REPORT

PRELIMINARY SOIL AND GEOLOGY INVESTIGATION

Proposed Single-Family Residence
Lot 7, Tract No. 50667
32022 Isthmus View Drive
Rancho Palos Verdes, California 90275

for

Michael Mulligan Development
31990 Emerald View Drive
Rancho Palos Verdes, CA 90275

Project No. GSS-2243-2(7)
October 5, 2016

REPORT

PRELIMINARY SOIL AND GEOLOGY INVESTIGATION

PROPOSED SINGLE-FAMILY RESIDENCE

LOT 7, TRACT NO. 50667

32022 ISTHMUS VIEW DRIVE

RANCHO PALOS VERDES, CALIFORNIA 90275

FOR

MICHAEL MULLIGAN DEVELOPMENT

INTRODUCTION

The following report presents the results of a preliminary soil and geology investigation conducted on the property located at 32022 Isthmus View Drive, in the City of Rancho Palos Verdes, County of Los Angeles, California. The location of the site relative to surrounding streets and landmarks is shown on Plate 1, Vicinity Map. A geology study of the site was performed by our consultant Mr. Ray A. Eastman, Engineering Geologist. A report of his findings and conclusions is attached as a part of this report.

The purpose of this investigation was to obtain the geotechnical engineering properties of the subsurface soils and bedrock at the subject site on which to base conclusions and recommendations for foundations support and other geotechnical matters pertinent to the proposed construction. Implementation of the recommendations made in this report is intended to reduce certain risks associated with construction projects. The scope of this investigation does not include the work related in any way to identify asbestos and/or hazardous waste material.

This report has been prepared for use in design of the described project. It may not contain sufficient information for other purposes. Our professional services have been performed in accordance with generally accepted engineering procedures under similar circumstances. No other warranty, expressed or implied, is made as to the professional advice included in this report.

PROPOSED CONSTRUCTION

It is understood that the subject property will be utilized for the development of a single-family residence with an attached garage. The proposed structure will be one story in height, constructed of wood frame and stucco with slab on grade. No basement is proposed.

The proposed finish grade of the project is expected to be at or near the existing pad elevation. Thus only minor grading other than removal and recompaction of the existing unsuitable surface soils will be required to develop the building pad and to provide proper site drainage. No detailed grading plan and design loads are available at the time of this investigation.

SITE CONDITIONS

The subject property is located on the east side of Isthmus View Drive, south of La Rotonda Drive, in the City of Rancho Palos Verdes, County of Los Angeles, California, California. The site is bordered by vacant lots on the north and south, and by a descending slope on the east.

The site consist of a near trapezoid-shaped residential lot that measured approximately 95 feet wide by 150 to 180 feet deep in plan dimensions. The lot extends levelly from Isthumus View Drive for approximately 150 horizontal feet, and then followed by a 2 horizontal to 1 vertical descending slope. At the time of this investigation, the site was vacant. Surface vegetation at the site consists of sparse growth of wild grasses.

Cross sections showing the existing grade and the proposed construction are depicted on Plates 3 through 5.

PAST GRADING

Records available to us indicate that the subject property was graded between the Year 1998 and 2000 in conjunction with the tract development. Geotechnical observation and testing during rough grading and fill placement at the subject properties were performed by Converse Consultants. An as-graded geotechnical report including the results of compaction tests was prepared by Converse Consultants on April 10, 2000.

FIELD EXPLORATIONS AND LABORATORY TESTING

Field explorations were performed to establish the geotechnical conditions of the site. The field explorations were conducted in conjunction with the adjacent lots (Lots 6 and 8). A total of four (4) test borings were excavated at the locations shown on Plate 2. The explorations were logged by the geologist and relatively undisturbed samples were obtained for laboratory testing and inspection. A detailed description of the exploration procedures and the logs of test borings are presented in the Appendix.

Laboratory tests were performed to evaluate static soil properties. A description of the test procedures and the test results are also presented in the Appendix.

SOIL AND GROUNDWATER CONDITIONS

Soil Conditions

Compacted fill was encountered in all test borings from the existing grade to depths of 5 to 12 feet. It consists of moderately compacted to compacted, fine to medium sandy, silty clay with rock fragments, rootlets, and boulders. Some loose silty sand was piled at the site at the time of our onsite visit.

Bedrock was encountered in all test borings below the fill material to the depths explored of 20 to 27 feet. It consists of firm siltstone, hard limestone, and hard cherty shale.

Groundwater

No groundwater or seepage was observed in any of the test borings penetrated to a maximum depth of 27 feet. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors not evident at the time measurements were made and reported herein.

EARTHQUAKE HAZARDS

Seismicity

The subject property lies within the seismically active southern California region. As with all sites in southern California, the site is expected to experience ground shaking from both near and distant earthquake sources during the life of the proposed structure. The type and magnitude of seismic hazard affecting the site are dependent on the distance of causative faults and the intensity and magnitude of the seismic event.

Surface Rupture

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone. No faults, active or potentially active, are known to exist within the site. The probability of surface rupture at the site is, therefore, considered very low.

Ground Shaking

Based on "Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada" by California Department of Conservation, the closest fault zone to the site is the Palos Verdes Fault Zone located at approximately 6 km to the northeast of the site. It is our opinion that the intensity of future ground shaking at the site is not expected to be greater than any other sites in the immediate vicinity. The proposed structures shall be designed in accordance with the Earthquake Regulations of the California Building Code and the seismic design parameters provided in the other section of this report.

Soil Liquefaction

Earthquake-induced liquefaction is a phenomenon in which loose to medium dense saturated cohesionless soils undergo extreme losses in shear strength due to earthquake shaking. The liquefaction potential is directly related to the groundwater conditions at the site, as well as to the characteristics of the underlying soil deposits. Loose to medium dense sands below groundwater level are generally considered to be susceptible to liquefaction under strong ground shaking conditions.

The site is not located in the area as delineated by the State Geologist to have potential of soil liquefaction during strong earthquakes. Hence, no soil liquefaction evaluation of the site was performed. As no groundwater was encountered in the test borings to a maximum depth of 27 feet, and the onsite materials consist primarily of compacted soil underlain by bedrock, it is our opinion that potential of soil liquefaction at the site is considered very low.

CONCLUSIONS AND RECOMMENDATIONS

General

Based on an evaluation of the site conditions and findings of this investigation, it is concluded that construction of the new single-family residence on the subject property as proposed is considered feasible from a geotechnical engineering viewpoint provided the following conclusions and recommendations are incorporated into design criteria and project specifications and are implemented during construction.

Conventional spread footings founded into compacted fill will provide adequate support for the proposed structure. Please refer to 'Subgrade Preparation' and 'Grading Specification' sections of this report for detail removal and recompaction specifications.

Expansive Soil Considerations

On-site surface soils exhibit medium expansion potential as determined by the ASTM D-4829. The expansive characteristics of these materials should be considered in design of floor slabs, concrete flatwork or other structural elements in contact with these materials.

The recommendations provided herein for expansive soil should be considered subject to review of as-graded site conditions. These recommendations must be emphasized as minimums and, accordingly, some risk is associated with adopting the minimums. Lower risk is associated with more restrictive criteria. Slab subgrade presaturation should be verified by the geotechnical consultant prior to placement of slab concrete.

Safety Statement

As per City of Rancho Palos Verdes Building Code, it is our opinion that the subject site will be safe for the proposed single-family residential development against hazard from landslide, settlement or slippage from the geotechnical engineering viewpoint. The proposed grading and construction of the project will not adversely affect the stability of the adjacent properties provided the recommendations presented in the report are incorporated into the project design, plans and specifications and are carried out during construction of the project.

Site Preparation

General

Precautions should be taken during the performance of all work under the following sections, especially if construction is performed during the rainy season of approximately October 1 to April 15. Protection should be provided to the work site, particularly excavated areas, from flooding, ponding, and inundation due to poor or improper temporary surface drainage. During periods of impending inclement weather, temporary provisions should be made to adequately direct surface drainage, from all sources, away from and off the work site and to provide adequate pumps and sumps to handle any flow into the excavations.

Site Clearing

Clearing and grubbing should consist of the removal of vegetation such as brush, grass, woods, stumps, trees, roots of trees and otherwise deleterious natural materials from the areas to be graded. Clearing and grubbing should extend to the outside of all proposed excavation and fill areas.

Debris generated during clearing, grubbing and/or demolition operations should be wasted from areas to be graded and disposed of off-site. During site grading, laborers should clear any

roots, tree branches, and other deleterious materials missed during clearing and grubbing operations from all areas to receive fill.

The depths of excavation should be reviewed by the Soils Engineer during actual construction. Any surface or subsurface obstructions, or questionable material, encountered during grading should be brought immediately to the attention of the Soils Engineer for proper exposure, removal or processing as directed. No underground obstructions or facilities should remain in any structural areas.

Subgrade Preparation

Prior to receiving of new fill or where compacted soil is to provide support of structural loads, it is recommended that the existing surface soils within the proposed building area be removed to underlying stiff compacted soil/ bedrock, or to a depth of 3 feet below the base of the footings, whichever is greater, and then replaced with properly compacted fill. The area of removal shall extend at least 5 feet beyond the outside edge of the footings. The exposed bottom surface in each removal area should first be scarified to a depth of at least 8 inches, processed, watered or air dried as necessary to achieve 3 percent over optimum moisture conditions, and then compacted in-place to at least 90 percent of the maximum laboratory density. Locally, some areas exposing loose or soft soils may require deeper removal than indicated above. Actual depth of removal is to be determined in the field at the time of grading.

The existing surface soils within the proposed driveway and pavement areas should be removed to a depth of 24 inches below the proposed finish subgrade and recompacted.

Fill Placement

All new fill shall be brought to achieve 3 percent over optimum moisture, placed in layers not exceeding 8 inches thick, and compacted to at least 90 percent of the maximum laboratory density.

Compaction characteristics of all fill soils shall be determined by ASTM D-1557-09 standard. The field density and degree of compaction shall be determined by ASTM D-1556, or by other ASTM standard methods that are acceptable to the governing public agency.

Seismic Design Parameters

Based on the results of this preliminary soil investigation and in accordance with 2013 California Building Code, the following seismic data are applicable to the subject site.

Longitude	-118.33595
Latitude	33.72612
S_s	1.433
S_1	0.542
Site Class	D
F_a	1.0
F_v	1.5
S_{MS}	1.433
S_{M1}	0.813
S_{DS}	0.955
S_{D1}	0.542

The proposed construction at the site is assigned to "Seismic Design Category "D" per CBC.

Foundation Recommendations

Footings on Compacted Soil

Provided the subgrade soils within the proposed building area are prepared as recommended, an allowable bearing value of 2000 pounds per square foot is recommended for spread footings of at least 15 inches in width, placed at a depth of at least 2 feet below the lowest adjacent final grade, founded into compacted soil.

The bearing value is for dead plus live load and may be increased by one-third for momentary wind or seismic loads.

Foundation Setback From Descending Slope

Footings located on/or adjacent to a descending slope shall be placed at sufficient depth to provide horizontal setback from the slope surface. The required setback of the Building Code is 1/3 the height of the slope with a minimum of five feet and a maximum of 40 feet measured horizontally from the base of the foundation to the slope face.

Foundation Settlement

Maximum ultimate settlement of footings up to 3 feet wide continuous and 4 feet square under the recommended bearing pressure is not expected to exceed ¾ an inch. Differential settlement between adjacent footings is not expected to exceed 1/4 of an inch within a span of 40 feet. Settlement will be approximately in direct proportion to the width of the footings and actual applied load.

Footing Reinforcement

Continuous footings should be reinforced with at least four No. 4 bars; two near the top and two near the bottom of the footings. Reinforcement of isolated footings shall be utilized as deemed necessary by the Structural Engineer for the project. This reinforcement is based on soil characteristics and is not intended to be in lieu of reinforcement necessary to satisfy structural considerations.

Foundation Inspections

All foundation excavations should be inspected and approved by the Soils Engineer prior to placement of forms, reinforcement or concrete. The excavations should be trimmed neat, level and square. All loose, sloughed and moisture softened materials should be removed prior to the placement of concrete.

Materials from foundation excavations should not be spread in slab-on-grade areas unless they are compacted and tested.

Footings should be located below a line measured upward at a 45-degree angle from the bottom of the adjacent footings or utility trench, unless reviewed and approved by the Soils Engineer.

Lateral Design

An allowable lateral bearing value against the sides of footings of 250 pounds per square foot per foot of depth, to a maximum of 2000 pounds per square foot, may be used provided there is positive contact between the vertical bearing surface and compacted soil. Friction between the base of the footings and the underlying soil may be assumed to be 0.3 times the dead load. When combining passive pressure and friction for lateral resistance, the passive component should be reduced by one-third.

Slabs On Grade

Floor Slab

Slabs on grade should be cast over properly prepared subgrade. Any soils loosened or over-excavated should be wasted from the site or properly compacted in-place.

Subgrade soils disturbed due to installation of utility lines should either be completely removed or be properly compacted prior to concrete pour. The subgrade fill soils should be moisture-conditioned to achieve near 3 percent over optimum water content and then compacted to at least 90 percent of the maximum dry density as determined by the ASTM D-1557-09 compaction test method.

It should be recognized that minor cracks normally occur in concrete slabs due to shrinkage during curing or redistribution of stresses and thus, some cracks should be anticipated. Such cracks are not necessarily indicative of excessive vertical movements.

Slab Reinforcement

Slab resting on expansive soil shall be designed per Building Code Section 1808.6.2. The following recommendations are considered minimum and are not intended to preclude the code requirement.

Floor slabs constructed on-grade should be supported by a minimum thickness of 6 inches of gravel or crushed rock. Slabs shall be a minimum of 5 inches thick and reinforced with No. 4 bars spaced 16 inches on centers, both ways. All slab reinforcement should be supported on concrete chairs or brick to ensure the desired placement near mid-depth.

The above criteria are recommended to minimize potential distress to floor slabs related to the effects of subgrade soil conditions. The Structural Engineer for the project may need to address other factors that may require modification of the above recommendations.

Moisture Barrier

A moisture barrier beneath slabs-on-grade, consisting of a waterproof vapor barrier, such as a plastic membrane of at least 10 mils in thickness, is recommended in areas where slab moisture would be detrimental. The membrane should be overlain by a minimum of 2 inches of clean sands to provide a working surface and aid in concrete curing.

It is important that the soil subgrade, which will support the concrete slab, is maintained at the "as-graded" or has a sufficient soil water content. Prior to slab construction, the water content of the soil subgrade should be measured to verify that the subgrade has not dried out significantly. It is suggested that the top 12 inches subgrade soil in the building slab-on-grade

area be artificially saturated to 10 percent over the optimum moisture content prior to placing moisture barrier.

Concrete Flatwork

The soil subgrade in all areas supporting concrete flatwork or driveway should be processed, moisture conditioned to achieve near 3 percent over optimum moisture content, to a depth of 24 inches and compacted to at least 90 percent relative compaction prior to placing concrete. The concrete for patio and sidewalks should be a nominal four inches thick with construction or expansion joints every six feet or less and reinforced with No. 4 bars spaced 24 inches on center, both ways. Concrete driveway should be at least six inches thick. Reinforcement should be positioned at about mid-height in the concrete.

It is anticipated that the on-site expansive soils will be encountered in the flatwork or driveway areas. The owner, project architect, and/or structural engineer may want to consider increasing the concrete thickness and/or reinforcing the concrete with No. 4 bars spaced 16 inches on center, both ways to enhance the performance of the concrete and reduce the potential for significant cracking.

Corrosivity

According to the corrosivity test result in the compaction report dated April 10, 2000, prepared by Converse Consultant, the concentration of water-soluble sulfate in the soil sample was determined to be 0.0142% to 0.0585%. The on-site soil is considered low deleterious to concrete. The following criteria are recommended for the preliminary concrete design:

Sulfate Content (%)	0.0142~0.0585
Exposure Class (ACI 318, Table 4.2.1)	S0

Cement Type	No Type Restriction
Maximum Water- Cement Ratio, by weight (ACI 318, Table 4.3.1)	N/A
Minimum *fc'* ,psi (ACI 318, Table 4.3.1)	2500
Calcium Chloride Admixture (ACI 318, Table 4.3.1)	No Restriction

According to the same rough grading compaction report, the on-site soil is considered severely corrosive to ferrous metals. Underground steel utilities should be blasted and given a high quality protective coating. Buried steel piping should be electrically insulated from dissimilar metals, cement-mortar or concrete coated steel, and above ground steel pipe. It is recommended that a corrosion specialist be consulted.

Excavation

Excavation should be in accordance with all applicable requirements of the State of California Construction and General Industry Safety Order, the Occupational Safety and Health Act of 1970, the Construction Safety Act, and all other public agencies have jurisdiction. Construction specifications should clearly establish the responsibilities of the contractor for construction safety in accordance with CAL/OSHA requirements.

Temporary excavation for construction purposes may be made vertically in the onsite engineering fill to a maximum height of 4 feet without shoring or bracing, provided no surcharge loads or adjacent structures are located within a horizontal distance equal to the depth of excavation. For cuts made to a depth greater than 4 feet, the lower 4 feet can be made vertically and the portion above 4 feet shall be sloped back to an inclination of 1 horizontal to 1 vertical.

Excavated surfaces should be kept moist but not saturated to retard raveling and sloughing during construction. Water should not be allowed to pond on the top of the excavation nor flow towards it.

No excavation shall be made during unfavorable weather. It is recommended that the excavated banks be entirely covered with plastic sheets when threatened by rains. When the excavation is interrupted by rain, operations shall not be resumed until the Soils Engineer indicates that conditions will permit satisfactory results.

Slope Maintenance

All proposed cut or fill slopes shall be maintained at a slope gradient no steeper than 2 horizontal to 1 vertical except approved by the project geotechnical engineer.

Landscape Plants

In order to enhance surficial slope stability, slope surface should be provided with deep-rooting vegetation requiring little watering. Plants native to the southern California area and plants relative to native plants are generally desirable.

Irrigation

Irrigation pipes should be anchored to slope faces, not placed in trenches excavated into slope faces. Slope irrigation should be minimized. If automatic timing devices are utilized or irrigation systems, provisions should be made for interrupting normal irrigation during periods of rainfall. Property owners should be made aware that over-watering of slope is detrimental to slope stability.

Maintenance

Periodic inspections of landscaped slope areas should be planned and appropriate measures should be taken to control weeds and enhance growth of the landscape plants. Some areas may require occasional replanting and/or reseeding.

Post Grading Considerations

Site Drainage

The provision and maintenance of adequate site drainage and moisture protection of supporting soil is an important design consideration. Foundation recommendations presented herein assume proper site drainage will be established and maintained.

To enhance future site performance, positive drainage devices such as sloping sidewalks, graded swales, and/or area drains should be provided around the building to collect and direct all water away from the structure. Neither rain nor excess irrigation water should be allowed to collect or pond on the property. Where slabs or pavement are not feasible adjacent to the buildings, the ground surface should be provided with a minimum gradient away from the structures per 2013 CBC. All drainage should ultimately be directed to street or other designated area.

Water should be transported off the site in approved drainage devices or unobstructed swales. Drainage swales should have a minimum gradient per 2013 CBC. Where necessary, drainage paths could be shortened by use of area drains and collector pipes.

Planters adjacent to buildings should be avoided insofar as possible. Planting areas at grade should be provided with good positive drainage. Wherever possible, exposed soil areas should be above adjacent paved grades. Planters should not be depressed below adjacent paved grades unless provisions for drainage, such as catch basins and pipe drains are made.

Adequate drainage gradient, devices and curbing should be provided to prevent runoff from adjacent pavement or walks into planting areas. Consideration should be given to irrigation methods that will promote uniformity of moisture in planters and beneath adjacent concrete "flat-work". Over-watering and under-watering of landscape areas must be avoided.

All roof and wall surface drainage should be collected and conducted by a non-erosive device to the streets or to a designated area.

Trench Backfill

It is our opinion that utility trench and/or structural backfill consisting of the on-site material types could be best placed by mechanical compaction to a minimum of 90 percent of the laboratory maximum density. Density testing, along with probing, should be performed by the project soils engineer, or his representative, to verify proper compaction.

If utility contractors indicate that it is undesirable to use compaction equipment in close proximity to a buried conduit, we would recommend the utilization of lightweight mechanical equipment and/or bedding of conduit with clean granular material prior to initiating mechanical compaction procedures. Other methods of utility trench compaction may also be appropriate as approved by the project geotechnical consultant at the time of construction.

Where utility trenches are proposed parallel to building footings (interior and/or exterior trenches), the bottom of the trench should not extend below a 1 horizontal to 1 vertical plane project downward from the outside bottom edge of the adjacent footing. Where this condition occurs, the adjacent footing should be deepened.

Plan Review

In order to prevent misinterpretation of this report by other consultants it is recommended that the Soils Engineer be provided the opportunity to review the final grading and foundation plans. The Soils Engineer will also determine whether any change in concept may have had any effect

on the validity of the Soils Engineer's recommendations, and whether those recommendations have, in fact, been implemented in the design and specifications.

If the Soils Engineer is not accorded the privilege of making this recommended review, he can assume no responsibility for misinterpretation or misapplication of his recommendations or for their validity in the event changes have been made in the original design concept without this prior review.

Geotechnical Inspection

All rough grading of the property must be performed under engineering supervision of the geotechnical consultants. Rough grading includes, but is not limited to, site preparation, cleaning, over-excavation, and fill placement.

The geotechnical consultant should inspect all foundation excavations. Inspections should be made prior to installation of concrete forms and reinforcing steel to verify or modify, if necessary, conclusions and recommendations in this report.

Inspections of the finish grading, utility or other trench backfill, retaining wall backfill, or other earthwork completed for the subject project should also be performed by the geotechnical consultant.

It should be understood that the contractor shall supervise and direct the work and he shall be responsible for all construction means, methods, techniques, sequences and procedures. The contractor will be solely and completely responsible for conditions at the job site, including safety of all persons and property during the performance of the work. Periodic or continuous inspection by GSS Engineering, Inc. is not intended to include verification of dimensions or review of the adequacy of the contractor's safety measures in, on or near the construction site.

If any of these inspections to verify site geotechnical conditions are not performed by the geotechnical consultant, liability for the safety and stability of the project is limited only to the actual portions of the project approved by the geotechnical consultant.

GRADING SPECIFICATIONS

The following guidelines may be used in preparation of the grading plan and job specifications.

1) All site grading operations should conform to the local building and safety codes and to the rules and regulations of those governmental agencies having jurisdiction over the subject construction.

2) The grading contractor is responsible to notify governmental agencies, as required, and the Soils Engineer prior to initiating grading operations and any time grading is resumed after an interruption.

3) A diligent search for septic tanks, cesspools or underground lines should be performed during grading operations. Any abandoned water or oil wells encountered should be properly capped and treated in accordance with best-accepted practices.

4) Please refer to 'Subgrade Preparation' section of this report for detail removal and recompaction specifications.

5) The on-site soils are suitable for use in compacted fills provided all trash, vegetation and other deleterious materials are removed prior to placement.

6) No rock over 3 inches in greatest dimension shall be used in fill unless otherwise approved by the Soils Engineer.

7) Where import materials are required for use on site, the Soils Engineer should be notified at least 48 hours in advance of importing in order to sample and test materials from proposed borrow sites. No import materials should be delivered for use on site without prior sampling and testing by the Soils Engineer.

8) All new fill shall consist of approved clean on-site or similar earth material, free of trash or debris, roots, vegetation or other deleterious material and shall be placed in thin horizontal lifts not exceeding 8 inches in loose thickness prior to compaction. Each lift should be watered or dried as needed, thoroughly blended to achieve near 3 percent over optimum moisture conditions then thoroughly compacted by mechanical methods.

9) No jetting or water tamping of fill soils shall be permitted.

10) No fill materials should be placed, spread or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations should not be resumed until the field tests by the Soils Engineer indicate that the moisture content and density of the fill are as previously specified.

11) Unless otherwise specified, all other fills and backfills should be compacted to at least 90 percent of maximum laboratory density.

12) The compaction characteristics of all fill soils shall be determined by ASTM D-1557-09 standard. The field density and degree of compaction shall be determined by ASTM D-1556, or by other ASTM standard methods that are acceptable to the governing public agency.

13) Observation and testing of all compaction shall be under the direction of the Soils Engineer. The Soils Engineer shall advise the owner and grading contractor immediately if any unsatisfactory soils related conditions exist and shall have the authority to reject the compacted fill ground until such time as corrective measures necessary are taken to comply with the specifications.

14) The Soils Engineer should be notified at least 2 days in advance of the start of grading. A joint meeting between a representative of the client, the contractor, and the Soils Engineer is recommended prior to grading to discuss specific procedures and scheduling.

SELECTED REFERENCES

Selected references include the following – As-Graded Geotechnical Report, Phase 1, Tract 50667, Converse Consultants, April 10, 2000; California Building Code, 2010; Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, California Department of Conservation, February 1998; Geologic Map of the Palos Verdes Peninsula, T.W. Dibblee, 1999; Seismic Hazard Program, US Geological Survey, 2014.

INVESTIGATION LIMITATIONS

The conclusions and recommendations contained in this report are based on the data obtained from the test borings at the dates and locations indicated in the logs and the site plan, and the information contained in the aforementioned compaction report. It is assumed that the soil conditions at the other areas do not deviate significantly from those disclosed in the test borings. If any variations or undesirable conditions are encountered during construction, this office should be notified so as to consider the need for modifications.

No responsibility for construction compliance with the design concepts, specifications, or recommendations is assumed unless an on-site review by a representative of this office is performed during the course of construction that pertains to the specific areas covered by the recommendations contained herein.

This report has been compiled for the exclusive use of Michael Mulligan Development, or its authorized agent. It shall not be transferred to any other party or to any other project without the consent and/or thorough review of this office.

The findings of this report are valid as of the present date. However, changes in the conditions of the property can occur with the passage of time, whether they are due to natural processes or to 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 of our control. Therefore, this report is subject to review and should not be relied upon after a period of one year without such a review.

This report is issued with the understanding that it is the responsibility of the owner, or the proper representative thereof, to insure that the information and recommendations contained herein are called to the attention of all parties interested in the project and that the necessary steps are taken to see that the contractors and subcontractors carry out such recommendations in the field.

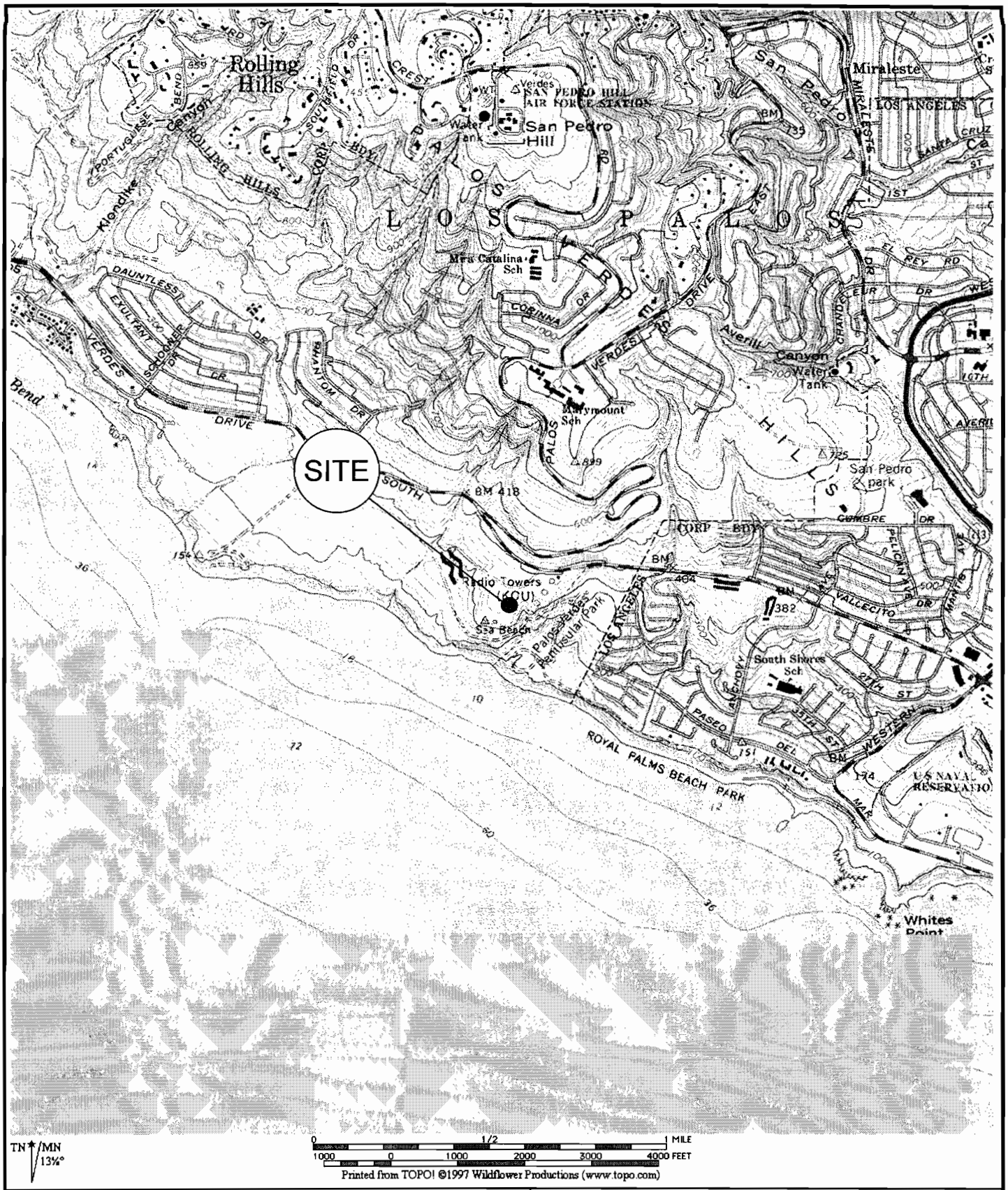
Final approval of plans and reports by all consultants, and issuance of any building and grading permits, rests with the controlling agencies. As the circumstances that control the decision process are clearly beyond the control of this facility, we cannot assume any responsibility for the success of obtaining proper authorizations, nor for the costs involved.

All exploratory borings used for subsurface exploration were backfilled with reasonable effort to restore the areas to their original condition. As with any backfill, some consolidation and subsidence of the backfill soils may result in time, causing some depression of the boring areas and possibly a potentially hazardous condition. The client and/or owner of the property are advised to periodically examine the boring areas, and if necessary, backfill any resulting depressions. GSS Engineering, Inc. shall not be liable for any resulting injury or damage.

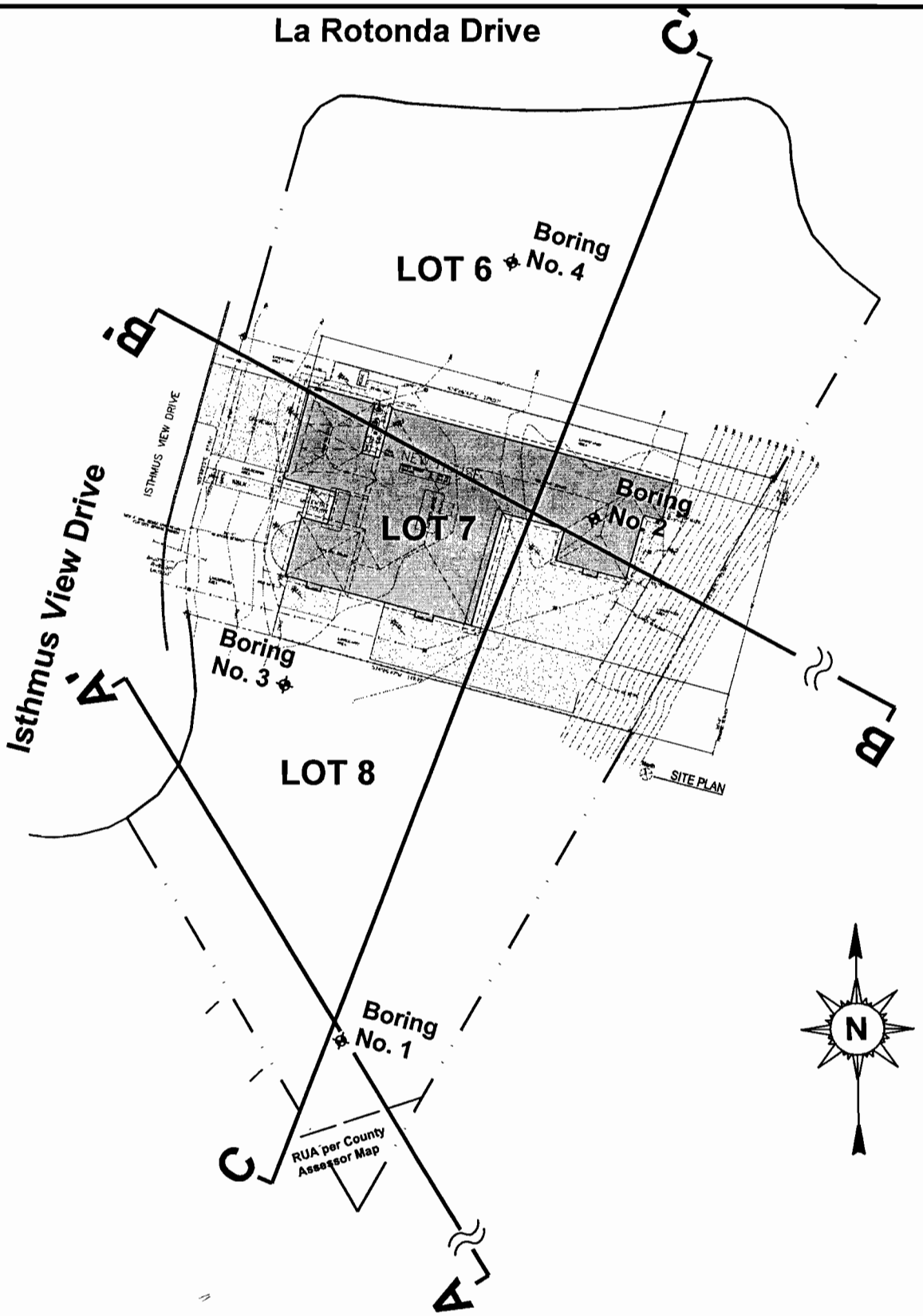
The report is subject to review by controlling public agencies having jurisdiction.

Respectfully submitted,
GSS ENGINEERING, INC.

Allen Lee, GE
Principle Engineer



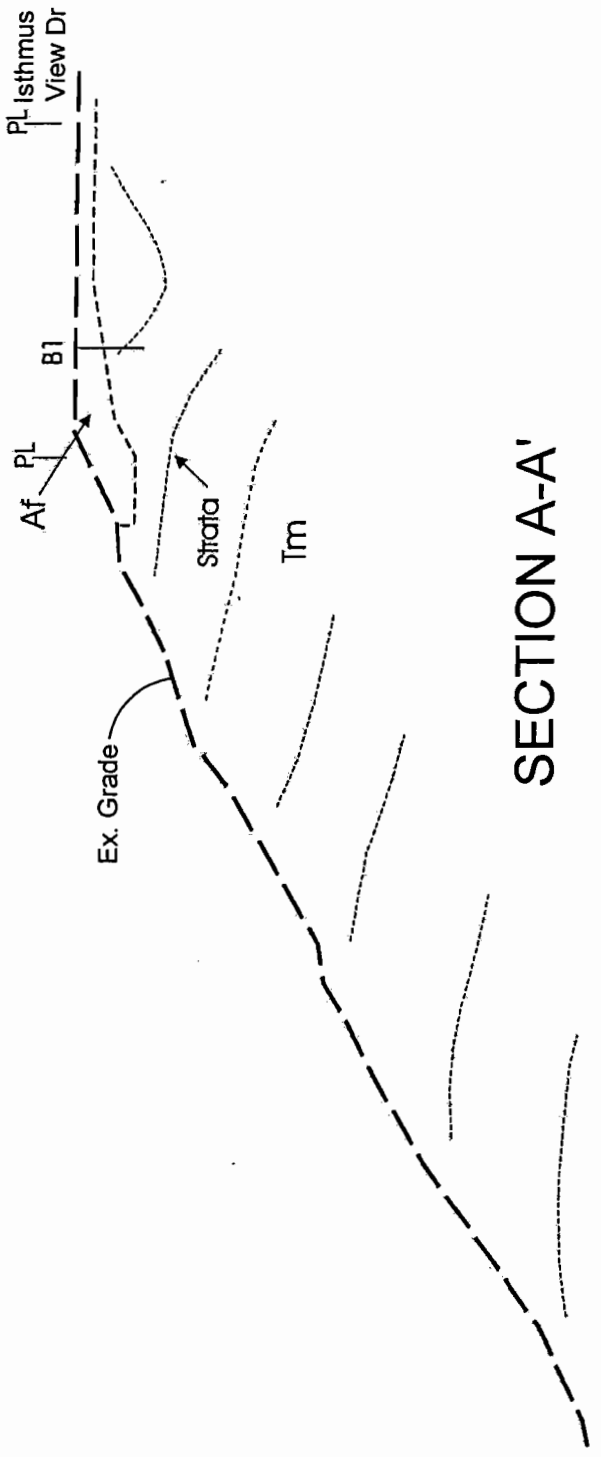
VICINITY MAP	Proposed Single-Family Residence 32022 Isthmus Drive (Lot 7) Rancho Palos Verdes, *California* 90275
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT No.** GSS-2243-2(7) **PLATE** 1



REFERENCE: "Site Plan", provided by Michael Mulligan Development, undated.

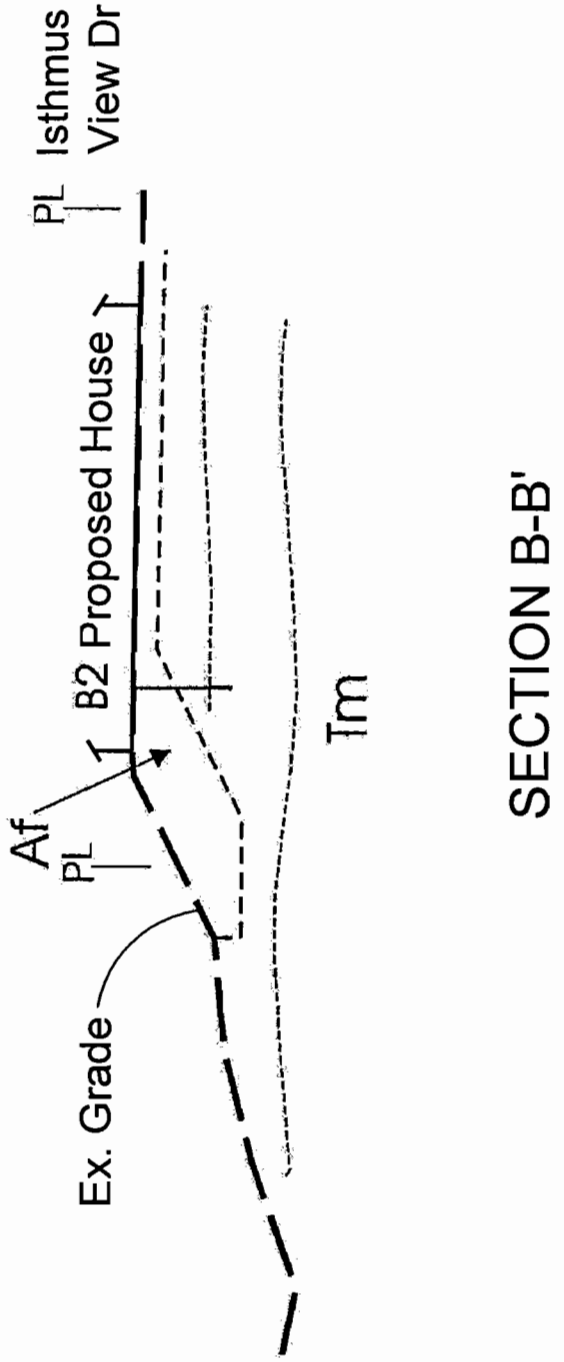
SCALE: 1" = 50'

PLOT PLAN AND BORING LOCATION	Proposed Single-Family Residence 32022 Isthmus View Drive (Lot 7) Rancho Palos Verdes, California
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT NO.** GSS-2243-2(7) **PLATE** 2



SCALE: 1" = 80'

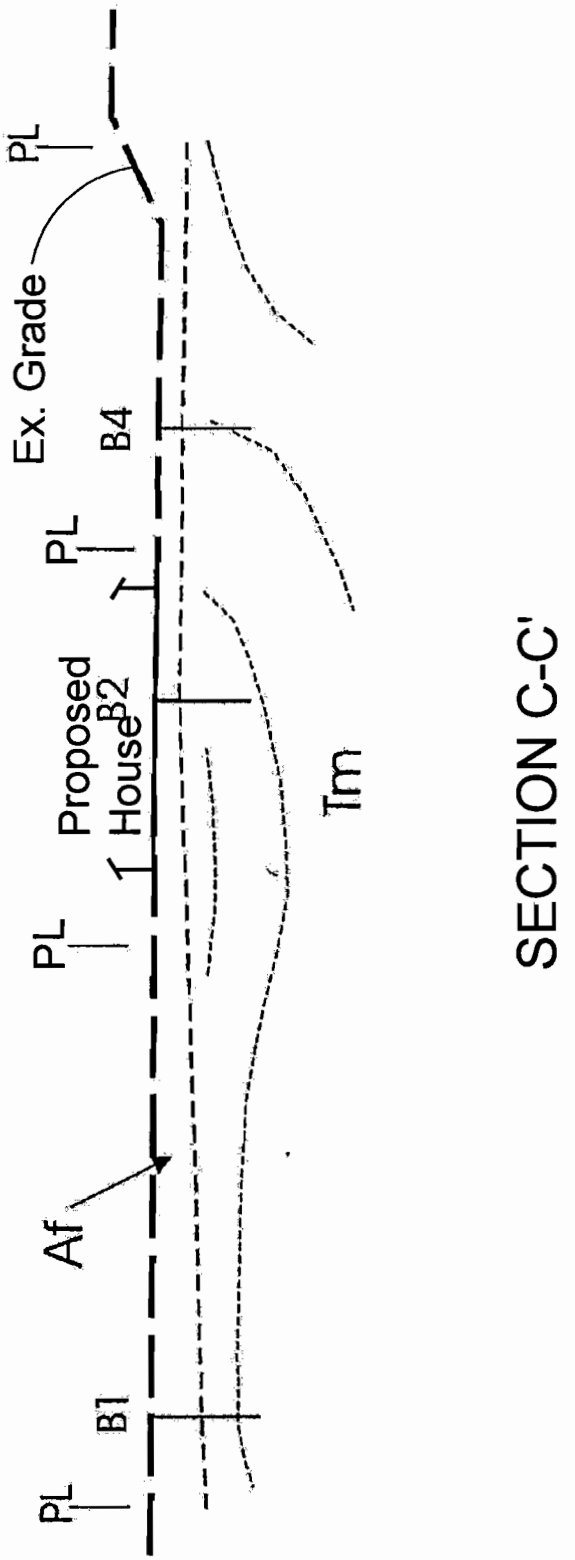
CROSS SECTION	Proposed Single-Family Residence 32022 Isthmus View Drive (Lot 7) Rancho Palos Verdes, California
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT NO.** GSS-2243-2(7) **PLATE** 3



SECTION B-B'

SCALE: 1" = 50'

CROSS SECTION	Proposed Single-Family Residence 32022 Isthmus View Drive (Lot 7) Rancho Palos Verdes, California	
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT NO.** GSS-2243-2(7)	**PLATE** 4



SECTION C-C'

SCALE: 1" = 50'

CROSS SECTION	Proposed Single-Family Residence 32022 Isthmus View Drive (Lot 7) Rancho Palos Verdes, California	
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT NO.** GSS-2243-2(7)	**PLATE** 5

APPENDIX

FIELD EXPLORATION AND LABORATORY TESTING

FIELD EXPLORATIONS

The subsurface conditions at the sites (Lots 6, 7, and 8) were explored by excavating four (4) test borings at the locations shown on the Plot Plan, Plate 2. The test borings were excavated by means of a 24-inch diameter bucket auger to the depths of 20 to 27 feet below the existing ground surface. The approximate locations of the test borings were determined by tape measurements from the property boundaries. The locations of the test borings should be considered accurate only to the degree implied by the method used.

The soils and bedrock encountered during excavation were logged by the field engineer. The soils are classified in accordance with the Unified Soil Classification System described on Plate A-1. Undisturbed samples as well as bulk samples of on-site soils and bedrock were extracted at selected intervals from the test borings in a barrel sampler with tapered cutting shoe. The undisturbed samples retained in 2.5-inch diameter by one-inch rings within the sampler were secured in moisture resistant bags and plastic sample cans as soon as taken to minimize the loss of field moisture while being transported to the laboratory for testing. The relative sampler penetration resistance exhibited by the soil and bedrock types encountered is tabulated in the Blow per Foot column of the Log of Test Boring. Detailed logs of test borings are presented on Plates A-2 through A-5, Log of Test Boring.

The lines designating the interface between soil/ bedrock materials on the logs of test borings represent approximate boundaries. The transition between materials may be gradual.

LABORATORY TESTING

Moisture-Density

The field moisture content and dry density of the materials encountered were determined by performing tests on selected undisturbed samples to aid in the classification and correlation of the soil and to obtain qualitative information relative to their strengths and compressibility. The field moisture content and dry density of the samples were determined in accordance with ASTM-2216 and ASTM D-2937 standard. The results of the tests are shown on the Log of Test Boring, Plates A-2 through A-5.

Direct Shear Tests

Direct shear tests were performed in accordance with ASTM D-3080 standard on selected undisturbed samples of the onsite material to evaluate shear strength and supporting capacity of the foundation materials. Shear tests were made with a direct shear machine of the displacement control type at a displacement rate of approximately 0.005 inches per minute. The samples were soaked in water for at least 24 hours to approximately saturated moisture condition and then sheared under various normal stresses. The residual shear strength values determined from the tests are presented on Plate A-6, Direct Shear Test.

Consolidation Tests

Consolidation tests were performed on representative undisturbed samples of the onsite material in accordance with ASTM D-2435 standard to evaluate the volume changes of soil subjected to increased loads. Deformations of the specimen are recorded at selected intervals. The results of pressure consolidation curves, which are used to estimate the probable magnitude and rate of settlement of the tested soil under applied loads, are presented on Plate A-7, Consolidation Test.

Expansion Tests

Expansion tests were performed on representative samples of the on-site materials in accordance with the ASTM D-4829 to evaluate its volume change with moisture. The results are as follows:

Sample	Classification	Expansion Index	Expansion Potential
B-1 @ 3'	CLAY, silty, fine to medium sandy, with rock fragments	72	medium
B-3 @ 3'	CLAY, silty, fine to medium sandy, with rock fragments	70	medium

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of material is LARGER than No. 200 sieve size)	GRAVELS (More than 50% of coarse fraction is LARGER than No. 4 sieve size)	CLEAN GRAVELS (Little or no fines)	GW	Well graded gravels and gravel - sand mixtures, little or no fines
			GP	Poorly graded gravels and gravel - sand mixtures, little or no fines
		GRAVELS WITH FINES (Appreciable Amount of fines)	GM	Silty gravels, gravel - sand - silt mixtures
			GC	Clayey gravels, gravel - sand - clay mixtures
	SANDS (More than 50% of coarse fraction is SMALLER than No. 4 sieve size)	CLEAN SANDS (Little or no fines)	SW	Well graded sands and gravelly sands, little or no fines
			SP	Poorly graded sands and gravelly sands, little or no fines
		SANDS WITH FINES (Appreciable Amount of fines)	SM	Silty sands, sand - silt mixtures
			SC	Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (More than 50% of material is SMALLER than No. 200 sieve size)	SILTS AND CLAYS (Liquid limit LESS than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			OL	Organic silts and organic silty clays of low plasticity
	SILTS AND CLAYS (Liquid limit GREATER than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
			CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS			Pt	Peat, muck and other highly organic soils

BOUNDARY CLASSIFICATIONS: Soils possessing characteristics of two groups are designated by combinations of group symbols.

Reference: The Unified Soil Classification System, Corps of Engineers, U. S. Army Technical Memorandum No. 3 - 357, Vol 1, March, 1953 (Revised April, 1960)

UNIFIED SOIL CLASSIFICATION SYSTEM

Proposed Single-Family Residence
32022 Isthmus Drive (Lot 7)
Rancho Palos Verdes, California 90275

NOTE: The data presented on this log is a simplification of actual subsurface conditions encountered and applies only at the location of this boring and the date of drilling. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING NO. 1

Elevation: N/A

Depth in Feet	Blow per Foot	Field Moisture % of Dry Weight	Dry Density lbs./cu.ft.	Shear Resistance kips/sq.ft.	Confining Pressure kips/sq.ft.	Unified Classification	Soil Symbol				
						ML		**ENGINEERING FILL(12')**	SILT, fine to medium sandy w/ rock fragments and rootlets	brown	dry	mod comp
	7	18.2	99.0			CL			CLAY, silty, fine to medium sandy w/ rock fragments and boulders	gray brown to dark brown	moist	comp
5	5	19.6	104.5								very moist	
10	9	23.7	94.2						CLAY, silty, fine to medium sandy			
								BEDROCK	SILTSTONE, siliceous & SHALE, cherty	gray brown to dark brown	moist to slightly moist	firm to hard
15	16	10.9	101.5									
20	bag	8.0										
25												
	bag	5.9										

End of Test Boring @ 27'

Date Drilled: 09/9/16
Drilling Equipment: 24-inch diameter bucket auger
Driving Weight: 4507 lbs @ 12-inch drop, 3007 lbs @ 12-inch drop below 22'
Water Depth: not encountered

LOG OF TEST BORING	Proposed Single-Family Residence 32022 Isthmus Drive (Lot 7) Rancho Palos Verdes, California 90275	
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT No.** GSS-2243-2(7)	**PLATE** A-2

NOTE: The data presented on this log is a simplification of actual subsurface conditions encountered and applies only at the location of this boring and the date of drilling. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING NO. 2

Elevation: N/A

Depth in Feet	Blow per Foot	Field Moisture % of Dry Weight	Dry Density lbs./cu.ft.	Shear Resistance kips/sq.ft.	Confining Pressure kips/sq.ft.	Unified Classification	Soil Symbol					
						SM		FILL	SAND, fine to medium, silty	gray	dry	loose
						CL		ENGINEERING FILL	CLAY, silty, fine to medium sandy w/ rock fragments	brown to dark brown	moist to very moist	m comp to comp
	2	25.6	94.2									
	bag	25.4										
5	4	24.5	92.5									
								BEDROCK	SILTSTONE & SHALE, cherty	gray brown to brown	moist to slightly moist	firm to hard
10	12	8.3	125.4									
15												
	14	20.6	81.0								very moist	
20												
									LIMESTONE		moist	hard
25	bag	11.9							End of Test Boring @ 25'			

Date Drilled: 09/20/16
Drilling Equipment: 24-inch diameter bucket auger
Driving Weight: 4507 lbs @ 12-inch drop, 3007 lbs @ 12-inch drop below 22'
Water Depth: not encountered

LOG OF TEST BORING

Proposed Single-Family Residence
32022 Isthmus Drive (Lot 7)
Rancho Palos Verdes, California 90275

NOTE: The data presented on this log is a simplification of actual subsurface conditions encountered and applies only at the location of this boring and the date of drilling. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING NO. 3

Elevation: N/A

Depth in Feet	Blow per Foot	Field Moisture % of Dry Weight	Dry Density lbs./cu.ft.	Shear Resistance kips/sq.ft.	Confining Pressure kips/sq.ft.	Unified Classification	Soil Symbol				
						ML		ENGINEERING FILL(7')	SILT, fine to medium sandy w/ rock fragments and rootlets	brown	moist	mod comp
	5	22.2	93.2			CL			CLAY, silty, fine to medium sandy w/ rock fragments and boulders	brown to dark brown		comp
5								BEDROCK	SILTSTONE, siliceous & SHALE, cherty	light brown to gray brown	moist	firm
10	15	16.7	110.3									
15									SHALE, cherty, w/ SILTSTONE	gray brown	very moist	hard
20	18	21.4	100.3									

End of Test Boring @ 20'

Date Drilled: 09/20/16
Drilling Equipment: 24-inch diameter bucket auger
Driving Weight: 4507 lbs @ 12-inch drop
Water Depth: not encountered

LOG OF TEST BORING	Proposed Single-Family Residence 32022 Isthmus Drive (Lot 7) Rancho Palos Verdes, California 90275	
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT No.** GSS-2243-2(7)	**PLATE** A-4

NOTE: The data presented on this log is a simplification of actual subsurface conditions encountered and applies only at the location of this boring and the date of drilling. It is not warranted to be representative of subsurface conditions at other locations and times.

BORING NO. 4

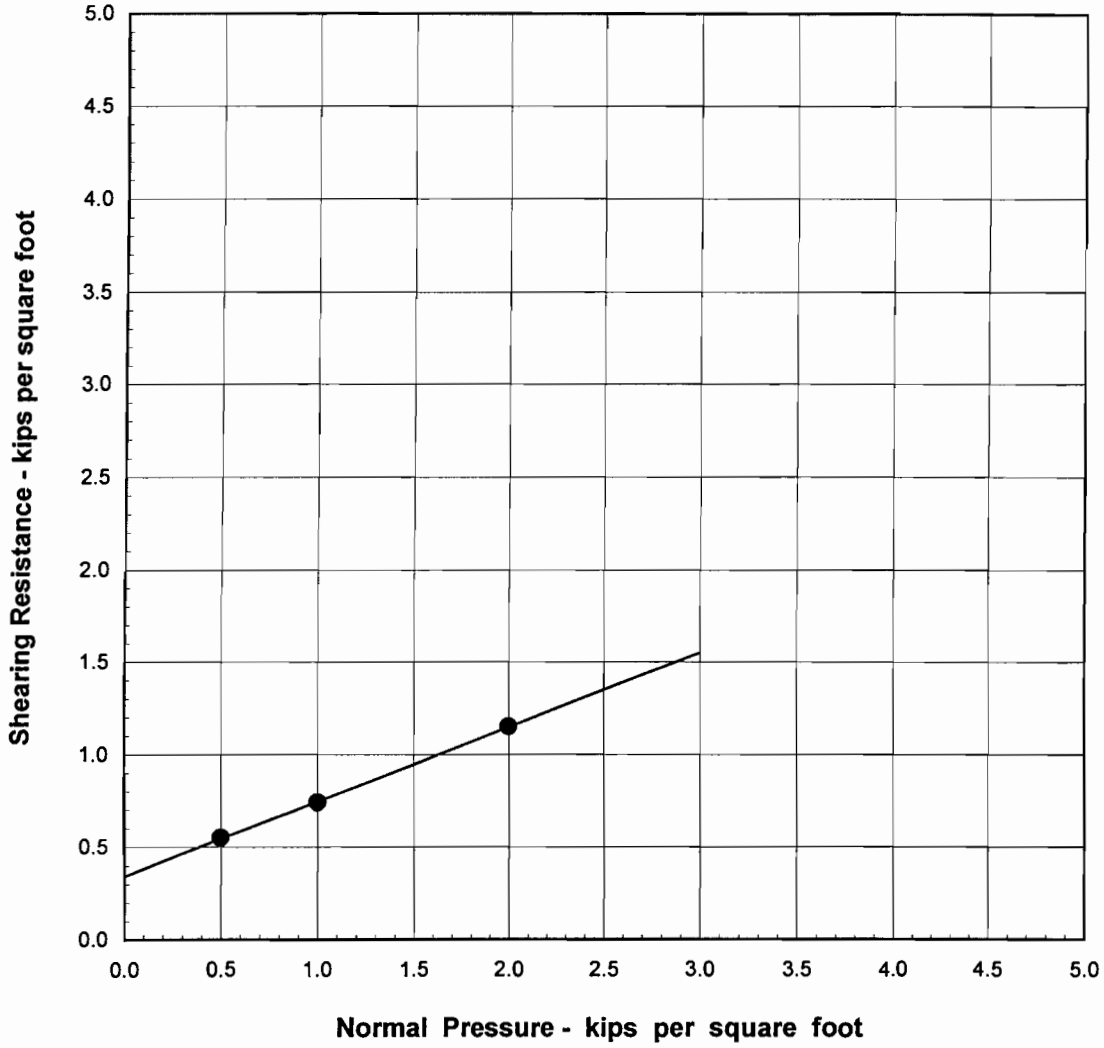
Elevation: N/A

Depth in Feet	Blow per Foot	Field Moisture % of Dry Weight	Dry Density lbs./cu.ft.	Shear Resistance kips/sq.ft.	Confining Pressure kips/sq.ft.	Unified Classification	Soil Symbol					
						SM		FILL	SAND, fine to medium, silty	lt brn	dry	loose
						CL		ENGINEERING FILL(5')	CLAY, silty, fine to medium sandy w/ rock fragments and boulders	brown to dark brown	moist to very moist	m comp to comp
5	4	23.9	94.0					BEDROCK	SHALE, cherty, w/ SILTSTONE	gray brown to dark brown	moist to very moist	hard
10	9	16.1	115.1									
15												
20	15	6.4	135.7								slightly moist	
	bag	5.6										

End of Test Boring @ 24'

Date Drilled: 09/20/16
Drilling Equipment: 24-inch diameter bucket auger
Driving Weight: 4507 lbs @ 12-inch drop, 3007 lbs @ 12-inch drop below 22'
Water Depth: not encountered

LOG OF TEST BORING	Proposed Single-Family Residence 32022 Isthmus Drive (Lot 7) Rancho Palos Verdes, California 90275	
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT No.** GSS-2243-2(7)	**PLATE** A-5



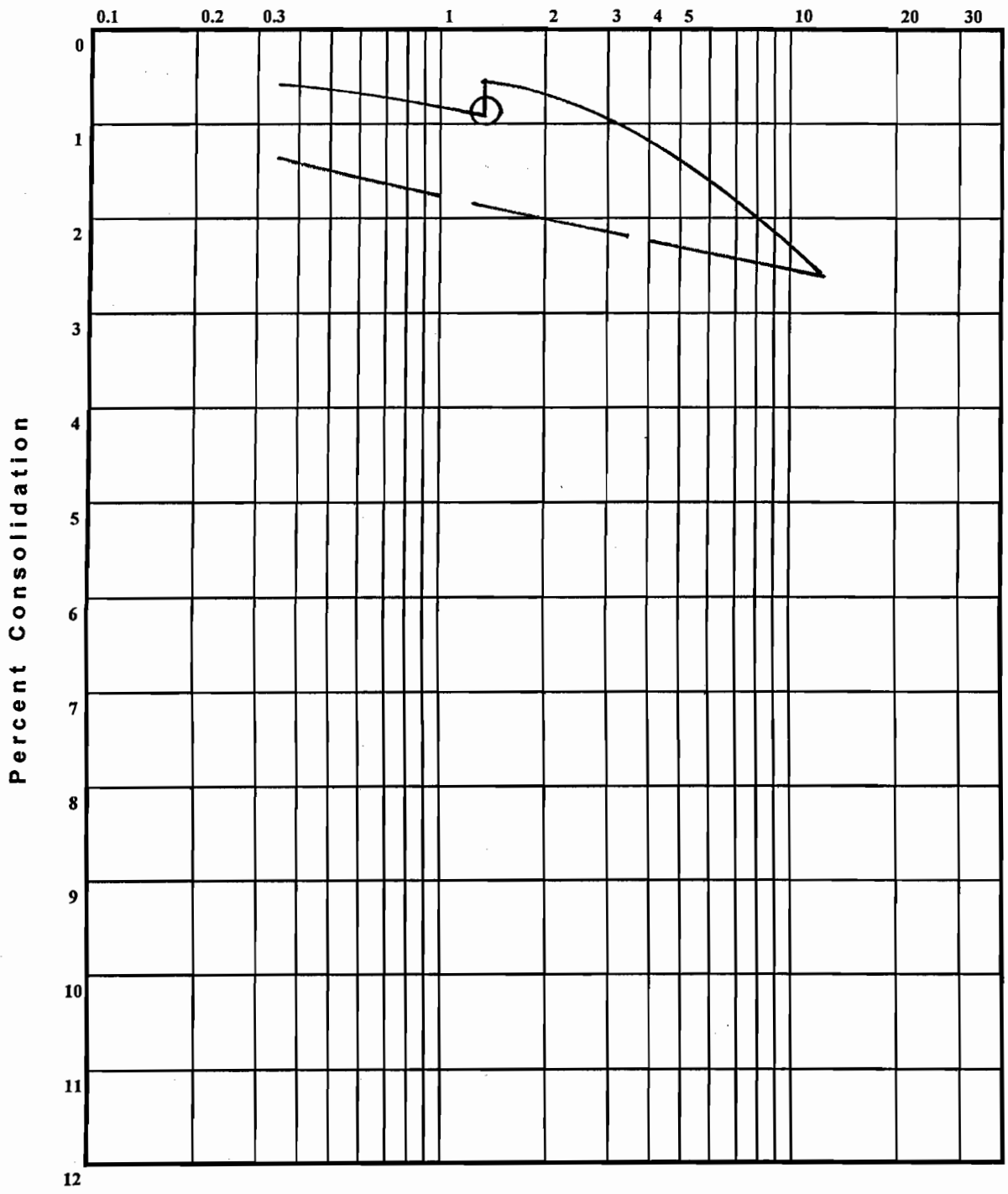
Compacted fill: Samples were tested under saturated and drained conditions.

	Boring No.	Depth (feet)	UC	Initial Water Content (% of dry wt.)	Final Water Content (% of dry wt.)	Dry Density (lbs / cu.ft.)	Cohesion (lbs / sq. ft.)	Angle of Friction (degrees)
●	1	7	CL	19.6	22.8	104.5	350 residual shear strength	22

DIRECT SHEAR TEST DATA

Proposed Single-Family Residence
32022 Isthmus Drive (Lot 7)
Rancho Palos Verdes, California 90275

Normal Load - kips per square foot



Test Boring No. 1 @ 6.0'

O Water Permitted to Contact Sample

CONSOLIDATION TEST	Proposed Single-Family Residence 32022 Isthmus Drive (Lot 7) Rancho Palos Verdes, California 90275
GSS ENGINEERING, INC. *Geotechnical Engineering Consultants*	**PROJECT No.** GSS-2243-2(7) **PLATE** A-7

RAY A. EASTMAN
ENGINEERING GEOLOGIST

2461 East Orangethorpe Avenue, Suite 229
Fullerton, California 92831

September 23, 2016

GSS Engineering, Inc.
11823 Slauson Avenue, Su 46
Santa Fe Springs, CA. 90670

Subject: Interim Phase of Engineering Geologic Exploration
Proposed Residential Development
Lots 6, 7 & 8 of Tract No. 50667 on Isthmus View Drive
Rancho Palos Verdes, CA.
Project No. 4007

Gentlemen:

At your request, we have conducted an interim phase of engineering geologic exploration in order to identify pertinent geologic factors with respect to a proposed three lot residential development. The main factors, in turn, included evaluation of the geologic setting with particular interest directed towards the stratigraphy, structural features and seismicity at the site.

The development plan is conceptual and the discussions and recommendations provided herein must be considered as general. We understand, however, that proposed construction will be comprised by a one and/or two story, wood frame residence/garage structure at each lot; the related foundations may typically consist of continuous footing, grade beam and/or drilled pile type systems. Also, we understand that related grading may typically consist of nominal cut/fill with associated retaining walls and slopes at 2:1 that range to ~ 5 feet in height.

SCOPE OF WORK

The geologic work was based upon conceptual planning information and same was conducted in accordance with generally accepted practice for the particular circumstances. More specifically, typical factors include:

- ✓ Review of selected geologic maps.
- ✓ Field geologic observation of the site.
- ✓ Subsurface geologic exploration by four test borings.
- ✓ And, visual evaluation of the units encountered with respect to proposed construction.

The said review, of course, also included a geotechnical report for said lots as prepared by Converse Engineering as dated May 2006. In turn, the said report also included an overall reference to as graded geotechnical reports for the general tract as dated April

2000 and October 1999. Also of note is a geologic map of the South Shores Landslide and Adjacent Areas as prepared by Moore & Taber Engineering as dated January 1987.

SITE CONDITIONS

The overall site occupies ~ 1.5 acres of graded but vacant land situated at the lower, southerly slope of the Palos Verdes Hills. It is bounded on the west by Isthmus View Drive, on the east by undeveloped canyon terrain and otherwise in general by residential development. In turn, the noted Converse reports indicate a history of rough grading that spanned a sequence through 1999 to completion of the pads in 2000.

Topography in general is formed by a graded tract of irregular but moderate relief whereby the nearest descending slope of significance is situated towards the east as noted above. In detail, it is formed by level building pads with an irregular but moderately steep canyon slope of ~ 220 feet in height as noted above.

Also, of course, see the accompanying base maps for an overview of the site and topographic conditions.

GEOLOGIC CONDITIONS

The geologic province of interest is formed by the moderately rugged Peninsular Range, which extends southeasterly from the relatively nearby Santa Monica and San Gabriel Mountains into Baja California. The major geologic formations in the area include alluvium at the valley floors, and sedimentary, volcanic and metamorphic bedrock in the mountainside terrain; major fault lines include the nearby Palos Verdes and Inglewood systems.

Geology at the site is inclusive of two basic units: namely, sedimentary bedrock and fill. Also, of course, see the accompanying geologic maps, section lines and logs for an overview.

✓ The bedrock is assigned to the Monterey Formation. It typically consists of interbedded firm-hard, gray brown-brown, diatomaceous and siliceous siltstone, cherty shale and particularly hard limestone; the associated strata are highly folded and same at the site have dips of ~ 15-75 degrees towards each compass direction.

✓ The fill is present in two main parts: namely, as a pad fill of ~ 5 feet over the lot and as a stabilization fill of ~ 20 feet in depth at the aforementioned descending slope. It typically consists of moderately compact, brown-dk brown, silty and f-m sandy clay with numerous rock fragments and occasional boulders.

A third feature of note is formed by the moderate sized South Shores Landslide that is located offsite towards the east; it is nearby but not on the site.

Finally, we may note that groundwater seepage was not encountered during the field exploration work.

SEISMIC CONDITIONS

Relatively nearby active faults of significance to the site include:

Fault Zone	Approximation Location	Earthquake Magnitude*
Palos Verdes	4 miles NE	7.3
Inglewood	10 " NE	7.2
San Pedro Basin	12 " SW	6.6
Puente Hills	19 " NE	7.0
Santa Monica	22 " NW	6.6.

(*) Maximum probable moment magnitude, CDMG 2008.

Also, of course, see the accompanying fault and earthquake epicenter maps for an overview.

CONCLUSIONS/RECOMMENDATIONS

Minor constraints to development are, of course, posed by the presence of moderately significant fill of some 16 years in age. Even so, said residential development is considered to be feasible from an engineering geologic standpoint. More specifically, typical factors include:

✓ Geologic Stability – The site topography and firm–folded dip characteristics of the underlying bedrock strata are favorable for gross stability. Fill soils of this age and character, however, are typically subject to some additional minor settlements and sloughing slope wise; these features, of course, require consideration and typically same involves overexcavated and recompacted as a precautionary measure.

✓ Seismicity – Nearby active fault lines include the Palos Verdes, Inglewood and San Pedro Basin; these have associated postulated, maximum probable earthquake magnitudes of 6.6-7.3. In turn, the probabilistic ground motion accelerations may range upwards to ~ 0.57g as per a 2 percent in 50 years criterion.

✓ Site Grading – The site grading is anticipated to be amenable to the use of conventional earth moving equipment with moderate to extremely heavy ripping. Also, the bulk of excavated materials are anticipated to be suitable for use in compacted fills. Naturally, stripping of unsuitable soils and fills to expose underlying competent soils and/or bedrock will be required prior to placement of newly compacted fill.

✓ Proposed Cut and Fill Slopes – Typically, cut slopes are encompassed by two main factors: namely, 1) those that are at 2:1 with favorable soil conditions and/or bedrock with into slope bedding, jointing or faulting are anticipated to be stable to heights on the order of 40 feet; and 2) those that expose unfavorable soil conditions and/or out of slope bedding, jointing or faulting are anticipated to require buttress fills or retaining walls. In turn, fill slopes of compacted soils at 2:1 are typically stable to heights on the order of 40 feet.

Cut slopes of nominal significance in this case are anticipated to encounter existing fill soils.

✓ Expansive Soils – Portions of the geologic units are anticipated to be expansive.

and precautions may be required relative thereto.

✓ Foundation Criteria – Two basic considerations must be fulfilled with respect to the engineering geologic aspects of the foundation criteria: namely, 1) the foundations must be safe against shear failure of the soils or rock, and 2) the post-construction settlement must be within permissive limits.

Compacted fills and/or building and wall foundations are anticipated to have adequate support provided by the bedrock strata subject, of course, to the earlier discussions. Naturally, we recommend that all fills and building/wall foundations be established in competent bedrock strata or newly compacted fill as the case may be. As noted, existing fill soils of this age and character typically required some consideration and a program of overexcavation and recompaction of same is typically carried out as a precautionary measure. Also, the foundations should be established such as to have minimal setbacks per the applicable building code from any adjacent slope faces and/or a 1:1 projection from the base of any adjacent slope or excavation. Lastly, the footing excavations and detailed work areas may require extremely heavy ripping and jackhammer work due to zones of hard rock and/or boulders.

✓ Engineering Geologic Inspection – We recommend that our geologist review the finalized grading and construction plans in order to verify our findings. Further, we recommend that site inspections be made by our geologist during grading and construction in order to verify the geologic conditions encountered and, of course, additional recommendations may be required if conditions other than anticipated are found.

SELECTED REFERENCES

Probabilistic Seismic Hazard Assessment, California Division of Mines and Geology, 2008; Geologic Map of the Northeast Part of the Palos Verdes Hills, California Division of Mines and Geology, 1976; Geologic Map of the Palos Verdes Peninsula, T.W. Dibblee, 1999; Active Fault Source Data, U.S. Geological Survey Web Page, 2016; Ground Acceleration Data, U.S. Geological Survey Web Page, 2016; Map Showing Late Quaternary Faults of the Los Angeles Region, U.S. Geological Survey, 1989; Evaluating Earthquake Hazards in the Los Angeles Region, U.S. Geological Survey, 1985; Geologic Map of the Palos Verdes Hills, U.S. Geological Survey, 1946.

REMARKS

Several of the aforementioned items, of course, also fall under the purview of your office as the soils engineer and same may require further evaluation; these items include the site grading, slope stability, expansive soils, retaining walls, shoring and foundation design criteria.

The conclusions and recommendations express our best evaluation of the project requirements as based upon the planning information provided and geologic information obtained by review of previous workers, at nearby outcrops and at our exploratory boring locations. The client must recognize, however, that evaluation of subsurface deposits is subject to the influence of undisclosed and unforeseen variations in conditions that may occur and the client has a related responsibility to bring to our attention any unusual condition that may be encountered.

We trust that this interim engineering geologic exploration report will meet with your needs at this time.

Sincerely,

Ray A. Eastman, CEG 423

GEOLOGIC LOG - TEST BORING

Project No.: 4007	Date: 9/9/16	Boring No.: 1
Equipment: Bucket Rig	Dimensions: 2.5'/27'	Elevation: --
Depth '	Description	Geologic Unit
0-2	Med loose dry brn f-m sdy silt w/ rk fgs & rootlets	Fill
2-12	Med stiff damp brn-dk brn & gray f-m sdy clay w/ rk fgs & bldrs	
12-27	Interbeds of hard damp gray brn-dk brn fractured siliceous siltstone & cherty shale -- noticeable caving - N5W25S at 15' & N20W70S at 21'	Bedrock
	Backfilled	

GEOLOGIC LOG - TEST BORING

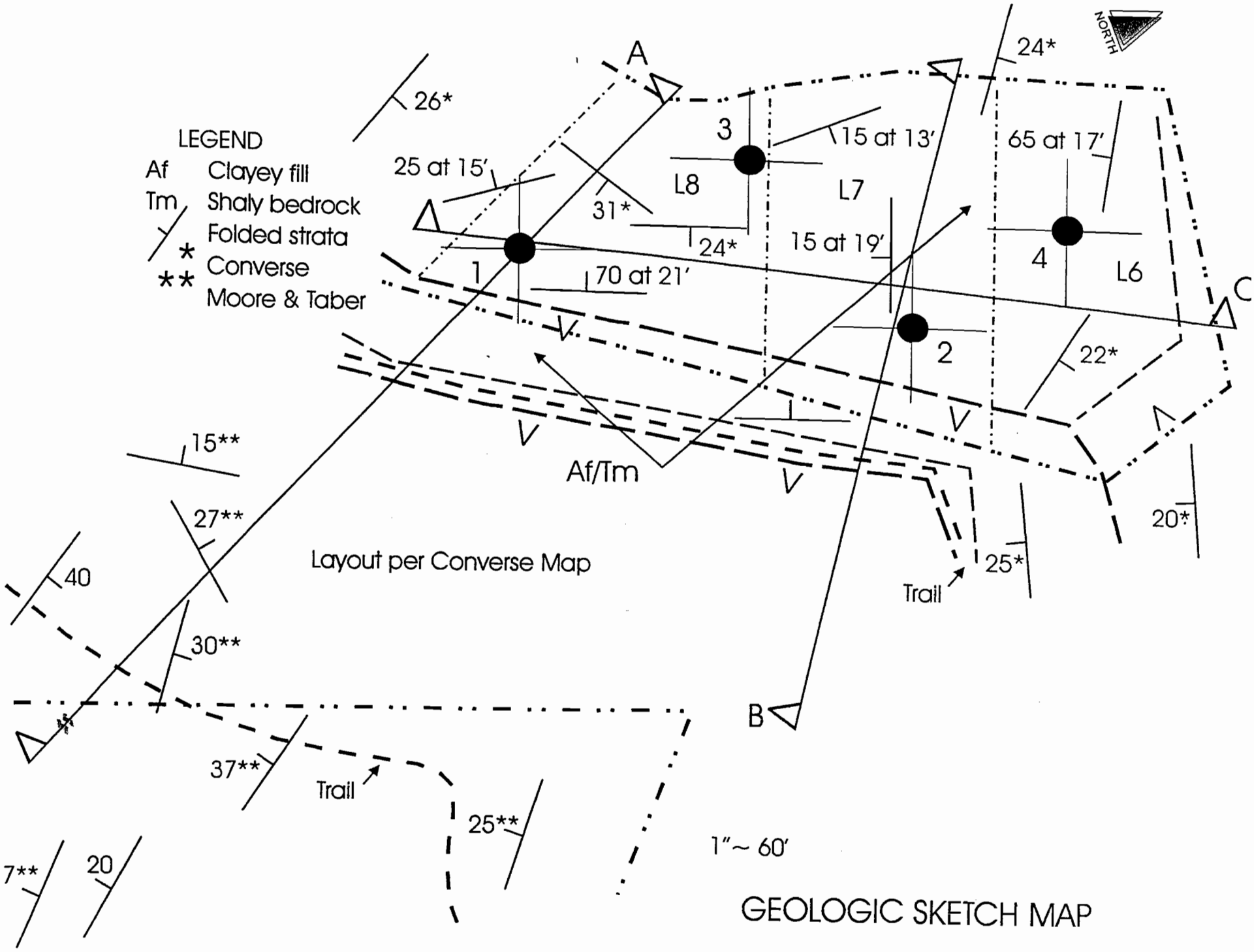
Project No.: 4007	Date: 9/20/16	Boring No.: 2
Equipment: Bucket Rig	Dimensions: 2.5'/25'	Elevation: --
Depth '	Description	Geologic Unit
0-1	Loose dry gray brn f-m sand	Fill
1-6	Med stiff moist brn-dk brn & gray f-m sdy clay w/ rk fgs	
6-25	Interbeds of firm moist gray brn-brn siltstone & hard cherty shale – ~ 1' bed limestone at 7' – N45W15S at 12' & N80W15S at 19'	Bedrock
25	Hard limestone	
	Backfilled	

GEOLOGIC LOG - TEST BORING

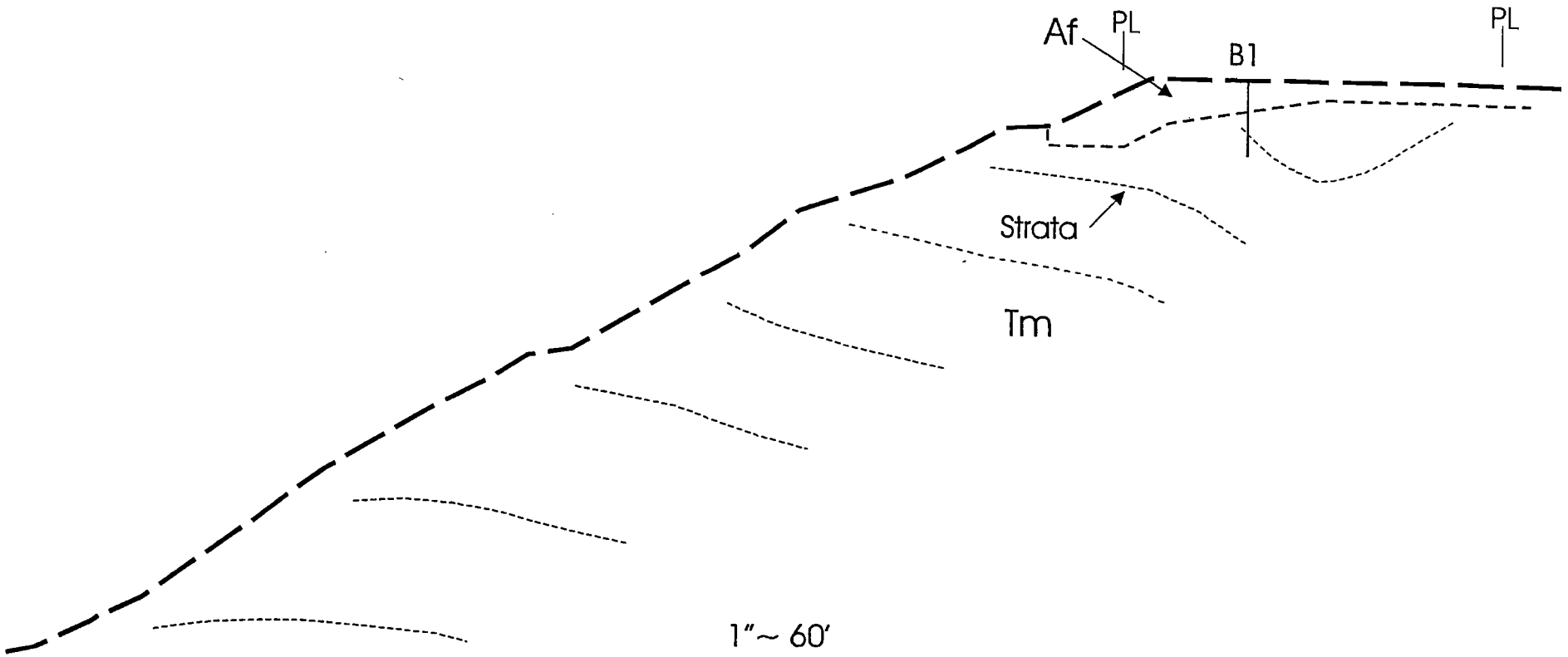
Project No.: 4007	Date: 9/20/16	Boring No.: 3
Equipment: Bucket Rig	Dimensions: 2.5'/24'	Elevation: --
Depth '	Description	Geologic Unit
0-2	Med loose dry brn f-m sdy silt w/ rk fgs & rootlets	Fill
2-7	Med stiff damp brn-dk brn & gray f-m sdy silt & clay w/ rk fgs & bldrs	
7-17	Interbeds of firm damp lt brn siltstone w/ siliceous siltstone & gray brn-dk brn fractured cherty shale	Bedrock
17-20	Hard damp gray brn cherty shale w/ beds of brn siltstone-N10W15N at 13'	
	Backfilled	

GEOLOGIC LOG - TEST BORING

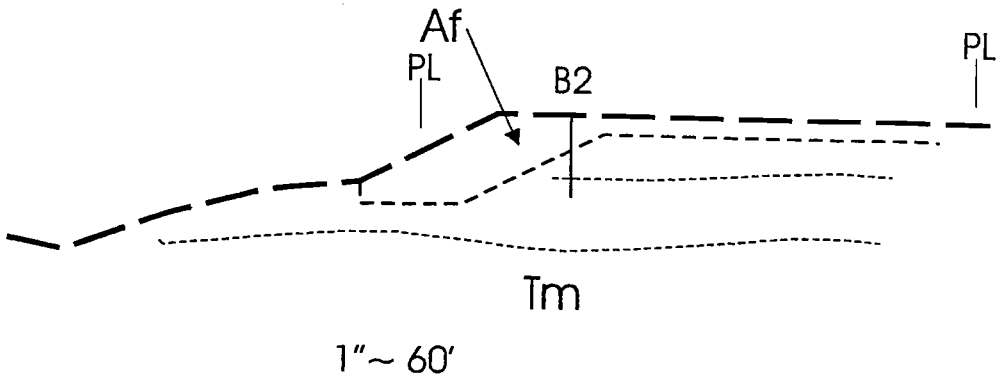
Project No.: 4007	Date: 9/9/16	Boring No.: 4
Equipment: Bucket Rig	Dimensions: 2.5'/24'	Elevation: --
Depth '	Description	Geologic Unit
0-1	Loose dry lt brn si f-m sand	Fill
1-5	Med stiff damp brn-dk brn & gray f-m sdy clay w/ rk fgs & bldrs	
5-24	Interbeds of hard damp gray brn-dk brn fractured cherty shale & gray brn siltstone -- noticeable caving - N60W75S at 6' & N60W65S at 17'	Bedrock
	Backfilled	



GEOLOGIC SKETCH MAP

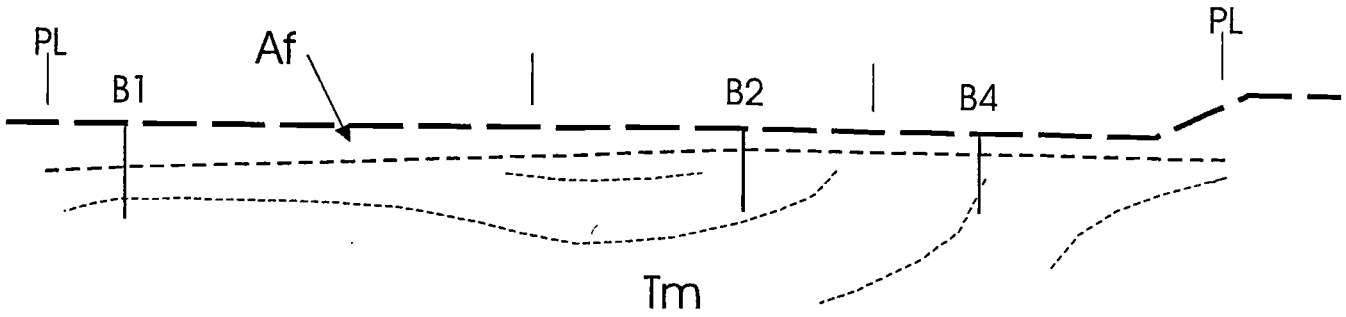


SKETCH SECTION A



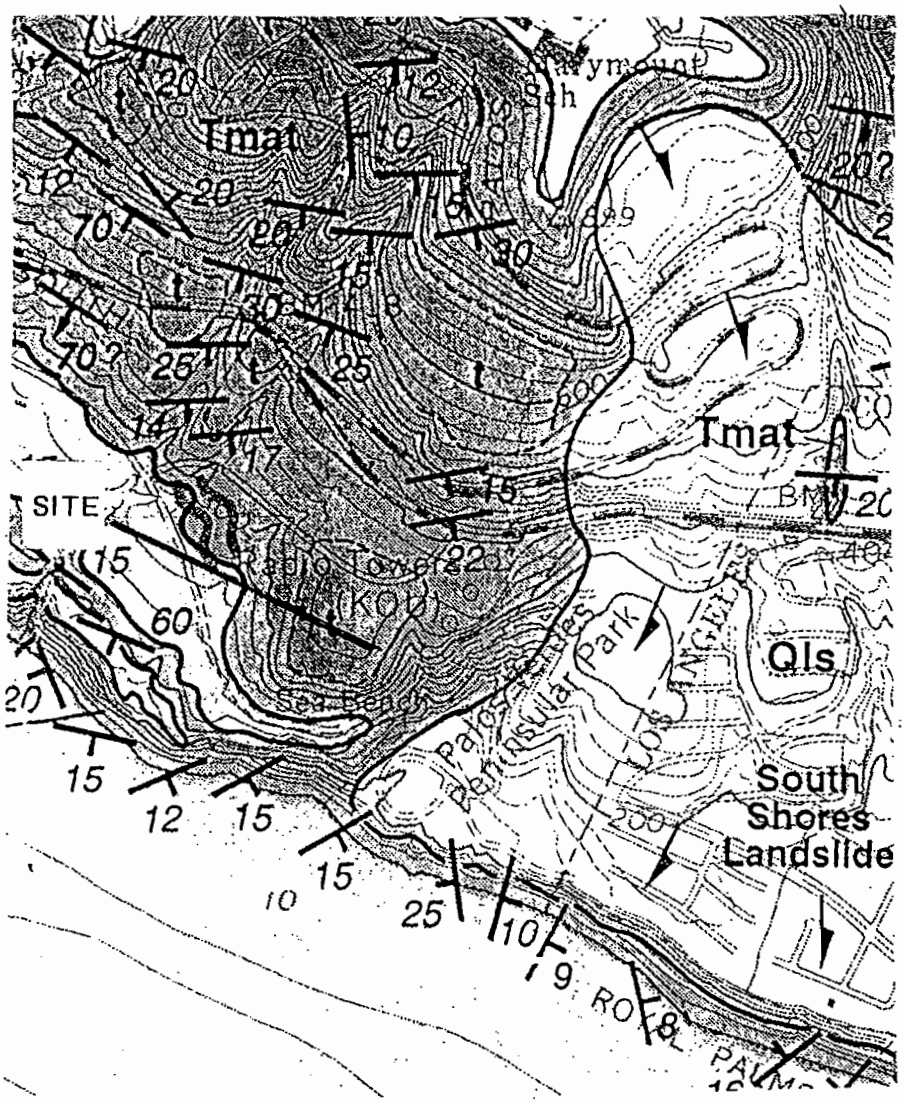
1"~ 60'

SKETCH SECTION B



1"~ 60'

SKETCH SECTION C



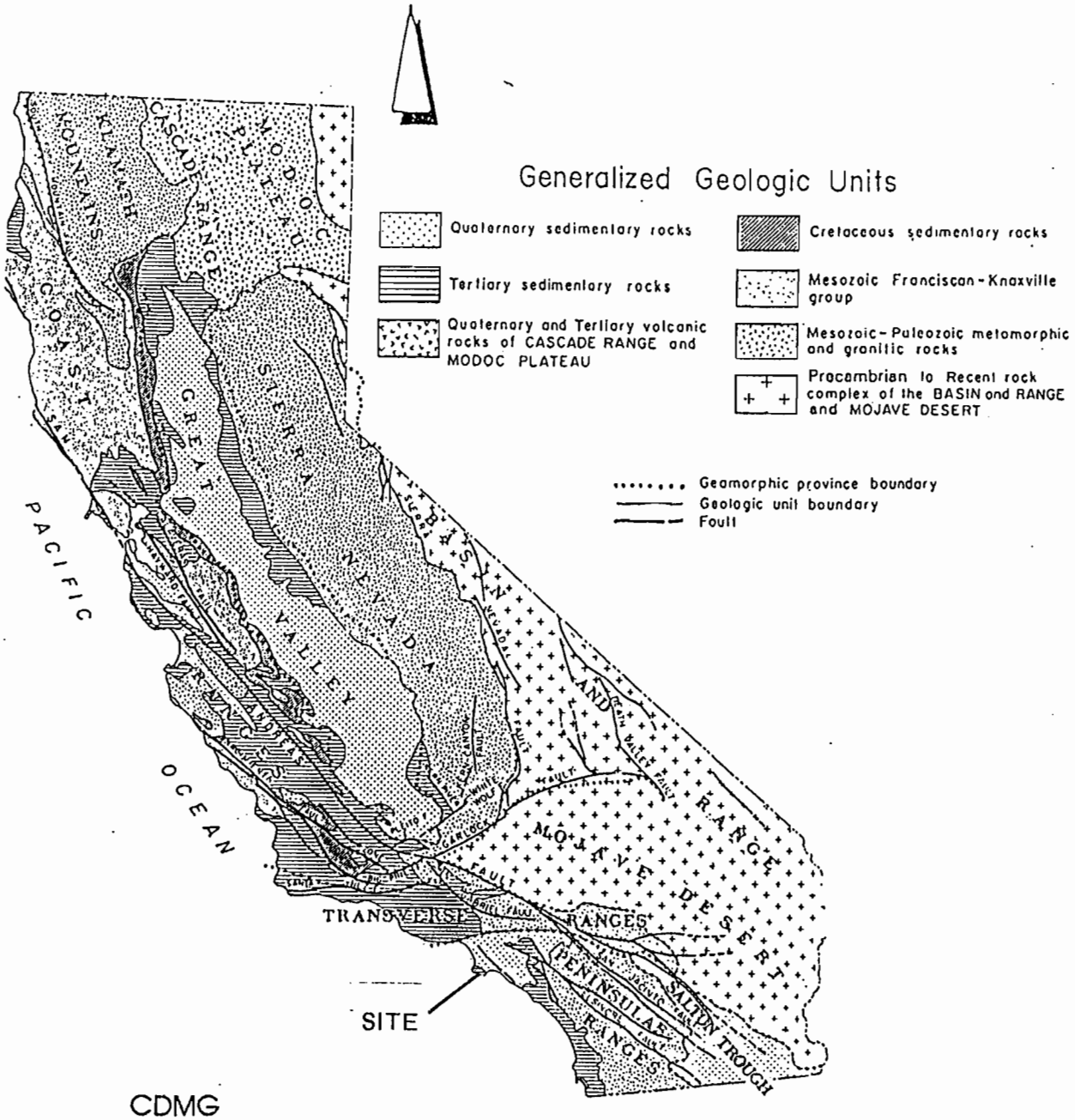
Dibblee

Tmat ***Altamira Shale - lower part:*** *mostly light gray shale and mudstone, with tuffaceous and dolomitic strata throughout,*

AREA GEOLOGIC MAP

1In ~ 1000 ft

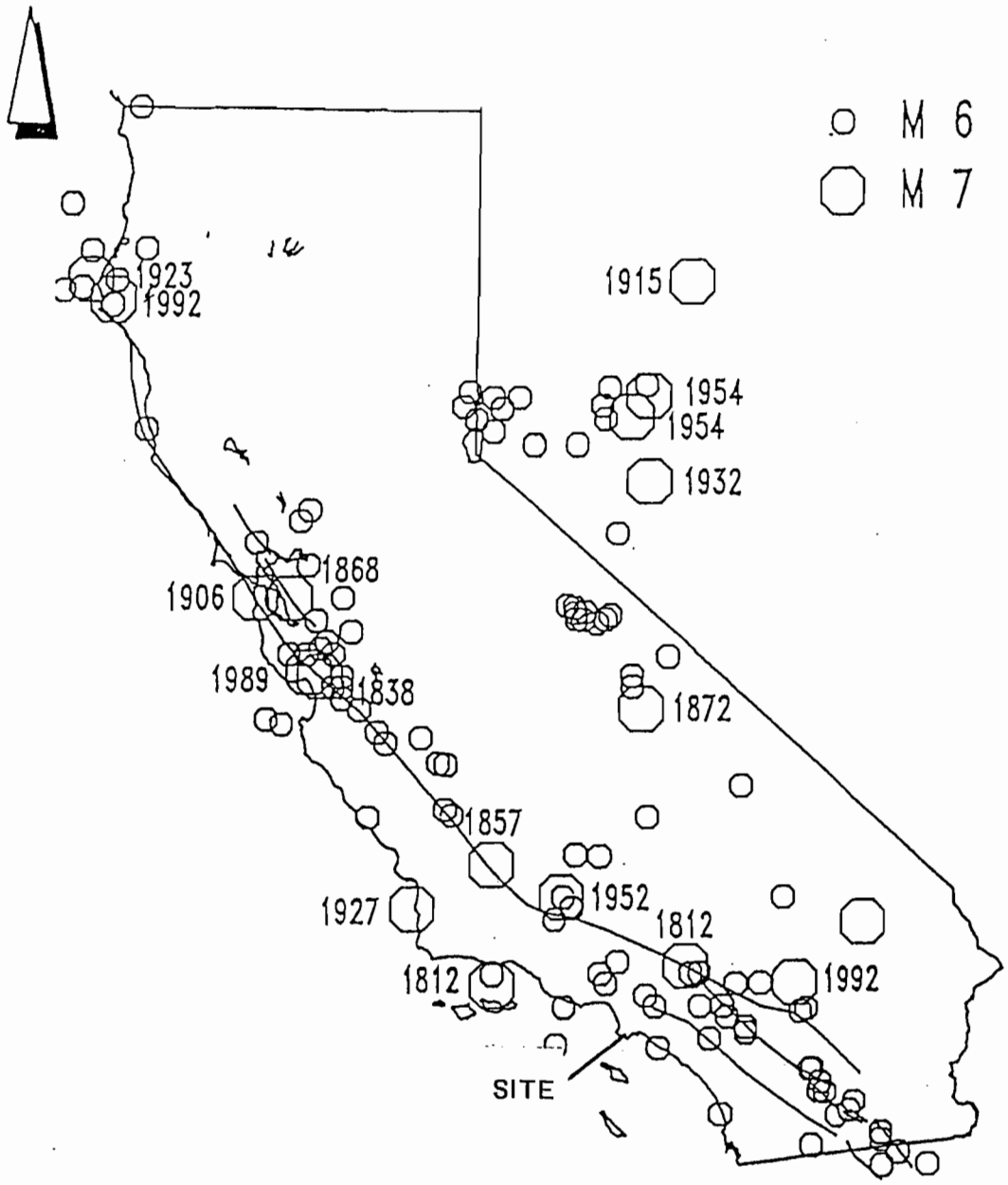
"The Geologic Outfit"



REGIONAL GEOLOGIC MAP

1 In ~ 100 mi

"The Geologic Outfit"



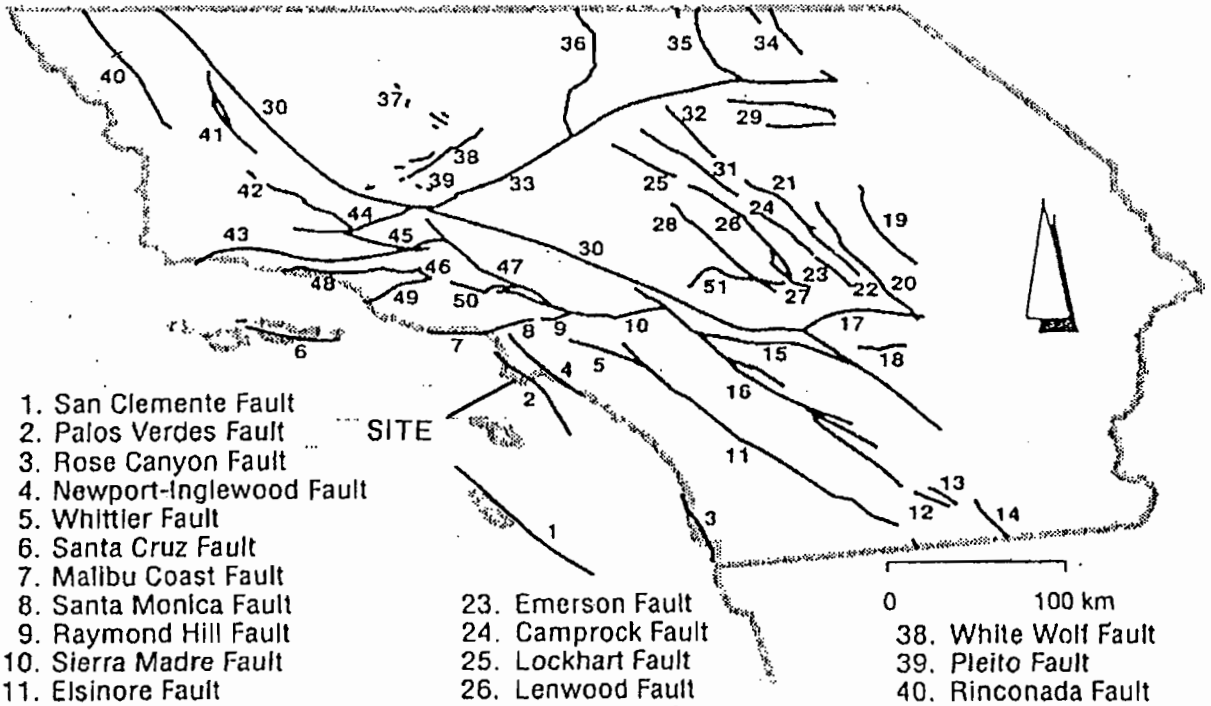
CDMG

EPICENTER MAP

1In ~ 100 ml

"The Geologic Outfit"

MAJOR ACTIVE SURFACE FAULTS IN SOUTHERN CALIFORNIA



1. San Clemente Fault
2. Palos Verdes Fault
3. Rose Canyon Fault
4. Newport-Inglewood Fault
5. Whittier Fault
6. Santa Cruz Fault
7. Malibu Coast Fault
8. Santa Monica Fault
9. Raymond Hill Fault
10. Sierra Madre Fault
11. Elsinore Fault
12. Superstition Mountain Fault
13. Superstition Hills Fault
14. Imperial Fault
15. Banning Fault
16. San Jacinto Fault
17. Pinto Mountain Fault
18. Blue Cut Fault
19. Ludlow Fault
20. Pisgah Fault
21. Calico Fault
22. West Calico Fault
23. Emerson Fault
24. Camprock Fault
25. Lockhart Fault
26. Lenwood Fault
27. Old Woman Springs
28. Helendale Fault
29. Sierra Frontal Fault
30. San Andreas Fault
31. Harper Fault
32. Blackwater Fault
33. Garlock Fault
34. So. Death Valley Fault
35. Panamint Valley Fault
36. Sierra Nevada Fault
37. Kern Front Fault
38. White Wolf Fault
39. Pleito Fault
40. Rinconada Fault
41. San Juan Fault
42. Ozena Fault
43. Santa Ynez Fault
44. Big Pine Fault
45. Pine Mountain Fault
46. San Cayetano Fault
47. San Gabriel Fault
48. Arroyo Parida Fault
49. Oakridge Fault
50. Santa Susana Fault
51. North Frontal Fault

CDMG

FAULT MAP

1 In ~ 80 mi

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