Appendix D: Geology and Soils Supporting Information

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D.1 - Geotechnical Exploration

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3180 WALNUT BOULEVARD
WALNUT CREEK, CALIFORNIA

PRELIMINARY GEOTECHNICAL EXPLORATION

SUBMITTED TO
Mr. Carlos Yañez
Blue Mountain Communities
707 Aldridge Road, Suite B
Vacaville, CA 95688

PREPARED BY
ENGEO Incorporated

March 12, 2020

PROJECT NO.
17043.000.000

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GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
17043.000.000

March 12, 2020

Mr. Carlos Yañez
Blue Mountain Communities
707 Aldridge Road, Suite B
Vacaville, CA 95688

Subject: 3180 Walnut Boulevard
Walnut Creek, California

PRELIMINARY GEOTECHNICAL EXPLORATION

Dear Mr. Yañez

ENGEO prepared this preliminary geotechnical exploration report for Blue Mountain Communities as outlined in our agreement dated November 21, 2019. The preliminary conclusions and recommendations of this report are based on geotechnical and geologic studies completed to date.

It is our opinion from a geotechnical engineering viewpoint, that the project site is suitable for residential developments, provided the recommendations by ENGEO Incorporated, as summarized in this document, are incorporated into project planning. The primary geotechnical considerations for the planned development include seismic ground motions, existing undocumented fill, and expansive soil.

We trust that this document provides geotechnical guidance appropriate for the current planning process. Please contact us if you have any questions regarding this document.

Sincerely,

ENGEO Incorporated

Jerry Chen

Phil Stuecheli, CEG

CERTIFIED ENGINEERING GEOLOGIST
PHILIP STUECHELI
No. 1640
STATE OF CALIFORNIA

jc/ps/dt

2010 Crow Canyon Place, Suite 250 • San Ramon, CA 94583 • (925) 866-9000 • Fax (888) 279-2698
www.engeo.com

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

We prepared this geotechnical exploration report for design of a residential development in Walnut Creek, California. We prepared this report as outlined in our agreement dated November 21, 2019. Blue Mountain Communities authorized ENGEO to conduct the following scope of services:

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

We were not given a preliminary site plan for this investigation. However, based on our conversation with you, we understand the current plan is to develop the site into five residential lots.

This report was prepared for the exclusive use of Blue Mountain Communities and their consultants for design of this project. 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 site is located at 3180 Walnut Boulevard in Contra Costa County, California, immediately west of the intersection of Walnut Boulevard and View Lane, with Assessor's Parcel Number (APN) 180-240-002. The existing improvements at the site currently include a single-family house located near the center of the parcel and low height seasonal grasses, trees, and landscaping.

1.3 PROPOSED PROJECT

Based on discussions with Blue Mountain Communities, the proposed project will be developed into five residential lots with accompanying site improvements. We anticipate the residential structures will be two to three stories and wood framed; therefore, we estimate that the building loads will be light to moderate and similar to other developments of this size.

2.0 FINDINGS

2.1 FIELD EXPLORATIONS

Our field explorations included excavating six test pits within the site. We performed the test pit excavation on February 25, 2020.

The locations and elevations of our explorations are approximate and were estimated by pacing from features shown on the Site Plan (Figure 2); they should be considered accurate only to the degree implied by the method used.

2.1.1 Test Pits

We observed excavation of five test pits at the locations shown on the Site Plan, Figure 2. An ENGEO representative observed the test pit excavation and logged the subsurface conditions at each location. We retained a midsize excavator to excavate the test pits using a 2.5-foot-wide bucket and logged the type, location, and uniformity of the underlying soil/rock. The maximum depth penetrated by the test pits was approximately 10 feet.

We obtained bulk disturbed soil samples from the test pits using hand-sampling techniques. The test pit logs present descriptions that depict the subsurface conditions encountered. All exploratory test pits were backfilled with the excavated soil with nominal compactive effort, which should be considered as non-engineered fill.

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

2.2 SITE HISTORY

We reviewed historic aerial photographs and topographic maps to determine if discernable changes in topography or surface modifications pertaining to the property have been recorded.

Our historic aerial images review included assessing readily available aerials from 1939 to 2016, including sources from UC Santa Barbara Library Online database, Historic aerials.com, and Google Earth, listed in the References. In the 1939 images, the site is open undeveloped agricultural land flanked on the west and east by incised drainage areas. Walnut Boulevard was in place along the south property boundary. An incised drainage formerly passed through the southeast corner of the site and passed under Walnut Boulevard via a culvert. The existing structure is first visible on 1958 areal images, and by 1968, the low-lying incised drainage at the southeast corner of the site had been filled to close to the existing condition. In a 2009 aerial image, there was visible construction activity on the site and it appears that additional fill was placed on the northeast portion of the site.

2.3 GEOLOGY AND SEISMICITY

2.3.1 Geology

Graymer (1997) maps the site as being primarily underlain by bedrock of the Miocene age Tassajara Green Valley Group (Tgvt) with the northeast portion of the site being underlain by Pleistocene-age Alluvial Fan Deposits (Qal) (Figure 3).

2.3.2 Seismicity

The site is not located within a State of California Earthquake Fault Hazard Zone (1982) for active faults, and no known faults cross the site (Figure 4). 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).

The nearest known active fault surface trace is the Mount Diablo Thrust fault, which is mapped approximately 1.3 miles south of the site. Other active faults near the site are summarized in Table 2.3.2-1 and include the Mount Diablo Thrust fault, Calaveras fault, and the

Hayward-Rodgers Creek fault. Because of the presence of nearby active faults, the Bay Area Region is considered seismically active. Numerous small earthquakes occur every year in the region, and large (greater than Moment Magnitude 7) earthquakes have been recorded and can be expected to occur in the future. Figure 5 shows the approximate locations of these faults and significant historic earthquakes recorded within the Greater Bay Area Region.

TABLE 2.3.2-1: Active Faults Capable of Producing Significant Ground Shaking at the Site
Latitude: 37.89532 **Longitude:** -122.04223

FAULT NAME	DISTANCE FROM SITE (miles)	DIRECTION FROM SITE	MAXIMUM MOMENT MAGNITUDE (Ellsworth)
Mount Diablo Thrust	1.3	South	6.7
Concord - Green Valley Connected	2.7	Northeast	6.8
Calaveras	5.7	South	7.0
Hayward-Rodgers	10.4	Southwest	7.0
Great Valley 5	13.0	Northeast	6.7
Greenville Connected	11.4	Northeast	7.0
West Napa	21.6	North	6.7

2.4 SURFACE CONDITIONS

The site consists currently of a single-family house located near the center of the parcel and low height seasonal grasses, trees, and landscaping. According to topographic data available from Google Earth, the site slopes down generally from northeast to southwest, from an elevation of 232 feet (WGS84) down to a minimum of 192 feet. The center of the site, where the current structure is located, represents a ridge that extends to the northeast corner of the site.

2.5 SUBSURFACE CONDITIONS

During our exploration, we encountered an existing fill layer our test pits, which ranges from approximately 1 to 3½ feet thick, and consists of sandy silt and sandy clay. Native surficial soil (Colluvium) deposits consisting of fat clay ranging from few feet to over approximately 8 feet thick were encountered mantling bedrock across the site. The surficial soil is underlain by mudstone, sandstone, and conglomerate bedrock. The bedrock is highly weathered and very weak near the surface, but become less weathered, moderately strong at depth.

Atterberg limit testing of the existing soil encountered at the site yielded a Plasticity Index (PI) of 44 for the native clayey soil and PI of 13 for the mudstone. It is an indication that the site soil has a moderate to very high expansion potential.

Consult the Site Plan and exploration logs for specific subsurface conditions at each location. We include our test pit logs in Appendix A. The logs contain the soil type, color, and visual classification in general accordance with the Unified Soil Classification System. The logs graphically depict the subsurface conditions encountered at the time of the exploration.

2.6 GROUNDWATER CONDITIONS

We did not observe static or perched groundwater in any of our subsurface explorations. We were also not able to find any nearby groundwater data using the online tool, Geotracker.

Fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, and other factors not evident at the time measurements were made. Future irrigation may cause an overall rise in groundwater levels.

2.7 LABORATORY TESTING

We performed laboratory tests on selected soil samples collected from the test pits to evaluate their engineering properties. For this project, we performed plasticity index testing. The test results are included in Appendix B.

3.0 DISCUSSION AND CONCLUSIONS

Based upon this preliminary study, it is our opinion that the project site is feasible for the proposed residential developments from a geotechnical standpoint provided that the preliminary recommendations contained in this report and future design-level geotechnical studies are incorporated into the development plans. A more comprehensive site-specific geotechnical exploration should be performed as part of the design process. The exploration would include borings and laboratory soil testing to provide data for preparation of specific recommendations regarding grading and foundation design for the proposed development. The exploration will also allow for more detailed evaluations of the geotechnical issues discussed below and afford the opportunity to provide recommendations regarding techniques and procedures to be implemented during construction to mitigate potential geotechnical/geological hazards.

Based upon our field exploration and review of readily available published maps for the site, the main geotechnical concerns for the proposed site development include:

- Disturbed near-surface soil and existing undocumented fill.
- Expansive soil.

3.1 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, ground lurching, regional subsidence or uplift, landslides, tsunamis, flooding and seiches. 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, tsunamis, flooding, or seiches is considered low to negligible at the site. We discuss ground shaking, ground lurching, landslides, soil liquefaction, lateral spreading and flooding in the later sections.

3.1.1 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.

3.1.2 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 2019 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).

3.1.3 2019 CBC Seismic Design Parameters

We characterized the site as Site Class C in accordance with the 2019 CBC. We provide the 2019 CBC seismic design parameters in Table 3.1.3-1 below, which include design spectral response acceleration parameters based on the mapped Risk Targeted Maximum Considered Earthquake (MCE_R) spectral response acceleration parameters.

TABLE 3.1.3-1: 2016 CBC Seismic Design Parameters
Latitude: 37.89532 **Longitude:** -122.04223

PARAMETER	VALUE
Site Class	C
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	2.12
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.70
Site Coefficient, F_A	1.20
Site Coefficient, F_V	1.40
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	2.55
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	0.70
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	1.70
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	0.65
MCE_G Peak Ground Acceleration adjusted for Site Class effects, PGA_M (g)	1.04

3.1.4 Ground Lurching

Ground lurching is a result of the rolling motion imparted to the ground surface during energy released by an earthquake. Such rolling motion can cause ground cracks to form in weaker soil. The potential for the formation of these cracks is considered greater at contacts between deep alluvium and bedrock. Such an occurrence is unlikely at the site given that shallow rock was encountered in the upper 10 feet below ground surface; therefore, it is our opinion that ground lurching is negligible.

3.1.5 Liquefaction and Cyclic Softening

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soil most susceptible to liquefaction are clean, loose, saturated, uniformly graded, fine-grained sand. Empirical evidence indicates that loose to medium-dense gravel, silty sand,

and low- to moderate-plasticity silt and clay may be susceptible to liquefaction. In addition, sensitive high-plasticity soil may be susceptible to significant strength loss (cyclic softening) because of significant cyclic loading. Since the site is underlain by weathered mudstone at shallow depths, groundwater was not encountered within our exploration locations, and the existing fill will be removed and recompacted, the site soil is considered not suspectible to liquefaction.

3.1.6 Lateral Spreading

Lateral spreading is a failure within a nearly horizontal soil zone (possibly due to liquefaction) that causes the overlying soil mass to move toward a free face or down a gentle slope. Generally, effects of lateral spreading are most significant at the free face or the crest of a slope and diminishes with distance from the slope. Given the shallow bedrock on the west site of the site, the consistency of the bedrock, and the absence of groundwater, the potential for lateral spreading at the site is negligible.

3.1.7 Flooding

Based on a review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map, Figure 6, the site is located outside the 0.2% annual chance floodplain, and therefore, flooding is not expected at the subject site. Nonetheless, the Civil Engineer should review pertinent information relating to possible flood levels for the subject site based on final pad elevations and provide appropriate design measures for development of the project, if necessary.

3.2 EXISTING FILL

As discussed in Section 2.5, an existing fill layer up to1 to 3½ feet thick was encountered in the test pits. The estimated limits of fill are depicted on Figure 2. It is likely that fills greater than 3.5 feet thick underlie the southeast corner of the site adjacent to Walnut Boulevard where a previously existing incised drainage was filled.

Since the compaction conditions of this fill are unknown, it is our opinion that this undocumented fill should be removed and can be recompacted as engineered fill.

3.3 EXPANSIVE SOIL

We performed sampling and testing of the site soil and bedrock; test results indicate Plasticity Index (PI) of the native clay is as high as 44, whereas the PI of the fines content of the bedrock is 13. These test results indicate the native clay material has a very high expansion potential and the bedrock had a moderate expansion potential. Expansive soil shrinks and swells as a result of moisture changes. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations.

Successful construction on expansive soil requires special attention during grading. It is imperative to keep exposed soil moist by occasional sprinkling. If the soil dries, it is extremely difficult to remoisturize (because of its clayey nature) without excavation, moisture conditioning, and recompaction.

In addition, site grading and treatment of expansive soil may include selective moisture conditioning requirements and compaction within selected ranges. The purpose of these recommendations is to reduce the swell potential of the near surface clay by compacting the soil at a high moisture content and controlling the compaction. We present subgrade soil recommendations in Section 4.4 of this report.

3.4 EXCAVATABILITY

We used a midsize excavator during our exploratory test pit excavation. Based upon our observation and experience, we provide the following conclusions regarding excavation resistance of bedrock at the site:

1. Conventional grading and backhoe equipment will likely be able to excavate the soil deposits.

2. We observed the underlying bedrock to be slightly to moderately weathered at depth. Conventional grading and backhoe equipment will likely be able to excavate the site soil using light to moderate effort. Deeper grading excavations may encounter more massive and intact bedrock, which may require moderate effort with a CAT D8 or larger bulldozer, equipped with single or multi-shank rippers.

3. It can be expected that some well-cemented beds or lenses may be encountered that will be difficult to process.

Trenching using conventional equipment is expected to be plausible, unless a well-cemented bed or layer is encountered. During grading, zones of hard rock exposed near finished grade within the roadway should be identified; overexcavation may be conducted to accommodate future utility installation. Also, in the exposed areas of hard rock, overexcavation of the cut lots and transition lots may be performed to facilitate foundation or pool construction.

Oversized rocks generated or encountered during grading should be placed in accordance with recommendations provided in Section 4.3.

We provide the above excavatability information for general planning purposes only. This information is not intended for bidding purposes.

4.0 EARTHWORK RECOMMENDATIONS

The following preliminary recommendations are for initial land planning and preliminary estimating purposes. Final recommendations regarding site grading and foundation construction will be provided after more detailed land plans have been prepared.

4.1 GENERAL SITE CLEARING/DEMOLITION

After demolition of the existing structures, paving, and associated improvements, the development portion of the site should be cleared of all obstructions, including existing foundations, septic systems, construction materials, trees and associated root systems, and general debris. Any existing underground utilities within the proposed development area should be identified and removed entirely including pipes and associated backfill. Depressions resulting from the removal of underground obstructions extending below the proposed finish grades should be cleared and backfilled with suitable material compacted to the recommendations presented in Fill Compaction section.

Areas containing surface vegetation or organic laden topsoil within the areas to be improved should be stripped to an appropriate depth to remove these materials. Tree roots should be removed to a depth of at least 3 feet below finished grade in cut areas and 3 feet below original grade in fill areas. The amount of actual stripping and tree root removal should be determined in the field by the Geotechnical Engineer at the time of construction. Subject to approval by the Landscape Architect, strippings and organically contaminated soil can be used in landscape areas. Otherwise, such soil should be removed from the project site. Any topsoil that will be retained for future use in landscape areas should be stockpiled in areas where it will not interfere with grading operations.

Stripping and demolition below design grades should be cleaned to a firm undisturbed soil surface determined by the Geotechnical Engineer. This surface should then be cleaned, scarified, moisture conditioned, and backfilled with suitable material compacted to the recommendations presented in Section 4.4. No loose or uncontrolled backfilling of depressions resulting from demolition and stripping should be permitted.

4.2 REMOVAL OF EXISTING FILL

As discussed in the previous section, fill materials were encountered at the site and range from 1 to 3½ feet thick. The Site Plan (Figure 2) and exploration logs in Appendix A display fill thickness at specific locations. Since the compaction data of the fill is unknown, fill removal should be anticipated. The extent and quality of existing fill should be evaluated at the time of site grading activities.

Remove all existing fill to competent native soil, as evaluated by ENGEO, and replaced with engineered fill. If any perched groundwater found during construction may inhibit full removal of the existing fill, the Geotechnical Engineer will determine the required depth of existing fill removal. The removed fill can be used as compacted fill to raise the grade throughout the site given recommendations in Section 4.4 are implemented.

4.3 SELECTION OF MATERIALS

With the exception of construction debris (wood, brick, asphalt, concrete, metal, etc.), trees, high organic content soil (soil which contains more than 3 percent organic content by weight), and environmentally impacted soil (if any), we anticipate the site soil is suitable for use as engineered fill. Other material and debris, including trees with their root balls, should be removed from the project site. Rocks greater than 18 inches in size (if any) should be broken down such that their maximum dimension is less than 12 inches, or otherwise removed from the site.

4.4 FILL COMPACTION

For land planning and cost estimating purposes, the following compaction control requirements should be anticipated for general fill areas:

- Test Procedures: ASTM D-1557.
- Required Moisture Content: Not less than 4 percentage points above optimum moisture content for soil with PI of 15 or greater.

  Not less than 3 percentage points above optimum moisture content for soil with PI of less than 15.
- Minimum Relative Compaction: 90 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 for deeper fills and retaining wall backfill. These additional requirements will be developed during our detailed exploration.

5.0 FOUNDATION RECOMMENDATIONS

5.1 PRELIMINARY FOUNDATION DESIGN

We developed preliminary foundation recommendations using data obtained from our field exploration, laboratory test results, and engineering analysis. The proposed residential developments may be supported on post-tension mats.

For design purposes, we recommend obtaining subsurface geotechnical data below the proposed foundations once the building layouts and types are known to develop design-level foundation recommendations.

5.1.1 Post-Tensioned Mat Foundations

For preliminary purposes, post-tensioned (PT) slab foundations on properly prepared compacted fill may be considered for supporting the proposed single-family and townhome structures. On a preliminary basis, we recommend that PT mats be a minimum of 10 inches thick or greater and have a thickened edge at least 2 inches greater than the mat thickness. The Structural Engineer should determine the actual PT mat thickness using the geotechnical recommendations in the design-level report. We recommend that the thickened edge be at least 12 inches wide.

PT mats are typically underlain by a moisture reduction system as recommended in Section 5.2. In addition, the building pad subgrade is typically moisture conditioned such that the subgrade soil is at a moisture content at least 3 percentage points above optimum immediately prior to foundation construction. The subgrade should not be allowed to dry prior to concrete placement.

5.2 SLAB MOISTURE VAPOR REDUCTION

When buildings are constructed with mats, water vapor from beneath the mat will migrate through the foundation and into the building. This water vapor can be reduced but not eliminated. Vapor transmission can negatively affect floor coverings and lead to increased moisture within a building. Where water vapor migrating through the mat would be undesirable, we recommend the following measures to reduce water vapor transmission upward through the mat foundations.

1. Install a vapor retarder membrane directly beneath the mat. Seal the vapor retarder at all seams and pipe penetrations. Vapor retarders should conform to Class A vapor retarder in accordance with ASTM E 1745-11 “Standard Specification for Plastic Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs.”

2. Concrete should have a concrete water-cement ratio of no more than 0.5.

3. Provide inspection and testing during concrete placement to check that the proper concrete and water cement ratio are used.

4. Consider and implement adequate moist cure procedures for mat foundations.

5. Protect foundation subgrade soil from seepage by providing impermeable plugs within utility trenches.

The structural engineer should be consulted as to the use of a layer of clean sand or pea gravel (less than 5 percent passing the U.S. Standard No. 200 Sieve) placed on top of the vapor retarder membrane to assist in concrete curing.

5.3 SUBGRADE TREATMENT FOR MAT FOUNDATIONS

The subgrade material under structural mats should be uniform. The upper 12 inches of pad subgrade should be moisture conditioned to a moisture content of at least 4 percentage points above optimum. The subgrade should be thoroughly soaked prior to placing the concrete. The subgrade should not be allowed to dry prior to concrete placement.

5.4 PRELIMINARY PAVEMENT DESIGN

The following preliminary pavement sections have been determined for an assumed Resistance Value (R-value) of 5 and in accordance to the design methods contained in Chapter 630 of Caltrans Highway Design Manual.

TABLE 5.4-1: Preliminary Pavement Section

TRAFFIC INDEX	AC (INCHES)	AB (INCHES)
5.0	3.0	10.0
6.0	3.5	13.0
7.0	4.0	16.0

Notes: AC – Asphalt Concrete
AB – Caltrans Class 2 aggregate base (R-value of 78 or greater)

The above preliminary pavement sections are provided for estimating only. We recommend the actual subgrade material should be tested for R-value, and the Traffic Index and minimum pavement section(s) should be confirmed by the Civil Engineer and the City of Walnut Creek/Contra Costa County.

6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1.3 for the residential development project located in Walnut Creek, California. 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 principles and practices currently employed in the area; no warranty is express 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; 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 are 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, ENGEO must be notified 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, the proper regulatory officials must be notified 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.

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AERIAL IMAGES

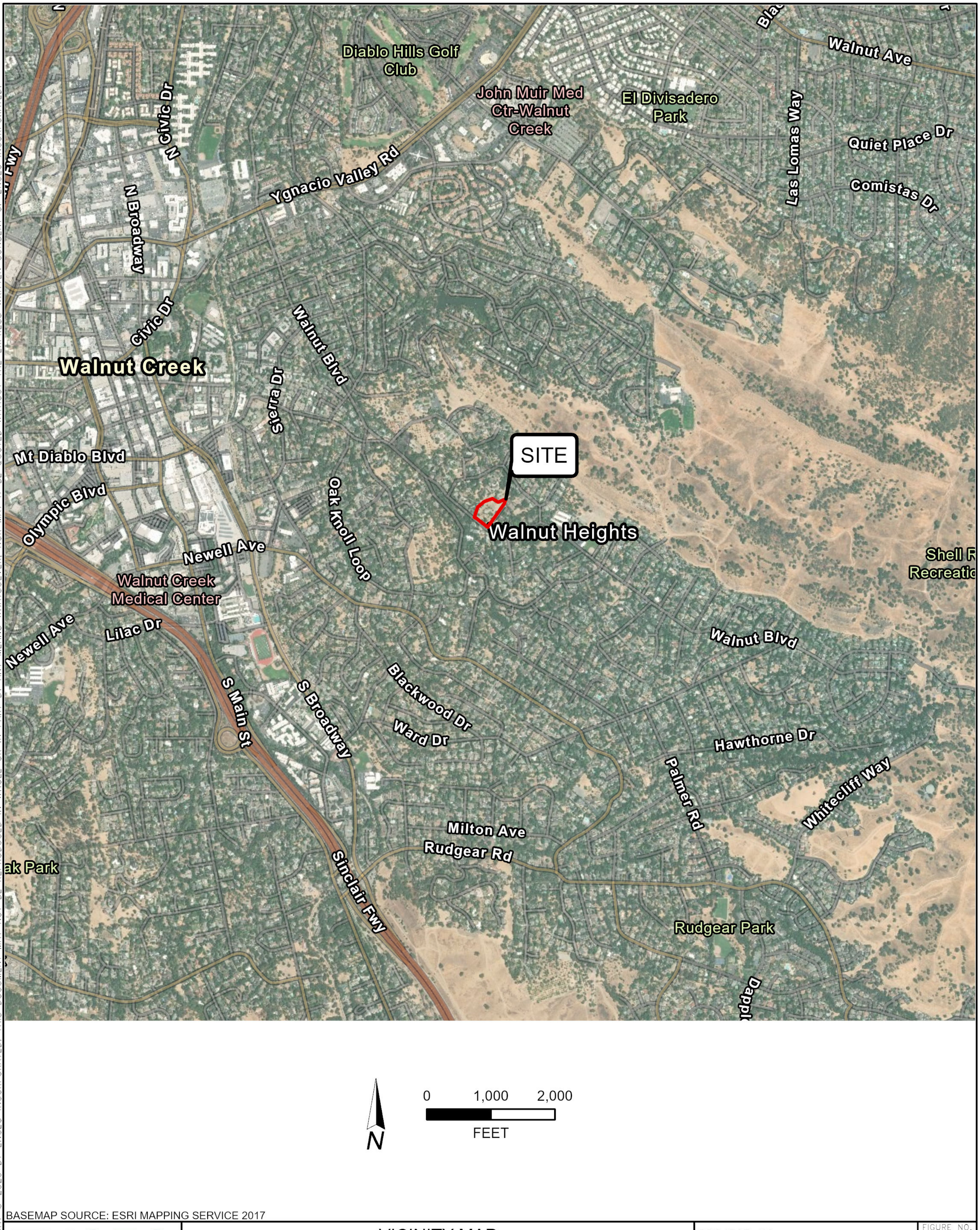
Flight C_5750, Frames 280-60 and 61, USDA, Flown July 25, 1939, 1:20,000 scale.

Flight BUU_1958, Frame 6V-58and 59, USDA, Flown January 1, 1958, 1:20,000 scale

Flight CAS_65_130, Frame 6-19 and 6-20, Cartwright Aerial Surveys, Flown May 1, 1965, at 1:12,00 scale.

Google Earth, Historic Aerial Imagery, Various Years, 1939-2016

FIGURES



BASEMAP SOURCE: ESRI MAPPING SERVICE 2017

ENGEO
Expect Excellence

VICINITY MAP
3180 WALNUT BOULEVARD
WALNUT CREEK, CALIFORNIA

PROJECT NO. : 17043.000.000	FIGURE NO. 1
SCALE: AS SHOWN	
DRAWN BY: MAT	CHECKED BY: PJS

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USER: MTORRES

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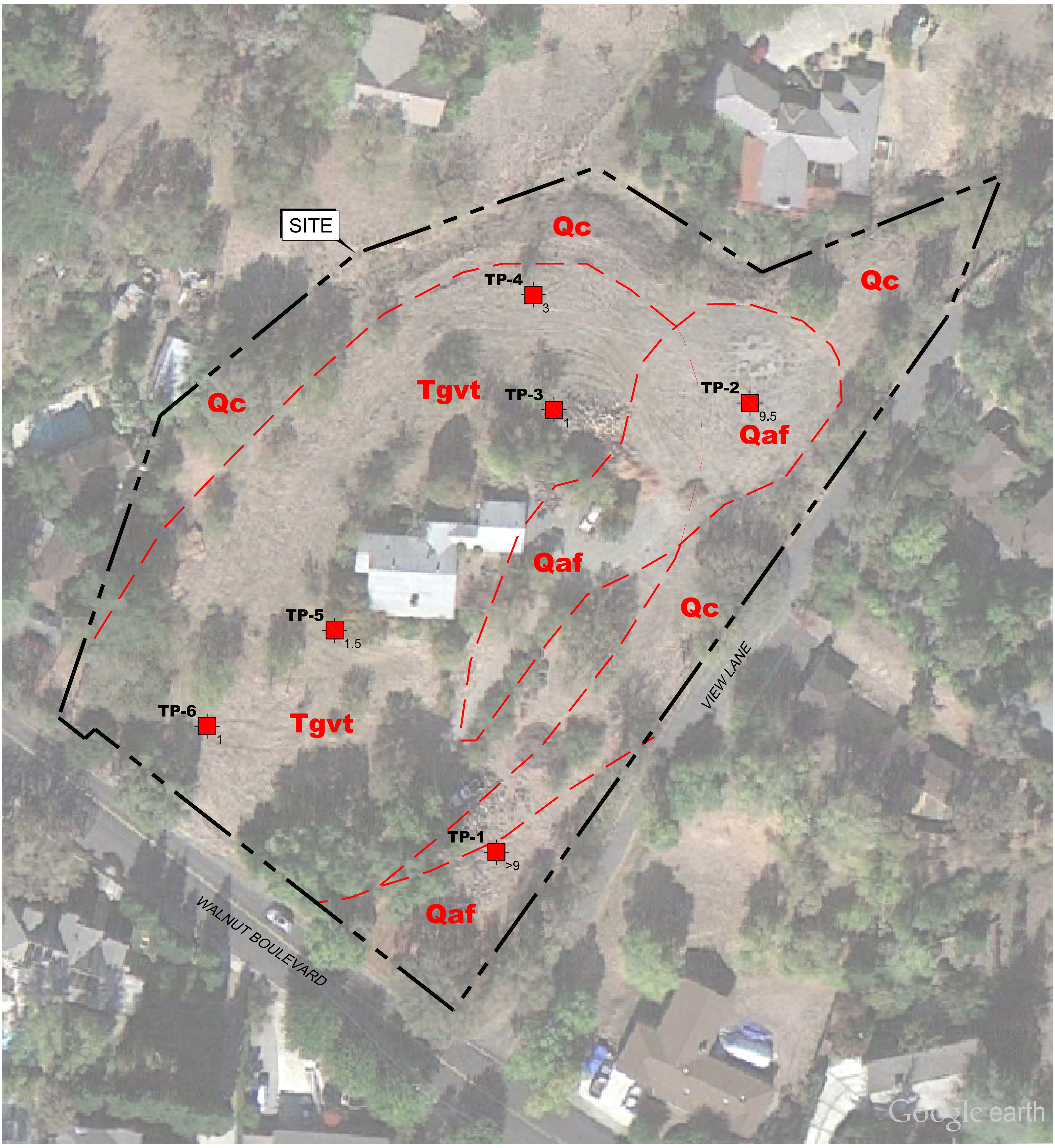
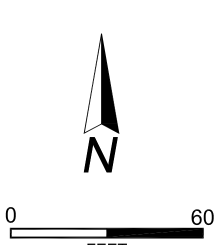




EXPLANATION

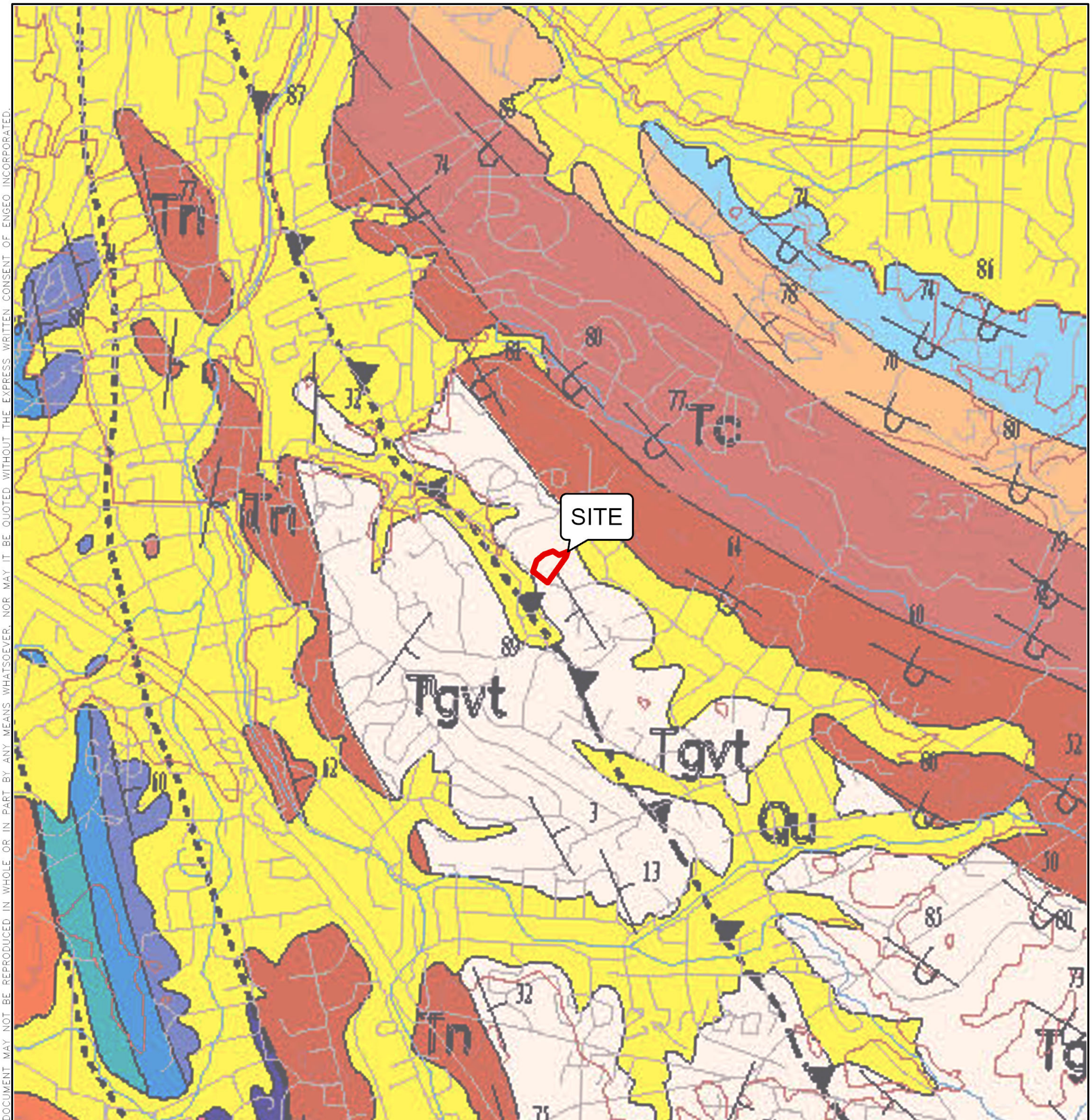
ALL LOCATIONS ARE APPROXIMATE

TP-6 ■ 1	ENGEO TEST PIT, 2020 WITH DEPTH TO BEDROCK
— — —	GEOLOGIC CONTACT
— — —	CONCEALED GEOLOGIC CONTACT
Qaf	UNDOCUMENTED FILL
Qc	COLLUVIUM
Tgvt	TASSAJERA/GREEN VALLEY GROUP (BEDROCK)

BASE MAP SOURCE: GOOGLE EARTH MAPPING SERVICE

ENGEO Expect Excellence	SITE PLAN 3180 WALNUT BOULEVARD WALNUT CREEK, CALIFORNIA	PROJECT NO.: 17043.000.000 SCALE: AS SHOWN DRAWN BY: MAT CHECKED BY: PJS	FIGURE NO. 2

ORIGINAL FIGURE PRINTED IN COLOR



N

0 1,000 2,000

FEET

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

Tgvt	GREEN VALLEY / TASSAJARA GROUP
Qu	UNDIVIDED QUATERNARY DEPOSITS
Tc	CIERBO FORMATION - SANDSTONE
Tn	NEROLY FORMATION - BLUE SANDSTONE

BASEMAP SOURCE: GRAYMER 1994

ENGEO
Expect Excellence

REGIONAL GEOLOGIC MAP
3180 WALNUT BOULEVARD
WALNUT CREEK, CALIFORNIA

PROJECT NO.: 17043.000.000	FIGURE NO. 3
SCALE: AS SHOWN	
DRAWN BY: MAT	CHECKED BY: PJS

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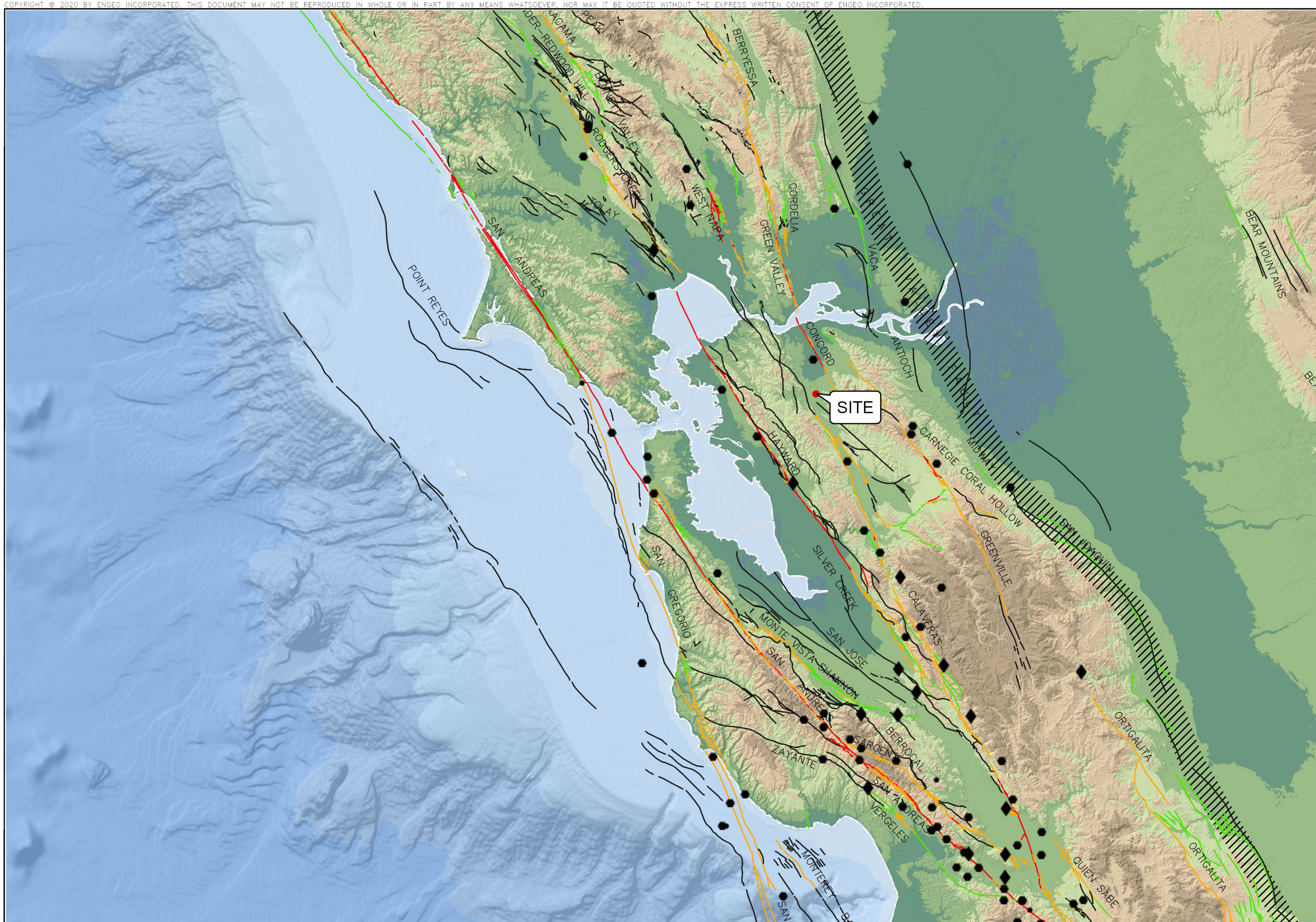
ORIGINAL FIGURE PRINTED IN COLOR



N
0 7.5 15
Miles

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

EARTHQUAKE

- MAGNITUDE 7+
- MAGNITUDE 6-7
- MAGNITUDE 5-6

USGS QUATERNARY FAULTS

- HISTORICAL
- LATEST QUATERNARY
- LATE QUATERNARY
- UNDIFFERENTIATED QUATERNARY
- HISTORIC BLIND THRUST FAULT ZONE

BASE MAP SOURCE
ESRI, GARMIN, GEBCO, NOAA NGDC, AND OTHER CONTRIBUTORS
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, 2018
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800-PRESENT)

ENGEO
Expect Excellence

REGIONAL FAULTING AND SEISMICITY	PROJECT NO.: 17043.000.000	FIGURE NO.
3180 WALNUT BOULEVARD	SCALE: AS SHOWN	4
WALNUT CREEK, CALIFORNIA	DRAWN BY: MAT / CHECKED BY: PJS	

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APPENDIX A

TEST PIT LOGS

TEST PIT LOG

3180 Walnut Blvd. Walnut Creek, CA. 17043.000.000	Logged By: Jerry Chen Logged Date: February 25, 2020

Test Pit Number	Depth (ft.)	Description
1-TP1	0 – 2	Sandy Silt (ML), dark brown, moist, rootlets, some fine-grained sand. [FILL]
	2 – 3.5	Sandy Clay (CL), pale olive with strong brown, moist, medium plasticity, some fine-grained sand. [FILL]
	3.5 – 10	Fat Clay (CH), very dark brown, dry, high plasticity, clean. [NATIVE]
	6.5	Becomes much harder with pockets of white fine-grained sand
	9	Becomes strong brown, trace rounded gravel
		-Groundwater was not encountered at time of test pits
		-Pit Dimensions: 2.5’ x 10’ x 8’, oriented northeast-southwest

TEST PIT LOG

3180 Walnut Blvd.
Walnut Creek, CA.
17043.000.000

Logged By: Jerry Chen
Logged Date: February 25, 2020

Test Pit Number	Depth (ft.)	Description
1-TP2	0 – 1.5	Sandy Silt (ML), dark brown, moist, rootlets, some fine-grained sand. [FILL]
	1.5 – 9.5	Fat clay (CH), dark brown, moist to dry, high plasticity, little to trace fine-grained sand. [NATIVE]
	5	Becomes much harder with pockets of white fine-grained sand
	9.5 - 10	MUDSTONE, pale olive with reddish yellow, extremely weak, highly weathered to completely weathered, closely fractured
		-Groundwater was not encountered at time of test pits
		-Pit Dimensions: 2.5’ x 10’ x 8’, oriented north-south

ENGEO Expect Excellence	TEST PIT LOG	
3180 Walnut Blvd. Walnut Creek, CA. 17043.000.000	Logged By: Jerry Chen Logged Date: February 25, 2020	

Test Pit Number	Depth (ft.)	Description
1-TP3	0 – 1	Sandy Silt (ML), dark brown, moist, rootlets, some fine-grained sand. [FILL]
	1 – 5	MUDSTONE, pale olive with reddish yellow, weak, highly weathered to moderately weathered, closely fractured, increasing strength with depth
	5	Becomes significantly harder
		-Groundwater was not encountered at time of test pits
		-Pit Dimensions: 2.5’ x 5’ x 5’, oriented east-west

TEST PIT LOG

3180 Walnut Blvd.
Walnut Creek, CA.
17043.000.000

Logged By: Jerry Chen
Logged Date: February 25, 2020

Test Pit Number	Depth (ft.)	Description
1-TP4	0 – 3	Sandy Silt (ML) with clay, dark brown, moist, rootlets, some fine-grained sand. [Native]
	3 – 5	MUDSTONE, pale olive with reddish yellow, weak, highly weathered to moderately weathered, closely fractured, increasing strength with depth
		-Groundwater was not encountered at time of test pits
		-Pit Dimensions: 2.5’ x 5’ x 6’, oriented east-west

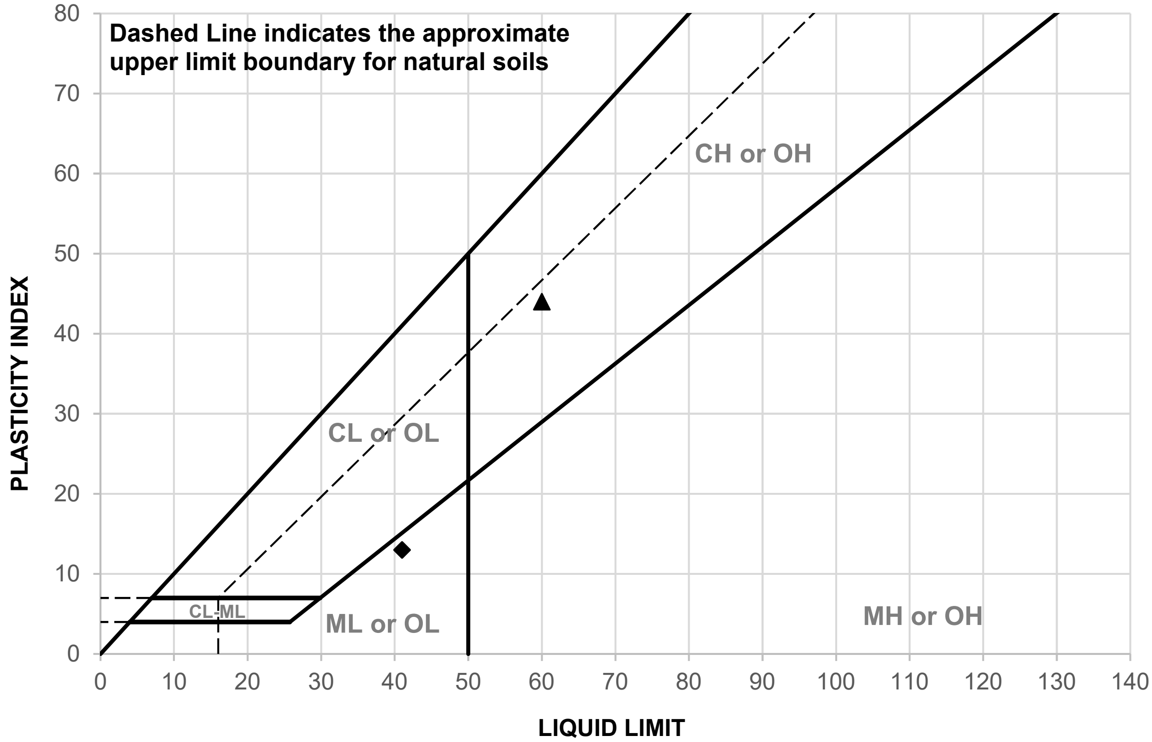
ENGEO Expect Excellence	TEST PIT LOG	
3180 Walnut Blvd. Walnut Creek, CA. 17043.000.000	Logged By: Jerry Chen Logged Date: February 25, 2020	
Test Pit Number	Depth (ft.)	Description
1-TP5	0 – 1.5	Sandy Silt (ML), strong brown, dry, rootlets, trace fine-grained sand, small tree branches at the bottom of layer. [NATIVE]
	1.5 – 6	MUDSTONE, pale olive with reddish yellow, weak, highly weathered to moderately weathered, closely fractured, increasing strength with depth, some moisture and small rootlets
		-Groundwater was not encountered at time of test pits
		-Pit Dimensions: 2.5’ x 6’ x 6’, oriented east-west

ENGEO Expect Excellence		# TEST PIT LOG
3180 Walnut Blvd. Walnut Creek, CA. 17043.000.000		Logged By: Jerry Chen Logged Date: February 25, 2020
Test Pit Number	Depth (ft.)	Description
1-TP6	0 – 1	Sandy Silt (ML), strong brown, dry, rootlets, trace fine-grained sand, small tree branches at the bottom of layer. [NATIVE]
	1 – 6.5	Poorly Graded Sand (SP), pale olive to pale yellow, rounded gravel, veins of white chalky substance, small branches and rootlets [Weathered Sandstone]
	6.5 – 9	CONGLOMERATE, pale yellow to reddish yellow, moderately weathered, weak to medium strong, fine-grained sand/silt matrix with fine to coarse rounded gravel clasts
		-Groundwater was not encountered at time of test pits
		-Pit Dimensions: 2.5’ x 9’ x 8’, oriented north-south

APPENDIX B

LABORATORY TEST RESULTS

LIQUID AND PLASTIC LIMITS TEST REPORT
ASTM D4318



	SAMPLE ID	DEPTH	MATERIAL DESCRIPTION	LL	PL	PI
▲	1-TP1@4	4.0 ft	See exploration logs	60	16	44
◆	1-TP3@4"	4.0 in	See exploration logs	41	28	13

	SAMPLE ID	TEST METHOD	REMARKS
▲	1-TP1@4	PI: ASTM D4318, Wet Method	
◆	1-TP3@4"	PI: ASTM D4318, Wet Method	

ENGEO Expect Excellence

CLIENT: BLUE MOUNTAIN COMMUNITIES
PROJECT NAME: 3180 Wlanut Boulevard, Contra Costa County, CA
PROJECT NO: 17043.000.000
PROJECT LOCATION: Contra Costa County, California
REPORT DATE: 3/5/2020
TESTED BY: M. Quasem
REVIEWED BY: G. Criste

ENGEO

Expect Excellence

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D.2 - Paleontological Records Search Results

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Kenneth L. Finger, Ph.D.
Consulting Paleontologist

18208 Judy St., Castro Valley, CA 94546-2306   510.305.1080   klfpaleo@comcast.net

October 4, 2022

Dana DePietro
FirstCarbon Solutions
1350 Treat Boulevard, Suite 380
Walnut Creek, CA 94597

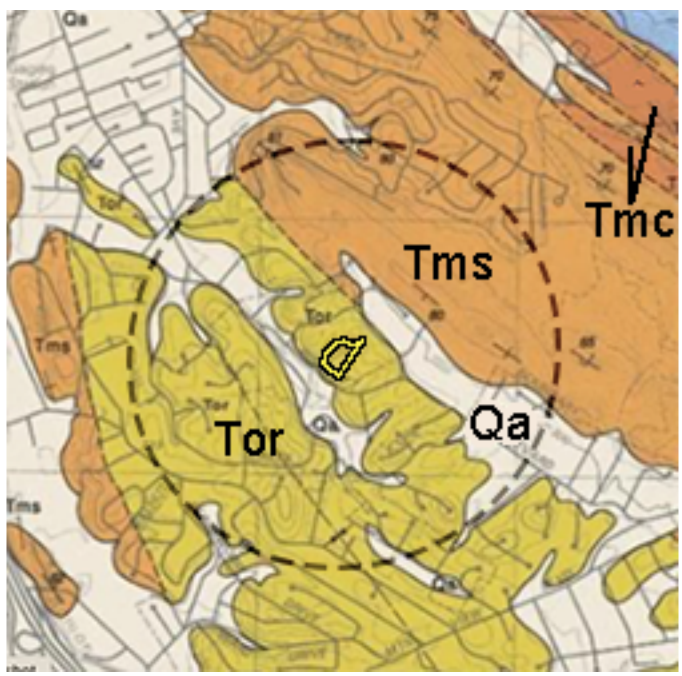
Re: Paleontological Records Search for the Walnut Boulevard Residential Project (5778.0002), Walnut Creek, Contra Costa County

Dear Dr. DePietro:

As per the request of Isobel Cooper, I have performed a paleontological records search on the University of California Museum of Paleontology (UCMP database search for the proposed project at 3180 Walnut Boulevard in Walnut Creek. Its Public Land Survey location is SW¼, SW¼, Sec. 25 and NW¼, NW¼, Sec. 36, T1N, R2W, Walnut Creek quadrangle (USGS 7.5-series topographic map). The site is within the area bounded by Walnut Boulevard and single-family homes to the south, single-family homes to the west, single-family homes and Nob Hill Drive to the north, and View Lane and single-family homes to the east. Interstate 680 (I-680) is located approximately 0.89 mile southwest of the site. The project site has numerous trees and is centered on a small grassy hilltop with a single dwelling.

<u>Geologic Units</u>

According to the part of the Dibblee and Minch (2005) geologic map shown here, the surface of the project site (yellow outline at center) consists of the Pliocene to late Miocene Orinda Formation (Tor). The surrounding half-mile search area (dashed outline) also includes Holocene alluvium (Qa) and the late to middle Miocene Monterey Formation.



Key to Adjacent Map
Qa Alluvium (Holocene)
Tor Orinda Formation (Pliocene to late Miocene)
Tm Monterey Formation (late to middle Miocene)
  Tms Sobrante Sandstone
  Tmc clay, shale, siltstone

Paleontological Records Search

Holocene deposits are too young to be fossiliferous. The records search on the UCMP database therefore focused on the Orinda and Monterey formations in the Contra Costa and Alameda counties. Although the database records 46 vertebrate localities in the Monterey Formation, the vast majority of them are in central and southern California. Four vertebrate localities in Contra Costa County are recorded but only a single cetacean vertebra from the Tomey locality more than 10 miles to the northwest is has been entered into the specimens database. The Monterey Formation also has one locality in adjacent Alameda County, which yielded 10 vertebrates, but it is in the Sunol Wilderness much farther from the project site. In contrast, the Orinda Formation has 23 vertebrate localities listed for Contra Costa County plus another three for Alameda County. They yielded a rich composite assemblage of 140 specimens (see Appendix for systematic list), 75% of which were collected during construction of the fourth bore of Caldecott Tunnel in Orinda. The locality nearest to the project site is in Orinda and more than five miles east of the project site.

Paleontological Assessment and Mitigation Recommendations

The disturbance and groundcover of the project site precludes a preconstruction paleontological walkover survey. I recommend paleontological monitoring of all earth-disturbing construction activities for this project because the site is on the Orinda Formation, which has a moderate potential and high sensitivity for significant paleontological resources.

Should any significant fossils (i.e., bones, teeth, or unusually abundant and well-preserved invertebrates or plants) be unearthed, the construction crew should not attempt to remove them, as they could be extremely fragile and prone to crumbling, and to ensure their occurrence is properly recorded; instead, all work in the immediate vicinity of the discovery should be diverted at least 15 feet until a professional paleontologist assesses the find and, if deemed appropriate, salvages it in a timely manner. All recovered fossils should be deposited in an appropriate repository, such as the UCMP, where they will be properly curated and made accessible for future study.

Sincerely,

Reference Cited

Dibblee, T.W., Jr., and Minch, J.A., 2005, Geologic map of the Walnut Creek quadrangle, Contra Costa County, California. Dibblee Foundation Map DF-149, scale 1:24,000.

APPENDIX

UCMP Vertebrates from the Pliocene Orinda Formation

Class Osteichthyes (bony fish)
  Order Lepisosteiformes
    Family Lepisosteidae
      Lepisosteus (gar)
  Order Perciformes
    Family cf. Lutjanidae (snappers)
    Family Cyprinidae (carps & minnows)
Class Reptilia (reptiles)
  Order Testudines
    Family Testudinidae
      Hesperotestudo (tortoise)
Class Aves (birds)
Class Mammalia (mammals)
  Order Artiodactyla (even-toed ungulates)
    Family Camelidae (camels)
      Procamelus
    Family Dromomerycidae
      Cranioceras
    Family Merycoidodontidae (oreodonts)
      Ticholeptus
  Order Carnivora
    Family Felidae
      Barbourofelis (false sabre-tooth cat)
    Family Mustelidae (weasels, badgers, etc.)
  Order Cetacea
    Family Cetotheriidae (baleen whales)
  Order Desmostylia
    Family Desmostylidae
      Desmostylus (extinct hippo-like marine mammal)
  Order Lagomorpha
    Family Leporidae (rabbits & hares)
      Hypolagus
  Order Lipotyphla
    Family Soricidae
      Sorex (shrew)
  Order Perissodactyla (odd-toed ungulates)
    Family Equidae (horses)
      Hipparion cf. *H. mohavense*
      Nannippus tehonensis
      Pliohippus cf. *P. leardi*
    Family Rhinocerotidae (rhinoceroses)
      Aphelops?
  Order Proboscidea
    Family Gomphotheriidae
      Gomphotherium simpsoni
    Family Mammutidae (mastodons)
  Order Rodentia
    Family Cricetidae (mice)
      *Copemy*s
    Family Geomyidae (gopher)
      cf. *Pliosaccomys*

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