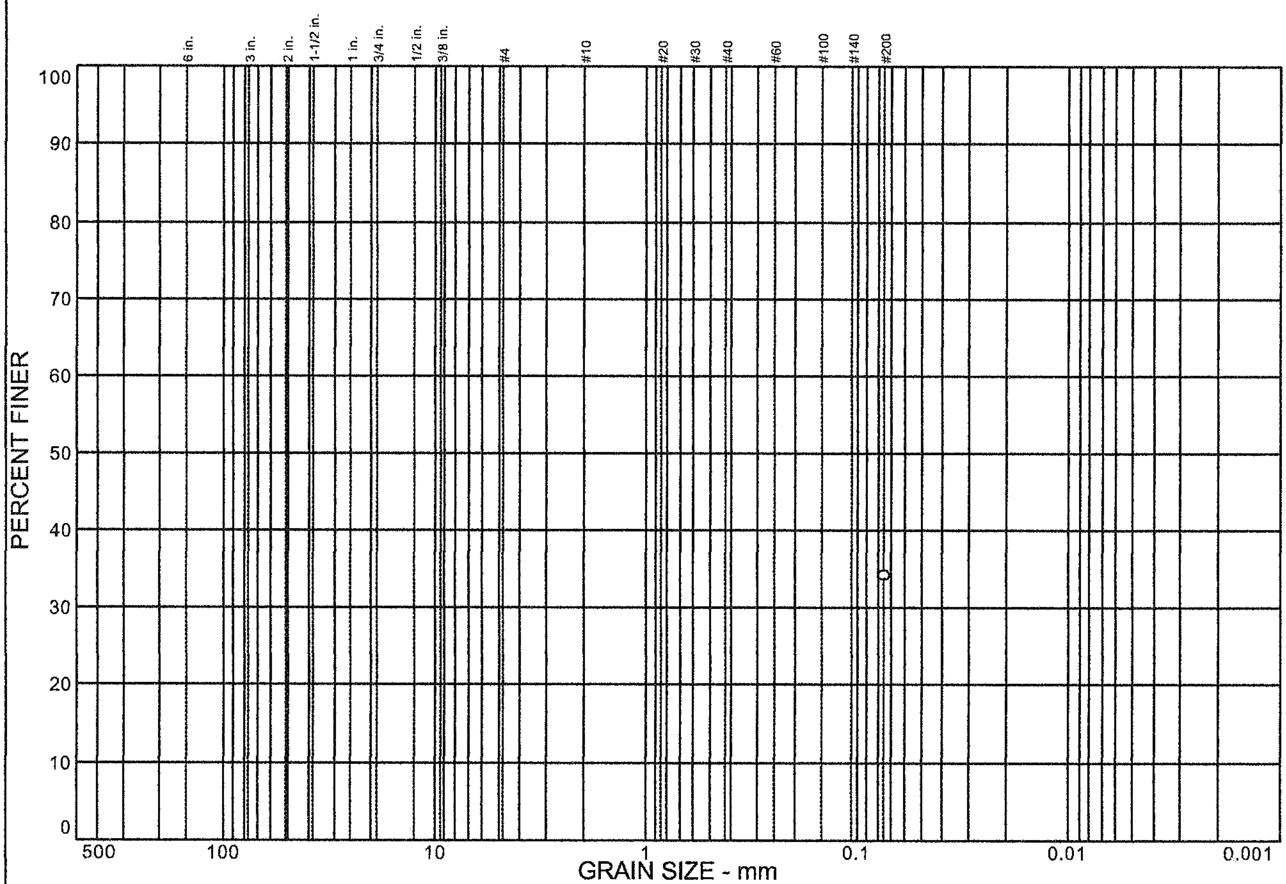
Remarks

Sample No.: 8-2 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 5 to 5.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			34.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	34.2		

* (no specification provided)

Soil Description

Very dark brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

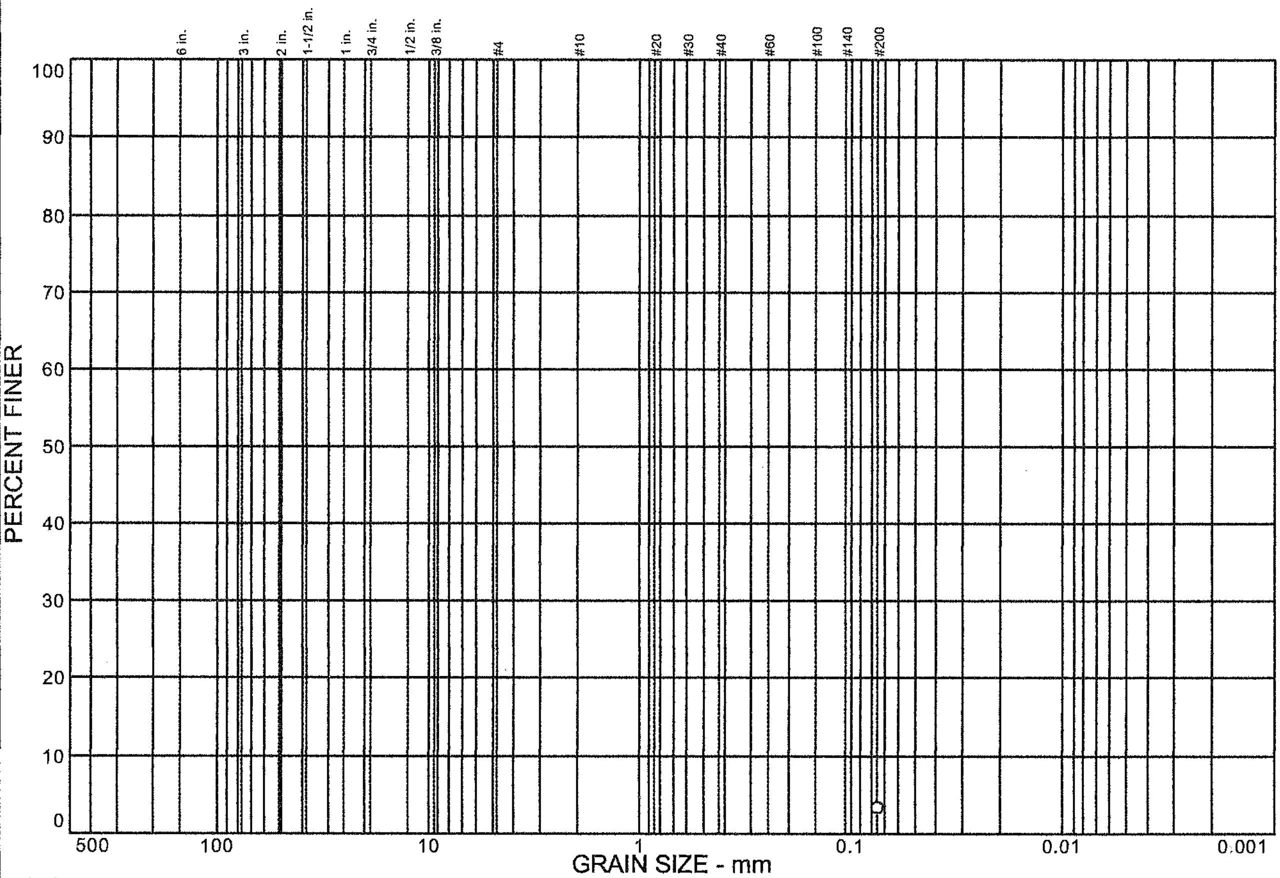
Sample No.: 8-4 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 9 to 9.5 ft.

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I

Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			3.2	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	3.2		

* (no specification provided)

Soil Description

Very dark brown poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

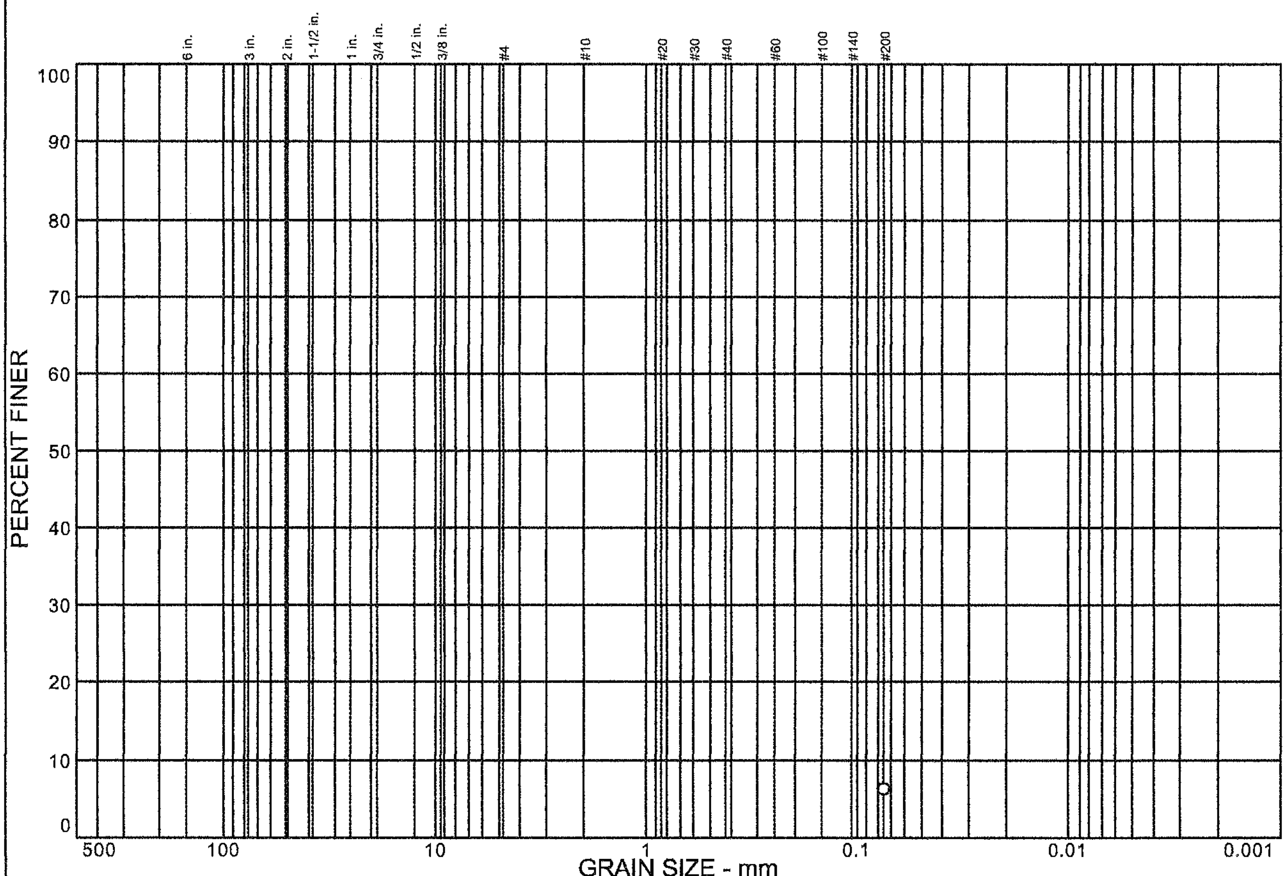
Sample No.: 9-1 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 2 to 2.5 ft.

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I

Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			6.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	6.1		

* (no specification provided)

Soil Description

Mottled dark yellowish brown and brownish yellow poorly graded Sand with silt

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SP-SM AASHTO=

Remarks

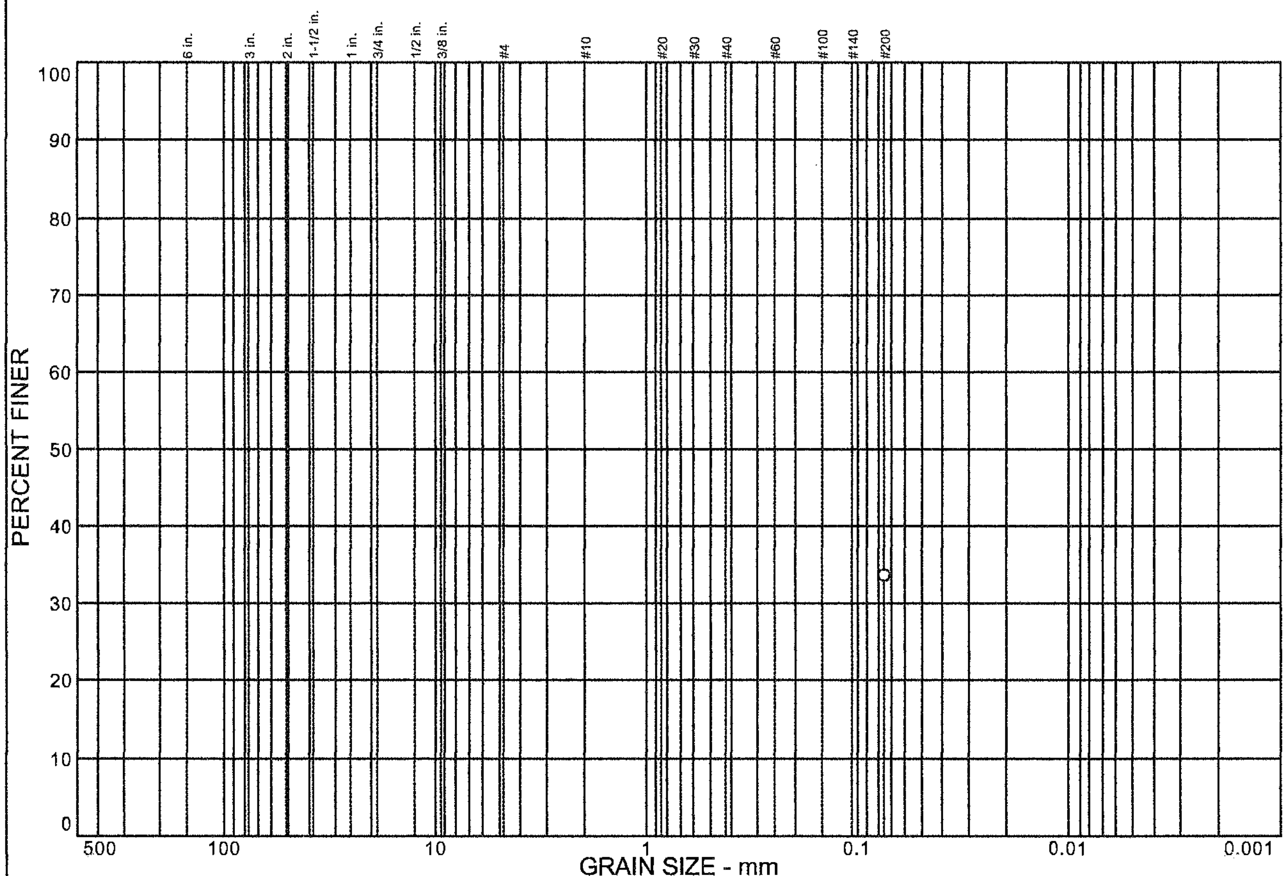
Sample No.: 10-4 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 8 to 8.5 ft.

ENGEO INCORPORATED GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I

Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
			33.6	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#200	33.6		

* (no specification provided)

Soil Description

Brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= D_{60}= D_{50}=
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

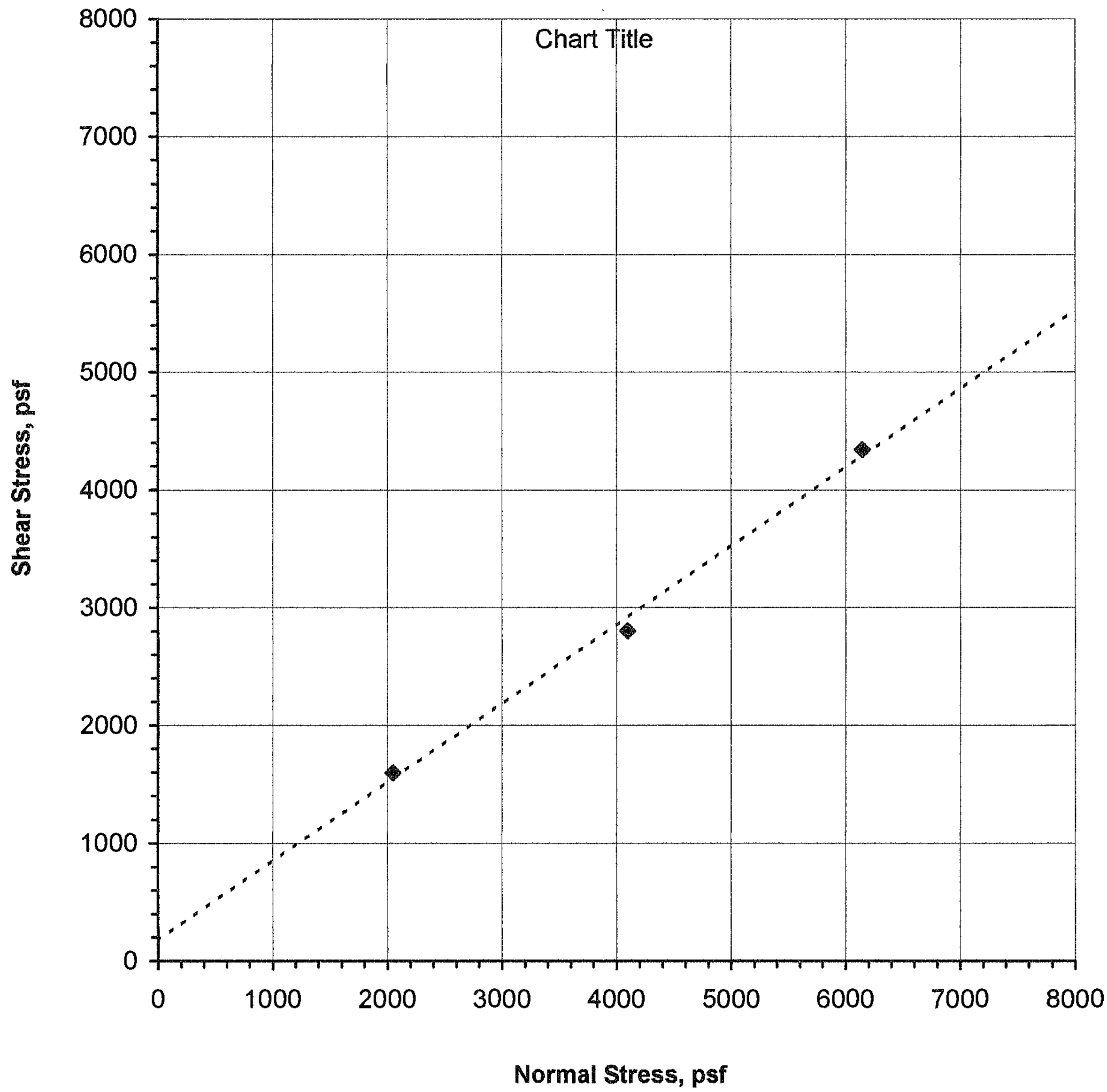
Remarks

Sample No.: 12-2 **Source of Sample:** %200 **Date:** 04-12-03
Location: **Elev./Depth:** 4 to 4.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Direct Shear Test
ASTM Test Method D3080

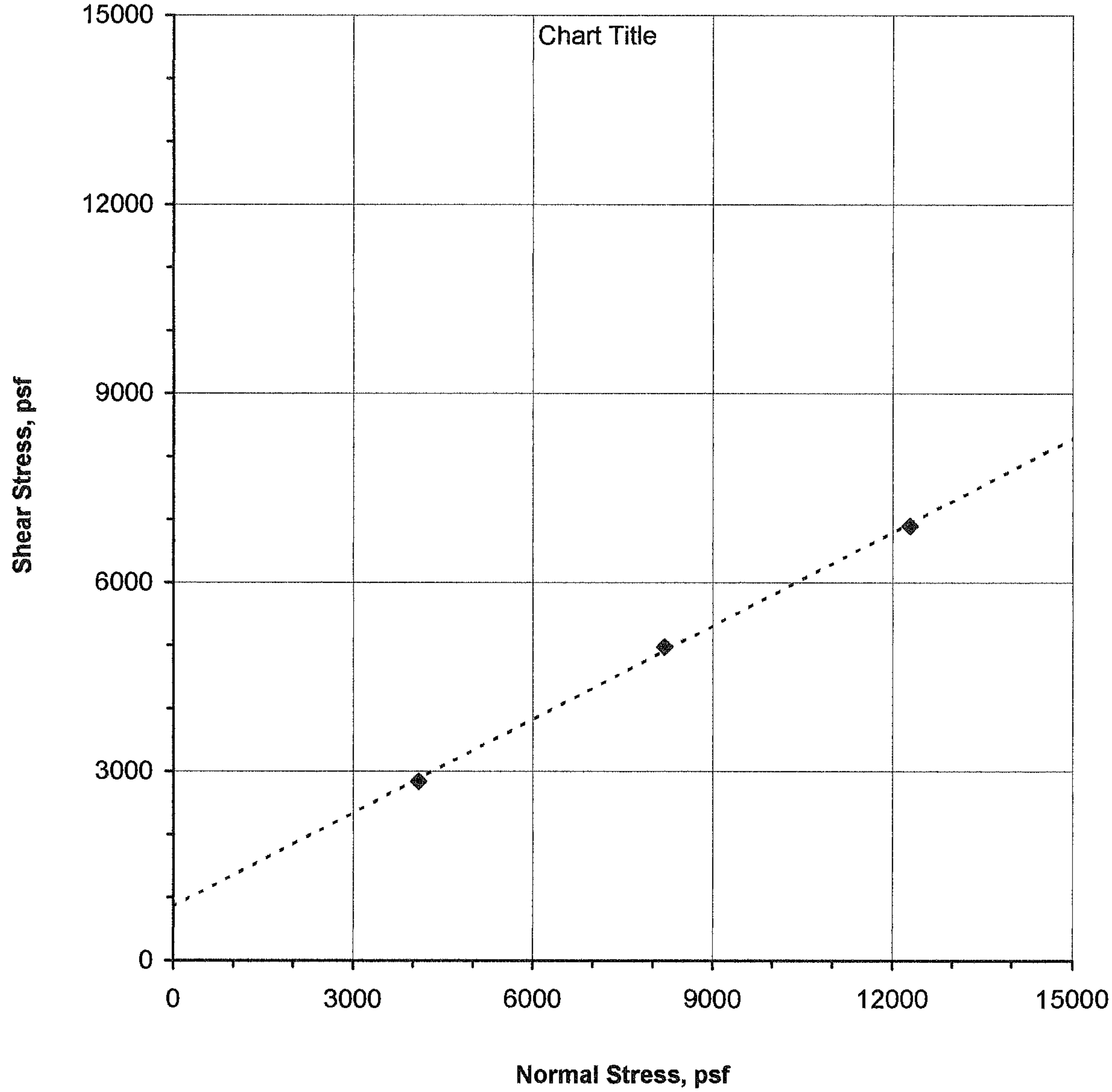


	FRICTION ANGLE	COHESION
Peak	34 degrees	171 psf

Dry Density:	105.6 pcf
Moisture Content:	4.8 %
USCS Classification:	SP-SM
Shear Type:	CD
Shear Rate:	Slow

ENGEO INCORPORATED	EAST GARRISON - PHASE I Monterey, California	Job No.: 5866.3.001.01	Figure No.
		Sample Number: 1-5	
		Date: 4/12/2003	

Direct Shear Test
ASTM Test Method D3080

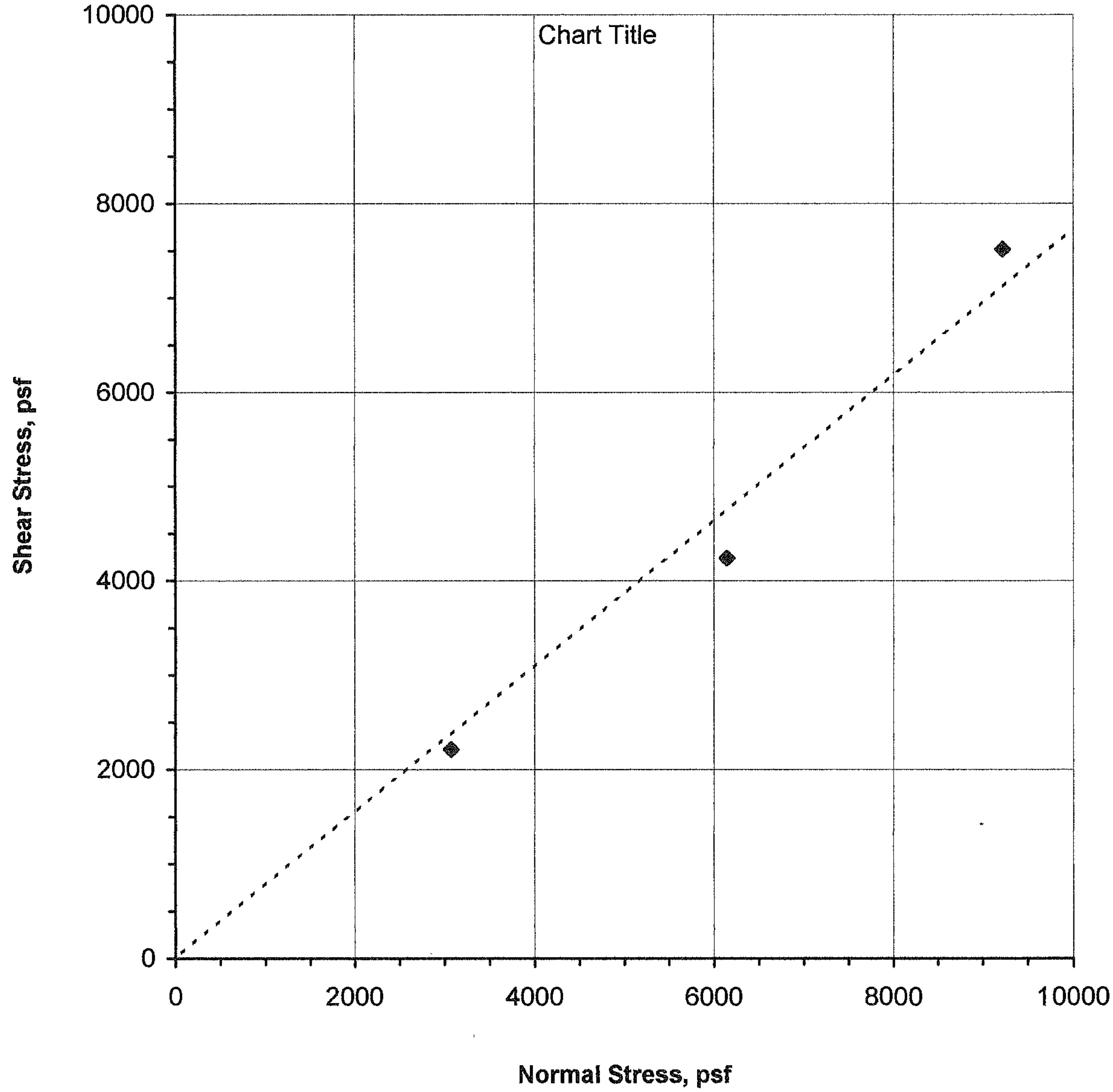


	FRICTION ANGLE	COHESION
Peak	26 degrees	853 psf

Dry Density:	117.3 pcf
Moisture Content:	8.3 %
USCS Classification:	SM
Shear Type:	CD
Shear Rate:	Slow

ENGEO INCORPORATED	EAST GARRISON - PHASE I Monterey, California	Job No.: 5866.3.001.01	Figure No.
		Sample Number: 2-11	
		Date: 4/12/2003	

Direct Shear Test
ASTM Test Method D3080

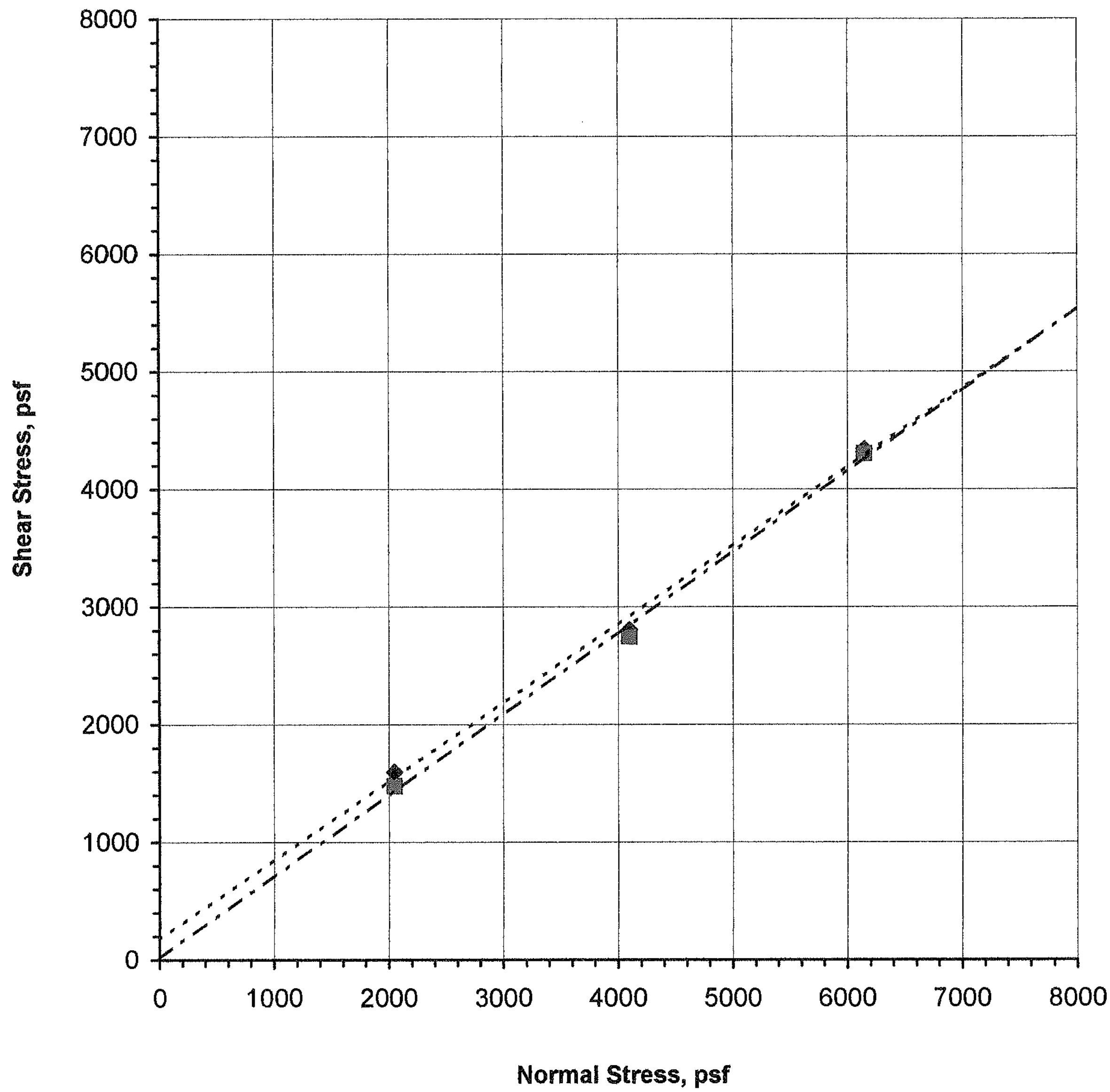


	FRICTION ANGLE	COHESION
Peak	39 degrees	0 psf

Dry Density:	102.5 pcf
Moisture Content:	5 %
USCS Classification:	SP
Shear Type:	CD
Shear Rate:	Slow

ENGEO INCORPORATED	EAST GARRISON - PHASE I Monterey, California	Job No.:	5866.3.001.01	Figure No.
		Sample Number:	4-10	
		Date:	4/12/2003	

Direct Shear Test
ASTM Test Method D3080



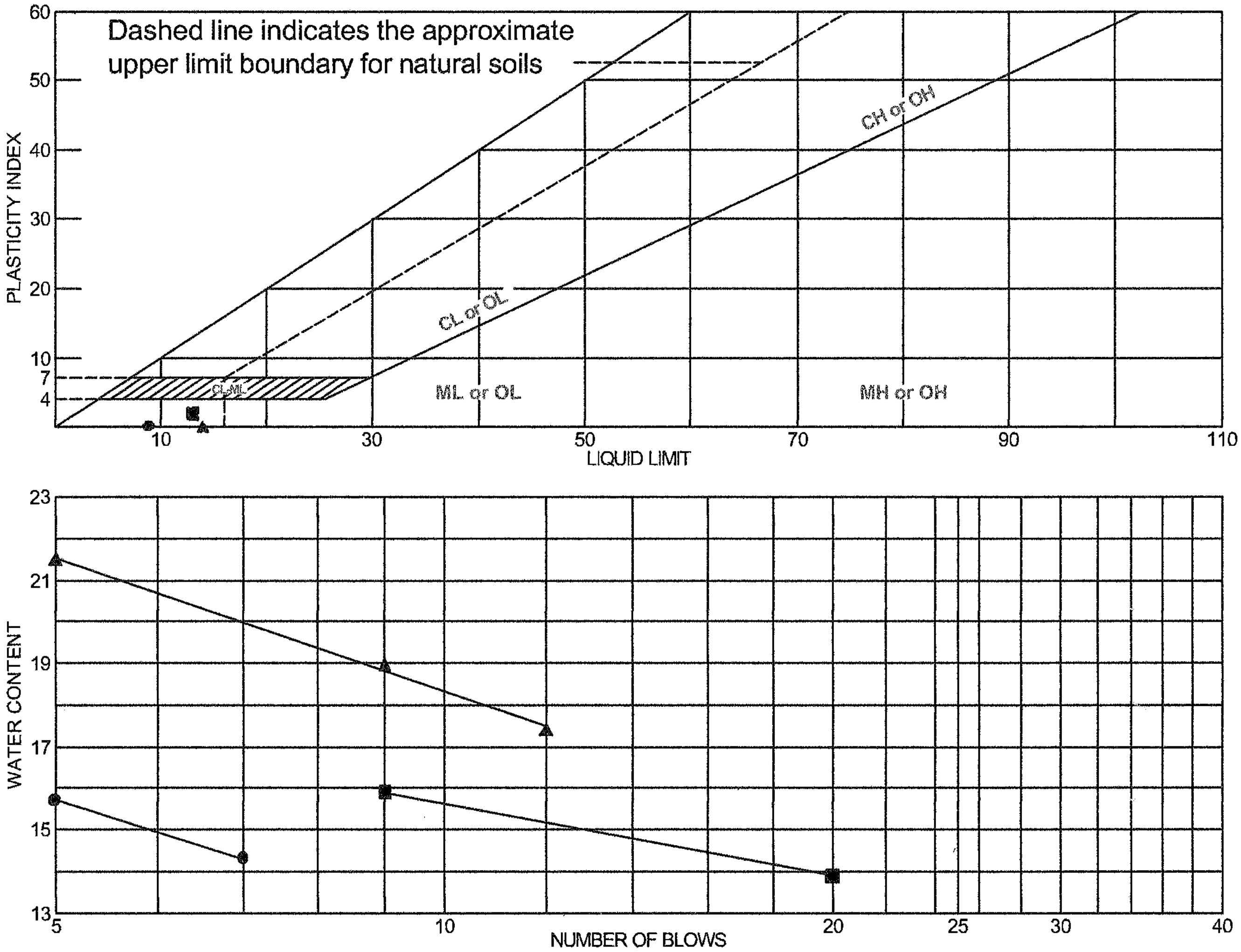
	FRICTION ANGLE	COHESION
Peak	34 degrees	171 psf
Softened	35 degrees	14 psf

Dry Density:	105.9 pcf
Moisture Content:	6.9 %
USCS Classification:	SM
Shear Type:	CD
Shear Rate:	Slow

SAMPLE REMOLDED TO 92% COMPACTION @ OPTIMUM

ENGEO INCORPORATED	EAST GARRISON - PHASE I Monterey, California	Job No.: 5866.3.001.01	Figure No.
		Sample Number: T-1	
		Date: 4/9/2003	

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Yellowish brown silty Sand	9	14	NP	78.4	17.4	SM
■	Very dark brown silty Sand	13	11	2	90.5	45.3	SM
▲	Dark brown becoming olive brown silty Sand	14	14	NP	87.2	23.5	SM

Project No. 5866.3.001.01 **Client:**

Project: East Garrison - Phase I

● **Source:** W.S. **Sample No.:** 10-1

■ **Source:** W.S. **Sample No.:** 11-1

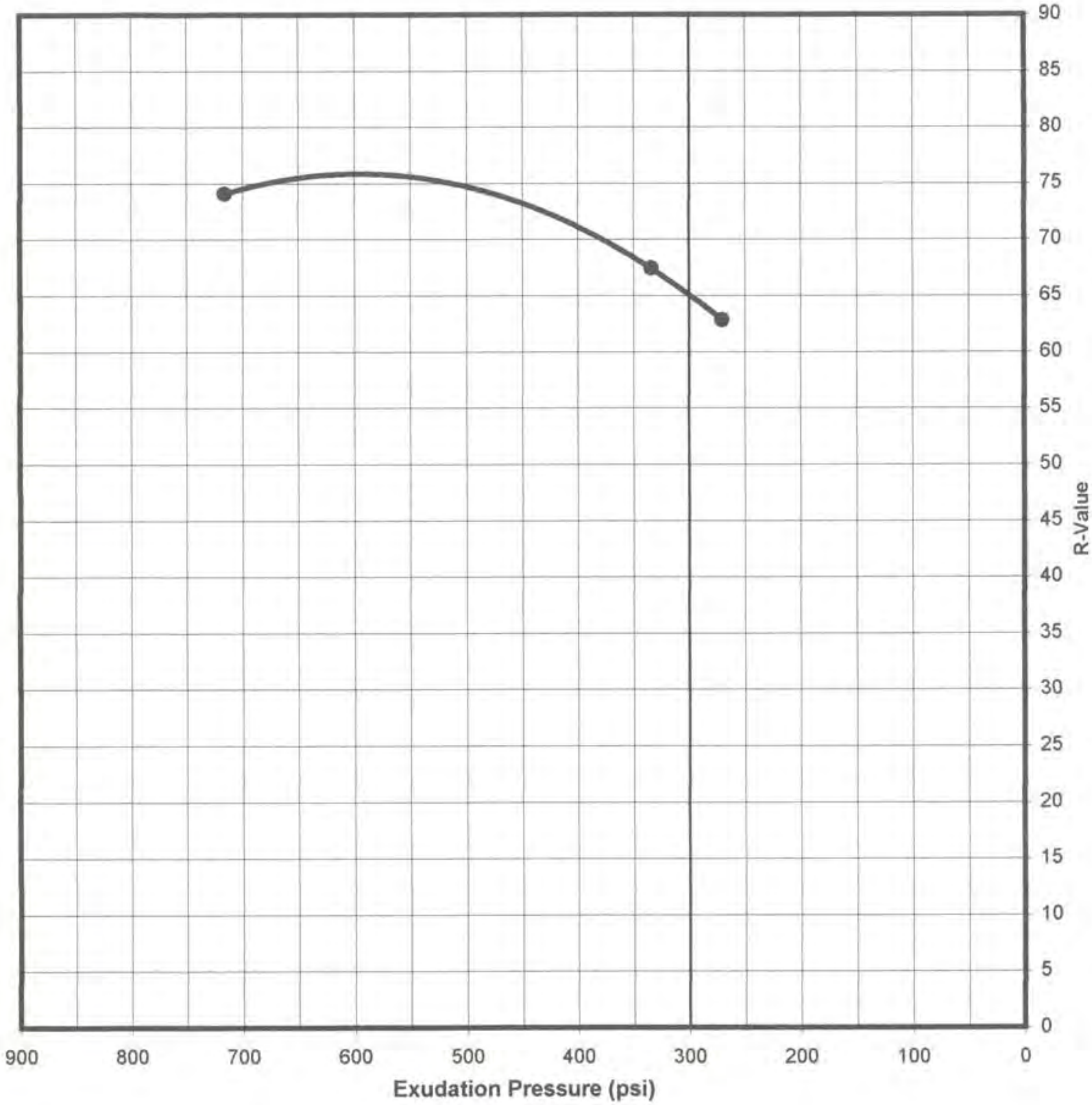
▲ **Source:** W.S. **Sample No.:** 13-1

Remarks:
● 10-1 (2 to 2.5 ft.)
■ 11-1 (2 to 2.5 ft.)
▲ 13-1 (2 to 2.5 ft.)

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

ENGEO
INCORPORATED

R VALUE TEST REPORT
CAL-301

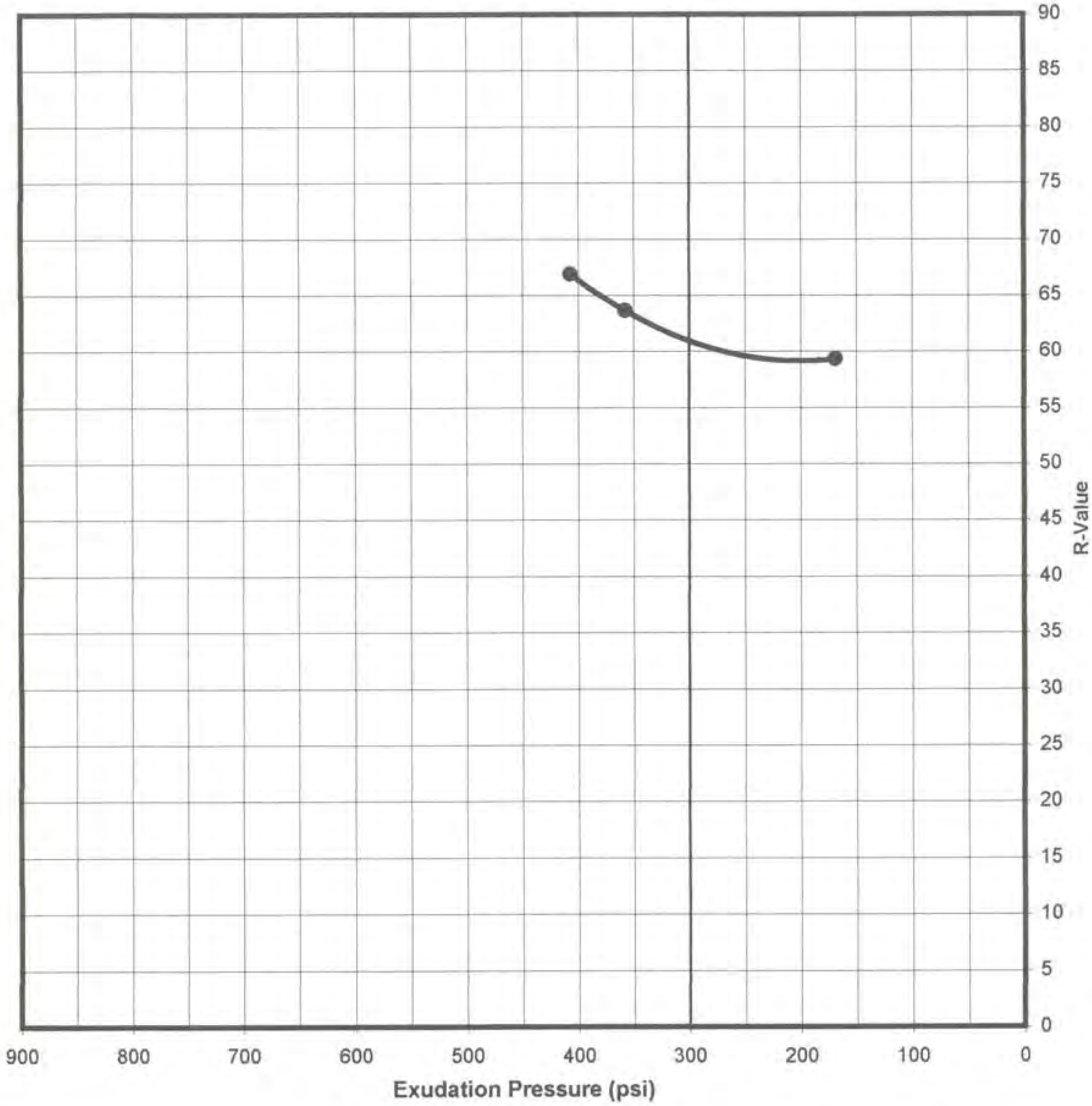


Date: 4/11/03
Project Name: East Garrison - Phase I
Project Number: 5866.3.001.01
Sample: Bulk 10-A
Description: Very dark brown fine Sand with silt

Specimen	A	B	C
Exudation Pressure, p.s.i.	716	334	270
Expansion dial (.0001")	0	0	0
Expansion Pressure, p.s.f.	0	0	0
Resistance Value, "R"	74	67	63
% Moisture at Test	10.3	11.2	12.0
Dry Density at Test, p.c.f.	111.0	109.8	109.0
"R" Value at 300 p.s.i., Exudation Pressure		65	

ENGEO INCORPORATED

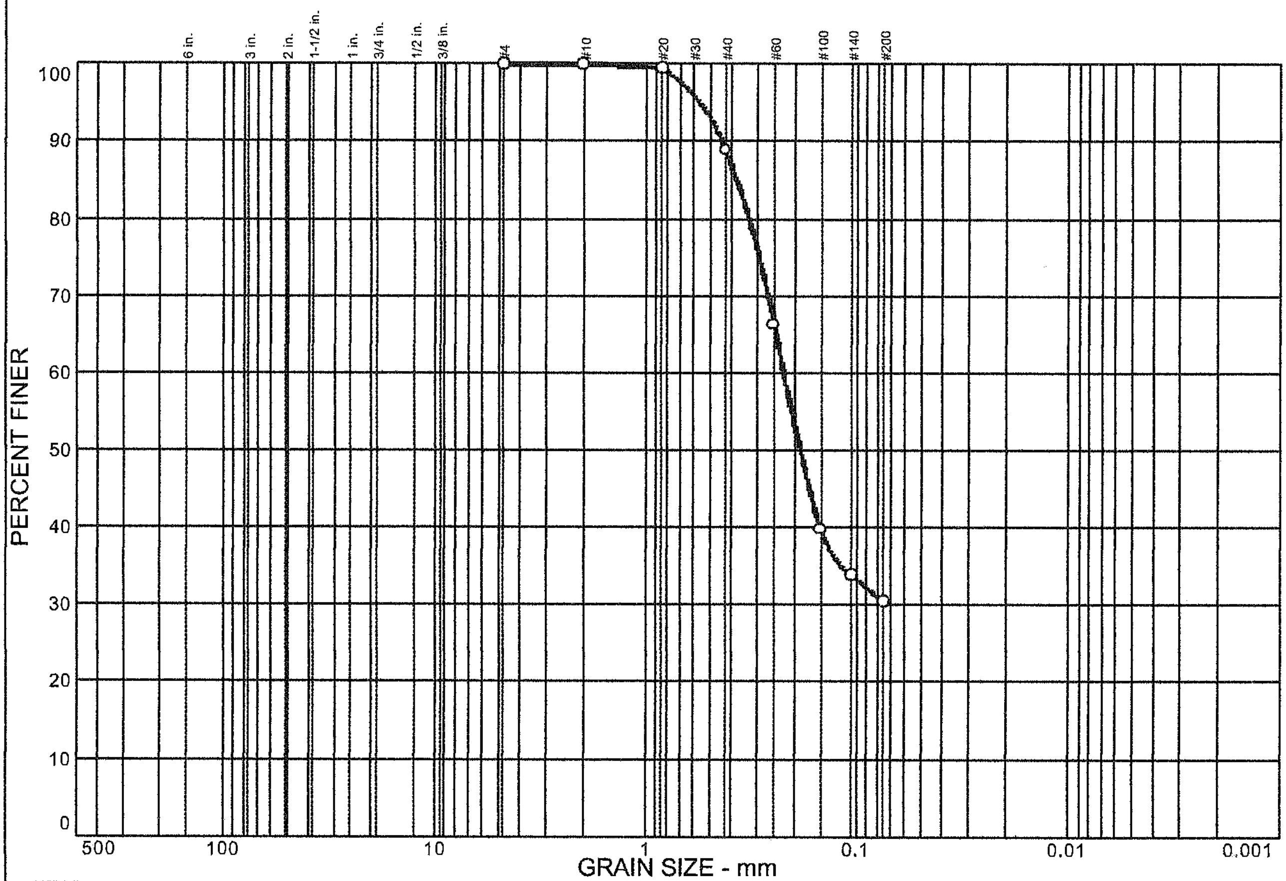
R VALUE TEST REPORT
CAL-301



Date: 4/9/03
Project Name: East Garrison - Phase I
Project Number: 5866.3.001.01
Sample: TP-3
Description: Yellowish brown silty Sand

Specimen	A	B	C
Exudation Pressure, p.s.i.	407	358	169
Expansion dial (.0001")	0	0	0
Expansion Pressure, p.s.f.	0	0	0
Resistance Value, "R"	67	64	59
% Moisture at Test	7.7	8.6	9.5
Dry Density at Test, p.c.f.	121.7	119.2	116.8
"R" Value at 300 p.s.i., Exudation Pressure		61	

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	69.6	30.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.5		
#40	88.9		
#60	66.3		
#100	39.8		
#140	33.8		
#200	30.4		

* (no specification provided)

Soil Description

Brown fine silty fine Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.376 D_{60}= 0.224 D_{50}= 0.188
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

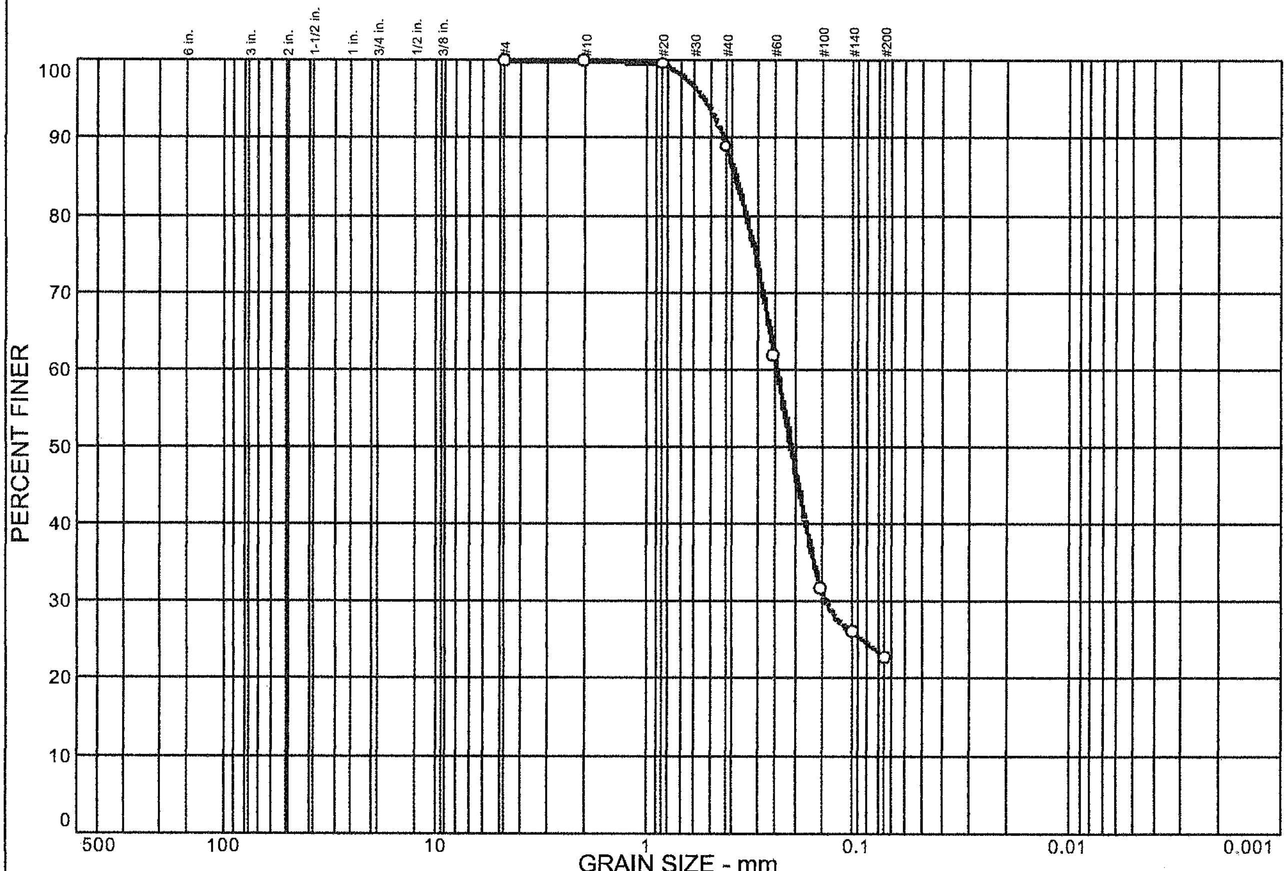
Remarks

Sample No.: 2-1 **Source of Sample:** W.S. **Date:** 04-12-03
Location: **Elev./Depth:** 2 to 2.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	77.3	22.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.6		
#40	88.9		
#60	61.7		
#100	31.7		
#140	26.0		
#200	22.7		

* (no specification provided)

Soil Description

Brown silty fine Sand.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.383 D_{60}= 0.244 D_{50}= 0.210
D_{30}= 0.142 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

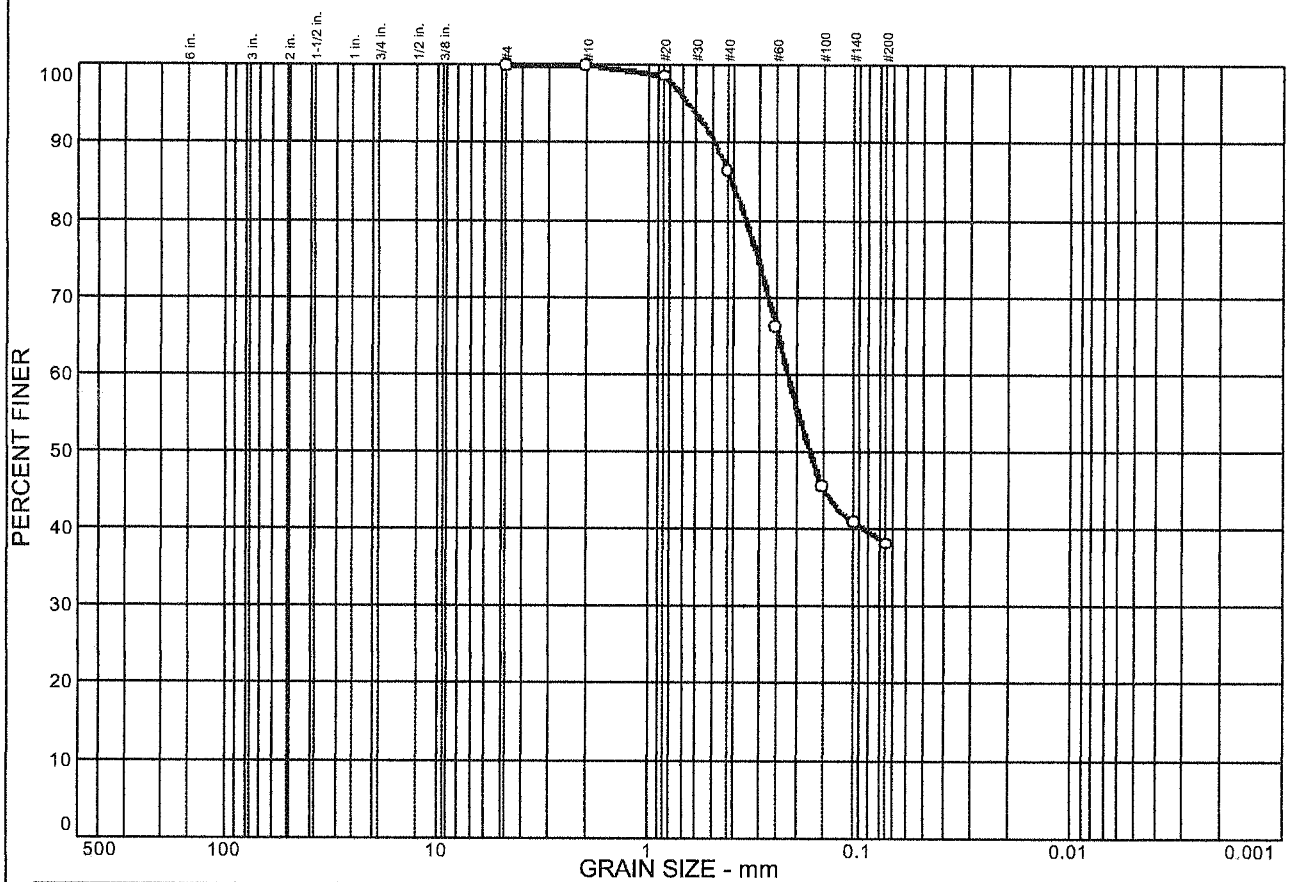
Remarks

Sample No.: 3-1 **Source of Sample:** W.S. **Date:** 04-12-03
Location: **Elev./Depth:** 2 to 2.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	61.9	38.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	98.6		
#40	86.3		
#60	66.1		
#100	45.5		
#140	40.9		
#200	38.1		

* (no specification provided)

Soil Description

Brown silty fine Sand.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.407 D_{60}= 0.219 D_{50}= 0.173
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

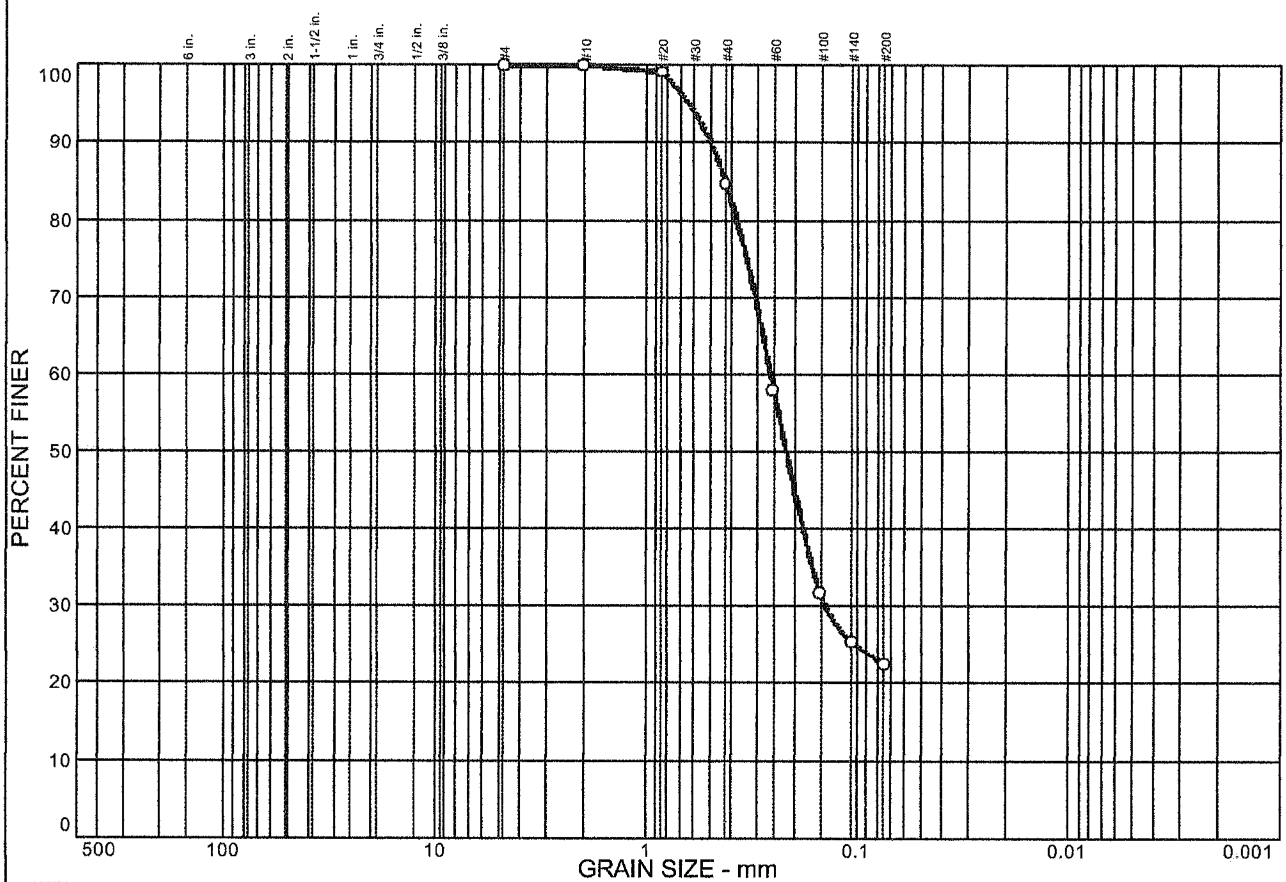
Remarks

Sample No.: 4-1 **Source of Sample:** W.S. **Date:** 04-12-04
Location: **Elev./Depth:** 3 to 3.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	77.6	22.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.1		
#40	84.7		
#60	57.8		
#100	31.6		
#140	25.4		
#200	22.4		

* (no specification provided)

Soil Description

Dark yellowish brown silty Sand

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.428 D_{60}= 0.260 D_{50}= 0.219
D_{30}= 0.142 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

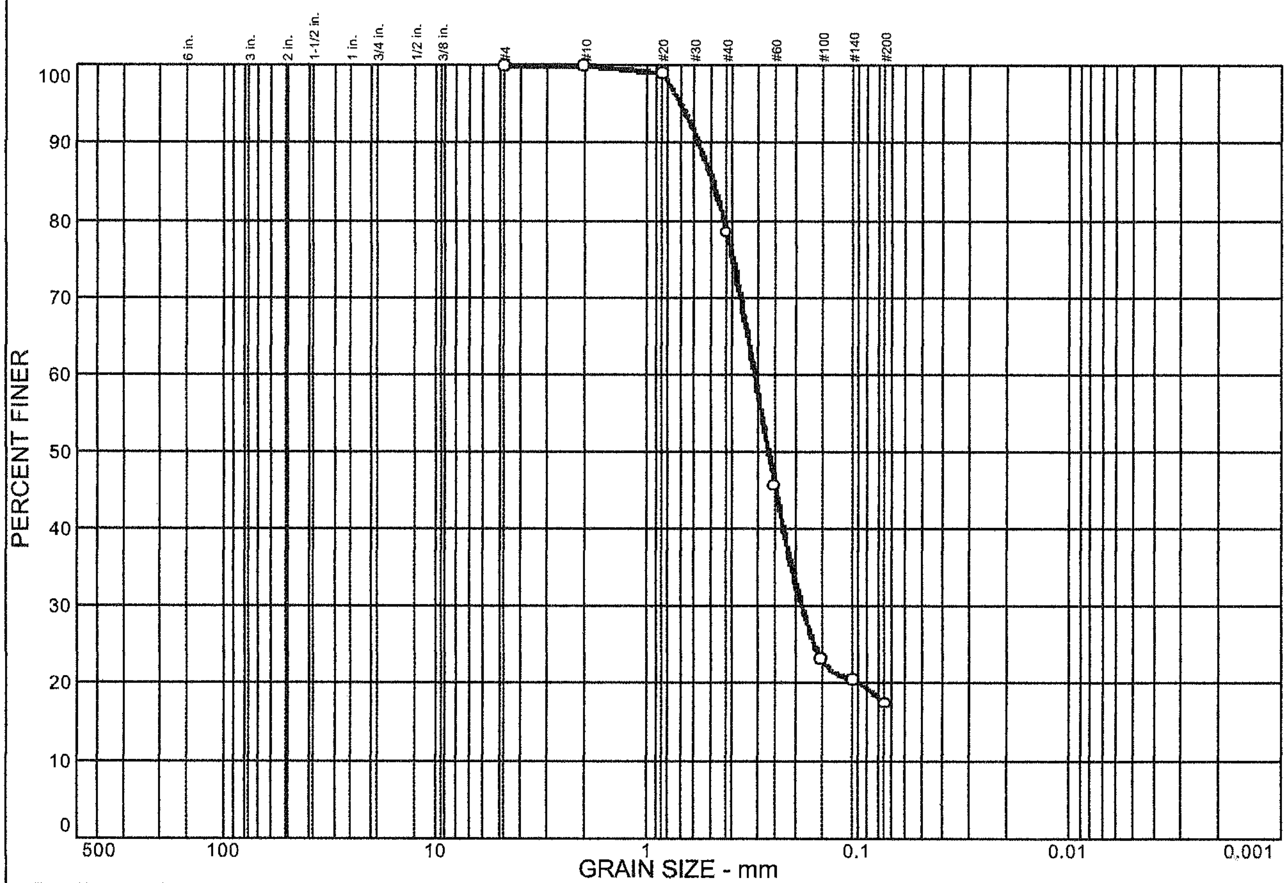
Remarks

Sample No.: 6-2 **Source of Sample:** W.S. **Date:** 04-12-03
Location: **Elev./Depth:** 4 to 4.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	82.6	17.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.0		
#40	78.4		
#60	45.6		
#100	23.2		
#140	20.5		
#200	17.4		

* (no specification provided)

Soil Description

Yellowish brown silty Sand

Atterberg Limits

PL= 14 LL= 9 PI= NP

Coefficients

D_{85}= 0.494 D_{60}= 0.312 D_{50}= 0.268
D_{30}= 0.186 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

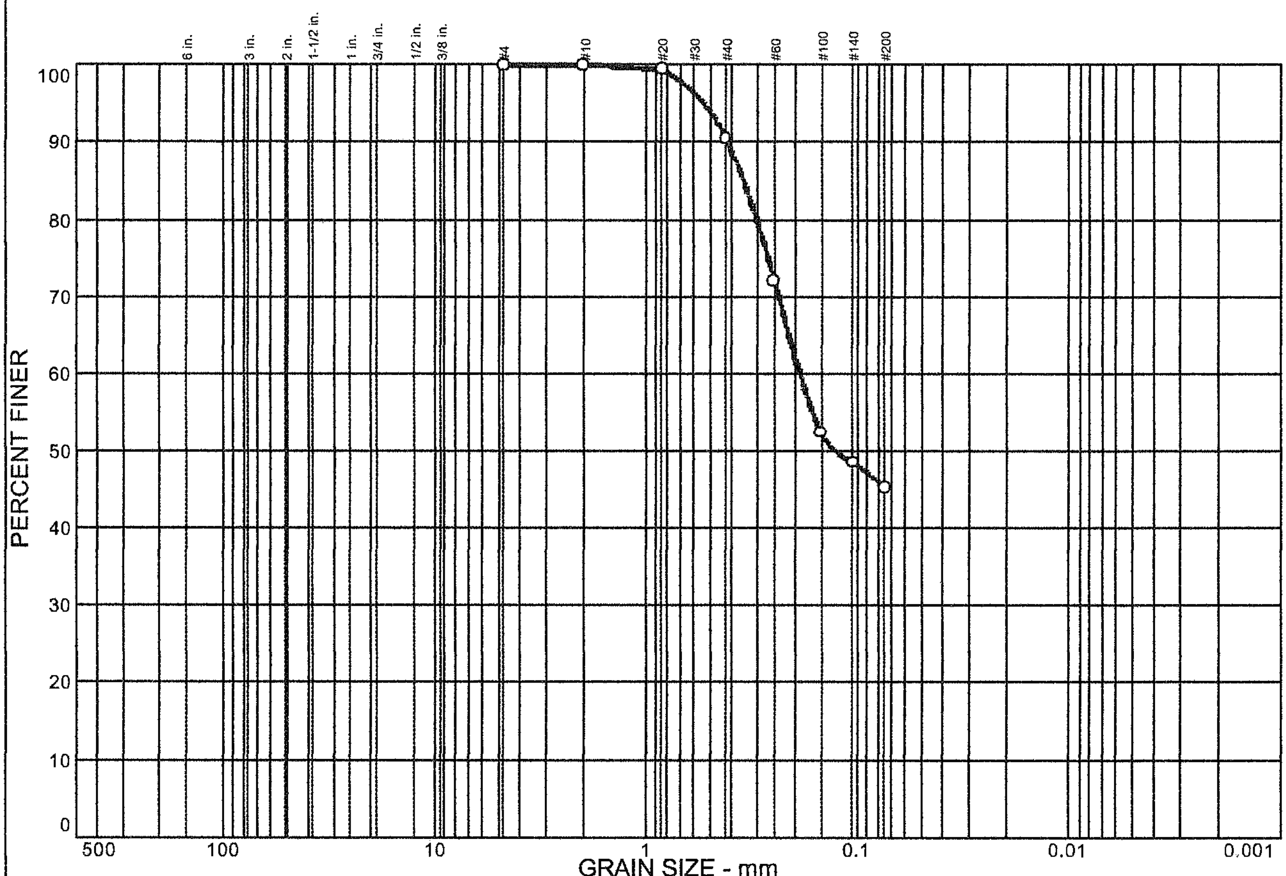
Remarks

Sample No.: 10-1 **Source of Sample:** W.S. **Date:** 04-12-03
Location: **Elev./Depth:** 2 to 2.5 ft.

ENGEO INCORPORATED
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	54.7	45.3	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	99.4		
#40	90.5		
#60	72.0		
#100	52.4		
#140	48.5		
#200	45.3		

* (no specification provided)

Soil Description

Very dark brown silty Sand

Atterberg Limits

PL= 11 LL= 13 PI= 2

Coefficients

D_{85}= 0.351 D_{60}= 0.190 D_{50}= 0.129
D_{30}= D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

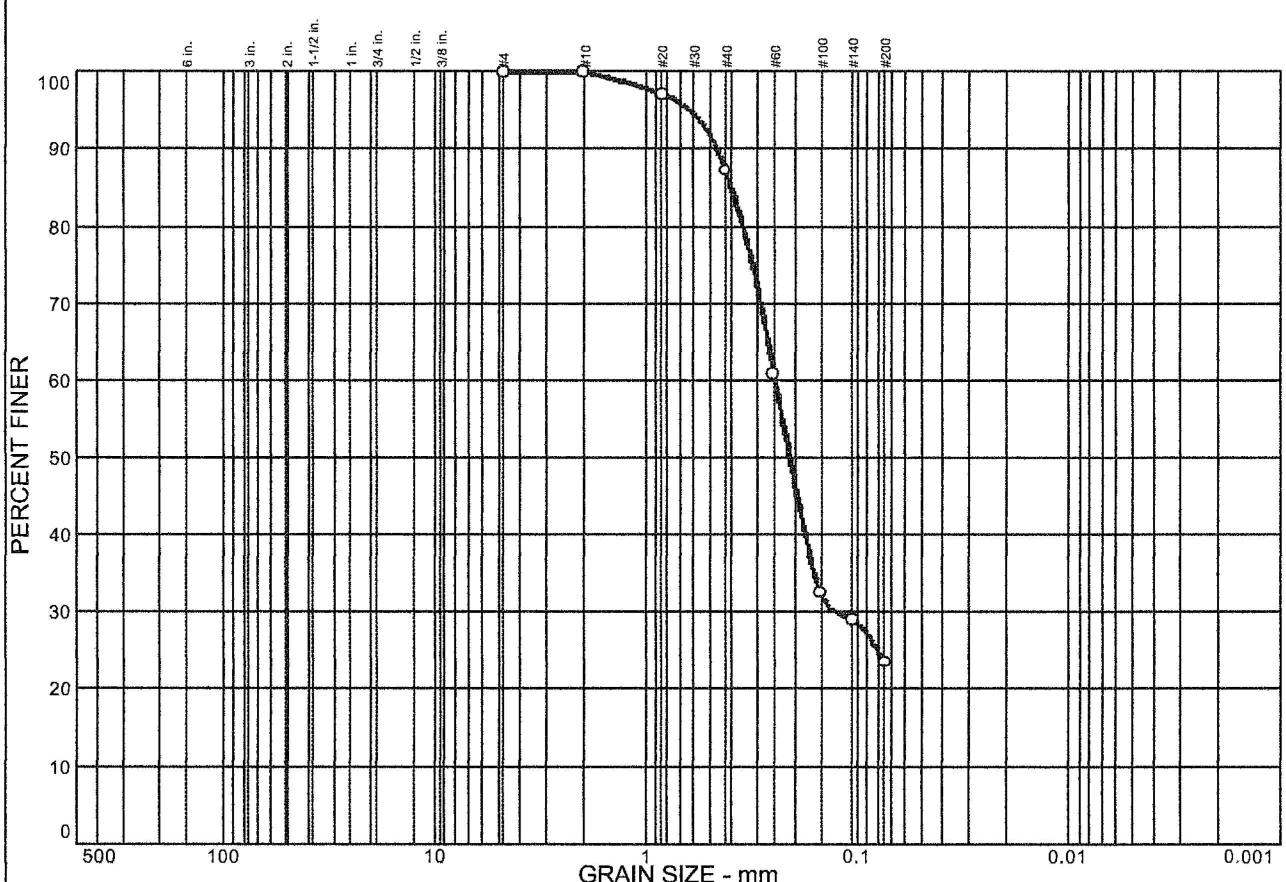
Sample No.: 11-1 **Source of Sample:** W.S. **Date:** 04-12-03
Location: **Elev./Depth:** 2 to 2.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I

Project No: 5866.3.001.01

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	76.5	23.5	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	97.1		
#40	87.2		
#60	60.8		
#100	32.5		
#140	29.0		
#200	23.5		

* (no specification provided)

Soil Description

Dark brown becoming olive brown silty Sand

Atterberg Limits

PL= 14 LL= 14 PI= NP

Coefficients

D_{85}= 0.399 D_{60}= 0.247 D_{50}= 0.212
D_{30}= 0.128 D_{15}= D_{10}=
C_u= C_c=

Classification

USCS= SM AASHTO=

Remarks

Sample No.: 13-1 **Source of Sample:** W.S. **Date:** 04-12-03
Location: **Elev./Depth:** 2 to 2.5 ft.

ENGEO INCORPORATED — GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS, MATERIALS TESTING

Client:
Project: East Garrison - Phase I
Project No: 5866.3.001.01

APPENDIX C

Select Preliminary Slope Stability Analysis Results

Sections 1, 2, 3, 4, 5, 6 (Static and Seismic Conditions)

Existing Condition
2:1 Line of Projection
2.5:1 Line of Projection

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

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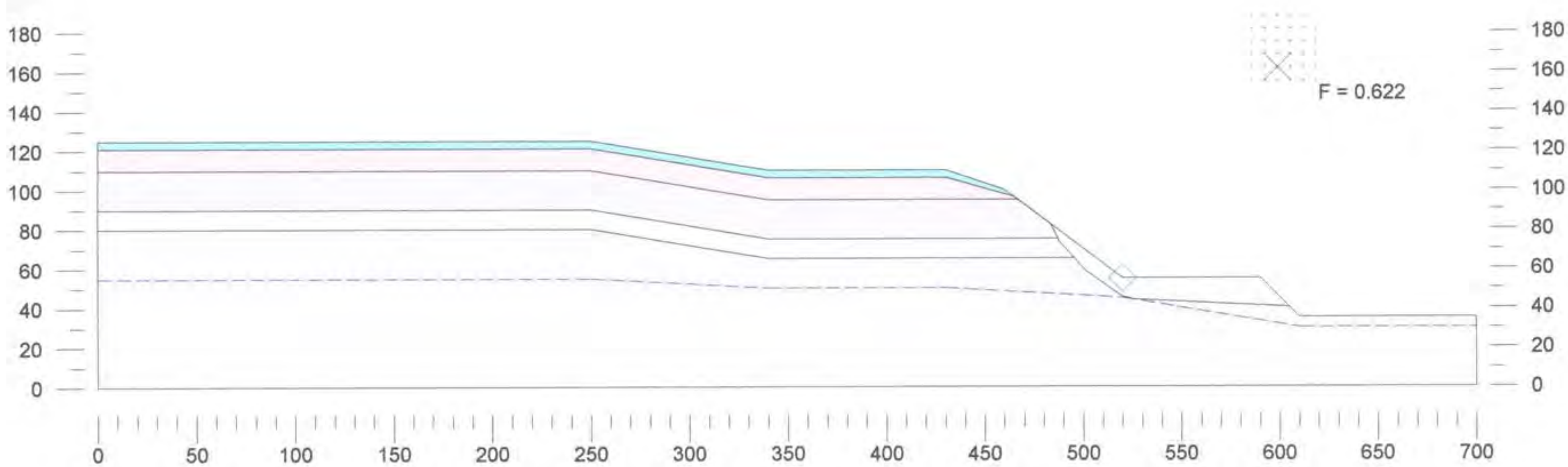
Section 1
Existing Grade



4/28/2003 2:27:34 PM G:\DRAFTI~1\5866\GSLOPE\SEC1\EXISTING\SEC1E1.GSL ENGEO Incorporated - San Ramon, CA F = 0.622

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

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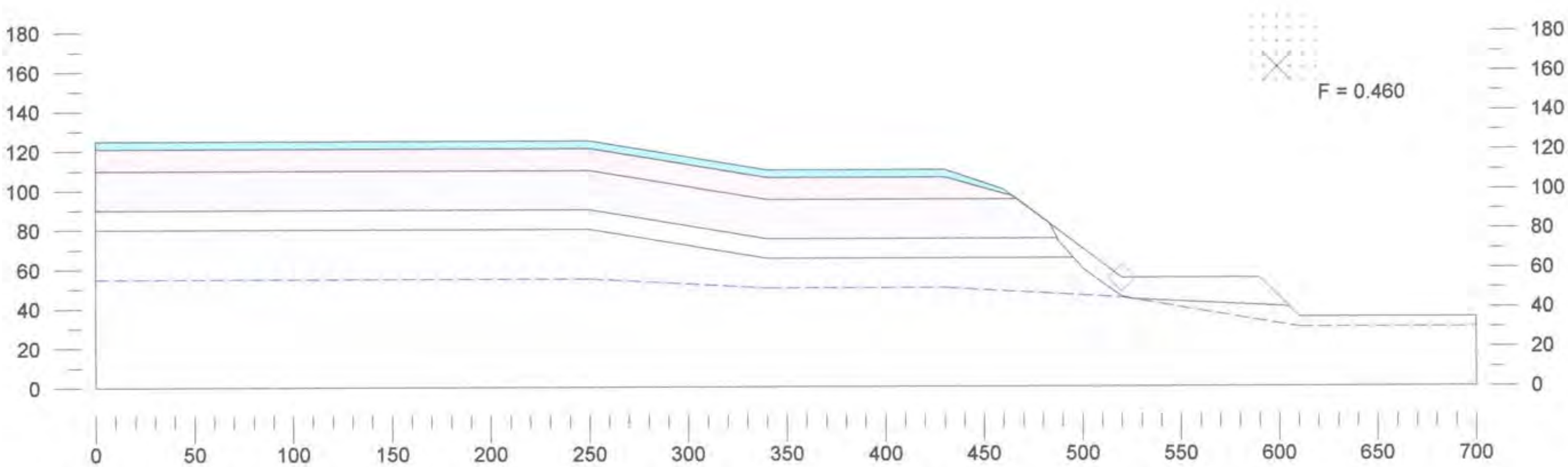
4/14/03
Section 1
Existing Grade, Seismic



4/28/2003 2:27:21 PM G:\DRAFTI~1\5866\GSLOPE\SEC1\EXISTING\SEC1E2.GSL ENGEO Incorporated - San Ramon, CA F = 0.460

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

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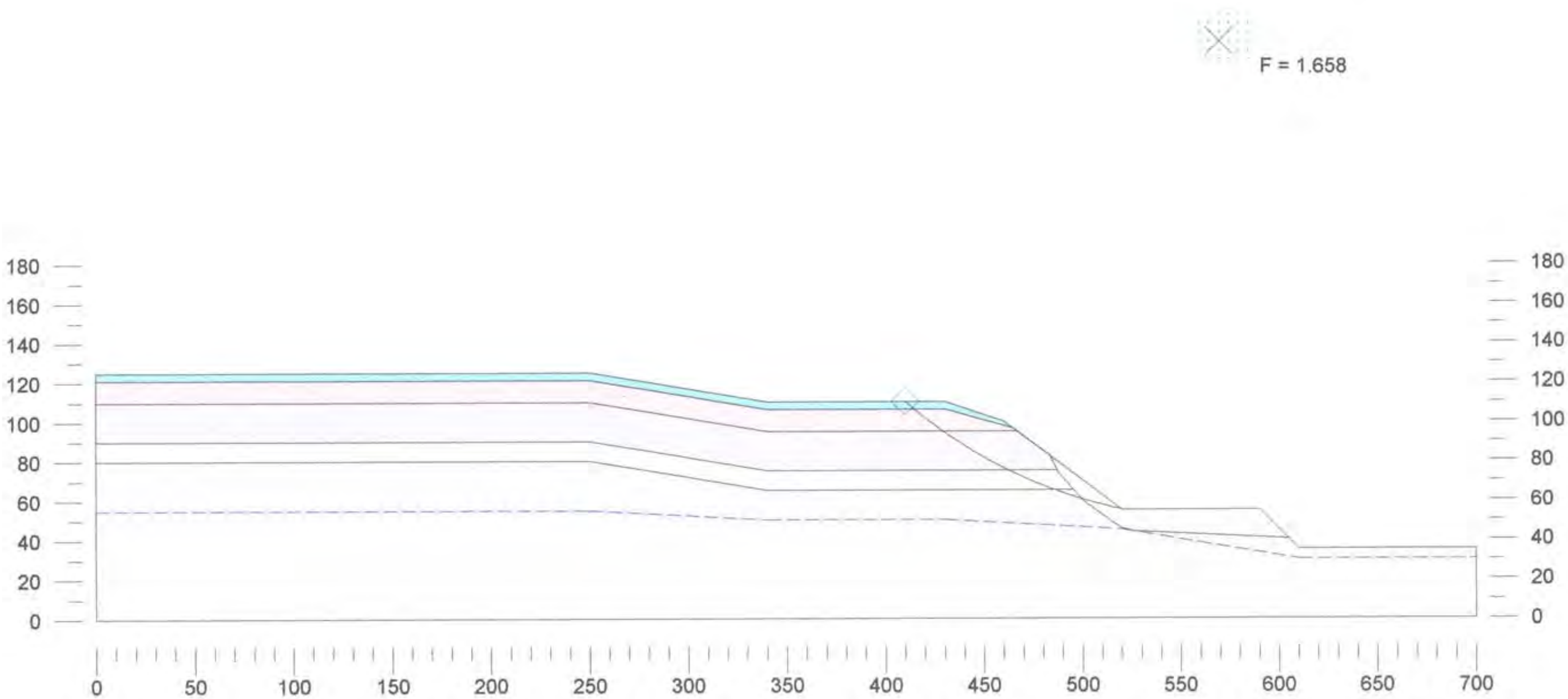
East Garrison
4/14/03
Section 1
Existing Grade, HP at 2:1



4/28/2003 2:28:01 PM G:\DRAFTI~1\5866\GSLOPE\SEC1\PROPOSED\SEC1P1.GSL ENGEO Incorporated - San Ramon, CA F = 1.658

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

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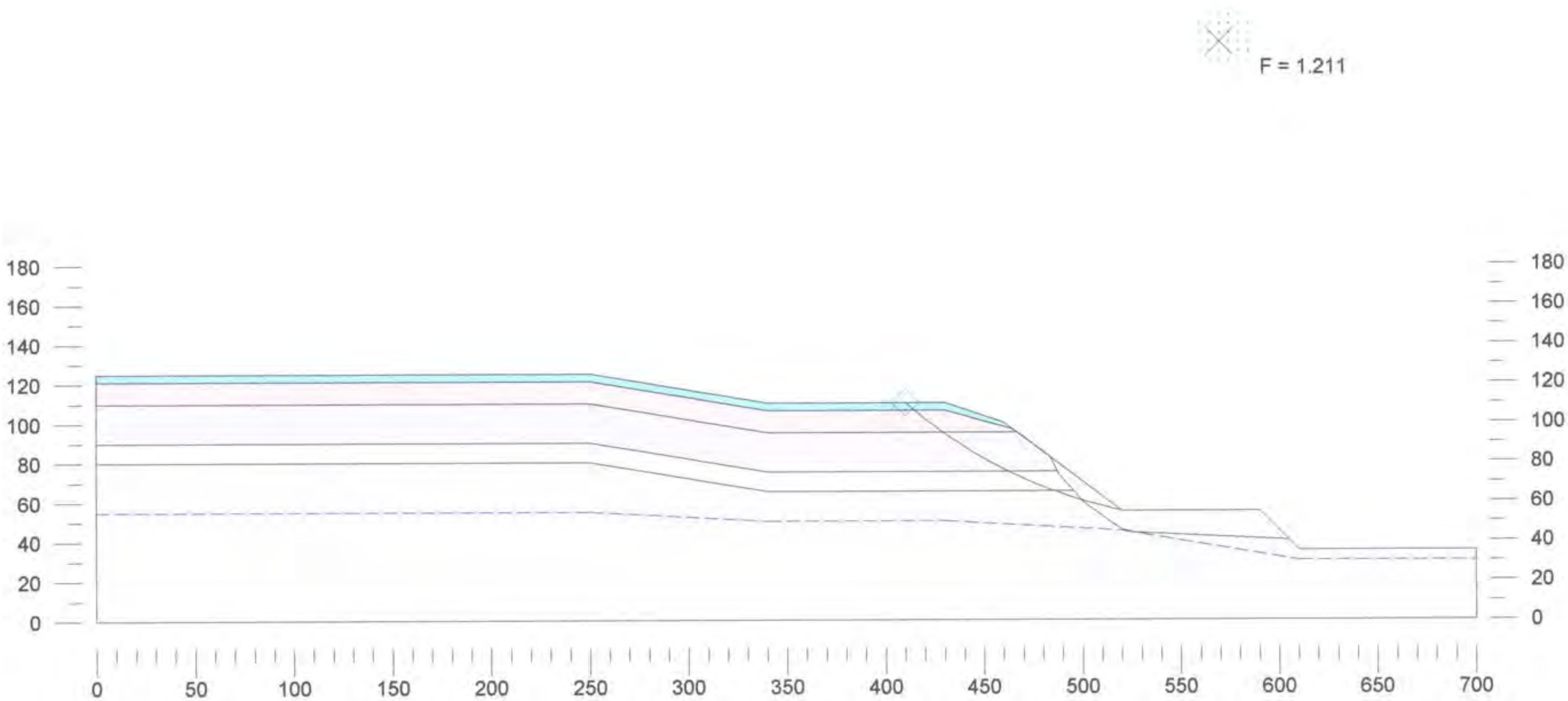
East Garrison
4/14/03
Section 1
Existing Grade, HP at 2:1, Seismic



4/28/2003 2:30:13 PM G:\DRAFTI~1\5866\GSLOPE\SEC1\PROPOSED\SEC1P3.GSL ENGEO Incorporated - San Ramon, CA F = 1.211

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

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East Garrison
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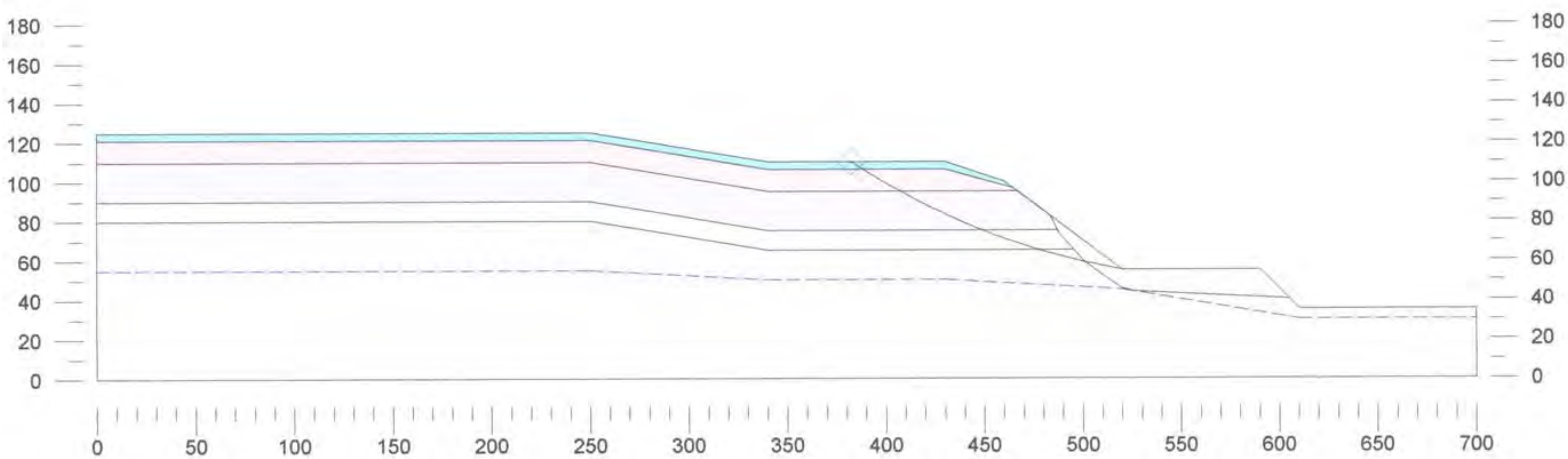
Section 1
Existing Grade, HP at 2.5:1

F = 2.009



4/28/2003 2:29:22 PM G:\DRAFTI~1\5866\GSLOPE\SEC1\PROPOSED\SEC1P2.GSL ENGEO Incorporated - San Ramon, CA F = 2.009

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

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East Garrison
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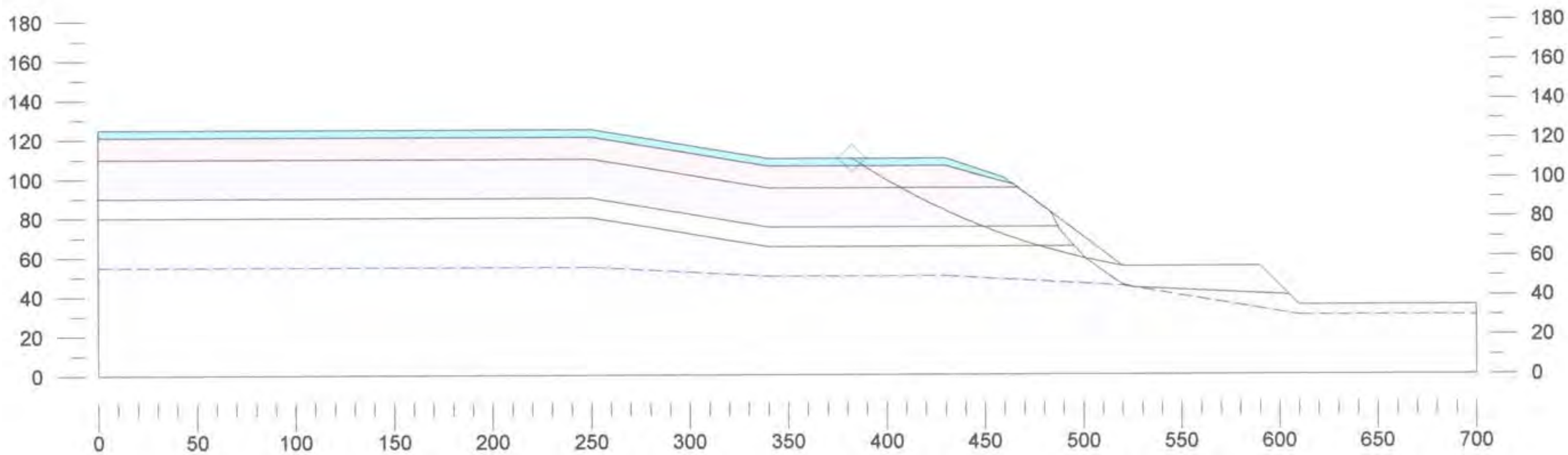
Section 1
Existing Grade, HP at 2.5:1, Seismic

F = 1.395



4/28/2003 2:30:40 PM G:\DRAFTI~1\5866\GSLOPE\SEC1\PROPOSED\SEC1P4.GSL ENGEO Incorporated - San Ramon, CA F = 1.395

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

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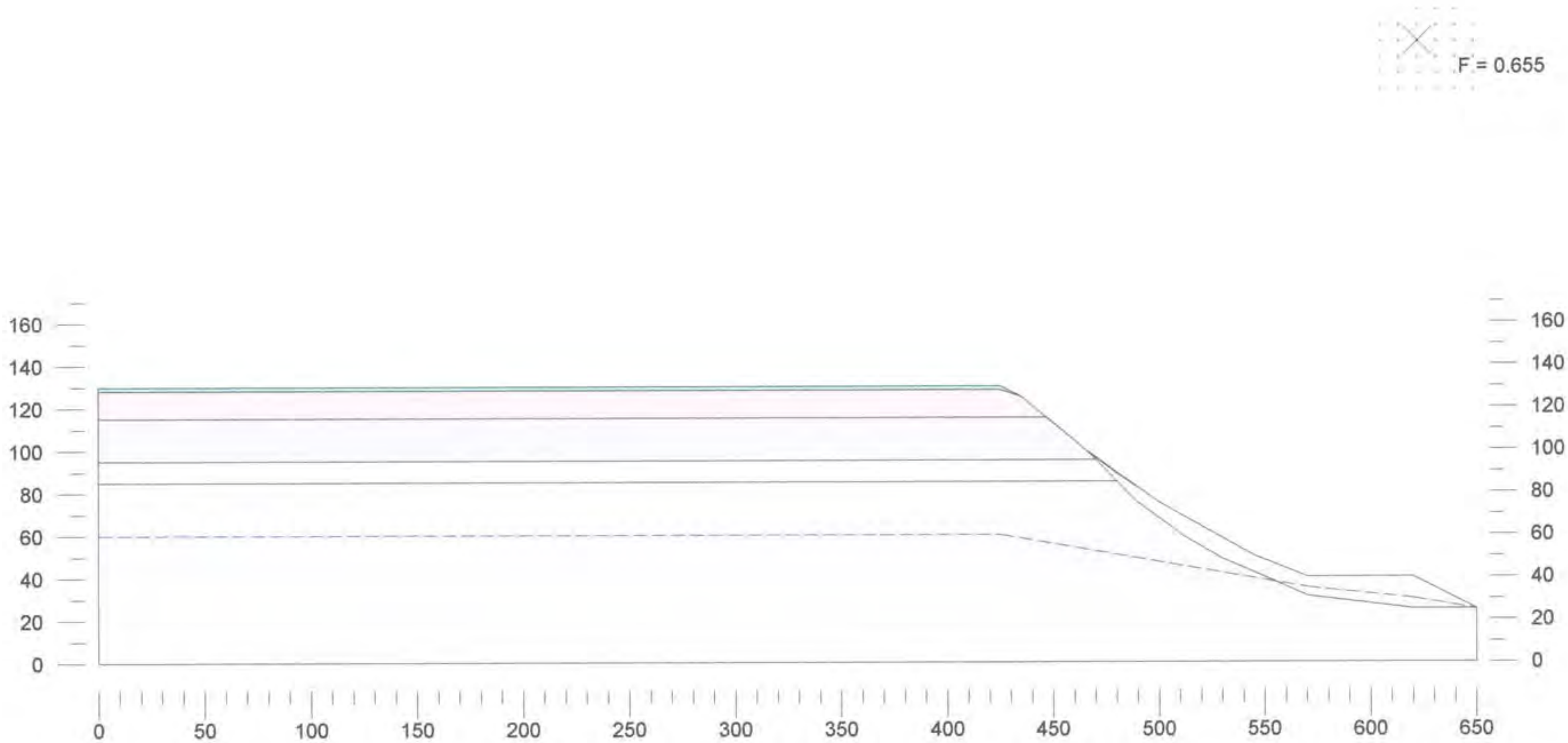
East Garrison
4/14/03
Section 2
Existing Grade



4/28/2003 2:37:48 PM G:\DRAFTI~1\5866\GSLOPE\SEC2\EXISTING\SEC2E1.GSL ENGEO Incorporated - San Ramon, CA F = 0.655

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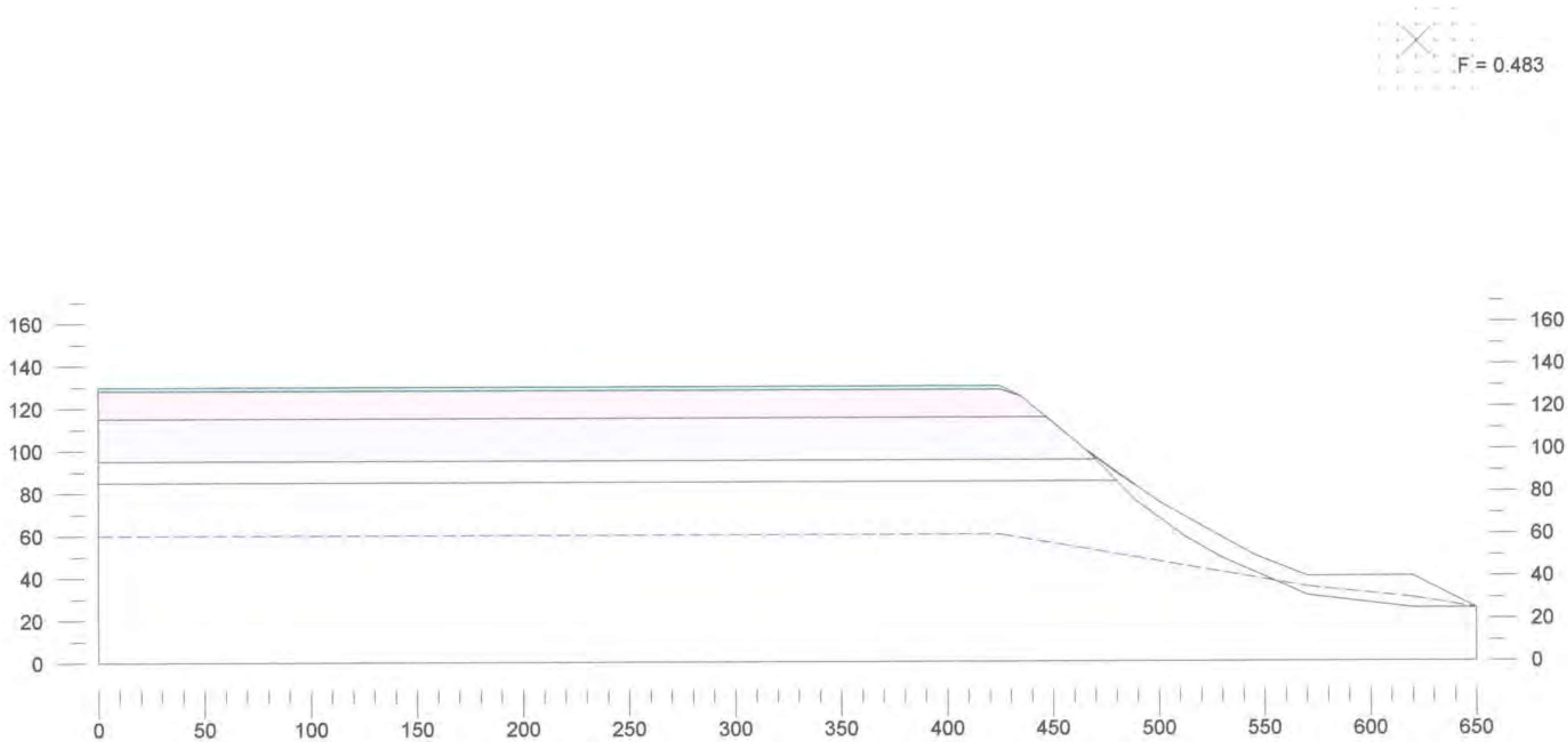
East Garrison
4/14/03
Section 2
Existing Grade, Seismic

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15



4/28/2003 2:38:37 PM G:\DRAFTI~1\5866\GSLOPE\SEC2\EXISTING\SEC2E3.GSL ENGEO Incorporated - San Ramon, CA F = 0.483

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

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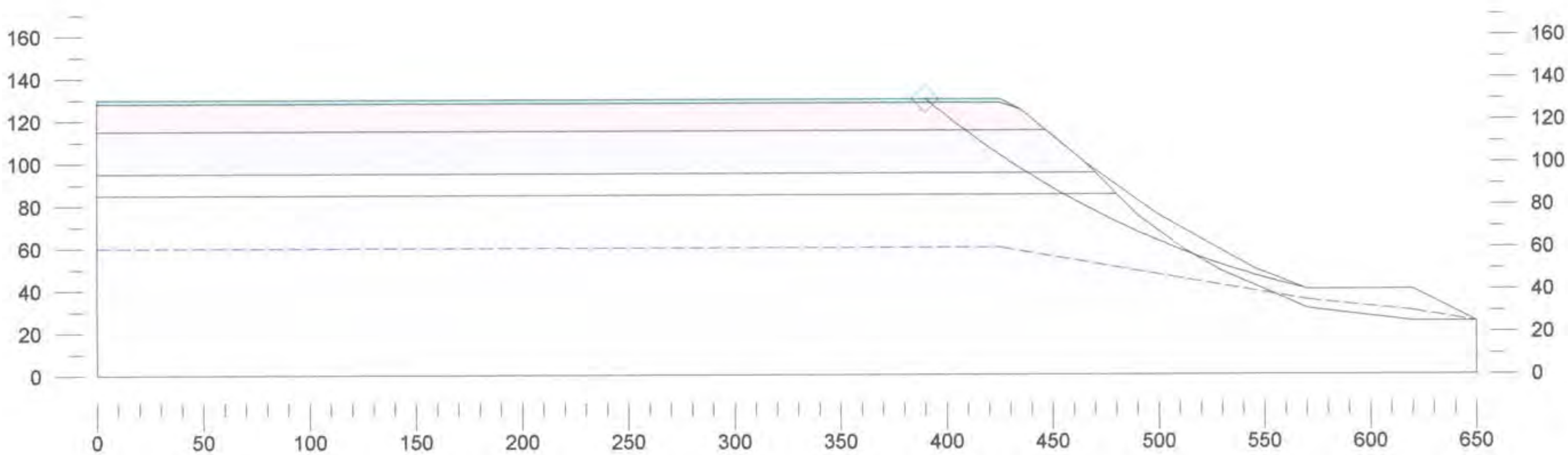
East Garrison
4/14/03
Section 2
Existing Grade, HP at 2:1

F = 1.442



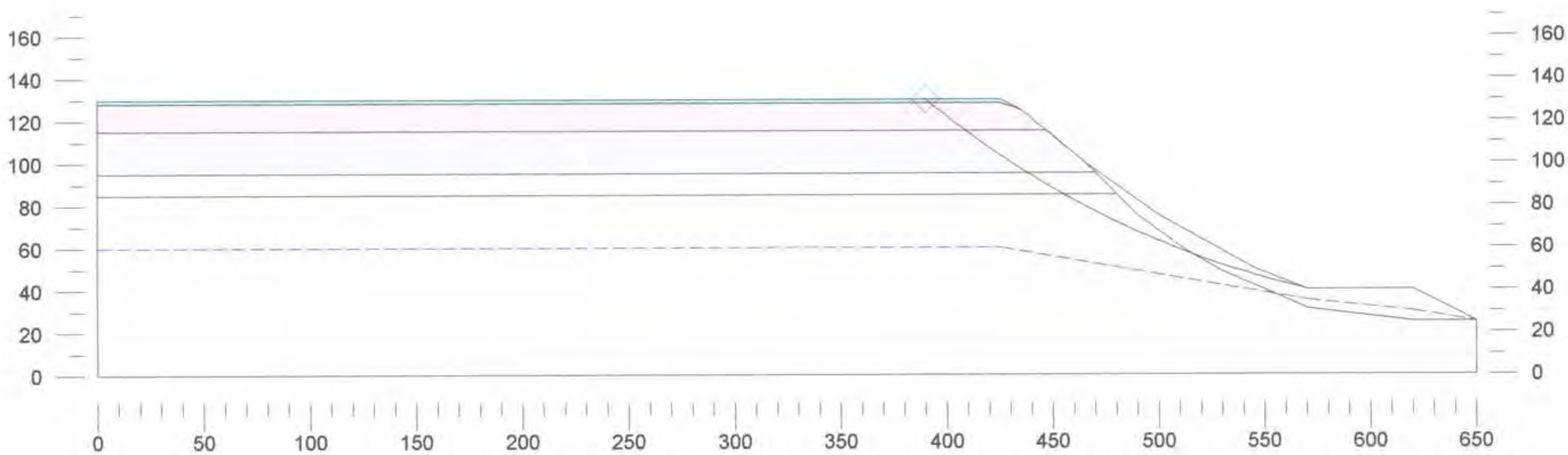
4/28/2003 2:40:09 PM G:\DRAFTI~1\5866\GSLOPE\SEC2\PROPOSED\SEC2P1.GSL ENGEO Incorporated - San Ramon, CA F = 1.442

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 2
Existing Grade, HP at 2:1, Seismic

F = 1.055



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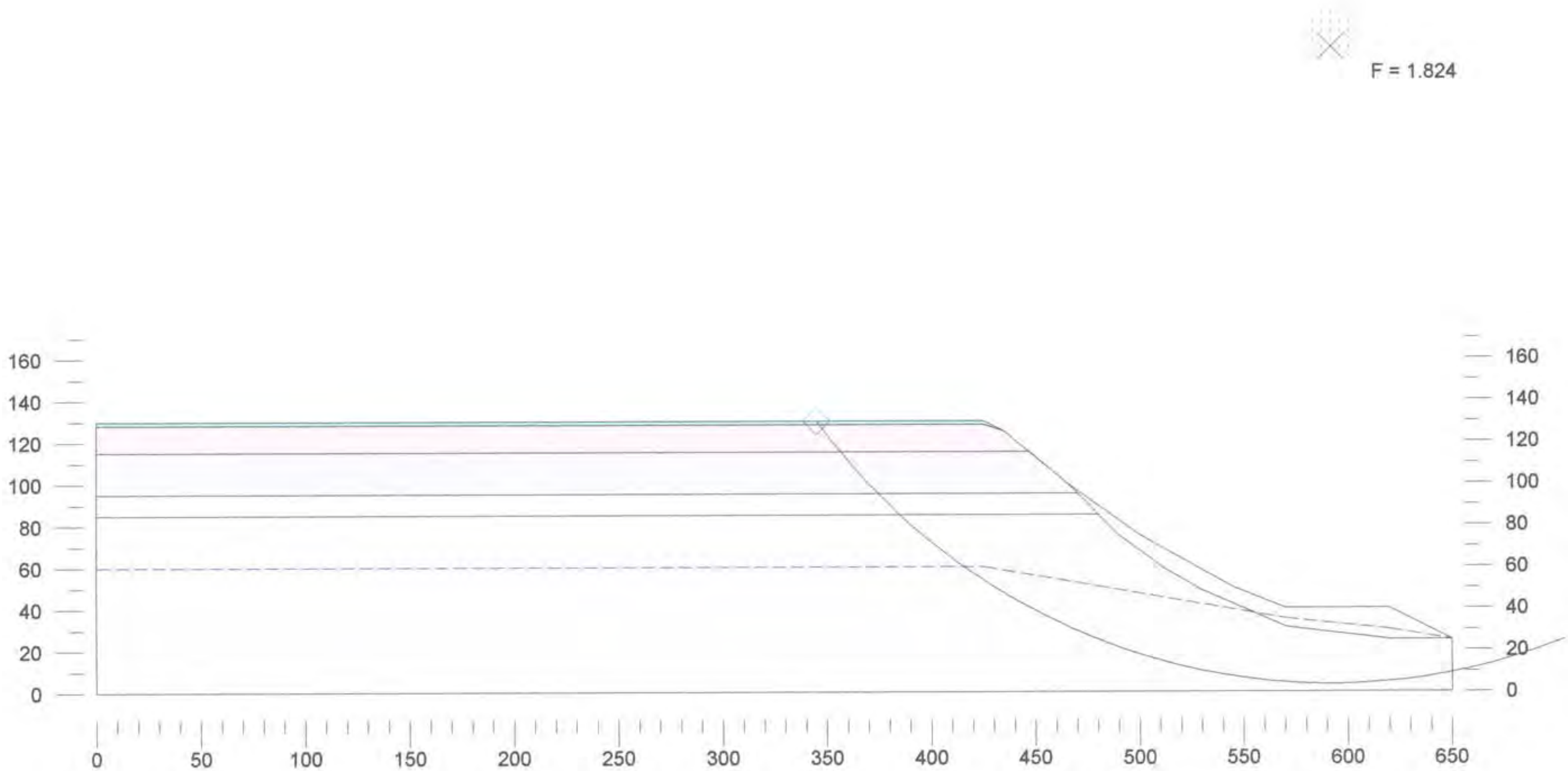
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 2
Existing Grade, HP at 2.5:1

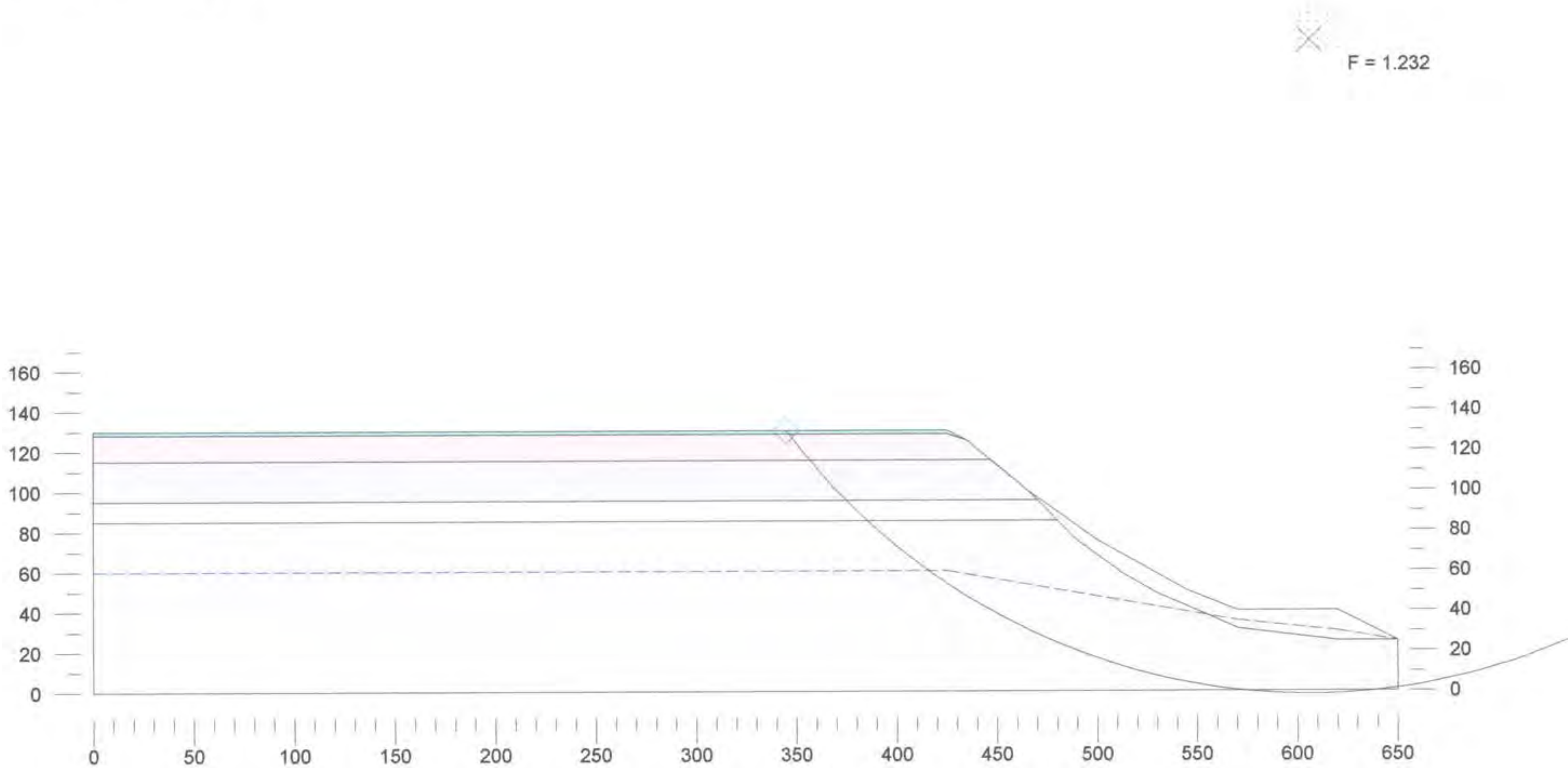


4/28/2003 2:41:40 PM G:\DRAFTI~1\5866\GSLOPE\SEC2\PROPOSED\SEC2P2.GSL ENGEO Incorporated - San Ramon, CA F = 1.824

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

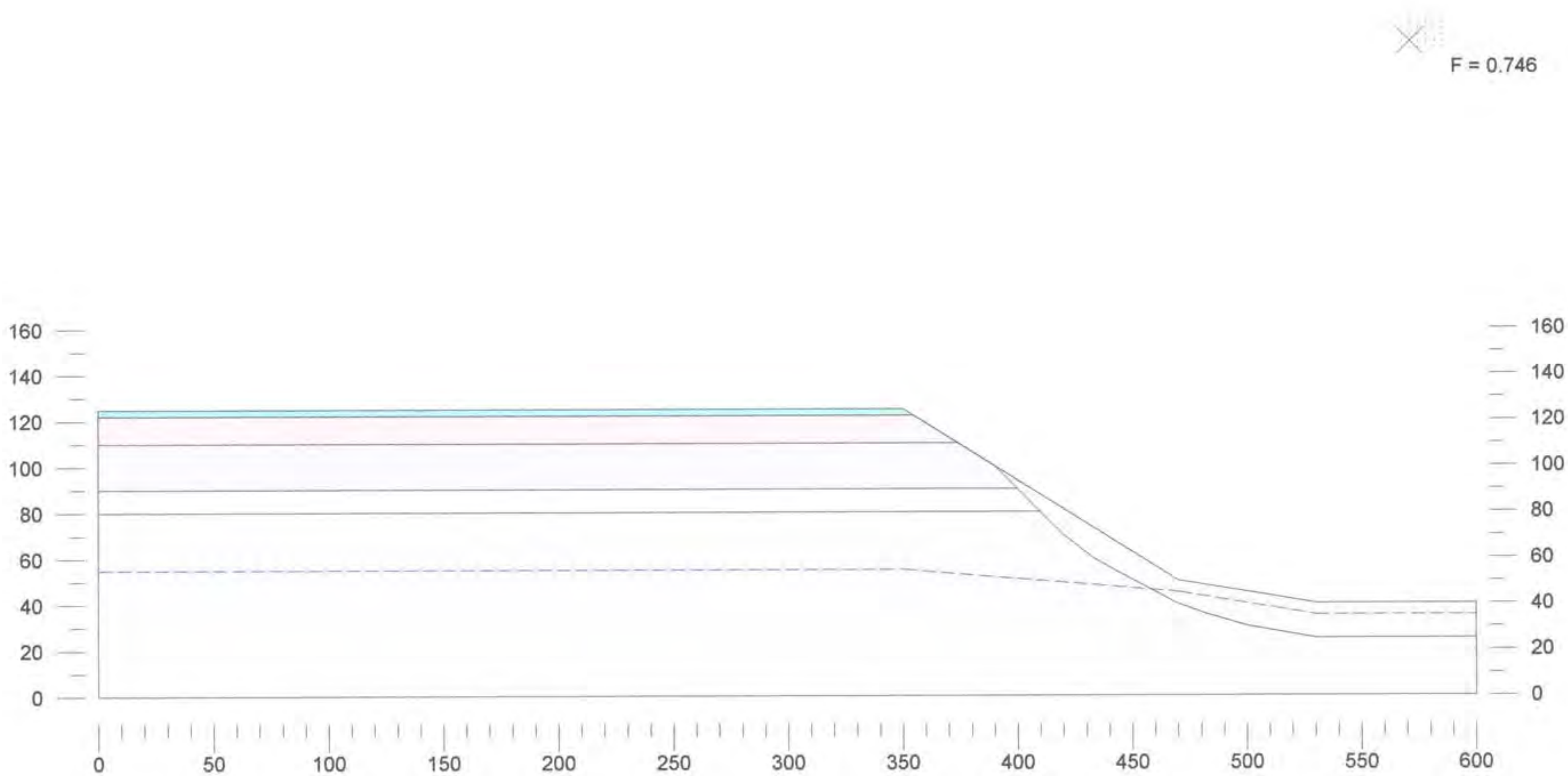
Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 2
Existing Grade, HP at 2.5:1, Seismic



	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 3
Existing Grade



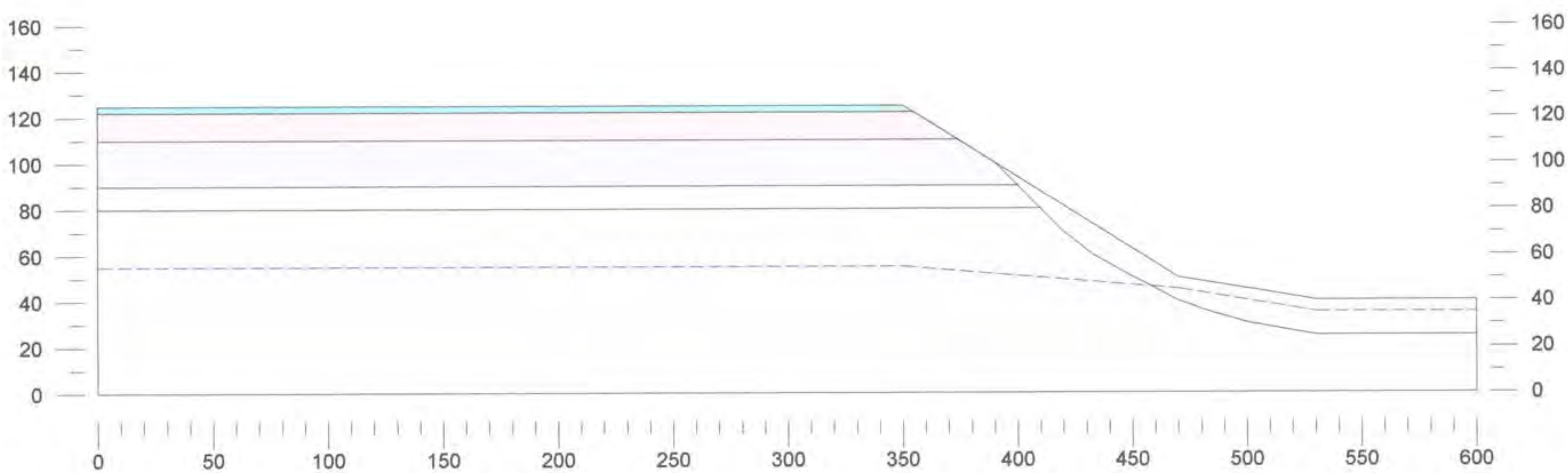
4/28/2003 2:43:49 PM G:\DRAFTI~1\5866\GSLOPE\SEC3\EXISTING\SEC3E1.GSL ENGEO Incorporated - San Ramon, CA F = 0.746

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 3
Existing Grade, Seismic

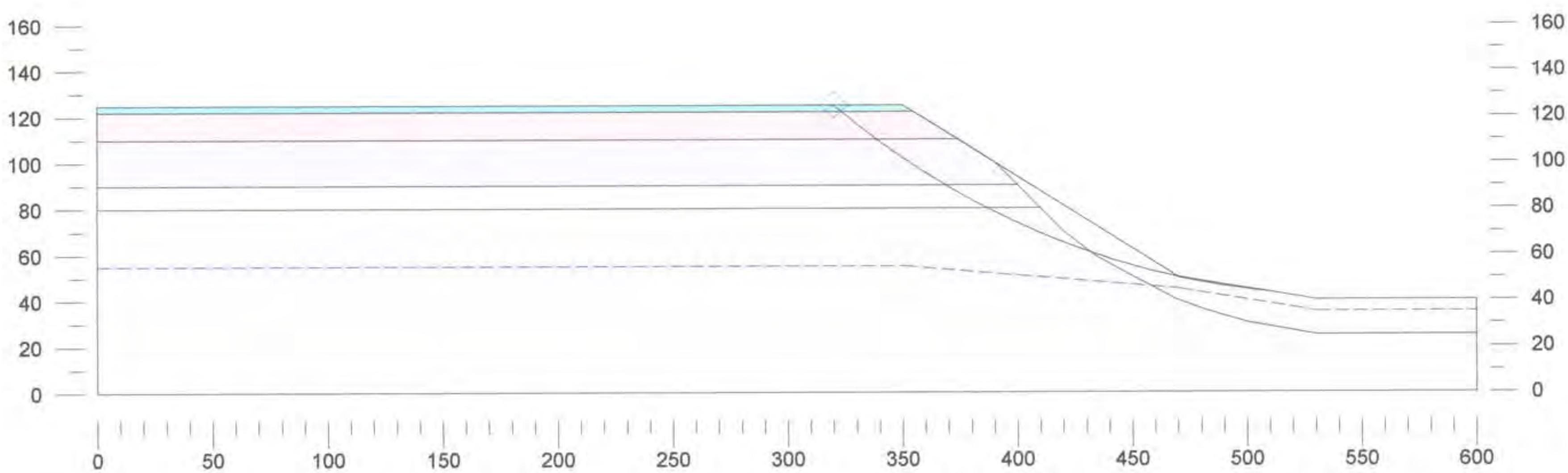
F = 0.546



4/28/2003 2:44:34 PM G:\DRAFTI~1\5866\GSLOPE\SEC3\EXISTING\SEC3E3.GSL ENGEO Incorporated - San Ramon, CA F = 0.546

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 3
Existing F = 1.533 at 2:1

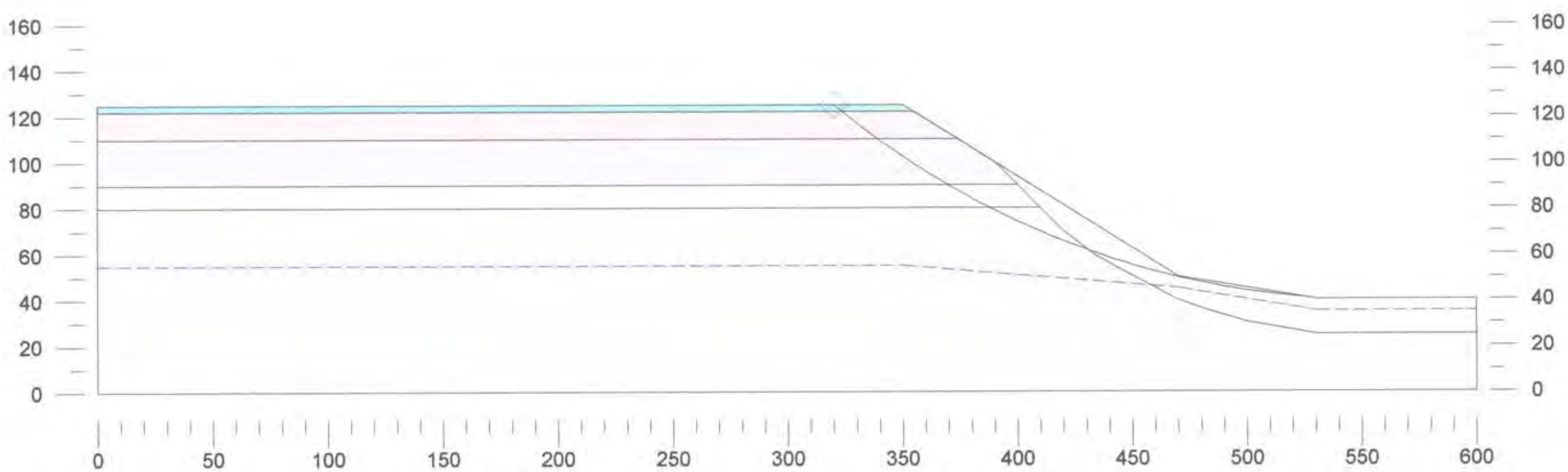


4/28/2003 2:45:22 PM G:\DRAFTI~1\5866\GSLOPE\SEC3\PROPOSED\SEC3P1.GSL ENGEO Incorporated - San Ramon, CA F = 1.533

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
F = 1.111 4/03
Section 3
Existing Grade, HP at 2:1, Seismic

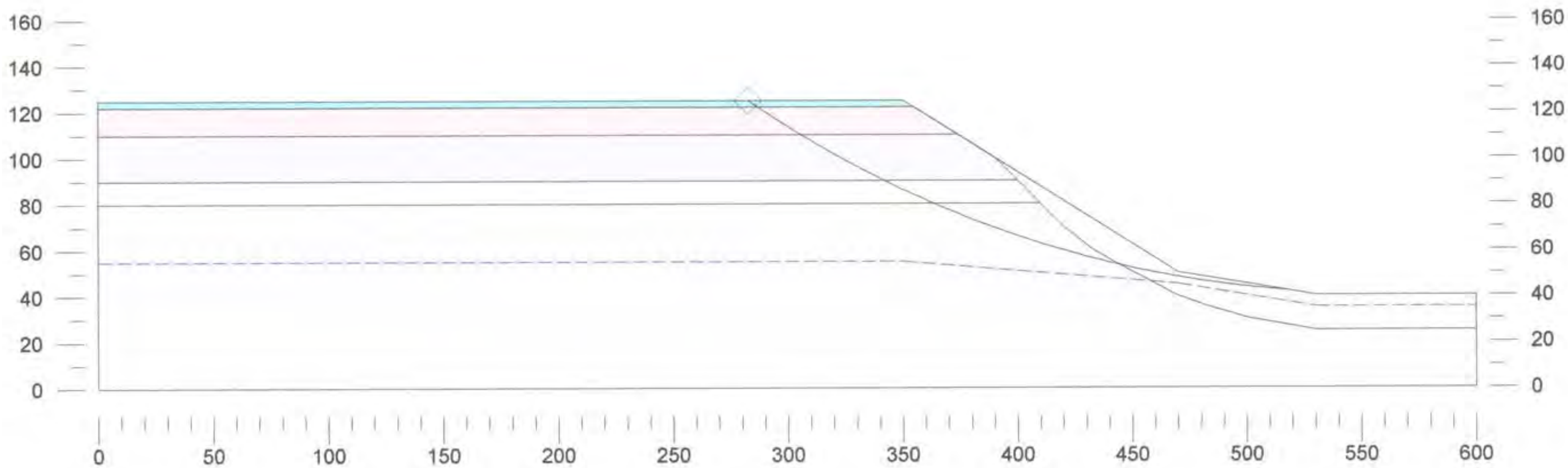


4/28/2003 2:46:14 PM G:\DRAFTI~1\5866\GSLOPE\SEC3\PROPOSED\SEC3P3.GSL ENGEO Incorporated - San Ramon, CA F = 1.111

F = 1.907

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 3
Existing Grade, HP at 2.5:1



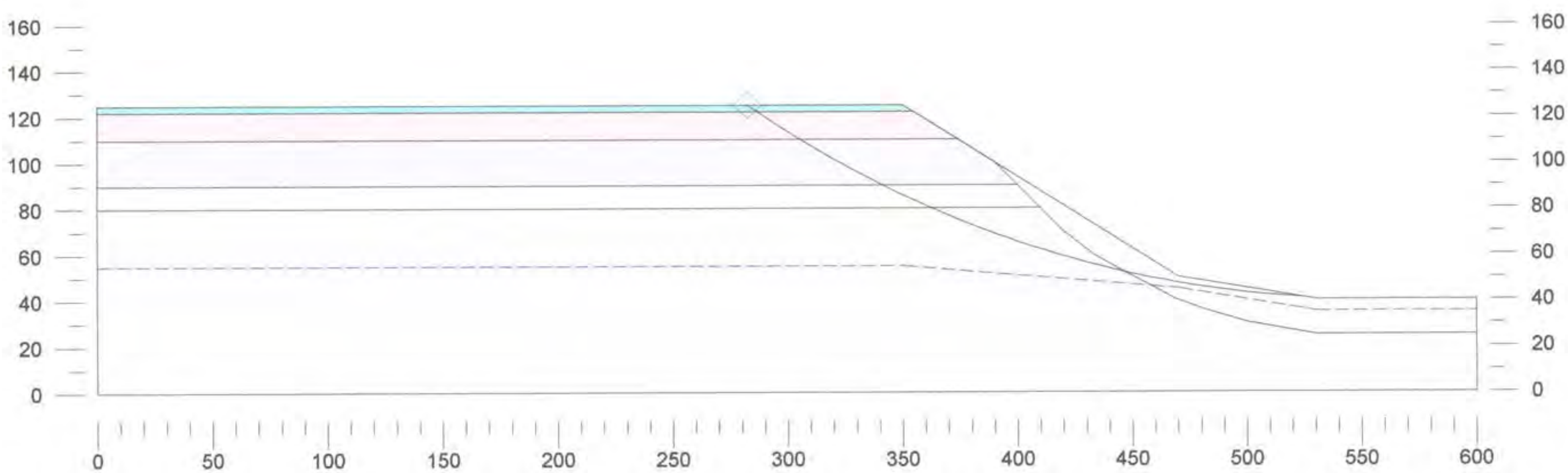
4/28/2003 2:46:54 PM G:\DRAFTI~1\5866\GSLOPE\SEC3\PROPOSED\SEC3P2.GSL ENGEO Incorporated - San Ramon, CA F = 1.907

F = 1.326

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 3
Existing Grade, HP at 2.5:1, Seismic



	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

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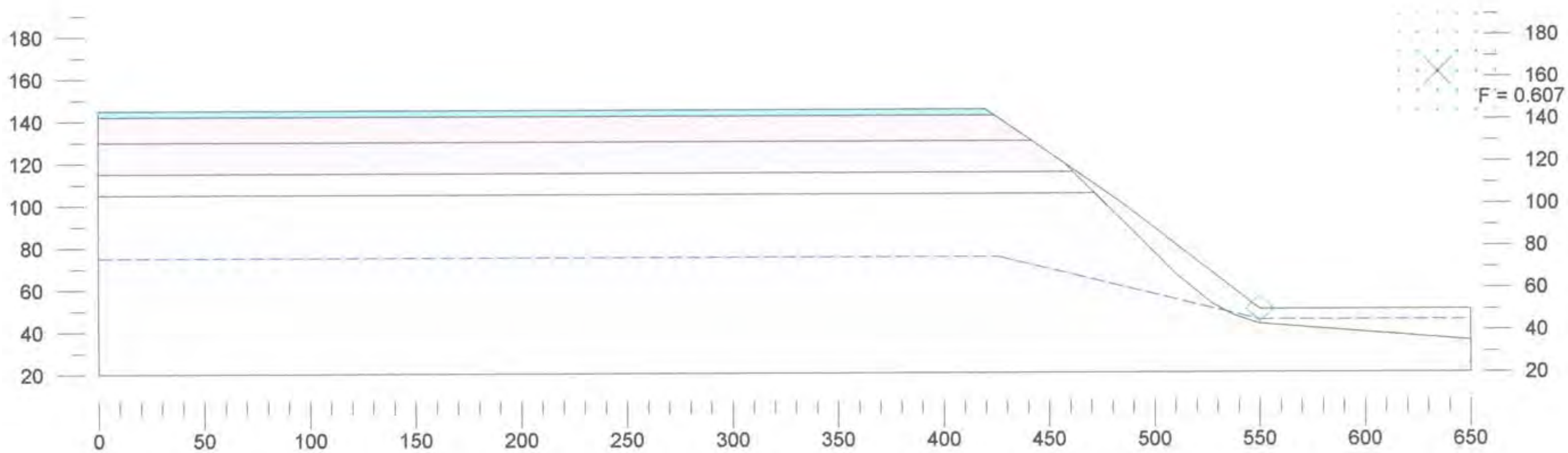
5866.3.001.01
East Garrison
4/14/03
Section 4
Existing grade



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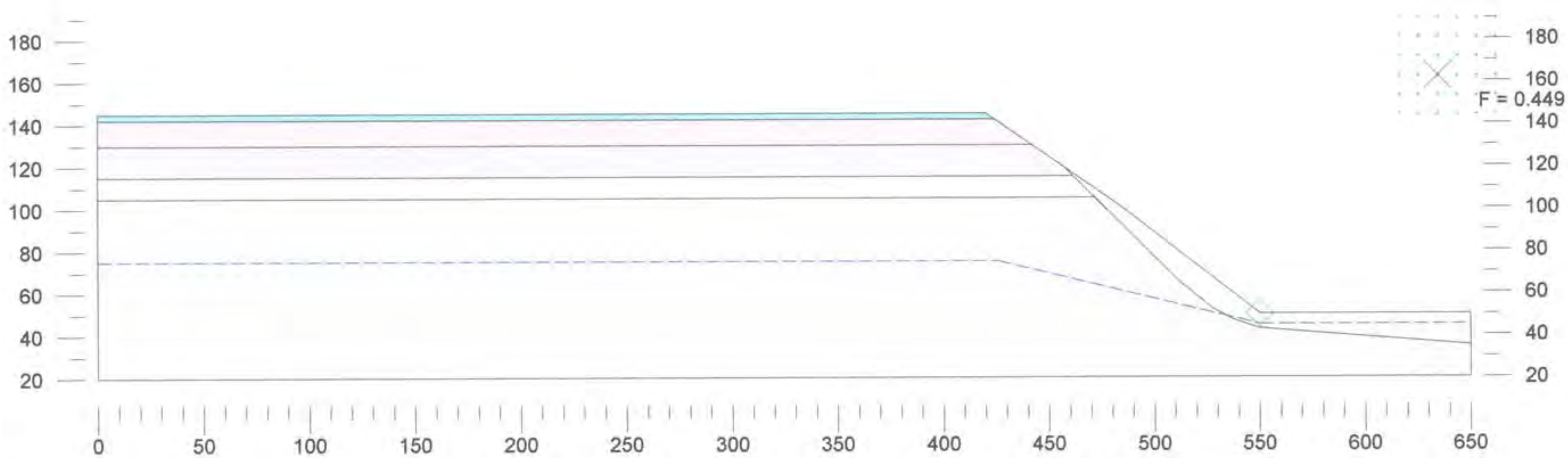
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 4
Existing grade, Seismic



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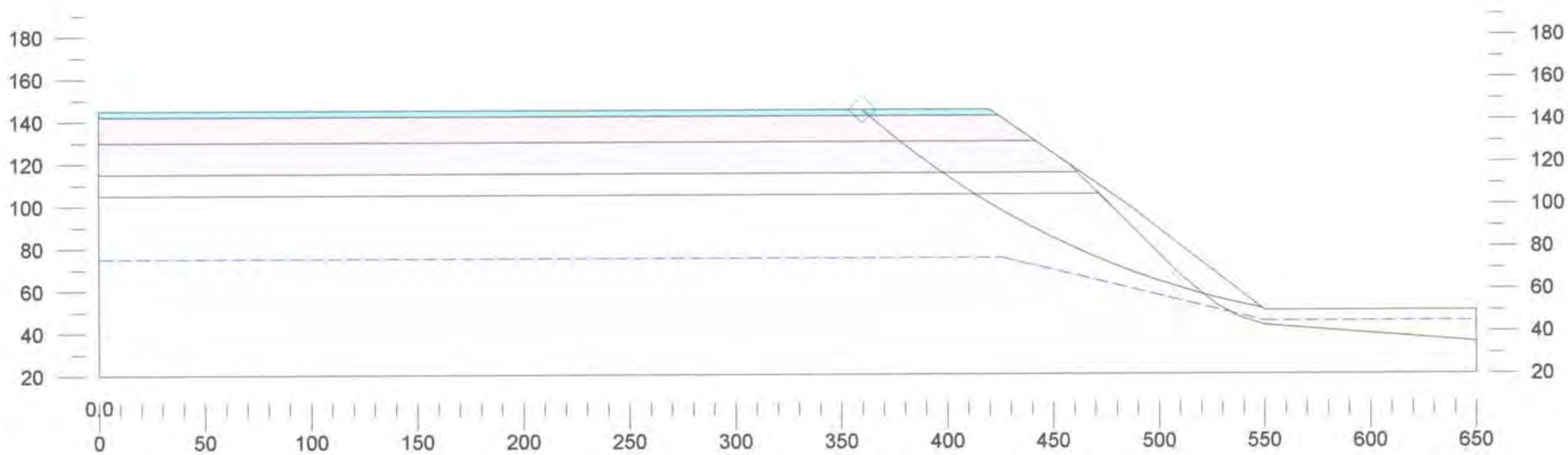
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 4
F = 1.592
Existing grade, HP at 2:1



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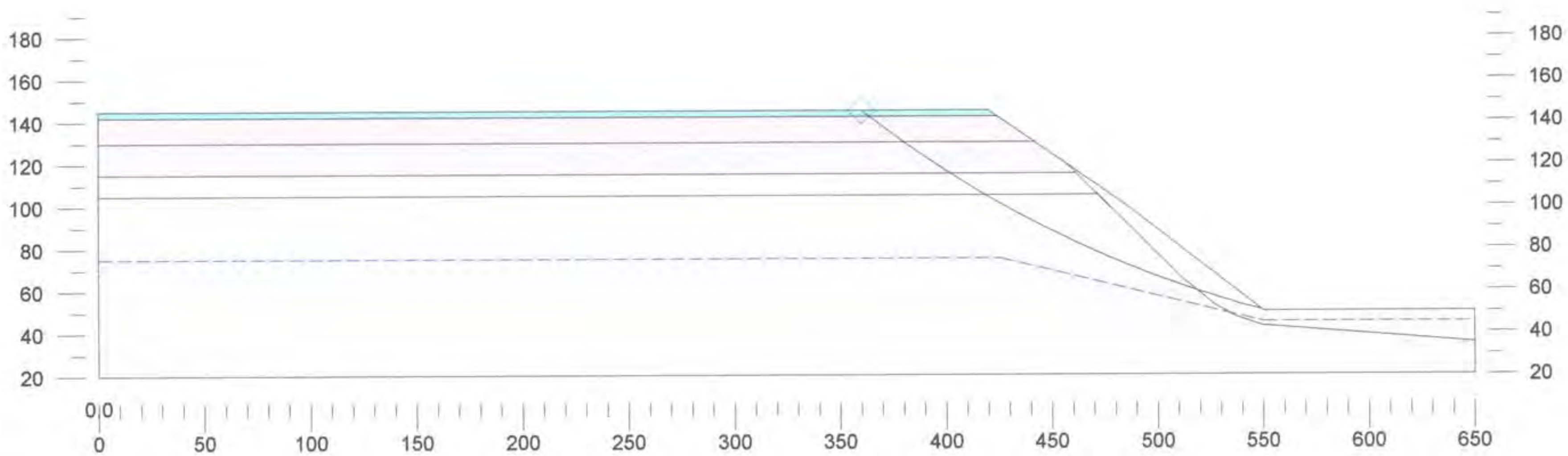
F = 1.127

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 4
Existing grade, HP at 2:1, Seismic



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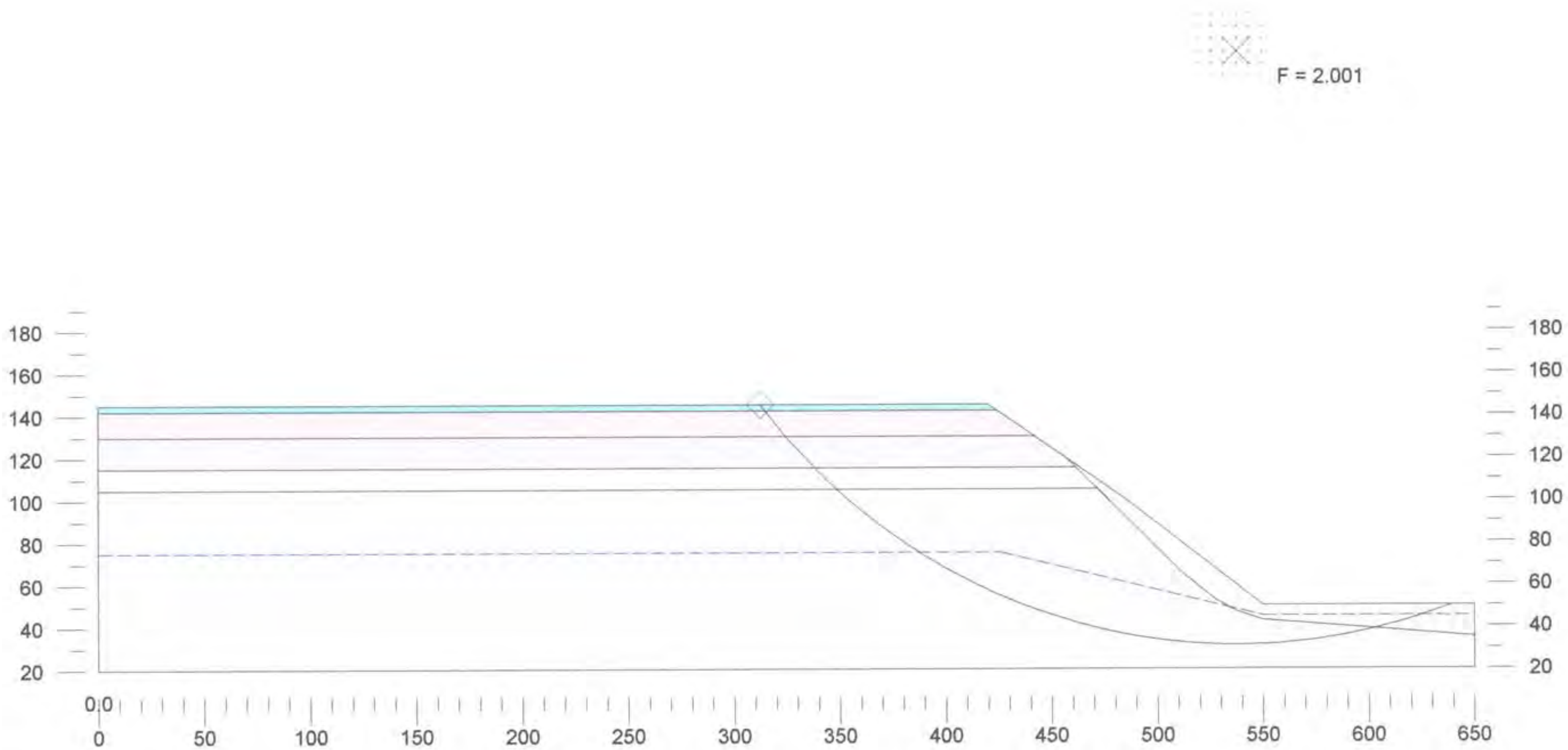
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

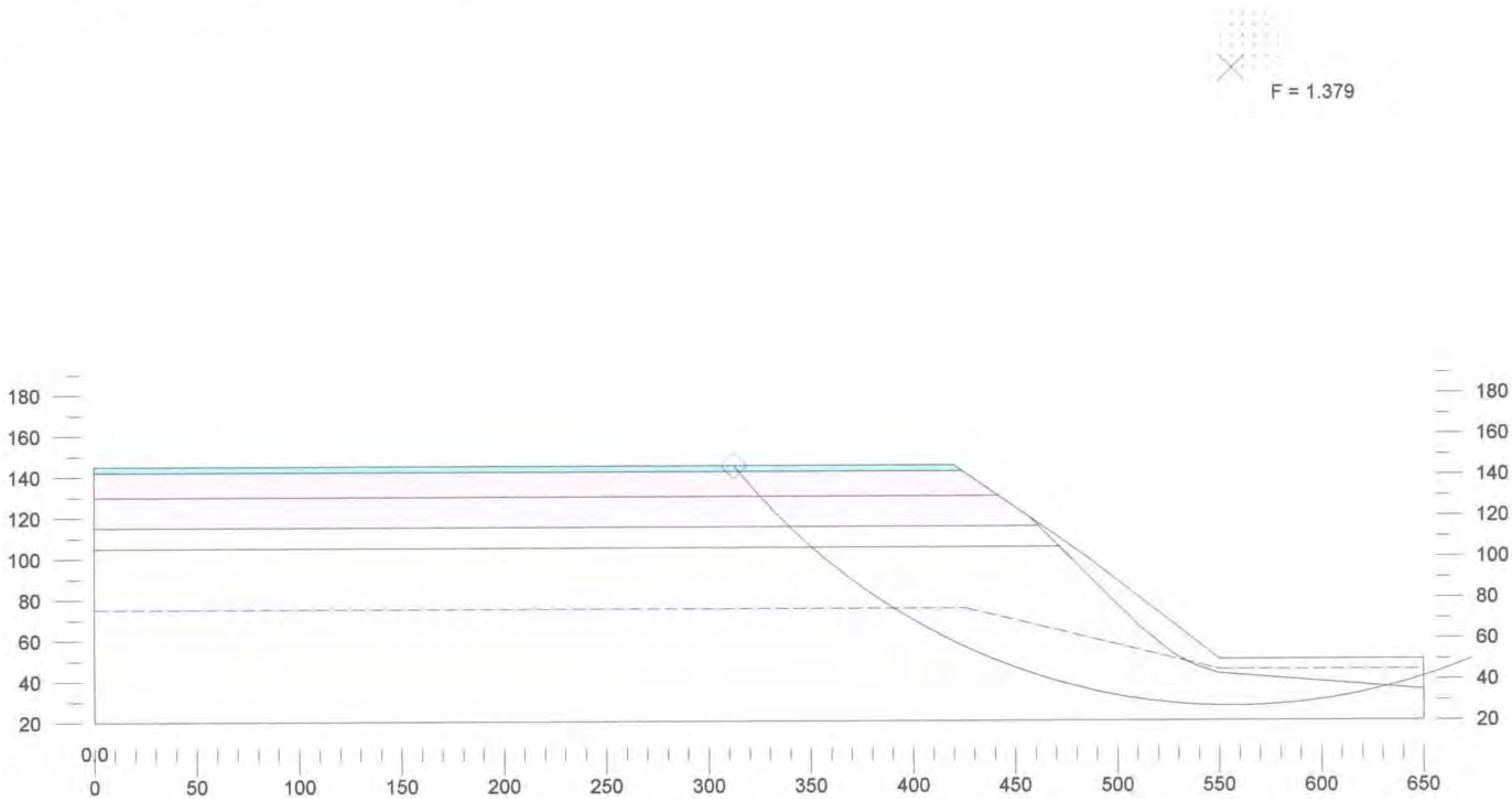
ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 4
Existing grade, HP at 2.5:1



	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

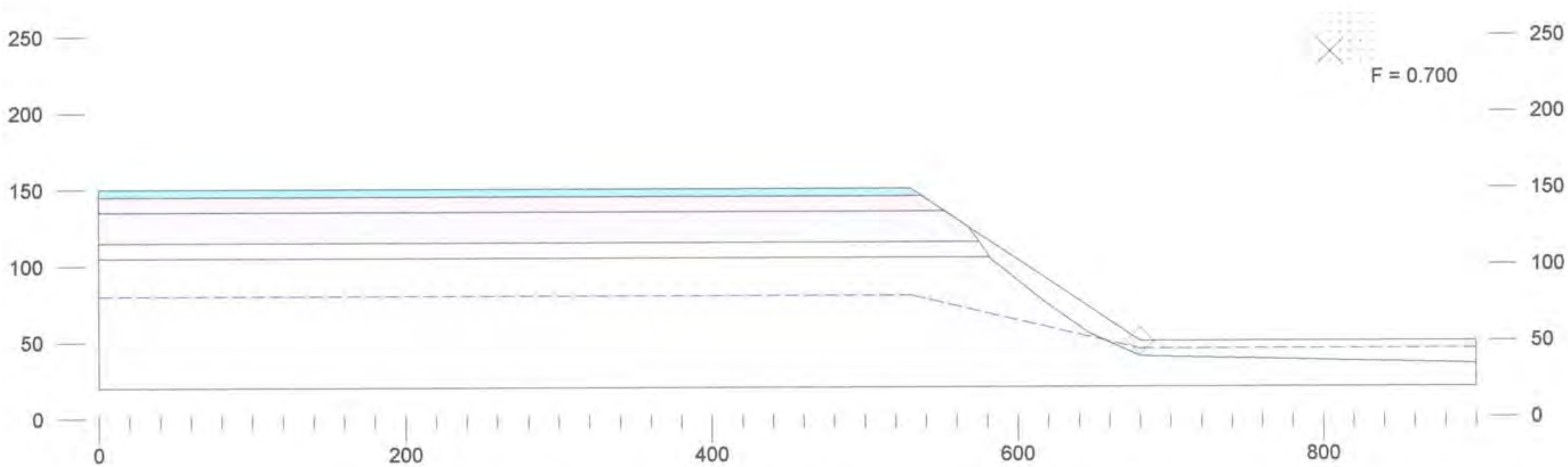
Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 4
Existing grade, HP at 2.5:1, Seismic



	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 5
Existing Grade



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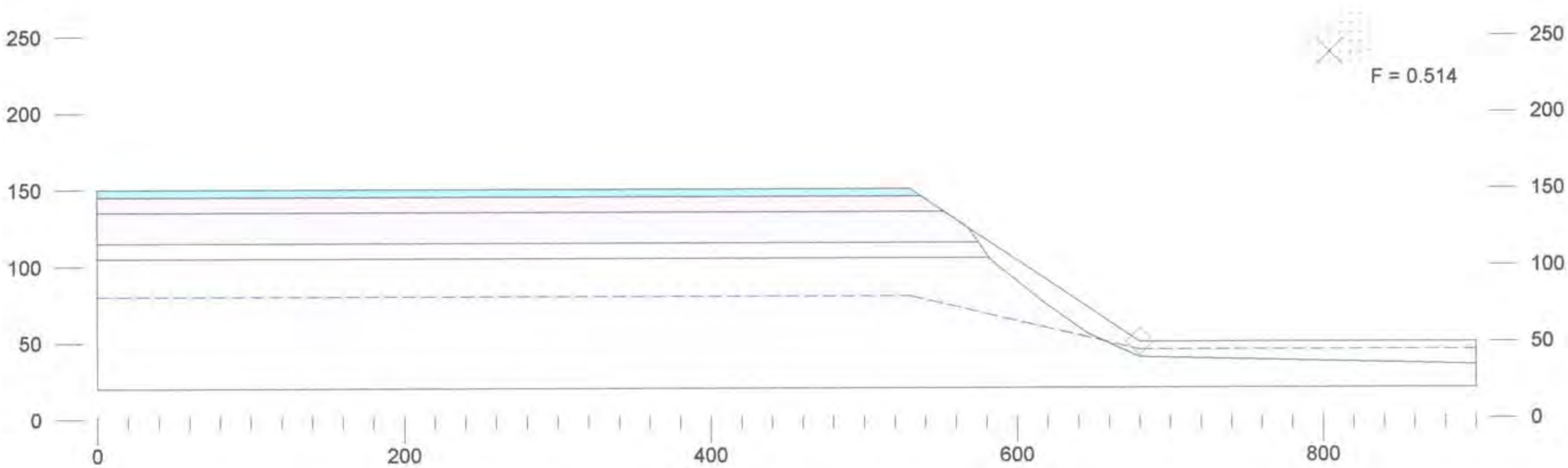
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 5
Existing Grade, Seismic



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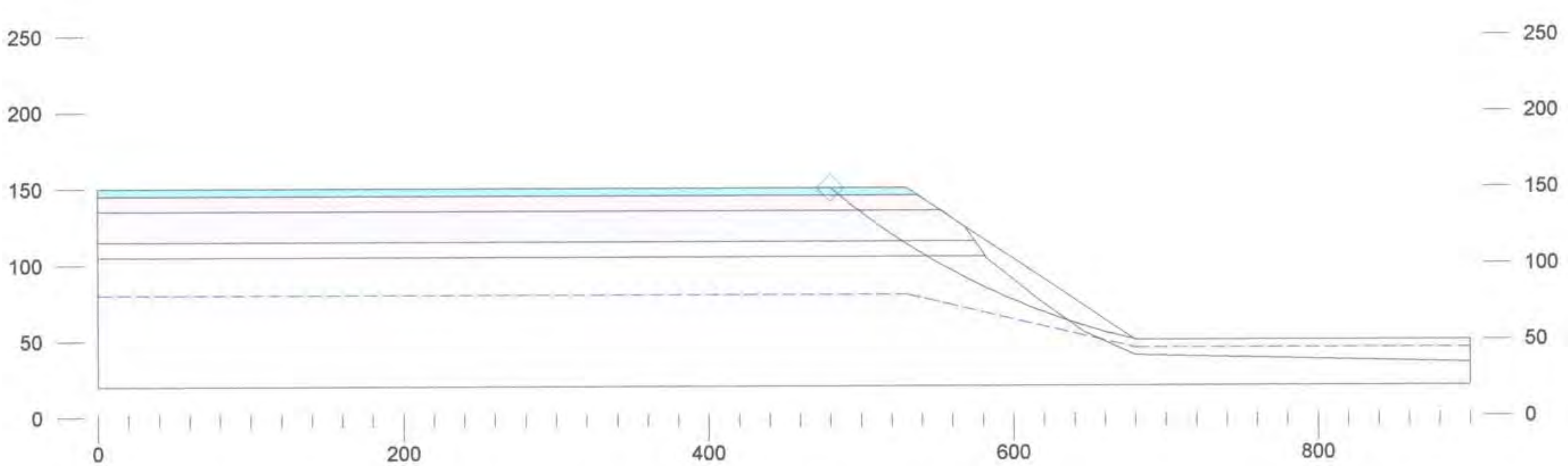
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 5
Existing Grade, HP at 2:1

F = 1.509

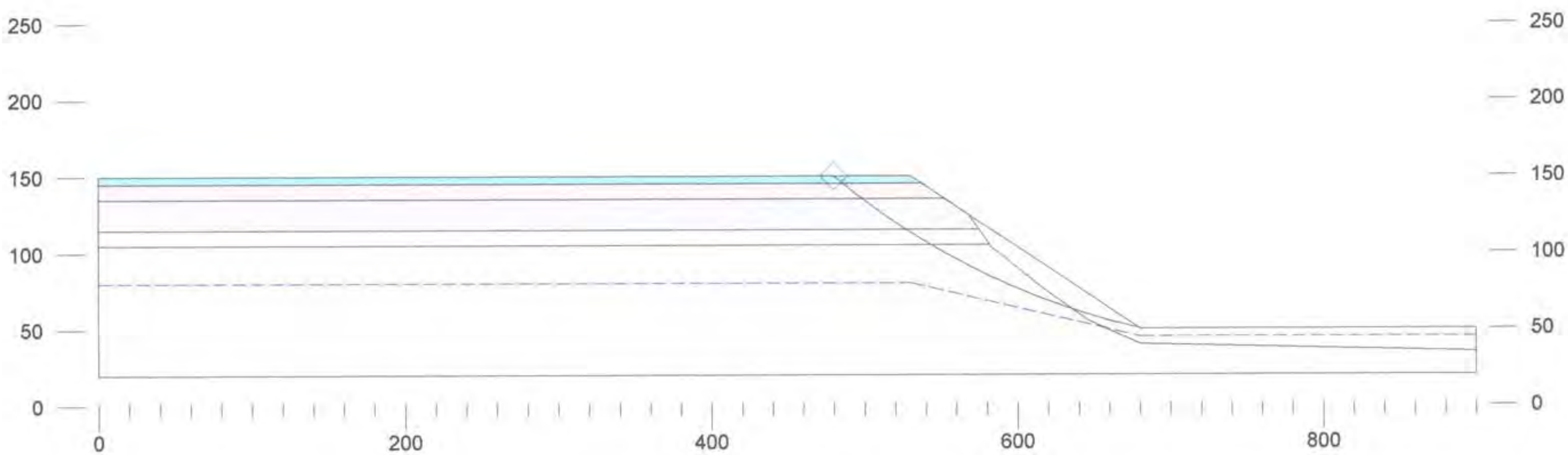


	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 5
Existing Grade, HP at 2:1, Seismic

F = 1.092



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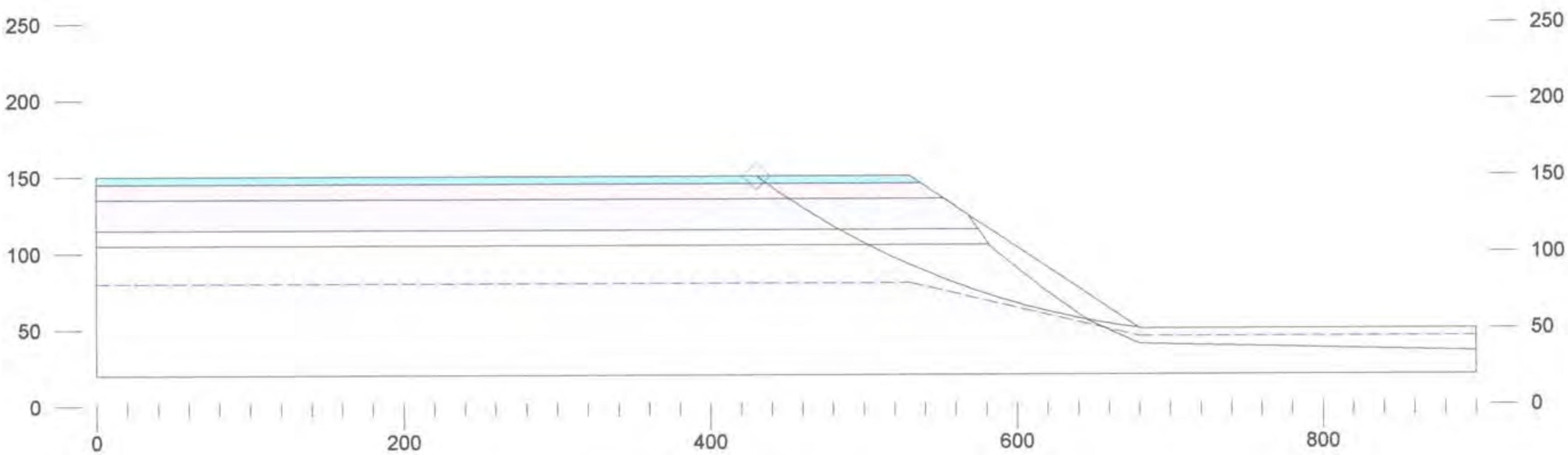
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 5
Existing Grade, HP at 2.5:1
F = 1.985



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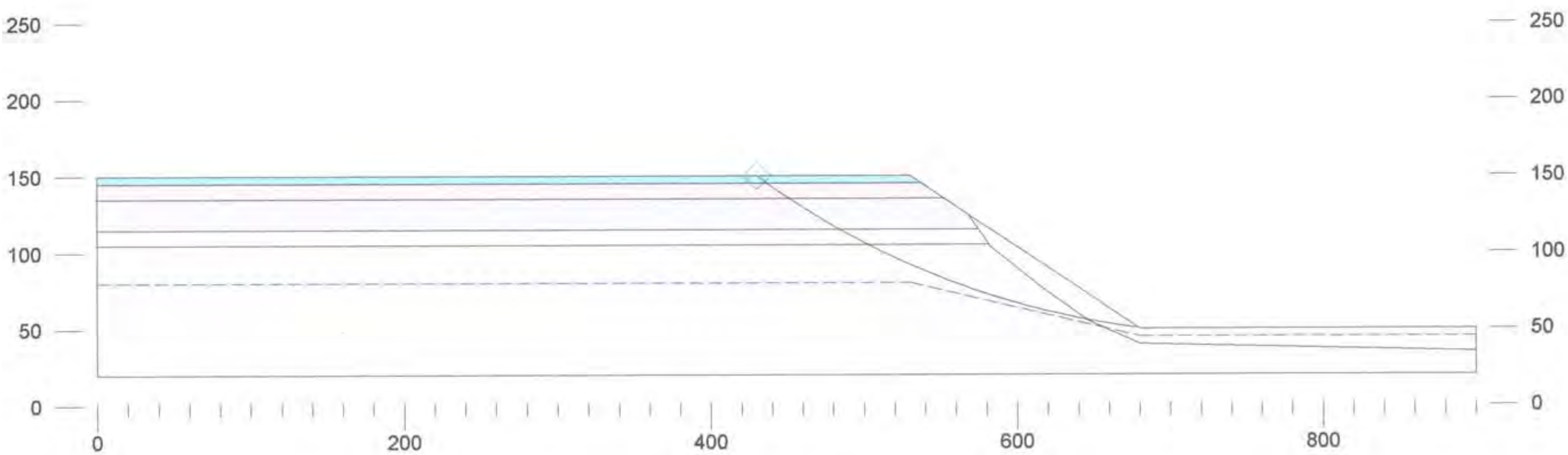
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 5
Existing Grade, HP at 2.5:1, Seismic
F = 1.379



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Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
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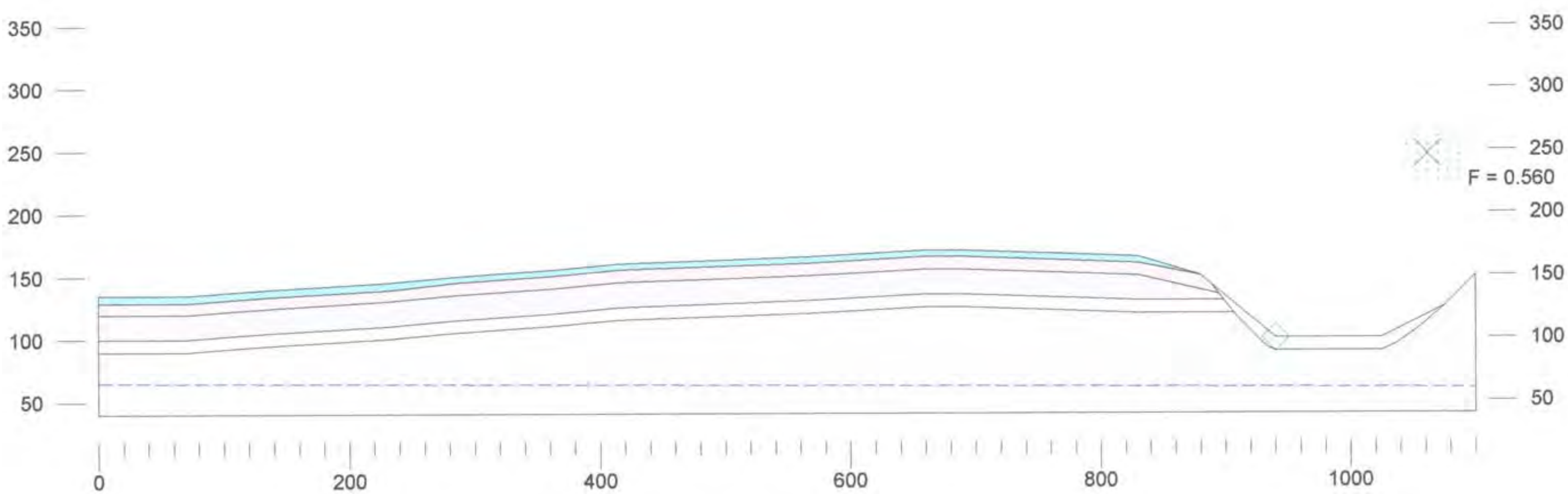
East Garrison
4/14/03
Section 6
Existing Grade



4/28/2003 2:58:49 PM G:\DRAFTI~1\5866\GSLOPE\SEC6\EXISTING\SEC6E1.GSL ENGEO Incorporated - San Ramon, CA F = 0.560

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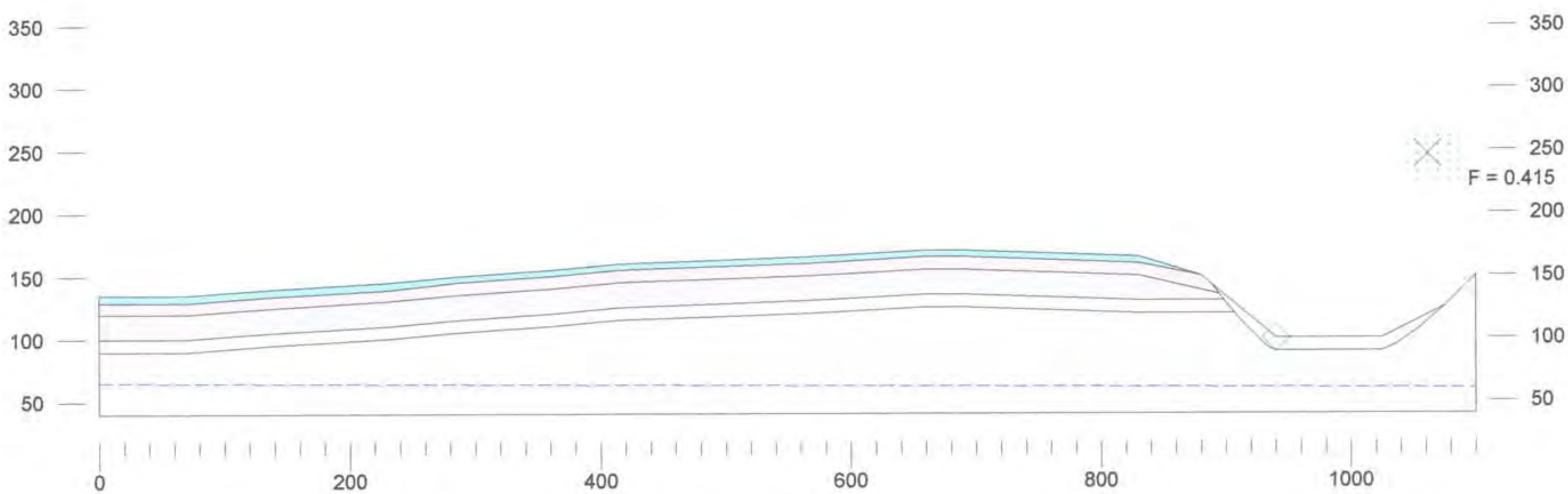
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

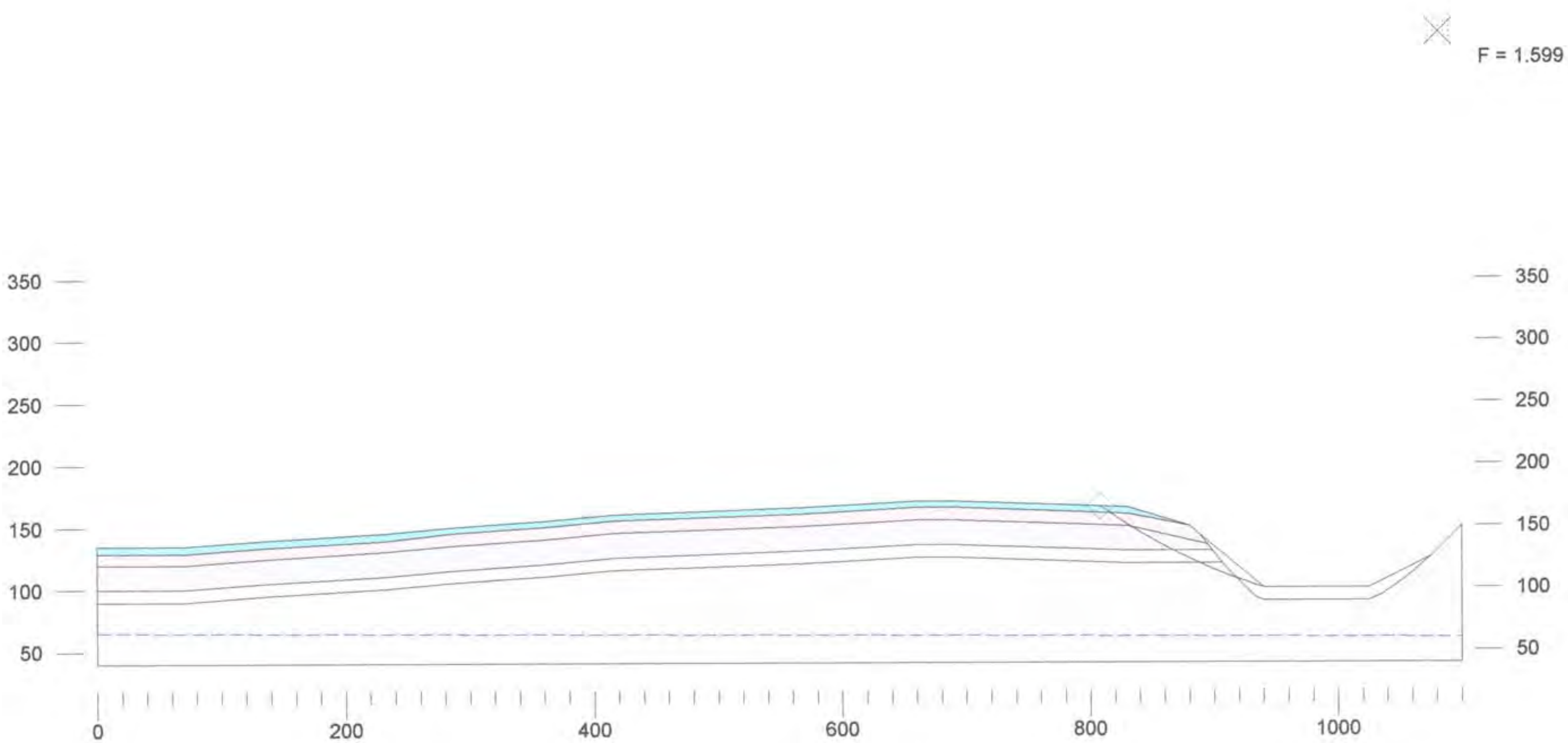
Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 6
Existing Grade, Seismic



	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 6
Existing Grade, HP at 2:1



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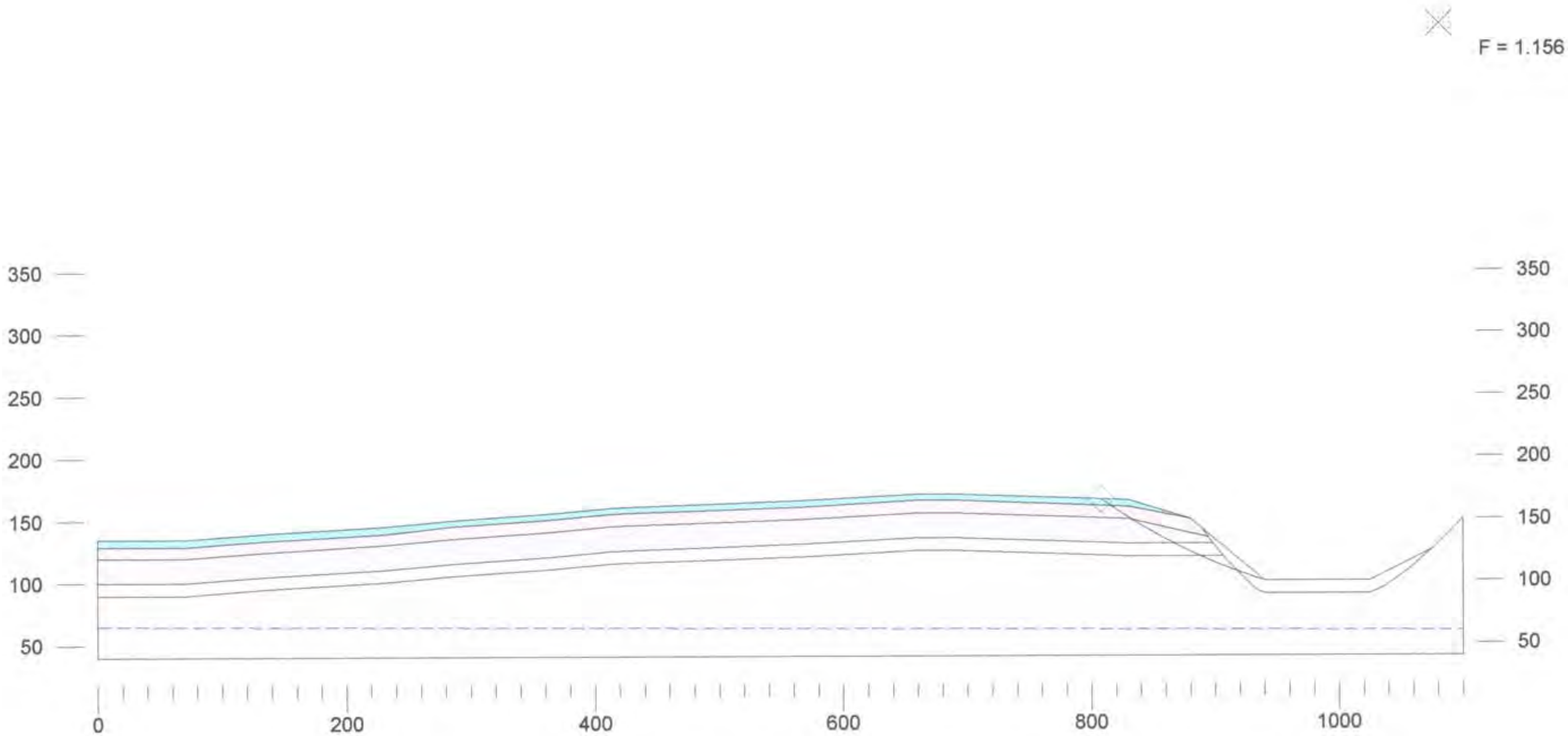
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

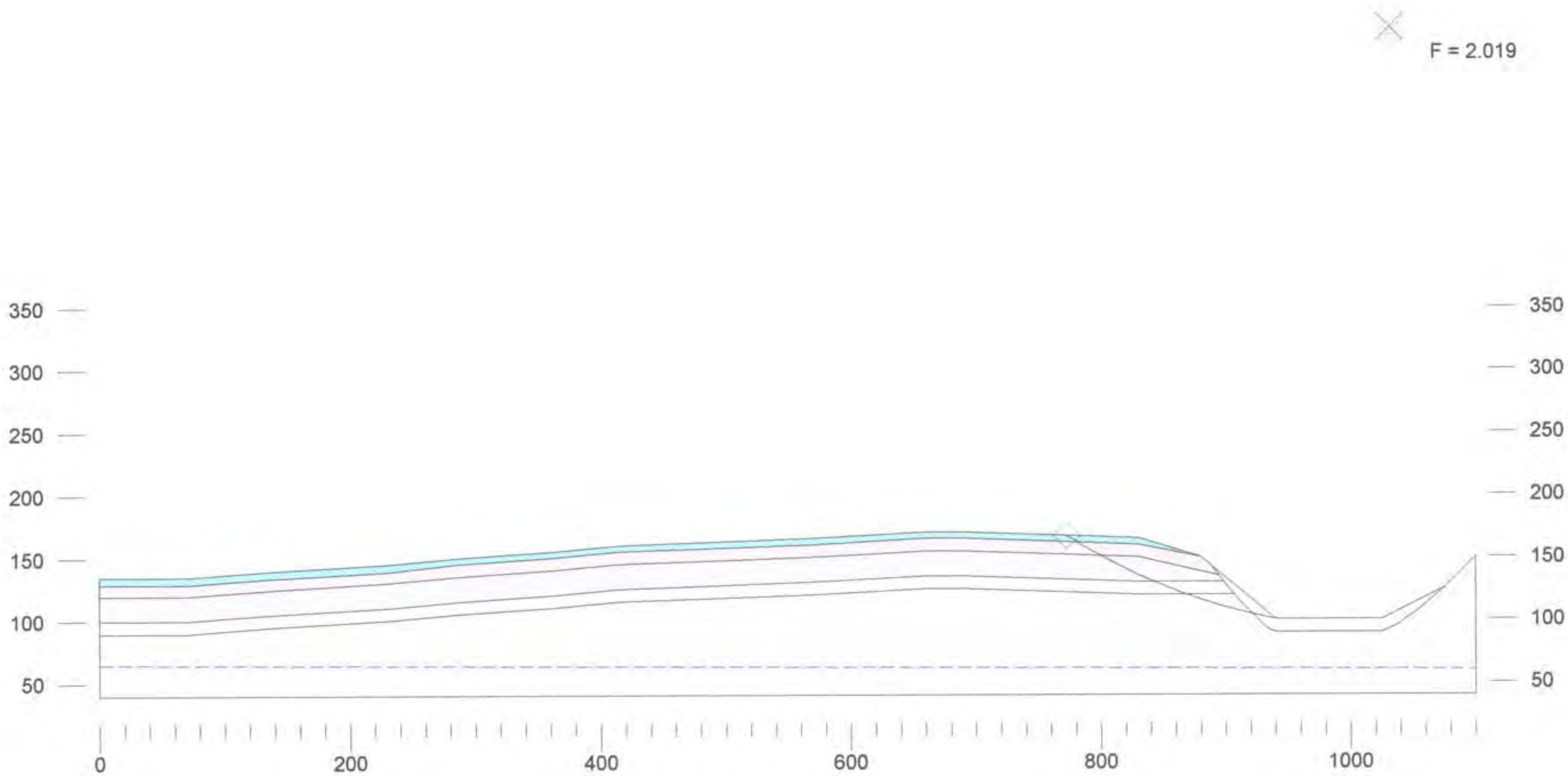
ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 6
Existing Grade, HP at 2:1, Seismic



4/28/2003 3:02:20 PM G:\DRAFTI~1\5866\GSLOPE\SEC6\PROPOSED\SEC6P3.GSL ENGEO Incorporated - San Ramon, CA F = 1.156

	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 6
Existing Grade, HP at 2.5:1



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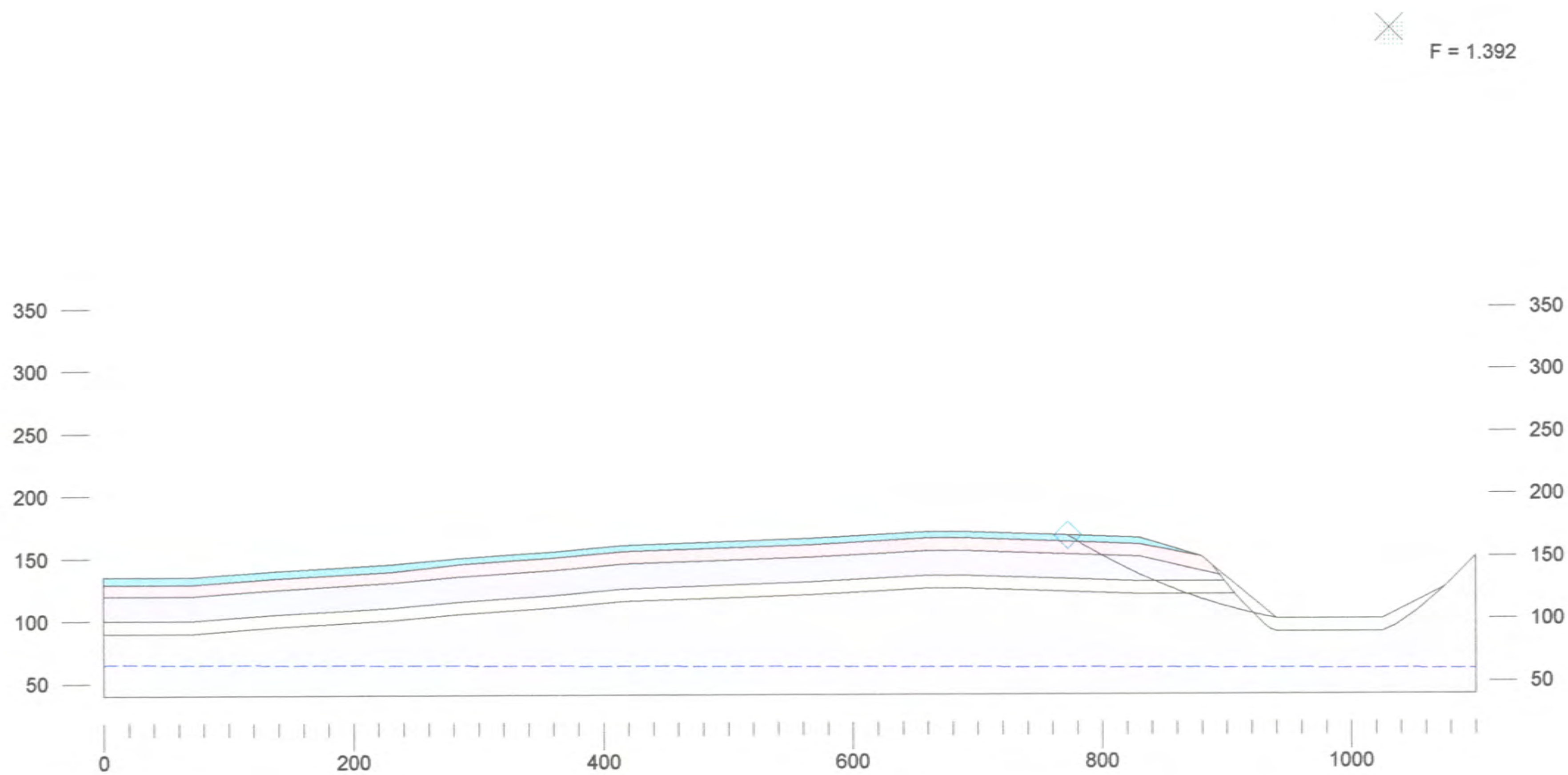
	Gamma pcf	C psf	Phi deg	Piezo Surf.
Silty Sand	125	0	25	1
Slopewash&Debris	125	0	25	1
Sand with Silt 1	115	150	34	1
Sand with Silt 2	110	0	39	1
Silty Sand	128	800	26	1
Sand with Silt 2	110	0	39	1

Seismic coefficient = 0.15

ENGEO Incorporated - San Ramon, CA
5866.3.001.01
East Garrison
4/14/03
Section 6
Existing Grade, HP at 2.5:1, Seismic



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APPENDIX D

Guide Contract Specifications

5866.3.001.01
July 22, 2003

GUIDE CONTRACT SPECIFICATIONS

PART I - EARTHWORK

PREFACE

These specifications are intended as a guide for the earthwork performed at the subject development project. If there is a conflict between these specifications (including the recommendations of the geotechnical report) and agency or code requirements, it should be brought to the attention of ENGEO and Owner prior to contract bidding.

PART 1 - GENERAL

1.01 WORK COVERED

A. Grading, excavating, filling and backfilling, including trenching and backfilling for utilities as necessary to complete the Project as indicated on the Drawings.

B. Subsurface drainage as indicated on the Drawings.

1.02 CODES AND STANDARDS

A. Excavating, trenching, filling, backfilling, and grading work shall meet the applicable requirements of the Uniform Building Code and the standards and ordinances of state and local governing authorities.

1.03 SUBSURFACE SOIL CONDITIONS

A. The Owners' Geotechnical Exploration report is available for inspection by bidder or Contractor. The Contractor shall refer to the findings and recommendations of the Geotechnical Exploration report in planning and executing his work.

1.04 DEFINITIONS

A. Fill: All soil, rock, or soil-rock materials placed to raise the grades of the site or to backfill excavations.

B. Backfill: All soil, rock or soil-rock material used to fill excavations and trenches.

C. On-Site Material: Soil and/or rock material which is obtained from the site.

D. Imported Material: Soil and/or rock material which is brought to the site from off-site areas.

E. Select Material: On-site and/or imported material which is approved by ENGEO as a specific-purpose fill.

F. Engineered Fill: Fill upon which ENGEO has made sufficient observations and tests to confirm that the fill has been placed and compacted in accordance with specifications and requirements.

G. Degree of Compaction or Relative Compaction: The ratio, expressed as a percentage, of the in-place dry density of the fill and backfill material as compacted in the field to the maximum dry density of the same material as determined by ASTM D-1557 or California 216 compaction test method.

H. Optimum Moisture: Water content, percentage by dry weight, corresponding to the maximum dry density as determined by ASTM D-1557.

I. ENGEO: The project geotechnical engineering consulting firm, its employees or its designated representatives.

J. Drawings: All documents, approved for construction, which describe the Work.

1.05 OBSERVATION AND TESTING

A. All site preparation, cutting and shaping, excavating, filling, and backfilling shall be carried out under the observation of ENGEO, employed and paid for by the Owners. ENGEO will perform appropriate field and laboratory tests to evaluate the suitability of fill material, the proper moisture content for compaction, and the degree of compaction achieved. Any fill that does not meet the specification requirements shall be removed and/or reworked until the requirements are satisfied.

B. Cutting and shaping, excavating, conditioning, filling, and compacting procedures require approval of ENGEO as they are performed. Any work found unsatisfactory or any work disturbed by subsequent operations before approval is granted shall be corrected in an approved manner as recommended by ENGEO.

C. Tests for compaction will be made in accordance with test procedures outlined in ASTM D-1557, as applicable. Field testing of soils or compacted fill shall conform with the applicable requirements of ASTM D-2922.

D. All authorized observation and testing will be paid for by the Owners.

1.06 SITE CONDITIONS

A. Excavating, filling, backfilling, and grading work shall not be performed during unfavorable weather conditions. When the work is interrupted by rain, excavating, filling, backfilling, and grading work shall not be resumed until the site and soil conditions are suitable.

B. Contractor shall take the necessary measures to prevent erosion of freshly filled, backfilled, and graded areas until such time as permanent drainage and erosion control measures have been installed.

PART 2 - PRODUCTS

2.01 GENERAL

A. Contractor shall furnish all materials, tools, equipment, facilities, and services as required for performing the required excavating, filling, backfilling, and grading work, and trenching and backfilling for utilities.

2.02 SOIL MATERIALS

A. Fill

1. Material to be used for engineered fill and backfill shall be free from organic matter and other deleterious substances, and of such quality that it will compact thoroughly without excessive voids when watered and rolled. Excavated on-site material will be considered suitable for engineered fill and backfill if it contains no more than 3 percent organic matter, is free of debris and other deleterious substances and conforms to the requirements specified above. Rocks of maximum dimension in excess of two-thirds of the lift thickness shall be removed from any fill material to the satisfaction of ENGEO.

2. Excavated earth material which is suitable for engineered fill or backfill, as determined by ENGEO, shall be conditioned for reuse and properly stockpiled as required for later filling and backfilling operations. Conditioning shall consist of spreading material in layers not to exceed 8 inches and raking free of debris and rubble. Rocks and aggregate exceeding the allowed largest dimension, and deleterious material shall be removed from the site and disposed off site in a legal manner.

3. ENGEO shall be notified at least 48 hours prior to the start of filling and backfilling operations so that it may evaluate samples of the material intended for

use as fill and backfill. All materials to be used for filling and backfilling require the approval of ENGEO.

B. Import Material: Where conditions require the importation of fill material, the material shall be an inert, nonexpansive soil or soil-rock material free of organic matter and meeting the following requirements unless otherwise approved by ENGEO.

Gradation (ASTM D-421):	Sieve Size	Percent Passing
	2-inch	100
	#200	15 - 70
Plasticity (ASTM D-4318):	Liquid Limit	Plasticity Index
	< 30	< 12
Swell Potential (ASTM D-4546B): (at optimum moisture)	Percent Heave	Swell Pressure
	< 2 percent	< 300 psf
Resistance Value (ASTM D-2844):	Minimum 25	
Organic Content (ASTM D-2974):	Less than 2 percent	

A sample of the proposed import material should be submitted to ENGEO for evaluation prior to delivery at the site.

2.03 SAND

A. Sand for sand cushion under slabs and for bedding of pipe in utility trenches shall be a clean and graded, washed sand, free from clay or organic material, suitable for the intended purpose with 90 to 100 percent passing a No. 4 U.S. Standard Sieve, not more than 5 percent passing a No. 200 U.S. Standard Sieve, and generally conforming to ASTM C33 for fine aggregate.

2.04 AGGREGATE DRAINAGE FILL

A. Aggregate drainage fill under concrete slabs and paving shall consist of broken stone, crushed or uncrushed gravel, clean quarry waste, or a combination thereof. The aggregate shall be free from fines, vegetable matter, loam, volcanic tuff, and other deleterious substances. It shall be of such quality that the absorption of water in a saturated surface dry condition does not exceed 3 percent of the oven dry weight of the samples.

B. Aggregate drainage fill shall be of such size that the percentage composition by dry weight as determined by laboratory sieves (U. S. Series) will conform to the following grading:

Sieve Size	Percentage Passing Sieve
1½-inches	100
1-inch	90 - 100
#4	0 - 5

2.05 SUBDRAINS

A. Perforated subdrain pipe of the required diameter shall be installed as shown on the drawings. The pipe(s) shall also conform to these specifications unless otherwise specified by ENGEO in the field.

Subdrain pipe shall be manufactured in accordance with one of the following requirements:

Design depths less than 30 feet

- Perforated ABS Solid Wall SDR 35 (ASTM D-2751)
- Perforated PVC Solid Wall SDR 35 (ASTM D-3034)
- Perforated PVC A-2000 (ASTM F949)
- Perforated Corrugated HDPE double-wall (AASHTO M-252 or M-294, Caltrans Type S, 50 psi minimum stiffness)

Design depths less than 50 feet

- Perforated PVC SDR 23.5 Solid Wall (ASTM D-3034)
- Perforated Sch. 40 PVC Solid Wall (ASTM-1785)
- Perforated ABS SDR 23.5 Solid Wall (ASTM D-2751)
- Perforated ABS DWV/Sch. 40 (ASTM D-2661 and D-1527)
- Perforated Corrugated HDPE double-wall (AASHTO M-252 or M-294, Caltrans Type S, 70 psi minimum stiffness)

Design depths less than 70 feet

- Perforated ABS Solid Wall SDR 15.3 (ASTM D-2751)
- Perforated Sch. 80 PVC (ASTM D-1785)
- Perforated Corrugated Aluminum (ASTM B-745)

B. Permeable Material (Class 2): Class 2 permeable material for filling trenches under, around, and over subdrains, behind building and retaining walls, and for pervious blankets shall consist of clean, coarse sand and gravel or crushed stone, conforming to the following grading requirements:

Sieve Size	Percentage Passing Sieve
1-inch	100
¾-inch	90 - 100
$^{3}/8$-inch	40 - 100
#4	25 - 40
#8	18 - 33
#30	5 - 15
#50	0 - 7
#200	0 - 3

C. Filter Fabric: All filter fabric shall meet the following Minimum Average Roll Values unless otherwise specified by ENGEO.

Grab Strength (ASTM D-4632)..180 lbs
Mass Per Unit Area (ASTM D-4751).................................6 oz/yd^2
Apparent Opening Size (ASTM D-4751)...........................70-100 U.S. Std. Sieve
Flow Rate (ASTM D-4491)..80 gal/min/ft^2
Puncture Strength (ASTM D-4833)...................................80 lbs

D. Vapor Retarder: Vapor Retarders shall consist of PVC, LDPE or HDPE impermeable sheeting at least 10 mils thick..

2.06 PERMEABLE MATERIAL (Class 1; Type A)

A. Class 1 permeable material to be used in conjunction with filter fabric for backfilling of subdrain excavations shall conform to the following grading requirements:

Sieve Size	Percentage Passing Sieve
¾-inch	100
½-inch	95 - 100
$^{3}/8$-inch	70 - 100
#4	0 - 55
#8	0 - 10
#200	0 - 3

PART 3 - EXECUTION

3.01 STAKING AND GRADES

A. Contractor shall lay out all his work, establish all necessary markers, bench marks, grading stakes, and other stakes as required to achieve design grades.

3.02 EXISTING UTILITIES

A. Contractor shall verify the location and depth (elevation) of all existing utilities and services before performing any excavation work.

3.03 EXCAVATION

A. Contractor shall perform excavating as indicated and required for concrete footings, drilled piers, foundations, floor slabs, concrete walks, and site leveling and grading, and provide shoring, bracing, underpinning, cribbing, pumping, and planking as required. The bottoms of excavations shall be firm undisturbed earth, clean and free from loose material, debris, and foreign matter.

B. Excavations shall be kept free from water at all times. Adequate dewatering equipment shall be maintained at the site to handle emergency situations until concrete or backfill is placed.

C. Unauthorized excavations for footings shall be filled with concrete to required elevations, unless other methods of filling are authorized by ENGEO.

D. Excavated earth material which is suitable for engineered fill or backfill, as determined by ENGEO, shall be conditioned for reuse and properly stockpiled for later filling and backfilling operations as specified under Section 2.02, "Soil Materials."

E. Abandoned sewers, piping, and other utilities encountered during excavating shall be removed and the resulting excavations shall be backfilled with engineered fill as required by ENGEO.

F. Any active utility lines encountered shall be reported immediately to the Owner's Representative and authorities involved. The Owner and proper authorities shall be permitted free access to take the measures deemed necessary to repair, relocate, or remove the obstruction as determined by the responsible authority or Owner's Representative.

3.04 SUBGRADE PREPARATION

A. All brush and other rubbish, as well as trees and root systems not marked for saving, shall be removed from the site and legally disposed of.

B. Any existing structures, foundations, underground storage tanks, or debris must be removed from the site prior to any building, grading, or fill operations. Septic tanks, including all drain fields and other lines, if encountered, must be totally removed. The resulting depressions shall be properly prepared and filled to the satisfaction of ENGEO.

C. Vegetation and organic topsoil shall be removed from the surface upon which the fill is to be placed and either removed and legally disposed of or stockpiled for later use in approved landscape areas. The surface shall then be scarified to a depth of at least eight inches until the surface is free from ruts, hummocks, or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

D. After the foundation for the fill has been cleared and scarified, it shall be made uniform and free from large clods. The proper moisture content must be obtained by adding water or aerating. The foundation for the fill shall be compacted at the proper moisture content to a relative compaction as specified herein.

3.05 ENGINEERED FILL

A. Select Material: Fill material shall be "Select" or "Imported Material" as previously specified.

B. Placing and Compacting: Engineered fill shall be constructed by approved and accepted methods. Fill material shall be spread in uniform lifts not exceeding 8 inches in uncompacted thickness. Each layer shall be spread evenly, and thoroughly blade-mixed to obtain uniformity of material. Fill material which does not contain sufficient moisture as specified by ENGEO shall be sprinkled with water; if it contains excess moisture it shall be aerated or blended with drier material to achieve the proper water content. Select material and water shall then be thoroughly mixed before being compacted.

C. Unless otherwise specified in the Geotechnical Exploration report, each layer of spread select material shall be compacted to at least 90 percent relative compaction at a moisture content of at least three percent above the optimum moisture content. Minimum compaction in all keyways shall be a minimum of 95 percent with a minimum moisture content of at least 1 percentage point above optimum.

D. Unless otherwise specified in the Geotechnical Exploration report or otherwise required by the local authorities, the upper 6 inches of engineered fill in areas to receive pavement shall be compacted to at least 95 percent relative compaction with a minimum moisture content of at least 3 percentage points above optimum.

E. Testing and Observation of Fill: The work shall consist of field observation and testing to determine that each layer has been compacted to the required density and that the required moisture is being obtained. Any layer or portion of a layer that does not attain the compaction required shall be reworked until the required density is obtained.

F. Compaction: Compaction shall be by sheepsfoot rollers, multiple-wheel steel or pneumatic-tired rollers or other types of acceptable compaction equipment. Rollers shall be of such design that they will be able to compact the fill to the specified compaction. Rolling shall be accomplished while the fill material is within the specified moisture content range. Rolling of each layer must be continuous so that the required compaction may be obtained uniformly throughout each layer.

G. Fill slopes shall be constructed by overfilling the design slopes and later cutting back the slopes to the design grades. No loose soil will be permitted on the faces of the finished slopes.

H. Strippings and topsoil shall be stockpiled as approved by Owner, then placed in accordance with ENGEO's recommendations to a minimum thickness of 6 inches and a maximum thickness of 12 inches over exposed open space cut slopes which are 3:1 or flatter, and track walked to the satisfaction of ENGEO.

I. Final Prepared Subgrade: Finish blading and smoothing shall be performed as necessary to produce the required density, with a uniform surface, smooth and true to grade.

3.06 BACKFILLING

A. Backfill shall not be placed against footings, building walls, or other structures until approved by ENGEO.

B. Backfill material shall be Select Material as specified for engineered fill.

C. Backfill shall be placed in 6-inch layers, leveled, rammed, and tamped in place. Each layer shall be compacted with suitable compaction equipment to 90 percent relative compaction at a moisture content of at least 3 percent above optimum.

3.07 TRENCHING AND BACKFILLING FOR UTILITIES

A. Trenching:

1. Trenching shall include the removal of material and obstructions, the installation and removal of sheeting and bracing and the control of water as necessary to provide the required utilities and services.

2. Trenches shall be excavated to the lines, grades, and dimensions indicated on the Drawings. Maximum allowable trench width shall be the outside diameter of the pipe plus 24 inches, inclusive of any trench bracing.

3. When the trench bottom is a soft or unstable material as determined by ENGEO, it shall be made firm and solid by removing said unstable material to a sufficient depth and replacing it with on-site material compacted to 90 percent minimum relative compaction.

4. Where water is encountered in the trench, the contractor must provide materials necessary to drain the water and stabilize the bed.

B. Backfilling:

1. Trenches must be backfilled within 2 days of excavation to minimize desiccation.

2. Bedding material shall be sand and shall not extend more than 6 inches above any utility lines.

3. Backfill material shall be select material.

4. Trenches shall be backfilled as indicated or required and compacted with suitable equipment to 90 percent minimum relative compaction at the required moisture content.

3.08 SUBDRAINS

A. Trenches for subdrain pipe shall be excavated to a minimum width equal to the outside diameter of the pipe plus at least 12 inches and to a depth of approximately 2 inches below the grade established for the invert of the pipe, or as indicated on the Drawings.

B. The space below the pipe invert shall be filled with a layer of Class 2 permeable material, upon which the pipe shall be laid with perforations down. Sections shall be joined as recommended by the pipe manufacturer.

C. Rocks, bricks, broken concrete, or other hard material shall not be used to give intermediate support to pipes. Large stones or other hard objects shall not be left in contact with the pipes.

D. Excavations for subdrains shall be filled as required to fill voids and prevent settlement without damaging the subdrain pipe. Alternatively, excavations for subdrains may be filled with Class 1 permeable material (as defined in Section 2.06) wrapped in Filter Fabric (as defined in Section 2.05).

3.09 AGGREGATE DRAINAGE FILL

A. ENGEO shall approve finished subgrades before aggregate drainage fill is installed.

B. Pipes, drains, conduits, and any other mechanical or electrical installations shall be in place before any aggregate drainage fill is placed. Backfill at walls to elevation of drainage fill shall be in place and compacted.

C. Aggregate drainage fill under slabs and concrete paving shall be the minimum uniform thickness after compaction of dimensions indicated on Drawings. Where not indicated, minimum thickness after compaction shall be 4 inches.

D. Aggregate drainage fill shall be rolled to form a well-compacted bed.

E. The finished aggregate drainage fill must be observed and approved by ENGEO before proceeding with any subsequent construction over the compacted base or fill.

3.10 SAND CUSHION

A. A sand cushion shall be placed over the vapor retarder membrane under concrete slabs on grade. Sand cushion shall be placed in uniform thickness as indicated on the Drawings. Where not indicated, the thickness shall be 2 inches.

3.11 FINISH GRADING

A. All areas must be finish graded to elevations and grades indicated on the Drawings. In areas to receive topsoil and landscape planting, finish grading shall be performed to a uniform 6 inches below the grades and elevations indicated on the Drawings, and brought to final grade with topsoil.

3.12 DISPOSAL OF WASTE MATERIALS

A. Excess earth materials and debris shall be removed from the site and disposed of in a legal manner. Location of dump site and length of haul are the Contractor's responsibility.

PART II - GEOGRID SOIL REINFORCEMENT

1. DESCRIPTION:

Work shall consist of furnishing geogrid soil reinforcement for use in construction of reinforced soil slopes and retention systems.

2. GEOGRID MATERIAL:

2.1 The specific geogrid material shall be preapproved by ENGEO.

2.2 The geogrid shall be a regular network of integrally connected polymer tensile elements with aperture geometry sufficient to permit significant mechanical interlock with the surrounding soil or rock. The geogrid structure shall be dimensionally stable and able to retain its geometry under construction stresses and shall have high resistance to damage during construction, to ultraviolet degradation, and to all forms of chemical and biological degradation encountered in the soil being reinforced.

2.3 The geogrids shall have an Allowable Strength (T_a) and Pullout Resistance, for the soil type(s) indicated, as listed in Table I.

2.4 Certifications: The Contractor shall submit a manufacturer's certification that the geogrids supplied meet the respective index criteria set when geogrid was approved by ENGEO, measured in full accordance with all test methods and standards specified. In case of dispute over validity of values, the Contractor will supply test data from an ENGEO-approved laboratory to support the certified values submitted.

3. CONSTRUCTION:

3.1 Delivery, Storage, and Handling: Contractor shall check the geogrid upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the geogrid shall be protected from temperatures greater than 140 °F, mud, dirt, dust, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the geogrid will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be repaired by placing a patch over the damaged area. Any geogrid damaged during storage or installation shall be replaced by the Contractor at no additional cost to the owner.

3.2 On-Site Representative: Geogrid material suppliers shall provide a qualified and experienced representative on site at the initiation of the project, for a minimum of three days, to assist the Contractor and ENGEO personnel at the start of construction. If there is more than one slope on a project, this criterion will apply to construction of the initial slope only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s).

3.3 Geogrid reinforcement may be joined with mechanical connections or overlaps as recommended and approved by the Manufacturer. Joints shall not be placed within 6 feet of the slope face, within 4 feet below top of slope, nor horizontally or vertically adjacent to another joint.

3.4 Geogrid Placement: The geogrid reinforcement shall be installed in accordance with the manufacturer's recommendations. The geogrid reinforcement shall be placed within the layers of the compacted soil as shown on the plans or as directed.

The geogrid reinforcement shall be placed in continuous longitudinal strips in the direction of main reinforcement. However, if the Contractor is unable to complete a required length with a single continuous length of geogrid, a joint may be made with the Manufacturer's approval. Only one joint per length of geogrid shall be allowed. This joint shall be made for the full width of the strip by using a similar material with similar strength. Joints in geogrid reinforcement shall be pulled and held taut during fill placement.

Adjacent strips, in the case of 100 percent coverage in plan view, need not be overlapped. The minimum horizontal coverage is 50 percent, with horizontal spacings between reinforcement no greater than 40 inches. Horizontal coverage of less than 100 percent shall not be allowed unless specifically detailed in the construction drawings.

Adjacent rolls of geogrid reinforcement shall be overlapped or mechanically connected where exposed in a wrap around face system, as applicable.

The Contractor may place only that amount of geogrid reinforcement required for immediately pending work to prevent undue damage. After a layer of geogrid reinforcement has been placed, the next succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, the next geogrid reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of geogrid reinforcement and soil.

Geogrid reinforcement shall be placed to lay flat and pulled tight prior to backfilling. After a layer of geogrid reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geogrid reinforcement in position until the subsequent soil layer can be placed.

Under no circumstances shall a track-type vehicle be allowed on the geogrid reinforcement before at least six inches of soil have been placed. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geogrid reinforcement. If approved by the Manufacturer, rubber-tired equipment may pass over the geosynthetic reinforcement at slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided.

During construction, the surface of the fill should be kept approximately horizontal. Geogrid reinforcement shall be placed directly on the compacted horizontal fill surface. Geogrid reinforcements are to be placed within three inches of the design elevations and extend the length as shown on the elevation view unless otherwise directed by ENGEO. Correct orientation of the geogrid reinforcement shall be verified by ENGEO.

Table I
Allowable Geogrid Strength
With Various Soil Types
For Geosynthetic Reinforcement In
Mechanically Stabilized Earth Slopes

(Geogrid Pullout Resistance and Allowable Strengths vary with reinforced backfill used due to soil anchorage and site damage factors. Guidelines are provided below.)

SOIL TYPE	MINIMUM ALLOWABLE STRENGTH, T_a (lb/ft)*		
	GEOGRID Type I	GEOGRID Type II	GEOGRID Type III
A. Gravels, sandy gravels, and gravel-sand-silt mixtures (GW, GP, GC, GM & SP)**	2400	4800	7200
B. Well graded sands, gravelly sands, and sand-silt mixtures (SW & SM)**	2000	4000	6000
C. Silts, very fine sands, clayey sands and clayey silts (SC & ML)**	1000	2000	3000
D. Gravelly clays, sandy clays, silty clays, and lean clays (CL)**	1600	3200	4800

* All partial Factors of Safety for reduction of design strength are included in listed values. Additional factors of safety may be required to further reduce these design strengths based on site conditions.

** Unified Soil Classifications.

PART III - GEOTEXTILE SOIL REINFORCEMENT

1. DESCRIPTION:

Work shall consist of furnishing geotextile soil reinforcement for use in construction of reinforced soil slopes.

2. GEOTEXTILE MATERIAL:

2.1 The specific geotextile material and supplier shall be preapproved by ENGEO.

2.2 The geotextile shall have a high tensile modulus and shall have high resistance to damage during construction, to ultraviolet degradation, and to all forms of chemical and biological degradation encountered in the soil being reinforced.

2.3 The geotextiles shall have an Allowable Strength (T_a) and Pullout Resistance, for the soil type(s) indicated as listed in Table II.

2.4 Certification: The Contractor shall submit a manufacturer's certification that the geotextiles supplied meet the respective index criteria set when geotextile was approved by ENGEO, measured in full accordance with all test methods and standards specified. In case of dispute over validity of values, the Contractor will supply the data from an ENGEO-approved laboratory to support the certified values submitted.

3. CONSTRUCTION:

3.1 Delivery, Storage and Handling: Contractor shall check the geotextile upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the geotextile shall be protected from temperatures greater than 140 °F, mud, dirt, dust, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the geotextile will be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be repaired by placing a patch over the damaged area. Any geotextile damaged during storage or installation shall be replaced by the Contractor at no additional cost to the owner.

3.2 On-Site Representative: Geotextile material suppliers shall provide a qualified and experienced representative on site at the initiation of the project, for a minimum of three days, to assist the Contractor and ENGEO personnel at the start of construction. If there is more than one slope on a project, this criterion will apply to construction of the initial slope only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s).

3.3 Geotextile Placement: The geotextile reinforcement shall be installed in accordance with the manufacturer's recommendations. The geotextile reinforcement shall be placed within the layers of the compacted soil as shown on the plans or as directed.

The geotextile reinforcement shall be placed in continuous longitudinal strips in the direction of main reinforcement. Joints shall not be used with geotextiles.

Adjacent strips, in the case of 100 percent coverage in plan view, need not be overlapped. The minimum horizontal coverage is 50 percent, with horizontal spacings between reinforcement no greater than 40 inches. Horizontal coverage of less than 100 percent shall not be allowed unless specifically detailed in the construction drawings.

Adjacent rolls of geotextile reinforcement shall be overlapped or mechanically connected where exposed in a wrap around face system, as applicable.

The Contractor may place only that amount of geotextile reinforcement required for immediately pending work to prevent undue damage. After a layer of geotextile reinforcement has been placed, the succeeding layer of soil shall be placed and compacted as appropriate. After the specified soil layer has been placed, the next geotextile reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of geotextile reinforcement and soil.

Geosynthetic reinforcement shall be placed to lay flat and be pulled tight prior to backfilling. After a layer of geotextile reinforcement has been placed, suitable means, such as pins or small piles of soil, shall be used to hold the geotextile reinforcement in position until the subsequent soil layer can be placed.

Under no circumstances shall a track-type vehicle be allowed on the geotextile reinforcement before at least six inches of soil has been placed. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill and the geotextile reinforcement. If approved by the Manufacturer, rubber-tired equipment may pass over the geotextile reinforcement as slow speeds, less than 10 mph. Sudden braking and sharp turning shall be avoided.

During construction, the surface of the fill should be kept approximately horizontal. Geotextile reinforcement shall be placed directly on the compacted horizontal fill surface.

Geotextile reinforcements are to be placed within three inches of the design elevations and extend the length as shown on the elevation view unless otherwise directed by ENGEO. Correct orientation of the geotextile reinforcement shall be verified by ENGEO.

Table II
Allowable Geotextile Strength
With Various Soil Types
For Geosynthetic Reinforcement In
Mechanically Stabilized Earth Slopes

(Geotextile Pullout Resistance and Allowable Strengths vary with reinforced backfill used due to soil anchorage and site damage factors. Guidelines are provided below.)

SOIL TYPE	MINIMUM ALLOWABLE STRENGTH, T_a (lb/ft)*		
	GEOTEXTILE Type I	GEOTEXTILE Type II	GEOTEXTILE Type III
A. Gravels, sandy gravels, and gravel-sand-silt mixtures (GW, GP, GC, GM & SP)**	2400	4800	7200
B. Well graded sands, gravelly sands, and sand-silt mixtures (SW & SM)**	2000	4000	6000
C. Silts, very fine sands, clayey sands and clayey silts (SC & ML)**	1000	2000	3000
D. Gravelly clays, sandy clays, silty clays, and lean clays (CL)**	1600	3200	4800

* All partial Factors of Safety for reduction of design strength are included in listed values. Additional factors of safety may be required to further reduce these design strengths based on site conditions.

** Unified Soil Classifications.

PART IV - EROSION CONTROL MAT OR BLANKET

1. DESCRIPTION:

   Work shall consist of furnishing and placing a synthetic erosion control mat and/or degradable erosion control blanket for slope face protection and lining of runoff channels.

2. EROSION CONTROL MATERIALS:

   2.1 The specific erosion control material and supplier shall be pre-approved by ENGEO.

   2.2 Certification: The Contractor shall submit a manufacturer's certification that the erosion mat/blanket supplied meets the criteria specified when the material was approved by ENGEO. The manufacturer's certification shall include a submittal package of documented test results that confirm the property values. In case of a dispute over validity of values, the Contractor will supply property test data from an ENGEO-approved laboratory, to support the certified values submitted. Minimum average roll values, per ASTM D 4759, shall be used for conformance determinations.

3. CONSTRUCTION:

   3.1 Delivery, Storage, and Handling: Contractor shall check the erosion control material upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the erosion mat shall be protected from temperatures greater than 140 °F, mud, dirt, and debris. Manufacturer's recommendations in regard to protection from direct sunlight must also be followed. At the time of installation, the erosion mat/blanket shall be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be removed by cutting OUT a section of the mat. The remaining ends should be overlapped and secured with ground anchors. Any erosion mat/blanket damaged during storage or installation shall be replaced by the Contractor at no additional cost to the Owner.

   3.2 On-Site Representative: Erosion control material suppliers shall provide a qualified and experienced representative on site, for a minimum of one day, to assist the Contractor and ENGEO personnel at the start of construction. If there is more than one slope on a project, this criteria will apply to construction of the initial slope only. The representative shall be available on an as-needed basis, as requested by ENGEO, during construction of the remaining slope(s).

3.3 Placement: The erosion control material shall be placed and anchored on a smooth graded, firm surface approved by the Engineer. Anchoring terminal ends of the erosion control material shall be accomplished through use of key trenches. The material in the trenches shall be anchored to the soil on maximum 1½ foot centers. Topsoil, if required by construction drawings, placed over final grade prior to installation of the erosion control material shall be limited to a depth not exceeding 3 inches.

3.4 Erosion control material shall be anchored, overlapped, and otherwise constructed to ensure performance until vegetation is well established. Anchors shall be as designated on the construction drawings, with a minimum of 12 inches length, and shall be spaced as designated on the construction drawings, with a maximum spacing of 4 feet.

3.5 Soil Filling: If noted on the construction drawings, the erosion control mat shall be filled with a fine grained topsoil, as recommended by the manufacturer. Soil shall be lightly raked or brushed on/into the mat to fill the mat voids or to a maximum depth of 1 inch.

PART V - GEOSYNTHETIC DRAINAGE COMPOSITE

1. DESCRIPTION:

   Work shall consist of furnishing and placing a geosynthetic drainage system as a subsurface drainage medium for reinforced soil slopes.

2. DRAINAGE COMPOSITE MATERIALS:

   2.1 The specific drainage composite material and supplier shall be preapproved by ENGEO.

   2.2 The drain shall be of composite construction consisting of a supporting structure or drainage core material surrounded by a geotextile. The geotextile shall encapsulate the drainage core and prevent random soil intrusion into the drainage structure. The drainage core material shall consist of a three dimensional polymeric material with a structure that permits flow along the core laterally. The core structure shall also be constructed to permit flow regardless of the water inlet surface. The drainage core shall provide support to the geotextile. The fabric shall meet the minimum property requirements for filter fabric listed in Section 2.05C of the Guide Earthwork Specifications.

   2.3 A geotextile flap shall be provided along all drainage core edges. This flap shall be of sufficient width for sealing the geotextile to the adjacent drainage structure edge to prevent soil intrusion into the structure during and after installation. The geotextile shall cover the full length of the core.

   2.4 The geocomposite core shall be furnished with an approved method of constructing and connecting with outlet pipes or weepholes as shown on the plans. Any fittings shall allow entry of water from the core but prevent intrusion of backfill material into the core material.

   2.5 Certification and Acceptance: The Contractor shall submit a manufacturer's certification that the geosynthetic drainage composite meets the design properties and respective index criteria measured in full accordance with all test methods and standards specified. The manufacturer's certification shall include a submittal package of documented test results that confirm the design values. In case of dispute over validity of design values, the Contractor will supply design property test data from an ENGEO-approved laboratory, to support the certified values submitted. Minimum average roll values, per ASTM D 4759, shall be used for determining conformance.

3. CONSTRUCTION:

3.1 Delivery, Storage, and Handling: Contractor shall check the geosynthetic drainage composite upon delivery to ensure that the proper material has been received. During all periods of shipment and storage, the geosynthetic drainage composite shall be protected from temperatures greater than 140 °F, mud, dirt, and debris. Manufacturer's recommendations in regards to protection from direct sunlight must also be followed. At the time of installation, the geosynthetic drainage composite shall be rejected if it has defects, tears, punctures, flaws, deterioration, or damage incurred during manufacture, transportation, or storage. If approved by ENGEO, torn or punctured sections may be removed or repaired. Any geosynthetic drainage composite damaged during storage or installation shall be replaced by the Contractor at no additional cost to the Owner.

3.2 On-Site Representative: Geosynthetic drainage composite material suppliers shall provide a qualified and experienced representative on site, for a minimum of one half day, to assist the Contractor and ENGEO personnel at the start of construction with directions on the use of drainage composite. If there is more than one application on a project, this criterion will apply to construction of the initial application only. The representative shall also be available on an as-needed basis, as requested by ENGEO, during construction of the remaining applications.

3.3 Placement: The soil surface against which the geosynthetic drainage composite is to be placed shall be free of debris and inordinate irregularities that will prevent intimate contact between the soil surface and the drain.

3.4 Seams: Edge seams shall be formed by utilizing the flap of the geotextile extending from the geocomposite's edge and lapping over the top of the fabric of the adjacent course. The fabric flap shall be securely fastened to the adjacent fabric by means of plastic tape or non-water-soluble construction adhesive, as recommended by the supplier. Where vertical splices are necessary at the end of a geocomposite roll or panel, an 8-inch-wide continuous strip of geotextile may be placed, centering over the seam and continuously fastened on both sides with plastic tape or non-water-soluble construction adhesive. As an alternative, rolls of geocomposite drain material may be joined together by turning back the fabric at the roll edges and interlocking the cuspidations approximately 2 inches. For overlapping in this manner, the fabric shall be lapped and tightly taped beyond the seam with tape or adhesive. Interlocking of the core shall always be made with the upstream edge on top in the direction of water flow. To prevent soil intrusion, all exposed edges of the geocomposite drainage core edge must be covered. Alternatively, a 12-inch-wide strip of fabric may be utilized in the same manner, fastening it to the exposed fabric 8 inches in from the edge and folding the remaining flap over the core edge.

3.5 Soil Fill Placement: Structural backfill shall be placed immediately over the geocomposite drain. Care shall be taken during the backfill operation not to damage the geotextile surface of the drain. Care shall also be taken to avoid excessive settlement of the backfill material. The geocomposite drain, once installed, shall not be exposed for more than seven days prior to backfilling.

APPENDIX E

Percolation Test Field Data and Calculated Rates for Ponds 1, 2, 3 and 5

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by: Will Carter

Address: East Garrison Phase 1

Test Hole #: 1A   Diameter of hole: 6"

Location: Potential Infiltration Pond #1 Location

Depth at bottom of hole: OG-24 inches

Date presoak started: 7/14/2003   Starting at: 9:30 AM

Depth of initial water filling: 12" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours: 5 gallon buckets

Date presoak ended: 7/14/2003   Ending at: 2:06 PM

Date perc readings conducted: 7/14/2003   Starting at: 2:06 PM

Test Number	Elapsed Time (min)	Drop in Water Level (inches)	Percolation Rate (mpi)	Corrected Rate (mpi)	Percolation Rate (cm/sec)
1	8	1.0	8	10	4.1E-03
2	10	1.0	10	13	3.3E-03
3	10	0.8	13	17	2.4E-03
4	10	0.8	13	17	2.4E-03
5	10	0.8	13	17	2.4E-03
6	10	0.8	13	17	2.4E-03
7	10	0.8	13	17	2.4E-03

Average Percolation Rate for Pond 1: 2.8E-03 cm/sec

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by: Will Carter

Address: East Garrison Phase 1

Test Hole #: 1B Diameter of hole: 6"

Location: Potential Infiltration Pond #1 Location

Depth at bottom of hole: OG-24 inches

Date presoak started: 7/14/2003 Starting at: 9:30 AM

Depth of initial water filling: 12" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours: 5 gallon buckets

Date presoak ended: 7/14/2003 Ending at: 3:14 PM

Date perc readings conducted: 7/14/2003 Starting at: 3:14 PM

Test Number	Elapsed Time (min)	Drop in Water Level (Inches)	Percolation Rate (mpi)	Corrected Rate (mpi)	Percolation Rate (cm/sec)
1	6	1.0	6	8	5.4E-03
2	8	1.0	8	10	4.1E-03
3	9	1.0	9	12	3.6E-03
4	9.75	1.0	10	13	3.3E-03
5	10	1.0	10	13	3.3E-03
6	10	1.0	10	13	3.3E-03
7	10	1.0	10	13	3.3E-03

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by: Kshitija Naphade

Address: East Garrison Phase 1

Test Hole #: 2A Diameter of hole: 6"

Location: Potential Infiltration Pond #2 Location

Depth at bottom of hole: OG-24 inches

Date presoak started: 7/14/2003 Starting at: 8:30 AM

Depth of initial water filling: 12" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours: 5 gallon buckets

Date presoak ended: 7/14/2003 Ending at: 12:57 PM

Date perc readings conducted: 7/14/2003 Starting at: 12:57 PM

Test Number	*Elapsed Time (min)*	*Drop in Water Level (inches)*	*Percolation Rate (mpi)*	*Corrected Rate (mpi)*	*Percolation Rate (cm/sec)*
1	10	0.5	20	26	1.6E-03
2	10	0.5	20	26	1.6E-03
3	10	0.5	22	29	1.5E-03
4	10	0.5	20	26	1.6E-03
5	10	0.5	20	26	1.6E-03
6	10	0.5	20	26	1.6E-03

Average Percolation Rate for Pond 2: 1.5E-03 cm/sec

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by Kshitija Naphade

Address East Garrison Phase 1

Test Hole # 2B Diameter of hole 6"

Location Potential Infiltration Pond #2 Location

Depth at bottom of hole OG-24 inches

Date presoak started 7/14/2003 Starting at 8:30 AM

Depth of initial water filling 12" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours 5 gallon buckets

Date presoak ended 7/14/2003 Ending at 3:16 PM

Date perc readings conducted 7/14/2003 Starting at 3:16 PM

Test Number	***Elapsed Time (min)***	***Drop in Water Level (inches)***	***Percolation Rate (mpi)***	***Corrected Rate (mpi)***	***Percolation Rate (cm/sec)***
1	10	0.4	25	33	1.3E-03
2	10	0.4	25	33	1.3E-03
3	10	0.4	25	33	1.3E-03
4	10	0.4	25	33	1.3E-03
5	10	0.4	25	33	1.3E-03
6	10	0.4	25	33	1.3E-03

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by: Kshitija Naphade

Address: East Garrison Phase 1

Test Hole #: 3A Diameter of hole: 6"

Location: Potential Infiltration Pond #3 Location

Depth at bottom of hole: OG-24 inches

Date presoak started: 7/14/2003 Starting at: 8:00 AM

Depth of initial water filling: 12" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours: 5 gallon buckets

Date presoak ended: 7/14/2003 Ending at: 11:18 AM

Date perc readings conducted: 7/14/2003 Starting at: 11:18 AM

Test Number	Elapsed Time (min)	Drop in Water Level (inches)	Percolation Rate (mpi)	Corrected Rate (mpi)	Percolation Rate (cm/sec)
1	10	0.3	33	43	9.8E-04
2	10	0.2	50	65	6.5E-04
3	10	0.2	50	65	6.5E-04
4	10	0.2	50	65	6.5E-04
5	10	0.2	50	65	6.5E-04
6	10	0.2	50	65	6.5E-04

Average Percolation Rate for Pond 3: 6.5E-04 cm/sec

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by: Kshitija Naphade

Address: East Garrison Phase 1

Test Hole #: 3B   Diameter of hole: 6"

Location: Potential Infiltration Pond #3 Location

Depth at bottom of hole: OG-24 inches

Date presoak started: 7/14/2003   Starting at: 8:00 AM

Depth of initial water filling: 11" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours: 5 gallon buckets

Date presoak ended: 7/14/2003   Ending at: 4:45 PM

Date perc readings conducted: ---   Starting at: ---

Test Number	Elapsed Time (min)	Drop in Water Level (inches)	Percolation Rate (mpi)	Corrected Rate (mpi)	Percolation Rate (cm/sec)
1					
2					
3	Only 0.5" water soaked between 8:00 am and 4:45 pm				
4	No readings taken.				
5	Roughly 10.5" standing water in pipe				
6					
7					

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by: Will Carter

Address: East Garrison Phase 1

Test Hole #: 5A Diameter of hole: 6"

Location: Potential Infiltration Pond #5 Location

Depth at bottom of hole: OG-24 inches

Date presoak started: 7/14/2003 Starting at: 9:00 AM

Depth of initial water filling: 12" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours: 5 gallon buckets

Date presoak ended: 7/14/2003 Ending at: 12:20 PM

Date perc readings conducted: 7/14/2003 Starting at: 12:20 PM

Test Number	*Elapsed Time (min)*	*Drop in Water Level (inches)*	*Percolation Rate (mpi)*	*Corrected Rate (mpi)*	*Percolation Rate (cm/sec)*
1	8	1.0	8	10	4.1E-03
2	10	0.8	13	17	2.4E-03
3	10	0.9	11	15	2.8E-03
4	10	0.9	11	15	2.8E-03
5	10	0.9	11	15	2.8E-03
6	10	0.9	11	15	2.8E-03
7	10	0.9	11	15	2.8E-03

Average Percolation Rate for Pond 5: 1.8E-03 cm/sec

JOB #	5866.3.001.01

PERCOLATION TEST DATA SHEET

Company Name: ENGEO Incorporated

Percolation Test Performed by Will Carter

Address East Garrison Phase 1

Test Hole # 5B Diameter of hole 6"

Location Potential Infiltration Pond #5 Location

Depth at bottom of hole OG-24 inches

Date presoak started 7/14/2003 Starting at 9:00 AM

Depth of initial water filling 12" above hole bottom

Method used to maintain 12" of water depth in hole for 4 hours 5 gallon buckets

Date presoak ended 7/14/2003 Ending at 4:20 PM

Date perc readings conducted 7/14/2003 Starting at 4:20 PM

Test Number	Elapsed Time (min)	Drop in Water Level (inches)	Percolation Rate (mpi)	Corrected Rate (mpi)	Percolation Rate (cm/sec)
1	10	0.3	40	52	8.1E-04
2	10	0.3	40	52	8.1E-04
3	10	0.3	40	52	8.1E-04
4	10	0.3	40	52	8.1E-04
5	10	0.3	40	52	8.1E-04