Appendix F:
Geology and Soils Supporting Information

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F.1 - Geologic Hazards Assessment Report

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TOYOTA OF WALNUT CREEK DEVELOPMENT
WALNUT CREEK, CALIFORNIA

GEOLOGIC HAZARDS ASSESSMENT REPORT

SUBMITTED TO
Mr. Stephen Scanion
Toyota of Walnut Creek
2100 Broadway
Walnut Creek, CA 94596

PREPARED BY
ENGEO Incorporated

August 30, 2021
Revised November 18, 2021

PROJECT NO.
18773.000.001

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GEOTECHNICAL
ENVIRONMENTAL
COASTAL/MARITIME
WATER RESOURCES
CONSTRUCTION SERVICES

Project No.
18773.000.001

August 30, 2021
Revised November 18, 2021

Mr. Stephen Scanlon
Toyota of Walnut Creek
2100 Broadway
Walnut Creek, CA 94596

Subject: Toyota of Walnut Creek Development
Walnut Creek, California

GEOLOGIC HAZARDS ASSESSMENT REPORT

Dear Mr. Scanlon:

As requested, we have prepared this geologic hazards ("geohazards") assessment report for the developments under consideration for the Toyota of Walnut Creek (TOWC) property in Walnut Creek, California. We have evaluated surface and subsurface conditions based on a review of available published data. On the basis of that evaluation, we have assessed potential geologic hazards that could impact the proposed project. No field exploration has been carried out for this phase of the project. The purpose of this geohazards report is to aid in the preparation of CEQA/NEPA documents for the project's environmental approval and to support other preliminary development planning efforts.

Based on our assessment, we anticipate that the risks associated with potential geologic hazards at the TOWC site can be mitigated through: (1) a design level field exploration program to further characterize the subsurface conditions; and (2) design and implementation of appropriate mitigation measures.

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

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1.0 INTRODUCTION

To support of the planning and design of site developments at the Toyota of Walnut Creek (TOWC) site in Walnut Creek, California, we have prepared this "Geohazards Report" presenting an overview of geotechnical and geologic hazards that could impact future developments at the site. The location of the project study area is shown in Figure 1. The project site comprises approximately 8 acres of land that is currently used as commercial space and surface parking. The eastern portion of the site includes two separate parcels that are at present occupied by Toyota of Walnut Creek.

While there are no specific development plans available to us at this time, from conversations with you, we understand the site may be developed for a mixed-use residential and commercial development with associated streets, underground utilities, landscaping, and surface parking. It is also our understanding that the proposed building heights may range depending on zoning allowances and building type. We assume that cuts and fill for mass grading will be minimal, likely less than 2 to 3 feet maximum; however, we presume excavations may be planned if below-grade parking is desired.

The geotechnical and geologic hazards assessed in this report are intended to support the preparation of CEQA/NEPA documents for environmental approval and aid in the initial planning and design of site developments. Our findings presented in this report are on the basis of our review of existing available geotechnical and geological information in the project vicinity. No field explorations were carried out for this phase of the project study.

1.1 WORK PERFORMED

Our scope of work completed for this geohazards assessment included:

- Review of Available Relevant Data and Information. We reviewed available published geologic maps, document, reports, and relevant subsurface exploration logs that were pertinent for the project vicinity, including:
  - Published geologic maps from the United States Geological Survey (USGS) and California Geologic Survey (CGS).
  - Published hazard reports and maps, including liquefaction, landslide, faulting, and tsunami inundation maps.
  - Previous geotechnical engineering investigation report for the Toyota of Walnut Creek Dealership (CTE CAL, Inc., 2021).
  - Regional subsurface investigations available on the CGS Geotracker website (https://geotracker.waterboards.ca.gov).
- Report Preparation. We prepared this geohazards report presenting our findings and interpretations regarding geotechnical/geological hazards in the study area and their potential impact on future developments under consideration.

2.0 SITE SETTING

The TOWC study area encompasses an approximately eight-acre site spanning across the east and west sides of North Broadway between Pine Street (to the north) and Ygnacio Valley Road (to the south) in Walnut Creek, California. The study area is situated in a commercial area of Walnut Creek that is zoned under “Auto Sales/Service and Custom Manufacturing” that includes the Toyota of Walnut Creek automobile dealership and neighboring auto repair and services shops. The terrain is predominantly paved areas (streets and parking lots) and includes minor vegetated strips, primarily along sidewalks and building fronts that includes lawns, bushes, shrubs, and trees.

Ground surface across the study area is generally flat sloping very gently from a high elevation of about +160 feet at the eastern end of the site to a low elevation of about +145 feet at the western end (WGS84 Datum).

2.1 GEOLOGIC SETTING

The proposed TOWC site is part of a region that is located within the Coast Ranges geomorphic province of California. The Coast Ranges geomorphic province is characterized by a system of northwest-trending, fault-bounded mountain ranges and intervening alluvial valleys. Bedrock in the Coast Ranges comprises igneous, metamorphic and sedimentary rocks that range in age from Jurassic to Pleistocene. The present topography and geology of the Coast Ranges are considered to be 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, Hayward, and Calaveras faults, as well as other lesser-order faults.

The proposed TOWC site is located within the west portion of Ygnacio Valley. Ygnacio Valley represents an area of low relief, between Mount Diablo within the Diablo Range to the east and the Briones Hills within the East Bay Hills to the west. As shown in Figure 2, the site spans across exposed Monterey Formation tertiary sandstone (east of N. Broadway) that in lower-lying areas is in-filled and overlain by younger alluvial deposits (e.g. on the west of N. Broadway).

Dibblee (2005) describes the Monterey Formation sandstone as a typically light grey to tan, medium grained, arkosic (i.e. feldspar rich), basal unit that is middle to lower Miocene age. The alluvial deposits are commonly unconsolidated, heterogeneous, poorly to moderately sorted, irregularly interbedded clay and silt containing discontinuous lenses of sand, silty clay, and gravel. Dibblee (2005) and others (Graymer et al., 1997, etc.) describe the mapped surficial deposits as undivided Holocene and Pleistocene gravel, sand, and clay.

2.2 SEISMIC SETTING

The study area is located within a seismically active region near the boundary between two major tectonic plates, the Pacific Plate to the west and the North American Plate to the east. Movement of these plates is primarily translated in the Bay Area as right lateral slip along the San Andreas Fault Zone, with some compressional component, which is accommodated by vertical reverse-slip displacement on the Great Valley and other reverse/thrust faults in the central California area. The relative movement between the Pacific Plate and the North American Plate generally occurs across a 50-mile-wide zone extending from the San Gregorio Fault in the southwest to the Great Valley Thrust Belt to the northeast.

As shown in Figure 3, the region surrounding the project study area contains numerous active faults. The California Geologic Survey (CGS) defines an active fault as one that has had surface displacement within Holocene time (about the last 11,700 years) (CGS SP42, 2018). The Working Group on California Earthquake Probabilities (WGCEP, 2015) evaluated the 30-year probability of an earthquake with Moment Magnitude (M_w) 5 or greater occurring on the known active fault systems in the Bay Area in Third Uniform California Rupture Forecast (UCERF3). According to UCERF3, there is a 72 percent probability of an earthquake with a M_w 6.7 or greater in the Bay Area as a whole, including probabilities of 14.3 percent for the Hayward Fault, 7.4 percent for the Calaveras Fault, and 6.4 for the Northern San Andreas Fault. We queried the UCERF3 Fault Database to determine nearby active faults that are capable of generating strong seismic ground shaking at the site. We interpolated individual fault activity rates to determine the expected magnitude at a 2,475-year return period, with the resulting faults and magnitudes listed below in Table 2.2-1. Although all the faults listed below are capable of generating strong ground motions at the site, some of the faults do not have a high probability of experiencing large seismic events, and therefore may not contribute significantly to the shaking hazard at the site.

TABLE 2.2-1: Nearby Active Faults

FAULT NAME	DISTANCE (MILES) [1]	DIRECTION FROM STUDY AREA	MOMENT MAGNITUDE [2]
Contra Costa (Larkey) [1]	1.07	SW	6.28
Franklin [1]	1.12	SW	7.09
Mount Diablo Thrust North CFM [1]	1.97	E	7.14
Contra Costa Shear Zone (connector) [4]	2.68	W	7.08
Concord [2]	3.65	NE	6.66
Contra Costa (Lafayette) [1]	2.78	W	6.98
Concord [1]	5.96	NE	6.56
Calaveras (North) [0]	5.19	S	6.99
Hayward (North) [1]	9.85	SE	6.993

Notes:
1. Fault distances are measure to the rupture zone with respect to the following site coordinates: Lat. 37.909134; Long. -122.062096
2. Expected earthquake moment magnitude based on a 2475-year recurrence interval

2.3 GROUNDWATER

Our review of available groundwater monitoring data on the CGS Geotracker website uncovered the following nearby sites that have had past well installations a groundwater level monitoring:

- North Main Street at Pringle Avenue
- North Main Street at Parkside Drive
- Ygnacio Blvd. at N. Broadway (NE corner)
- Ygnacio Blvd. at N. Broadway (SE corner)

Groundwater monitoring data at these sites consistently indicated a groundwater table ranging from about 20 to 25 feet below ground surface (bgs) with minor seasonal fluctuations of +/- 5 feet or less.

3.0 GEOLOGIC HAZARDS

The following sections provide our assessment of potential geologic hazards that could impact the design and construction of future developments at the TOWC site. Our assessments are based on our review of available existing geotechnical and geological information from available resources as listed in Section 1.1. Potential geohazards assessed include fault rupture, ground shaking, liquefaction, lateral spread, earthquake-induced settlement, landsliding, potentially expansive soil, compressive soil, and corrosive soil.

On the basis of our review of published information, we anticipate that the primary geohazard that could impact future developments at the TOWC site is ground shaking caused by a moderate to strong earthquake on one of the active faults in the region. Other hazards that are not expected to have a major impact on future developments but should be further explored and evaluated during future design phases include dynamic settlement, consolidation settlement, potential expansive soil, and soil corrosion. Hazards such as tsunami inundation and flooding have a low probability of impact on future site developments and are not discussed further in this report.

3.1 FAULT RUPTURE

The TOWC site is not located within a State of California Earthquake Fault Hazard Zone and no known active or potentially active faults cross the site (California Geologic Survey Walnut Creek Quadrangle, 1993). Therefore, we consider the risk of ground rupture from fault displacement to be very low.

3.2 GROUND SHAKING

Strong ground shaking can occur within the project study area as a result of a moderate to large earthquake occurring on one of the active regional faults listed on Table 2.2-1. Of the active regional faults, the Concord Fault contributes the most to the ground-shaking hazard at the site.

The geologic conditions within the study area indicate that the TOWC site is situated on borderline seismic Site Class C/D ground conditions as defined in the American Society of Civil Engineers' "Minimum design loads for buildings and other structures" (ASCE 7-16). Peak ground acceleration adjusted for these site classes for the Maximum Considered Earthquake (MCE) as defined in ASCE 7-16 and adopted by the CBC 2019, is estimated to range from approximately 0.9g to 1.0g within the study area.

To mitigate strong ground shaking effects, future developments should be designed using current state of engineering practice and comply with the current California Building Code (CBC) requirements, at a minimum. Seismic design provisions of current building codes generally prescribe minimum seismically induced lateral forces, applied statically to the structure, combined with the gravity forces of dead loads and live loads.

3.3 LIQUEFACTION

Liquefaction is a phenomenon wherein a temporary reduction of soil shear strength occurs as a result of increases in pore pressure that result from cyclic loading of soil during earthquakes. In general, saturated, loose to medium-dense sand and silty sand that are within a depth of about 45 to 50 feet below ground surface (bgs) are most susceptible to liquefaction. Non-plastic and low-plasticity silt have also been known to liquefy with a corresponding reduction of soil shear strength. Gravel that is susceptible to excess pore water pressure generation can also potentially liquefy under the right set of conditions.

On the basis of our review of the US Geologic Survey (USGS) liquefaction susceptibility map (Wentworth et al, 2000) for the study area, we expect the TOWC site to have a very low susceptibility to liquefaction (Figure 4).

3.4 LATERAL SPREAD

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 diminish with distance from the slope. Based on site topography and subsurface conditions, it is our opinion that the risk of lateral spreading at the site is low.

3.5 EARTHQUAKE-INDUCED SETTLEMENT

Ground settlements can be caused by earthquakes, particularly in loosely deposited/compacted sandy deposits. Settlement can occur as a result of the relatively rapid rearrangement, compaction, and settling of unsaturated, sandy soil during strong ground shaking or the reconsolidation of liquefied, saturated sandy soil shortly after strong ground shaking. Settlement can occur both uniformly and differentially.

The risk of significant earthquake-induced settlement within the sandstone on the eastern half of the TOWC site (east of N. Broadway) and the relatively dense alluvial deposits that occupy the western half of the site (west of N. Broadway) is considered low. Some very limited seismic densification may occur within localized medium dense granular deposits with the stratified alluvium, but are not anticipated to manifest into ground settlements that can impact the project.

3.6 LANDSLIDES

Due to the topographic conditions of the site, we consider the potential for landslide hazards impacting future developments to be very low.

3.7 COMPRESSIBLE SOIL

Generally, clay soil is subject to consolidation settlement when a new compressive loading is introduced by structure foundations, earthworks such as aerial fill placement, or heavy equipment. The amount of consolidation settlement is dependent on the magnitude and duration of the applied load, the shape and size of the applied load area, the depth, thickness and the stress history of the potentially compressible soil.

A review of available subsurface data for the project vicinity indicates that the alluvial deposits underlying the TOWC site on the east side of N. Broadway may include stiff clayey soil of medium plasticity that are likely over-consolidated. Based on our knowledge and experience, it is our opinion that clayey alluvial deposits, if present on the western half of the TOWC site, may experience re-consolidation when subjected to new structural foundation loads, possibly resulting in consolidation settlements. Compressible soil and associated consolidation settlements are not anticipated on the eastern half of the TOWC site (i.e. east of N. Broadway) due to the presence of shallow underlying bedrock.

We recommend that design-level geotechnical explorations for future developments at the site include sufficient soil sampling, laboratory testing, and analysis to characterize the extent of potentially compressible clayey soil, if any, and the potential for consolidation-induced settlement when subjected to design foundation loads.

3.8 EXPANSIVE SOIL

Expansion and contraction of expansive soil in response to changes in moisture content can cause differential and cyclical movements that can cause damage and/or distress to structures. They can shrink or swell and cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Granular soil is typically not expansive while moderate to high plasticity cohesive soil may exhibit expansive behavior.

Building damage due to volume changes associated with expansive soil can be reduced by: (1) using a rigid mat foundation that is designed to resist the settlement and heave of expansive soil, (2) deepening the foundations to below the zone of moisture fluctuation, i.e. by using deep footings or drilled piers, and/or (3) using lime treatment in the upper 18 inches of the building pad to reduce the expansion potential of the on-site soil.

Based on review of available subsurface data in the TOWC site vicinity, we note that near-surface alluvial deposits typically consist of low-plasticity silt, silty sand, and silty gravel that exhibit a low potential for expansion. Medium plasticity clayey soil observed in some of the available regional borings were typically at depths greater than 10 feet bgs and are not expected to be subjected to wetting-and-drying cycles that could cause volumetric soil expansion/contraction. On the east side of N. Broadway, the TOWC site is underlain by sandstone that does not impose a risk of expansive behavior.

Although we anticipate the potential impacts of expansive soil on future developments of be minor, we recommend that during design-level geotechnical explorations for future developments at the site, sufficient soil sampling, laboratory testing, and analysis be performed to determine the presence and extent of clayey soil deposits, if any, and characterize their expansion potential.

3.9 SOIL CORROSION

Corrosion is the deterioration of metal and concrete through a reaction with the surrounding soil and groundwater environment. If not properly mitigated, corrosion can cause degradation and weakening of buried steel structural elements and/or below-grade concrete walls, footings, etc.

For metals that come in contact with soil or water, corrosion is typically a result of contact with soluble salts found in the soil or water or atmosphere. The characterization of a site as having a "corrosive environment" is typically performed by testing the soil for specific electrochemical characteristics and presence of chemical constituents. These tests typically include electrical resistivity, pH, Redox potential, chlorides, sulfides, and sulfates.

In addition to its detrimental effects towards buried steel, high amounts of sulfates are deleterious to concrete. Sulfates react with lime in the concrete to form expansive products that cause the concrete to soften and crack. Cracked concrete is more susceptible to attack by water and other aggressive ions that may accelerate the corrosion process.

We did not find, on the basis of our review of available geological and geotechnical information in the TOWC site vicinity, any corrosion test results. We recommend that during design-level geotechnical explorations for future developments at the site, soil sampling, laboratory testing, and analysis be performed to characterize the corrosion potential of the site, and that appropriate corrosion control/mitigation measures be implemented as necessary.

4.0 LIMITATIONS

The conclusions and opinions we present herein are on the basis of review, evaluation, and interpretation of relevant published information including geologic maps, groundwater maps, and jurisdictional hazard maps and reports. The conclusions and opinions are intended to be used solely for future development planning, preliminary design, and development of CEQA/NEPA environmental documents. This report is not intended for use in the design or the construction of any structures or facilities at the TOWC site.

This report is based on the project information available at the date of submittal and the project as described. Should additional data become available that could potentially impact these conclusions and opinions, we should be given the opportunity to evaluate such data and to modify these conclusions and opinions as appropriate.

The geohazard characterizations presented in this report are professional opinions based on our understanding of the proposed project. The findings and professional opinions presented in this report are presented within the limits prescribed by the client, in accordance with generally accepted professional engineering and geologic practices. There is no warranty, either express or implied.

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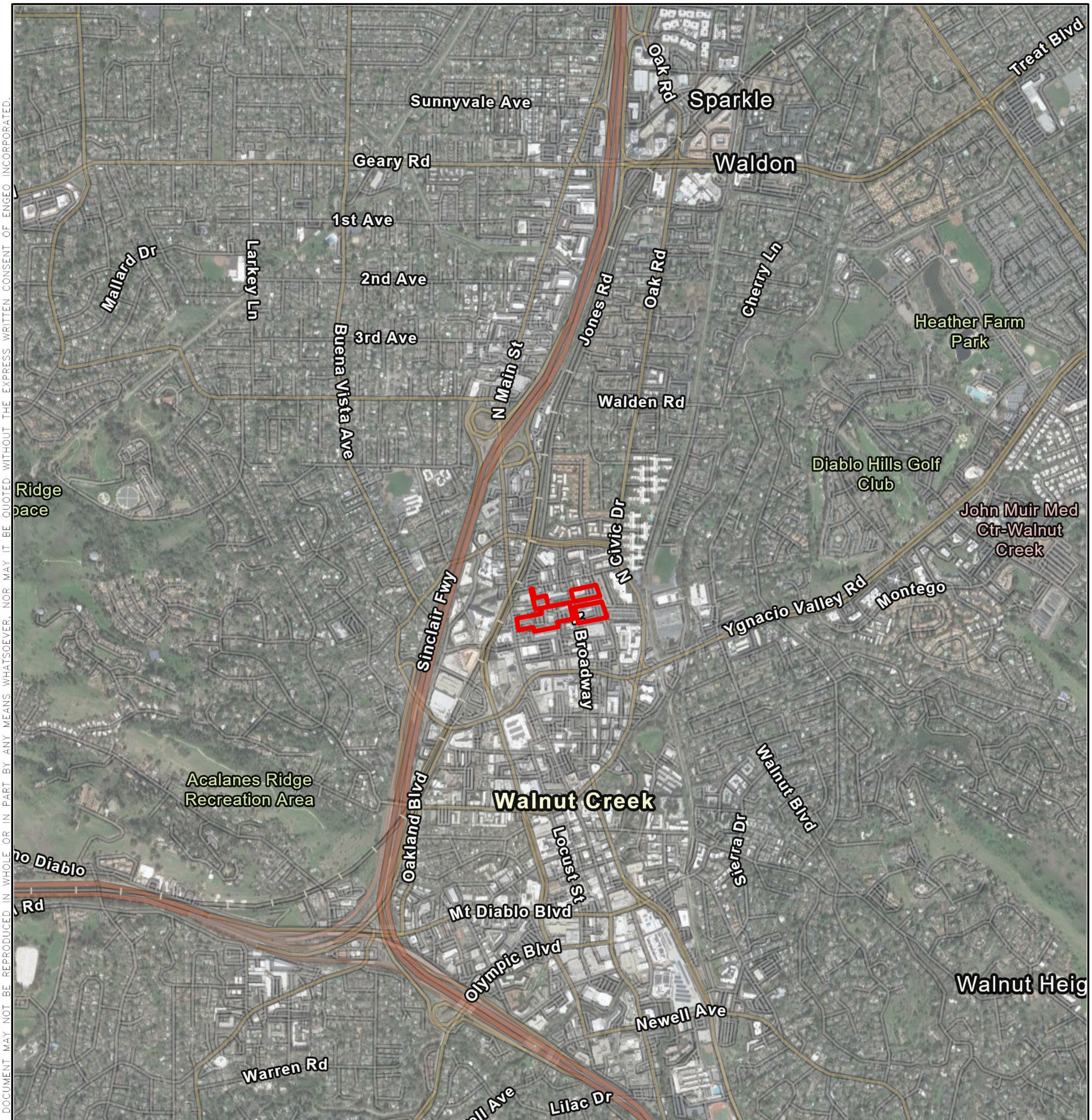
FIGURES

FIGURE 1: Vicinity Map
FIGURE 2: Regional Geologic Map
FIGURE 3: Regional Faulting and Seismicity
FIGURE 4: USGS Liquefaction Susceptibility Map



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FEET

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

PROJECT SITE

BASEMAP SOURCE: GOOGLE EARTH MAPPING SERVICE 2021

ENGEO Expect Excellence	VICINITY MAP TOYOTA WALNUT CREEK WALNUT CREEK , CALIFORNIA	PROJECT NO. : 18773.000.001 SCALE: AS SHOWN DRAWN BY: NLK CHECKED BY: TTB	FIGURE NO. 1

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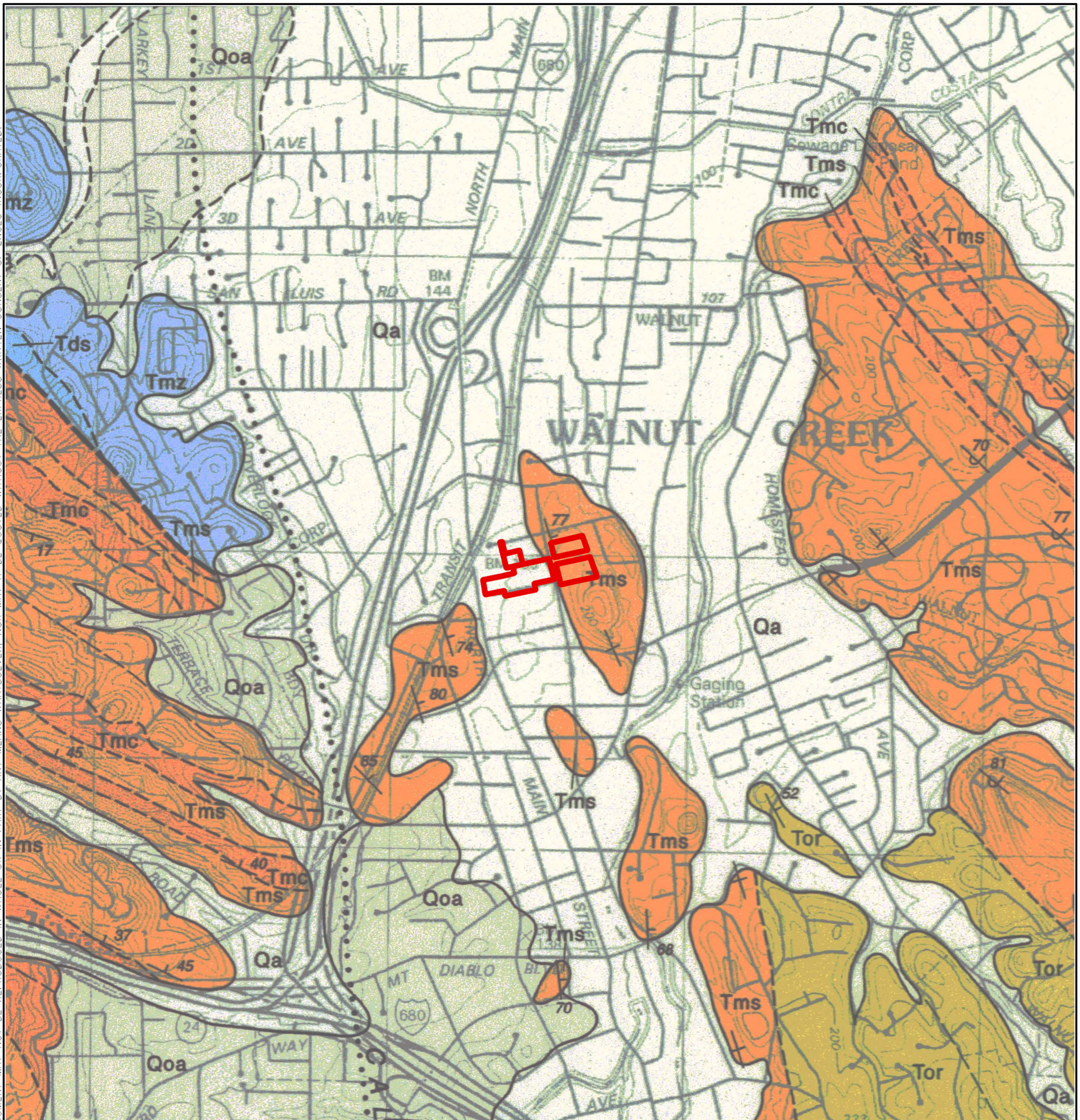

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

- PROJECT SITE
- Qa SURFICIAL SEDIMENTS
- Qoa OLDER SURFICIAL SEDIMENTS
- Tor ORINDA FORMATION
- Tms MONTEREY FORMATION
- Tmc MONTEREY FORMATION
- Tds DOMENGENE SANDSTONE
- Tmz MARTINEZ FORMATION

N

0 1,000 2,000
FEET

BASEMAP SOURCE: DIBBLE DF-149 2005

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REGIONAL GEOLOGIC MAP TOYOTA WALNUT CREEK WALNUT CREEK , CALIFORNIA	PROJECT NO. : 18773.000.001		FIGURE NO. 2
	SCALE: AS SHOWN		
	DRAWN BY: NLK	CHECKED BY: TTB	

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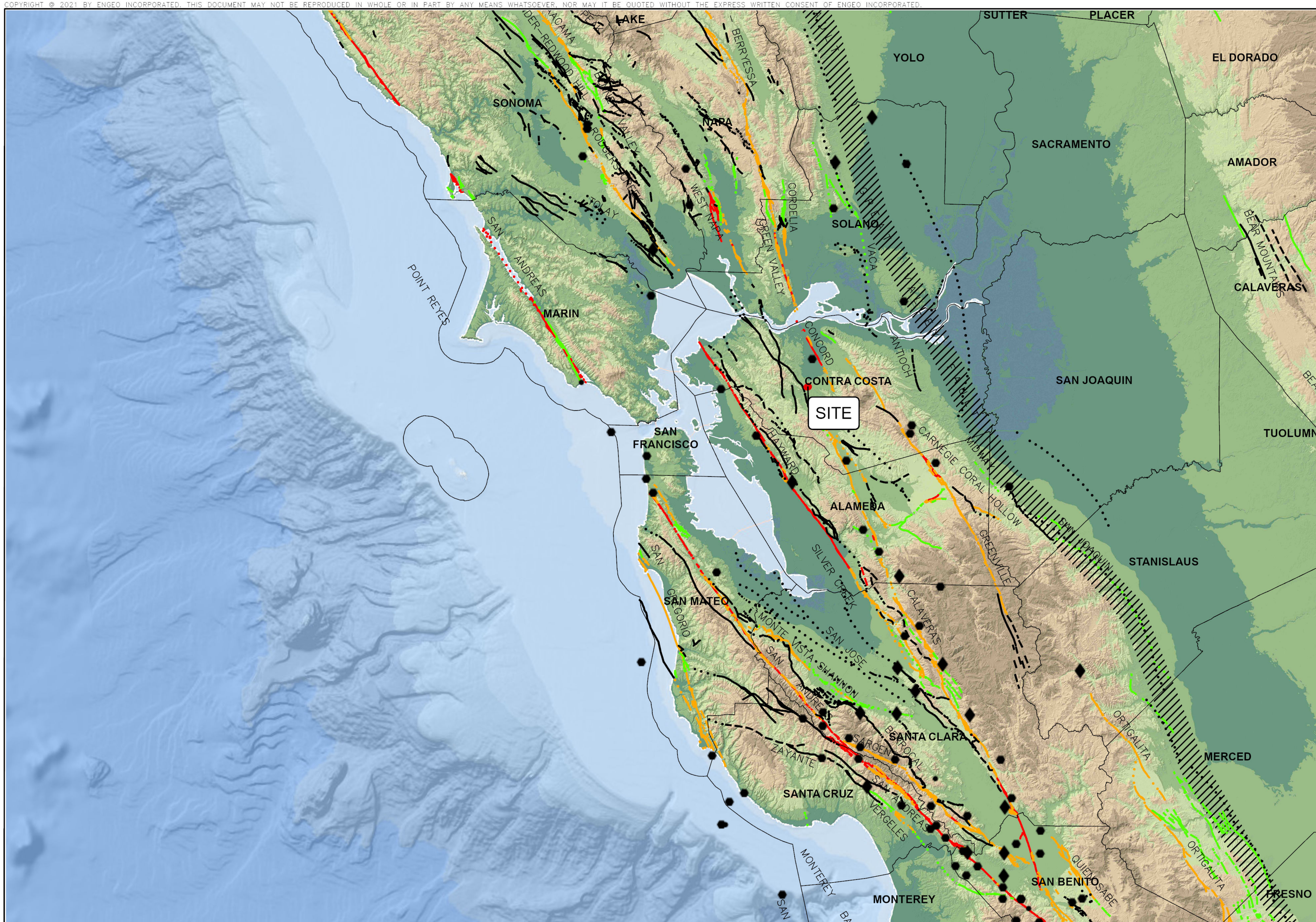

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

EARTHQUAKE

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

QUATERNARY FAULTS

BASED ON TIME OF MOST RECENT SURFACE DEFORMATION

- HISTORICAL (<150 YEARS), WELL CONSTRAINED LOCATION
- HISTORICAL (<150 YEARS), MODERATELY CONSTRAINED LOCATION
- HISTORICAL (<150 YEARS), INFERRED LOCATION
- LATEST QUATERNARY (<15,000 YEARS), WELL CONSTRAINED LOCATION
- LATEST QUATERNARY (<15,000 YEARS), MODERATELY CONSTRAINED LOCATION
- LATEST QUATERNARY (<15,000 YEARS), INFERRED LOCATION
- LATE QUATERNARY (<130,000 YEARS), WELL CONSTRAINED LOCATION
- LATE QUATERNARY (<130,000 YEARS), MODERATELY CONSTRAINED LOCATION
- LATE QUATERNARY (<130,000 YEARS), INFERRED LOCATION
- UNDIFFERENTIATED QUATERNARY(<1.6 MILLION YEARS), WELL CONSTRAINED LOCATION
- UNDIFFERENTIATED QUATERNARY(<1.6 MILLION YEARS), MODERATELY CONSTRAINED LOCATION
- UNDIFFERENTIATED QUATERNARY(<1.6 MILLION YEARS), INFERRED LOCATION
- GREAT VALLEY FAULT ZONE

BASE MAP SOURCE
ESRI, GEBCO, DELORME, NATURALVUE
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 TOYOTA WALNUT CREEK WALNUT CREEK, CALIFORNIA	PROJECT NO.: 18773.000.001 SCALE: AS SHOWN DRAWN BY: NLK CHECKED BY: TTB	FIGURE NO. 3

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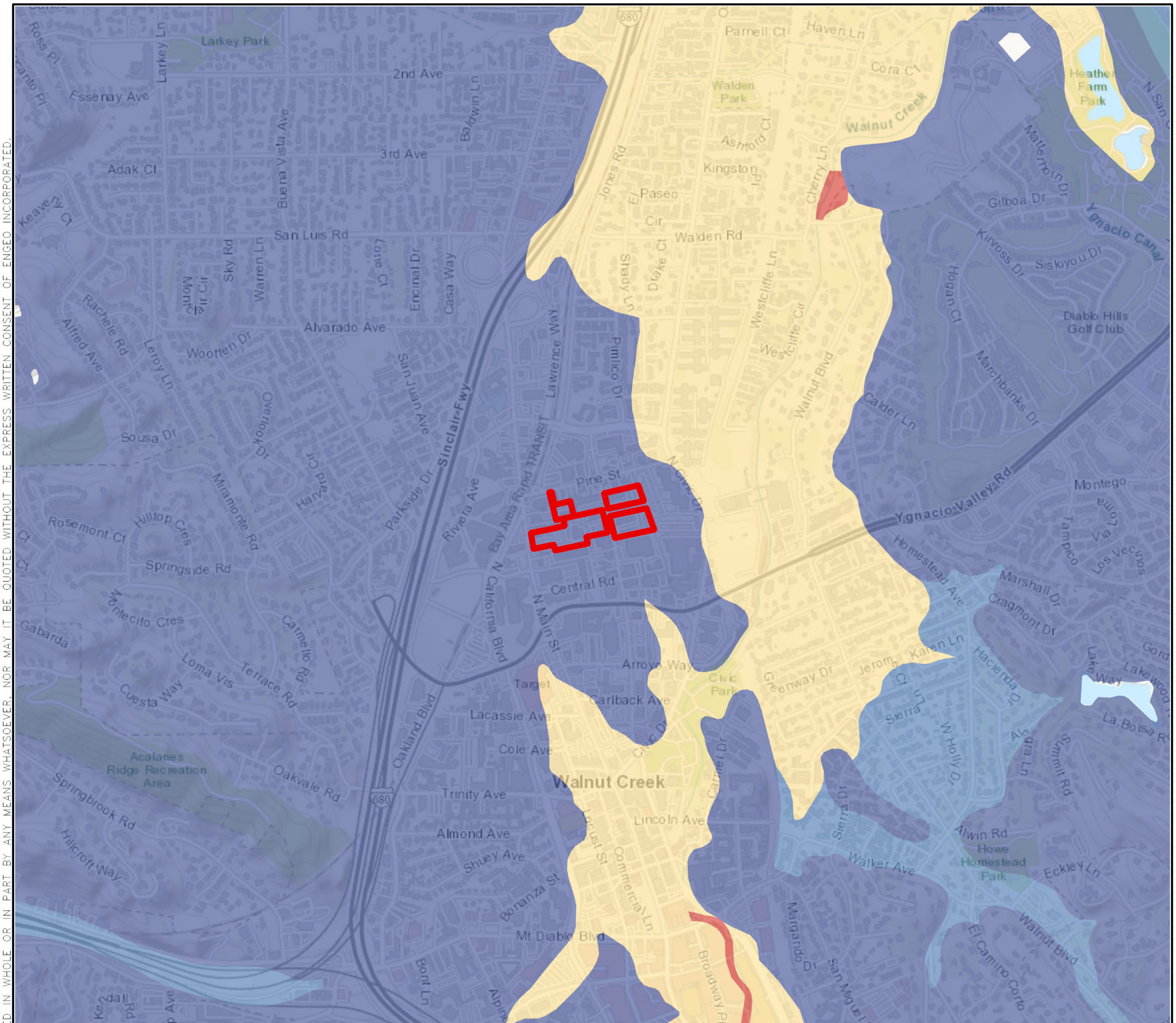


EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

PROJECT SITE

USGS LIQUEFACTION SUSCEPTIBILITY

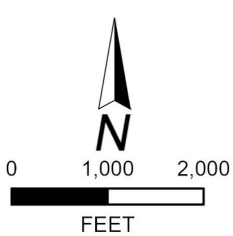
VERY HIGH

HIGH

MODERATE

LOW

VERY LOW



BASEMAP SOURCE: ESRI MAPPING SERVICE AND USGS, WITTER, ET. AL., 2006

ENGEO Expect Excellence	USGS LIQUEFACTION SUSCEPTIBILITY MAP TOYOTA WALNUT CREEK WALNUT CREEK , CALIFORNIA	PROJECT NO. : 18773.000.001 SCALE: AS SHOWN DRAWN BY: NLK CHECKED BY: TTB	FIGURE NO. 4

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F.2 - Paleontological Record Search

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1350 Treat Boulevard, Suite 380
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Re: Paleontological Records Search for the Walnut Creek Mixed Use Special District Project (2444.0011), Contra Costa County

Dear Dr. DePietro:

As per the request of Madelyn Dolan, I have performed a paleontological records search for the Walnut Creek Mixed-Use Special District Project. This commercially developed 6.1-acre site is located south of Pine Street and extends from North Main Street eastward across North Broadway. Its PRS location is NE¼, NE¼, Sec. 27 and NW¼, NW¼, Sec. 26, T1N, R2W, Walnut Creek quadrangle (USGS 7.5-series topographic map). The applicant is proposing to amend the NDSP to create a new Auto Sales-Custom Manufacturing Mixed Use Special District overlay.

Geologic Units

According to the part of the geologic map of Dibblee and Minch (2005) shown here, the surface of the project site (yellow outlines at center) consists of Holocene alluvium (Qa) and Miocene Monterey Formation sandstone (Tms), while the half-mile search area (dashed black outline) also includes Pleistocene alluvium (Qoa), Monterey shale (Tms), and the Paleocene Martinez Formation (Tmz). Other geologic units just outside the search area are the Pliocene Orinda Formation (Tor) and the Paleocene Martinez Formation (Tmz). All of the units are sedimentary in origin and, with the exception of the Holocene deposits (which are too young), have the potential to yield significant paleontological resources.

Key to Adjacent Map

Qa	alluvium (Holocene)
Qoa	older surficial sediments (Pleistocene)
Tor	Orinda Formation (Pliocene)
Tmc	Monterey Formation shale (middle–late Miocene)
Tms	Monterey Formation sandstone (middle–late Miocene)
Tmz	Martinez Formation (Paleocene)

UCMP Records Search

The paleontological records search of the UCMP database focused was restricted to Contra Costa County and the four potentially fossiliferous units mapped in the vicinity of the project site:

The County has 63 late Pleistocene vertebrate localities that have yielded 9,952 specimens of the Rancholabrean fauna (see Appendix for systematic list). Nearest to the project site is UCMP locality V6108 (Dinsmore Used Car Lot), located approximately 1000 feet to the south on Ygnacio Valley Road and which yielded mammoth (*Mammuthus*). Dibblee and Minch's (2005) map has the locality mapped as Holocene, which implies the fossil was excavated at a shallow depth from a subjacent late Pleistocene layer. No Pleistocene plant localities are recorded.

There are 23 Pliocene vertebrate localities in the Orinda Formation, with the nearest to the site at about 4.5 miles to the south. They yielded 135 Clarendonian specimens, including boney fish, turtle (*Hesperotestudo*), bird (Aves), camel (*Procamelus*), ancestral deer (*Cranioceras*), oreodont (*Ticholeptus*), false sabre-tooth cat (*Barbourfelis*), weasel (Mustelidae), whale (Cetotheriidae), extinct hippo-like marine mammal (*Desmostylus*), rabbit (*Hypolagus*), horses (*Hipparion* cf. *H. mohavense*, *Nannippus tehonensis*, *Pliohippus* cf. *P. leardi*), rhinoceros (*Aphelops*?), elephants (*Gomphothere simpsoni*, Mammutidae), and rodents (*Copemys*, *Pliosaccomys*). The Orinda Formation is also represented by six plant localities along the Caldecott Tunnel.

The results for the Monterey Formation indicate one vertebrate locality (V4616, Tormey B), which yielded a Barstovian-aged (upper Miocene) cetacean vertebra. In addition, there are three other Barstovian localities in unidentified geological units, and their yield was a pelvis fragment of *Desmostylus*, a *Carcarocles megalodon* shark tooth, and ribs of an unidentified marine mammal. Of these four coeval localities, the closest to the project site is V68104 (Bellamy) in Pleasant Hill, nearly two miles to the north, and which yielded the megalodon tooth, while the other three localities are about 16 miles to the northwest. The location of V68104 is in an area that Dibblee and Minch (2005) map as Holocene; hence, the Monterey Formation must have been encountered in the shallow subsurface. No plant localities are recorded.

There are three vertebrate localities in the Martinez Formation, all approximately five miles east of Mount Diablo, and each yielded a single element of fish. No plant localities are recorded.

Remarks and Recommendations

A preconstruction paleontological walkover survey of the proposed project site is not recommended because its natural surface is heavily disturbed and obscured by commercial development. I strongly recommend paleontological monitoring of all project-related earth-disturbing construction activities primarily because a significant paleontological resource was found within the search area, suggesting that any project-related excavations into previously undisturbed earth materials could encounter additional fossils of similar importance. Furthermore, project-related excavations could impact potentially fossiliferous deposits in the shallow subsurface, notably Pleistocene alluvium and the Monterey Formation.

Should any earth-disturbing construction-related activities uncover significant fossils, those activities should be diverted at least 15 feet away from the discovery until a professional paleontologist assesses the find for possible salvage. The construction crew should not attempt to remove the specimens, which could be quite fragile and require special treatment for their intact recovery.

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

Pleistocene (Rancholabrean) Vertebrates from Contra Costa County

Class Amphibia
- Order Anura
  - Family Hylidae
    - cf. *Pseudacris* (chorus frog)
  - Family Ranidae
    - cf. *Rana* (bullfrog)
- Order Caudata (Urodela)
  - Family Ambystomatidae
    - cf. *Ambystoma* (mole salamander)
  - Family Plethodontidae
    - Aneides cf. *A. lugu*bris (aboreal salamander)
  - Family Salamandridae
    - cf. *Taricha* (western newt)

Class Reptilia
- Order Sauria
  - Family Anguidae
    - *Elgaria coerulea* (western alligator lizard)
    - *Gerrhonotus* (alligator lizard)
  - Family Iguanidae
    - *Uta* (sideblotched lizard)
  - Family Phrynosomatidae
    - *Sceloporus* (spiny lizard)
- Order Serpentes
  - Family Viperidae
    - *Crotalu*s (rattlesnake)
- Order Testudines
  - Family Emydidae
    - *Actinemys marmorata* (northwestern pond turtle)
    - *Clemmys* (pond turtle)
- Order Cypriniformes
  - Family Cyprinidae
    - *Orthodon* (blackfish)
- Order Gasterosteiformes
  - Family Gasterosteidae
    - *Gasterosteus aculeatus* (3-spined stickleback)

Class Chondrichthyes (cartilaginous fish)
- Order Batoidea
  - Family Myliobatidae
    - *Myliobatis* (bat ray)

Class Aves
- Order Anseriformes
  - Family Anatidae
    - *Anas acuta*? (pintail duck)
    - cf. *Melanitta* (scoter)
- Order Ciconiiformes
  - Family Ardeidae (herons)
- Order Cuculiformes
  - Family Cuculidae
    - *Geococcyx* (roadrunner)
  - Family Odontophoridae
    - *Callipepla* (crested quail)
  - Family Phasianidae
    - cf. *Centrocercus* (sage grouse)
- Order Passeriformes
  - Family Corvidae (crows)
  - Family Icteridae
    - *Euphagus* (American blackbird)
  - Family Turdidae
    - *Turdus* (thrush)
- Order Piciformes
  - Family cf. Picidae (woodpeckers)
- Order Podicipediformes
  - Family Podicipedidae
    - *Aechmophorus occidentalis* (western grebe)
- Order Strigiformes
  - Family Strigidae
    - *Asio flammeus* (short-eared owl)
  - Family Tytonidae
    - *Tyto* (barn owl)

Class Mammalia
- Order Artiodactyla
  - Family Antilocapridae
    - *Antilocapra pacifica* (pacific pronghorn)
    - *Capromeryx minor* (diminutive pronghorn)
    - *Sphenophalos* (pronghorn)
  - Family Bovidae
    - *Bison bison antiquus* (ancient bison)
    - *Bison latifrons* (long-horned bison)
  - Family Camelidae
    - *Camelops* cf. *C. hesternus* (yesterday's camel)
  - Family Cervidae
    - *Cervus*? (elk)
    - *Odocoileus* (mule deer)
- Order Carnivora
  - Family Canidae
    - *Cynodesmus thooides* (extinct canid)
    - *Urocyon cinereoargenteus* (grey fox)
  - Family Mustelidae
    - *Enhydra lutris* (sea otter)
    - *Taxidea*? (badger)
  - Family Procyonidae
    - *Procyon lotor* (racoon)
  - Family Ursidae
    - *Ursus* cf. *U. americanus* (black bear)
- Order Chiroptera
  - Family Vespertilionidae
    - *Antrozous* cf. *A. pallidus* (pallid bat)
    - *Eptesicus* cf. *E. fuscus* (big brown bat)
    - cf. *Lasiurus* (hairy tailed bat)
- Order Lagomorpha
  - Family Leporidae
    - *Lepus* (hare)
    - *Sylvilagus bachmani* (cottontail rabbit)

Order Lipotyphla
  - Family Soricidae
    - *Sorex ornatus* (ornate shrew)
  - Family Talpidae
    - *Scapanus latimanus* (broad-footed mole)

Order Perissodactyla
  - Family Equidae
    - *Equus caballus* (modern horse)
    - *Equus pacificus* (Pacific horse)
  - Family Tapiridae
    - *Tapirus merriami* (Merriam's tapir)

Order Primates

Order Proboscidea
  - Family Elephantidae
    - *Elephas* (elephant)
    - *Mammuthus columbi* (Columbian mammoth)
  - Family Mammutidae
    - *Mammut americanum* (American mastodon)
    - *Mammut pacificus* (Pacific mastodon)

Order Rodentia
  - Family Cricetidae
    - *Microtus californicus* (California vole)
    - *Neotoma fuscipes* (wood rat)
    - *Reithrodontomys raviventris* (salt-marsh harvest mouse)
  - Family Geomyidae
    - *Thomomys bottae* (Botta's pocket gopher)
  - Family Heteromyidae
    - *Perognathus* (pocket mouse)
  - Family Muridae
    - *Peromyscus boylii* (brush mouse
    - *Peromyscus truei* (pinyon mouse)
  - Family Procyonidae
    - *Procyon lotor* (racoon)
  - Family Sciuridae
    - *Otospermophilus beecheyi* (California ground squirrel)
    - *Sciurus* (bushy-tailed squirrel)
    - *Tamias* (chipmunk)

Order Xenarthra
  - Family Megalonychidae
    - *Megalonyx* cf. *M. jeffersonii* (Jefferson's ground sloth)
  - Family Mylodontidaes
    - *Glossotherium harlani* (Harlan's ground sloth)

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