GEOMAX ENGINEERING, INC.

GEOLOGY • SOILS **INSPECTIONS • TESTING**

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PRELIMINARY GEOLOGIC AND SOILS ENGINEERING INVESTIGATION REPORT

PROPOSED TWO-STORY DWELLING

LOTS 147, 148 AND 170 OF TRACT No. 6759

APN'S: 5679-016-001/002/024

CORONA DRIVE

GLENDALE, CALIFORNIA

PROJECT No. GE16045 **DATE: JULY 19, 2016**

COPY

PREPARED FOR:

MR. EMIGDIO CARRILLO

C/O CEM CONSTRUCTION CORPORATION

8207 BROOKGREEN ROAD

DOWNEY, CALIFORNIA

90240

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CORONA DRIVE
GLENDALE, CALIFORNIA

PROJECT No. GE16045 **DATE: SEPTEMBER 25, 2016**

INTRODUCTION

This report presents the results of a preliminary geological and soils engineering investigation performed on the subject property. The purpose of the investigation was to determine the general geologic and soils parameters applicable to the design and construction of the proposed two-story dwelling. This office utilized a generalized plot plan of the house shown superimposed onto the topographic map as site plan. A grading plan has not been prepared yet, and it will be subject to the recommendations in this report.

Based on the findings, the geological and soils conditions at the subject site are suitable for the construction of the proposed improvements provided the recommendations included herein are incorporated into future design and construction.

SCOPE

The scope of this investigation was limited and included the following items:

1. Visited site and observed site conditions.
2. Performed exploratory work involving exploratory pits to determine the type(s) of the on-site soils, the geological features of the underlying bedrock, and to obtain samples of the earth materials encountered.
3. Laboratory testing of samples to determine their physical properties.
4. Reviewed an undated, preliminary site plan on a topographic survey map provided by the client.
5. Reviewed Dibblee Foundation Map "Geologic Map of the Pasadena Quadrangle, Los Angeles County, California".
6. California Department of Conservation, Division of Mines and Geology, "Official Map of Seismic Hazard Zones, Pasadena Quadrangle.
7. Reviewed California Geological Survey, "Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117-A".
8. Reviewed United States Geological Survey "Design Maps Summary and Detailed Reports Website".
9. Analyzed data, formulated conclusions and recommendations, and prepared this report.

PROPOSED IMPROVEMENTS

The preliminary site plan provided (reference # 4) shows that the proposed improvements include a two-story, single-family dwelling with an attached three-car garage to be located on the vacant, up-sloping lots. A concrete driveway and concrete stairs will provide access from the street to the proposed improvements. Extensive grading, retaining walls and continuous and independent footings will be necessary to place the proposed improvements on the up-sloping sites (Plates 1 thru 5).

Although not shown on the drawings, in addition to the retaining walls needed for the construction of the proposed residence, additional retaining walls will also be required along the base of the slope along the front of the lots to support the over-steepened portions of the existing slope. Otherwise, the existing slopes must be trimmed to a maximum slope gradient of 2-horizontal to 1-vertical.

The existing slope is very steep and will require specialized excavation equipment and shoring during construction. Excavation into the steep hillside will undermine support of the hillside and the homes above, so shoring will be required that likely necessitates drilling and installation of piles or caissons into the steep hillside before excavation can begin. Project planning should include discussions with contractors who specialize in grading, shoring and excavation on steep hillsides so specialized recommendations can be included in future grading plans and drawings.

SITE CONDITIONS

The subject site is located north of York Boulevard and west of the Glendale Freeway in the City of Glendale (Figure 1).

The properties are vacant, up-sloping, trapezoidal-shaped lots which together have an approximated width of 188 feet and an approximated length of 48 feet. The sites are located on the westerly-facing slope of a northerly-trending ridge. The front portion of the lots has been roughly-graded leaving a steep slope that ascends about 10-15 feet from the street at a slope gradient of about 1-horizontal to 1-vertical. Then, the terrain continues ascending about 35 feet to the rear property line and beyond at a slope gradient of about 1.5-horizontal to 1-vertical. These gradients are steeper than current code allows for new construction and additional retaining walls and grading will be required to develop the lots as planned. Total relief from the street to the rear property line is about 50 feet.

The surface is mostly bare. Patches of dry wild grass, dry weeds and small trees and bushes are scattered dispersed through the site. Several tree stumps are present along the lots where trees were cut off.

The slope drainage is by uncontrolled sheet flow towards the street. Two minor areas of concentrated drainage (slight gullying of the slope emanating from between the upper houses) appear to be present from homes up slope. The properties above and behind the rear property lines are occupied by single-family dwellings.

SUBJECT SITE

LOTS 147, 148 AND 170 OF TRACT No. 6579
APN: 5679-016-001/ 002/ 024
CORONA DRIVE, GLENDALE, CA 91205

FIGURE 1

FIELD EXPLORATION

On March 12, 2016, four exploratory pits were dug with hand-held tools to a maximum depth of 8 feet. Additionally, exposures of bedrock on the roughly-graded cut along and above the street were also observed for geologic structure. The earth materials encountered were logged and classified using the visual and tactile field identification procedures of the Unified Soil Classification System. Undisturbed 2.5-inch diameter core samples were obtained for laboratory testing. The earth materials encountered are described in the Earth Materials Section and on the logs of the exploratory pits included in the Appendix (Plates 6 thru 9). The locations of the exploratory sites are shown on Plates 1 thru 5.

EARTH MATERIALS

The earth materials encountered at the site consist of thin amounts of fill and native soils overlying bedrock.

Artificial Fill (Af)

The fill soils consist of silty sands which are dry to slightly moist, loose to medium dense and light to dark brown with scattered roots, pieces of glass, plastic, brick, and abundant bedrock fragments to 6 inches in maximum size. The maximum thickness of the fill soils encountered in Test Pits #'s 2 and 3 is about 12 inches. The fill is a thin veneer of soil overlying the natural slope and it appears to have been generated as spill-fill from past construction of the upper street or lots/houses on the adjacent upslope properties to the east. As such, it is loose and subject to creep and rilling (erosion). However, the fill soils are few inches thick and will be mostly removed during grading operations. The portion of the fill soils left behind the rear property line will be supported by a designed planter wall. Thus, problems associated with instability of the fill soils are not expected.

Native Soil (Na)

The native soils are also silty sands which are slightly moist, dense and light to dark brown with scattered roots and bedrock fragments to ½-inch in maximum size.

The maximum thickness of the native soils is about 3 feet as encountered in Test Pits #'s 2 and 4.

Breccia (Ttqdb)

The bedrock underlying the site (and exposed along the base of the hill, is composed of Topanga Formation conglomerate/breccia. The sedimentary rock is composed of angular fragments of igneous rocks up to 1 foot in size embedded in a fine-to medium-grained sandstone matrix. The bedrock is massive, slightly moist, hard to very hard and light brown to yellowish-brown.

Geologic Structure

The breccia at the sites is massive and no evidence of geologic structure was observed at the site during the field investigation. The Dibblee Geologic Map (reference # 5) does not show any geologic structure within the subject sites or their vicinity. Such a lack of geologic mapping information generally indicates the massiveness (lack of structure) of the bedrock. The area has also been mapped by Lamar (CDMG Special Report 101). That geologic map also indicates massive texture, but the nearest geologic mapped symbol indicates an apparent northerly dip of 45 degrees. No joints and no evidence of faulting were observed during the field investigation.

Geologic Stability

The breccia is well indurated/cemented and massive. Such a geologic condition is favorable for gross stability and precludes bedding planes slippage. The nearest mapped bedding orientation was described by Lamar as a northerly apparent dip of 45 degrees which would be neutral to the westerly facing slope. Moreover, no deep seated landslides, significant erosion, settlement or other evidence of gross instability was noted on the ascending slope. No springs, seeps, hydrophilic plants or other evidence of groundwater were found. Consequently, no problems associated with groundwater are anticipated.

Evidence of past shallow soil slippage was noted on the site where the upper soils have slipped or eroded in locations that are unsupported due to the steep cuts near the roadway. All the slopes steeper than 2:1 should be supported with designed walls or by trimming or a combination of walls and trimming.

Seismic Considerations

The subject site is not located within any Alquist-Priolo Earthquake Fault Zone. The subject property is probably less prone to damaging seismic shaking than most locations in southern California because of the shallow depth of bedrock. Nevertheless, the seismic response factors shown in the Seismic Coefficients Section included herein should be utilized in the design of the proposed improvements.

LABORATORY TESTS

Laboratory tests were performed on representative samples of the bedrock. Field moisture content, saturated moisture content, dry unit weight and direct shear strength characteristics were determined from these tests.

Direct Shear

These tests were performed on representative samples of the native soils and bedrock that were saturated at least 24 hours under a normal load prior to application of the shear load. Each sample was sheared at a constant rate of displacement of 0.05 inches per minute in accordance with the consolidated-undrained shear test procedure (Plates 10 thru 14).

CONCLUSIONS AND RECOMMENDATIONS

The sites are considered geologically and geotechnically suitable for the construction of the proposed dwelling and garage provided the recommendations herein are considered in the design and followed during planning and construction.

The fact that no grading plan has yet been prepared so planning should consider several issues discussed in this report need to be addressed on the future grading plan including: additional retaining walls will be required along the base of the slope along the front of the lots to support the over-steepened portions of the existing slope. These gradients are steeper than current code (2:1) allows for new construction and additional retaining walls and grading will be required to develop the lot as planned.

Foundations

The proposed dwelling, garage and appurtenant retaining walls shall be supported on continuous and/or independent footings entirely placed into firm bedrock. The bearing capacity for continuous and independent footings with a minimum width of 15 inches and a minimum depth of 24 inches is 4,000 psf for bedrock. The bearing value may be increased 20 percent for each additional foot of width or depth to a maximum value of 6,400 psf.

As shown in Geologic Cross-Sections A-A', B-B', C-C' and D-D' (Plates 2, 3, 4 and 5),retaining walls up to a height of about 22 feet will be needed along the east side of the proposed dwelling and garage. The construction of these walls will remove the lateral support of the existing structures above the subject sites. Thus, retaining walls higher than 10 feet shall be constructed using friction piles, steel "I" beams and lagging as a permanent shoring system that will be designed by the Structural Engineer using a friction value of 500 pcf for the portion of the pile below the lowest adjacent grade, and a building surcharge derived from any structure located to a horizontal distance equal or less to the total height of the retaining wall.

The soldier piles shall have a minimum diameter of 2 feet and a minimum embedment depth of 10 feet below the lowest adjacent grade (garage and house finish floor elevations) but not less than the required embedment depth to provide adequate vertical and lateral support. Friction piles placed on areas with a slope gradient steeper than 5:1should be designed to resist a lateral force due to soil creep of 1,000 psf per lineal foot of fill and native soil above the bearing stratum (bedrock).

Retaining walls up to a height of 10 feet shall be constructed using the recommendations in the Temporary Excavation Walls and Retaining Walls Sections shown in Pages 15 and 16.

The bearing capacity allowed is for the total of dead and frequently applied live loads and may be increased by one-third for short duration wind and seismic loading.

Lateral Design

Resistance to lateral loads may be derived from the skin frictional forces acting at the base of footings and by passive pressure.

The friction coefficient for use with dead load forces is 0.35 for bedrock. The unit passive pressure for the first foot of depth using both internal frictional and cohesive shear strength components for the first foot of depth is 500 psf for bedrock with an increase of 50 percent for each additional foot of depth to a maximum of 5,000 pcf.

If the passive and skin frictional components are combined, the passive components should be reduced by a factor of one third. The passive pressure allowed is for the total of dead and frequently applied live loads and may be increased by one-third for short duration wind and seismic loading.

Friction piles spaced at an edge distance of more than twice their diameter may be designed based on a passive bedrock pressure value equal to two times the above value.

Slope Stability

The surficial stability of the fill and native soils was not analyzed because these soils will be entirely removed or properly supported during grading operations.

The gross stability of the entire site was not analyzed because the slope is essentially consists of breccia bedrock which is well cemented, massive, very hard and not prone to surficial or gross instability. Such geological conditions are favorable for gross stability and the lack of geologic structure will inhibit bedding plane slippage. The slope has performed well over time, but regardless, we recommend during planning that all slopes steeper than 2:1 be supported with retaining walls or by trimming. This may require walls along the front property line. No deep seated landslides, significant erosion, settlement or evidence of gross instability was noted on the ascending slope at the time of the field exploration. Furthermore, the new building will be supported with retaining walls that will be designed to support the hillside.

In summary, the subject properties appear surficially and grossly stable and the proposed extensive grading and structures will improve both factors by diverting runoff and minimizing infiltration of water into the earth materials.

Temporary Excavations Walls

Temporary excavation walls in bedrock will have a height of about 10 to 22 feet. Temporary excavations higher than 10 feet shall be supported using a shoring system designed by a Structural Engineer using a value of 80 pcf applied as an equivalent fluid pressure. Temporary excavations up to a height of 10 feet shall be cut vertical to a maximum height of 5 feet. All cuts higher than 5 feet shall be trimmed to a 1:1 slope.

Retaining Walls

The proposed retaining walls will have a height that will vary from 4 to 26 feet with a horizontal and a 2:1 sloped back-surface. Retaining walls up to height of 6 feet with a horizontal and a 2:1 back-surface shall be designed using values of 45 and 80 pcf, respectively, applied as an equivalent fluid pressure (EFP).

Retaining walls higher than 6 feet with a horizontal and a 1.5:1 back-surface shall be designed using the static and seismic lateral pressures to be calculated as follows:

Combined effect of Static and Seismic Lateral Force = $P_{AE} = F_1 + F_2$

Static Force = $F_1 = \frac{1}{2} \times A \times H^2$

Resultant acting at a distance of H/3 from base of wall.

Seismic Force = $F_2 = 3/8 \times K_h \times \gamma \times H^2$

Resultant acting at a distance of (0.6 x H) from base of wall.

Where:

F1 = Static Force (plf) on active pressure

F2 = Seismic lateral Force (plf) based on seismic pressure

$\gamma = 128$ pcf

$K_h = PGA_M / 2.5 = 1.081$ g/2.5 = 0.43 (Plate 19)

A = Active Pressure (See EFP values herein above)

H = Height of retained soils

Building surcharge derived from adjacent structures located within a horizontal distance equal or less than the height of the retaining wall shall be calculated by a Structural Engineer and added to the EFP values recommended herein above.

Retaining walls shall be provided with a sub-drainage system that shall consist of a 4-inch diameter, perforated pvc pipe placed at the bottom of the walls with perforations downward, wrapped with a filter fabric, covered with at least 1 cubic foot of ¾-inch gravel per lineal foot of wall and outletted to open air.

Vertical head joints in exterior walls should be left ungrouted opposite the drain materials for seepage.

The preliminary site plan and sections provided show that a proposed 3-foot high planter wall will be located along the rear property line. This wall shall be designed using a value of 80 pcf applied as an equivalent fluid pressure (EFP). All other retaining walls along the toe of a slope must be provided with a minimum freeboard of 1 foot and a v-gutter.

Settlement

Settlement of the foundation is expected to occur immediately upon initial load application. A settlement of ¼ to ½ may be anticipated. Differential settlement should not exceed ¼ inch provided all foundations are supported as recommended.

Expansive Soils

The proposed improvements will be entirely supported on footings placed into massive breccia bedrock which is considered non- expansive. Nevertheless, continuous and spread footings into bedrock shall be provided with two, No. 4 re-bars at top and bottom and slabs-on-grade shall be reinforced with No. 4 re-bars spaced at 16 inches on center each way.

Liquefaction Potential

The Seismic Hazard Map of the Pasadena Quadrangle (reference # 6) shows that the subject site is not located within an area susceptible to soil liquefaction. Thus, special recommendations to mitigate the potential of soil liquefaction are not necessary.

Seismic-Induced Landslides

The lower portion of Lots 147 and 148 are located within an area susceptible to seismic-induced landslides. These areas are located within the limits of the proposed structures and they will be fully graded creating flat pads or 2:1 slopes supported by designed retaining walls. Moreover, no evidence of ancient or recent landslides, surficial failures, slumps, erosion or any other evidence of slope instability was observed at the time of the field investigation, this firm concludes that the subject property is surficially and grossly stable and that the proposed grading, structures and retaining walls will improve both factors by diverting runoff and minimizing infiltration of water into the earth materials. Slope stability analysis to determine the stability of the subject sites is not necessary.

Seismic Coefficients

The proposed structures shall be designed in accordance with the provisions in Chapter 16, Section 1613 Earthquake Loads of the 2014 California Building Code. The seismic design values below have been obtained using the United States Geological Survey (USGS) Design Maps for the Seismic Design Values for Buildings (reference # 8, Plate 21).

Coordinates: 34.1319 N and -118.2369 W

Occupancy Category: II (Table 1604.5)

Site Class: (D) Native Soils (Table 1613.5.2 and Section 1623.5)

Mapped Spectral Accelerations: S_s = 2.81 (g) Short Period (0.2 s) (Fig. 1613.5(3)

S_1 = 1.00 (g) One-second Period (Fig. 1613.5(4)

Site Coefficients: F_a = 1.0 Short Period (0.2 s) (Table 1613.5.3(1)

F_v = 1.5 One-second Period) (Table 1613.5.3(2)

Spectral Response Accelerations: S_{MS} = 2.81 (g) Short Period (0.2 s) (Eq. 16-37)

S_{M1} = 1.50 (g) One-second Period) (Eq. 16-38)

Design Accelerations: S_{DS} = 1.88 (g) Short Period (0.2 s) (Eq. 16-39)

S_{D1} = 1.00 (g) One-second Period) (Eq. 16-40)

Seismic Design Category: D (Tables 1613.5.6(1) and 1613.5.6(2)

The southern California region can be subject to heavy shaking as a result of moderate to major earthquakes with a magnitude of 6 or greater. The use of the seismic coefficients herein above are intended to prevent loss of life and to minimize but not entirely eliminate structural damage.

Moreover, major foundation problems are not anticipated as a result of earthquake-induced liquefaction, fault ground rupture or displacement and settlement provided the proposed foundation system is constructed as recommended with the limitations mentioned herein.

Tsunami

The site is located approximately 721 feet above sea level. Based on this, the California Emergency Management Agency describes the site as not within a tsunami or seiche hazard zone.

Hydro-collapse

The phenomenon of hydro-collapse affects mostly granular soils that are transported and deposited by a fast, storm flow typical of deserts that drained rapidly without full saturation. The native silty sands and the breccia bedrock within the subject site and its vicinity are not subject to hydro-collapse.

Floor Slabs-On-Grade and Concrete Pavements

Floor slabs-on-grade and concrete pavements should be at least 4 inches of concrete reinforced with # 4 re-bars spaced at 16 inches on center each way supported on bedrock or on a 12-inch layer of certified compacted fill. Slabs on-grade and pavements on cut/fill transition areas are not allowed. Structural slabs may be used if designed by a Structural Engineer to support the proposed live and dead loads without soil support.

Concrete slabs which are to be covered with flooring should be underlain by a plastic vapor barrier. (A vapor barrier is not required for pavements). Per Section 4.505.2.1 of the 2013 California Green Building Standards Code, a 4-inch thick base of ½-inch or larger clean aggregate base materials shall be provided with a vapor barrier in direct contact with concrete and a concrete mix design, which will address bleeding, shrinkage, and curling, shall be used. This base materials layer will protect the plastic sheet while the concrete is being placed. The sub-grade materials should be thoroughly-saturated prior to casting concrete.

Grading

Grading operations shall be in conformance with the following specifications and as specifically shown on approved grading plans:

1. The excavation soils may be used as compacted fill provide they are clean and free of debris.
2. Imported soils (if needed) shall be granular, non-cohesive soils subject to approval by this firm before placing as backfill.
3. Areas to be covered with compacted fill should be grubbed and stripped of all vegetation, debris and other deleterious materials. If loose fill is present, it should be removed before placing new fill on top as directed by the soil engineer. Exceptions to complete removal are allowed for old fills of 3:1 in gradient or less if there is no structural support anticipated.

4. The compacted fill shall be used for support of the proposed concrete pavements, provided the top 12 inches are removed and re-compacted at a minimum relative density of 90 percent. Slabs on-grade and pavements on cut/fill transition areas are not allowed.
5. The top 4 inches of the exposed surface(s) should be scarified, watered as needed to reach their near-optimum moisture content and thoroughly-compacted to a minimum relative density of 90%
6. If the space between the back of a retaining wall and the excavation face is less than 18 inches, ¾-inch crushed gravel may be placed up to 2 feet of finish grade and thoroughly densified without requiring compaction tests. The top 2 feet of backfill may consist of either soil compacted to 90 percent or of gravel capped with concrete for a v-gutter or slab.
7. The soils to be used for compaction should be watered and mixed to obtain an uniform near-optimum moisture content, placed in layers not thicker than 8 inches and mechanically compacted to a minimum relative compaction of 90 percent. This should be confirmed by a density test performed by the Soils Engineer or his representative at intervals not to exceed 2 feet in thickness. This procedure of layering, compaction, and testing should be continued until final grade is reached.

8. The compaction characteristics of compacted fill should be based on a laboratory maximum compaction test performed in accordance with ASTM Method D1557. The field unit dry weight should be determined by the Sand Cone Method, ASTM Method D1556.
9. No jetting or flooding of fill or backfill soils is permitted.
10. Care shall be exercised during rough grading so that affected areas will drain properly without causing erosion offsite.
11. Inspection and testing of all compaction work shall be under the supervision of the Soil Engineer or his representative. Please allow at least 24 hours to schedule the required inspections or tests.
12. The Contractor shall have a responsible field superintendent on the project, in full charge of the work, with authority to make decisions. He shall cooperate fully with the Soil Engineer in carrying out the work.
13. Fill or backfill soils shall not be placed, spread or rolled during unfavorable weather. When the work is interrupted by rain, operations shall not be resumed until the Soil Engineer in collaboration with the Contractor to determine that conditions will permit satisfactory results.

14. An abandoned sewage disposal system encountered during grading operations shall be treated in the following manner. Liquids and compressible materials in a septic tank and seepage pit should be pumped out. Any structural portion within 5 feet of finish grade should be removed, and the cavity should be filled with suitable compacted soil, gravel or clean sand. A two-sack cement-sand slurry mix may be used in lieu of compacted materials except within 5 feet below any footing bottom. Septic tanks should be removed entirely and the cavity backfilled entirely with compacted soil, sand, or with gravel up to within 2 feet of the surface and capped with soil.

No evidence of an on-site sewage disposal system was noticed during the field investigation but such structures may have been used and abandoned.

Drainage

Roof and pad drainage should be collected and conveyed to the street via non-erodible conduits. Drainage should not be allowed to pond against the footings. Slope drainage shall be collected by a concrete swale and directed to the street below via non-erodible conditions.

Inspections and Approval

The bottom of the proposed fill areas and all footing excavations should be inspected and approved by this firm prior to the placement of compacted fill or placing forms. Approval by the City Inspector may also be required. Compacted materials should be tested to confirm that the required minimum relative compaction value of 90 percent for soils has been achieved based on ASTM Test Method D-1557. Please advise this office at least 24 hours prior to any required inspection or compaction testing. **(NOTE: ADDITIONAL COSTS FOR REQUESTED INSPECTIONS, ADDITIONAL INVESTIGATION, SUPPLEMENTAL REPORTS DUE TO DESIGN CHANGES, COMPACTION TESTING AND APPROVAL OF BUILDING PLANS ARE NOT INCLUDED IN THE CONTRACT FEE FOR THIS REPORT).**

Limitations

This report has been prepared for the exclusive use of Mr. Emigdio Carrillo C/O CEM Construction Corporation. It is their responsibility or their representative to assure that the information and recommendations contained herein are made available to the designers and contractors of this project. This report is subject to review and approval by the Building Official.

This report is based on the information obtained from the exploratory pits and sampling locations using generally-accepted geologic and soils engineering practices. However, conditions can be expected to vary between points of exploration.

No warranty, expressed or implied is made or intended in connection with this report or by any other oral or written statement. Any liability in connection herein shall not exceed the fees for the investigation.

The opportunity to be of professional service is sincerely appreciated. Please call if you have any questions concerning this report.

Respectfully submitted,

GEOMAX Engineering, Inc.

Pablo B. Sanchez
Chief Engineer
RCE C29664
Exp. 03-31-17

Hector Medina
Project Geologist

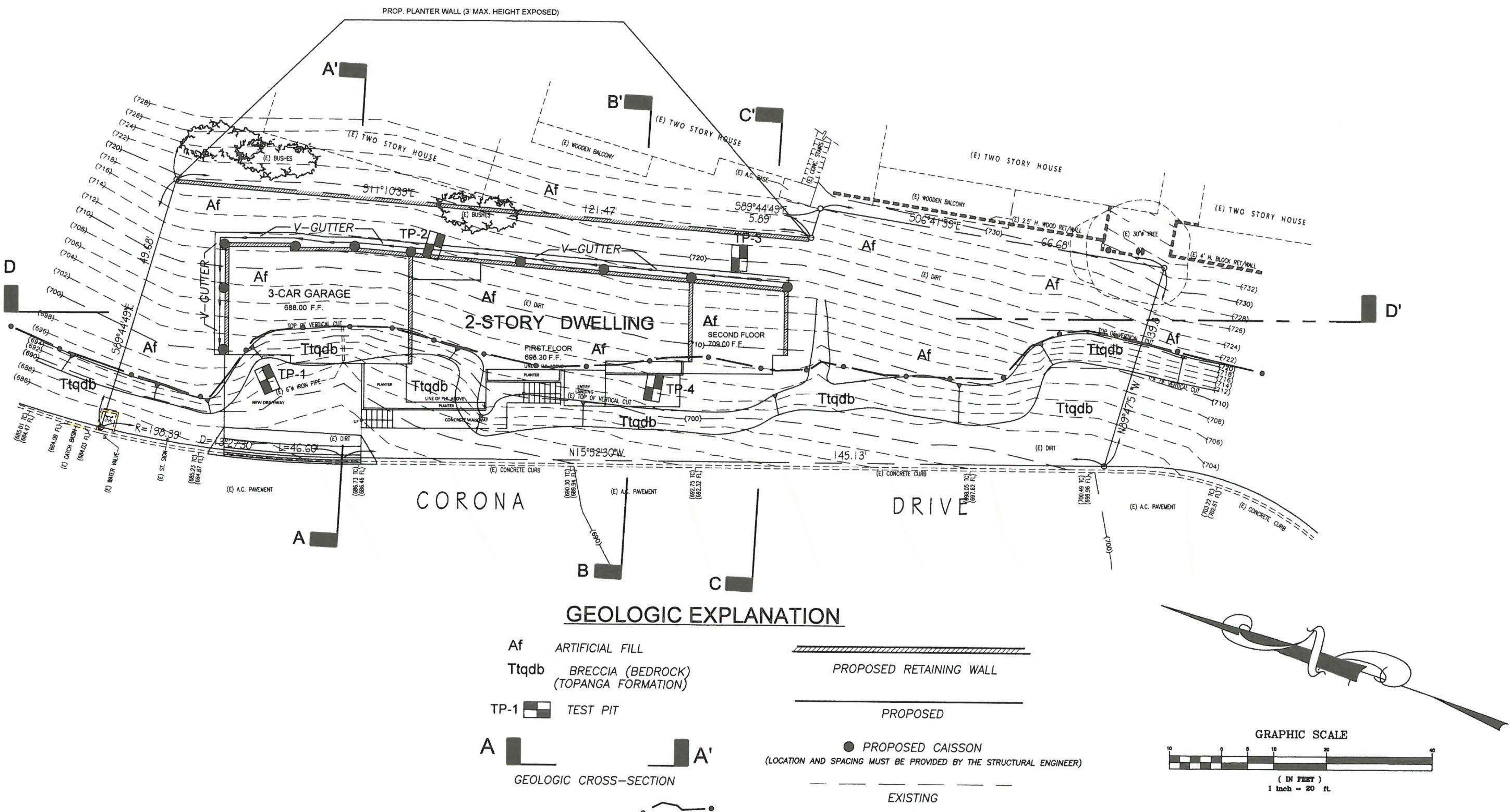
Keith G. Farrell
Cert. Eng. Geologist
CEG No. 1314
Expires 9/30/17

REGISTERED PROFESSIONAL ENGINEER
PABLO B. SANCHEZ
C029664
exp: 03-31-17
CIVIL
STATE OF CALIFORNIA

PBS/KGF/HM: em

Attachments: Appendix with 21 Plates

APPENDIX



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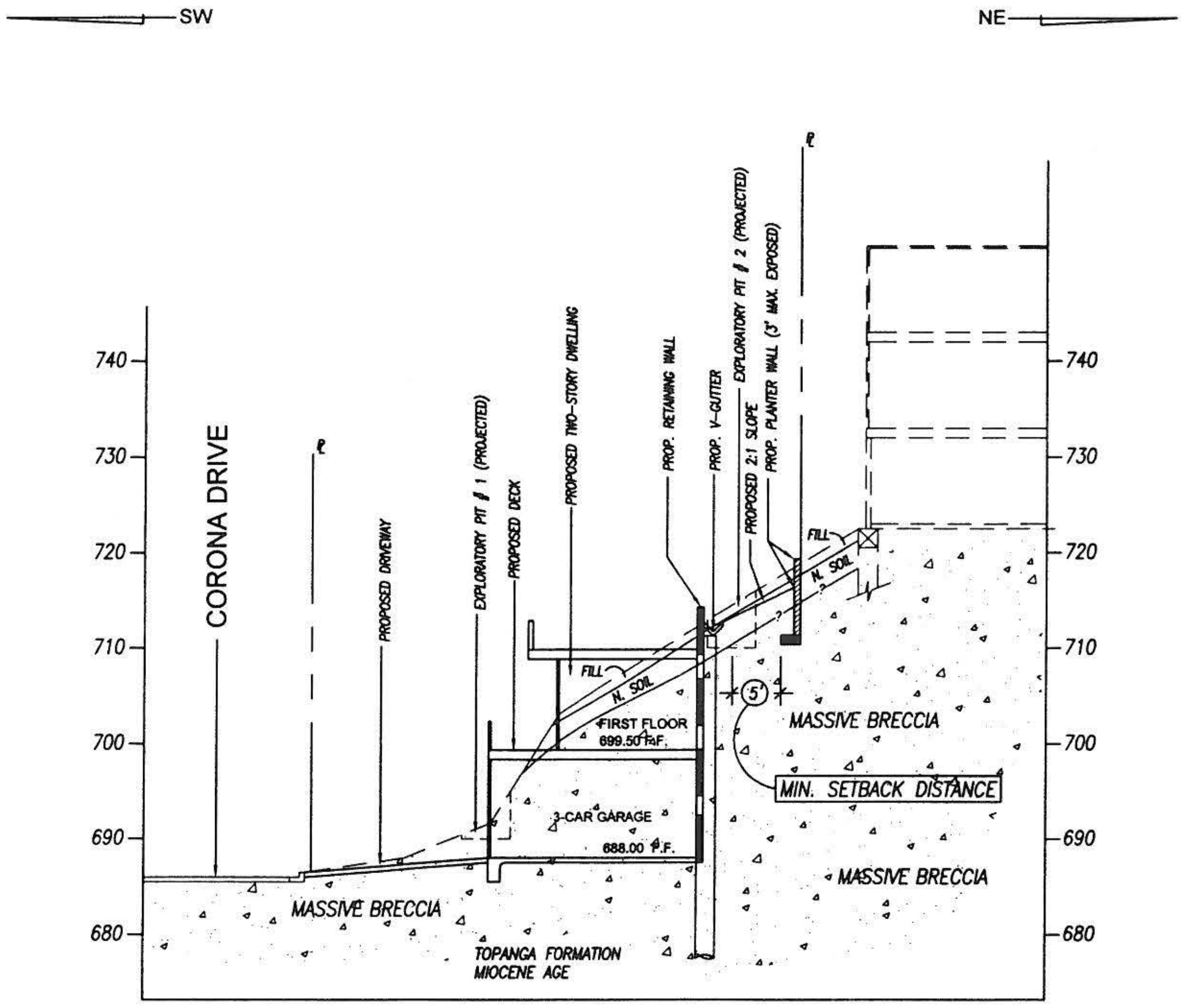
GEOLOGIC MAP

LOTS 147, 148 AND 170 OF TRACT No. 6579
APN'S: 5679-016-001/002/024
GLENDALE, CA

DATE:	07-10-16
SCALE:	1" = 20'
DRAWN:	H.M.
JOB No.:	GE16045
PLATE	1



GEOLOGIC CROSS-SECTION A-A'

SCALE 1" = 20'

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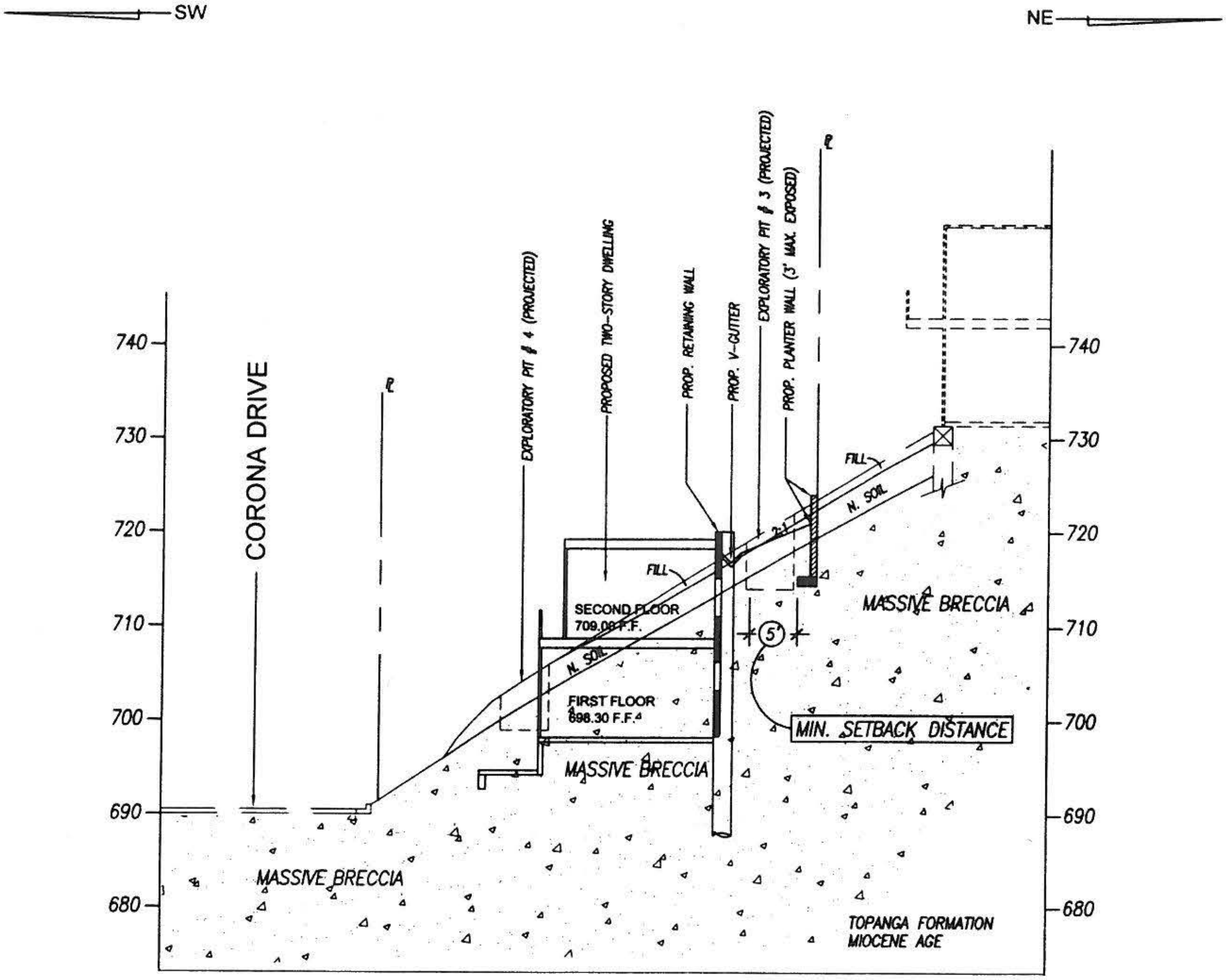
GEOLOGIC CROSS-SECTION A-A'

DATE:	07-11-16
SCALE:	1"=20'
DRAWN:	H.M.
JOB No.:	GE16045
PLATE	2



GEOLOGIC CROSS-SECTION B-B'

SCALE 1" = 20'

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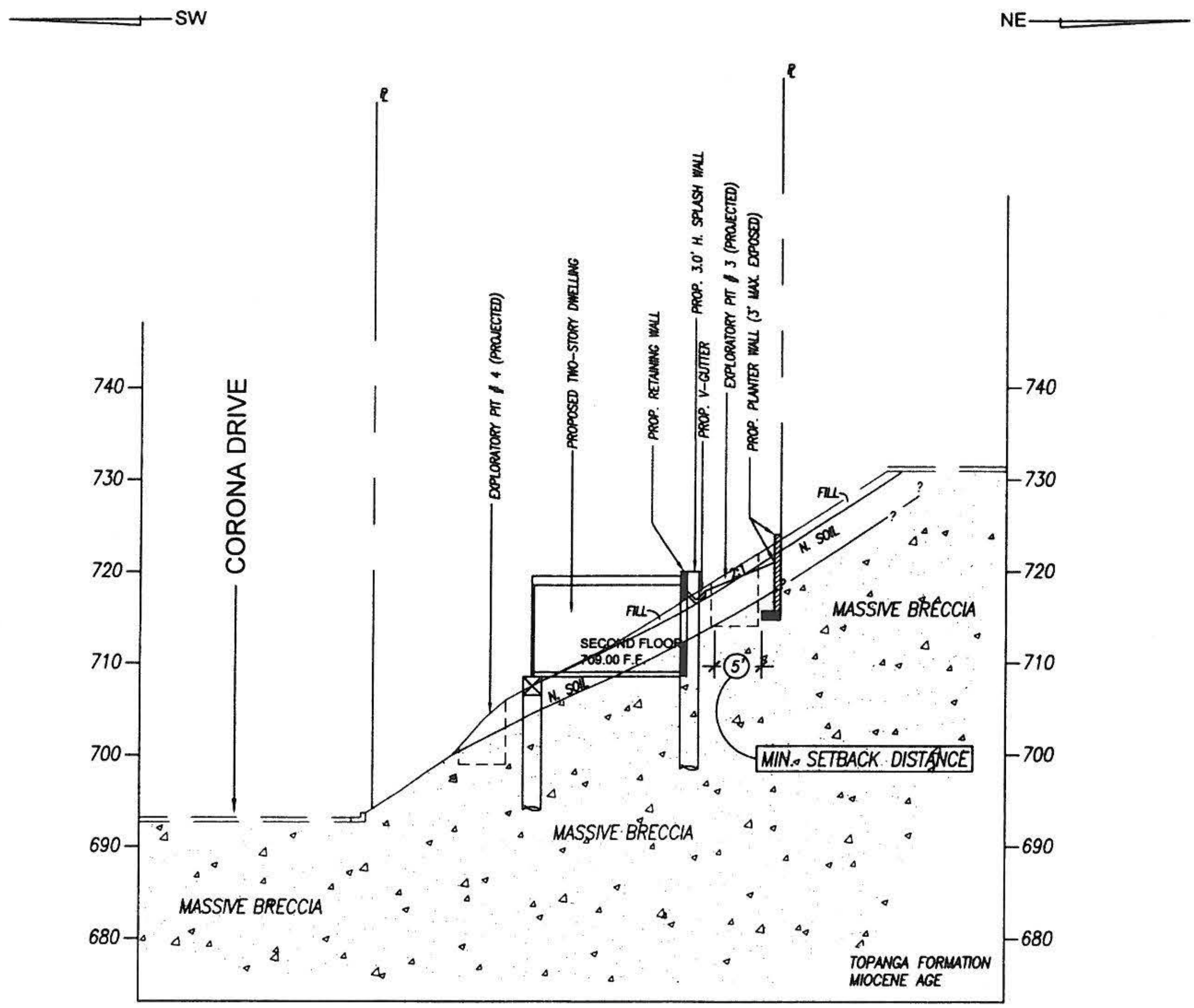
GEOLOGIC CROSS-SECTION B-B'

DATE: 07-11-16
SCALE: 1"=20'
DRAWN: H.M.
JOB No.: GE16045
PLATE 3



GEOLOGIC CROSS-SECTION C-C'

SCALE 1" = 20'

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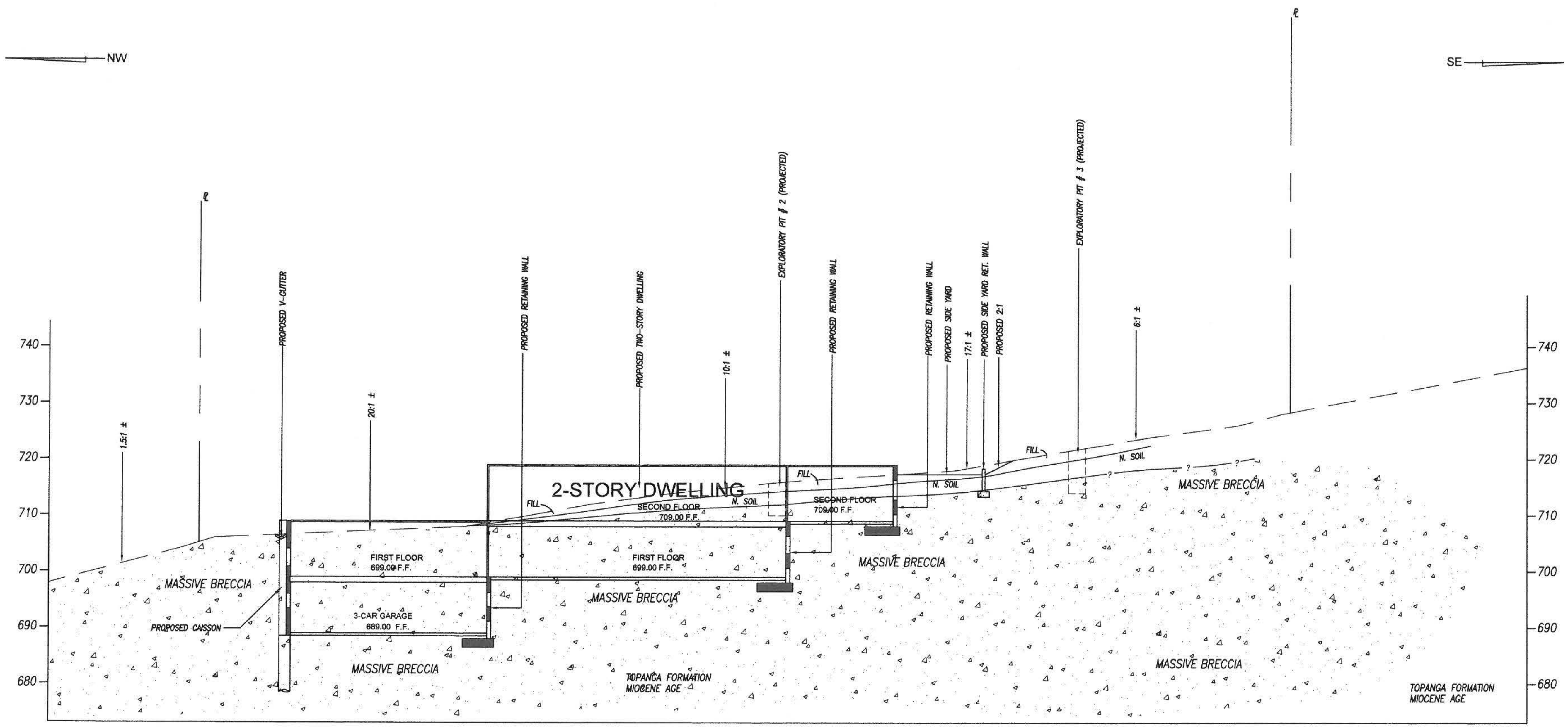
GEOLOGIC CROSS-SECTION C-C'

DATE:	07-11-16
SCALE:	1"=20'
DRAWN:	H.M.
JOB No.:	GE16045
PLATE	4



GEOLOGIC CROSS-SECTION D-D'

SCALE 1" = 20'

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GEOLOGIC CROSS-SECTION D-D'

DATE:	07-11-16
SCALE:	1" = 20'
DRAWN:	H.M.
JOB No.:	GE16045
PLATE	5

LOG OF BORING

PROJECT: CORONA DIVE	PROJECT No.: GE16045	PIT No.: 1
LOCATION: SEE PLOT PLAN	LOGGED BY: KGF/HM	DATE: 03-12-16 | PLATE: 6

CLASSIFICATION, MOISTURE, TIGHTNESS AND GEOLOGIC STRUCTURE	GRAPHIC LOG	DEPTH (FEET)	SAMPLE No.	SAMPLE DEPTH (FEET)	TUBE ■ /BULK ●	DRY DENSITY (PCF)	WET DENSITY (PCF)	FIELD MOIST. (%)	SATURATED MOISTURE (%)
(0–5') BRECCIA (BEDROCK); COBBLES AND BOULDERS OF IGNEOUS ROCKS IN A SANDSTONE MATRIX. MASSIVE, SLIGHTLY MOIST, HARD TO VERY HARD AND LIGHT BROWN TO YELLOWISH-BROWN.		1							
TOPANGA FORMATION									
MIOCENE		2							
NO ATTITUDES TAKEN BECAUSE OF MASIVENESS OF BEDROCK.									
		3	1	3	■	116	129	6	11
		4							
		5							
STOPPED @ 5'		6							
		7							
		8							
		9							
		10							

GEOMAX ENGINEERING

LOG OF BORING

PROJECT: CORONA DIVE	PROJECT No.: GE16045		PIT No.: 2
LOCATION: SEE PLOT PLAN	LOGGED BY: KGF/HM	DATE: 03-12-16	PLATE: 7

CLASSIFICATION, MOISTURE, TIGHTNESS AND GEOLOGIC STRUCTURE	GRAPHIC LOG	DEPTH (FEET)	SAMPLE No.	SAMPLE DEPTH (FEET)	TUBE ■ /BULK ●	DRY DENSITY (PCF)	WET DENSITY (PCF)	FIELD MOIST. (%)	SATURATED MOISTURE (%)
(0–1') SILTY SAND (FILL); DRY TO SLIGHTLY MOIST, LOOSE TO MEDIUM DENSE AND LIGHT TO DARK BROWN; SCATTERED ROOTS AND PIECES OF GLASS, BRICK AND BEDROCK FRAGMENTS TO 4 INCHES IN MAX. SIZE.		1							
(1'–4') NATIVE SILTY SANDS (SM); SLIGHTLY MOIST, DENSE AND LIGHT TO DARK BROWN; SCATTERED ROOTS AND BEDROCK FRAGMENTS TO 1/4-INCH IN MAXIMUM SIZE.		2	1	2	■	101	114	7	13
		3							
(4'–6') BRECCIA (BEDROCK); COBBLES AND BOULDERS OF IGNEOUS ROCKS IN A SANDSTONE MATRIX. MASSIVE, SLIGHTLY MOIST, HARD TO VERY HARD AND LIGHT BROWN TO YELLOWISH-BROWN.		4							
TOPANGA FORMATION MIOCENE *NO ATTITUDES TAKEN BECAUSE OF MASIVENESS OF BEDROCK.*		5	2	5	■	119	125	5	12
STOPPED @ 5'		6							
		7							
		8							
		9							
		10							

LOG OF BORING

PROJECT: CORONA DIVE	PROJECT No.: GE16045	PIT No.: 3	
LOCATION: SEE PLOT PLAN	LOGGED BY: KGF/HM	DATE: 03-12-16	PLATE: 8

CLASSIFICATION, MOISTURE, TIGHTNESS AND GEOLOGIC STRUCTURE	GRAPHIC LOG	DEPTH (FEET)	SAMPLE No.	SAMPLE DEPTH (FEET)	TUBE■/BULK ●	DRY DENSITY (PCF)	WET DENSITY (PCF)	FIELD MOIST. (%)	SATURATED MOISTURE (%)
(0–1') SILTY SAND (FILL); DRY TO SLIGHTLY MOIST, LOOSE TO MEDIUM DENSE AND LIGHT TO DARK BROWN; SCATTERED ROOTS AND PIECES OF GLASS, BRICK, PLASTIC AND BEDROCK FRAGMENTS TO 6 INCHES IN MAXIMUM SIZE.		1							
(1'–5') NATIVE SILTY SANDS (SM); SLIGHTLY MOIST, DENSE AND LIGHT TO DARK BROWN; SCATTERED ROOTS AND BEDROCK FRAGMENTS TO 1/2-INCH IN MAXIMUM SIZE.		2 3 4 5	1	4	■	103	116	7	14
(5'–8') BRECCIA (BEDROCK); COBBLES AND BOULDERS OF IGNEOUS ROCKS IN A SANDSTONE MATRIX. MASSIVE, SLIGHTLY MOIST, HARD TO VERY HARD AND LIGHT BROWN TO YELLOWISH-BROWN. *TOPANGA FORMATION* *MIOCENE* *NO ATTITUDES TAKEN BECAUSE OF MASIVENESS OF BEDROCK.*		6 7 8							
STOPPED @ 8'		9 10							

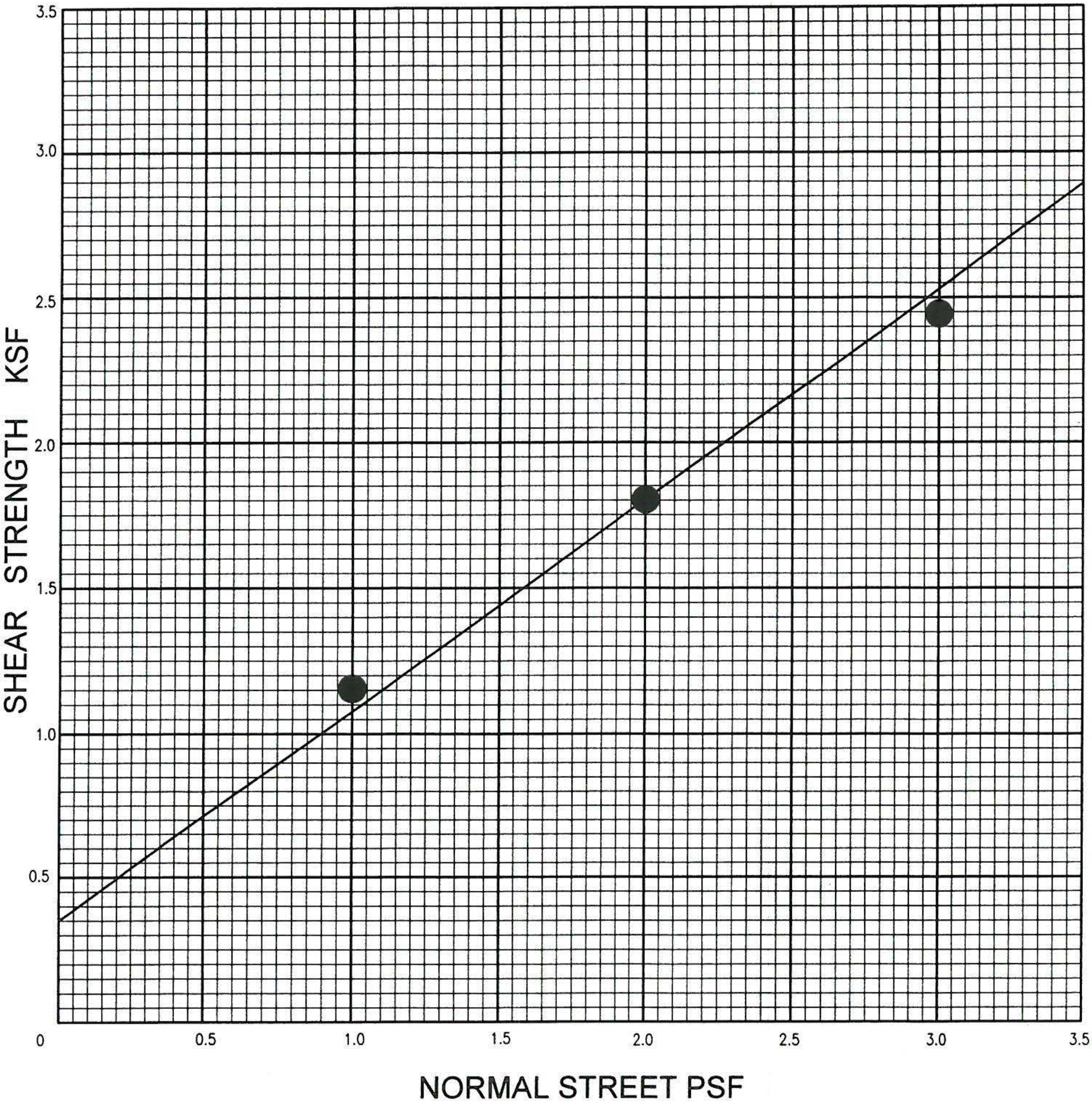
GEOMAX ENGINEERING

LOG OF BORING

PROJECT: CORONA DIVE	PROJECT No.: GE16045	PIT No.: 4
LOCATION: SEE PLOT PLAN	LOGGED BY: KGF/HM | DATE: 03-12-16	PLATE: 9

CLASSIFICATION, MOISTURE, TIGHTNESS AND GEOLOGIC STRUCTURE	GRAPHIC LOG	DEPTH (FEET)	SAMPLE No.	SAMPLE DEPTH (FEET)	TUBE ■ /BULK ●	DRY DENSITY (PCF)	WET DENSITY (PCF)	FIELD MOIST. (%)	SATURATED MOISTURE (%)
(0-1') SILTY SAND (FILL); DRY TO SLIGHTLY MOIST, LOOSE TO MEDIUM DENSE AND LIGHT TO DARK BROWN; SCATTERED ROOTS AND PIECES OF GLASS, BRICK, PLASTIC AND BEDROCK FRAGMENTS TO 3 INCHES IN MAXIMUM SIZE.		1							
(1'-4') NATIVE SILTY SANDS (SM); SLIGHTLY MOIST, DENSE AND LIGHT TO DARK BROWN; SCATTERED ROOTS AND BEDROCK FRAGMENTS TO 1/2-INCH IN MAXIMUM SIZE.		2 3 4							
(4'-7') BRECCIA (BEDROCK); COBBLES AND BOULDERS OF IGNEOUS ROCKS IN A SANDSTONE MATRIX. MASSIVE, SLIGHTLY MOIST, HARD TO VERY HARD AND LIGHT BROWN TO YELLOWISH-BROWN. *TOPANGA FORMATION* *MIOCENE* *NO ATTITUDES TAKEN BECAUSE OF MASIVENESS OF BEDROCK.*		5 6	1	6	■	122	135	4	10
STOPPED @ 7'		7 8 9 10							

GEOMAX ENGINEERING



● ULTIMATE

SOIL CLASSIFICATION: BRECCIA BEDROCK	SAMPLE NO.: 1-1 @ 3'

Ws: 6.5 %	Wf: 10.8 %	γd: 116.1 PCF	C= 350 PCF	φ 36 °

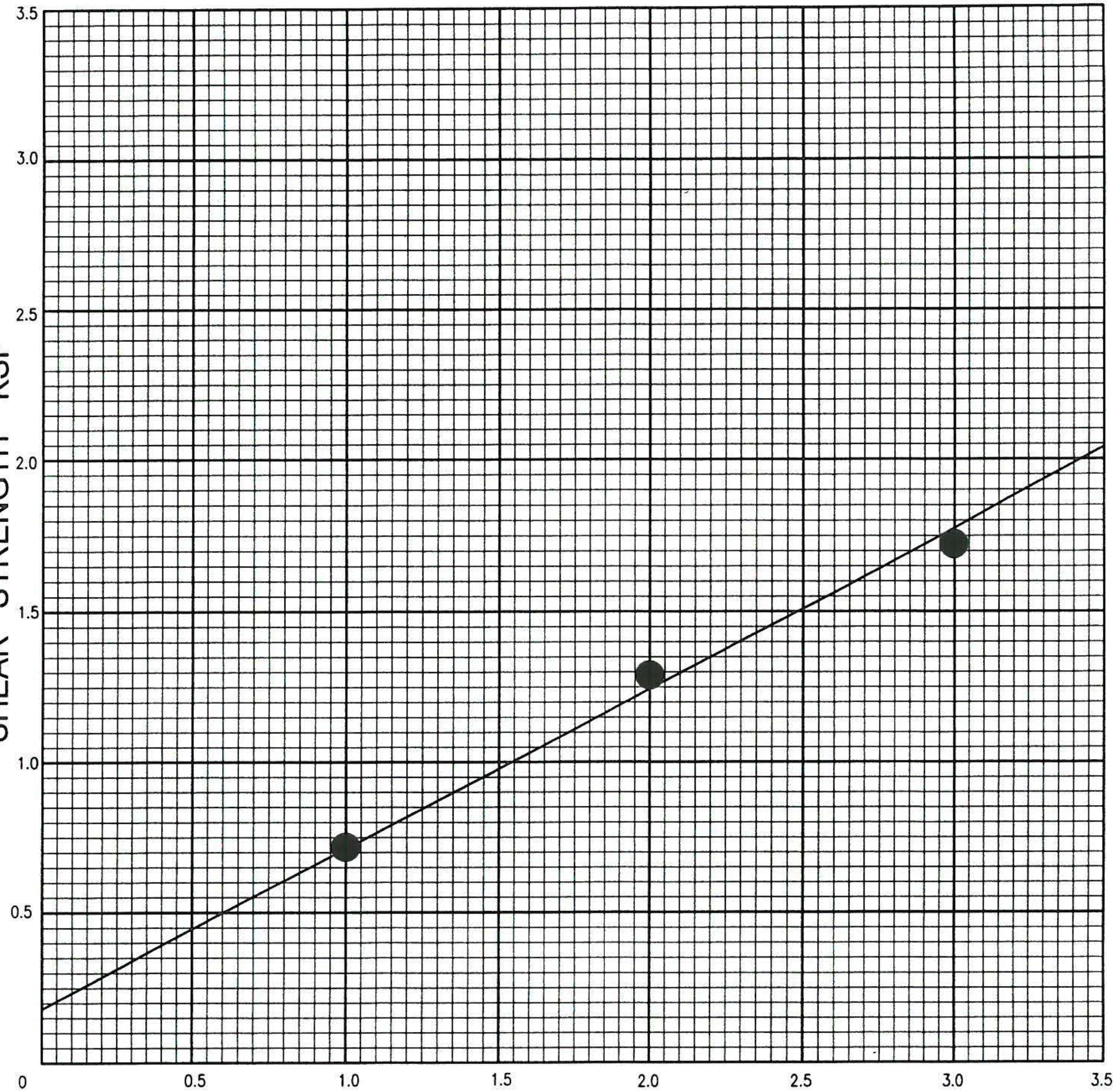
GEOMAX ENGINEERING

DIRECT SHEAR

DATE: 04-05-16

JOB #: GE16045

PLATE 10



● ULTIMATE

SOIL CLASSIFICATION: NATIVE SILTY SAND (SM)

SAMPLE NO.: 2-1 @ 2'

Ws: 7.4 %

Wf: 12.8 %

γd: 101.1 PCF

C= 180 PCF

φ 28 °

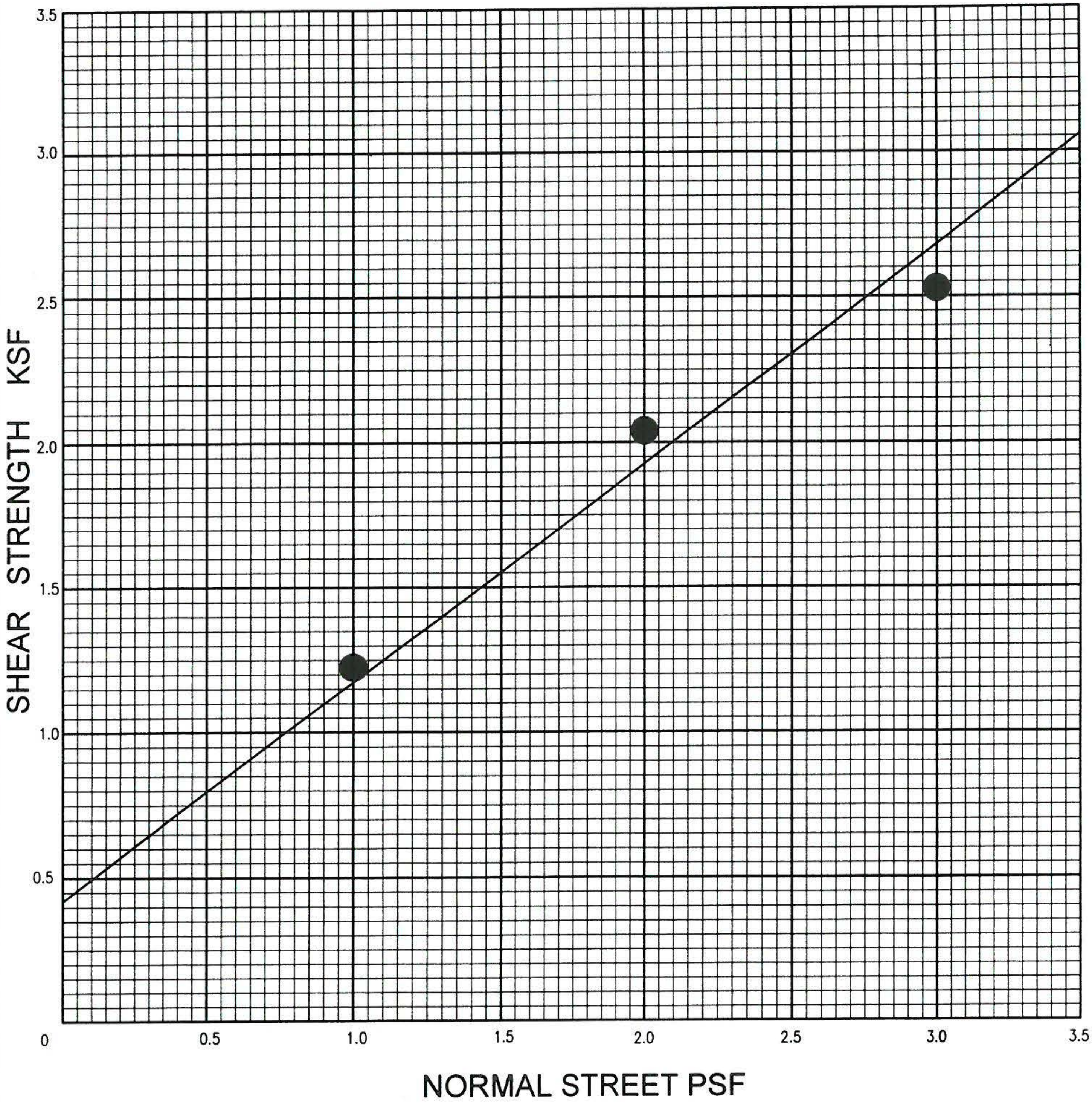
GEOMAX ENGINEERING

DIRECT SHEAR

DATE: 04-05-16

JOB #: GE16045

PLATE 11



● ULTIMATE

SOIL CLASSIFICATION: BRECCIA BEDROCK

SAMPLE NO.: 2-2 @ 5'

Ws: 5.3 %	Wf: 11.9 %	γ_d: 119.4 PCF	C= 420 PCF	φ 37 °

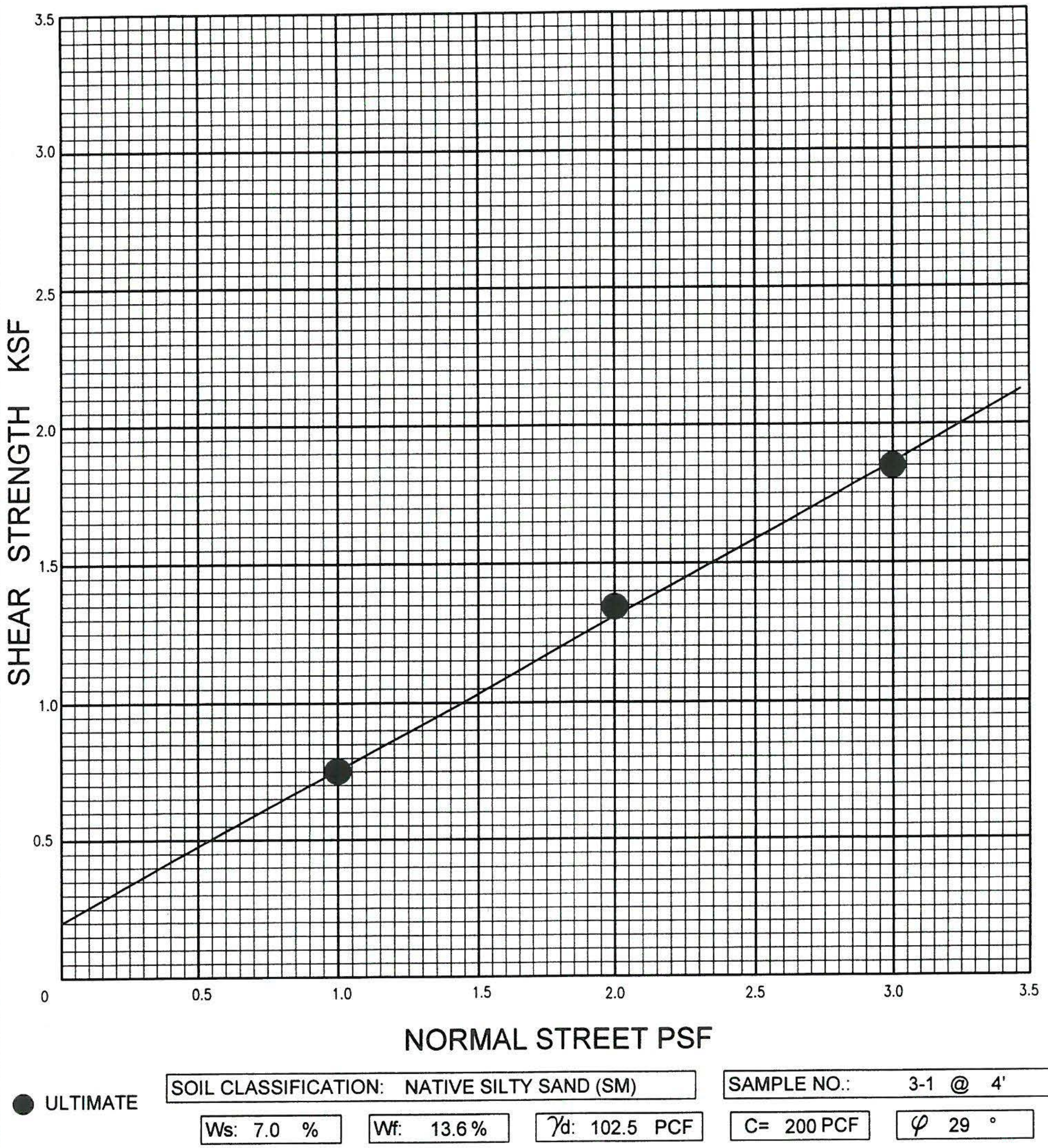
GEOMAX ENGINEERING

DIRECT SHEAR

DATE: 04-05-16

JOB #: GE16045

PLATE 12



SOIL CLASSIFICATION: NATIVE SILTY SAND (SM)

SAMPLE NO.: 3-1 @ 4'

Ws: 7.0 %

Wf: 13.6 %

γd: 102.5 PCF

C= 200 PCF

φ 29 °

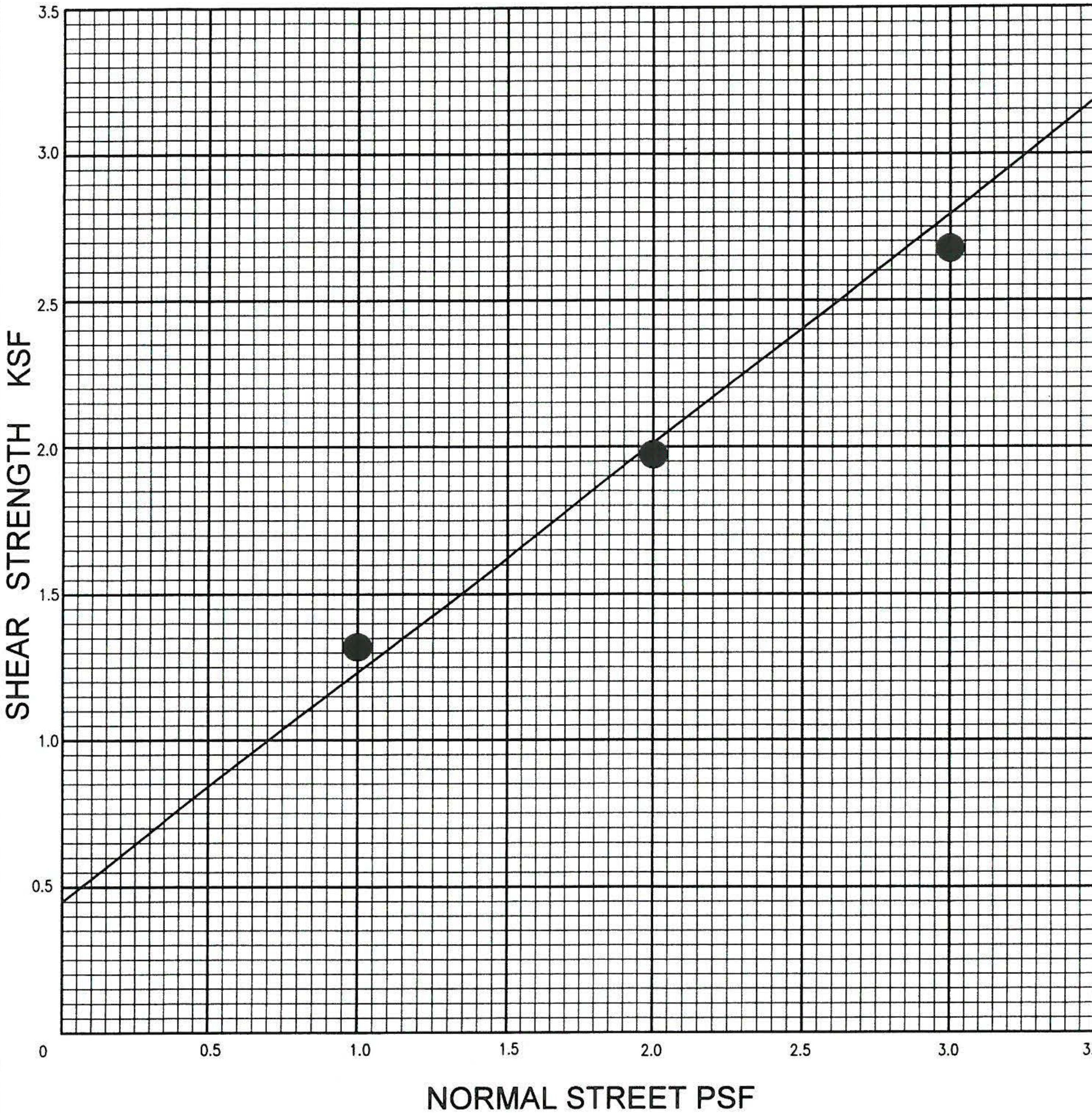
GEOMAX ENGINEERING

DIRECT SHEAR

DATE: 04-05-16

JOB #: GE16045

PLATE 13



● ULTIMATE

SOIL CLASSIFICATION: BRECCIA BEDROCK

SAMPLE NO.: 4-1 @ 6'

Ws: 4.1 %

Wf: 10.2 %

γd: 122.2 PCF

C= 450 PCF

φ 38 °

GEOMAX ENGINEERING

DIRECT SHEAR

DATE: 04-05-16

JOB #: GE16045

PLATE 14

USGS Design Maps Detailed Report

ASCE 7-10 Standard (34.1319°N, 118.2369°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1] $S_S = 2.813$ g

From Figure 22-2 [2] $S_1 = 1.003$ g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index $PI > 20$, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u < 500$ psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

PLATE 15

Section 11.4.3 — Site Coefficients and Risk-Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4-1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_S

For Site Class = D and S_S = 2.813 g, F_a = 1.000

Table 11.4-2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1-s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight-line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 1.003 g, F_v = 1.500

PLATE 16

Equation (11.4-1): $S_{MS} = F_aS_S = 1.000 \times 2.813 = 2.813$ g

Equation (11.4-2): $S_{M1} = F_vS_1 = 1.500 \times 1.003 = 1.504$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

Equation (11.4-3): $S_{DS} = ⅔\ S_{MS} = ⅔ \times 2.813 = 1.876$ g

Equation (11.4-4): $S_{D1} = ⅔\ S_{M1} = ⅔ \times 1.504 = 1.003$ g

Section 11.4.5 — Design Response Spectrum

From Figure 22-12 [3] T_L = 8 seconds

Figure 11.4-1: Design Response Spectrum

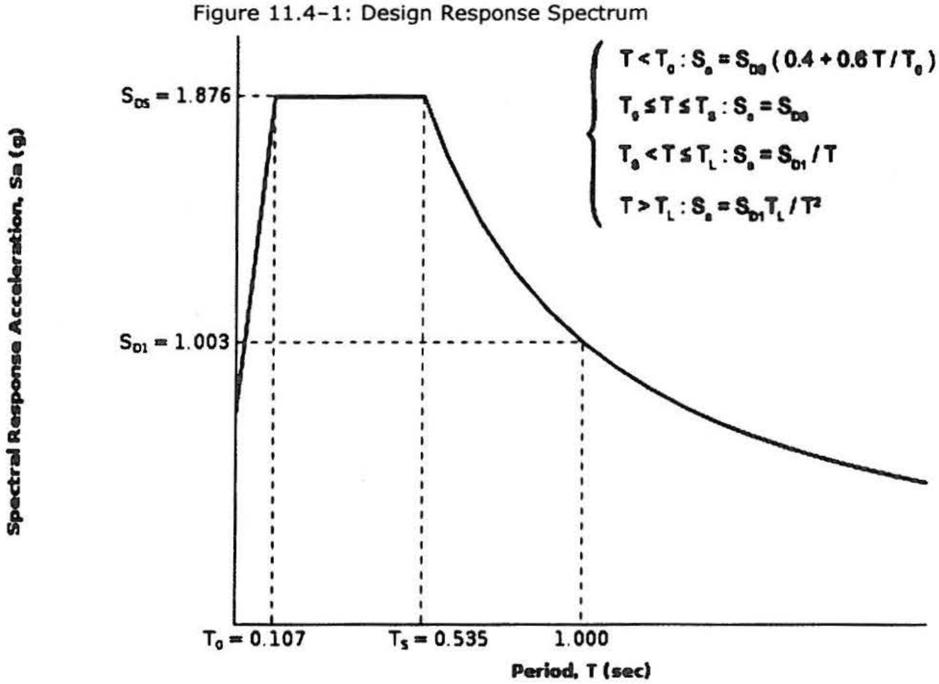


PLATE 17

Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4] PGA = 1.081

Equation (11.8–1): $PGA_M = F_{PGA}PGA = 1.000 \times 1.081 = 1.081$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 1.081 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5] $C_{RS} = 0.941$

From Figure 22-18 [6] $C_{R1} = 0.944$

PLATE 19