Appendix D:
Geology Supporting Information

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D.1 - Preliminary Geotechnical Exploration

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1444 WILLOW AVE
HERCULES, CALIFORNIA

PRELIMINARY GEOTECHNICAL EXPLORATION

SUBMITTED TO
Mr. Michael Conley
Claremont Homes, Inc.
380 Civic Drive, Suite C
Pleasant Hill, CA 94523

PREPARED BY
ENGEO Incorporated

November 16, 2017

PROJECT NO.
14359.000.000

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GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
14359.000.000

November 16, 2017

Mr. Michael Conley
Claremont Homes, Inc.
380 Civic Drive, Suite C
Pleasant Hill, CA 94523

Subject: 1444 Willow Ave
Hercules, California

PRELIMINARY GEOTECHNICAL EXPLORATION

Dear Mr. Conley:

As requested and as outlined in our agreement dated March 10, 2017, ENGEO Incorporated (ENGEO) prepared this preliminary geotechnical report for Claremont Homes, Inc. The accompanying report presents the findings of our review of available information, field exploration and reconnaissance mapping and recommendations regarding geologic hazards for planning purposes of the proposed improvements at the site.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

CERTIFIED ENGINEERING GEOLOGIST
PHILIP STUECHELI
No. 1640
STATE OF CALIFORNIA

Curtis E. Hall, GIT

Philip J. Stuecheli, CEG

ch/pjs/dt

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

ENGEO prepared this preliminary geotechnical report for planning purposes of 1444 Willow Ave in Hercules, California. We prepared this report as outlined in our agreement dated March 10, 2017. Michael Conley authorized ENGEO to conduct the following scope of services:

- Subsurface field exploration
- Soil laboratory testing
- Data analysis and conclusions
- Report preparation

For our use, we received a preliminary grading plan prepared by Bellecci & Associates, Inc., dated August 31, 2017, delivered electronically via email on September 21, 2017.

This report was prepared for the exclusive use of our client and their consultants. In the event that any changes are made in the character, design or layout of the development, we must be contacted to review the conclusions and recommendations contained in this report to evaluate whether modifications are recommended. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

1.2 PROJECT LOCATION

The approximately 7-acre property encompasses Assessor Parcel Numbers (APN) 406-522-001 and 406-522-004 located in Hercules, California. The subject property comprises undeveloped land located south of Willow Avenue, east of Palm Avenue and north of the BNSF railroad tracks, as shown in Figure 1.

The current topography of the site can be generally characterized by low knolls in the east and west portions of the site and a low-lying area of seasonally ponded water adjacent to the railroad tracks.

1.3 PROJECT DESCRIPTION

Based on our review of the information provided, we understand that the following site improvements are proposed:

1. Earthwork cuts and fills up to approximately 20 and 30 feet, respectively.
2. Construction of four buildings, including storage and office space.
3. Paved parking and drive lanes.
4. Utilities and other infrastructure improvements.
5. Detention basin extending approximately 5 feet below planned future grade.
6. Corrective grading to address geotechnical considerations may also be required.

2.0 FINDINGS

2.1 SITE BACKGROUND AND AERIAL PHOTOGRAPH REVIEW

The original topography of the site appears to be relatively unchanged based on our review of historic aerial photographs and topographic maps. Historic aerials dating back to 1948 show a similar landscape to the current conditions. The current BNSF railroad tracks appear to be in-place in the 1916 topographic map.

2.2 FIELD EXPLORATION

Our field exploration included excavating 11 test pits on October 12, 2017. We also performed geologic field mapping concurrently.

The location of our explorations are approximate and were estimated by pacing from features observed in the field; they should be considered accurate only to the degree implied by the method used.

2.2.1 Test Pits

We observed excavation of 11 test pits at the locations shown on the Site Plan, Figure 2. An ENGEO geologist observed the test pit excavation and logged the subsurface conditions at each location. We retained a John Deere 310J backhoe to excavate the test pits using a 3-foot-wide bucket and logged the type, location, and uniformity of the underlying soil/rock. The maximum depth penetrated by the test pits was 13½ feet.

We obtained bulk samples of both the colluvium and bedrock from select test pits using hand sampling techniques. The test pit logs present descriptions of the subsurface conditions encountered.

We used the field logs to develop the report logs in Appendix A. The logs depict subsurface conditions at the exploration locations for the date of exploration; however, subsurface conditions may vary with time.

2.2.2 Geologic Field Mapping

During our field explorations, an ENGEO geologist observed the surface conditions and visible geologic features at the site; we summarize our findings on the Site Plan, Figure 2.

2.3 GEOLOGY AND SEISMICITY

2.3.1 Regional Geology

The site is located within the Coast Ranges geomorphic province of California. The Coast Ranges have experienced a complex geological history characterized by Late Tertiary folding and faulting that has resulted in a system of northwest-trending, fault-bounded mountain ranges and intervening alluvial valleys. More specifically, the site is part of a northwest-trending ridge located southeast of San Pablo Bay.

Bedrock in the Coast Ranges comprises igneous, metamorphic and sedimentary rocks that range in age from Jurassic to Pleistocene. The present physiography and geology of the Coast Ranges are the result of deformation and deposition along the tectonic boundary between the North American plate and the Pacific plate. Plate boundary fault movements are largely concentrated along the well-known fault zones, which in the area include the San Andreas, Calaveras and Hayward faults, as well as other lesser-order faults.

2.3.2 Site Geology

According to published maps by Graymer et al. (1994) and Dibblee (1981), the site is primarily underlain by early to middle Miocene-aged sedimentary rock. The rock is described as a massive to vaguely bedded, gray, semi-siliceous shale and siltstone. The Quarternary deposits on site consist of colluvium and are primarily located in the low-lying areas.

Mapping by Nilsen (1975), as shown in Figure 5, shows landslides east of the property, but no landslides mapped within the site boundaries.

2.3.3 Geologic Mapping

During our exploration, an ENGEO geologist performed geologic mapping at the site. Below are the descriptions of the geologic units encountered during our exploration of the site.

2.3.3.1 Colluvium (Qc)

Colluvium was mapped in each of the eleven test pits. In general, the colluvium can be described as a yellowish to grayish brown, medium stiff to hard, sandy clay. In the majority of the test pits, the colluvium was ½ to 4 feet thick. In test pits 1-TP3 and 1-TP4, the colluvium extended to 13½ and 8½ feet below ground surface, respectively. The colluvium appears to have high plasticity (PI = 43).

2.3.3.2 Briones Formation, Hercules Shale Member (Tbh)

Bedrock within the site consists of a highly weathered gray shale. The rock is weak to medium strong and closely to very closely fractured. Iron oxide staining was observed in the exposed bedrock, with possible iron-hydroxide deposits observed in test pits 1-TP7 and 1-TP8. Fractures observed in the test pits tended to strike northeast with shallow to moderate dips to west. Bedding measured in test pits 1-TP1 and 1-TP6 strikes northwest and dips moderately to the east. Bedrock was not observed in test pits 1-TP3 and 1-TP4. The bedrock on site appears to have plasticity ranging from low to high (PI = 18 to 52).

2.3.4 Seismicity

The Hercules area contains numerous active earthquake faults. Nearby active faults, include the Hayward and Concord faults. An active fault is defined by the State Mining and Geology Board as one that has had surface displacement within Holocene time (about the last 11,000 years) (Bryant and Hart, 2007).

Numerous small earthquakes occur every year in the San Francisco Bay Region, and larger earthquakes have been recorded and can be expected to occur in the future. Figure 4 shows the approximate locations of these faults and significant historic earthquakes recorded within the San Francisco Bay Region.

The site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone and no known surface expression of active faults is believed to exist within the site. Fault rupture through the site, therefore, is not anticipated.

TABLE 2.3.4-1: Active Faults Capable of Producing Significant Ground Shaking at the Site

FAULT NAME	DISTANCE FROM SITE (MILES)	MAXIMUM MOMENT MAGNITUDE (ELLSWORTH)
Hayward-Rodgers Creek	5.2	7.2
Green Valley Connected	9.9	6.8
West Napa	10.5	6.7
Mount Diablo Thrust	15.1	6.7
Calaveras	19.0	6.9
Great Valley 5, Pittsburg Kirby Hills	21.0	6.7
San Andreas	23.1	7.8

The Uniform California Earthquake Rupture Forecast (UCERF3, 2014) evaluated the 30-year probability of a Moment Magnitude 6.7 or greater earthquake occurring on the known active fault systems in the Bay Area, including the Calaveras fault. The UCERF generated an overall probability of 72 percent for the Bay Area as a whole, a probability of 14.3 percent for the Hayward fault, 7.4 percent for the Calaveras fault, 6.4 for the Northern San Andreas fault, and 3.5 percent for the Concord-Green Valley fault.

2.4 GROUNDWATER CONDITIONS

We did not observe static or perched groundwater in any of our subsurface explorations. However, we did observe what appeared to be surface water inside select fractures within the bedrock in test pit 1-TP6.

Fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, and other factors not evident at the time of our exploration.

2.5 LABORATORY TESTING

We performed laboratory tests on selected soil samples to evaluate their engineering properties. A sample of the colluvium was collected from test pit 1-TP2 and a sample of the bedrock was collected from test pit 1-TP10. Additional samples of the bedrock were collected from the three locations shown on Figure 2. For this project, we performed plasticity index and hydrometer testing. Laboratory data is included in Appendix B.

3.0 CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the site is suitable for the proposed development, provided the geotechnical recommendations in this report are properly incorporated into the design plans and specifications.

The primary geotechnical concerns that could affect development on the site is expansive soil. We summarize our conclusions below.

3.1 EXPANSIVE SOIL

We observed potentially expansive fat clay and shale near the surface of the site in the 11 test pits. Our laboratory testing indicates that these soils exhibit high shrink/swell potential with variations in moisture content.

Based on our review of the grading plans, the finished grades supporting improvements are likely to be underlain by a combination of fills that will consist of mixtures of expansive surface soils and bedrock of variable plasticity, and cuts in layered bedrock with variable plasticity. It will therefore be necessary to design foundations for expansive soil conditions, as describe below. It should be expected that other improvements such as pavements and exterior concrete flatwork will be subject to seasonal expansive soil movements.

We have provided specific grading recommendations for compaction of clay soil at the site. The purpose of these recommendations is to reduce the swell potential of the clay by compacting the soil at a high moisture content and controlling the amount of compaction. Expansive soil mitigation recommendations are presented in Section 5.1 of this report.

3.2 KEYWAYS AND BENCHED FILLS

We anticipate that significant cut and fill slopes will include the construction of drained keyways and benched fills to provide proper stability of the compacted fill. We present typical recommendations for keyways, benching and subdrains in Section 5.8.2. Retain ENGEO to review the final grading plans and provide locations and layouts for fill keyways, benching, and subdrains.

3.3 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, and ground lurching. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift, soil liquefaction, lateral spreading, landslides, tsunamis, flooding or seiches is considered low to negligible at the site.

3.3.1 Ground Rupture

Since there are no known active faults crossing the property and the site is not located within an Earthquake Fault Special Study Zone, it is our opinion that ground rupture is unlikely at the subject property.

3.3.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, structures should be designed using sound engineering judgment and the 2013 California Building Code (CBC) requirements, as a minimum. Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead-and-live loads. The code_prescribed lateral forces are generally considered to be substantially smaller than the comparable forces that would be associated with a major earthquake. Therefore, structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage but with some nonstructural damage, and (3) resist major earthquakes without collapse but with some structural as well as nonstructural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

3.4 2013 CBC SEISMIC DESIGN PARAMETERS

The 2013 CBC utilizes design criteria set forth in the 2010 ASCE 7 Standard. Based on the subsurface conditions encountered, we characterized the site as Site Class D in accordance with the 2013 CBC. We provide the 2013 CBC seismic design parameters in Table 3.4-1 below, which include design spectral response acceleration parameters based on the mapped Risk Targeted Maximum Considered Earthquake (MCER) spectral response acceleration parameters.

TABLE 3.4-1: 2013 CBC Seismic Design Parameters, Latitude: 38.012255° **Longitude:** -122.256465°

PARAMETER	VALUE
Site Class	D
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	1.50
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.60
Site Coefficient, F_A	1.00
Site Coefficient, F_V	1.50
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	1.50
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	0.90
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	1.00
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	0.60
Mapped MCE Geometric Mean (MCE_G) Peak Ground Acceleration, PGA (g)	0.55
Site Coefficient, F_{PGA}	1.00
MCE_G Peak Ground Acceleration adjusted for Site Class effects, PGA_M (g)	0.55
Long period transition-period, T_L	8 sec

4.0 CONSTRUCTION MONITORING

Our experience and that of our profession clearly indicate that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to:

1. Review the final grading and foundation plans and specifications prior to construction to evaluate whether our recommendations have been implemented, and to provide additional or modified recommendations, as needed. This also allows us to check if any changes have occurred in the nature, design or location of the proposed improvements and provides the opportunity to prepare a written response with updated recommendations.

2. Perform construction monitoring to check the validity of the assumptions we made to prepare this report. Earthwork operations should be performed under the observation of our representative to check that the site is properly prepared, the selected fill materials are

satisfactory, and that placement and compaction of the fills has been performed in accordance with our recommendations and the project specifications. Sufficient notification to us prior to earthwork is important.

If we are not retained to perform the services described above, then we are not responsible for any party's interpretation of our report (and subsequent addenda, letters, and verbal discussions).

5.0 EARTHWORK RECOMMENDATIONS

The relative compaction and optimum moisture content of soil referred to in this report are based on the most recent ASTM D1557 test method. Compacted soil is not acceptable if it is unstable. It should exhibit only minimal flexing or pumping, as observed by an ENGEO representative.

As used in this report, the term "moisture condition" refers to adjusting the moisture content of the soil by either drying if too wet or adding water if too dry.

5.1 GENERAL SITE CLEARING

Areas to be developed should be cleared of surface and subsurface deleterious materials, including buried utility and irrigation lines, debris, and designated trees, shrubs, and associated roots. Clean and backfill excavations extending below the planned finished site grades with suitable material compacted to the recommendations presented in Section 5.7. Retain ENGEO to observe and test backfilling.

Following clearing, strip the site to remove surface organic materials. Strip organics from the ground surface to a depth of at least 2 to 3 inches below the surface. Remove strippings from the site or, if considered suitable by the landscape architect and owner, use them in landscape fill.

5.2 CUT/FILL TRANSITION OR CUT LOTS

Building pads constructed in cuts may encounter variably expansive subsurface conditions in the near-surface soil and rock; these pads may therefore be subject to damaging differential soil movements. Building pads that transition from cut to fill within the building pad area also can experience differential soil movements.

We recommend such building pads be reconstructed to create uniform subgrade conditions. This can be accomplished by subexcavating the soil on the building pads to a minimum depth of 3 feet below finished pad grade on cut lots or lots constructed over cut-and-fill transitions and replacing the subexcavated material with uniformly mixed compacted fill. The subexcavation should be performed over the entire flat pad area. Compacted fill used to replace subexcavated soil should be placed in accordance with Section 5.7.

5.3 DIFFERENTIAL FILL THICKNESS

Differential building movements may result from conditions where building pads have significant differentials in fill thickness. We recommend that the differential fill thickness across any lot be no greater than 10 feet. Local subexcavation of soil material and replacement with compacted fill may be needed to achieve this recommendation.

5.4 OVER-OPTIMUM SOIL MOISTURE CONDITIONS

The contractor should anticipate encountering excessively over-optimum (wet) soil moisture conditions during winter or spring grading, or during or following periods of rain. In addition, wet soil conditions may be found around the seasonal pond along the southern site boundary. Wet soil can make proper compaction difficult or impossible. Wet soil conditions can be mitigated by:

1. Frequent spreading and mixing during warm dry weather.
2. Mixing with drier materials.
3. Mixing with a lime, lime-flyash, or cement product; or
4. Stabilizing with aggregate, geotextile stabilization fabric, or both.

Options 3 and 4 should be evaluated by ENGEO prior to implementation.

5.5 ACCEPTABLE FILL

Onsite soil and rock material is suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 8 inches in maximum dimension.

Fill within 2 feet of finished grade in building pad areas should not contain significant concentrations of clay, as evaluated by an ENGEO field representative.

Imported fill materials should meet the above requirements and have a plasticity index less than 12, and at least 20 percent passing the No. 200 sieve. Allow ENGEO to sample and test proposed imported fill materials at least 5 days prior to delivery to the site.

5.6 FILL COMPACTION

The following compaction control requirements should be anticipated for general fill areas such as slopes, roadways and parking areas:

Test Procedures:	ASTM D-1557.
Required Moisture Content:	Not less than 4 percentage points above optimum moisture content.
Minimum Relative Compaction:	Not less than 90 percent.

In order to reduce the effects of expansive soils in building pad areas, we recommend the following compaction specifications for building pads.

Test Procedures:	ASTM D-1557.
Required Moisture Content:	Not less than 5 percentage points above optimum moisture content.
Minimum Relative Compaction:	Not less than 87 percent and not greater than 92 percent.

Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same material. Additional compaction requirements may be required that will be developed during our design-level exploration.

5.7 ALTERNATIVE EXPANSIVE SOIL MITIGATION

If it is desired to reduce the effects of expansive soils on building foundation and improvements, you could consider the following alternatives.

- Construct the upper 24 inches of the building pads extending at least 10 feet laterally beyond building areas with selected fill derived from excavations in lower plasticity bedrock. Due to the distribution of expansive materials on site, selective grading may be difficult to perform. Alternatively, building pads could be constructed with imported non-expansive fil.

- Lime treat the upper 24 inches of the building pad to reduce the expansion potential of the onsite soil.

5.8 SLOPES

5.8.1 Gradients

The proposed grading plans depict finished slopes around the project perimeter inclined at 2:1 (horizontal:vertical). As noted above, the site soils and bedrock include high plasticity materials. It should be expected that slopes inclined at 2:1 will be subject to surface creep and that improvements located at the tops of slopes could be subject to minor lateral movements. The effects of surficial slope creep can be reduced by selectively constructing the outer 15 feet of slope faces with selected lower plasticity bedrock derived cut materials. Alternatively, the upper potions of the slope adjacent to improvements could be reinforced with geogrid reinforcement layers.

5.8.2 Fill Placed on Existing Slopes

We recommend keying and benching where fills are placed on original grade with a gradient of 6:1 or steeper.

Construct a minimum 25-foot-wide key inward from the toe of the new fill slope. Extend the key at least 5 feet below original grade or into firm competent soil/rock whichever is deeper. The actual keyway depth should be evaluated in the field by ENGEO. Slope the key bottom at least 2 percent downward toward the heel of the key.

Cut benches into original grade after the key has been nearly filled and compacted in accordance with Section 5.7. Construct benches into original slope grade as filling proceeds every 2 feet vertically, to remove loose soil/rock. Deeper bench depths may be recommended by ENGEO depending on actual conditions observed during construction. Bench widths may vary depending on the original slope grade and actual bench depth. Keyway and bench subdrain alternatives are presented on Figure 6.

5.9 STORMWATER BIORETENTION AREAS

We understand that a bioretention area is to be implemented. We recommend that, when practical, it be located a minimum of 5 feet away from structural site improvements, such as buildings, streets, retaining walls, and sidewalks/driveways. When this is not practical, bioretention areas located within 5 feet of structural site improvements can either:

1. Be constructed with structural side walls capable of withstanding the loads from the adjacent improvements, or

2. Incorporate filter material compacted to between 85 and 90~percent relative compaction (ASTM D1557, latest edition) and a waterproofing system designed to reduce the potential for moisture transmission into the subgrade soil beneath the adjacent improvement.

In addition, one of the following options should be followed.

1. We recommend that bioretention design incorporate a waterproofing system lining the bioswale excavation and a subdrain, or other storm drain system, to collect and convey water to an approved outlet. The waterproofing system should cover the bioretention area excavation in such a manner as to reduce the potential for moisture transmission beneath the adjacent improvements.

2. Alternatively, and with some risk of movement of adjacent improvements, if infiltration is desired, we recommend the perimeter of the bioretention areas be lined with an HDPE tree root barrier that extends at least 1 foot below the bottom of the bioretention areas/infiltration trenches.

Site improvements located adjacent to bioretention areas that are underlain by base rock, sand, or other imported granular materials, should be designed with a deepened edge that extends to the bottom of the imported material underlying the improvement.

Where adjacent site improvements include buildings greater than three stories, streets steeper than 3 percent, or design elements subject to lateral loads (such as from impact or traffic patterns), additional design considerations may be recommended. If the surface of the bioretention area is depressed, the slope gradient should follow the slope guidelines described in earlier section(s) of this document. In addition, although not recommended, if trees are to be planted within bioretention areas, HDPE Tree Boxes that extend below the bottom of the bioretention system should be installed to reduce potential impact to subdrain systems that may be part of the bioretention area design. For this condition, the waterproofing system should be connected to the HPDE Tree Box with a waterproof seal.

Given the nature of bioretention systems and possible proximity to improvements, we recommend ENGEO be retained to review design plans and provide testing and observation services during the installation of linings, compaction of the filter material, and connection of designed drains.

It should be noted that the contractor is responsible for conducting all excavation and shoring in a manner that does not cause damage to adjacent improvements during construction and future maintenance of the bioretention areas. As with any excavation adjacent to improvements, the contractor should reduce the exposure time such that the improvements are not detrimentally impacted.

5.10 REMEDIAL GRADING PLANS

Due to the complex geology and hillside topography, we recommend that ENGEO be retained to prepare remedial grading plans for this project. This is important to clarify our geotechnical recommendations related to keyways, benches, cut/fill transition subexcavations, and subdrains. In preparing these plans, we intend to overlay the grading plans with graphic representations of our grading and subsurface drainage recommendations presented in this report. This allows the unique hillside geotechnical recommendations to be clearly displayed on the grading plans. This can assist in obtaining more accurate earthwork bids as well as clarifying the geotechnical recommendations as they apply to the final grading plan.

6.0 FOUNDATION RECOMMENDATIONS

In order to reduce the effects of potentially expansive soils, the foundations should be sufficiently stiff to move as rigid units with minimum differential movements. This can be accomplished with construction of relatively rigid mat foundations, such as post-tensioned structural mats.

A minimum mat thickness of 10 inches should be anticipated for preliminary purposes. We anticipate that structural mats constructed on swelling soils will move differentially; therefore, structural mats may require stiffening to reduce differential movements due to swelling/shrinkage to a value compatible with the type of structure that will be constructed. Further foundation design recommendations will be developed in a design-level geotechnical report.

7.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1.3 for the 1444 Willow Ave project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strived to perform our professional services in accordance with generally accepted geotechnical engineering principles and practices currently employed in the area; no warranty is expressed or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data is representative of the actual subsurface conditions across the site. Considering possible underground variability of soil, rock, stockpiled material, and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, notify ENGEO immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include excavation sloping or shoring, soil volume change factors, flood potential, or a geohazard exploration. In addition, our geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, notify the proper regulatory officials immediately.

This document must not be subject to unauthorized reuse, that is, reusing without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

Actual field or other conditions will necessitate clarifications, adjustments, modifications or other changes to ENGEO's documents. Therefore, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications or other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, rock, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

SELECTED REFERENCES

Bryant, W. and Hart, E. (2007). Special Publication 42, “Fault-Rupture Hazard Zones in California”, Interim Revision 2007, California Department of Conservation.

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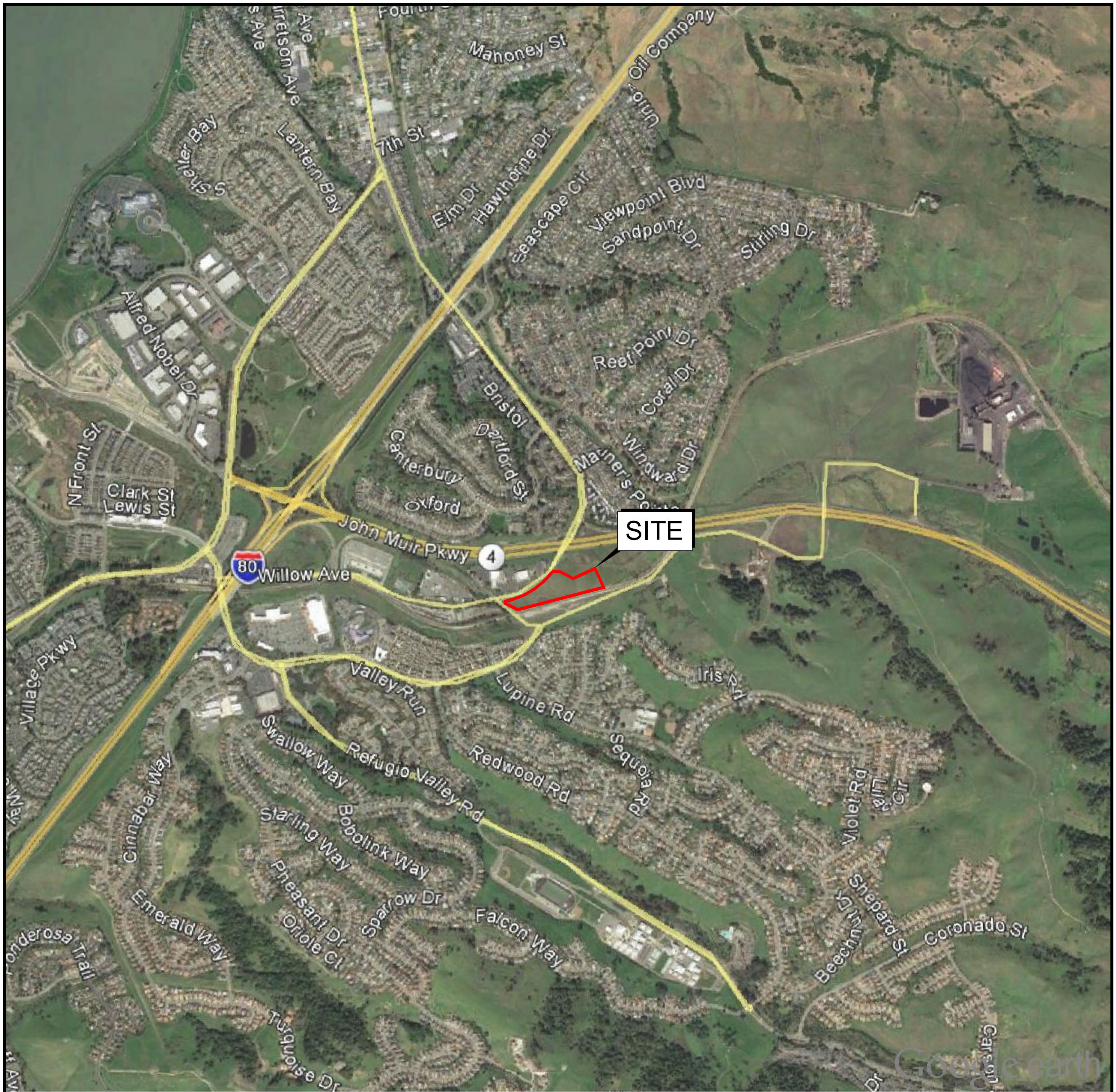
FIGURES



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BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE

ENGEO Expect Excellence	VICINITY MAP 1444 WILLOW AVENUE HERCULES, CALIFORNIA	PROJECT NO.: 14359.000.000 SCALE: AS SHOWN DRAWN BY: SRP CHECKED BY: PJS	FIGURE NO. 1

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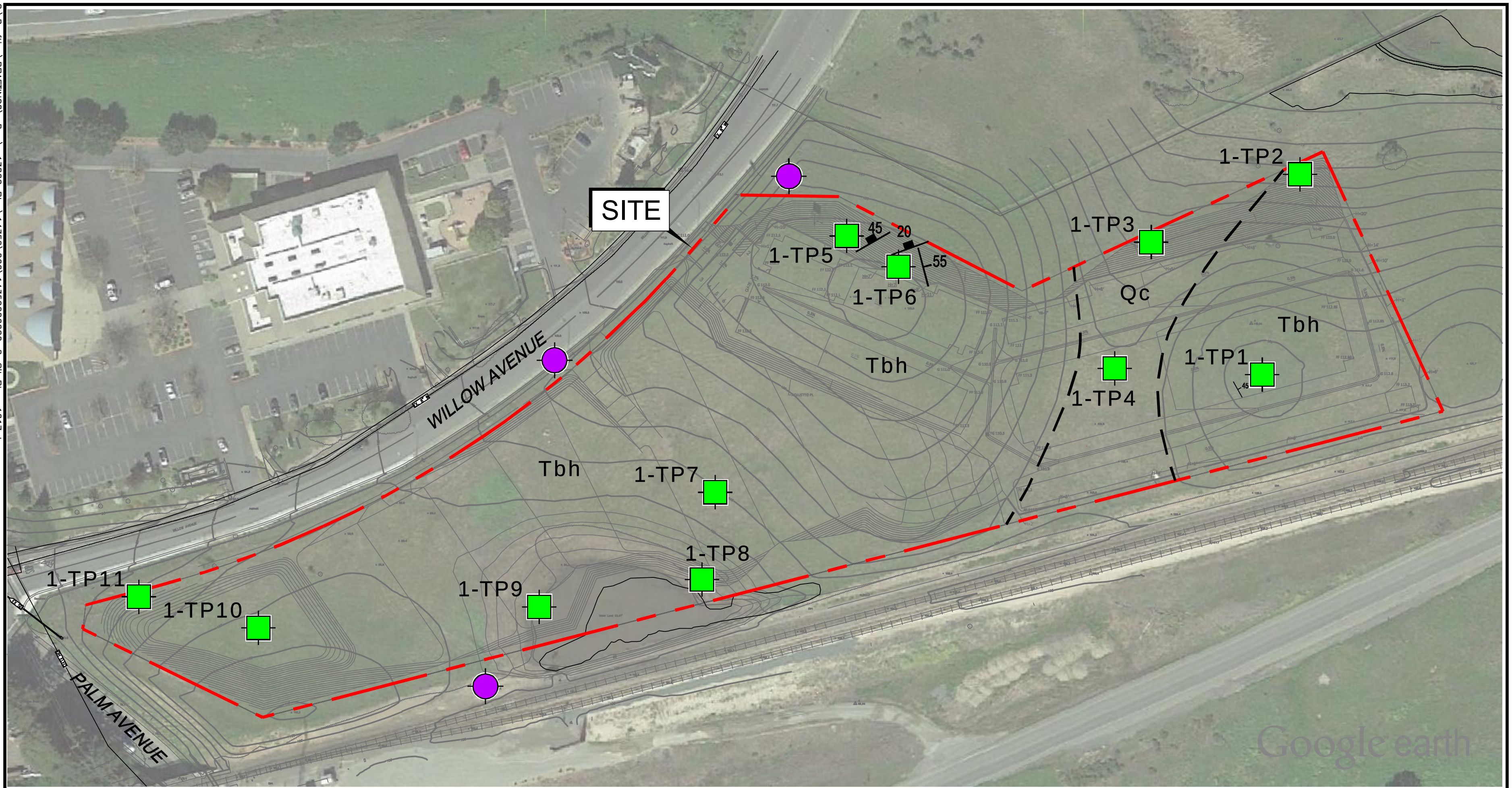


EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

1-TP11 TEST PIT (ENGEO, 2017)

SAMPLE (ENGEO, 2017)

Qc COLLUVIUM

Tbh BRIONES FORMATION HERCULES

45 FRACTURE

55 STRIKE AND DIP OF BEDDING

GEOLOGIC CONTACT

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE, UNKNOWN

N

0 FEET 150

0 METERS 75

ENGEO Expect Excellence

SITE PLAN

1444 WILLOW AVENUE

HERCULES, CALIFORNIA

PROJECT NO.: 14359.000.000

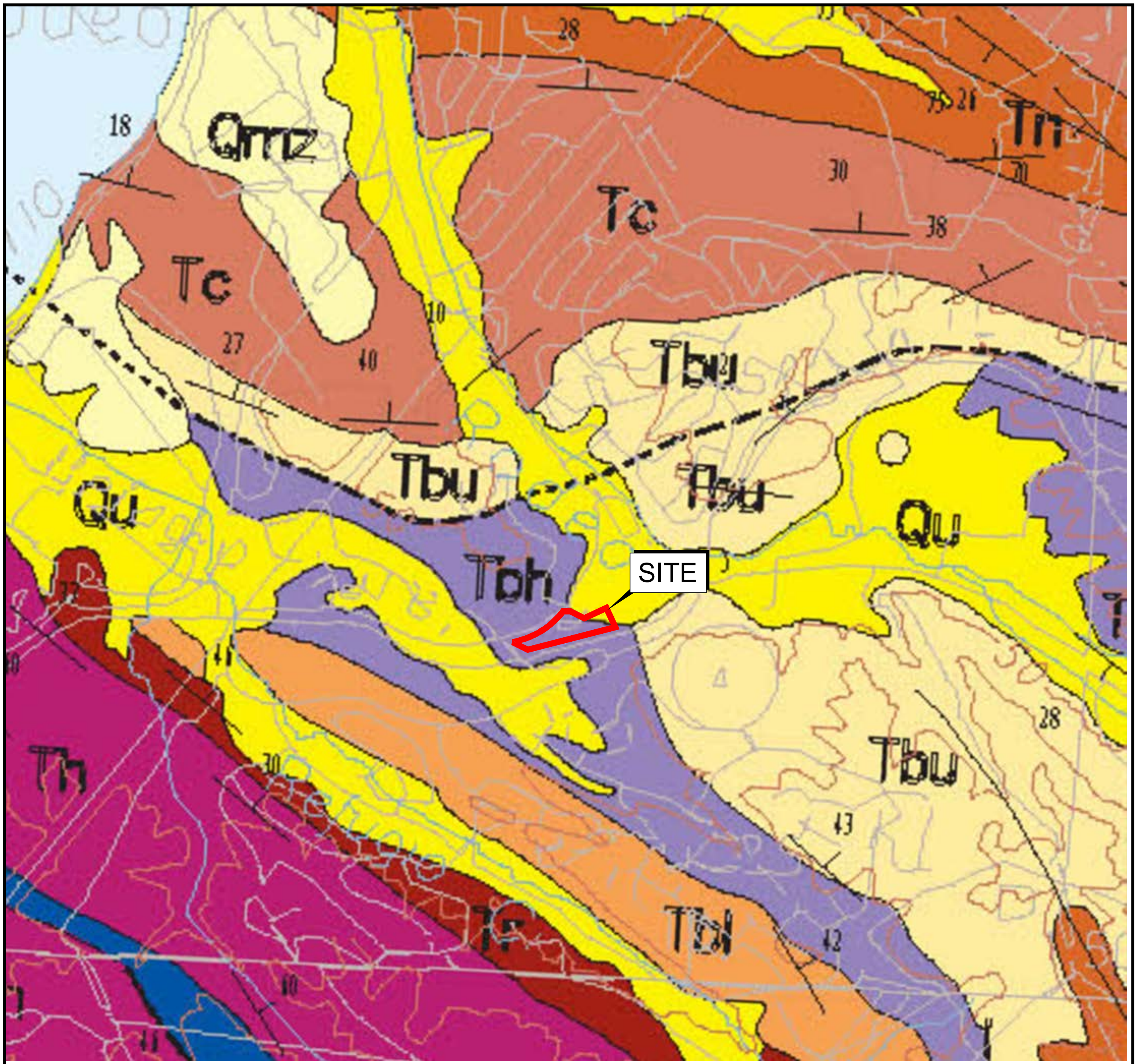
SCALE: AS SHOWN

DRAWN BY: SRP

CHECKED BY: PJS

FIGURE NO. 2

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

GEOLOGIC CONTACT-DASHED WHERE GRADATIONAL OR APPROXIMATELY LOCATED

FAULT-DASHED WHERE INFERRED, DOTTED WHERE CONCEALED, QUERIED WHERE EXISTENCE IS DOUBTFUL. SAWTEETH ARE ON UPPER PLATE OF LOW ANGLE THRUST FAULT

STRIKE AND DIP OF STRATA

INCLINED

Qu	UNDIVIDED QUATERNARY DEPOSITS
Qmz	MONTEZUMA FORMATION
Tn	NEROLY FORMATION
Tc	CIERBO FORMATION
Th	HAMBRE SANDSTONE
Tbu	UPPER BRIONES FORMATION SANDSTONE
Tbh	BRIONES FORMATION HERCULES SHALE MEMBER

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: GRAYMER, 1994

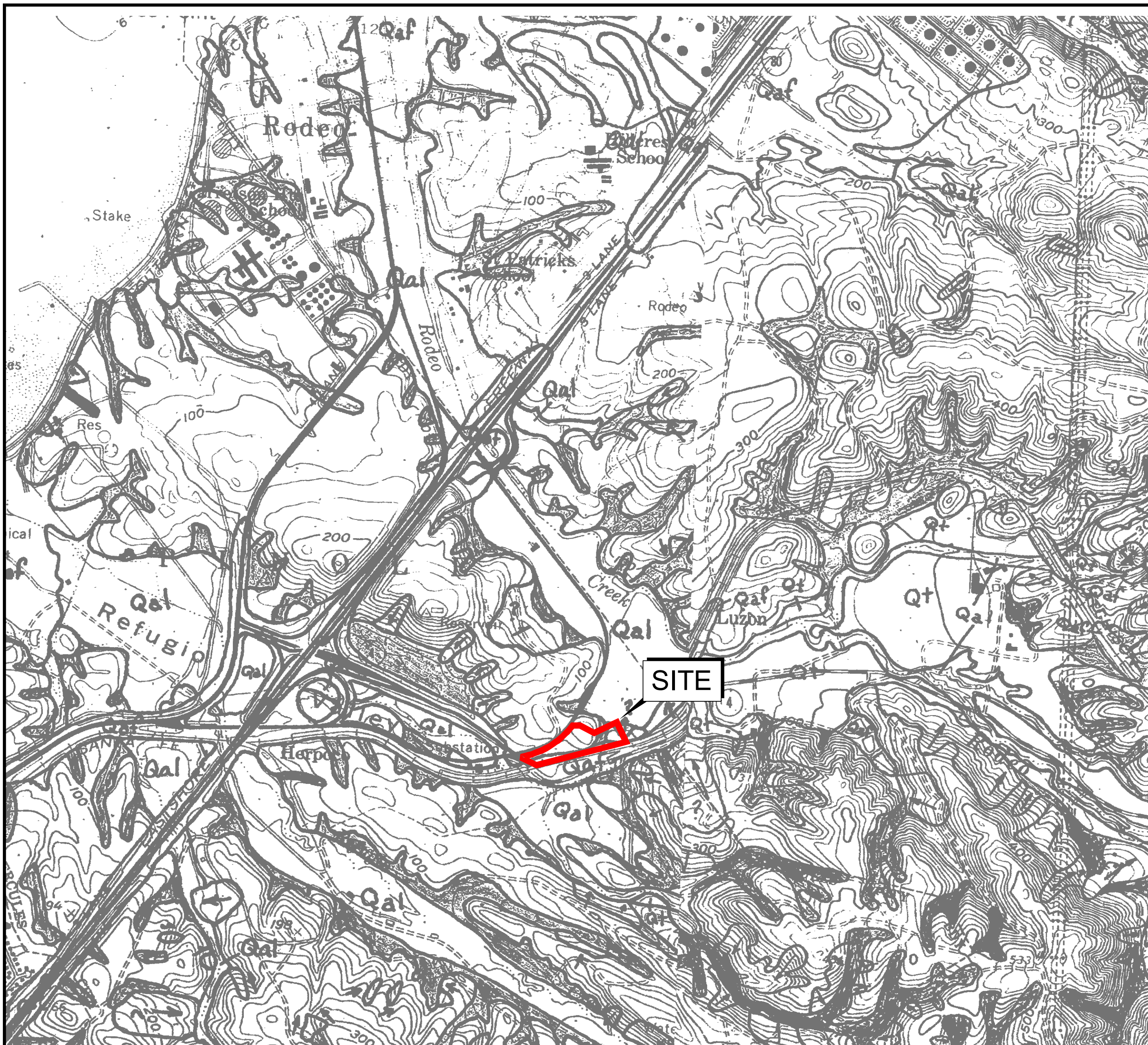
ENGEO
Expect Excellence

REGIONAL GEOLOGIC MAP
1444 WILLOW AVENUE
HERCULES, CALIFORNIA

PROJECT NO.: 14359.000.000
SCALE: AS SHOWN
DRAWN BY: SRP
CHECKED BY: PJS
FIGURE NO. 3

G:\Drafting\DRAFTING2_Dwg_13000 Plus\14359\000\14359000000-3-GeologicMap1017.dwg Plot Date: 10-31-17 spatters

ORIGINAL FIGURE PRINTED IN COLOR



EXPLANATION

	LANDSLIDE DEPOSIT. ARROWS INDICATE GENERAL DIRECTION OF DOWNSLOPE MOVEMENT. QUERIED WHERE UNCERTAIN
Qal	ALLUVIAL DEPOSIT
Qt	ALLUVIAL TERRACE DEPOSIT. QUERIED WHERE UNCERTAIN
	COLLUVIAL DEPOSIT AND/OR SMALL ALLUVIAL FAN DEPOSIT
Qaf	ARTIFICIAL FILL
	BEDROCK. QUERIED WHERE IDENTIFICATION UNCERTAIN

N

0 FEET 2000
0 METERS 1000

BASE MAP SOURCE: NILSEN, 1975

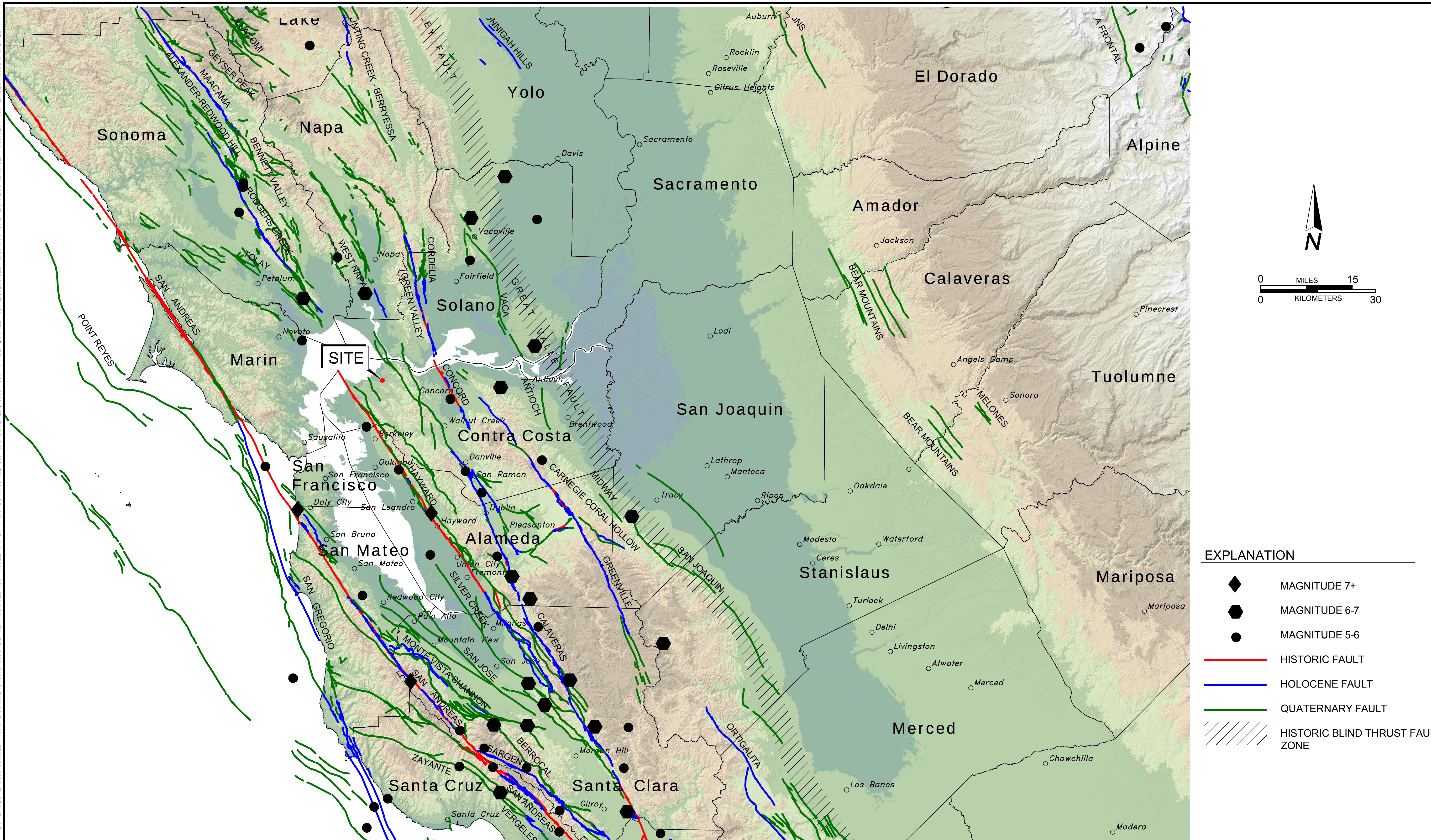
ENGEO
Expect Excellence

REGIONAL LANDSLIDE MAP
1444 WILLOW AVENUE
HERCULES, CALIFORNIA

PROJECT NO.: 14359.000.000
SCALE: AS SHOWN
DRAWN BY: SRP | CHECKED BY: PJS
FIGURE NO. 4

G:\Drafting\DRAFTING2_Dwg_13000 Plus\14359\000\14359000000-4-LandslideMap1017.dwg Plot Date: 10-31-17 spatters

ORIGINAL FIGURE PRINTED IN COLOR



BASE MAP SOURCE:
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATASET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, NOVEMBER, 2010
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800–2000)

ENGEO Expect Excellence	REGIONAL FAULTING AND SEISMICITY 1444 WILLOW AVENUE HERCULES, CALIFORNIA	PROJECT NO.: 14359.000.000 SCALE: AS SHOWN DRAWN BY: SRP / CHECKED BY: PJS	FIGURE NO. 5

ORIGINAL FIGURE PRINTED IN COLOR

G:\Drafting\DRAFTING2_Dwg_13000 Plus\14359\000\14359000000-5-FaultMap1017.dwg Plot Date: 10-31-17 spatters

APPENDIX A

EXPLORATION LOGS

ENGEO Expect Excellence		# TEST PIT LOGS
Hercules Storage Geotechnical Exploration Hercules, California 14359.000.000		Logged By: C. Hall Logged Date: September 14, 2017 Equipment: Deere 310J Backhoe with 3-foot Bucket
Test Pit Number	Depth (Feet)	Description
1-TP1		Latitude: 38.012363 Longitude: -122.25577
	0 - 1	Sandy CLAY (CL), light grayish brown, medium stiff, dry, desiccation cracks (Qc)
	1 - 2	CLAY (CH), dark grayish brown, stiff, moist, mottled reddish brown, trace gravels (Qc)
	2 - 4	SHALE, gray, weak to medium strong, moderately to highly weathered, very closely fractured, reddish-brown iron oxide staining on fracture surfaces (Bedrock)
		Bedding(?) 330/45
		Total depth 4 feet below ground surface, no free groundwater encountered
1-TP2		Latitude: 38.012877 Longitude: -122.255453
	0 - 1½	Sandy CLAY (CL), dark brown, stiff, dry to moist, rootlets, worm burrows (Qc)
	1½ - 3½	CLAY (CH), dark brown, stiff to very stiff, very moist, trace fine gravels, reddish brown iron oxide staining at base of unit (Qc)
	3½ - 6	SHALE, gray, weak to medium strong, moderately to highly weathered, very closely fractured, some reddish brown iron oxide staining on fracture surfaces (Bedrock)
		Total depth 6 feet below ground surface, no free groundwater encountered

ENGEO Expect Excellence	TEST PIT LOGS	
Hercules Storage Geotechnical Exploration Hercules, California 14359.000.000	Logged By: C. Hall Logged Date: September 14, 2017 Equipment: Deere 310J Backhoe with 3-foot Bucket	

Test Pit Number	Depth (Feet)	Description
1-TP3		Latitude: 38.012681 Longitude: -122.255945
	0 - 1	CLAY (CL), light yellowish brown, medium stiff, dry, animal burrows (Qc)
	1 - 13½	CLAY (CH), dark yellowish brown, stiff to hard, moist, trace gravels (Qc)
		Total depth 13½ feet below ground surface, no free groundwater encountered
1-TP4		Latitude: 38.012353 Longitude: -122.256074
	0 - 1	Sandy CLAY (CL), light grayish brown, medium stiff, dry (Qc)
	1 - 3	CLAY (CH), dark brown, medium stiff, moist (Qc)
	3 - 8½	CLAY (CH), dark yellowish brown, very stiff to hard, moist (Qc)
		Total depth 8½ feet below ground surface, no free groundwater encountered
1-TP5		Latitude: 38.012643 Longitude: -122.256967
	0 - 1	Sandy CLAY (CL), light grayish brown, medium stiff, dry, rootlets (Qc)
	1 - 4	SHALE, gray, highly weathered, weak, very closely fractured, reddish brown iron oxide staining (Bedrock)
		Fractures 240/45
		Total depth 5 feet below ground surface, no free groundwater encountered

ENGEO Expect Excellence		TEST PIT LOGS
Hercules Storage Geotechnical Exploration Hercules, California 14359.000.000		Logged By: C. Hall Logged Date: September 14, 2017 Equipment: Deere 310J Backhoe with 3-foot Bucket
Test Pit Number	Depth (Feet)	Description
1-TP6		Latitude: 38.012575 Longitude: -122.256815
	0 - ½	Sandy CLAY (CL), light grayish brown, medium stiff, dry, rootlets, trace gravel (Qc)
	½ - 5	SHALE, gray, weak to medium strong, moderately to highly weathered, reddish brown iron oxide staining, very closely to closely fractured, fractures wet at approximately 4 feet (Bedrock)
		Fractures 250/20 Bedding(?) 345/55
		Total depth 5 feet below ground surface, no free groundwater encountered
1-TP7		Latitude: 38.011982 Longitude: -122.257384
	0 - 1½	Sandy CLAY (CL), light grayish brown, medium stiff, dry (Qc)
	1½ - 2	Sandy CLAY (CL), dark grayish brown, very stiff, moist, rootlets (Qc)
	2 - 4	CLAY (CH), dark yellowish brown, very stiff, moist, trace fine gravels (Qc)
	4 - 6	SHALE, dark reddish brown, weak to very weak, highly weathered, very closely fractured to crushed, reddish yellow iron oxide staining on fracture surfaces, yellow iron hydroxide deposits on fracture surfaces starting at 6 feet bgs (Bedrock)
		Total depth 6 feet below ground surface, no free groundwater encountered

ENGEO Expect Excellence	**TEST PIT LOGS**	
Hercules Storage Geotechnical Exploration Hercules, California 14359.000.000		Logged By: C. Hall Logged Date: September 14, 2017 Equipment: Deere 310J Backhoe with 3-foot Bucket
Test Pit Number	**Depth (Feet)**	**Description**
1-TP8		Latitude: 38.011716 Longitude: -122.257438
	0 - 2½	Sandy CLAY (CL), light yellow brown, soft to medium stiff, dry, rootlets (Qc)
	2½ - 4	CLAY (CH), yellowish brown, very stiff, moist (Qc)
	4 - 6½	SHALE, dark gray to dark reddish brown, moderately to highly weathered, weak, crushed in upper 6 inches, very closely spaced horizontal fractures below, yellow iron hydroxide deposits on fracture surfaces starting at approximately 6 feet bgs (Bedrock)
		Total depth 6½ feet below ground surface, no free groundwater encountered
1-TP9		Latitude: 38.011646 Longitude: -122.258092
	0 - 2	Sandy CLAY (CL), light grayish brown, soft to medium stiff, dry, trace reddish yellow iron oxide staining, rootlets (Qc)
	2 - 3½	CLAY (CH), dark yellowish brown, very stiff, moist (Qc)
	3½ - 5	SHALE, dark gray to dark reddish brown, very weak to weak, highly weathered, crushed in upper 3 inches, very closely spaced horizontal fractures below (Bedrock)
		Total depth 5 feet below ground surface, no free groundwater encountered
1-TP10		Latitude: 38.011560 Longitude: -122.258950
	0 - 1½	Sandy CLAY (CL), light grayish brown to black, dry to moist, stiff (Qc)
	1½ - 3	SHALE, gray to dark gray, medium strong, slightly weathered, very closely fractured, reddish brown iron oxide staining on fracture surfaces (Bedrock)
		Total depth 3 feet below ground surface, no free groundwater encountered

Expect Excellence	# TEST PIT LOGS	
Hercules Storage Geotechnical Exploration Hercules, California 14359.000.000	Logged By: C. Hall Logged Date: September 14, 2017 Equipment: Deere 310J Backhoe with 3-foot Bucket	

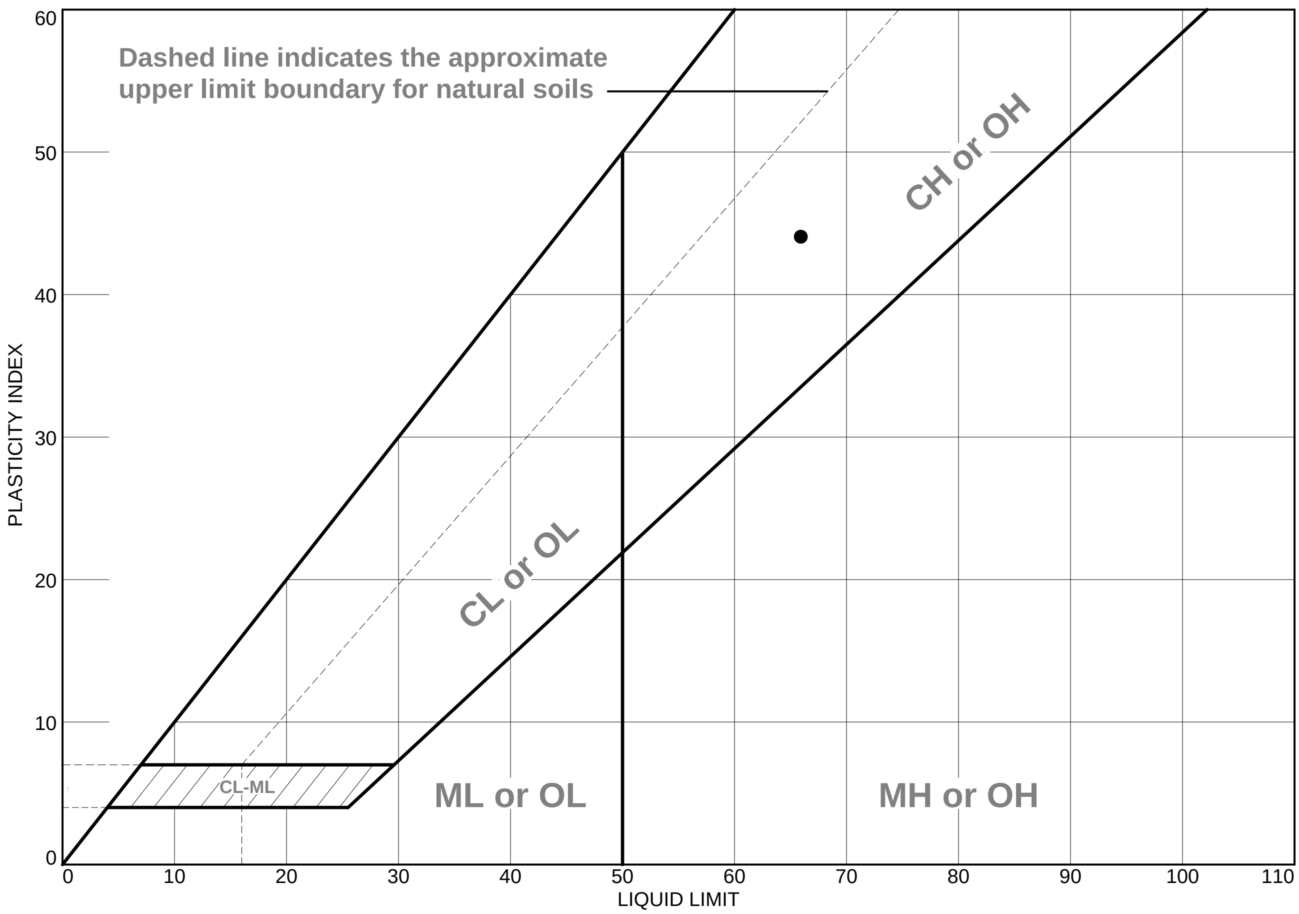
Test Pit Number	Depth (Feet)	Description
1-TP11		Latitude: 38.011668 Longitude: -122.259207
	0 - 3	Sandy CLAY (CL), light grayish brown, medium stiff, dry to moist (Qc)
	3 - 5	SHALE, gray on fresh surfaces, dark reddish brown on weathered surfaces, weak, highly weathered (Bedrock)
		Total depth 5 feet below ground surface, no free groundwater encountered

APPENDIX B

LABORATORY TEST DATA

Liquid and Plastic Limits Test Report
Particle Size Distribution Report

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	See exploration logs	66	22	44	100.0	99.5	CH

Project No. 14359.000.000 **Client:** Claremont Homes, Inc.

Project: 1444 Willow Ave

●**Depth:** 5.0 feet **Sample Number:** 1-TP2 @ 5

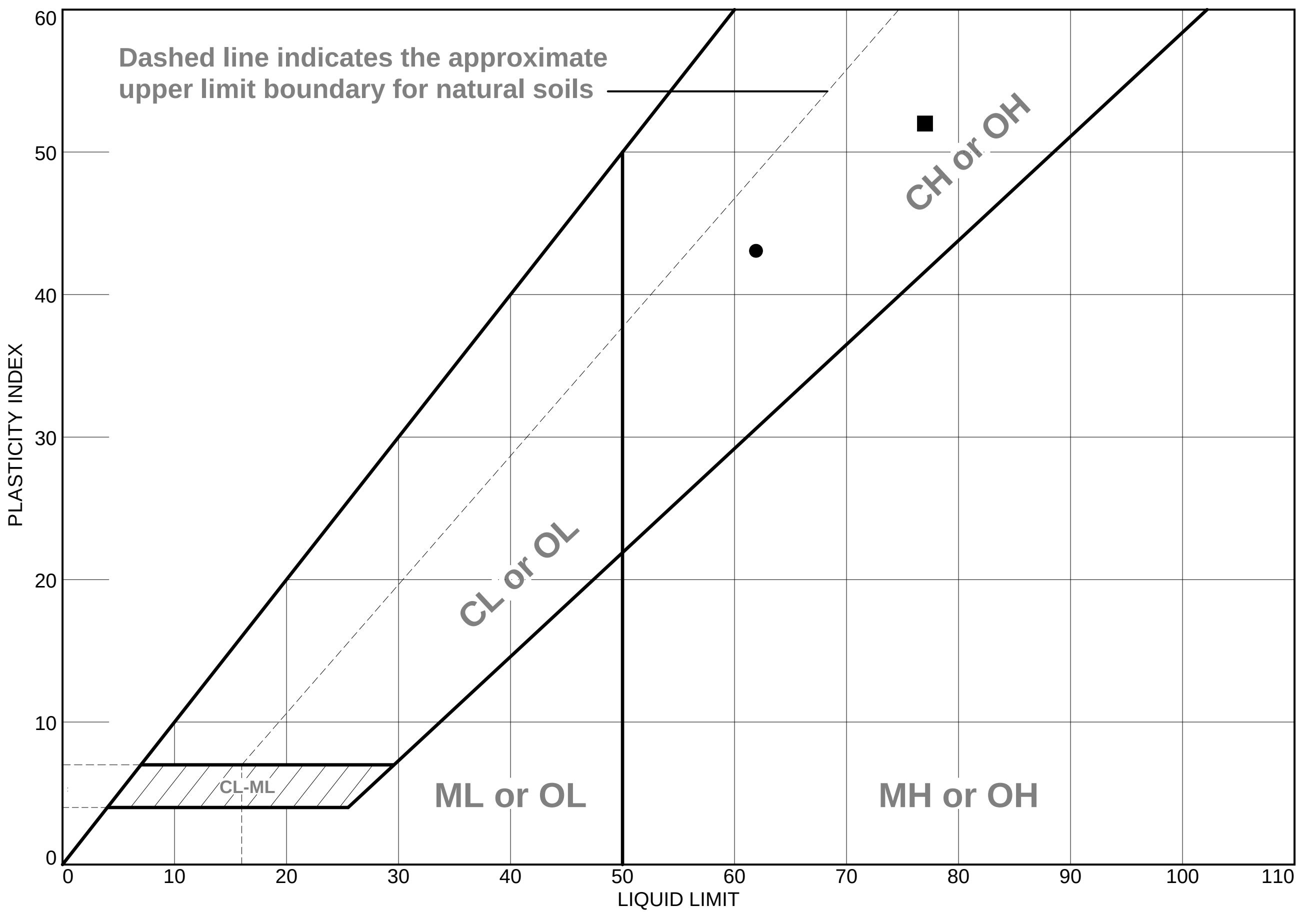
Remarks:

●PI: ASTM D4318, Wet method
GS: ASTM D422
USCS: ASTM D2487

ENGEO INCORPORATED

Tested By: J. Bodnar **Checked By:** M. Quasem

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	See exploration logs	62	19	43	100.0	98.5	CH
■	See exploration logs	77	25	52	92.0	89.3	CH

Project No. 14359.000.000 **Client:** Claremont Homes, Inc.

Project: 1444 Willow Ave

●**Depth:** 6.0 feet **Sample Number:** 1-TP3 @ 6

■**Depth:** 3.0 feet **Sample Number:** 1-TP10 @ 3

Remarks:

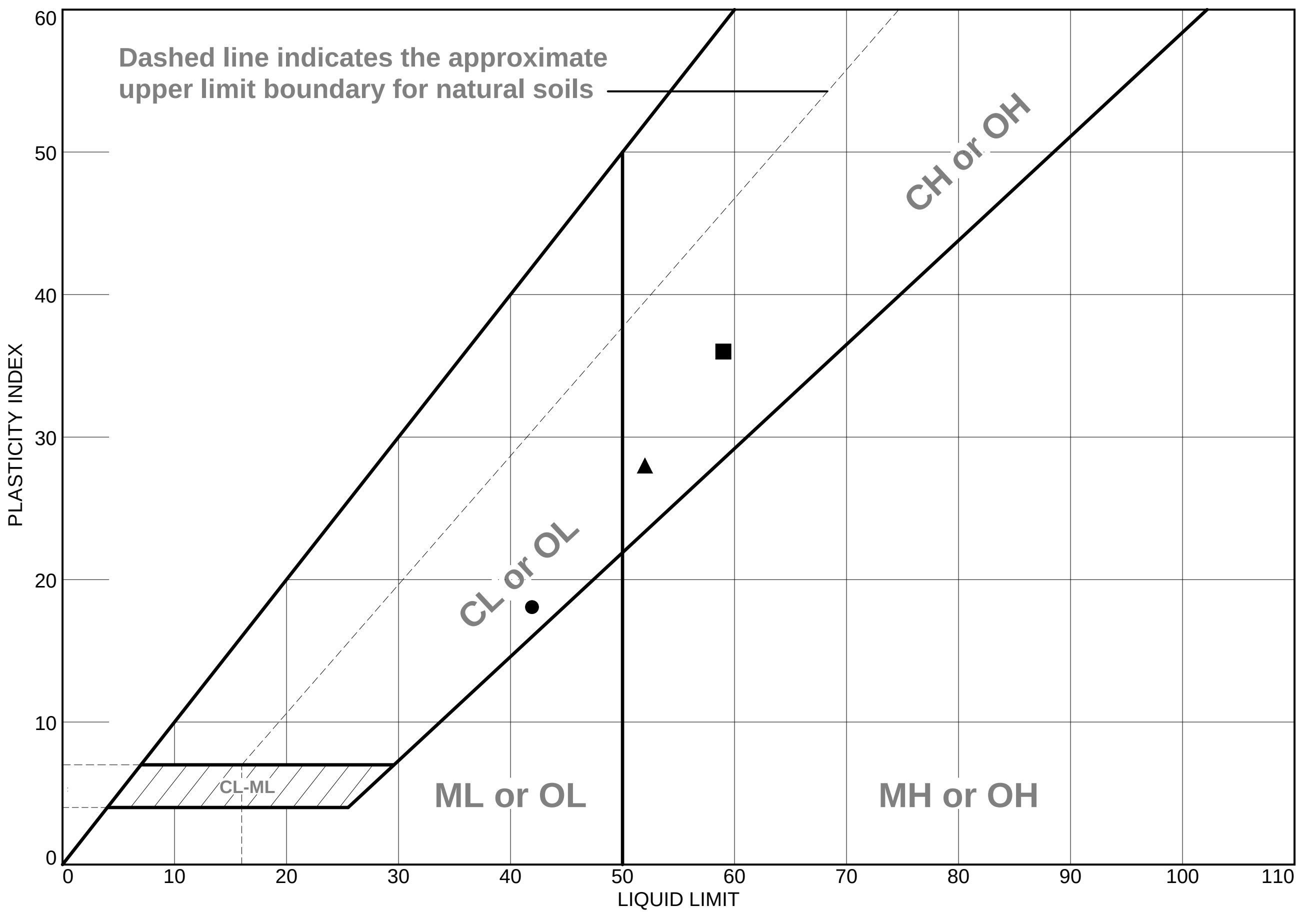
●PI: ASTM D4318, Wet method
GS: ASTM D422
USCS: ASTM D2487

■PI: ASTM D4318, Wet method
GS: ASTM D422
USCS: ASTM D2487

ENGEO INCORPORATED

Tested By: J. Bodnar **Checked By:** M. Quasem

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	See exploration logs	42	24	18	92.4	88.8	CL
■	See exploration logs	59	23	36	91.7	87.6	CH
▲	See exploration logs	52	24	28	92.9	78.7	CH

Project No. 14359.000.000 **Client:** Claremont Homes, Inc.

Project: 1444 Willow Ave

●**Depth:** Surface **Sample Number:** Willow Ave Road Cut

■**Depth:** Surface **Sample Number:** Lampost,Willow Ave

▲**Depth:** Surface **Sample Number:** RR Cut

ENGEO INCORPORATED

Remarks:

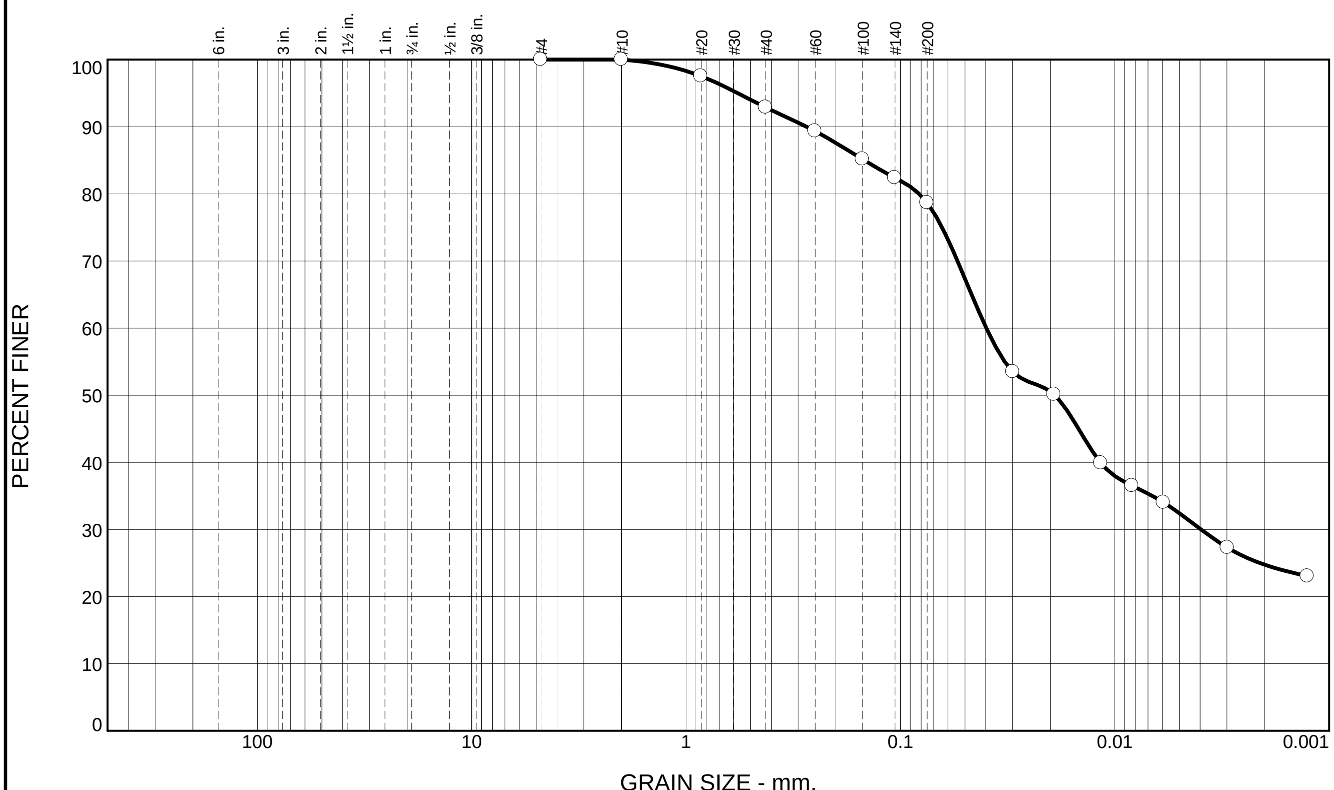
●PI: ASTM D4318, Wet method
GS: ASTM D422
USCS: ASTM D2487

■PI: ASTM D4318, Wet method
GS: ASTM D422
USCS: ASTM D2487

▲PI: ASTM D4318, Wet method
GS: ASTM D422
USCS: ASTM D2487

Tested By: J. Bodnar **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	7.1	14.2	54.0	24.7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	97.5		
#40	92.9		
#60	89.3		
#100	85.2		
#140	82.4		
#200	78.7		
0.0298 mm.	53.5		
0.0192 mm.	50.1		
0.0116 mm.	39.9		
0.0083 mm.	36.5		
0.0059 mm.	34.0		
0.0030 mm.	27.3		
0.0013 mm.	23.0		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 24 LL= 52 PI= 28

Coefficients

D_{90}= 0.2746 D_{85}= 0.1473 D_{60}= 0.0397
D_{50}= 0.0191 D_{30}= 0.0040 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(23)

Remarks

GS: ASTM D422; Specific gravity = 2.734, ASTM D854
PI: ASTM D4318, Wet method; USCS: ASTM D4287
Silt/clay division of 0.002mm was used

Sample Number: RR Cut **Depth:** Surface

Date: 10/30/17

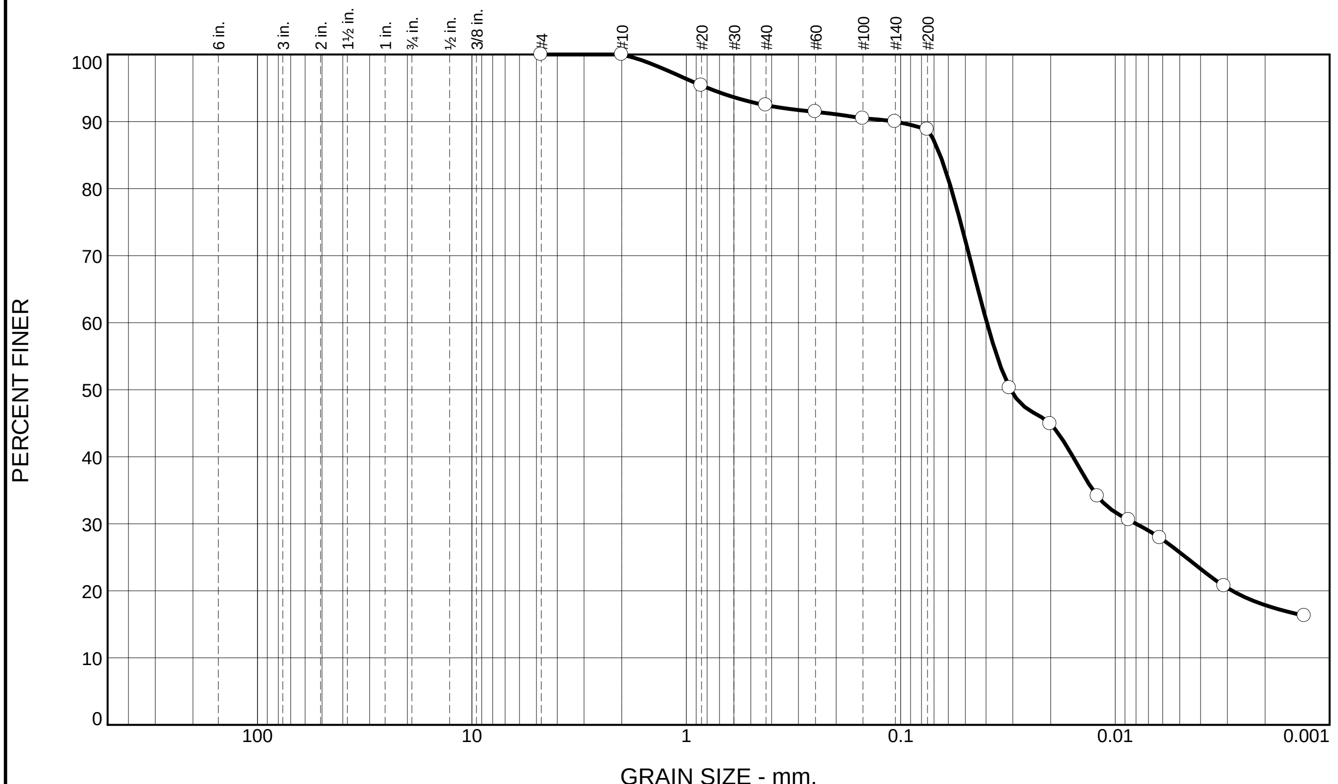
ENGEO INCORPORATED

Client: Claremont Homes, Inc.
Project: 1444 Willow Ave

Project No: 14359.000.000

Tested By: J. Bodnar **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	7.6	3.6	70.9	17.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	95.4		
#40	92.4		
#60	91.4		
#100	90.5		
#140	90.0		
#200	88.8		
0.0310 mm.	50.3		
0.0201 mm.	44.9		
0.0121 mm.	34.1		
0.0086 mm.	30.6		
0.0062 mm.	27.9		
0.0031 mm.	20.7		
0.0013 mm.	16.3		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 24 LL= 42 PI= 18

Coefficients

D_{90}= 0.1075 D_{85}= 0.0655 D_{60}= 0.0397
D_{50}= 0.0307 D_{30}= 0.0080 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-7-6(17)

Remarks

GS: ASTM D422; Specific gravity = 2.692, ASTM D854
PI: ASTM D4318, Wet method; USCS: ASTM D4287
Silt/clay division of 0.002mm was used

Sample Number: Willow Ave Road Cut **Depth:** Surface

Date: 10/30/17

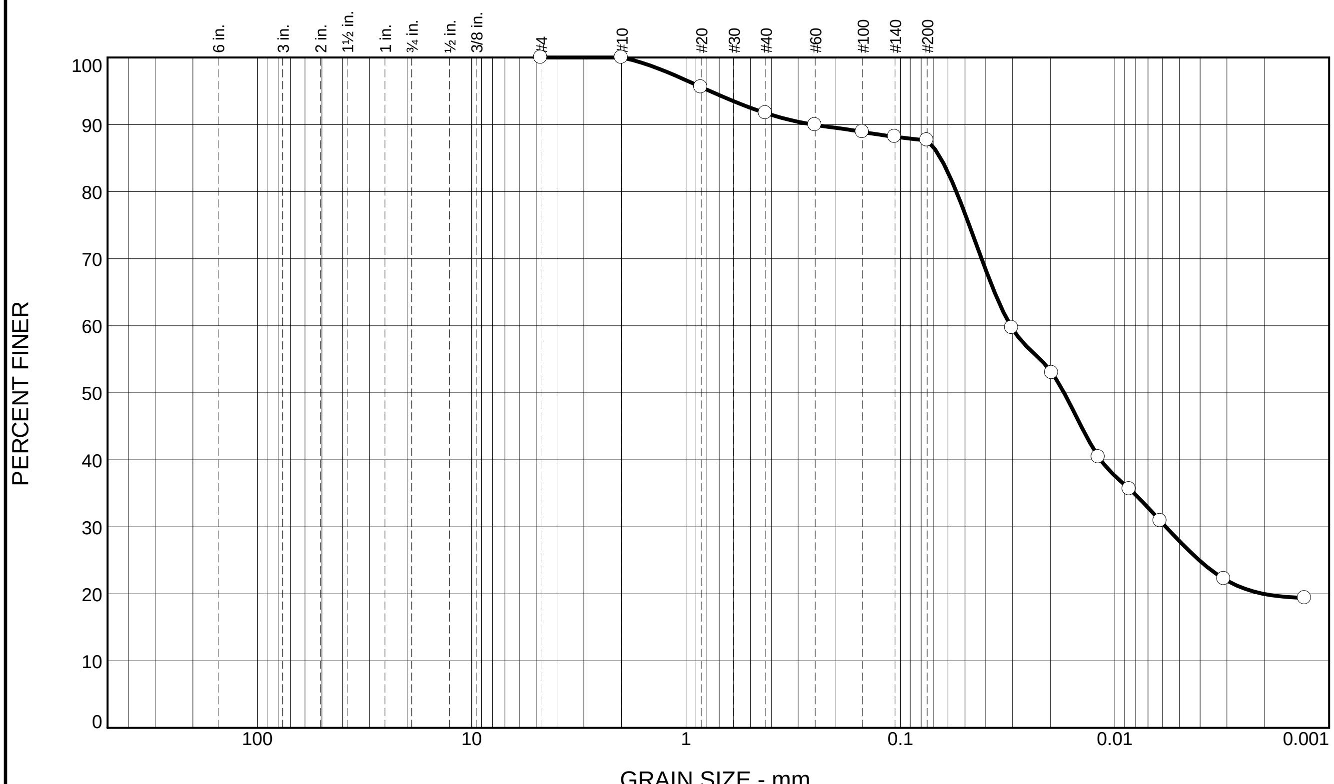
ENGEO INCORPORATED

Client: Claremont Homes, Inc.
Project: 1444 Willow Ave

Project No: 14359.000.000

Tested By: J. Bodnar **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	8.3	4.1	67.6	20.0

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	95.6		
#40	91.7		
#60	89.9		
#100	88.9		
#140	88.2		
#200	87.6		
0.0302 mm.	59.7		
0.0196 mm.	52.9		
0.0119 mm.	40.4		
0.0085 mm.	35.6		
0.0061 mm.	30.9		
0.0031 mm.	22.2		
0.0013 mm.	19.4		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 23 LL= 59 PI= 36

Coefficients

D_{90}= 0.2564 D_{85}= 0.0649 D_{60}= 0.0306
D_{50}= 0.0172 D_{30}= 0.0058 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(35)

Remarks

GS: ASTM D422; Specific gravity = 2.706, ASTM D854
PI: ASTM D4318, Wet method; USCS: ASTM D4287
Silt/clay division of 0.002mm was used

Sample Number: Lampost,Willow Ave **Depth:** Surface

Date: 10/30/17

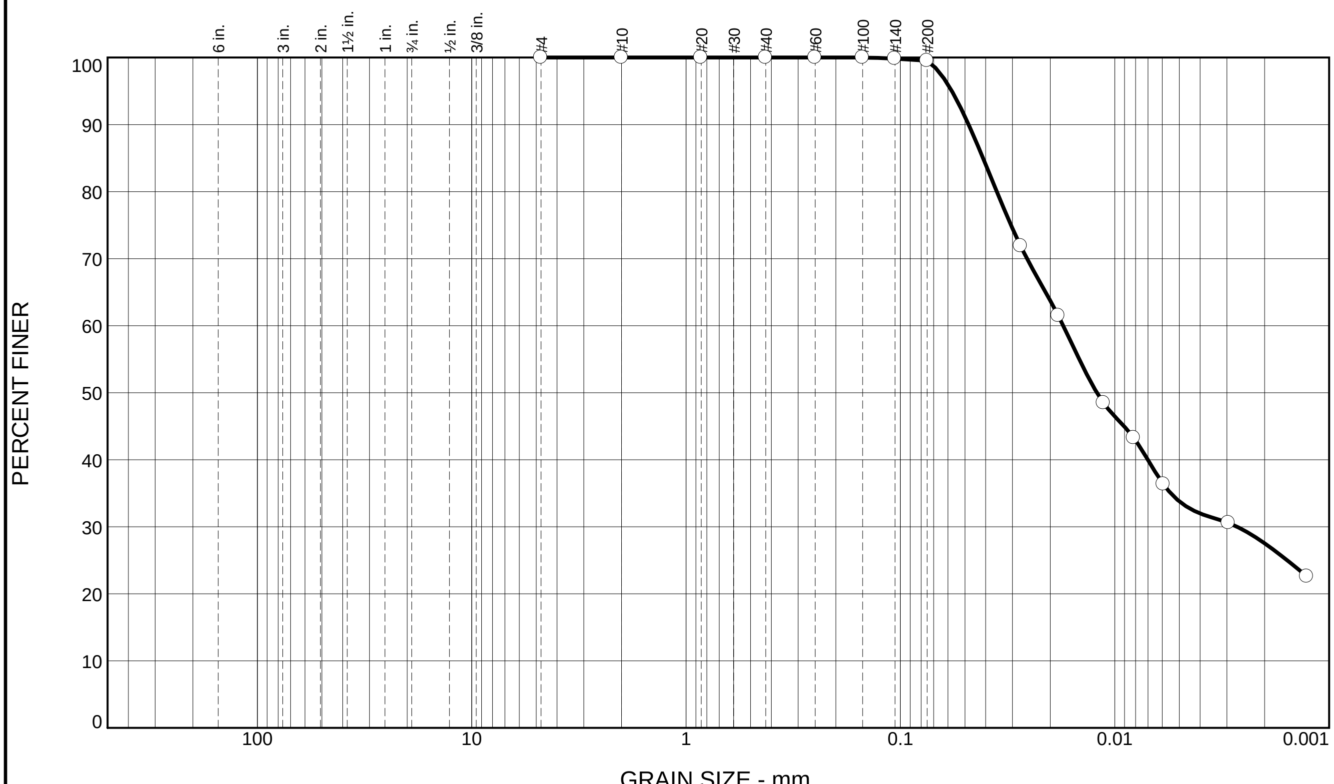
ENGEO INCORPORATED

Client: Claremont Homes, Inc.
Project: 1444 Willow Ave

Project No: 14359.000.000

Tested By: J. Bodnar **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	0.5	72.0	27.5

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	100.0		
#100	100.0		
#140	99.8		
#200	99.5		
0.0275 mm.	71.9		
0.0184 mm.	61.5		
0.0113 mm.	48.5		
0.0081 mm.	43.3		
0.0059 mm.	36.3		
0.0029 mm.	30.6		
0.0013 mm.	22.6		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 22 LL= 66 PI= 44

Coefficients

D_{90}= 0.0481 D_{85}= 0.0412 D_{60}= 0.0174
D_{50}= 0.0121 D_{30}= 0.0027 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(50)

Remarks

GS: ASTM D422; Specific gravity = 2.720, ASTM D854
PI: ASTM D4318, Wet method; USCS: ASTM D2487
Silt/clay division of 0.002mm was used

Sample Number: 1-TP2 @ 5 **Depth:** 5.0 feet

Date: 10/26/17

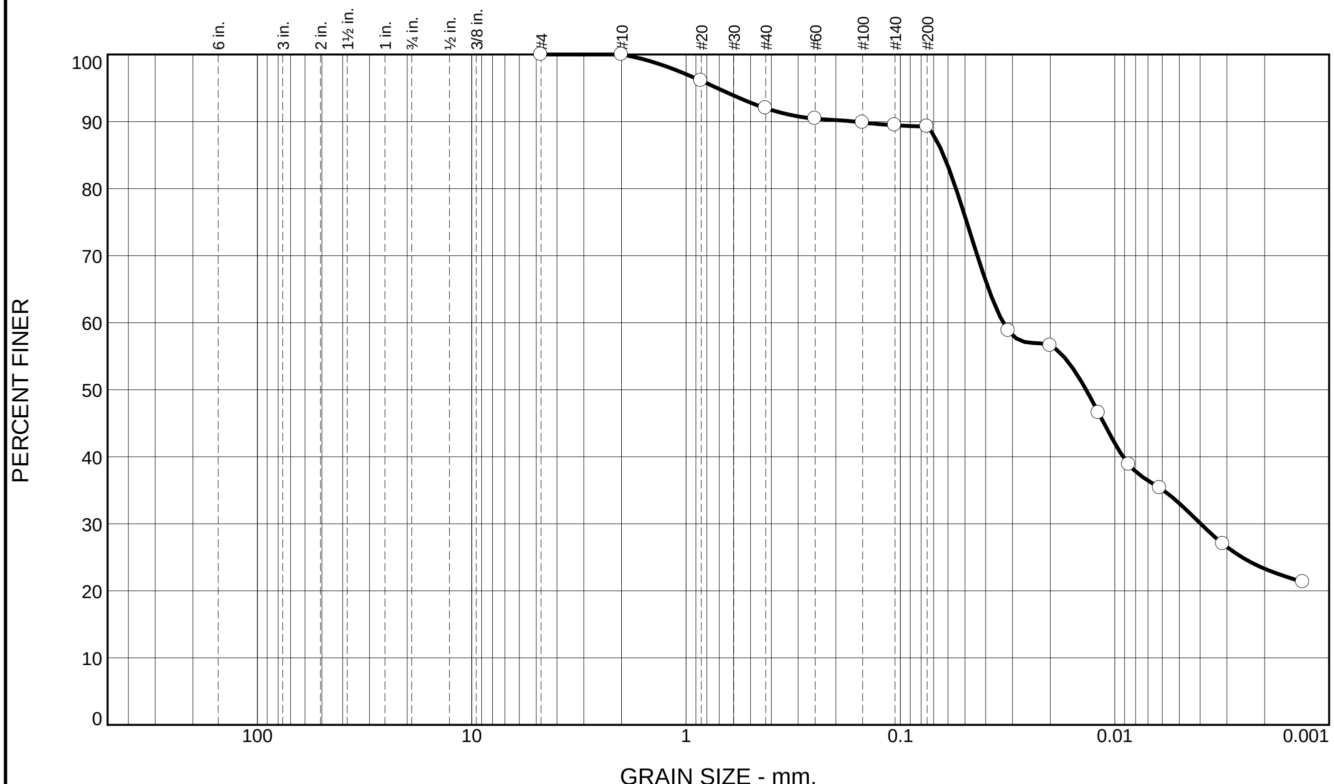
ENGEO INCORPORATED

Client: Claremont Homes, Inc.
Project: 1444 Willow Ave

Project No: 14359.000.000

Tested By: J. Bodnar **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	8.0	2.7	66.0	23.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	96.1		
#40	92.0		
#60	90.4		
#100	89.8		
#140	89.5		
#200	89.3		
0.0314 mm.	58.8		
0.0200 mm.	56.6		
0.0119 mm.	46.5		
0.0086 mm.	38.9		
0.0062 mm.	35.4		
0.0031 mm.	27.0		
0.0013 mm.	21.3		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 25 LL= 77 PI= 52

Coefficients

D_{90}= 0.1628 D_{85}= 0.0629 D_{60}= 0.0332
D_{50}= 0.0136 D_{30}= 0.0040 D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(52)

Remarks

GS: ASTM D422; Specific gravity = 2.643, ASTM D854
PI: ASTM D4318, Wet method; USCS: ASTM D2487
Silt/clay division of 0.002mm was used

Sample Number: 1-TP10 @ 3 **Depth:** 3.0 feet

Date: 10/23/17

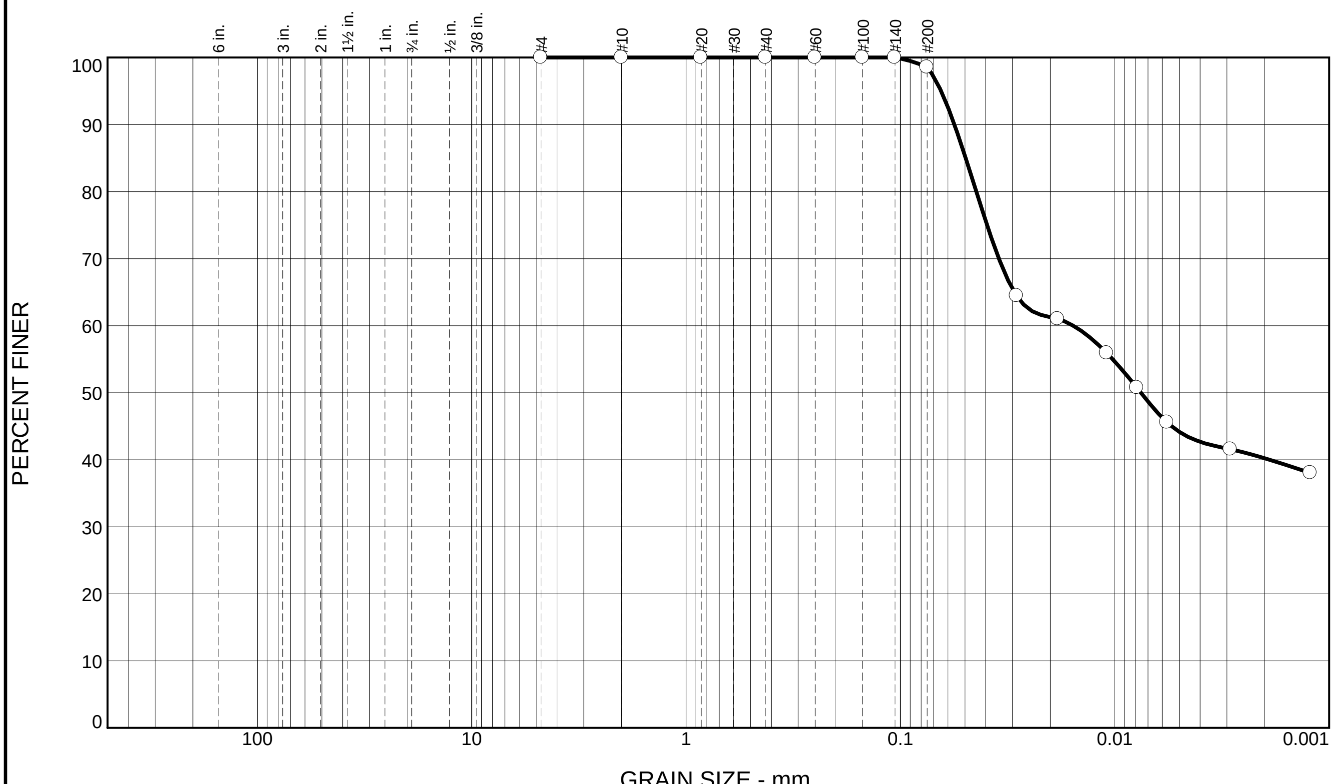
ENGEO INCORPORATED

Client: Claremont Homes, Inc.
Project: 1444 Willow Ave

Project No: 14359.000.000

Tested By: J. Bodnar **Checked By:** M. Quasem

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.0	0.0	0.0	1.5	58.3	40.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#4	100.0		
#10	100.0		
#20	100.0		
#40	100.0		
#60	100.0		
#100	100.0		
#140	100.0		
#200	98.5		
0.0287 mm.	64.4		
0.0184 mm.	61.0		
0.0109 mm.	55.9		
0.0079 mm.	50.7		
0.0057 mm.	45.6		
0.0029 mm.	41.6		
0.0012 mm.	38.0		

* (no specification provided)

Soil Description

See exploration logs

Atterberg Limits

PL= 19 LL= 62 PI= 43

Coefficients

D_{90}= 0.0560 D_{85}= 0.0496 D_{60}= 0.0156
D_{50}= 0.0076 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CH AASHTO= A-7-6(47)

Remarks

GS: ASTM D422; Specific gravity = 2.648, ASTM D854
PI: ASTM D4318, Wet method; USCS: ASTM D2487
Silt/clay division of 0.002mm was used

Sample Number: 1-TP3 @ 6 **Depth:** 6.0 feet

Date: 10/28/17

ENGEO INCORPORATED

Client: Claremont Homes, Inc.
Project: 1444 Willow Ave

Project No: 14359.000.000

Tested By: J. Bodnar **Checked By:** M. Quasem

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SAN FRANCISCO

SAN JOSE

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LATHROP

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D.2 - USDA Custom Soil Resource Report for Contra Costa County, California

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United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for
Contra Costa County, California

November 22, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:3,310 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 45, 90, 180, 270

Feet: 0, 150, 300, 600, 900

Map projection: Web Mercator   Corner coordinates: WGS84   Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Contra Costa County, California
Survey Area Data: Version 14, Sep 25, 2017

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 11, 2015—Jun 17, 2015

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Cc	Clear Lake clay, 0 to 15 percent slopes, MLRA 15	0.8	4.4%
CeA	Conejo clay loam, 0 to 2 percent slopes, MLRA 14	3.1	17.7%
DeF	Dibble silty clay loam, 16 to 54 percent slopes, MLRA 15	8.7	49.0%
LeF	Los Gatos loam, 30 to 50 percent slopes	0.9	5.0%
SdE	Sehorn clay, 15 to 30 percent slopes	4.3	24.0%
Totals for Area of Interest		**17.8**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Contra Costa County, California

Cc—Clear Lake clay, 0 to 15 percent slopes, MLRA 15

Map Unit Setting

National map unit symbol: 2vbsq
Elevation: 0 to 1,060 feet
Mean annual precipitation: 13 to 32 inches
Mean annual air temperature: 57 to 61 degrees F
Frost-free period: 260 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Clear lake and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Clear Lake

Setting

Landform: Basin-floor remnants
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Clayey alluvium derived from metamorphic and sedimentary rock

Typical profile

Ap - 0 to 5 inches: clay
Ass - 5 to 20 inches: clay
Bss - 20 to 30 inches: clay
Bkss1 - 30 to 46 inches: clay
Bkss2 - 46 to 60 inches: clay

Properties and qualities

Slope: 0 to 15 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Poorly drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Rare
Frequency of ponding: Frequent
Calcium carbonate, maximum in profile: 4 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.5 to 3.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 7.0
Available water storage in profile: Moderate (about 8.6 inches)

Interpretive groups

Land capability classification (irrigated): 2w
Land capability classification (nonirrigated): 4w
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Pescadero

Percent of map unit: 4 percent
Landform: Depressions
Hydric soil rating: Yes

Cropley

Percent of map unit: 4 percent
Hydric soil rating: No

Conejo

Percent of map unit: 4 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 3 percent
Landform: Strand plains
Hydric soil rating: Yes

CeA—Conejo clay loam, 0 to 2 percent slopes, MLRA 14

Map Unit Setting

National map unit symbol: 2xc94
Elevation: 40 to 730 feet
Mean annual precipitation: 19 to 27 inches
Mean annual air temperature: 59 to 61 degrees F
Frost-free period: 341 to 361 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Conejo and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Conejo

Setting

Landform: Stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Alluvium derived from sedimentary rock

Typical profile

Ap - 0 to 6 inches: clay loam
A - 6 to 27 inches: clay loam
Bw1 - 27 to 41 inches: clay loam
Bw2 - 41 to 60 inches: clay loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 1 percent
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Available water storage in profile: High (about 10.3 inches)

Interpretive groups

Land capability classification (irrigated): 1
Land capability classification (nonirrigated): 4c
Hydrologic Soil Group: C
Hydric soil rating: No

Minor Components

Botella

Percent of map unit: 5 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 5 percent
Landform: Depressions
Hydric soil rating: Yes

Clear lake

Percent of map unit: 3 percent
Landform: Depressions
Hydric soil rating: Yes

Garretson

Percent of map unit: 2 percent
Hydric soil rating: No

DeF—Dibble silty clay loam, 16 to 54 percent slopes, MLRA 15

Map Unit Setting

National map unit symbol: 2xc9s
Elevation: 820 to 2,130 feet
Mean annual precipitation: 19 to 26 inches
Mean annual air temperature: 59 to 60 degrees F
Frost-free period: 335 to 353 days
Farmland classification: Not prime farmland

Map Unit Composition

Dibble and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Dibble

Setting

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sandstone and shale

Typical profile

A1 - 0 to 6 inches: silty clay loam
A2 - 6 to 10 inches: silty clay loam
Bt1 - 10 to 17 inches: silty clay
Bt2 - 17 to 25 inches: silty clay
Bt3 - 25 to 30 inches: silty clay loam
Cr - 30 to 40 inches: bedrock

Properties and qualities

Slope: 16 to 54 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: STEEP LOAMY (R015XD116CA)
Hydric soil rating: No

Minor Components

Los gatos

Percent of map unit: 6 percent
Hydric soil rating: No

Los osos

Percent of map unit: 5 percent
Hydric soil rating: No

Millsholm

Percent of map unit: 2 percent
Hydric soil rating: No

Gaviota

Percent of map unit: 2 percent
Hydric soil rating: No

LeF—Los Gatos loam, 30 to 50 percent slopes

Map Unit Setting

National map unit symbol: h99r
Elevation: 500 to 2,000 feet
Mean annual precipitation: 18 to 25 inches
Mean annual air temperature: 55 degrees F
Frost-free period: 260 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Los gatos and similar soils: 85 percent
Minor components: 14 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Los Gatos

Setting

Landform: Upland slopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 27 inches: clay loam
H3 - 27 to 30 inches: unweathered bedrock

Properties and qualities

Slope: 30 to 50 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Low (about 4.5 inches)

Interpretive groups

Land capability classification (irrigated): 6e
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C

Ecological site: STEEP LOAMY (R015XD116CA)
Hydric soil rating: No

Minor Components

Dibble

Percent of map unit: 4 percent
Hydric soil rating: No

Los osos

Percent of map unit: 4 percent
Hydric soil rating: No

Millsholm

Percent of map unit: 4 percent
Hydric soil rating: No

Vallecitos

Percent of map unit: 2 percent
Hydric soil rating: No

SdE—Sehorn clay, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: h9by
Elevation: 200 to 1,500 feet
Mean annual precipitation: 15 to 25 inches
Mean annual air temperature: 57 degrees F
Frost-free period: 260 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Sehorn and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Sehorn

Setting

Landform: Ridges
Landform position (three-dimensional): Crest
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Residuum weathered from shale

Typical profile

H1 - 0 to 25 inches: clay
H2 - 25 to 35 inches: silty clay
H3 - 35 to 38 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 30 percent

Depth to restrictive feature: 25 to 40 inches to paralithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.7 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: D
Ecological site: CLAYEY (R015XD001CA)
Hydric soil rating: No

Minor Components

Los gatos

Percent of map unit: 4 percent
Hydric soil rating: No

Los osos

Percent of map unit: 4 percent
Hydric soil rating: No

Altamont

Percent of map unit: 4 percent
Hydric soil rating: No

Millsholm

Percent of map unit: 3 percent
Hydric soil rating: No

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