

APPENDIX 3.1.3-1
Updated Geotechnical Report

**UPDATE
GEOTECHNICAL REPORT**

**THE VILLAGES AT
ESCONDIDO COUNTRY CLUB
ESCONDIDO, CALIFORNIA**



GEOCON
INCORPORATED

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

**NEW URBAN WEST, INCORPORATED
SAN DIEGO, CALIFORNIA**

**OCTOBER 31, 2016
PROJECT NO. G1588-32-02**



Project No. G1588-32-02
October 31, 2016

New Urban West, Incorporated
16935 West Bernardo Drive, Suite 260
San Diego, California 92127

Attention: Mr. Jonathan Frankel

Subject: UPDATE GEOTECHNICAL REPORT
THE VILLAGES AT ESCONDIDO COUNTRY CLUB
ESCONDIDO, CALIFORNIA

Dear Mr. Frankel:

In accordance with your request and authorization of our proposal dated October 14, 2016, we have prepared this update geotechnical report for the subject project. The accompanying report presents a compilation of the existing subsurface information on a revised grading plan and provides updated recommendations based on the new plan. It is our opinion that the site can be developed as planned, provided the recommendations of this report are followed.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON INCORPORATED

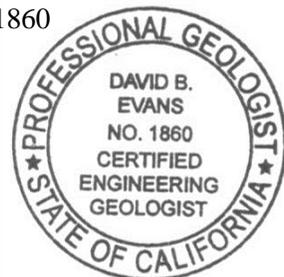
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UPDATE GEOTECHNICAL REPORT

1. PURPOSE AND SCOPE

The purpose and scope of this update geotechnical report was to prepare a compilation of the existing subsurface information on a revised grading plan and provide updated recommendations based on the new plan for the proposed 327-lot residential subdivision located in Escondido, California (see *Vicinity Map*, Figure 1). This report presents our geotechnical recommendations for developing the property based on the revised plans entitled, *Vesting Tentative Map, The Villages in the City of Escondido, State of California*, Sheets 2 through 12, prepared by Rick Engineering Company, print date October 26, 2016.

This report is intended to update our previous reports entitled *Preliminary Geotechnical Investigation, The Lakes, Escondido, California*, dated July 3, 2013 and *Update Geotechnical Report, The Lakes Escondido, Escondido, California*, dated May 26, 2015. It should be noted that the original investigation was based on a previous grading plan that has been modified. As a consequence, future subsurface studies may be necessary to focus on areas where information is lacking with respect to rock excavation characteristics and the extent of remedial grading.

The previous field work consisted of drilling 14 hollow-stem auger borings, 49 exploratory trenches, and 8 seismic traverses. The approximate locations of the subsurface information are shown on the *Geologic Map*, Figure 2. Details of the field exploration as well as descriptive boring and trench logs are presented in Appendix A. The laboratory tests performed during our original study are presented in Appendix B. The seismic refraction survey report performed by Southwest Geophysics is included in Appendix C.

The recommendations presented herein are based on analysis of the data and observations performed during our previous studies, laboratory information and our experience with similar soil and geologic conditions.

2. SITE AND PROJECT DESCRIPTION

The property consists of approximately 109-acres located within the boundaries of the former Escondido Country Club situated within the northwest portion of Escondido, California. The site is predominantly surrounded by single family residential homes with a limited number of low density multi-family units and a senior residential community.

Topographically, the site consists of generally flat terrain with some gentle to moderate sloped areas in the eastern portion of the property. The topography is characteristic of the geologic units present where surface morphology is dictated by the resistance of each unit to erosion. Gentle slopes comprise

the lower elevations of the site (alluvium and colluvium), whereas the exposures of hard rock has resulted in the moderately sloped, cone-shaped projections as observed within and surrounding areas of the property.

Vegetation primarily consists of previously maintained grass areas utilized for the golf course along with several mature trees scattered about the property. Man-made improvements consist of concrete paved golf cart paths, several shallow lakes, six wells, a bathroom facility and a clubhouse with associated pool, tennis court, asphalt paved parking lot and other hardscape improvements.

It is our understanding that the subject property will be developed to create 327 residential lots in three villages. Six-plex condominiums are proposed on thirteen of the lots yielding a total dwelling unit count of 392. A clubhouse site, HOA open space areas, bioretention basins and drainage swales are also proposed. In addition, associated infrastructure improvements such as wet and dry utilities, roadways, and sidewalks are planned throughout the project.

Based on our review of the referenced plans, grading will consist of approximately 850,000 cubic yards of cut and fill, respectively. We understand that these estimates do not account for shrinking of the surficial deposits that will require remedial grading. Cut and fill slopes are designed at 2:1 (horizontal:vertical) or flatter with maximum heights of 35 and 55 feet, respectively.

The locations and descriptions of the site and proposed development are based on our previous field investigation, site reconnaissance, a review of the available plans, and our understanding of the project. If project details vary significantly from those described, Geocon Incorporated should be consulted to provide additional recommendations and/or analysis.

3. SOIL AND GEOLOGIC CONDITIONS

Four surficial soil types and two geologic formations were encountered during the field investigations. The surficial deposits consist of undocumented fill, topsoil, alluvium, and colluvium. The formational units include Cretaceous-age granitic rock and Jurassic-age metasedimentary/metavolcanic rock. Due to their random occurrence and difficulty in identifying these units, we have identified the bedrock as Mesozoic Rock on the *Geologic Map*. Each of the surficial soil types and geologic units encountered is described in order of increasing age. The approximate extent of these materials, excluding topsoil, is shown on Figure 2.

3.1 Undocumented Fill (Qudf_{1&2})

In general, two types of undocumented fill soils were encountered within the project site. Fill soils associated with the development of the golf course are identified on the *Geologic Map* as Qudf₁ and embankments associated with the surrounding developments and infrastructure as Qudf₂.

The majority of the undocumented fill soils identified within the interior of the project were placed as part of the former golf course and are expected to be widespread and vary in thickness from a thin veneer to approximately 10-feet-thick. Only the fill deposits (Qudf₁), estimated to be over 2 feet thick were mapped on Figure 2. The materials observed within five of the exploratory trenches (T-1, T-2, T-4, T-6, and T-10) generally consist of silty sands with some gravel. Complete removal of these embankments will be required in areas of proposed improvements.

Undocumented fills associated with existing housing developments and roadways (Qudf₂) encroach onto the property along the boundaries of the project. These areas will need to be evaluated during grading to determine if remedial grading will be required (i.e. removal and compaction or stability fills) especially where settlement sensitive improvements are planned.

3.2 Topsoil (Unmapped)

Topsoils were encountered in four exploratory trenches (T-20, T-28, T-32, and T-38) and varied in thickness from 1 to 2 feet. The topsoils are characterized as loose, silty sands and are considered unsuitable in their present condition. These deposits will require remedial grading in areas of proposed improvements.

3.3 Alluvium (Qal)

Alluvial soils were found throughout the property with a maximum thickness of approximately 26 feet (Boring B-8). These deposits primarily consist of loose to dense, silty to clayey sands with varying amounts of gravel, cobble and boulder size rock fragments derived from the bedrock units. Some silt and clayier lenses were also encountered in several of the borings and trenches as well. Laboratory analysis indicates that portions of the alluvium have adequate compression characteristics to support the anticipated structural loads. Therefore, only the compressible portions of the alluvium will require remedial grading, as discussed in the *Conclusions and Recommendations* section.

It is anticipated that grading will expose alluvial and colluvial deposits within the majority of the proposed cut slopes throughout the project. Additional observation and testing during grading may be necessary to evaluate the suitability of these materials in the slopes. Remedial measures consisting of stability fills may be necessary where unsuitable materials are exposed in cut slope areas.

3.4 Colluvium (Qc)

Colluvial deposits up to a maximum of 6-feet-thick were encountered along the hillsides above the alluvial drainages overlying the formational rock units. These deposits generally consist of loose to medium dense, silty to clayey sands with varying amounts of gravel, cobble and boulders size rock fragments.

These deposits are similar to the alluvial soils in that the material observed/tested appears to have adequate strength to support fill soils and/or structural loads. As such, the same remedial grading requirements will also be recommended within future improvement areas as discussed in the *Conclusions and Recommendations* section.

3.5 Mesozoic Rock (Mr)

The property is underlain by Cretaceous-age granitic rock and Jurassic-age Santiago Peak Volcanics which are both Mesozoic in origin. The emplacement of the granitic rock through the older metavolcanic and metasedimentary units created mixing zones and outcrops of varying composition across the project area. Since it was difficult to distinguish between these units, we have designated the bedrock units as (Mr)-Mesozoic rock on the *Geologic Map*.

In general, the composition of the rock units encountered consisted primarily of weakly to moderately metamorphosed sandstones and siltstones while other areas contained granite and andesite. The rocks exhibited a variable weathering pattern ranging from completely weathered to slightly weathered, weak to very strong rock (Trench T-28). It should be anticipated that excavations within the various rock units may generate boulders and oversize materials (rocks greater than 12 inches in length) that will require special handling and placement as recommended hereinafter and discussed in the *Rippability and Rock Considerations* section of this report.

4. RIPPABILITY AND ROCK CONSIDERATIONS

To aid in evaluating the rippability characteristics of the rock within the project site, subsurface exploration consisting of a rubber tire backhoe, a small diameter hollow stem drill rig and seismic traverses were utilized. The exploratory trench and boring logs are presented in Appendix A and Appendix C contains the seismic refraction survey report and eight seismic traverses conducted by Southwest Geophysics.

In general, the results indicate that the rock materials observed have a variable weathering pattern ranging from completely weathered to slightly weathered and are weak to very strong rock. However, the majority of the excavations encountered highly weathered to weak/moderately weak rock conditions. Rock rippability is a function of natural weathering processes that can vary vertically and horizontally over short distances depending on jointing, fracturing, and/or mineralogic discontinuities within the bedrock.

Based on the relative thickness of the surficial deposits and cuts proposed for the project it is anticipated that the majority of the excavations will encounter medium dense to cemented alluvium and colluvium deposits, and Mesozoic rock material. The areas anticipated to encounter rock are primarily in the northeastern portion of the site north of the intersection of K Street and Country Club

Lane. Hard rock may also be encountered in areas where proposed utility corridors will extend through the surficial deposits and into Mesozoic rock. Some of the exploratory trenches encountered practical refusal and refusal within the cemented portions of alluvium, colluvium and within the Mesozoic rock, however, these excavations were advanced using a John Deere 410G rubber tire backhoe.

We estimate that conventional heavy-duty grading equipment will encounter areas of marginally to difficult ripping conditions that may generate oversized rock (rocks greater than 12-inches in dimension), which will necessitate typical hard rock handling and placement procedures during grading operations. Blasting may be required in the deeper cut areas and utility corridors. Since the new plan proposes deeper excavations than the original plan, a supplemental rippability study may be desired where the deeper excavations are proposed and rippability information is lacking (e.g. north of K Street and Country Club Lane). Perspective contractors should use their own judgment to evaluate the rippability and review the logs and seismic survey report presented in Appendices A and C, respectively.

Earthwork construction should be carefully planned to efficiently utilize available rock placement areas. Roadway/utility corridors and lot undercutting criteria should also be considered when calculating the volume of hard rock. Oversize materials should be placed in accordance with rock placement procedures presented in Appendix D of this report and the City of Escondido Grading Ordinance.

5. GROUNDWATER

Groundwater and/or seepage were encountered within several of the exploratory trenches and borings performed during the field investigation. Groundwater/seepage was found as shallow as 4½ feet in Trench No. T-22 and as deep as 24 feet in Boring No. B-8. However, due to the geologic conditions and the natural and artificial water sources inherent to the property, groundwater conditions are expected to fluctuate seasonally.

Remedial grading will likely encounter excavation and compaction difficulty due to wet and/or saturated soil conditions (see Trench Nos. T-13, T-21, and T-22). Dewatering and top loading may be required in the low-lying alluvial areas in order to remove the unsuitable materials.

Six groundwater wells were identified during our study as shown on the *Geologic Map*. The wells were constructed to provide irrigation for the golf course and are generally positioned in alluvial areas. Three of the wells (W-4 through W-6) were measured to identify the existing groundwater elevations. The elevations varied between minus 2 and 5 feet below existing grade.

6. GEOLOGIC HAZARDS

6.1 Faulting and Seismicity

A review of the referenced geologic materials and our knowledge of the general area indicate that the site is not underlain by active, potentially active, or inactive faults. An active fault is defined by the California Geological Survey (CGS) as a fault showing evidence for activity within the last 11,000 years. The site is not located within a State of California Earthquake Fault Zone.

According to the computer program *EZ-FRISK* (Version 7.62), 9 known active faults are located within a search radius of 50 miles from the property. The nearest known active fault is the Elsinore Fault, located approximately 14 miles east of the site and is the dominant source of potential ground motion. Earthquakes that might occur on the Elsinore Fault Zone or other faults within the southern California and northern Baja California area are potential generators of significant ground motion at the site. The estimated deterministic maximum earthquake magnitude and peak ground acceleration for the Elsinore Fault are 7.85 and 0.25g, respectively. Table 6.1.1 lists the estimated maximum earthquake magnitude and peak ground acceleration for the most dominant faults in relationship to the site location. We calculated peak ground acceleration (PGA) using Boore-Atkinson (2008) NGA USGS2008, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) NGA acceleration-attenuation relationships.

**TABLE 6.1.1
DETERMINISTIC SPECTRA SITE PARAMETERS**

Fault Name	Distance from Site (miles)	Maximum Earthquake Magnitude (Mw)	Peak Ground Acceleration		
			Boore-Atkinson 2008 (g)	Campbell-Bozorgnia 2008 (g)	Chiou-Youngs 2008 (g)
Elsinore	14	7.85	0.25	0.19	0.25
Newport-Inglewood	15	7.5	0.22	0.17	0.21
Rose Canyon	15	6.9	0.19	0.15	0.16
Coronado Bank	31	7.6	0.15	0.10	0.11
Palos Verdes Connected	31	7.7	0.17	0.11	0.13
Earthquake Valley	31	6.8	0.12	0.08	0.07
San Jacinto	39	7.88	0.15	0.10	0.12
San Joaquin Hills	44	7.1	0.10	0.09	0.08
Palos Verdes	47	7.3	0.11	0.07	0.07

We used the computer program *EZ-FRISK* to perform a probabilistic seismic hazard analysis. The computer program *EZ-FRISK* operates under the assumption that the occurrence rate of earthquakes

on each mappable Quaternary fault is proportional to the faults slip rate. The program accounts for fault rupture length as a function of earthquake magnitude, and site acceleration estimates are made using the earthquake magnitude and distance from the site to the rupture zone. The program also accounts for uncertainty in each of following: (1) earthquake magnitude, (2) rupture length for a given magnitude, (3) location of the rupture zone, (4) maximum possible magnitude of a given earthquake, and (5) acceleration at the site from a given earthquake along each fault. By calculating the expected accelerations from considered earthquake sources, the program calculates the total average annual expected number of occurrences of site acceleration greater than a specified value. We utilized acceleration-attenuation relationships suggested by Boore-Atkinson (2008) NGA USGS, Campbell-Bozorgnia (2008) NGA USGS, and Chiou-Youngs (2008) in the analysis. Table 6.1.2 presents the site-specific probabilistic seismic hazard parameters including acceleration-attenuation relationships and the probability of exceedence.

**TABLE 6.1.2
PROBABILISTIC SEISMIC HAZARD PARAMETERS**

Probability of Exceedence	Peak Ground Acceleration		
	Boore-Atkinson, 2007 (g)	Campbell-Bozorgnia, 2008 (g)	Chiou-Youngs, 2008 (g)
2% in a 50 Year Period	0.51	0.40	0.47
5% in a 50 Year Period	0.40	0.31	0.35
10% in a 50 Year Period	0.32	0.25	0.27

The California Geologic Survey (CGS) has a program that calculates the ground motion for a 10 percent of probability of exceedence in 50 years based on an average of several attenuation relationships. Table 6.1.3 presents the calculated results from the *Probabilistic Seismic Hazards Mapping Ground Motion* Page from the CGS website.

**TABLE 6.1.3
PROBABILISTIC SITE PARAMETERS FOR SELECTED FAULTS
CALIFORNIA GEOLOGIC SURVEY**

Calculated Acceleration (g) Firm Rock	Calculated Acceleration (g) Soft Rock	Calculated Acceleration (g) Alluvium
0.27	0.29	0.33

While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site. Seismic design of the structures should be

evaluated in accordance with the California Building Code (CBC) guidelines currently adopted by the County of San Diego.

6.2 Liquefaction and Seismically Induced Settlement

Liquefaction typically occurs when a site is located in a zone with seismic activity, the on-site soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If four of the previous criteria are met, a seismic event could result in a rapid pore-water pressure increase from the earthquake-generated ground accelerations. Seismically induced settlement may occur whether the potential for liquefaction exists or not. The potential for liquefaction at the site is considered low due to the relative density of the alluvium/colluvium to remain in-place, dense formational material encountered and remedial grading recommended.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 General

- 7.1.1 From a geotechnical engineering standpoint, it is our opinion that the site is suitable for the proposed development provided the recommendations presented herein are implemented in design and construction of the project. Since the original study was based on a different grading plan, additional subsurface investigation may be desired to address areas where information is lacking.
- 7.1.2 The site is underlain by surficial units that include undocumented fill soils, topsoils, colluvium, and alluvium. The undocumented fill, topsoils, and upper portions of alluvium and colluvium deposits are unsuitable in their present condition for support of fill and/or structural loads and will require remedial grading where improvements are planned. The actual extent of unsuitable soil removal will be determined in the field by the geotechnical engineer and/or engineering geologist.
- 7.1.3 Laboratory analysis generally indicates that the alluvial and colluvial material below approximately 5 feet of existing grade is suitable to be left in-place beneath the proposed improvements. However, isolated areas of the site (see Trench T-21 and T-22) may require removals below 5 feet. Additional field work and laboratory testing may be necessary to confirm this conclusion where existing geotechnical information is limited. It should be noted due to the unconfined nature of trenches some of the more cohesionless soils were described as loose, however, compression tests performed later indicated suitable conditions.
- 7.1.4 Remedial grading to remove existing undocumented fill soils mapped along the project margins (Qudf₂) will likely be affected by existing improvements and/or property line constraints. These areas will require evaluation during grading to determine the impacts, if any, to proposed and existing improvements.
- 7.1.5 Hard rock and cemented alluvial and colluvial deposits within proposed cut areas, if present, will require special consideration during site development. It is anticipated that the majority of the proposed excavations will require moderate to heavy ripping with conventional heavy-duty equipment. Possible blasting may be necessary in the deeper cuts or utility corridors of the project. In addition, heavy ripping and possible blasting may generate oversize materials and corestones that will require special handling and fill placement procedures. Oversize materials should be placed in accordance with Appendix D of this report.

- 7.1.6 Cut slopes should be observed during grading by an engineering geologist to verify that the soil and geologic conditions are suitable and do not differ significantly from those anticipated. Particular attention should be given to the slopes excavated in alluvium and colluvium deposits. Drained stability fills may be necessary if unsuitable materials are exposed in these slopes. Scaling of loose rock fragments from proposed cut slopes may also be necessary.
- 7.1.7 Due to shallow depth of groundwater/seepage encountered within the low lying alluvial drainages, possible dewatering and/or top loading may be required to remove the unsuitable surficial deposits within these areas.
- 7.1.8 The existing surficial soil may be impacted by chemicals that may have been used during the maintenance of the former golf course. The scope of our services did not address the environmental aspects of the property.
- 7.1.9 The six wells identified during our field reconnaissance will need to be destroyed in accordance with the County of San Diego Department of Environmental Health. Once the project has been approved, a licensed drilling contractor with a valid C57 license will need to be contracted to properly destroy the wells.
- 7.1.10 If import material is required, the soil should be tested and approved by Geocon Incorporated prior to importation. At least 3 working days should be allowed for laboratory testing of the soil prior to its importation. The imported soil should be predominantly granular, have an Expansion Index less than 50 and free from contaminants.
- 7.1.11 The review of the project grading plans indicates that bioretention basins are proposed throughout the development. The plans indicate that these features will be lined with a membrane to prevent water leakage and/or infiltration. Once the final grading plans are developed, Geocon should be consulted to review the basin design and provide additional geotechnical information, if necessary.

7.2 Subdrains

- 7.2.1 Based on the generally flat terrain, lack of any defined drainage, and inability to place subdrain systems on bedrock contacts, subdrains will not be necessary. However, if localized or perched groundwater conditions are encountered during grading that will allow for a drain system to be installed, recommendations will be provided at that time.

7.3 Corrosion

7.3.1 Geocon Incorporated does not practice in the field of corrosion engineering; therefore, if improvements that could be susceptible to corrosion are planned, it is recommended that further evaluation by a corrosion engineer be performed.

7.4 Excavation and Soil Characteristics

7.4.1 The soil encountered in the field investigation is considered to be “expansive” (expansion index [EI] of greater than 20) as defined by 2013 California Building Code (CBC) Section 1803.5.3. Table 7.4 presents soil classifications based on the expansion index. A majority of the soil encountered is planned to possess a “low” to “medium” expansion potential (expansion index of 90 or less).

TABLE 7.4
SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Soil Classification
0 – 20	Very Low
21 – 50	Low
51 – 90	Medium
91 – 130	High
Greater Than 130	Very High

7.4.2 Excavating within the Mesozoic rock materials, and to a lesser extent the alluvial and colluvial deposits, will generally vary in difficulty with the depth of excavation depending on the degree of weathering. Blasting may be required within the deeper proposed cut and utility corridor areas if unweathered/fresh rock materials are encountered. Since proposed fill areas and depths are relatively limited, oversize rock may require breakage to acceptable sizes or exportation from the property, if encountered. Placement of oversize rock within the area of proposed underground utilities should not be permitted.

7.4.3 Alluvium and colluvium may be very moist to saturated that may require mixing with drier material or drying prior to use as compacted fill. Possible dewatering and or top loading may be necessary during remedial grading especially along the eastern margin of the site.

7.4.4 It is the responsibility of the contractor to ensure that all excavations and trenches are properly shored and maintained in accordance with applicable OSHA rules and regulations in order to maintain safety and maintain the stability of adjacent existing improvements.

7.5 Grading

- 7.5.1 All grading should be performed in accordance with the *Recommended Grading Specifications* contained in Appendix D. Where the recommendations of Appendix D conflict with this report, the recommendations of this report should take precedence.
- 7.5.2 Prior to commencing grading, a preconstruction conference should be held at the site with the owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.
- 7.5.3 Site preparation should begin with the removal of all deleterious material and vegetation. The depth of removal should be such that material exposed in cut areas or soils to be used as fill is relatively free of organic matter. Material generated during stripping and/or site demolition should be exported from the site.
- 7.5.4 Undocumented fill soil, topsoils, and upper portions (minimum of 5 feet) of alluvium and colluvium deposits within areas of planned grading should be removed to firm natural ground and properly compacted prior to placing additional fill and/or structural loads. The actual extent of unsuitable soil removals will be determined in the field by the soil engineer and/or engineering geologist. Overly wet, surficial materials will require drying and/or mixing with drier soils to facilitate proper compaction.
- 7.5.5 The site should then be brought to final subgrade elevations with structural fill compacted in layers. In general, soils native to the site are suitable for re-use as fill if free from vegetation, debris and other deleterious material. Layers of fill should be no thicker than will allow for adequate bonding and compaction. All fill, including backfill and scarified ground surfaces, should be compacted to at least 90 percent of maximum dry density, at or above, optimum moisture content, as determined in accordance with ASTM Test Procedure D 1557. Fill materials near and/or below optimum moisture content may require additional moisture conditioning prior to placing additional fill.
- 7.5.6 To reduce the potential for differential settlement, and to facilitate the excavation of footings and utility trenches it is recommended that cut lots that encounter dense/cemented alluvium and colluvium, rock and cut-fill transition pads be undercut at least 3 feet and replaced with properly compacted “very low” to “low” expansive fill soils. Where the thickness of the fill below the building pad exceeds 15 feet, the depth of the undercut should be increased to one-fifth of the maximum fill thickness. The base of the undercut excavation in the cut portion of cut/fill transition lots or undercut pads should be inclined

approximately 1 percent towards the front of the lot to reduce the potential for ponding at the base of the fill.

7.5.7 Deeper undercutting of street areas should be considered to facilitate the excavation of underground utilities. If other subsurface improvements (i.e. landscape zones, swimming pools, retaining wall footings) are planned beyond areas that are not undercut, consideration should be given to undercutting these areas as well.

7.5.8 Where practical, the upper 3 feet of all building pads (cut or fill) and 12 inches in pavement areas should be composed of properly compacted or undisturbed formational “very low” to “low” expansive soils. The more highly expansive fill soils should be placed in the deeper fill areas and properly compacted. “Very low” to “low” expansive soils are defined as those soils that have an Expansion Index of 50 or less as defined by 2013 California Building Code (CBC) Section 1803.5.3.

7.5.9 Oversize materials greater than 12 inches in maximum dimension should not be placed within 10 feet of finish grade and a minimum of 2 feet below the deepest utility. Material greater than 6 inches in maximum dimension should not be placed within 3 feet of finish grade in building pad areas. This restriction may be modified upon approval of the City of Escondido.

7.6 Slope Stability

7.6.1 Slope stability analyses were performed utilizing average drained direct shear strength parameters obtained from our laboratory testing and our experience with similar soil conditions. These analyses indicate that the proposed fill and cut slopes constructed of on-site materials should have calculated factors of safety of at least 1.5 under static conditions for both deep-seated failure and shallow sloughing conditions. Slope stability calculations for deep-seated and surficial fill slope stability are presented on Figures 3 through 5.

7.6.2. Cut slopes in rock materials do not lend themselves to conventional slope stability analyses. Based on experience with similar rock conditions, the proposed cut slopes in rock should possess a factor of safety of at least 1.5 with respect to deep-seated slope instability if free of adversely oriented joints or fractures. The cut slope excavations should be observed during grading by an engineering geologist to verify that soil and geologic conditions do not differ significantly from those anticipated. In the event that adverse conditions are observed, stabilization recommendations can be provided.

- 7.6.3 The outer 15 feet (or a distance equal to the height of the slope, whichever is less) of fill slopes should be composed of properly compacted granular “soil” fill to reduce the potential for surficial sloughing. In general, soils with an Expansion Index of less than 50 or at least 35 percent sand size particles should be acceptable as “granular” fill. Soils of questionable strength to satisfy surficial stability should be tested in the laboratory for acceptable drained shear strength.
- 7.6.4 Fill slopes should be compacted by backrolling with a loaded sheepfoot roller at vertical intervals not to exceed 4 feet and should be track-walked at the completion of each slope such that the fill soils are uniformly compacted to at least 90 percent relative compaction to the face of the finished slope. Alternatively, the fill slope may be over-built and cut back to yield a properly compacted slope face.
- 7.6.5 All slopes should be landscaped with drought-tolerant vegetation, having variable root depths and requiring minimal landscape irrigation. In addition, all slopes should be drained and properly maintained to reduce erosion.

7.7 Seismic Design Criteria

- 7.7.1 We used the computer program *Seismic Hazard Curves and Uniform Hazard Response Spectra*, provided by the USGS. Table 7.7.1 summarizes site-specific design criteria obtained from the 2013 California Building Code (CBC; Based on the 2012 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements should be designed using a Site Class D. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2013 CBC and Table 20.3-1 of ASCE 7-10. The values presented in Table 7.7.1 are for the risk-targeted maximum considered earthquake (MCE_R).

**TABLE 7.7.1
2013 CBC SEISMIC DESIGN PARAMETERS**

Parameter	Value	2013 CBC Reference
Site Class	D	Section 1613.3.2
MCE _R Ground Motion Spectral Response Acceleration – Class B (short), S _S	1.046g	Figure 1613.3.1(1)
MCE _R Ground Motion Spectral Response Acceleration – Class B (1 sec), S ₁	0.407g	Figure 1613.3.1(2)
Site Coefficient, F _A	1.082	Table 1613.3.3(1)
Site Coefficient, F _V	1.593	Table 1613.3.3(2)
Site Class Modified MCE _R Spectral Response Acceleration (short), S _{MS}	1.131g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE _R Spectral Response Acceleration (1 sec), S _{MI}	0.648g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S _{DS}	0.754g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S _{DI}	0.432g	Section 1613.3.4 (Eqn 16-40)

7.7.2 Table 7.7.2 presents additional seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10 for the mapped maximum considered geometric mean (MCE_G).

**TABLE 7.7.2
2013 CBC SITE ACCELERATION DESIGN PARAMETERS**

Parameter	Value	ASCE 7-10 Reference
Mapped MCE _G Peak Ground Acceleration, PGA	0.392g	Figure 22-7
Site Coefficient, F _{PGA}	1.108	Table 11.8-1
Site Class Modified MCE _G Peak Ground Acceleration, PGA _M	0.435g	Section 11.8.3 (Eqn 11.8-1)

7.7.3 Conformance to the criteria in Tables 7.7.1 and 7.7.2 for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

7.8 Foundation and Concrete Slabs-On-Grade Recommendations

7.8.1 The following foundation recommendations are for proposed one- to three-story residential structures. The foundation recommendations have been separated into three categories based on either the maximum and differential fill thickness or Expansion Index. The foundation category criteria are presented in Table 7.8.1.

**TABLE 7.8.1
FOUNDATION CATEGORY CRITERIA**

Foundation Category	Maximum Fill Thickness, T (Feet)	Differential Fill Thickness, D (Feet)	Expansion Index (EI)
I	$T < 20$	--	$EI \leq 50$
II	$20 \leq T < 50$	$10 \leq D < 20$	$50 < EI \leq 90$
III	$T \geq 50$	$D \geq 20$	$90 < EI \leq 130$

7.8.2 Final foundation categories for each building or lot will be provided after finish pad grades have been achieved and laboratory testing of the subgrade soil has been completed. Lots underlain with alluvium/colluvium left in-place during grading will be designated CAT III.

7.8.3 Table 7.8.2 presents minimum foundation and interior concrete slab design criteria for conventional foundation systems.

**TABLE 7.8.2
CONVENTIONAL FOUNDATION RECOMMENDATIONS BY CATEGORY**

Foundation Category	Minimum Footing Embedment Depth (inches)	Continuous Footing Reinforcement	Interior Slab Reinforcement
I	12	Two No. 4 bars, one top and one bottom	6 x 6 - 10/10 welded wire mesh at slab mid-point
II	18	Four No. 4 bars, two top and two bottom	No. 3 bars at 24 inches on center, both directions
III	24	Four No. 5 bars, two top and two bottom	No. 3 bars at 18 inches on center, both directions

7.8.4 The embedment depths presented in Table 7.8.2 should be measured from the lowest adjacent pad grade for both interior and exterior footings. The conventional foundations should have a minimum width of 12 inches and 24 inches for continuous and isolated footings, respectively. A typical wall/column footing dimension detail is shown as Figure 6.

- 7.8.5 The concrete slab-on-grade should be a minimum of 4 inches thick for Foundation Categories I and II and 5 inches thick for Foundation Category III. Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) *Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials* (ACI 302.2R-06). In addition, the membrane should be installed in accordance with manufacturer's recommendations and ASTM requirements and installed in a manner that prevents puncture. The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity-controlled environment.
- 7.8.6 The bedding sand thickness should be determined by the project foundation engineer, architect, and/or developer. However, we should be contacted to provide recommendations if the bedding sand is thicker than 6 inches. Typically, concrete slabs on grade are underlain by 4 inches and 3 inches of clean sand for 4-inch-thick and 5-inch-thick slabs, respectively, with the vapor inhibitor placed at the midpoint. The foundation design engineer should provide appropriate concrete mix design criteria and curing measures to assure proper curing of the slab by reducing the potential for rapid moisture loss and subsequent cracking and/or slab curl. We suggest that the foundation design engineer present the concrete mix design and proper curing methods on the foundation plans. It is critical that the foundation contractor understands and follows the recommendations presented on the foundation plans.
- 7.8.7 As a substitute, the layer of clean sand (or crushed rock) beneath the vapor inhibitor recommended in the previous section can be omitted if a vapor inhibitor that meets or exceeds the requirements of ASTM E 1745 (Class A), and that exhibits permeance not greater than 0.012 perm (measured in accordance with ASTM E 96) is used. This vapor inhibitor may be placed directly on properly compacted fill or formational materials. The vapor inhibitor should be installed in general conformance with ASTM E 1643 and the manufacturer's recommendations. Two inches of clean sand should then be placed on top of the vapor inhibitor to reduce the potential for differential curing, slab curl, and cracking. Floor coverings should be installed in accordance with the manufacturer's recommendations.
- 7.8.8 As an alternative to the conventional foundation recommendations, consideration should be given to the use of post-tensioned concrete slab and foundation systems for the support of the proposed structures. The post-tensioned systems should be designed by a structural engineer experienced in post-tensioned slab design and design criteria of the Post-Tensioning Institute (PTI), Third Edition, as required by the 2013 California Building Code

(CBC Section 1808.6). Although this procedure was developed for expansive soil conditions, it can also be used to reduce the potential for foundation distress due to differential fill settlement. The post-tensioned design should incorporate the geotechnical parameters presented on Table 7.8.3 for the particular Foundation Category designated. The parameters presented in Table 7.8.3 are based on the guidelines presented in the PTI, Third Edition design manual.

**TABLE 7.8.3
POST-TENSIONED FOUNDATION SYSTEM DESIGN PARAMETERS**

Post-Tensioning Institute (PTI), Third Edition Design Parameters	Foundation Category		
	I	II	III
Thornthwaite Index	-20	-20	-20
Equilibrium Suction	3.9	3.9	3.9
Edge Lift Moisture Variation Distance, e_M (feet)	5.3	5.1	4.9
Edge Lift, y_M (inches)	0.61	1.10	1.58
Center Lift Moisture Variation Distance, e_M (feet)	9.0	9.0	9.0
Center Lift, y_M (inches)	0.30	0.47	0.66

7.8.9 Foundation systems for the lots that possess a foundation Category I and a “very low” expansion potential (expansion index of 20 or less) can be designed using the method described in Section 1808 of the 2013 CBC. If post-tensioned foundations are planned, an alternative, commonly accepted design method (other than PTI Third Edition) can be used. However, the post-tensioned foundation system should be designed with a total and differential deflection of 1 inch. Geocon Incorporated should be contacted to review the plans and provide additional information, if necessary.

7.8.10 The foundations for the post-tensioned slabs should be embedded in accordance with the recommendations of the structural engineer. If a post-tensioned mat foundation system is planned, the slab should possess a thickened edge with a minimum width of 12 inches and extend below the clean sand or crushed rock layer.

7.8.11 If the structural engineer proposes a post-tensioned foundation design method other than PTI, Third Edition:

- The deflection criteria presented in Table 7.8.3 are still applicable.
- Interior stiffener beams should be used for Foundation Categories II and III.
- The width of the perimeter foundations should be at least 12 inches.

- The perimeter footing embedment depths should be at least 12 inches, 18 inches and 24 inches for foundation categories I, II, and III, respectively. The embedment depths should be measured from the lowest adjacent pad grade.
- 7.8.12 Our experience indicates post-tensioned slabs are susceptible to excessive edge lift, regardless of the underlying soil conditions. Placing reinforcing steel at the bottom of the perimeter footings and the interior stiffener beams may mitigate this potential. Current PTI design procedures primarily address the potential center lift of slabs but, because of the placement of the reinforcing tendons in the top of the slab, the resulting eccentricity after tensioning reduces the ability of the system to mitigate edge lift. The structural engineer should design the foundation system to reduce the potential of edge lift occurring for the proposed structures.
- 7.8.13 During the construction of the post-tension foundation system, the concrete should be placed monolithically. Under no circumstances should cold joints be allowed to form between the footings/grade beams and the slab during the construction of the post-tension foundation system.
- 7.8.14 Category I, II, or III foundations may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf) (dead plus live load). This bearing pressure may be increased by one-third for transient loads due to wind or seismic forces.
- 7.8.15 Isolated footings, if present, should have the minimum embedment depth and width recommended for conventional foundations for a particular foundation category. The use of isolated footings, which are located beyond the perimeter of the building and support structural elements connected to the building, are not recommended for Category III. Where this condition cannot be avoided, the isolated footings should be connected to the building foundation system with grade beams.
- 7.8.16 For Foundation Category III, consideration should be given to using interior stiffening beams and connecting isolated footings and/or increasing the slab thickness. In addition, consideration should be given to connecting patio slabs, which exceed 5 feet in width, to the building foundation to reduce the potential for future separation to occur.
- 7.8.17 Footings that must be placed within seven feet of the top of slopes should be extended in depth such that the outer bottom edge of the footing is at least seven feet horizontally inside the face of the slope.

7.8.18 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in any such concrete placement.

7.8.19 Where buildings or other improvements are planned near the top of a slope steeper than 3:1 (horizontal:vertical), special foundations and/or design considerations are recommended due to the tendency for lateral soil movement to occur.

- For fill slopes less than 20 feet high, building footings should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.
- When located next to a descending 3:1 (horizontal:vertical) fill slope or steeper, the foundations should be extended to a depth where the minimum horizontal distance is equal to $H/3$ (where H equals the vertical distance from the top of the fill slope to the base of the fill soil) with a minimum of 7 feet but need not exceed 40 feet. The horizontal distance is measured from the outer, deepest edge of the footing to the face of the slope. An acceptable alternative to deepening the footings would be the use of a post-tensioned slab and foundation system or increased footing and slab reinforcement. Specific design parameters or recommendations for either of these alternatives can be provided once the building location and fill slope geometry have been determined.
- If swimming pools are planned, Geocon Incorporated should be contacted for a review of specific site conditions.
- Swimming pools located within 7 feet of the top of cut or fill slopes are not recommended. Where such a condition cannot be avoided, the portion of the swimming pool wall within 7 feet of the slope face be designed assuming that the adjacent soil provides no lateral support. This recommendation applies to fill slopes up to 30 feet in height, and cut slopes regardless of height. For swimming pools located near the top of fill slopes greater than 30 feet in height, additional recommendations may be required and Geocon Incorporated should be contacted for a review of specific site conditions.
- Although other improvements, which are relatively rigid or brittle, such as concrete flatwork or masonry walls, may experience some distress if located near the top of a slope, it is generally not economical to mitigate this potential. It may be possible, however, to incorporate design measures that would permit some lateral soil movement without causing extensive distress. Geocon Incorporated should be consulted for specific recommendations.

7.8.20 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein. Slab panels should be a minimum of 4 inches thick and should be reinforced with 6 x 6 - W2.9/W2.9 (6 x 6 - 6/6) welded wire mesh or No. 3 reinforcing bars at 18 inches on center in both directions to reduce the

potential for cracking. In addition, concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing. Subgrade soil for exterior slabs not subjected to vehicle loads should be compacted in accordance with criteria presented in the grading section prior to concrete placement. Subgrade soil should be properly compacted and the moisture content of subgrade soil should be checked prior to placing concrete.

7.8.21 Proper moisture conditioning of subgrade soil supporting flatwork is critical to reduce the effects of expansive soils. Prior to concrete placement, the upper 1 foot of subgrade should be scarified, moisture conditioned, and compacted to at least 90 percent of the maximum dry density at slightly over optimum moisture content. Soils placed below optimum moisture content should be reworked and retested prior to placing concrete. It is imperative that the moisture content be maintained until the concrete pour.

7.8.22 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil, differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, stucco walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular, where re-entrant slab corners occur.

7.8.23 Geocon Incorporated should be consulted to provide additional design parameters as required by the structural engineer.

7.9 Retaining Walls and Lateral Loads

7.9.1 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, retaining walls that support more than 6 feet of backfill should be designed with seismic lateral pressure in accordance with Section 1803.5.12 of the 2013 CBC. The seismic load is dependent on the retained height, where H is the retained height of the wall, in feet, and the calculated loads result in pounds per square foot (psf) exerted at the base of the wall and zero at the top of the soil. A seismic load of 19H should be used for design. We used the peak ground acceleration adjusted for Site Class effects,

PGA_M , of 0.392g calculated from ASCE 7-10 Section 11.8.3 and applied a pseudo-static coefficient of 0.33.

- 7.9.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid with a density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2.0 to 1.0, an active soil pressure of 50 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an Expansion Index of less than 50.
- 7.9.3 Unrestrained walls are those that are allowed to rotate more than $0.001H$ (where H equals the height of the retaining wall portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, an additional uniform pressure of $7H$ psf should be added to the above active soil pressure.
- 7.9.4 Retaining walls should be provided with a drainage system (Figure 7) adequate to prevent the buildup of hydrostatic forces and should be waterproofed as required by the project architect. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The above recommendations assume a properly compacted granular (EI less than 50) free-draining backfill material with no hydrostatic forces or imposed surcharge load. If conditions different than those described are anticipated, or if specific drainage details are desired, Geocon Incorporated should be contacted for additional recommendations.
- 7.9.5 In general, wall foundations at least 12 inches wide and 12 inches deep may be designed for an allowable soil bearing pressure of 2,000 psf, provided the soil within 3 feet below the base of the wall has an Expansion Index of less than 90.
- 7.9.6 Footings that must be placed within seven feet of the top of slopes should be extended in depth such that the outer bottom edge of the footing is at least seven feet horizontally inside the face of the slope.
- 7.9.7 For resistance to lateral loads, an allowable passive earth pressure equivalent to a fluid with a density of 300 pcf is recommended for footings or shear keys poured neat against properly compacted granular fill soils or undisturbed natural soils. The allowable passive pressure assumes a horizontal surface extending away from the face of the wall at least 5 feet or three times the height of surface generating the passive pressure, whichever is greater. The upper 12 inches of material not protected by floor slabs or pavement should

not be included in the design for lateral resistance. A friction coefficient of 0.40 may be used for resistance to sliding between soil and concrete. This friction coefficient may be combined with the allowable passive earth pressure when determining resistance to lateral loads.

- 7.9.8 The recommendations presented above are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 12 feet. In the event that walls higher than 12 feet or other types of walls are planned, such as crib-type walls, Geocon Incorporated should be consulted for additional recommendations.

7.10 Storm Water Management

- 7.10.1 If low-impact development (LID) integrated management practices (IMP's) are being considered, Geocon should review the design and provide specific geotechnical recommendations to reduce the potential adverse impacts to both on and off-site properties.
- 7.10.2 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to these devices. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important affect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. Based on our experience with similar clayey soil and shallow bedrock conditions, infiltration IMP's are considered infeasible due to the poor percolation characteristics. We have not performed a hydrogeology study at the site. Down-gradient and adjacent properties may be subjected to seeps, springs, slope instability, raised groundwater, movement of foundations and slabs, or other impacts as a result of water infiltration.
- 7.10.3 Due to site soil and geologic conditions, a heavy duty, non-permeable liner should be placed beneath any hydro-modification areas or IMP's where water infiltration into the underlying soils is planned. If permeable pavers are planned, the design should include a subdrain to prevent subgrade saturation and pavement distress. The strength and thickness of the membrane, and construction method should be adequate to assure that the liner will not be compromised throughout the life of the system. In addition, civil engineering provisions should be implemented to assure that the capacity of the system is never exceeded resulting in over topping or malfunctioning of the device. The system should also include a long-term maintenance program or periodic cleaning to prevent clogging of the filter media or drain envelope. Geocon Incorporated has no opinion regarding the design of the filtration system or its effectiveness.

7.11 Site Drainage and Moisture Protection

7.11.1 Adequate site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2013 CBC 1804.3 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

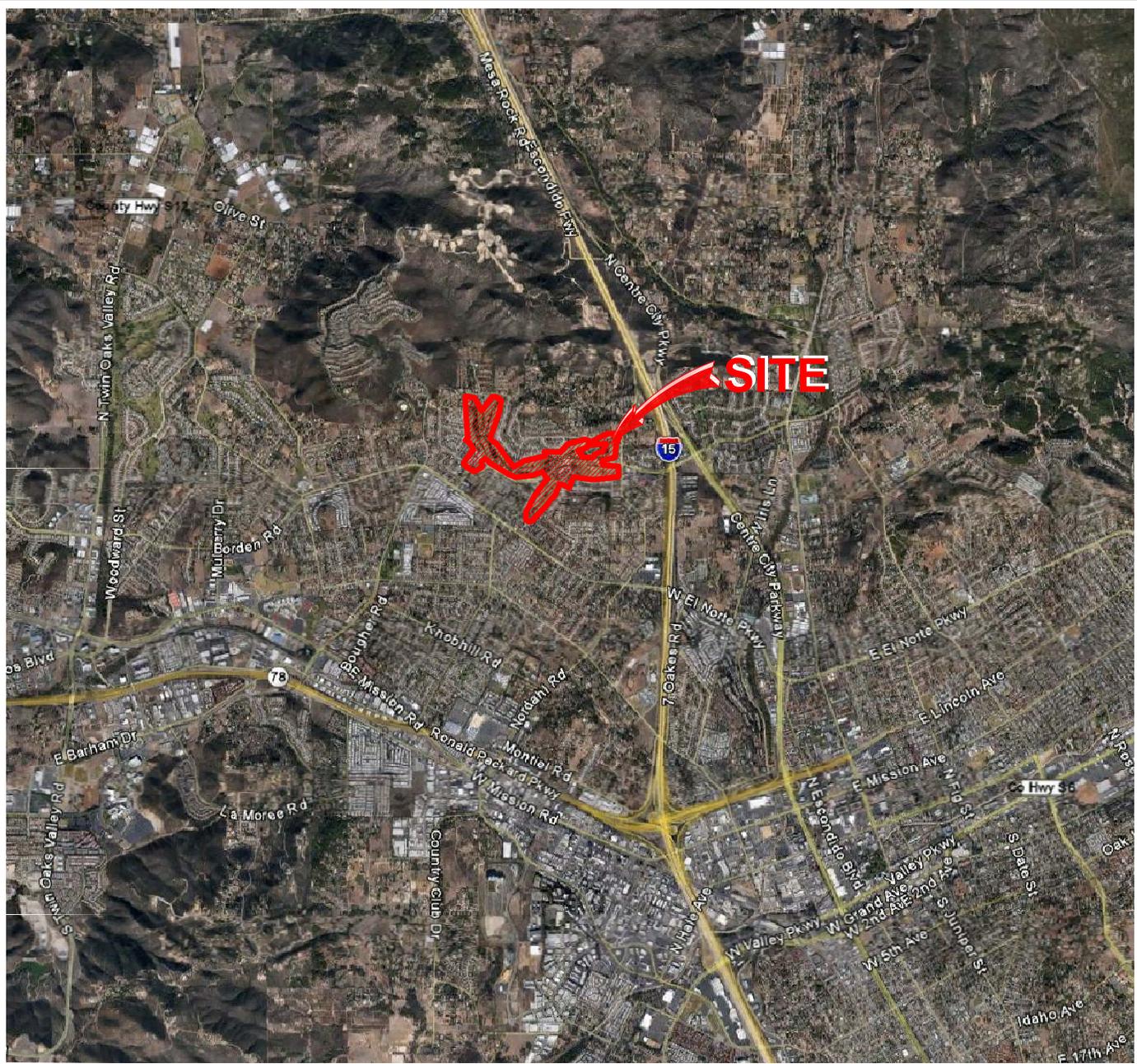
7.11.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

7.12 Grading and Foundation Plan Review

7.12.1 Geocon Incorporated should review the final grading plans and foundation plans for the project prior to final design submittal to evaluate whether additional analyses and/or recommendations are required.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.
2. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon Incorporated should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous or corrosive materials was not part of the scope of services provided by Geocon Incorporated.
3. This report is issued with the understanding that it is the responsibility of the owner or his representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.
4. The findings of this report are valid as of the present date. However, changes in the conditions of a property can occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.



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THE VILLAGES AT ESCONDIDO COUNTRY CLUB
ESCONDIDO, CALIFORNIA

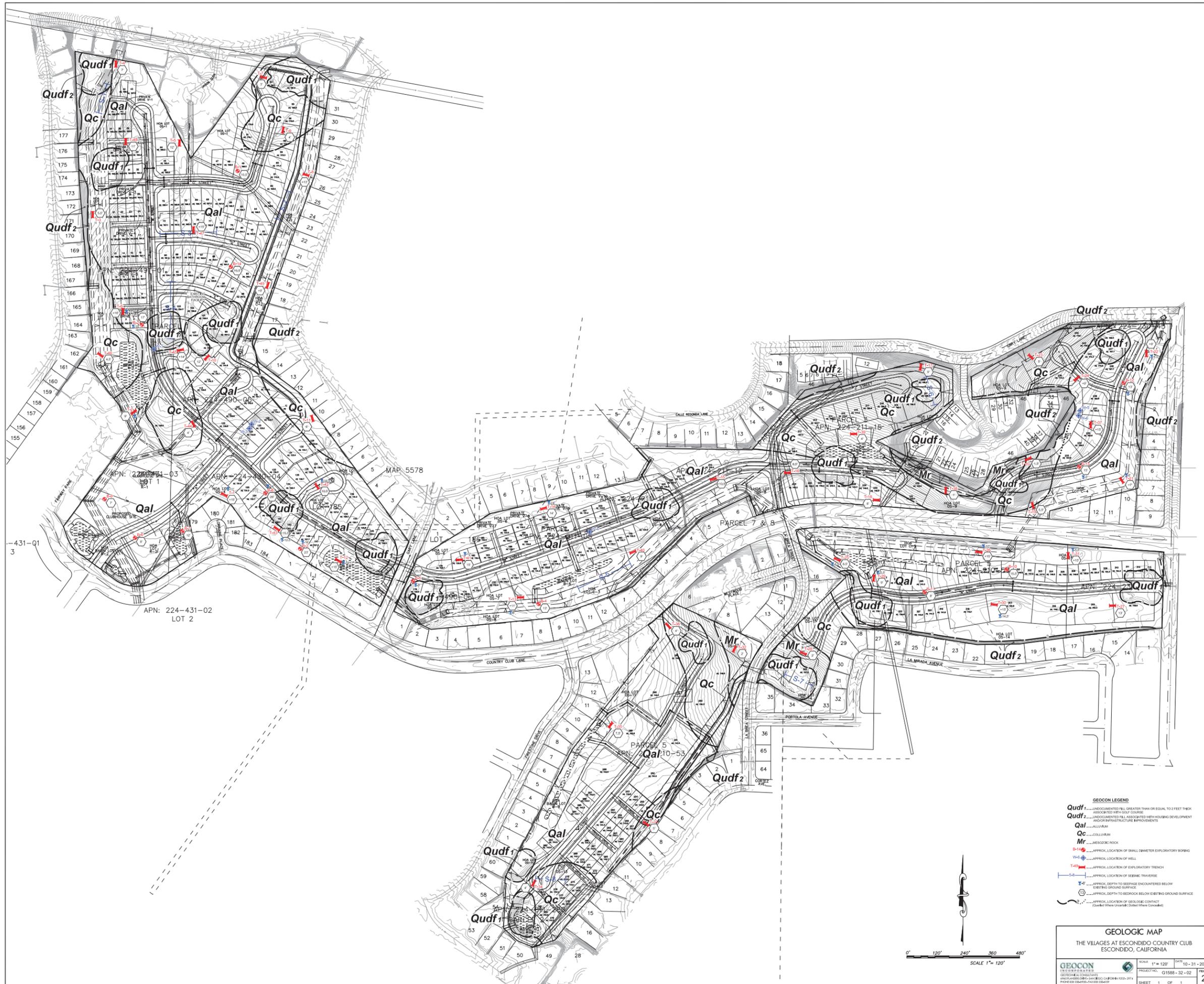
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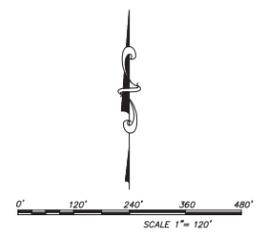
DATE 10 - 31 - 2016

PROJECT NO. G1588 - 32 - 02

FIG. 1



- GEOLOGIC LEGEND**
- Qudf 1 UNDOCUMENTED FILL GREATER THAN OR EQUAL TO 2 FEET THICK ASSOCIATED WITH GOLF COURSE
 - Qudf 2 UNDOCUMENTED FILL ASSOCIATED WITH HOUSING DEVELOPMENT AND/OR INFRASTRUCTURE IMPROVEMENTS
 - Qal ALLUVIUM
 - Qc COLLUVIUM
 - Mr MESOZOIC ROCK
 - W APPROX. LOCATION OF SMALL DIAMETER EXPLORATORY BORING
 - T APPROX. LOCATION OF WELL
 - S APPROX. LOCATION OF SEISMIC TRAVERSE
 - B APPROX. DEPTH TO BEDROCK BELOW EXISTING GROUND SURFACE
 - B₁ APPROX. DEPTH TO BEDROCK BELOW EXISTING GROUND SURFACE
 - B₂ APPROX. DEPTH TO BEDROCK BELOW EXISTING GROUND SURFACE
 - C APPROX. LOCATION OF GEOLOGIC CONTACT (Color When Usable; Dotted When Concealed)



GEOLOGIC MAP
THE VILLAGES AT ESCONDIDO COUNTRY CLUB
ESCONDIDO, CALIFORNIA

GEOCON GEOLOGICAL CONSULTANTS 1700 HANCOCK BLVD., SUITE 200 ESCONDIDO, CALIFORNIA 92025-3074 PHONE 951-284-9900 FAX 951-284-9901	SCALE 1" = 120' DATE 10-31-2016 PROJECT NO. G1588-32-02 SHEET 1 OF 1	DRAWN BY CHECKED BY PROJECT NO. G1588-32-02 SHEET 2
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ASSUMED CONDITIONS :

SLOPE HEIGHT H = 55 feet
SLOPE INCLINATION 2 : 1 (Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL γ_t = 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION ϕ = 30 degrees
APPARENT COHESION C = 250 pounds per square foot
NO SEEPAGE FORCES

ANALYSIS :

$\gamma_{c\phi} = \frac{\gamma_t H \tan \phi}{C}$ EQUATION (3-3), REFERENCE 1
FS = $\frac{NcfC}{\gamma_t H}$ EQUATION (3-2), REFERENCE 1
 $\gamma_{c\phi} = 16.5$ CALCULATED USING EQ. (3-3)
Ncf = 45 DETERMINED USING FIGURE 10, REFERENCE 2
FS = 1.6 FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

- 1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954
- 2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - FILL SLOPES

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FIG. 3

ASSUMED CONDITIONS :

SLOPE HEIGHT	H = 35 feet
SLOPE INCLINATION	2 : 1 (Horizontal : Vertical)
TOTAL UNIT WEIGHT OF SOIL	$\gamma_t = 135$ pounds per cubic foot
ANGLE OF INTERNAL FRICTION	$\phi = 32$ degrees
APPARENT COHESION	C = 350 pounds per square foot
NO SEEPAGE FORCES	

ANALYSIS :

$\gamma_{c\phi} = \frac{\gamma_t H \tan \phi}{C}$	EQUATION (3-3), REFERENCE 1
FS = $\frac{NcfC}{\gamma_t H}$	EQUATION (3-2), REFERENCE 1
$\gamma_{c\phi} = 8.4$	CALCULATED USING EQ. (3-3)
Ncf = 28	DETERMINED USING FIGURE 10, REFERENCE 2
FS = 2.1	FACTOR OF SAFETY CALCULATED USING EQ. (3-2)

REFERENCES :

- 1.....Janbu, N., Stability Analysis of Slopes with Dimensionless Parameters, Harvard Soil Mechanics, Series No. 46, 1954
- 2.....Janbu, N., Discussion of J.M. Bell, Dimensionless Parameters for Homogeneous Earth Slopes, Journal of Soil Mechanics and Foundation Design, No. SM6, November 1967.

SLOPE STABILITY ANALYSIS - CUT SLOPES

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THE VILLAGES AT ESCONDIDO COUNTRY CLUB
ESCONDIDO, CALIFORNIA

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FIG. 4

ASSUMED CONDITIONS :

SLOPE HEIGHT	H = Infinite
DEPTH OF SATURATION	Z = 3 feet
SLOPE INCLINATION	2 : 1 (Horizontal : Vertical)
SLOPE ANGLE	i = 26.5 degrees
UNIT WEIGHT OF WATER	γ_w = 62.4 pounds per cubic foot
TOTAL UNIT WEIGHT OF SOIL	γ_t = 130 pounds per cubic foot
ANGLE OF INTERNAL FRICTION	ϕ = 30 degrees
APPARENT COHESION	C = 250 pounds per square foot

SLOPE SATURATED TO VERTICAL DEPTH Z BELOW SLOPE FACE

SEEPAGE FORCES PARALLEL TO SLOPE FACE

ANALYSIS :

$$FS = \frac{C + (\gamma_t - \gamma_w) Z \cos^2 i \tan \phi}{\gamma_t Z \sin i \cos i} = 2.2$$

REFERENCES :

- 1.....Haefeli, R. *The Stability of Slopes Acted Upon by Parallel Seepage*, Proc. Second International Conference, SMFE, Rotterdam, 1948, 1, 57-62
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SURFICIAL SLOPE STABILITY ANALYSIS

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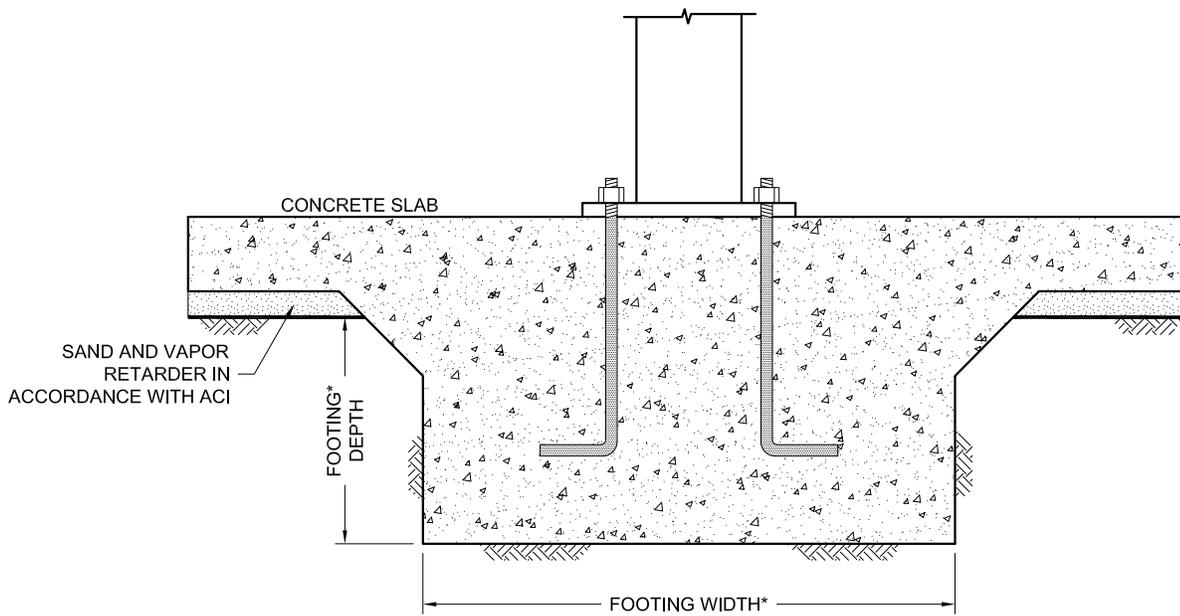
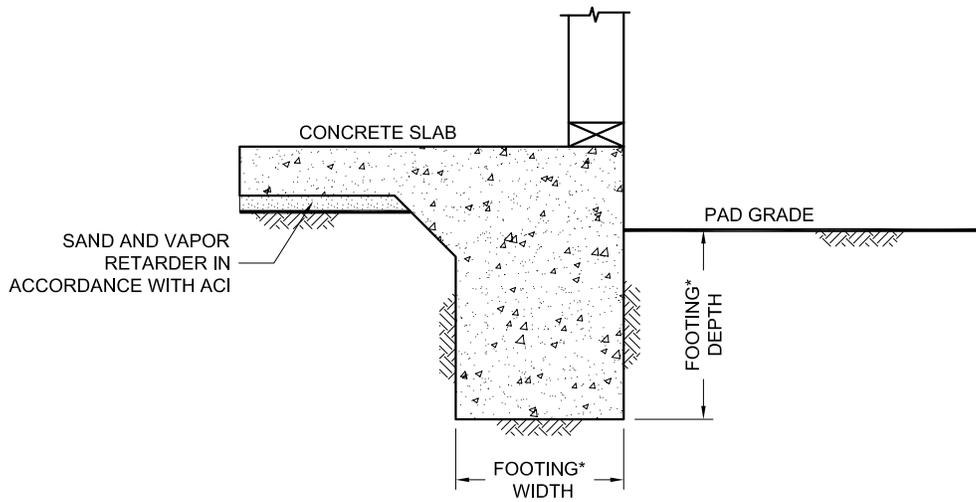
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FIG. 5



*SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

WALL / COLUMN FOOTING DIMENSION DETAIL

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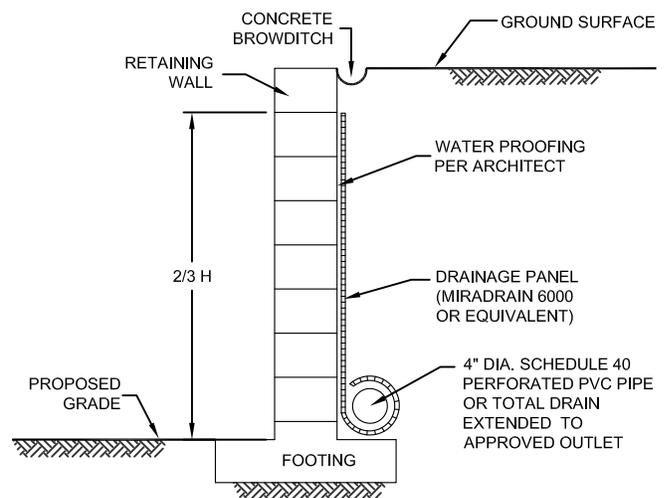
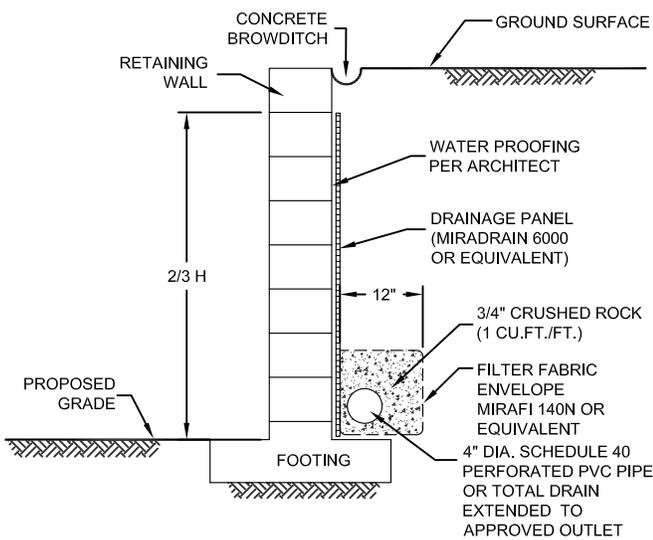
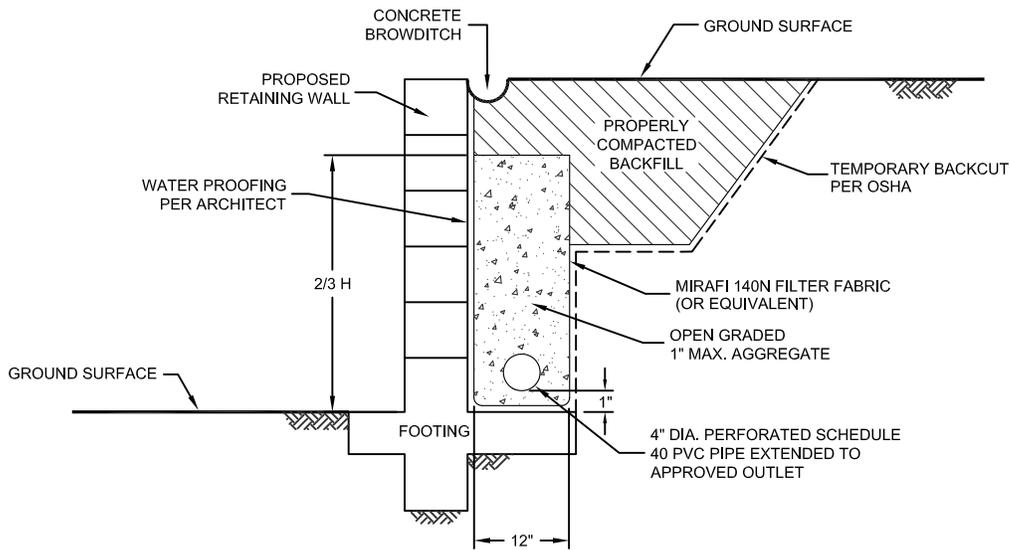
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FIG. 6



NOTE :

DRAIN SHOULD BE UNIFORMLY SLOPED TO GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPING

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

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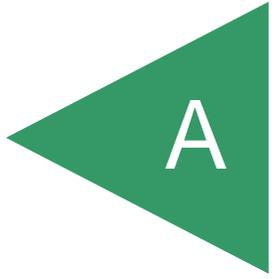
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FIG. 7

APPENDIX

A



APPENDIX A

FIELD INVESTIGATION

The original field investigation was performed between May 14 and 29, 2013, and consisted of a visual site reconnaissance, excavating 49 backhoe trenches and drilling 14 small-diameter borings. Eight seismic traverses were conducted in April 2014 as part of a supplemental rippability study performed by Southwest Geophysics. The approximate locations of the subsurface information are shown on the *Geologic Map*, Figure 2. The soil conditions encountered in the excavations were visually classified and logged in general accordance with American Society for Testing and Materials (ASTM) practice for Description and Identification of Soils (Visual Manual Procedure D 2844).

The small-diameter borings performed by Baja Exploration were advanced to a maximum depth of 26½ feet below existing grade using a CME-75 rig equipped with 6-inch hollow-stem augers. Relatively undisturbed samples were obtained by driving either a California split-spoon (CAL) or a Standard Penetration Test (SPT), split-tube sampler into the "undisturbed" soil mass. The CAL sampler was equipped with 1-inch by 2¾-inch, brass sampler rings to facilitate removal and testing. The SPT sampler was used primarily for recovering rock samples for identification purposes only. Logs of the small diameter borings depicting the soil and geologic conditions encountered and the depth at which samples were obtained are presented on Figures A-1 through A-14.

The exploratory trenches performed by Hillside Excavating were advanced to depths of 3½ to 16 feet using a John Deere 410G rubber tire backhoe equipped with a 24-inch-wide bucket. Bulk samples were obtained for laboratory testing. The logs of the trenches depicting the soil and geologic conditions encountered and the depth at which samples were obtained are presented on Figures A-15 through A-63.

The seismic refraction survey report and eight seismic traverses conducted by Southwest Geophysics is presented in Appendix C.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 1		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>763'</u>	DATE COMPLETED <u>05-29-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>	BY: <u>T. REIST</u>			
					MATERIAL DESCRIPTION				
0					ALLUVIUM Loose, damp, brown, Silty/Clayey, fine to medium SAND -Becomes medium dense, damp to moist and fine to coarse		45	121.1	13.0
2									
4									
6	B1-1			SM/SC					
8									
10	B1-2						54	119.0	14.5
					MESOZOIC ROCK Highly weathered, dark gray an brown, weak METASEDIMENTARY ROCK/ BORING TERMINATED AT 11 FEET Backfilled with approximately 2.2 ft³ of bentonite slurry				

Figure A-1,
Log of Boring B 1, Page 1 of 1

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SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 2		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>741'</u>	DATE COMPLETED <u>05-29-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, damp, dark brown, Silty/Clayey fine to coarse SAND				
2									
4									
6	B2-1				-Heavily disturbed sample due to gravel lodged in shoe; blow counts not accurate		28		
8									
10	B2-2			ML	Stiff, moist, mottled orange brown and gray, fine to medium, Sandy SILT, with clay and mica flakes		26	102.8	24.1
12									
14									
16	B2-3		▼	SC	Medium dense, wet, dark yellowish brown, Clayey, fine to coarse SAND with gravel; groundwater at 15 feet; blow counts likely not accurate due to gravels		82	119.8	16.8
18					-Contact based on drill rig efficiency and cuttings				
					MESOZOIC ROCK Highly to moderately weathered, dark gray, weak to moderately weak METASEDIMENTARY ROCK				
					BORING TERMINATED AT 19.5 FEET Backfilled with approximately 3.8 ft³ of bentonite slurry		50/3"		

Figure A-2,
Log of Boring B 2, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 3		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>726'</u>	DATE COMPLETED <u>05-29-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, dry, brown, Silty/Clayey, fine to medium SAND				
2									
4									
6	B3-1				-Becomes dense, damp, dark brown and fine to coarse		71	124.5	9.9
8									
10	B3-2				-Becomes cemented, moist and mottled reddish brown and gray		83/11"	114.0	16.3
12	B3-3								
14									
16	B3-4		▼		-Becomes medium dense and wet with charcoal flecks -Groundwater observed in shoe at 16 feet		47	92.1	30.0
18									
20	B3-5			ML	Stiff, wet, light brown to light gray, Sandy/Clayey SILT		38	103.3	21.5
22									
24					-Contact based on drill rig efficiency and cuttings MESOZOIC ROCK Highly weathered, gray brown-white, weak to moderately weak METASEDIMENTARY ROCK		50/3"		
					BORING TERMINATED AT 25.5 FEET Backfilled with approximately 5.0 ft ³ of bentonite slurry				

Figure A-3,
Log of Boring B 3, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	□ ... SAMPLING UNSUCCESSFUL	▣ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	▤ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

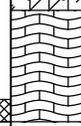
DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 4		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>722'</u>	DATE COMPLETED <u>05-29-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0									
2									
4									
6	B4-1			SM/SC	ALLUVIUM Loose, moist, dark reddish brown, Silty/Clayey, fine to medium SAND -Becomes medium dense and damp with charcoal flecks		52	115.9	16.2
8									
10	B4-2			ML	Stiff, moist, dark reddish brown, Clayey/Sandy SILT -Contact based on drill rig efficiency and cuttings		25	111.5	16.9
12									
14					MESOZOIC ROCK Highly weathered, dark gray and brown, weak METASEDIMENTARY ROCK -No recovery with CAL sampler; SPT used to obtain sample in shoe		50/4"		
					BORING TERMINATED AT 15.5 FEET Backfilled with approximately 3.0 ft ³ of bentonite slurry				

Figure A-4,
Log of Boring B 4, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 5			PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>721'</u>	DATE COMPLETED <u>05-29-2013</u>	EQUIPMENT <u>CME 75 (6-INCH AUGER)</u> BY: <u>T. REIST</u>			
MATERIAL DESCRIPTION										
0				SM/SC	ALLUVIUM Loose, moist, dark brown, Silty/Clayey, fine to medium SAND					
2										
4										
6	B5-1				-Becomes medium dense, mottled dark gray and orange and fine to coarse with clay and mica flakes	27	119.3	14.2		
8			▼		-Groundwater encountered at 8 feet					
10	B5-2				-Becomes wet and mottled dark gray and brown	19	107.5	21.0		
12										
14										
16	B5-3				-Becomes mottled dark gray, brown and fine to coarse	38	104.8	20.1		
18										
20	B5-4					75/9"	106.1	20.1		
					MESOZOIC ROCK Highly weathered, reddish brown, gray and orange brown, weak METASEDIMENTARY ROCK					
					BORING TERMINATED AT 21 FEET Backfilled with approximately 4.1 ft ³ of bentonite slurry					

Figure A-5,
Log of Boring B 5, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		
	... SAMPLING UNSUCCESSFUL	
	... DISTURBED OR BAG SAMPLE	
		
		... DRIVE SAMPLE (UNDISTURBED)
		... CHUNK SAMPLE
		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 6		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>725'</u>	DATE COMPLETED <u>05-29-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, damp, dark brown, Silty/Clayey, fine to medium SAND				
2									
4									
6	B6-1						50/6"	106.1	20.1
	B6-2								
8									
10	B6-3				MESOZOIC ROCK Highly weathered, gray, white and dark brown, moderately weak METASEDIMENTARY ROCK		50/5"	114.6	7.3
					BORING TERMINATED AT 10.5 FEET Backfilled with approximately 2.1 ft ³ of bentonite slurry				

Figure A-6,
Log of Boring B 6, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 7		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>725'</u>	DATE COMPLETED <u>05-29-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0					4" ASPHALT				
2				SM/SC	ALLUVIUM Loose, damp, dark brown, Silty/Clayey, fine to medium SAND				
4					-Becomes medium dense, moist and fine to coarse				
6	B7-1						52	116.8	16.1
8									
10	B7-2				-Becomes mottled gray-orange-brown with charcoal flecks		42	121.4	12.7
12					-Contact based on drill rig efficiency; bit grinding on rock				
					MESOZOIC ROCK -No recovery on CAL and SPT samples		50/2"		
					REFUSAL AT 13.5 FEET Backfilled with approximately 2.6 ft ³ of bentonite slurry				

Figure A-7,
Log of Boring B 7, Page 1 of 1

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SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 8		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>731'</u>	DATE COMPLETED <u>05-30-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, damp, brown, Silty/Clayey, fine to medium SAND				
2									
4									
6	B8-1				-Becomes cemented and fine to coarse		65/10"	111.5	13.4
8									
10	B8-2				-Becomes medium dense, moist, gray-brown and fine with charcoal flecks		43	111.8	17.5
12									
14					-Gravels present from 14 to 17 feet; blow counts not accurate due to gravels		60		
16					-Becomes reddish brown and fine to medium		32		
18									
20	B8-3				-Becomes fine to coarse with gravels; blow counts not accurate due to gravels		71	117.7	11.5
22									
24					-Groundwater encountered at 24 feet		65		
26					MESOZOIC ROCK Highly weathered, dark gray, white and orange, weak METASEDIMENTARY ROCK				
					BORING TERMINATED AT 26.5 FEET Backfilled with approximately 5.2 ft ³ of bentonite slurry				

Figure A-8,
Log of Boring B 8, Page 1 of 1

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SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL		... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE
			... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 9			PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>725'</u>	DATE COMPLETED <u>05-30-2013</u>	EQUIPMENT <u>CME 75 (6-INCH AUGER)</u> BY: <u>T. REIST</u>			
MATERIAL DESCRIPTION										
0	B9-1			SM/SC	4" ASPHALT			49	114.0	15.6
2					ALLUVIUM Loose, damp, dark brown, Silty/Clayey, fine to medium SAND					
4					-Becomes medium dense, moist, mottled gray and brown with some gravels					
6					-Contact based on drill rig efficiency and cuttings					
8					MESOZOIC ROCK Gray, METASEDIMENTARY ROCK			50/4"		
10	-No recovery on CAL sample; SPT sample only recovered gravel size piece									
					BORING TERMINATED AT 10.5 FEET Backfilled with approximately 2.1 ft³ of bentonite slurry					

Figure A-9,
Log of Boring B 9, Page 1 of 1

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SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 10			PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>744'</u>	DATE COMPLETED <u>05-30-2013</u>	EQUIPMENT <u>CME 75 (6-INCH AUGER)</u> BY: <u>T. REIST</u>			
MATERIAL DESCRIPTION										
0										
2	B10-1			SM/SC	ALLUVIUM Loose, damp, brown, Silty/Clayey, fine to medium SAND -Becomes medium dense, moist, mottled dark brown and dark orange with mica flakes -Some gravel and charcoal flecks present					
6	B10-2					45	116.2	16.6		
10	B10-3					48	120.2	14.2		
16	B10-4					80/9"	121.4	9.6		
					MESOZOIC ROCK Highly weathered, dark gray and dark brown, weak GRANITIC ROCK BORING TERMINATED AT 16 FEET Backfilled with approximately 3.1 ft ³ of bentonite slurry					

Figure A-10,
Log of Boring B 10, Page 1 of 1

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SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 11		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>736'</u>	DATE COMPLETED <u>05-30-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0									
2	B11-1			SM/SC	ALLUVIUM Loose, moist, dark gray, Silty/Clayey, fine to medium SAND -Becomes medium dense, moist, and dark brown with less clay -Contact estimated from drill rig efficiency and cuttings				
6	B11-2						31	116.8	17.2
8									
10	B11-3				MESOZOIC ROCK Highly weathered, light brown, weak METASEDIMENTARY ROCK				
					BORING TERMINATED AT 10.5 FEET Backfilled with approximately 2.1 ft ³ of bentonite slurry		50/3"	108.8	10.9

Figure A-11,
Log of Boring B 11, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 12		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>760'</u>	DATE COMPLETED <u>05-30-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0									
2									
4									
6	B12-1			SM/SC	ALLUVIUM Loose, moist to wet, dark gray, Silty/Clayey, fine to medium SAND		17	116.9	14.7
8									
10	B12-2				-Becomes medium dense, moist, reddish brown with charcoal flecks		66	121.7	11.5
12									
14					MESOZOIC ROCK -No recovery on CAL or SPT samples				
BORING TERMINATED AT 15.5 FEET Backfilled with approximately 3.0 ft ³ of bentonite slurry							50/2"		

Figure A-12,
Log of Boring B 12, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 13			PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	
					ELEV. (MSL.) <u>752'</u>	DATE COMPLETED <u>05-30-2013</u>	EQUIPMENT <u>CME 75 (6-INCH AUGER)</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION											
0				SM/SC	ALLUVIUM Loose, damp to moist, dark brown, Silty/Clayey, fine to medium SAND						
2											
4											
6	B13-1		▼		-Becomes medium dense, wet, mottled dark brown and brown, and fine to coarse; groundwater at 5 feet	46	122.5	13.4			
8											
10	B13-2					29	107.7	18.5			
12	B13-3										
14					-Gravels at 13 feet; SPT sampling unsuccessful; shoe destroyed; blow counts not accurate due to gravels	58/9"					
16	B13-4				MESOZOIC ROCK Highly weathered, brown and gray, moderately weak METASEDIMENTARY ROCK	90/9"					
					BORING TERMINATED AT 16.5 FEET Backfilled with approximately 3.2 ft ³ of bentonite slurry						

Figure A-13,
Log of Boring B 13, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B 14		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>753'</u>	DATE COMPLETED <u>05-30-2013</u>			
					EQUIPMENT <u>CME 75 (6-INCH AUGER)</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, dry to damp, brown, Silty/Clayey, fine to medium SAND				
2									
4									
6	B14-1				-Becomes medium dense, moist, and mottled dark gray brown and dark orange		30	114.6	18.0
8									
10	B14-2				-Becomes mottled gray and dark orange		49	110.9	19.3
12									
14									
16	B14-3				-Becomes primarily gray		19	106.0	20.6
18	B14-4								
20					MESOZOIC ROCK Highly weathered, dark reddish brown, weak METASEDIMENTARY ROCK				
					BORING TERMINATED AT 20.5 FEET Backfilled with approximately 4.0 ft ³ of bentonite slurry				

Figure A-14,
Log of Boring B 14, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL		... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE
			... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 1		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	
					ELEV. (MSL.) <u>730'</u>	DATE COMPLETED <u>05-14-2013</u>				
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>			
MATERIAL DESCRIPTION										
0				SM	UNDOCUMENTED FILL Loose to medium dense, light brown to brown, Silty, fine to coarse SAND					
2			SM/SC	ALLUVIUM Loose to medium dense, brown to light brown, Silty/Clayey, fine to coarse SAND -Becomes medium dense and brown below 2.5 feet						
4										
6										
8										
10										
12				▽		-Heavy seepage at 11 feet -Becomes light brown, coarser grained with some gravel, cobble and boulder size rock fragments up to 14" below 11 feet				
14										
TRENCH TERMINATED AT 15 FEET										

Figure A-15,
Log of Trench T 1, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 2		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>732'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	UNDOCUMENTED FILL Loose, damp, brown, Silty, fine to medium SAND				
2				SM/SC	ALLUVIUM Loose to medium dense, damp to moist, dark brown, Silty/Clayey, fine to medium SAND -Becomes medium dense and moist below 4 feet				
4									
6									
8									
10					MESOZOIC ROCK Completely weathered, pale green and orange, soil, METASEDIMENTARY ROCK; punky with remnant rock fabric -Becomes highly weathered, dark gray, moderately weak, with free water observed in fractures below 10.5 feet				
TRENCH TERMINATED AT 11 FEET									

Figure A-16,
Log of Trench T 2, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 3		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>763'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, damp, dark brown, Silty/Clayey, fine to medium SAND -Becomes medium dense and reddish brown below 1.5 feet				
2				CL	Stiff to very stiff, moist, reddish brown to dark brown, Sandy CLAY with white caliche pods				
4					MESOZOIC ROCK Highly weathered, gray to dark gray, weak METAVOLCANIC ROCK -Becomes moderately weathered and strong below 7 feet				
6									
8					PRACTICAL REFUSAL AT 8.5 FEET				

Figure A-17,
Log of Trench T 3, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 4		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>770'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	UNDOCUMENTED FILL Loose, damp, light brown, Silty, fine to medium SAND; topsoil				
2				SM/SC	ALLUVIUM Loose to medium dense, damp to moist, brown to dark brown, Silty/Clayey, fine to coarse SAND -Becomes clayier with depth				
4									
6									
8					MESOZOIC ROCK Moderately weathered, dark gray, strong METAVOLCANIC ROCK				
					PRACTICAL REFUSAL AT 8 FEET				

Figure A-18,
Log of Trench T 4, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 5		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)								
					ELEV. (MSL.) <u>762'</u>	DATE COMPLETED <u>05-14-2013</u>											
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>										
MATERIAL DESCRIPTION																	
0				SM/SC	ALLUVIUM Medium dense, damp, brown, Silty/Clayey, fine to coarse SAND												
2																	
4																	
6																	
8																	
10																	
12																	
											MESOZOIC ROCK Highly to moderately weathered, gray, moderately weak to moderately strong METASEDIMENTARY ROCK						
PRACTICAL REFUSAL AT 13 FEET																	

Figure A-19,
Log of Trench T 5, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS					
	... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 6		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>742'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	UNDOCUMENTED FILL Loose, damp, brown, Silty, fine to coarse SAND, with some gravel				
2									
4					SM	ALLUVIUM Loose to medium dense, moist, brown, Silty, fine to medium SAND			
6									
8				SM/SC	Loose to medium dense, moist, mottled orange brown and gray, Silty/Clayey, fine to medium SAND				
10									
12									
14									
16					-Moderate to heavy seepage at 15 feet				
TRENCH TERMINATED AT 16 FEET									

Figure A-20,
Log of Trench T 6, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 7		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>777'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0	T7-1			SC/SM	COLLUVIUM Loose to medium dense, moist, dark reddish brown, Clayey/Silty, fine to medium SAND				
2					MESOZOIC ROCK Moderately weathered, gray, moderately strong to strong METAVOLCANIC ROCK				
4									
PRACTICAL REFUSAL AT 5 FEET									

Figure A-21,
Log of Trench T 7, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 8 ELEV. (MSL.) <u>770'</u> DATE COMPLETED <u>05-14-2013</u> EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
MATERIAL DESCRIPTION								
0	T8-1			SM/SC	<p>ALLUVIUM Loose to medium dense, damp, brown, Silty/Clayey, fine to medium SAND</p> <p>-Becomes fine to coarse below 5 feet</p> <p>-Becomes cemented, brown and gray, fine to coarse with gravel and cobble size rock fragments up to 6" below 10.5 feet; difficult trenching</p>			
2								
4								
6								
8								
10								
12					PRACTICAL REFUSAL AT 13 FEET			

Figure A-22,
Log of Trench T 8, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 9		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>775'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	COLLUVIUM Loose, dry to damp, dark brown, Silty, fine to medium SAND				
2						-Becomes brown and medium dense below 3 feet			
4					MESOZOIC ROCK Moderately weathered, dark gray, moderately strong to strong METAVOLCANIC ROCK				
						PRACTICAL REFUSAL AT 5 FEET			

Figure A-23,
Log of Trench T 9, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 10		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>745'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	UNDOCUMENTED FILL Loose, damp, dark brown, Silty, fine to medium SAND				
2				SM/SC	ALLUVIUM Medium dense, damp, brown, Silty/Clayey, fine to medium SAND -Becomes fine to coarse below 3 feet				
4									
6									
8									
10					-Becomes cemented, light brown, fine to coarse, with gravel and cobble size rock fragments up to 4" below 9 feet				
12					MESOZOIC ROCK Highly weathered, dark gray, weak, METASEDIMENTARY ROCK				
14					TRENCH TERMINATED AT 14 FEET				

Figure A-24,
Log of Trench T 10, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 11		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>737'</u>	DATE COMPLETED <u>05-14-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	COLLUVIUM Loose, dry to damp, brown, Silty, fine to medium SAND				
2					-Becomes medium dense below 2 feet				
4					-Becomes cemented, fine to coarse, with gravel size rock fragments up to 3" below 4 feet				
6					MESOZOIC ROCK Moderately weathered, dark gray, moderately strong METASEDIMENTARY ROCK				
					PRACTICAL REFUSAL AT 7 FEET				

Figure A-25,
Log of Trench T 11, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 12		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>726'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Medium dense, damp, brown, Silty/Clayey, fine to medium SAND -Becomes fine to coarse below 2 feet				
2									
4									
6									
8									
10	T12-1			CL	Stiff, moist, mottled pale green and brown, Silty/Sandy, fine to medium CLAY -Becomes very moist, coarser grained and sandier below 12 feet -Moderate seepage at 14 feet -Cobble and boulder size rock fragments up to 16" present at 14.5 feet				
12									
14									
					TRENCH TERMINATED AT 15 FEET				

Figure A-26,
Log of Trench T 12, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 13		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)								
					ELEV. (MSL.) <u>720'</u>	DATE COMPLETED <u>05-15-2013</u>											
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>										
MATERIAL DESCRIPTION																	
0				SM/SC	<p>ALLUVIUM Loose, moist, dark brown, Silty/Clayey, fine to coarse SAND, with some clay</p> <p>-Becomes wet below 4 feet</p> <p>-Heavy seepage with moderate caving at 6 feet</p>												
2																	
4																	
6																	
8																	
10																	
TRENCH TERMINATED AT 11 FEET DUE TO CAVING																	

Figure A-27,
Log of Trench T 13, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 14		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>728'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Medium dense, damp, reddish brown, Silty/Clayey, fine to medium SAND				
2									
4							-Becomes damp to moist and fine to coarse below 3 feet		
6									
8									
10									
12									
14							-Slight seepage at contact at 14 feet		
							MESOZOIC ROCK Highly weathered, dark brown to gray, moderately weak METASEDIMENTARY ROCK		
							TRENCH TERMINATED AT 15 FEET		

Figure A-28,
Log of Trench T 14, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 15		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)							
					ELEV. (MSL.) <u>735'</u>	DATE COMPLETED <u>05-15-2013</u>										
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>									
MATERIAL DESCRIPTION																
0				SM/SC	<p>ALLUVIUM Medium dense, damp, reddish brown, Silty/Clayey, fine to medium SAND</p> <p>-Becomes damp to moist and fine to coarse below 3 feet</p> <p>-Becomes cemented with gravel and cobble size rock fragments up to 5" below 9 feet; difficult trenching</p>											
2																
4																
6																
8																
10																
										REFUSAL AT 10.5 FEET						

Figure A-29,
Log of Trench T 15, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 16		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>732'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose to medium dense, damp, reddish brown, Silty/Clayey, fine to medium SAND				
2					-Becomes moist and fine to coarse below 3 feet				
4					-Becomes cemented with gravel and cobble size rock fragments up to 6" below 6.5 feet				
6									
8									
10					MESOZOIC ROCK Highly to moderately weathered, gray-brown, moderately weak to moderately strong METAVOLCANIC ROCK				
					REFUSAL AT 10 FEET				

Figure A-30,
Log of Trench T 16, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 17		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>805'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0	T17-1			SM	COLLUVIUM Medium dense, damp, reddish brown, Silty, fine to coarse SAND				
2					-1' thick cobble/boulder lense at 3 feet with rock fragments up to 14"				
4									
6									
8	MESOZOIC ROCK Highly weathered, salt and pepper gray, weak to moderately weak GRANITIC ROCK								
10	-Becomes less weathered with depth								
12									
PRACTICAL REFUSAL AT 13 FEET									

Figure A-31,
Log of Trench T 17, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 18		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)			
					ELEV. (MSL.) <u>738'</u>	DATE COMPLETED <u>05-15-2013</u>						
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>					
MATERIAL DESCRIPTION												
0				SM/SC	ALLUVIUM Loose to medium dense, damp to moist, reddish brown, Silty/Clayey, fine to medium SAND -Becomes slightly cemented and fine to coarse with gravels below 5 feet							
2												
4												
6					MESOZOIC ROCK Highly weathered, dark gray, moderately weak GRANITIC ROCK							
8												
10					TRENCH TERMINATED AT 10 FEET							

Figure A-32,
Log of Trench T 18, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 19		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>752'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	COLLUVIUM Loose to medium dense, damp to moist, reddish brown, Silty, fine to medium SAND				
2					-1-foot thick gravel/cobble/boulder lense at 3 feet; rock fragments up to 14"				
4					MESOZOIC ROCK Highly weathered, dark gray and orange, and moderately weak, METASEDIMENTARY ROCK/GRANITIC ROCK				
6					TRENCH TERMINATED AT 7 FEET				

Figure A-33,
Log of Trench T 19, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 20		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>774'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	TOPSOIL Loose, damp, dark brown, Silty, fine to medium SAND				
2					MESOZOIC ROCK Highly weathered, gray, moderately weak, METASEDIMENTARY ROCK				
4									
TRENCH TERMINATED AT 5 FEET									

Figure A-34,
Log of Trench T 20, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 21		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>752'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0			▽	SM/SC	ALLUVIUM Loose, moist, dark brown, Silty/Clayey, fine to coarse SAND -Becomes wet below 3 feet -heavy seepage at 5 feet; heavy caving				
2									
4									
6									
TRENCH TERMINATED AT 7 FEET DUE TO CAVING									

Figure A-35,
Log of Trench T 21, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 22		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)			
					ELEV. (MSL.) <u>763'</u>	DATE COMPLETED <u>05-15-2013</u>						
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>							
MATERIAL DESCRIPTION												
0			▽	SM/SC	<p>ALLUVIUM Loose, moist, dark brown, Silty/Clayey, fine to coarse SAND</p> <p>-Becomes wet</p> <p>-Heavy seepage at 4.5 feet</p> <p>-Becomes mottled brown and orange with moderate caving below 5 feet</p>							
2												
4												
6												
8												
TRENCH TERMINATED AT 9 FEET DUE TO CAVING												

Figure A-36,
Log of Trench T 22, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 23		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>789'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	COLLUVIUM Medium dense, damp, reddish brown, Silty/Clayey, fine to medium SAND				
2									
4					MESOZOIC ROCK Moderately weathered, salt and pepper gray, moderately strong to strong GRANITIC ROCK/METASEDIMENTARY ROCK				
6							REFUSAL AT 6 FEET		

Figure A-37,
Log of Trench T 23, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 24		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>765'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0	T24-1			SM/SC	<p>ALLUVIUM Medium dense, damp, reddish brown, Silty/Clayey, fine to medium SAND</p> <p>-Becomes damp to moist below 4 feet</p> <p>-Becomes cemented and coarser grained with some gravels below 8 feet; difficult trenching</p>				
2									
4									
6									
8	PRACTICAL REFUSAL AT 9 FEET								

Figure A-38,
Log of Trench T 24, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 25		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	
					ELEV. (MSL.) <u>733'</u>	DATE COMPLETED <u>05-15-2013</u>				
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>			
MATERIAL DESCRIPTION										
0				SM/SC	ALLUVIUM Loose, moist, dark brown, Silty/Clayey, fine to medium SAND -Becomes medium dense and fine to coarse below 4 feet -Moderate seepage at contact at 8.5 feet					
2										
4										
6										
8										
8.5										
10						MESOZOIC ROCK Moderately weathered, light brown, moderately strong, METASEDIMENTARY ROCK				
TRENCH TERMINATED AT 11 FEET										

Figure A-39,
Log of Trench T 25, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 26		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)				
					ELEV. (MSL.) <u>745'</u>	DATE COMPLETED <u>05-15-2013</u>							
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>						
MATERIAL DESCRIPTION													
0	T26-1			SM/SC	ALLUVIUM								
2					Loose, moist, reddish brown, Silty/Clayey, fine to medium SAND								
4					-Becomes loose to medium dense below 3 feet								
6					-Becomes mottled reddish brown and gray below 5 feet								
8													
10					-Moderate seepage at 10 feet								
12													
14					-Becomes gray and finer grained below 14 feet								
TRENCH TERMINATED AT 15 FEET													

Figure A-40,
Log of Trench T 26, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

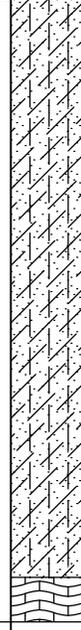
DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 27		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)			
					ELEV. (MSL.) <u>744</u>	DATE COMPLETED <u>05-15-2013</u>						
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>					
MATERIAL DESCRIPTION												
0				SM/SC	<p>ALLUVIUM Loose to medium dense, moist, dark brown, Silty/Clayey, fine to medium SAND</p> <p>-Becomes mottled reddish brown and gray below 6 feet</p> <p>-Becomes cemented with gravel and cobble size rock fragments up to 6" below 10 feet</p> <p>MESOZOIC ROCK Highly weathered, dark gray, moderately weak, METASEDIMENTARY ROCK</p> <p>TRENCH TERMINATED AT 14 FEET</p>							
2												
4												
6												
8												
10												
12												
14												

Figure A-41,
Log of Trench T 27, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 29		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>734'</u>	DATE COMPLETED <u>05-15-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose to medium dense, moist, reddish brown, Silty/Clayey, fine to medium SAND -Slight seepage at 5.5 feet MESOZOIC ROCK Moderately weathered, gray-brown, moderately strong, METASEDIMENTARY ROCK PRACTICAL REFUSAL AT 10 FEET				
2									
4									
6									
8									
10									

Figure A-43,
Log of Trench T 29, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 30		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)							
					ELEV. (MSL.) <u>742'</u>	DATE COMPLETED <u>05-15-2013</u>										
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>											
MATERIAL DESCRIPTION																
0				SM/SC	<p>ALLUVIUM Medium dense, damp, brown, Silty/Clayey, fine to medium SAND</p> <p>-Becomes moist below 5 feet</p> <p>-Becomes very moist and mottled pale gray and brown below 10 feet</p> <p>-Becomes slightly cemented, fine to coarse with gravel and cobble size rock fragments up to 5" -Slight seepage at 14.5 feet</p> <p style="text-align: center;">TRENCH TERMINATED AT 15 FEET</p>											
2																
4																
6																
8																
10																
12																
14																
										▽						

Figure A-44,
Log of Trench T 30, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 31		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)											
					ELEV. (MSL.) <u>747'</u>	DATE COMPLETED <u>05-15-2013</u>														
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>															
MATERIAL DESCRIPTION																				
0				SM/SC	<p>ALLUVIUM Loose, moist, dark brown, Silty/Clayey, fine to medium SAND</p> <p>-Becomes fine to coarse</p> <p>-Minor caving below 4 feet</p> <p>-Moderate seepage at 5.5 feet; becomes mottled pale gray and brown below 6 feet</p> <p>-Becomes coarser grained with gravel and cobble size rock fragments up 6" below 14 feet</p>															
2																				
4																				
6																				
8																				
10																				
12																				
14																				
TRENCH TERMINATED AT 15 FEET																				

Figure A-45,
Log of Trench T 31, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 32		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>764'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM	TOPSOIL Loose, damp, reddish brown, Silty, fine to medium SAND				
2					MESOZOIC ROCK Moderately weathered, gray brown, moderately strong METASEDIMENTARY ROCK				
					REFUSAL AT 3.5 FEET				

Figure A-46,
Log of Trench T 32, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

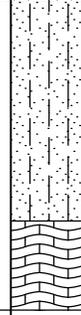
DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 33		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)	
					ELEV. (MSL.) <u>743'</u>	DATE COMPLETED <u>05-16-2013</u>				
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>			
MATERIAL DESCRIPTION										
0				SM	COLLUVIUM Medium dense, damp, brown, Silty, fine to medium SAND					
2						-1-foot thick lense of cobble and boulder size rock fragments up to 16" present at 3 feet				
4						MESOZOIC ROCK Highly to moderately weathered, orange brown, moderately weak to moderately strong METASEDIMENTARY ROCK				
6					PRACTICAL REFUSAL AT 7 FEET					

Figure A-47,
Log of Trench T 33, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

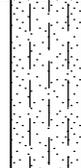
DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 34		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>734'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	COLLUVIUM Medium dense, damp to moist, brown to reddish brown, Silty, fine to medium SAND, with some gravel and cobble size rock fragments up to 6"				
2									
4					MESOZOIC ROCK Moderately weathered, dark gray-brown, moderately strong to strong METAVOLCANIC ROCK; highly fractured				
6						REFUSAL AT 6 FEET			

Figure A-48,
Log of Trench T 34, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 35		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)		
					ELEV. (MSL.) <u>729'</u>	DATE COMPLETED <u>05-16-2013</u>					
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION											
0				SM/SC	ALLUVIUM Loose, damp, brown, Silty/Clayey, fine to medium SAND -Becomes medium dense, moist and reddish brown below 3 feet -Becomes fine to coarse with gravel and cobble size rock fragments up to 10" below 6 feet						
2											
4											
6					MESOZOIC ROCK Highly to moderately weathered, orange brown, moderately weak to moderately strong METASEDIMENTARY ROCK PRACTICAL REFUSAL AT 9 FEET						
8											

Figure A-49,
Log of Trench T 35, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

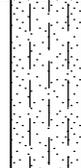
DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 36		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>740'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM	COLLUVIUM Medium dense, damp, brown-reddish brown, Silty, fine to medium SAND				
2									
4					MESOZOIC ROCK Moderately weathered, brown to dark brown, moderately strong to strong, METASEDIMENTARY ROCK; highly fractured				
6						PRACTICAL REFUSAL AT 6 FEET			

Figure A-50,
Log of Trench T 36, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS		... SAMPLING UNSUCCESSFUL		... STANDARD PENETRATION TEST		... DRIVE SAMPLE (UNDISTURBED)
		... DISTURBED OR BAG SAMPLE		... CHUNK SAMPLE		... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 37		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)							
					ELEV. (MSL.) <u>756'</u>	DATE COMPLETED <u>05-16-2013</u>										
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>									
MATERIAL DESCRIPTION																
0				SM/SC	<p>ALLUVIUM Loose, moist, dark reddish brown, Silty/Clayey, fine to coarse SAND</p> <p>-Becomes very moist and mottled orange brown and gray below 6 feet</p> <p>-Some gravels at 13 feet</p>											
2																
4																
6																
8																
10																
12																
14																
TRENCH TERMINATED AT 15 FEET																

Figure A-51,
Log of Trench T 37, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 38		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>756'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
					MATERIAL DESCRIPTION				
0				SM	TOPSOIL Loose, dry, dark brown, Silty, fine to medium SAND				
2					MESOZOIC ROCK Highly weathered, orange-brown, weak GRANITIC ROCK				
4					TRENCH TERMINATED AT 4 FEET				

Figure A-52,
Log of Trench T 38, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

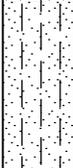
DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 39		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>753'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM	COLLUVIUM Medium dense, damp, brown to reddish brown, Silty, fine to coarse SAND				
2						-Some gravels present			
4					MESOZOIC ROCK Highly weathered, dark gray, weak to moderately weak GRANITIC ROCK/METASEDIMENTARY ROCK				
6					TRENCH TERMINATED AT 6 FEET				

Figure A-53,
Log of Trench T 39, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 40		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>726'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, moist, dark brown, Silty/Clayey, fine to medium SAND				
2									
4									
6									
8					-Gravel, cobble and boulder size rock fragments up to 14" present below 8 feet				
10					MESOZOIC ROCK Highly weathered, gray, weak METASEDIMENTARY ROCK				
TRENCH TERMINATED AT 11 FEET									

Figure A-54,
Log of Trench T 40, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 41		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)			
					ELEV. (MSL.) <u>725'</u>	DATE COMPLETED <u>05-16-2013</u>						
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>					
MATERIAL DESCRIPTION												
0				SM/SC	<p>ALLUVIUM Medium dense, damp, brown to reddish brown, Silty/Clayey, fine to medium SAND</p> <p>-Becomes cemented, moist, mottled dark brown and dark orange and fine to coarse below 6 feet</p> <p>-Moderate seepage at 12 feet</p> <p>-Becomes gray-brown below 14 feet -Possible bedrock contact at 15 feet; highly weathered fragments observed in spoil pile</p> <p style="text-align: center;">TRENCH TERMINATED AT 15 FEET</p>							
2												
4												
6												
8												
10												
12												
14												

Figure A-55,
Log of Trench T 41, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 42		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>731'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, damp, brown, Silty/Clayey, fine to coarse SAND -Becomes moist below 3 feet -Slight seepage at contact at 10.5 feet				
2									
4									
6									
8									
10									
12						MESOZOIC ROCK Highly weathered, dark gray, moderately weak to moderately strong METASEDIMENTARY ROCK ; highly fractured TRENCH TERMINATED AT 12 FEET			

Figure A-56,
Log of Trench T 42, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 43		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)			
					ELEV. (MSL.) <u>727'</u>	DATE COMPLETED <u>05-16-2013</u>						
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>							
MATERIAL DESCRIPTION												
0				SM/SC	<p>ALLUVIUM Loose to medium dense, damp, brown, Silty/Clayey, fine to coarse SAND</p> <p>-Becomes moist below 5 feet</p> <p>-Slight seepage at 12.5 feet</p> <p>-Becomes cemented with gravel and cobble size rock fragments up to 6" below 14 feet</p>							
2												
4												
6												
8												
10												
12												
14												
TRENCH TERMINATED AT 15.5 FEET												

Figure A-57,
Log of Trench T 43, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 44		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>736'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM/SC	COLLUVIUM Loose, damp, dark brown, Silty/Clayey, fine to coarse SAND				
2									
4					MESOZOIC ROCK Completely weathered, gray-brown, soil METASEDIMENTARY ROCK				
6						-Becomes highly weathered and weak to moderately weak below 6 feet			
TRENCH TERMINATED AT 7 FEET									

Figure A-58,
Log of Trench T 44, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 45		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)			
					ELEV. (MSL.) <u>745'</u>	DATE COMPLETED <u>05-16-2013</u>						
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>					
MATERIAL DESCRIPTION												
0				SM/SC	<p>ALLUVIUM Medium dense, damp, dark brown, Silty/Clayey, fine to coarse SAND</p> <p>-Becomes cemented from 3-6 feet</p> <p>-Becomes mottled orange-gray brown and fine to medium below 6 feet</p> <p>-Becomes cemented, light brown, fine to coarse with gravel and cobble size rock fragments up to 6" below 9 feet</p> <p>-Difficult trenching</p> <p>-Broke tooth off backhoe</p> <p style="text-align: center;">PRACTICAL REFUSAL AT 14 FEET</p>							
2												
4												
6												
8												
10												
12												
14												

Figure A-59,
Log of Trench T 45, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 46		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>747'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u> BY: <u>T. REIST</u>				
MATERIAL DESCRIPTION									
0				SM/SC	COLLUVIUM Loose, damp, dark brown, Silty/Clayey, fine to coarse SAND				
2									
4					MESOZOIC ROCK Completely weathered, gray-brown, soil METASEDIMENTARY/METAVOLCANIC ROCK; very punky material -Becomes highly weathered and weak to moderately weak below 7 feet				
6									
8					TRENCH TERMINATED AT 8 FEET				

Figure A-60,
Log of Trench T 46, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	 ... SAMPLING UNSUCCESSFUL	 ... STANDARD PENETRATION TEST	 ... DRIVE SAMPLE (UNDISTURBED)
	 ... DISTURBED OR BAG SAMPLE	 ... CHUNK SAMPLE	 ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 48		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>763'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose, damp, dark brown, Silty/Clayey, fine to coarse SAND				
2					-Becomes light brown with little cohesion below 2 feet				
4									
6					-Becomes medium dense, moist and reddish brown with some gravel and cobble size rock fragments up to 5"				
8									
10					-Becomes cemented and light brown with gravel, cobble and boulder size rock fragments up to 14" below 9 feet				
12					MESOZOIC ROCK Highly weathered, gray to light gray, moderately weak METASEDIMENTARY ROCK				
					TRENCH TERMINATED AT 12 FEET				

Figure A-62,
Log of Trench T 48, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	TRENCH T 49		PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					ELEV. (MSL.) <u>756'</u>	DATE COMPLETED <u>05-16-2013</u>			
					EQUIPMENT <u>RUBBER TIRE JD410G</u>		BY: <u>T. REIST</u>		
MATERIAL DESCRIPTION									
0				SM/SC	ALLUVIUM Loose to medium dense, dry to damp, brown, Silty/Clayey, fine to coarse SAND				
2			-Becomes medium dense below 2 feet						
4			-Becomes slightly cemented below 4 feet						
6			-Becomes cemented, light brown, with gravel below 6 feet						
8			-Difficult trenching						
PRACTICAL REFUSAL AT 9 FEET									

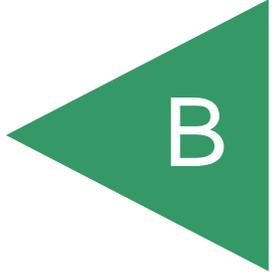
Figure A-63,
Log of Trench T 49, Page 1 of 1

G1588-32-02.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

APPENDIX



APPENDIX B

LABORATORY TESTING

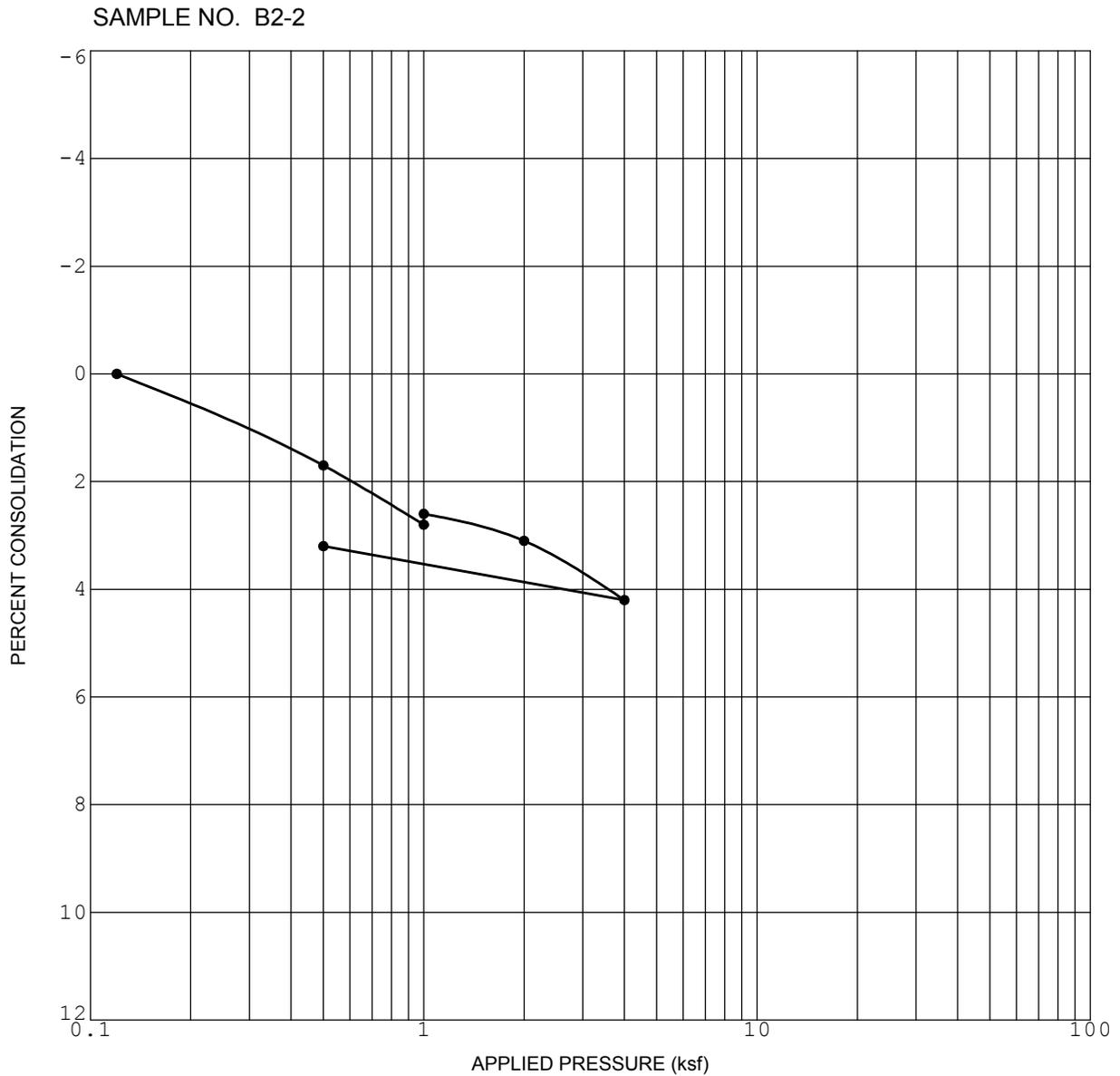
Laboratory tests were performed in accordance with generally accepted test methods of the American Society for Testing and Materials (ASTM) or other suggested procedures. Selected soil samples were tested for their in-place dry density and moisture content, shear strength, expansion and consolidation characteristics. The in-place dry density and moisture content results are indicated on the exploratory boring logs. The results of our laboratory tests are summarized on Tables B-I through B-II, and Figures B-1 through B-8.

**TABLE B-I
SUMMARY OF DIRECT SHEAR TEST RESULTS
ASTM D 3080**

Sample No.	Dry Density (pcf)	Moisture Content (%)	Unit Cohesion (psf)	Angle of Shear Resistance (degrees)
B4-1	115.9	16.2	900	37
B7-1	116.8	16.1	985	34

**TABLE B-II
SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS
ASTM D 4829**

Sample No.	Moisture Content (%)		Dry Density (pcf)	Expansion Index	CBC Classification
	Before Test	After Test			
B13-3	8.8	17.2	113.8	25	Low
T12-1	10.1	23.6	108.5	68	Medium



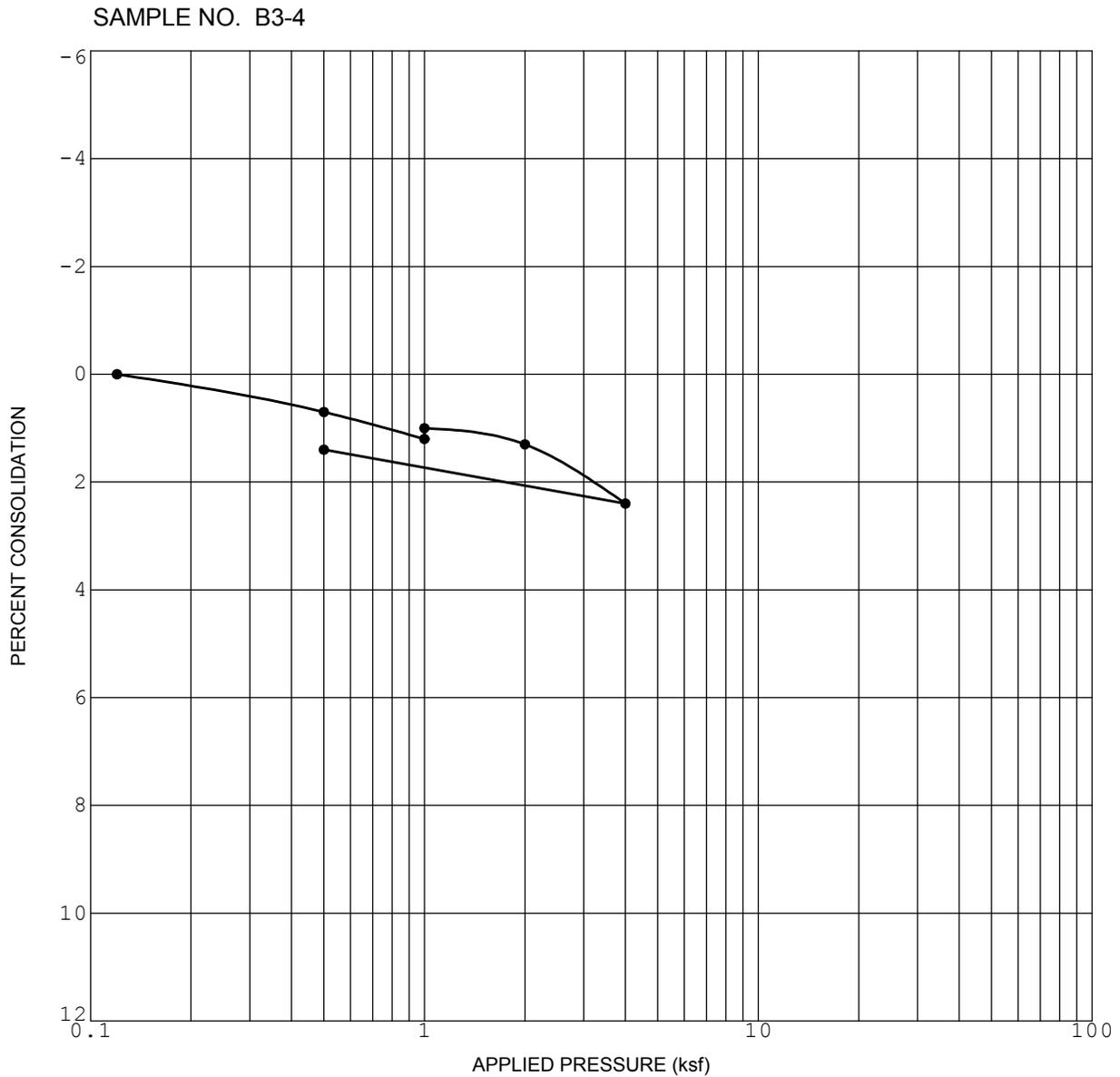
Initial Dry Density (pcf)	102.8
Initial Water Content (%)	24.1

Initial Saturation (%)	100+
Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA



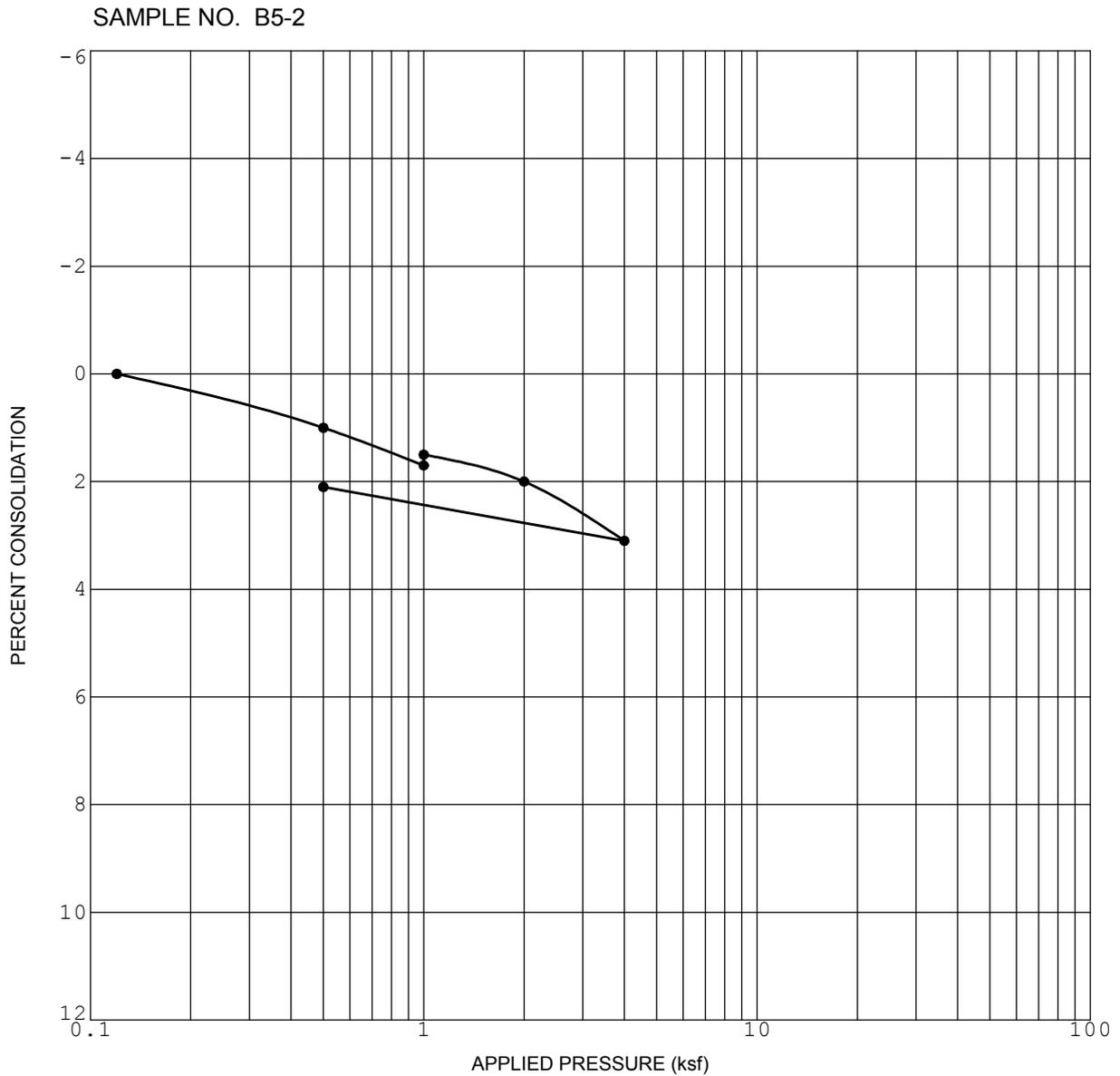
Initial Dry Density (pcf)	92.1
Initial Water Content (%)	30.0

Initial Saturation (%)	99.2
Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA



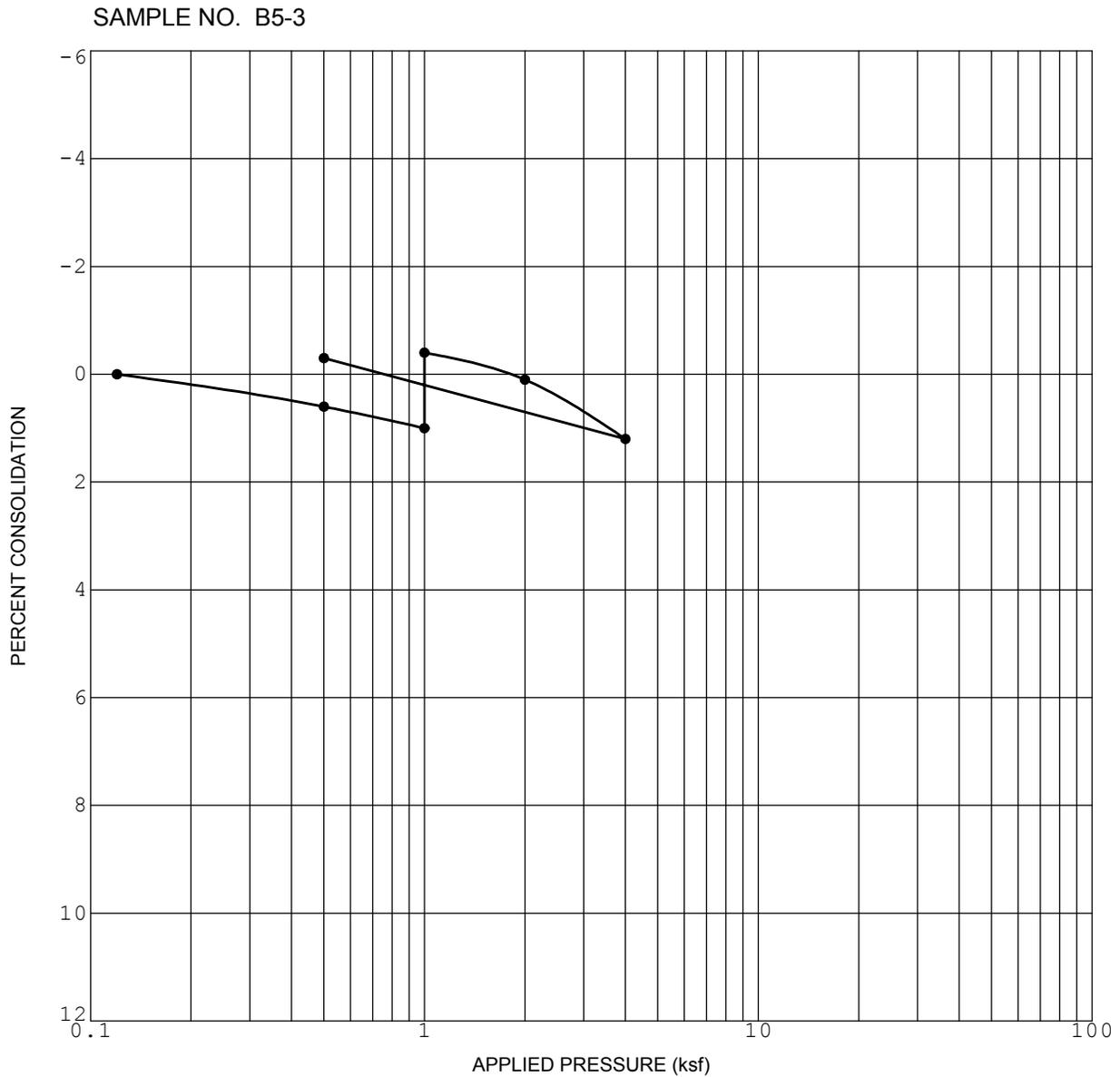
Initial Dry Density (pcf)	107.5
Initial Water Content (%)	21.0

Initial Saturation (%)	100+
Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA



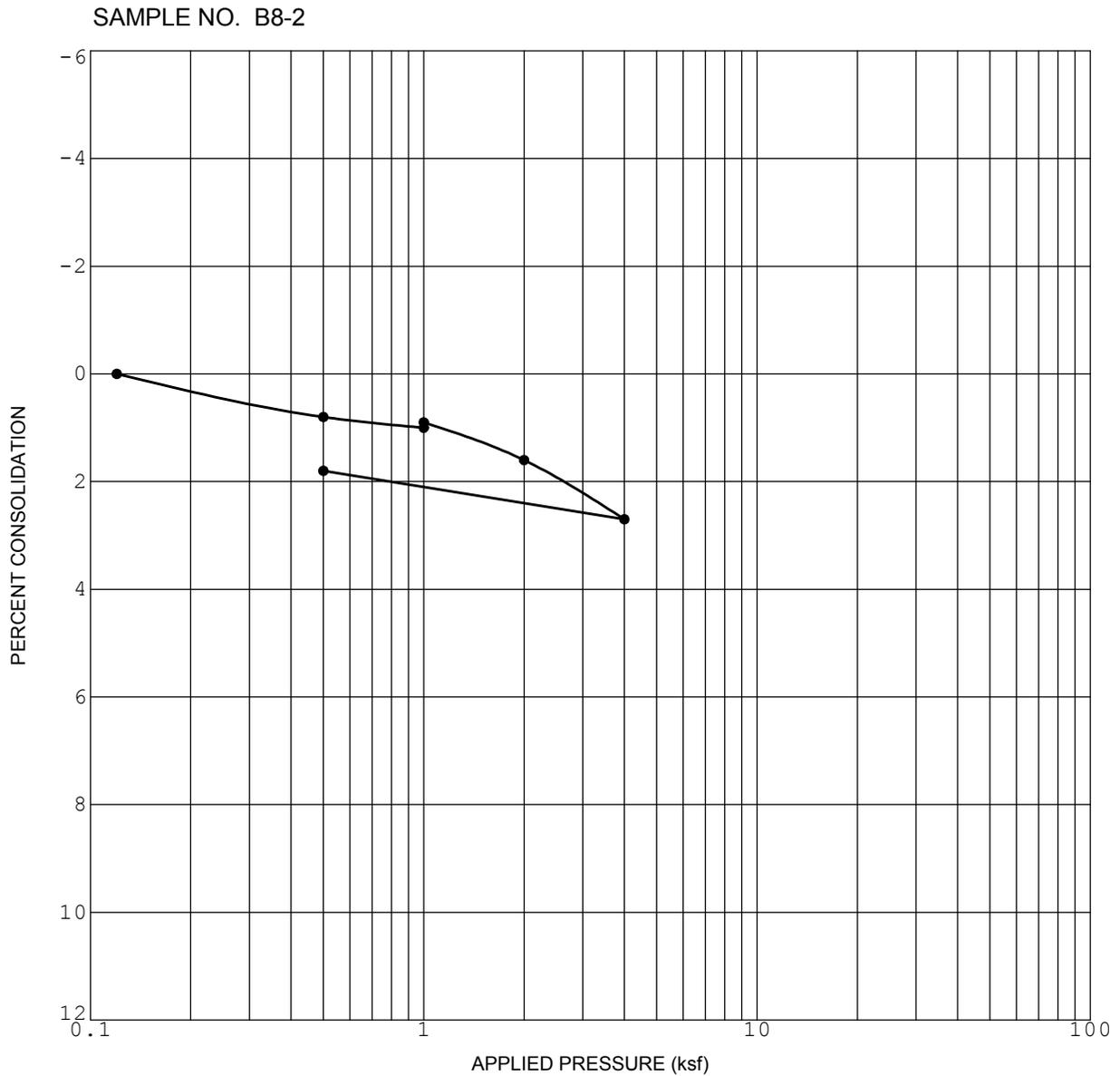
Initial Dry Density (pcf)	105.5
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Initial Saturation (%)	97.4
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CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA



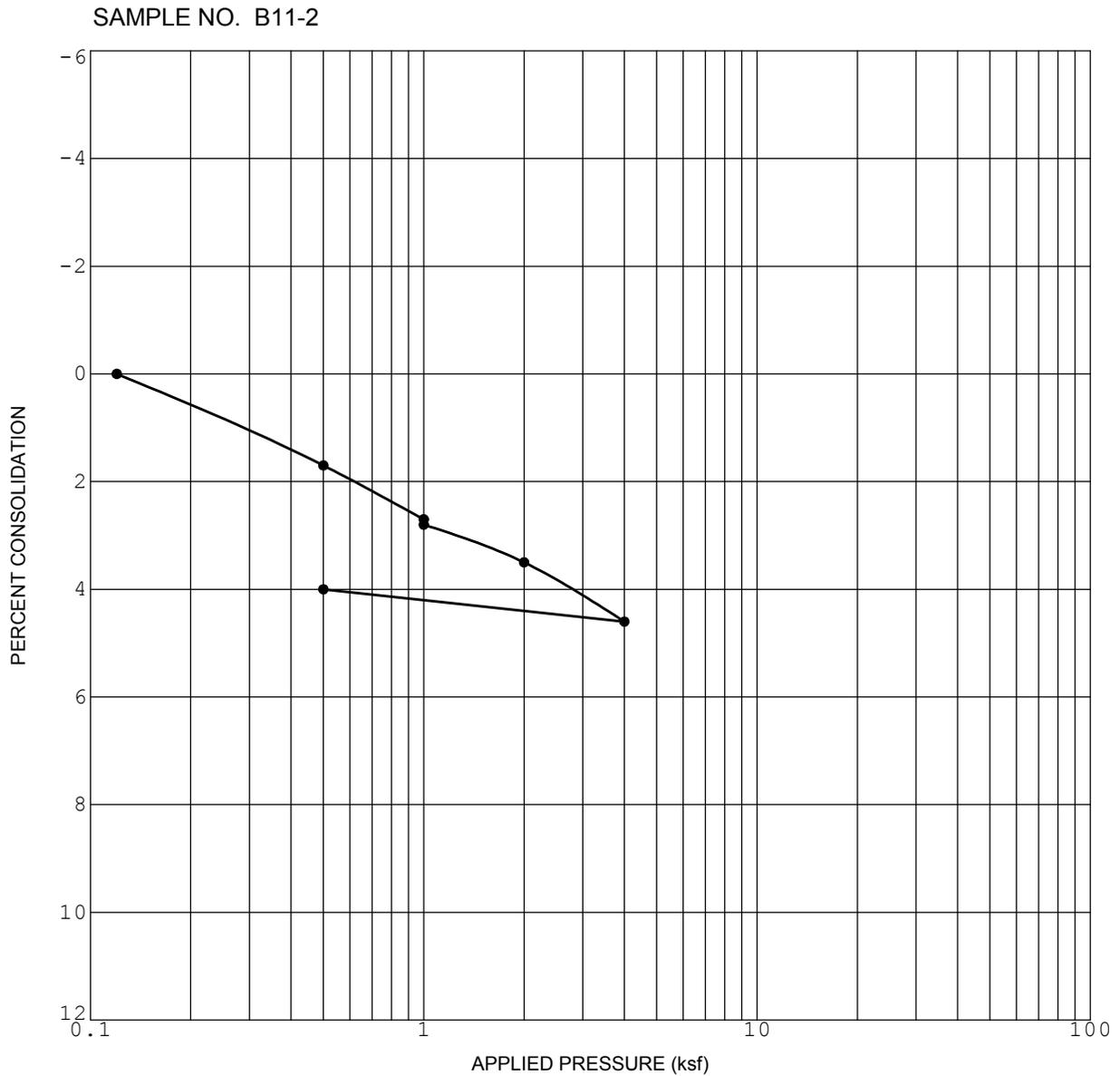
Initial Dry Density (pcf)	111.8
Initial Water Content (%)	17.5

Initial Saturation (%)	96.1
Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA



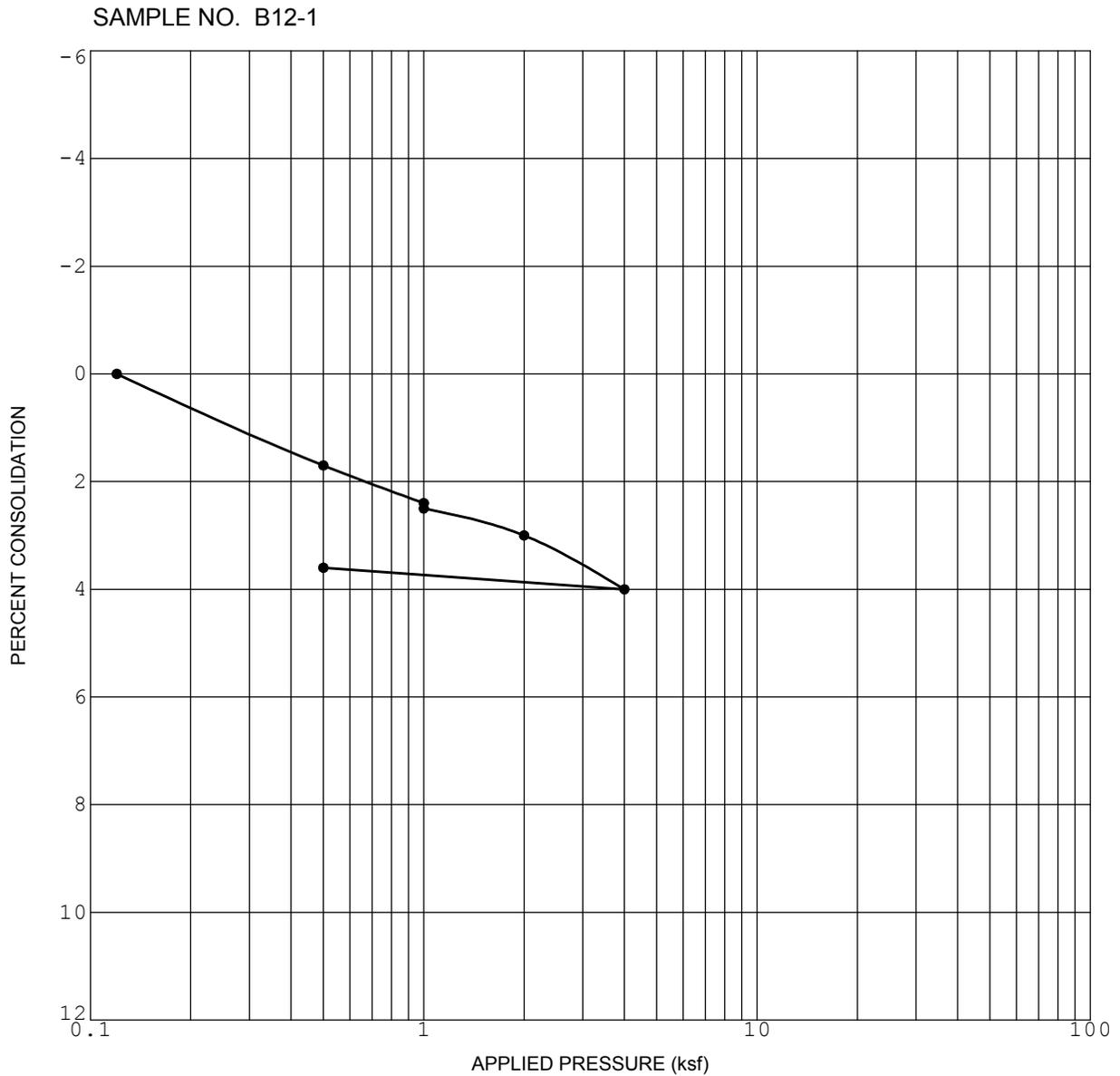
Initial Dry Density (pcf)	116.8
Initial Water Content (%)	17.2

Initial Saturation (%)	100+
Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA



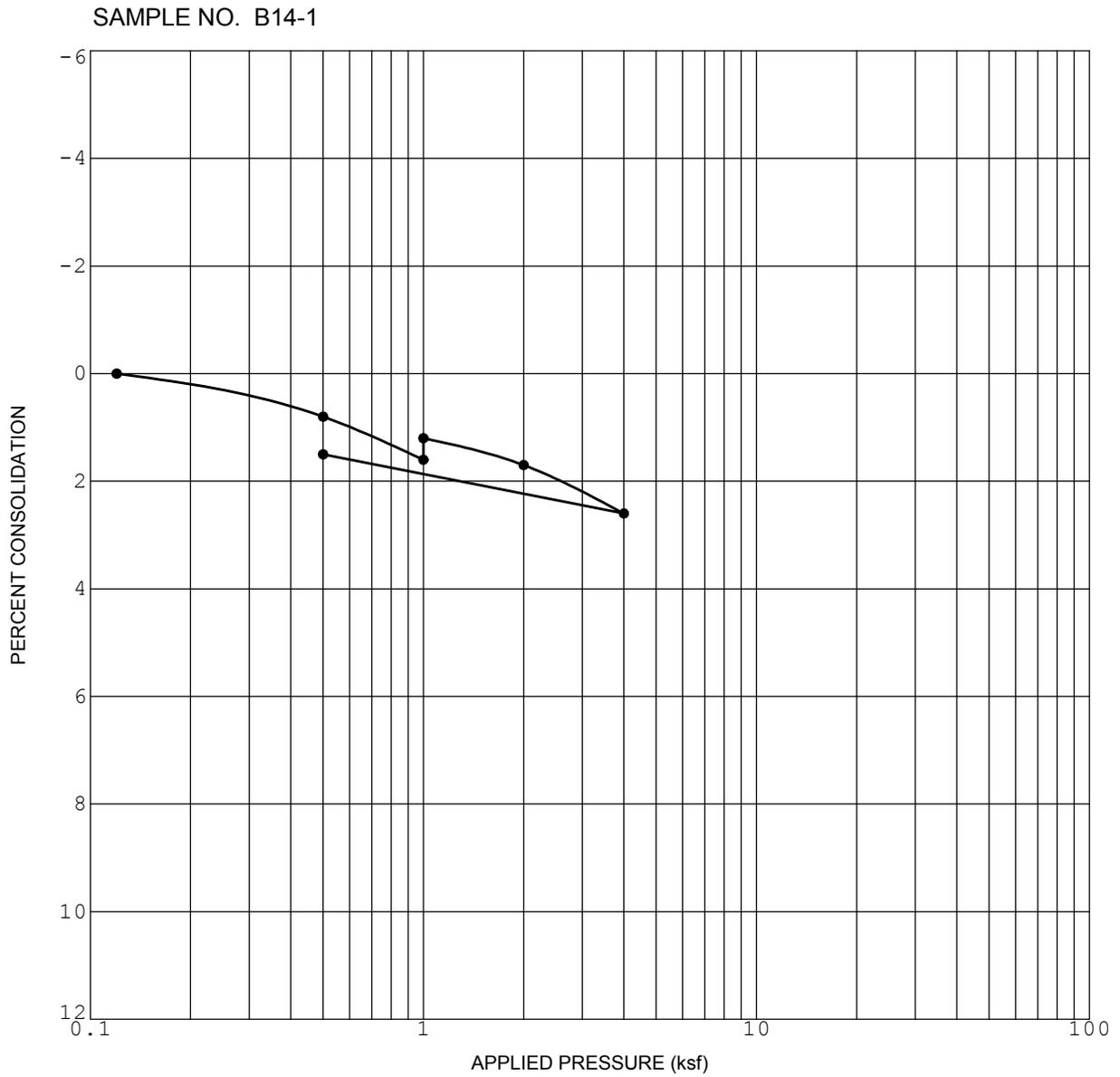
Initial Dry Density (pcf)	116.9
Initial Water Content (%)	14.7

Initial Saturation (%)	93.5
Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA



Initial Dry Density (pcf)	114.6
Initial Water Content (%)	18.0

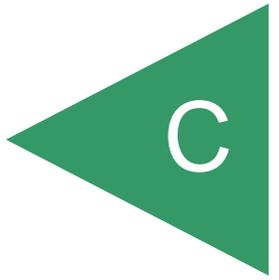
Initial Saturation (%)	100+
Sample Saturated at (ksf)	1.0

CONSOLIDATION CURVE

THE VILLAGES AT ESCONDIDO COUNTRY CLUB

ESCONDIDO, CALIFORNIA

APPENDIX



APPENDIX C

**SEISMIC REFRACTION REPORT
PERFORMED BY SOUTHWEST GEOPHYSICS**

FOR

**THE VILLAGES AT ESCONDIDO COUNTRY CLUB
ESCONDIDO, CALIFORNIA**

PROJECT NO. G1588-32-02

**SEISMIC REFRACTION SURVEY
THE LAKES
ESCONDIDO, CALIFORNIA**

PREPARED FOR:

Geocon. Inc.
6960 Flanders Drive
San Diego, CA 92121

PREPARED BY:

Southwest Geophysics, Inc.
8057 Raytheon Road, Suite 9
San Diego, CA 92111

April 14, 2014
Project No. 114128

April 14, 2014
Project No. 114128

Mr. Troy Reist
Geocon, Inc.
6960 Flanders Drive
San Diego, CA 92121

Subject: Seismic Refraction Survey
The Lakes
Escondido, California

Dear Mr. Reist:

In accordance with your authorization, we have performed a seismic refraction survey pertaining to the subject project located in Escondido, California. Specifically, our survey consisted of performing eight seismic refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas surveyed, and to assess the apparent rippability of the subsurface materials. This data report presents our survey methodology, equipment used, analysis, and results.

We appreciate the opportunity to be of service on this project. Should you have any questions related to this report, please contact the undersigned at your convenience.

Sincerely,
SOUTHWEST GEOPHYSICS, INC.



Aaron T. Puente
Senior Staff Geologist/Geophysicist



Hans van de Vrugt, C.E.G., P.Gp.
Principal Geologist/Geophysicist

ATP/HV/hv

Distribution: (1) Addressee (electronic)



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1. INTRODUCTION

In accordance with your authorization, we have performed a seismic refraction survey pertaining to the subject project located in Escondido, California (Figures 1a and 1b). Specifically, our survey consisted of performing eight seismic refraction traverses at the project site. The purpose of our study was to develop subsurface velocity profiles of the areas surveyed, and to assess the apparent rippability of the subsurface materials. This data report presents our survey methodology, equipment used, analysis, and results.

2. SCOPE OF SERVICES

Our scope of services included:

- Performance of eight seismic refraction lines (SL-1 through SL-8) at the project site.
- Compilation and analysis of the data collected.
- Preparation of this data report presenting our results and conclusions.

3. SITE AND PROJECT DESCRIPTION

The project site, which was a former golf course, is located along Country Club Lane, west of Interstate 15 in Escondido, California. Figures 1a and 1b depict the site location. The site consists of relatively open turf areas with trees and scattered concrete cart paths. Topography in the area of the seismic lines is predominantly flat with some small sloping areas. Figures 2a through 2c, 3a and 3b depict the site conditions in the area of the seismic traverses. It is our understanding that the construction of new homes is planned with cuts up to roughly 35 feet deep.

4. SURVEY METHODOLOGY

A seismic P-wave (compression wave) refraction survey was conducted at the site to evaluate the characteristics of the subsurface materials and to develop subsurface velocity profiles of the areas surveyed. The seismic refraction method uses first-arrival times of refracted seismic waves to estimate the thicknesses and seismic velocities of subsurface layers. Seismic P-waves generated at the surface, using a hammer and plate, are refracted at boundaries separating materials of contrasting velocities. These refracted seismic waves are then detected by a series of surface vertical component geophones and recorded with a 24-channel Geometrics StrataView seismograph. The

travel times of the seismic P-waves are used in conjunction with the shot-to-geophone distances to obtain thickness and velocity information on the subsurface materials.

Eight seismic lines (SL-1 through SL-8) were conducted in the study area. The general locations and lengths of the lines were selected by your office. Shot points (signal generation locations) were conducted along the lines at the ends, midpoint, and intermediate points between the ends and the midpoint for a total of five shot points along each line.

The refraction method requires that subsurface velocities increase with depth. A layer having a velocity lower than that of the layer above will not generally be detectable by the seismic refraction method and, therefore, could lead to errors in the depth calculations of subsequent layers. In addition, lateral variations in velocity, such as those caused by core stones or intrusions can also result in the misinterpretation of the subsurface conditions.

The rippability values presented in Table 1 are based on our experience with similar materials and assume that a Caterpillar D-9 dozer ripping with a single shank is used. We emphasize that the cutoffs in this classification scheme are approximate and that rock characteristics, such as fracture spacing and orientation, play a significant role in determining rock rippability. These characteristics may also vary with location and depth. For trenching operations, the rippability values should be scaled downward. For example, velocities as low as 3,500 feet/second may indicate difficult ripping during trenching operations. In addition, the presence of boulders, which can be troublesome in a narrow trench, should be anticipated.

Table 1 – Rippability Classification	
Seismic P-wave Velocity	Rippability
0 to 2,000 feet/second	Easy
2,000 to 4,000 feet/second	Moderate
4,000 to 5,500 feet/second	Difficult, Possible Blasting
5,500 to 7,000 feet/second	Very Difficult, Probable Blasting
Greater than 7,000 feet/second	Blasting Generally Required

It should be noted that the rippability cutoffs presented in Table 1 are slightly more conservative than those published in the Caterpillar Performance Handbook (Caterpillar, 2011). Accordingly, the above classification scheme should be used with discretion, and contractors should not be relieved of making their own independent evaluation of the rippability of the on-site materials prior to submitting their bids.

5. ANALYSIS

As previously indicated, eight seismic traverses were conducted as part of our study. The collected data were processed using SIPwin (Rimrock Geophysics, 2003), a seismic interpretation program, and analyzed using SeisOpt Pro (Optim, 2008) which uses first arrival picks and elevation data to produce subsurface velocity models. SeisOpt Pro uses a nonlinear optimization technique called adaptive simulated annealing. The resulting velocity model provides a tomography image of the estimated geologic conditions. Both vertical and lateral velocity information is contained in the tomography model. Changes in layer velocity are revealed as gradients rather than discrete contacts, which typically are more representative of actual conditions.

6. RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Figures 4a through 4h provide the velocity models calculated from SeisOpt Pro. Distinct vertical and lateral velocity variations are evident in the models. These inhomogeneities are likely related to the presence of remnant boulders, intrusions and differential weathering of the bedrock materials. It is also evident in the tomography models that the depth to bedrock is highly variable across the site.

Based on the refraction results, variability in the excavatability (including depth of rippability) of the subsurface materials should be expected across the project area. Furthermore, blasting may be required depending on the excavation depth, location, equipment used, and desired rate of production. In addition, oversized materials should be expected. A contractor with excavation experience in similar difficult conditions should be consulted for expert advice on excavation methodology, equipment and production rate.

7. LIMITATIONS

The field evaluation and geophysical analyses presented in this report have been conducted in general accordance with current practice and the standard of care exercised by consultants performing similar tasks in the project area. No warranty, express or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be present. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface surveying will be performed upon request.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Southwest Geophysics, Inc. should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document. This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

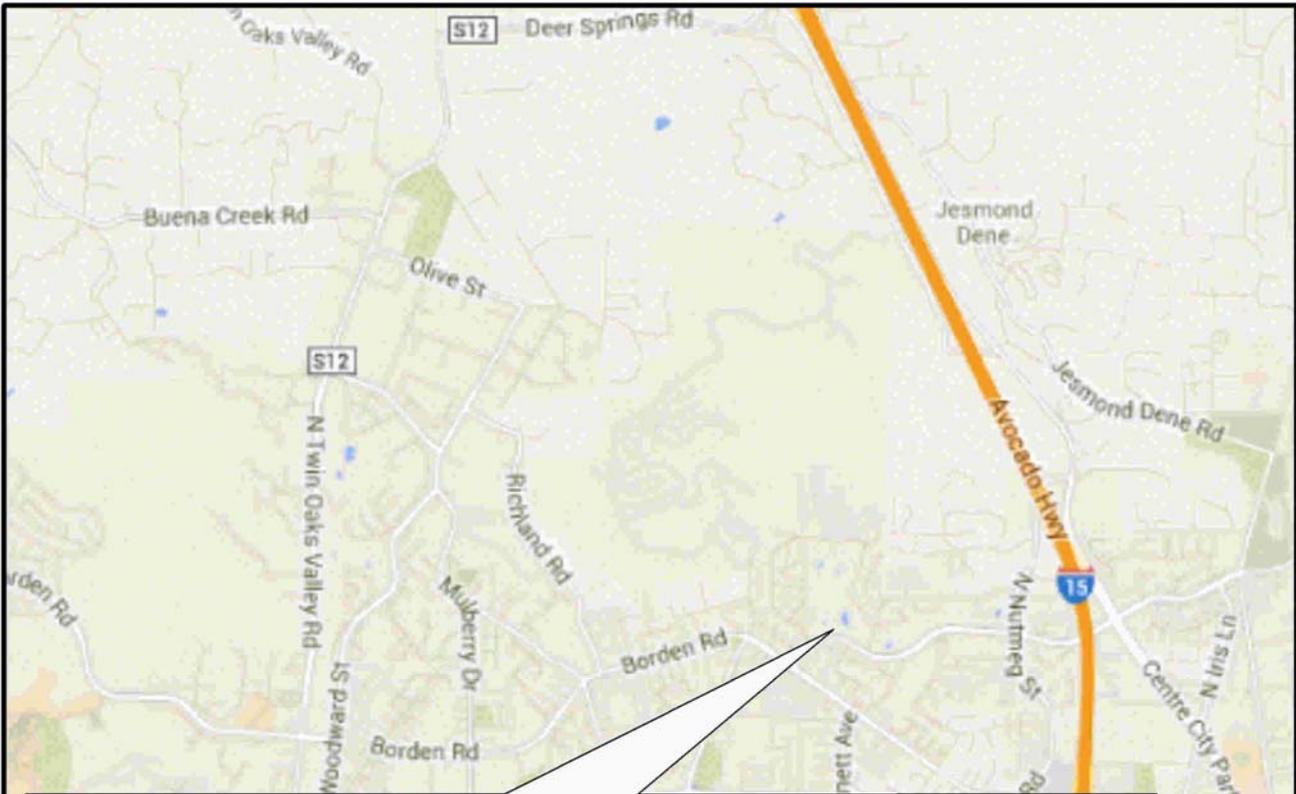
8. SELECTED REFERENCES

Mooney, H.M., 1976, Handbook of Engineering Geophysics, dated February.

Optim, Inc., 2008, SeisOpt Pro, V-5.0.

Rimrock Geophysics, 2003, Seismic Refraction Interpretation Program (SIPwin), V-2.76.

Telford, W.M., Geldart, L.P., Sheriff, R.E., and Keys, D.A., 1976, Applied Geophysics, Cambridge University Press.



VICINITY MAP



The Lakes
Escondido, California

Project No.: 114128

Date: 04/14



Figure 1a

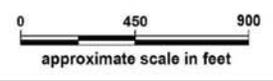
APPROXIMATE LINE LOCATIONS



SITE LOCATION MAP



The Lakes
Escondido, California
Project No.: 114128 Date: 04/14





**LINE LOCATION
MAP**
(SL-1 through SL-4)



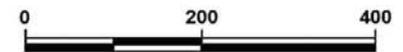
The Lakes
Escondido, California

Project No.: 114128

Date: 04/14



Figure 2a



approximate scale in feet



**LINE LOCATION
MAP**
(SL-5 through SL-7)



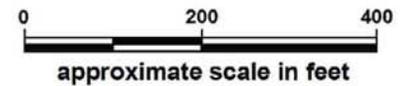
The Lakes
Escondido, California

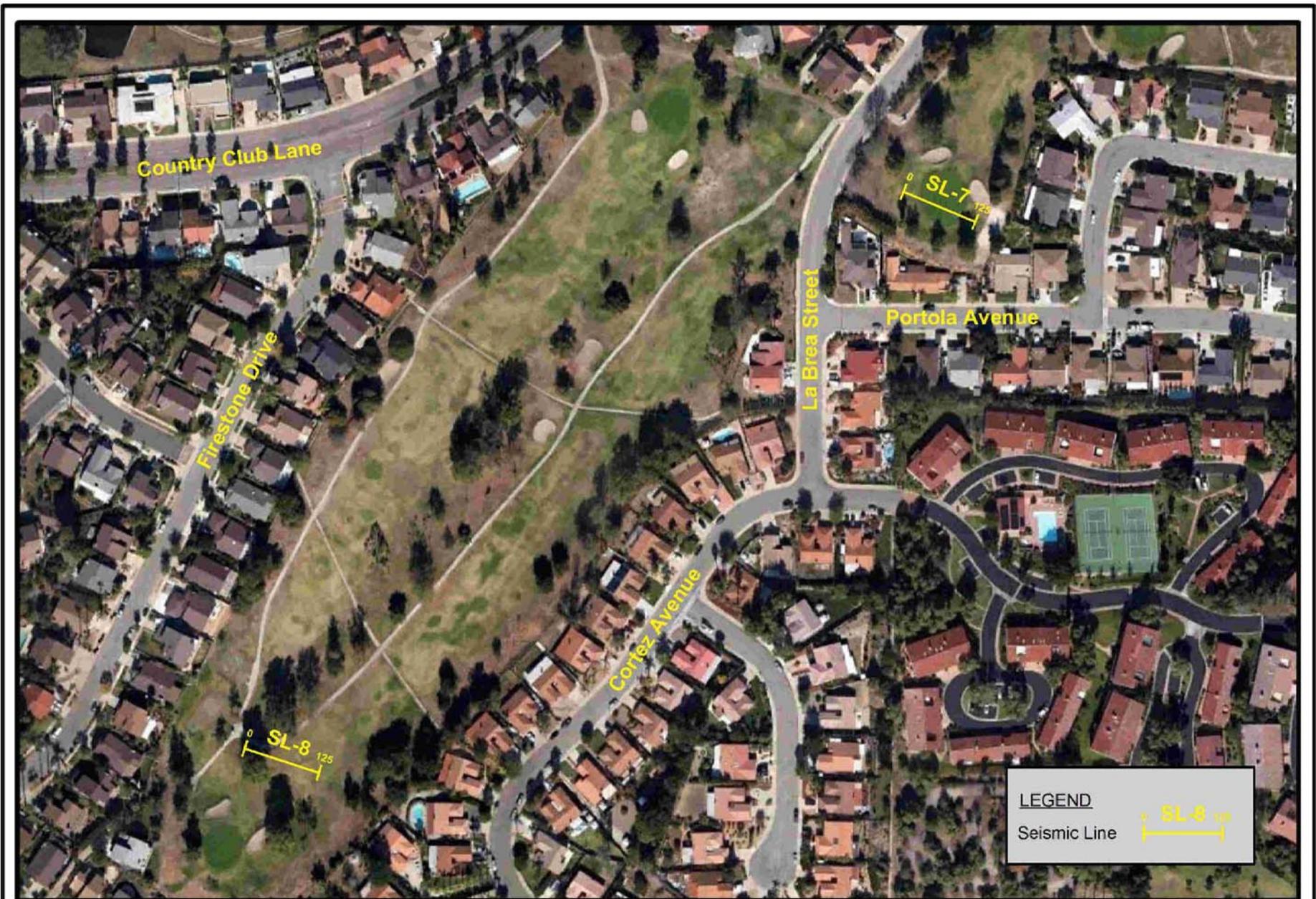
Project No.: 114128

Date: 04/14



Figure 2b





**LINE LOCATION
MAP**
(SL-7 and SL-8)



The Lakes
Escondido, California

Project No.: 114128

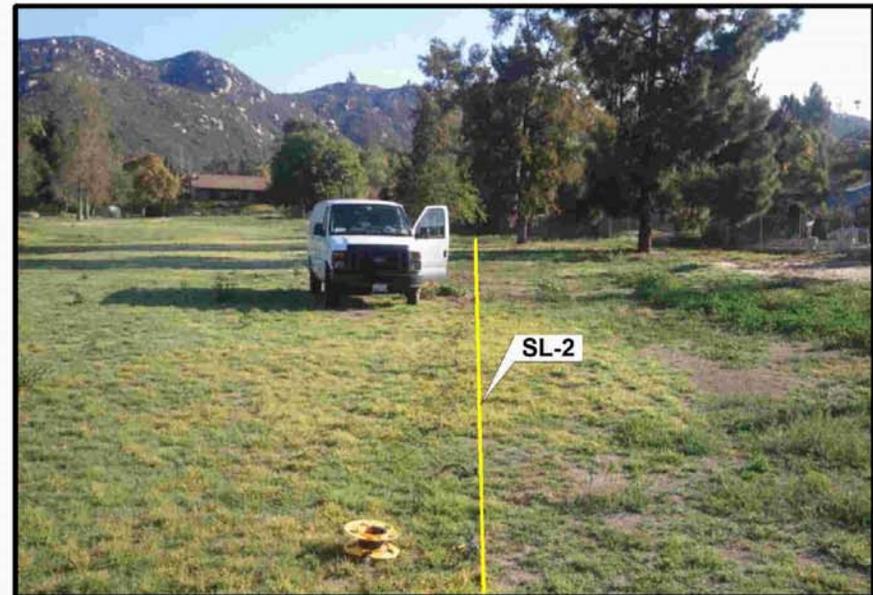
Date: 04/14



Figure 2c



approximate scale in feet



SITE PHOTOGRAPHS
(SL-1 through SL-4)

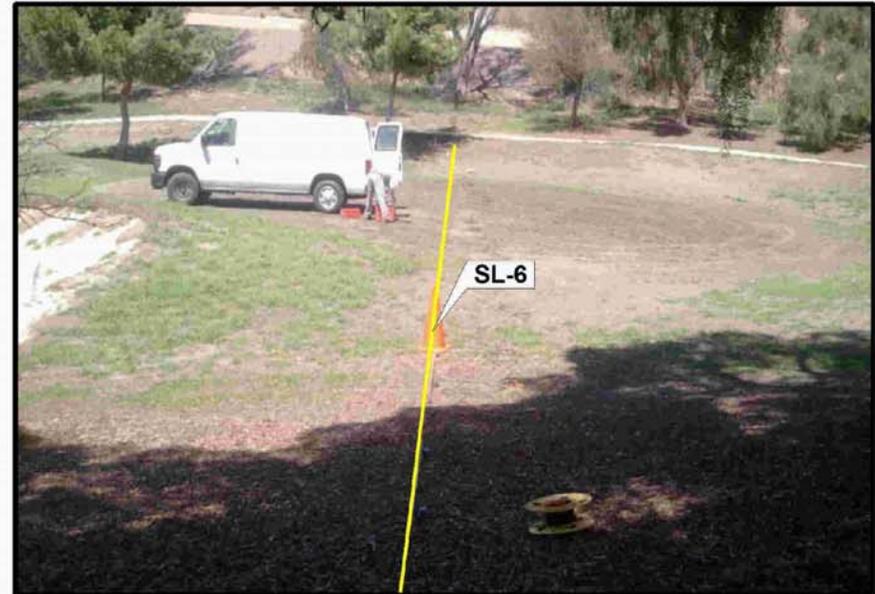
The Lakes
Escondido, California

Project No.: 114128

Date: 04/14



Figure 3a



SITE PHOTOGRAPHS
(SL-5 through SL-8)

The Lakes
Escondido, California

Project No.: 114128

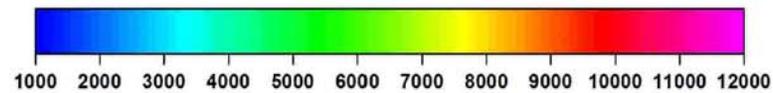
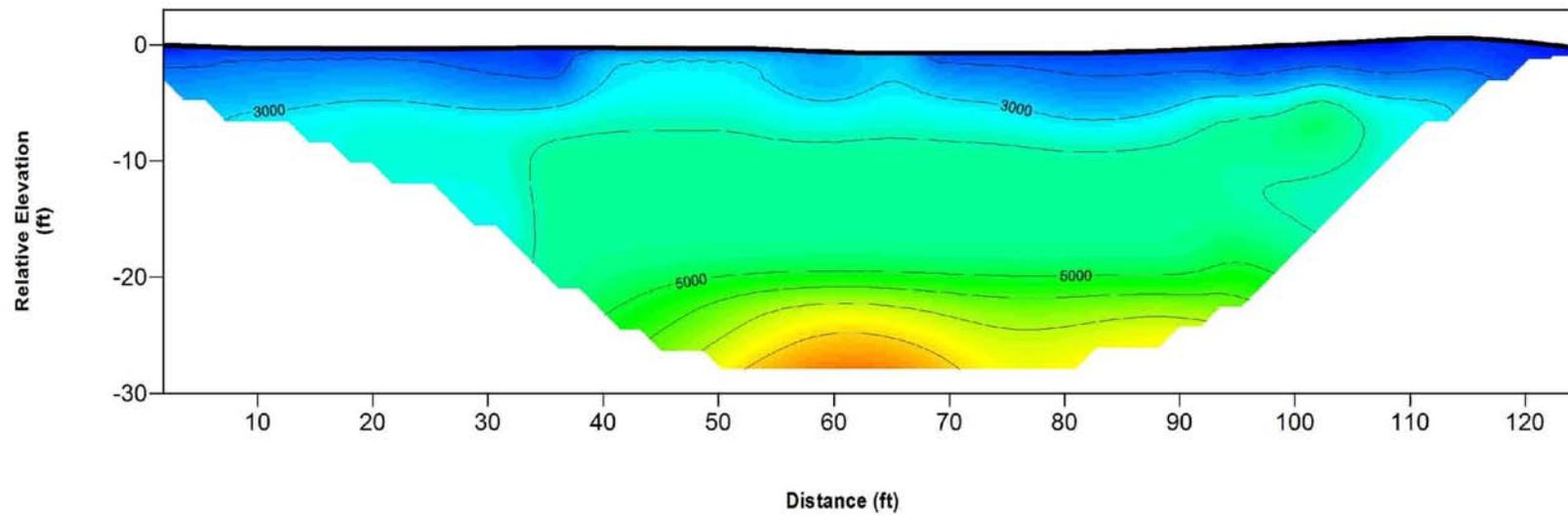
Date: 04/14



Figure 3b

TOMOGRAPHY MODEL

SL-1



Velocity (ft/s)

SEISMIC PROFILE

The Lakes
Escondido, California

Project No.: 114128

Date: 04/14

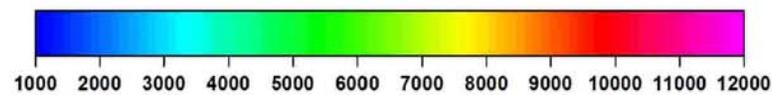
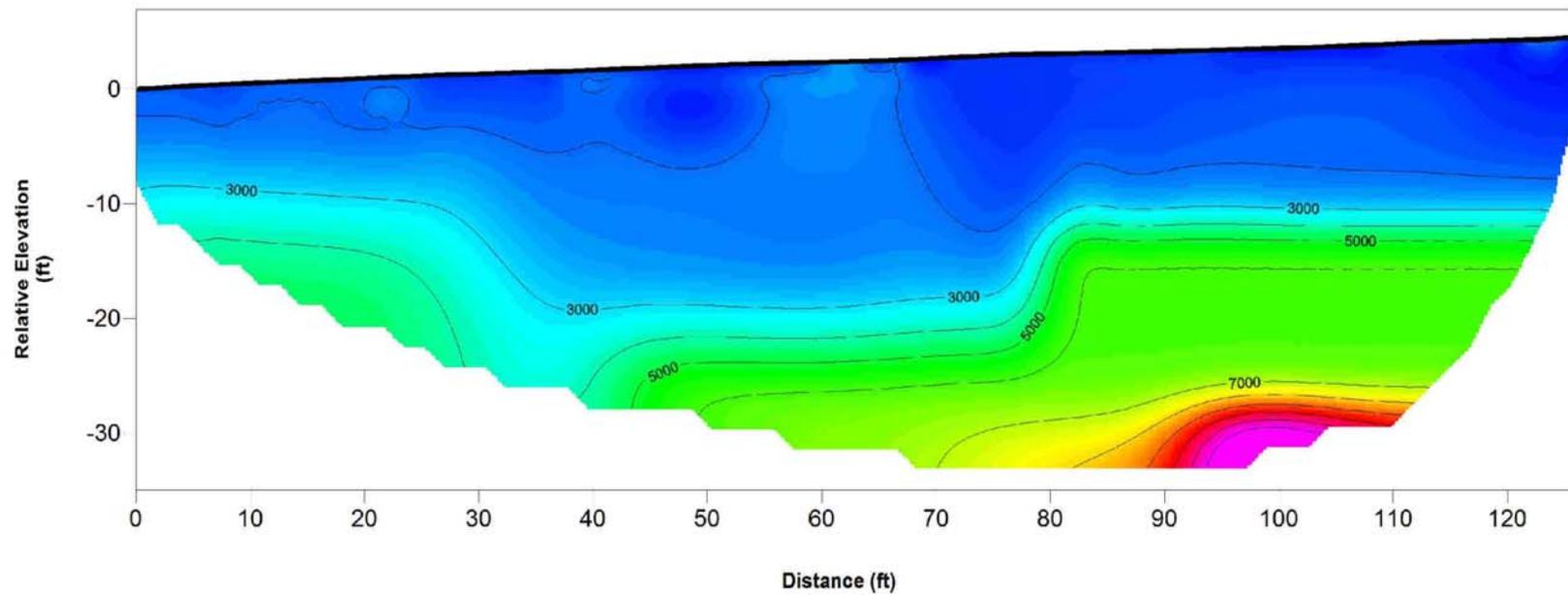


Figure 4a

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-2



Velocity (ft/s)

SEISMIC PROFILE

The Lakes
Escondido, California

Project No.: 114128

Date: 04/14

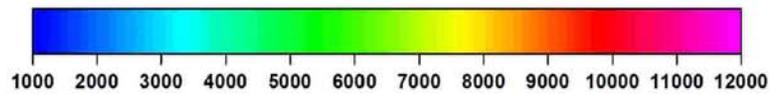
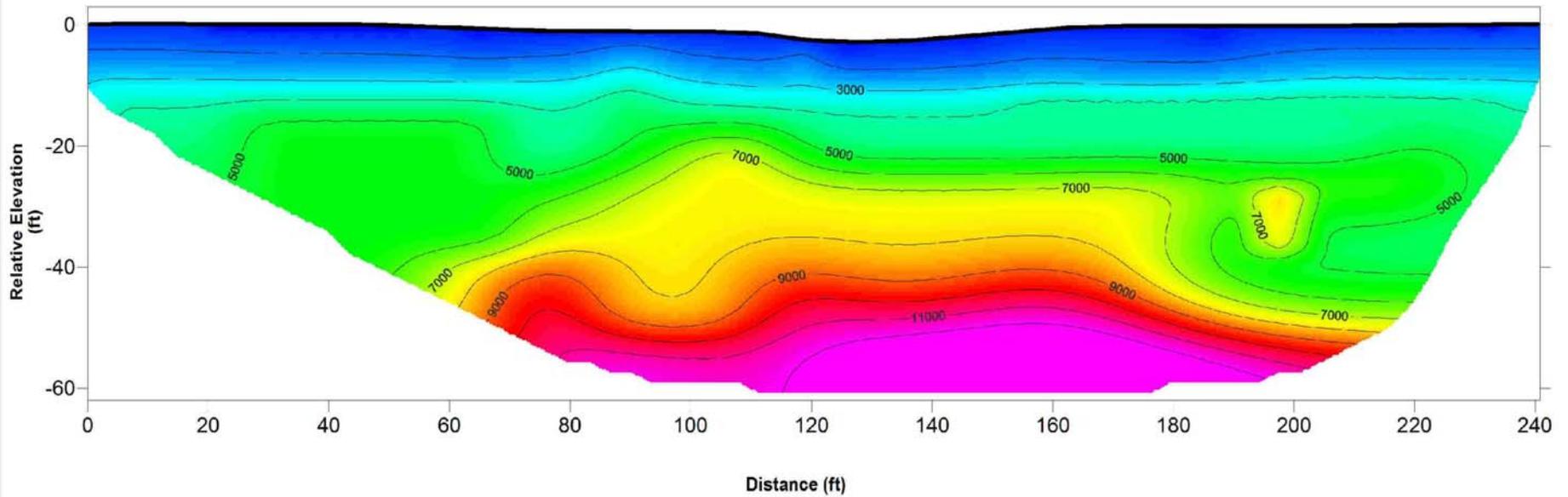


Figure 4b

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-3



Velocity (ft/s)

SEISMIC PROFILE

The Lakes
Escondido, California

Project No.: 114128

Date: 04/14

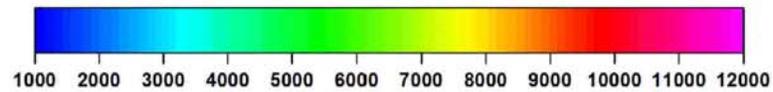
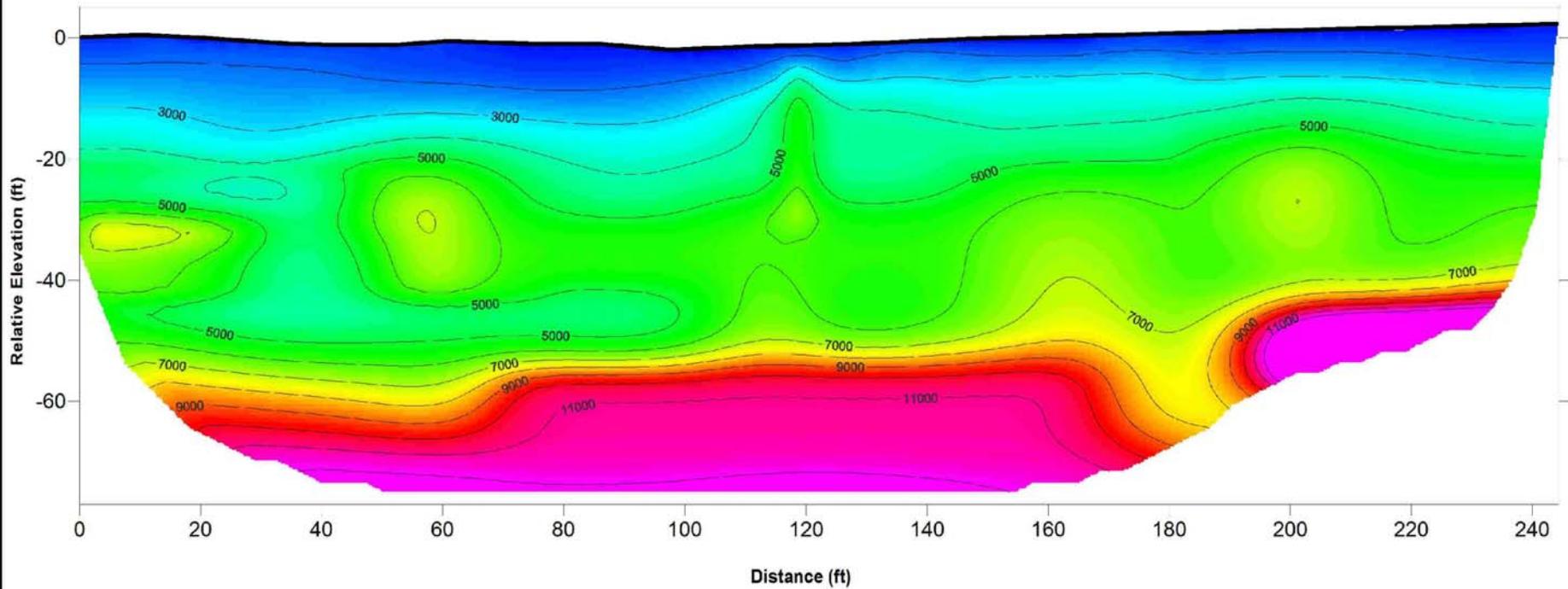


Figure 4c

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-4



Velocity (ft/s)

SEISMIC PROFILE

The Lakes
Escondido, California

Project No.: 114128

Date: 04/14

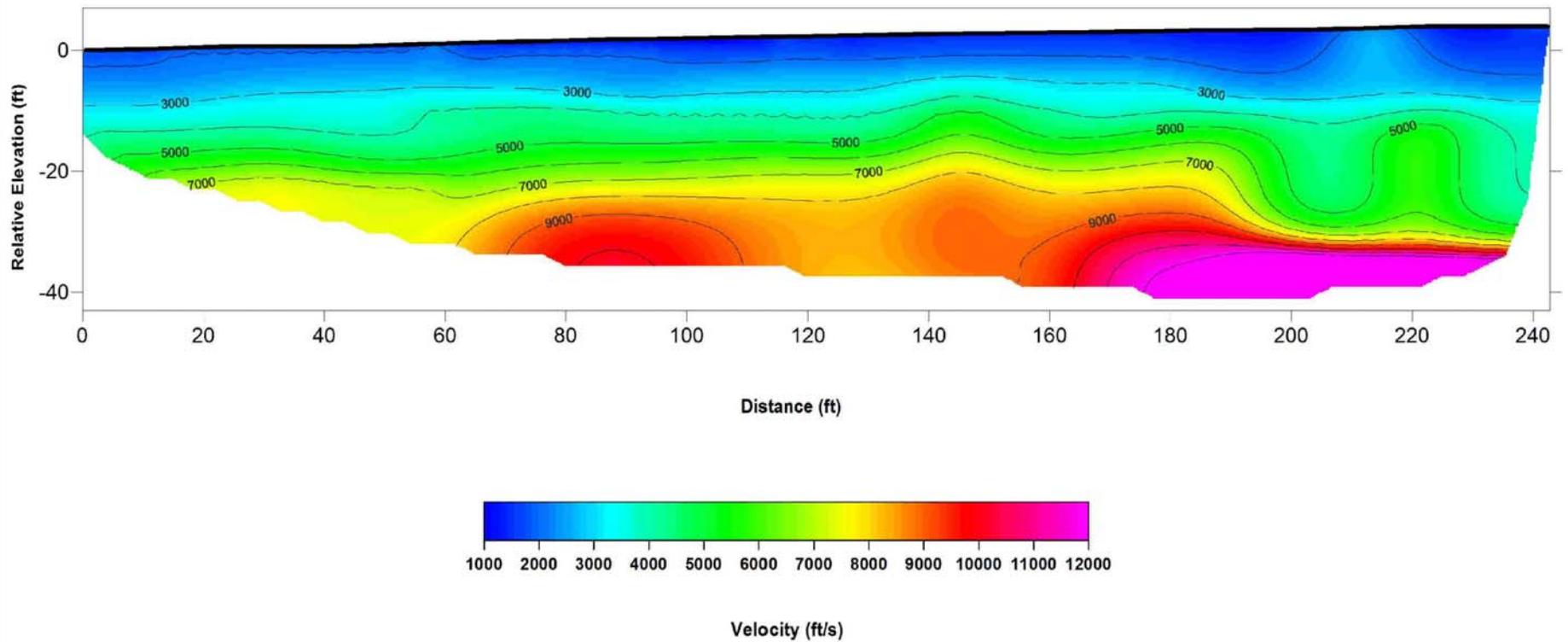


Figure 4d

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-5



SEISMIC PROFILE

The Lakes
Escondido, California



Project No.: 114128

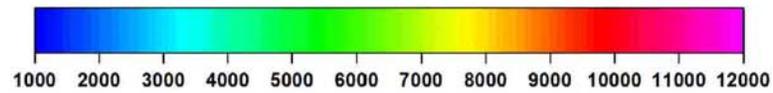
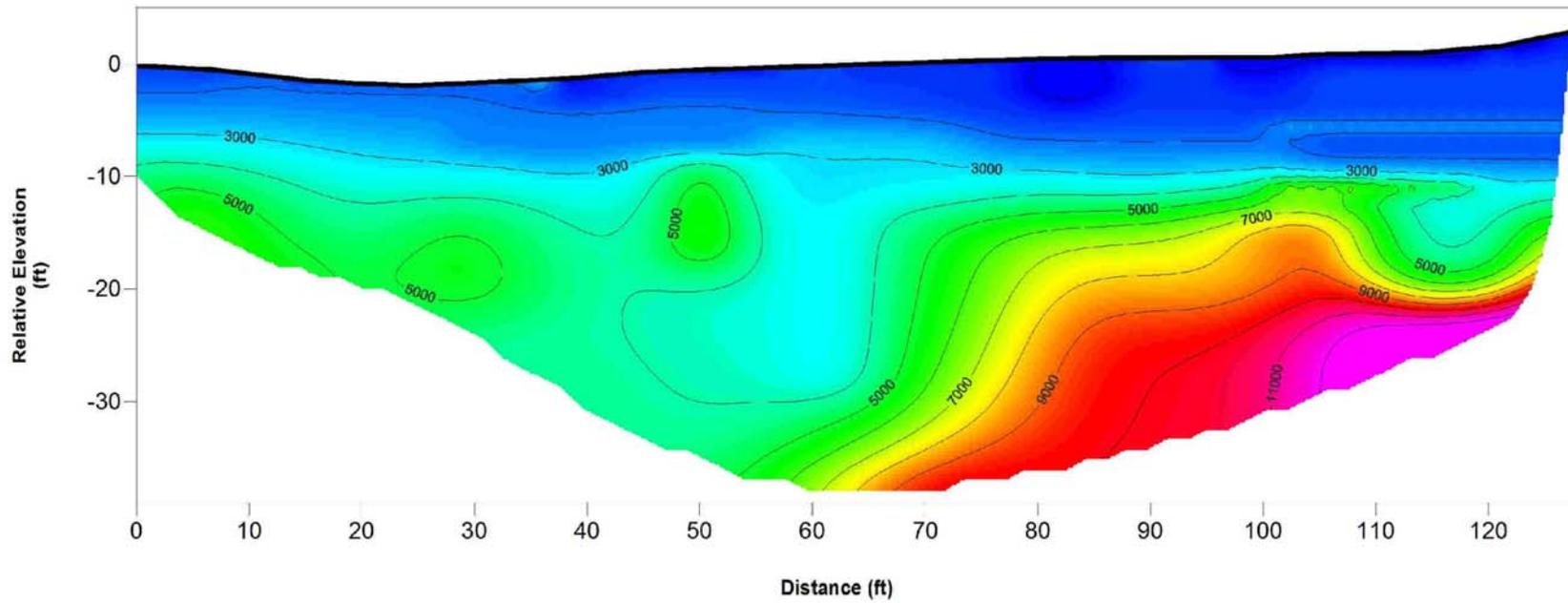
Date: 04/14

Figure 4e

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-6



Velocity (ft/s)

SEISMIC PROFILE

The Lakes
Escondido, California

Project No.: 114128

Date: 04/14

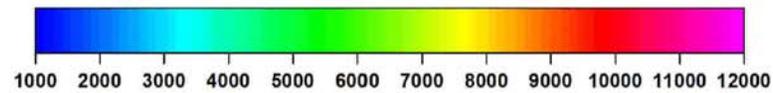
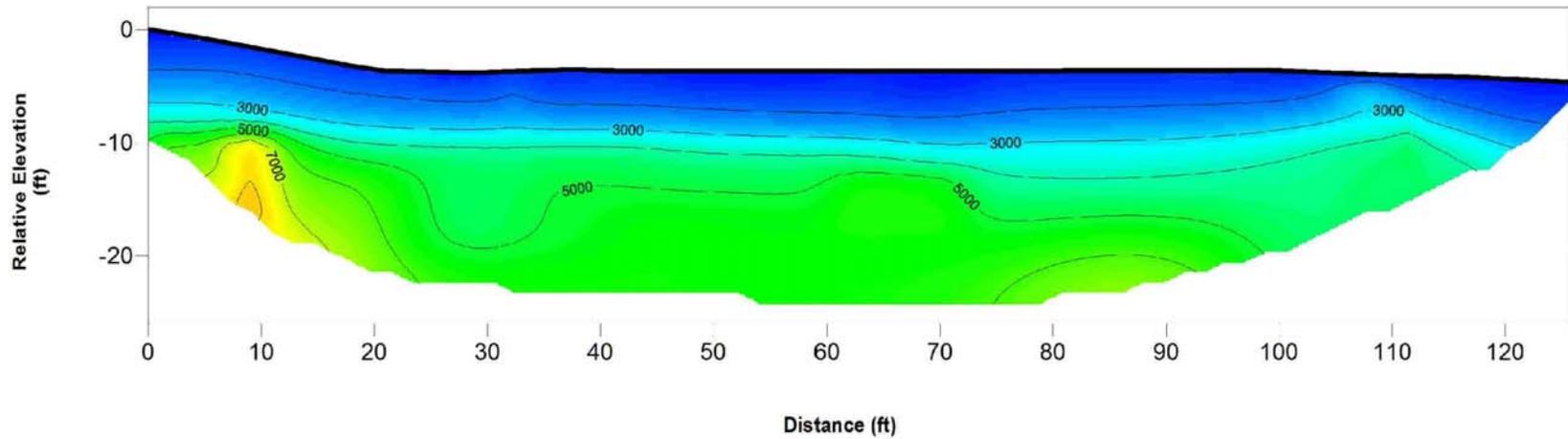


Figure 4f

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-7



Velocity (ft/s)

SEISMIC PROFILE

The Lakes
Escondido, California

Project No.: 114128

Date: 04/14

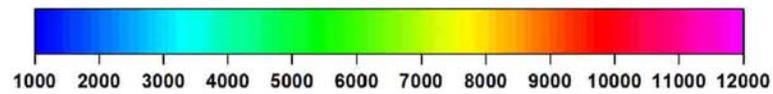
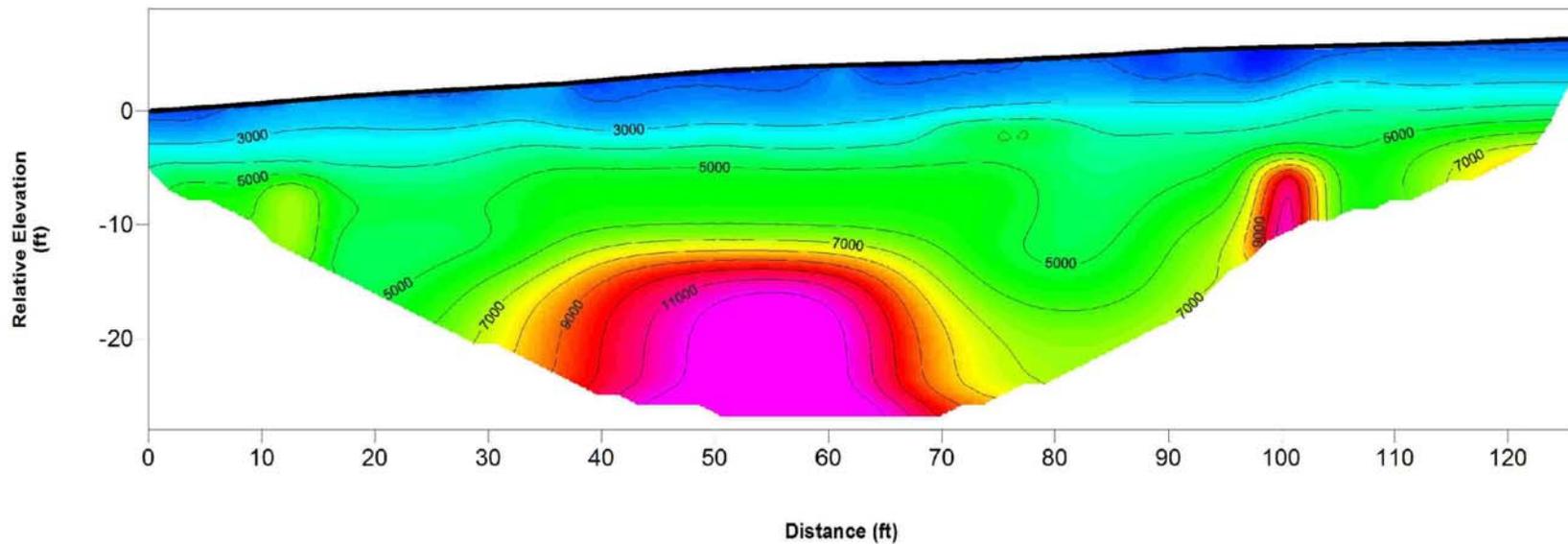


Figure 4g

Note: Contour Interval = 1,000 feet per second

TOMOGRAPHY MODEL

SL-8



Velocity (ft/s)

SEISMIC PROFILE

The Lakes
Escondido, California

Project No.: 114128

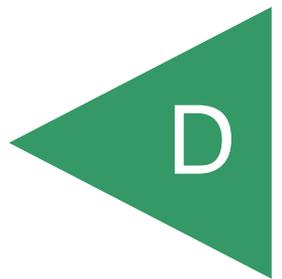
Date: 04/14



Figure 4h

Note: Contour Interval = 1,000 feet per second

APPENDIX



APPENDIX D

RECOMMENDED GRADING SPECIFICATIONS

FOR

THE VILLAGES AT ESCONDIDO COUNTRY CLUB
ESCONDIDO, CALIFORNIA

PROJECT NO. G1588-32-02

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

- 1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.
- 1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.
- 1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

- 2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.
- 2.2 **Contractor** shall refer to the Contractor performing the site grading work.
- 2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.
- 2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

- 2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.
- 2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.
- 2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

- 3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.
- 3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than $\frac{3}{4}$ inch in size.
- 3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.
- 3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than $\frac{3}{4}$ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.
- 3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.
- 3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9

and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

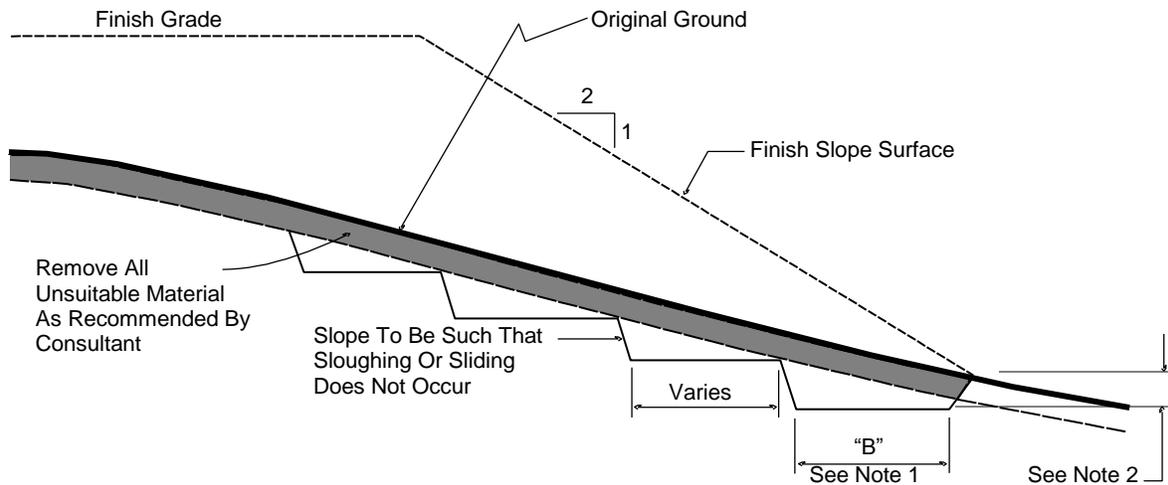
- 3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.
- 3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.
- 3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition.

4. CLEARING AND PREPARING AREAS TO BE FILLED

- 4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.
- 4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

- 4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.
- 4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

- DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.
- (2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

- 4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

- 5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.
- 5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

- 6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:
- 6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.
- 6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.
- 6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.
- 6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.
- 6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

- 6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.
 - 6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.
 - 6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.
- 6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:
- 6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.
 - 6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.
 - 6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.
 - 6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

- 6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.
- 6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.
- 6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:
- 6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.
- 6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.
- 6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection

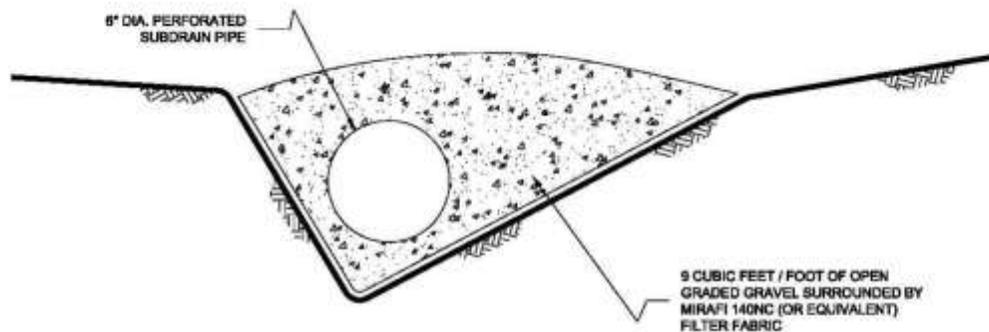
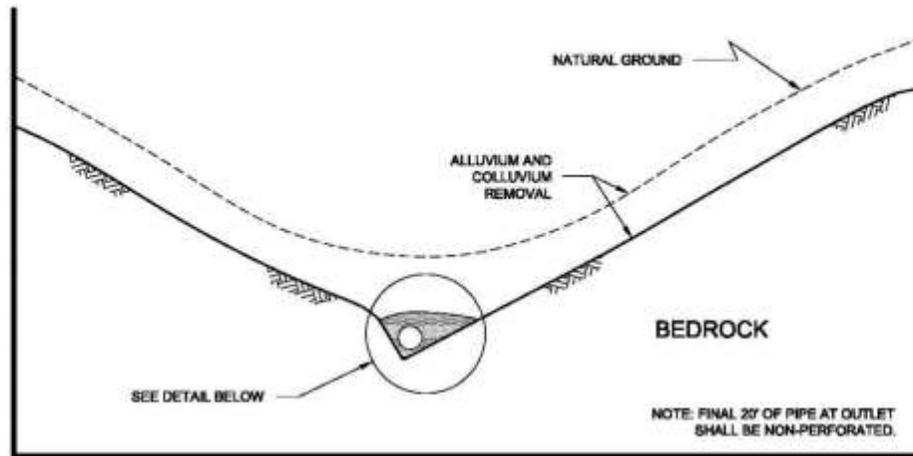
variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

- 6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.
- 6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.
- 6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.
- 6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

- 7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL



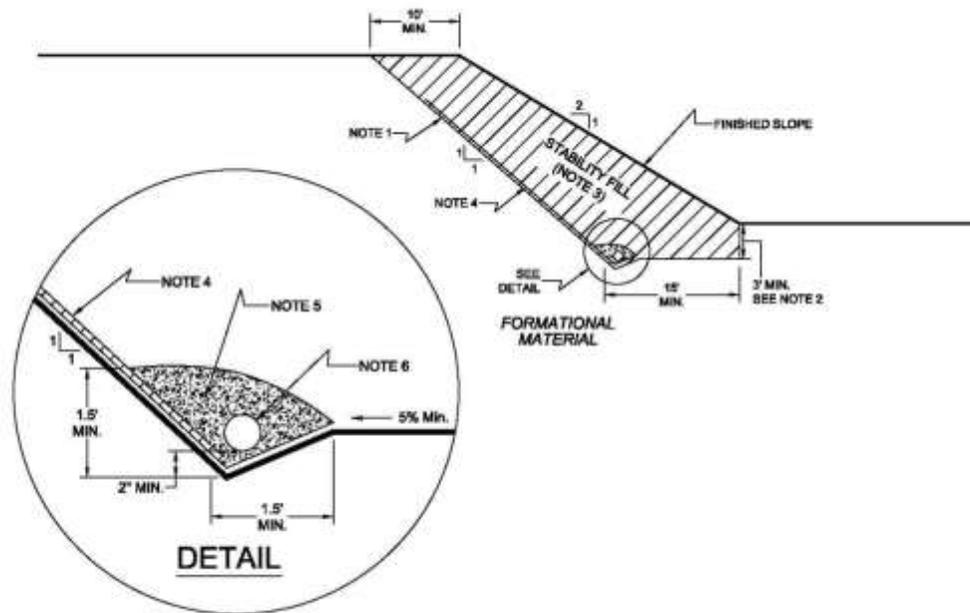
NOTES:

- 1.....6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.
- 2.....6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or larger) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

- 1....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).
- 2....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.
- 3....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.
- 4....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.
- 5....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).
- 6....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

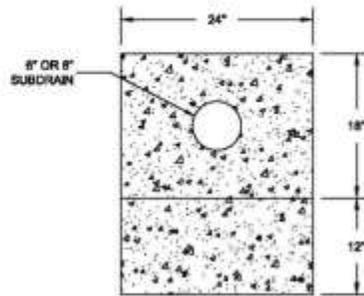
NO SCALE

7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock fill* or *soil-rock fill* areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock fill* drains should be constructed using the same requirements as canyon subdrains.

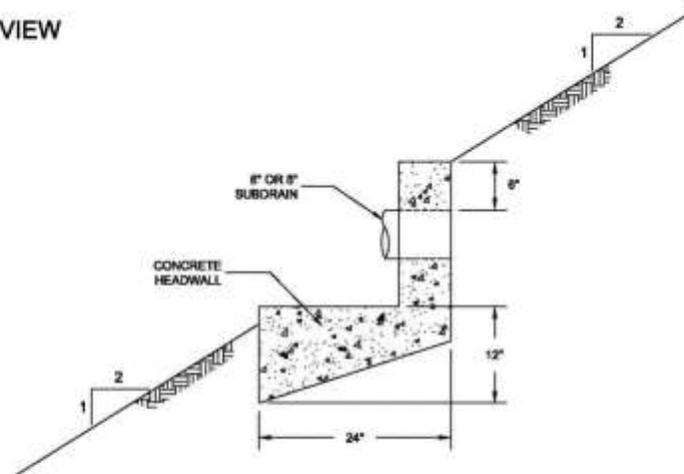
TYPICAL HEADWALL DETAIL

FRONT VIEW



NO SCALE

SIDE VIEW



NOTE: HEADWALL SHOULD OUTLET AT TOE OF FILL SLOPE
OR INTO CONTROLLED SURFACE DRAINAGE

NO SCALE

- 7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an “as-built” map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

- 8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.
- 8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.
- 8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.
- 8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.
- 8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.
- 8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

- 8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

- 8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth)*.
- 8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.
- 8.6.1.4 Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

- 9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.
- 9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

- 10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.
- 10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

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