Appendix C-2

Paleontological Analysis

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February 5, 2018
Rincon Project No: 17-05136

Drs. Wei-Min Shen & Ying Sai
26810 Fond Du Lac Road
Rancho Palos Verdes, California 90275

Subject: **Paleontological Resource Assessment for the Shen Residence Project, City of Rolling Hills, Los Angeles County, California**

Dear Drs. Shen and Sai:

Rincon Consultants, Inc. (Rincon) conducted a paleontological resource assessment for the Shen Residence Project (project) in the City of Rolling Hills, Los Angeles County, California. The goal of the assessment is to identify the geologic units that may be impacted by development of the proposed project, determine the paleontological sensitivity of geologic units within the project area, assess potential for impacts to paleontological resources from development of the proposed project, and recommend mitigation measures to avoid or mitigate impacts to scientifically significant paleontological resources, as necessary.

This paleontological resource assessment consisted of a fossil locality record search at the Natural History Museum of Los Angeles County (LACM) and review of existing geologic maps and primary literature regarding fossiliferous geologic units within the project area and vicinity. Following the literature review and records search, this report assessed the paleontological sensitivity of the geologic units underlying the project area, determined the potential for impacts to significant paleontological resources, and proposed mitigation measures to reduce impacts to less than significant. Figures are included in Attachment A.

This paleontological resource assessment has been prepared to support environmental review under the California Environmental Quality Act (CEQA). The City of Rolling Hills is the CEQA Lead Agency for the project.

Project Location and Description

The project is located at 77 Portuguese Bend Road in the City of Rolling Hills, on the Palos Verdes Peninsula in Los Angeles County, California. The project encompasses Assessor's Parcel Number (APN) 7567-013-005 within Township 5 South, Range 14 West on the United States Geological Survey (USGS) San Pedro, CA 7.5-minute quadrangle (Attachment A). The proposed project involves construction of an 8,847-square foot single-family residence on an undeveloped 21-acre site. Amenities associated with the single-family residence include a 2,427 square-foot guesthouse and a 2,766 square-foot pool area. The single-family residence would include two, two-car garages, four bedrooms, an open courtyard, a gym/workshop, a living room deck, a dining room deck, an entry porch, and foot stable and corral. The project would also include re-alignment and modification of an existing access road easement located between residences at 73 and 74 Portuguese Bend Road. A portion of the road easement is within the 74 Portuguese Bend Road property and development of the project would require expanding the roadcut southeast of the 73 Portuguese Bend Road property to shift the road west and out of the easement area.

Regulatory Setting

Fossils are remains of ancient, commonly extinct organisms, and as such are a nonrenewable resource. The fossil record is a document of the evolutionary history of life on earth, and fossils can be used to understand evolutionary pattern and process, rates of evolutionary change, past environmental conditions, and the relationships among modern species (i.e., systematics). The fossil record is considered a valuable scientific and educational resource, and individual fossils are afforded protection under state and federal environmental laws. State and local regulations applicable to potential paleontological resources in the project area are summarized below.

California Environmental Quality Act

Paleontological resources are protected under CEQA, which states, in part, that a project will “normally” have a significant effect on the environment if it, among other things, will disrupt or adversely affect…. a paleontological site except as part of a scientific study. Specifically, in Section V(c) of Appendix G of the CEQA Guidelines, the “Environmental Checklist Form,” the question is posed: “Will the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature”. In order to determine the uniqueness of a given paleontological resource, it must first be identified or recovered (i.e., salvaged). Therefore, mitigation of adverse impacts to paleontological resources is mandated by CEQA.

CEQA does not define “a unique paleontological resource or site.” However, the Society of Vertebrate Paleontology (SVP) has defined a “significant paleontological resource” in the context of environmental review. The SVP defines a Significant Paleontological Resources as:

> *…fossils and fossiliferous deposits, here defined as consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years).*

The loss of paleontological resources that meet the criteria outlined above (i.e., considered a significant paleontological resource) would be considered a significant impact under CEQA, and the CEQA lead agency is responsible for ensuring that paleontological resources are protected in compliance with CEQA and other applicable statutes.

The City of Rolling Hills General Plan does not have policies that specifically address paleontological resources.

Methods

Rincon evaluated the paleontological sensitivity of the geologic units that underlie the project area using the results of the paleontological locality search and review of existing information in the primary literature concerning known fossils within those geologic units. Rincon submitted a request to the LACM for a list of known fossil localities from the project area and immediate vicinity (i.e., localities recorded on the USGS San Pedro, 7.5-minute topographic quadrangles), and reviewed geologic maps and primary literature including: Barnes, 1976, 1985; Behl 1999; Berndmeyer et al. 2012; Beyer 1995; Bramlette 1946; California Geological Survey [CGS] 2002; Coast Geotechnical, Inc. 2012; The Cooper Center 2014; Dibblee et al. 1999; Harden 1998; Koch et al. 2004; MacKinnon 1989; McCulloh and Beyer 2004; McLeod 2018; Murphey et al. 2007; Norris and Webb 1990; Paleobiology database, 2014; Pisciotto and Garrison 1981; Saucedo et al. 2003; Schoellhamer et al. 1954; Woodring et al. 1946; Yerkes and Campbell 2005; and Yerkes et al. 1965.

Rincon assigned a paleontological sensitivity to the geologic units within the project area. The potential for impacts to significant paleontological resources is based on the potential for ground disturbance to directly impact paleontologically sensitive geologic units. The SVP (2010) has defined paleontological sensitivity and developed a system for assessing paleontological sensitivity, as discussed below.

Paleontological Resource Potential

Significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, diagnostically important, or are common but have the potential to provide valuable scientific information for evaluating evolutionary patterns and processes, or which could improve our understanding of paleochronology, paleoecology, paleophylogeography, or depositional histories. New or unique specimens can provide new insights into evolutionary history; however, additional specimens of even well represented lineages can be equally important for studying evolutionary pattern and process, evolutionary rates, and paleophylogeography. Even unidentifiable material can provide useful data for dating geologic units if radiocarbon dating is possible. As such, common fossils (especially vertebrates) may be scientifically important, and therefore considered highly significant.

The SVP (2010) describes sedimentary rock units as having high, low, undetermined, or no potential for containing significant nonrenewable paleontological resources. This criterion is based on rock units within which vertebrate or significant invertebrate fossils have been determined by previous studies to be present or likely to be present. While these standards were specifically written to protect vertebrate paleontological resources, all fields of paleontology have adopted these guidelines, which are given here verbatim:

I. **High Potential (sensitivity).** Rock units from which significant vertebrate or significant invertebrate fossils or significant suites of plant fossils have been recovered are considered to have a high potential for containing significant non-renewable fossiliferous resources. These units include but are not limited to, sedimentary formations and some volcanic formations which contain significant nonrenewable paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Sensitivity comprises both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, ecologic, or stratigraphic data. Areas which contain potentially datable organic remains older than Recent, including deposits associated with nests or middens, and areas which may contain new vertebrate deposits, traces, or trackways are also classified as significant.

II. **Low Potential (sensitivity).** Sedimentary rock units that are potentially fossiliferous, but have not yielded fossils in the past or contain common and/or widespread invertebrate fossils of well documented and understood taphonomic, phylogenetic species and habitat ecology. Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow determination that some areas or units have low potentials for yielding significant fossils prior to the start of construction. Generally, these units will be poorly represented by specimens in institutional collections and will not require protection or salvage operations. However, as excavation for construction gets underway it is possible that significant and unanticipated paleontological resources might be encountered and require a change of classification from Low to High Potential and, thus, require monitoring and mitigation if the resources are found to be significant.

III. **Undetermined Potential (sensitivity).** Specific areas underlain by sedimentary rock units for which little information is available are considered to have undetermined fossiliferous potentials. Field surveys by a qualified vertebrate paleontologist to specifically determine the potentials of the rock units are required before programs of impact mitigation for such areas may be developed.

IV. **No Potential.** Rock units of metamorphic or igneous origin are commonly classified as having no potential for containing significant paleontological resources.

Existing Conditions

Regional Geologic Setting

The project is located in the “petroliferous” Los Angeles Basin, a northwest-trending lowland plain at the northern end of the Peninsular Ranges Province, one of eleven major geomorphic provinces in California (CGS 2002; Yerkes and Campbell 2005). A geomorphic province is a region of unique topography and geology that is readily distinguished from other regions based on its landforms and geologic history (Norris and Webb 1990). The Los Angeles Basin is approximately 60 miles long and 35 miles wide and is defined by Yerkes et al. (1965) as the region bounded by the northern foothills of the Santa Monica Mountains to the north, the San Jose Hills and the Chino fault on the east, and the Santa Ana Mountains and San Joaquin Hills in the southeast. The Los Angeles Basin is underlain by a structural depression that was the site of extensive accumulation of interstratified fluvial, alluvial, floodplain, shallow marine and deep shelf deposits on underlying Mesozoic metamorphic and granitic plutonic basement rocks. Sediment accumulation and subsidence has occurred there since the Late Cretaceous and has reached a maximum thickness of more than 20,000 feet (McCulloh and Beyer 2004; Norris and Webb 1990; Yerkes et al. 1965). During that time, rise and fall of relative sea level, tectonic uplift and subsidence, and Pleistocene glaciation resulted in marine and terrestrial sedimentary deposition throughout the Los Angeles Basin (Beyer 1995; McCulloh and Beyer 2004).

The Los Angeles Basin is composed of four structural blocks, designated the southwestern, northwestern, central, and northeastern blocks whose boundaries are formed by major fault zones (Yerkes et al. 1965). The project is located on the southwestern block, a region approximately 28 miles long and 5 to 12 miles wide and defined as bounded by the Santa Monica fault to the north and Newport-Inglewood fault to the south. Significant geologic features in that area include, the Pacific coast; the Palos Verdes Hills, which consist of low hills and mesas that rise 1,300 feet over the basin floor; the Palos Verdes fault zone; and petroleum-bearing fossiliferous Cenozoic sedimentary basin deposits, including the Miocene Monterey Formation (Dibblee et al. 1999; Harden 1998; Saucedo et al. 2003; Schoellhamer et al. 1954; Woodring et al. 1946; Yerkes et al. 1965).

The project area is mapped at a scale of 1:24,000 by Dibblee et al. (1999) and includes three (3) geologic units mapped at ground surface: early middle Miocene basalt (Tb), the lower Altamira Shale member of the early middle to late Miocene Monterey Formation (Tmat), and Quaternary landslide deposits (Qls) (Coast Geotechnical, Inc. 2012; Dibblee et al. 1999).

The early middle to late Miocene Monterey Formation is well-documented within Los Angeles County (Yerkes and Campbell 2005). The Monterey Formation is named after exposures at its type section in coastal Monterey County and, although its lithology is variable, the unit is typically recognized by its pale buff to white fine-grained deposits, dark brown to black siliceous laminations, and common fossils (Berndmeyer et al. 2012). The deposit is up to approximately 5,000 feet thick and is dominated by finely laminated fine-grained diatomaceous and siliceous mudrocks; limestone and dolomite; calcareous and phosphatic mudrocks; chert and porcelanite; and subordinate tuff, sandstone, and conglomerate (Bramlette 1946; MacKinnon 1989). The Monterey Formation was deposited in deep submarine basins during a time of subsidence, transgression, abundant upwelling, and scant terrestrial sediment delivery; as a result, it contains abundant biologic material in relation to limited terrigenous material (Behl 1999; Pisciotto and Garrison 1981). The stratigraphy of the Monterey Formation is regionally variable, with many localized formal and informally named members. As a result, correlation of members is typically based on microfossils rather than lithology. At the type section, the basal member of the Monterey Formation consists of sandstone, sandy shale, and calcareous shale unconformably overlying granodiorite bedrock. The middle member consists of thinly bedded porcelaneous and siliceous shale and chert, and the upper member is primarily composed of diatomite and diatomaceous shale (Bramlette 1946).

In the project area, the early middle Miocene lower Altamira Shale member of the Monterey Formation is exposed in the center of the property boundary within the development footprint (Coast Geotechnical, Inc. 2012; Dibblee et al. 1999). The lower Altamira Shale consists of marine clastic mudrock composed of light gray shale and mudstone with interbedded fine-grained, white to tan, moderately indurated tuff and dolomitic strata. Very hard concretions have been previously documented in the Altamira Shale and have been known to beautifully preserve fossil specimens (McLeod 2018). The lower Altamira Shale contains flows and intrusions of early middle Miocene fine-grained basalt to andesite igneous rock. The basalt unit is mapped at ground surface in the southernmost corner on the project area, outside of the development footprint, and includes weathered submarine flows, pillow flows, and breccias, as well as intrusive sills and dikes. The basalt unit underlies the Altamira shale and may be up to several hundred feet thick above Catalina Schist basement rock. In the northwestern and eastern project areas, the Monterey Formation deposits have been displaced in the large Flying Triangle landslide and other smaller landslides, which contains *ex situ* debris from the volcanic and sedimentary marine deposits (Coast Geotechnical, Inc. 2012; McLeod 2018).

Numerous vertebrate localities have been documented from within the Monterey Formation, which yielded specimens of large sea turtles, whale, dolphins, sea lions, shark bones and teeth, sea cows, desmostylians, fish, birds, and many other fauna (Bramlette 1946; Harden 1998; Koch et al. 2004; Murphey et al. 2007). Within Southern California, localities have been especially rich in marine mammals, sharks, and foraminifera (Barnes 1976, 1985; Paleobiology database 2018; Woodring et al. 1946). In many cases, fossilized remains within the Monterey Formation, such as Cetacea (whale and dolphin), Chondrichthyes (cartilaginous fish), and Osteichthyes (bony fish), are remarkably well preserved and have previously yielded fully articulated specimens (Koch et al. 2004). Typically, the specimens within the Monterey Formation have been recovered from within the diatomite and shale deposits, but the limestone and sandstone beds also have yielded abundant remains (Murphey et al. 2007). In addition, the Monterey Formation has yielded numerous species of scientifically significant invertebrates, foraminifera, and plants, such as kelps and other large soft-bodied seaweeds. Additional localities for the Long Beach–Palos Verdes area (including portions of northern Orange County) were revealed during a search of the current Cooper Center specimen catalog, which indicates that over 30 additional vertebrate localities have been identified within exposures of the Monterey Formation in coastal Southern California, south of the project area in Orange County. The Cooper Center (2014) identified nearly 1,000 vertebrate fossil specimens recovered from within the Monterey Formation, including marine mammal, shark, fish, and bird.

Museum Fossil Locality Records

A search of the paleontological locality records at the LACM resulted in no previously recorded fossil localities within the project boundaries. According to LACM collection records, the closest vertebrate locality (LACM 7936) recorded within the middle Miocene Altamira Shale member of the Monterey Formation was identified nearby at an unspecified location just southwest of the project area, which produced five fossil specimens of the primitive baleen whale, Cetotheriidae. Further southwest at Inspiration Point, localities LACM 4130 and LACM 5743 produced several vertebrate fossils, including specimens of pipefish (*Syngnathus*), lanternfishes (Myctophidae), cod (*Eclipes*), herrings (*Ganolytes*, *Etringus* and *Xyne*), bird (Aves), and Cetotheriidae (McLeod 2018). Depth of recovery was unreported.

Results

Paleontological Resource Potential of the Project Area

Consistent with SVP (2010) guidelines, Rincon determined the paleontological sensitivity of the project area based on a literature review and museum locality search. The results of the study indicate that the geologic units underlying the project area have a paleontological sensitivity ranging from no potential to high potential (Attachment A; Table 1). The lower Altamira Shale member of the Monterey Formation immediately underlies the central project area and is considered to have a high paleontological sensitivity because the unit has proven to yield vertebrate fossils throughout the Los Angeles Basin. Quaternary landslide deposits that underlie the northwestern and eastern portions of the project area are determined to have a low paleontological sensitivity. Although landslide debris may contain intact concretions that have been known to contain well-preserved fossils, paleontological resources contained in the landslide have been disturbed and lack original stratigraphic context and would not generally be considered scientifically significant. The Miocene basalt unit has no paleontological sensitivity because the unit consists of igneous rock flows, sills, and dikes that crystallized from molten rock. Fossils are not preserved in this environment due to the extremely high heat of igneous rock crystallization.

Table 1 Paleontological Sensitivity of Paleontological Resources in the Project Area

Geologic Unit[1]	Symbol	Age	Typical Fossils	Paleontological Sensitivity[2]
Landslide debris	Qls	Quaternary	None	Low
Lower Altamira Shale member, Monterey Formation	Tmat	Miocene	Mammals, fish, plants, invertebrates	High
Basalt flow and intrusions	Tb	Miocene	None	None

[1]Dibblee et al. (1999)
[2]SVP (2010)

Impact Analysis

Ground disturbing activities in previously undisturbed portions of the project area underlain by geologic units with a high paleontological sensitivity (i.e., the early middle Miocene lower Altamira Shale member of the Monterey Formation) may result in significant impacts to paleontological resources under Appendix G of CEQA Guidelines. Impacts would be significant if construction activities result in the destruction, damage, or loss of scientifically important paleontological resources and associated stratigraphic and paleontological data. The activities may include grading, excavation, drilling, or any other activity that disturbs the surface or subsurface geologic formations with a high paleontological sensitivity.

Recommendations

The following mitigation measures would address the potentially significant impacts relating to the discovery of paleontological resources during project implementation. These measures would apply to all phases of project construction and would ensure that any fossils present on-site are preserved. Implementation of these measures would reduce potential impacts to paleontological resources to a less than significant level. In combination, these measures, which are presented below, would effectively mitigate the project's impacts to these resources through the recovery, identification, and curation of previously unrecovered fossils.

- **Paleontological Monitoring.** Prior to the commencement of ground disturbing activities under the project, a qualified professional paleontologist shall be retained. The Qualified Paleontologist (Principal Paleontologist) shall have at least a Master's Degree or equivalent work experience in paleontology, shall have knowledge of the local paleontology, and shall be familiar with paleontological procedures and techniques.

  Ground disturbing construction activities (including grading, trenching, drilling with an auger greater than 3 feet in diameter, and other excavation) within project areas with high paleontological sensitivity (i.e., the early middle Miocene lower Altamira Shale member of the Monterey Formation) shall be monitored on a full-time basis. Monitoring shall be supervised by the Qualified Paleontologist and shall be conducted by a qualified paleontological monitor, who is defined as an individual who meets the minimum qualifications per standards set forth by the SVP (2010), which includes a B.S. or B.A. degree in geology or paleontology with one year of monitoring experience and knowledge of collection and salvage of paleontological resources.

  The duration and timing of the monitoring shall be determined by the Qualified Paleontologist. If the Qualified Paleontologist determines that full-time monitoring is no longer warranted, he or she may recommend reducing monitoring to periodic spot-checking or cease entirely. Monitoring would be reinstated if any new ground disturbances are required and reduction or suspension would need to be reconsidered by the Qualified Paleontologist. Ground disturbing activity in the landslide deposits or basalt unit would not require paleontological monitoring.
- **Fossil Discovery, Preparation, and Curation.** In the event that a paleontological resource is discovered, the monitor shall have the authority to temporarily divert the construction equipment around the find until it is assessed for scientific significance and collected. Typically, fossils can be safely salvaged quickly by a single paleontologist and not disrupt construction activity. In some cases, larger fossils (such as complete skeletons or large mammals) require more extensive excavation and longer salvage periods. In this case, the paleontologist should have the authority to temporarily direct, divert or halt construction activity to ensure that the fossil(s) can be removed in a safe and timely manner.

Once salvaged, significant fossils shall be identified to the lowest possible taxonomic level, prepared to a curation-ready condition and curated in a scientific institution with a permanent paleontological collection (such as the LACM) along with all pertinent field notes, photos, data, and maps. The cost of curation is assessed by the repository and is the responsibility of the project owner.

- **Final Paleontological Mitigation Report.** At the conclusion of laboratory work and museum curation, a final report shall be prepared describing the results of the paleontological mitigation monitoring efforts associated with the project. The report shall include a summary of the field and laboratory methods, an overview of the project geology and paleontology, a list of taxa recovered (if any), an analysis of fossils recovered (if any) and their scientific significance, and recommendations. If the monitoring efforts produced fossils, then a copy of the report shall also be submitted to the designated museum repository.

If you have any questions regarding this Paleontological Resource Assessment, please contact us.

Sincerely,

Rincon Consultants, Inc.

Heather Clifford, M.S.
Associate Paleontologist

Jessica DeBusk, B.S., M.B.A.
Principal Investigator/Program Manager

Joe Power, AICP
Principal

Attachments
Attachment A: Figures

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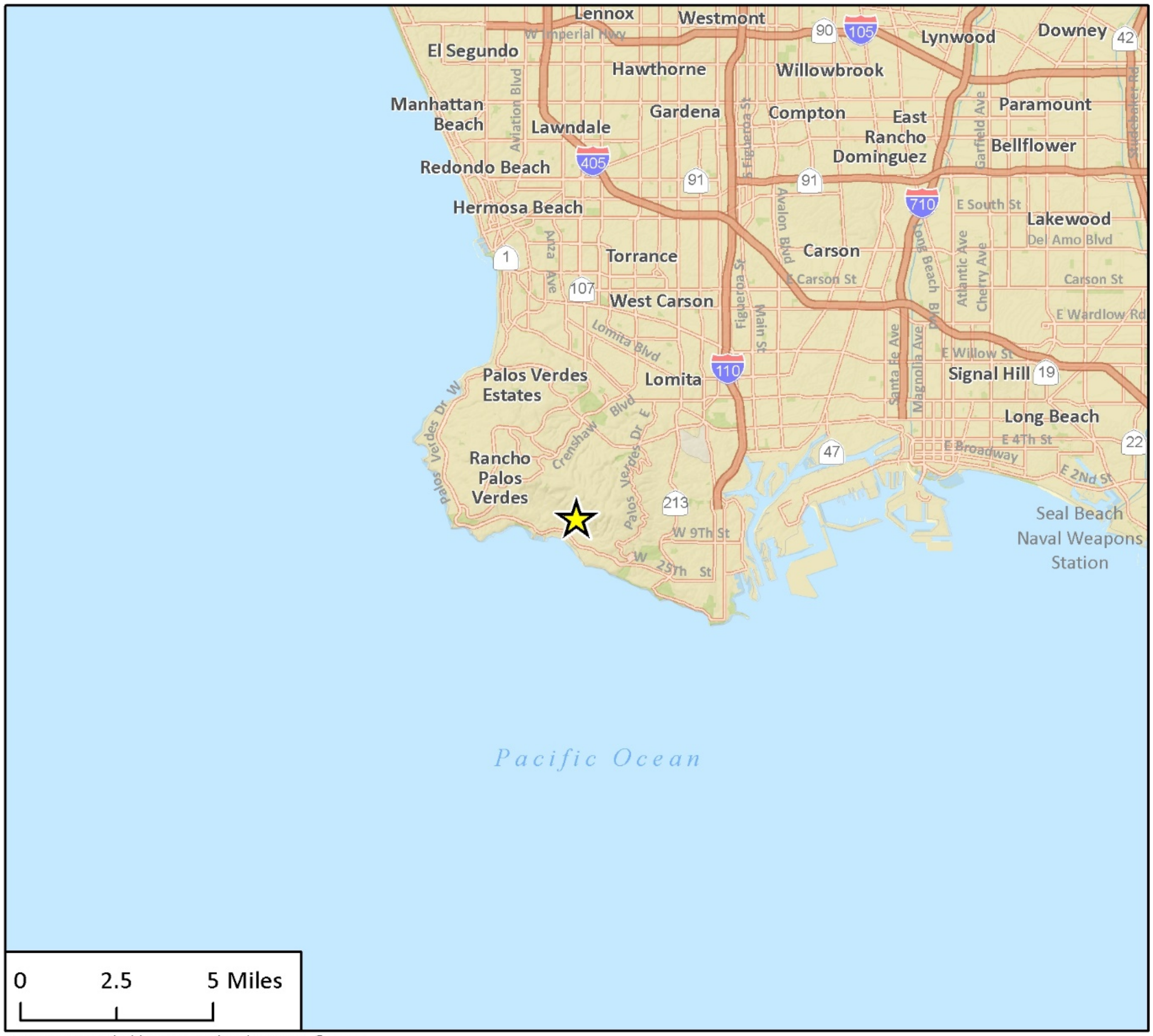
Attachment A

Figures

Figure 1 Project Vicinity Map



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☆ Project Location

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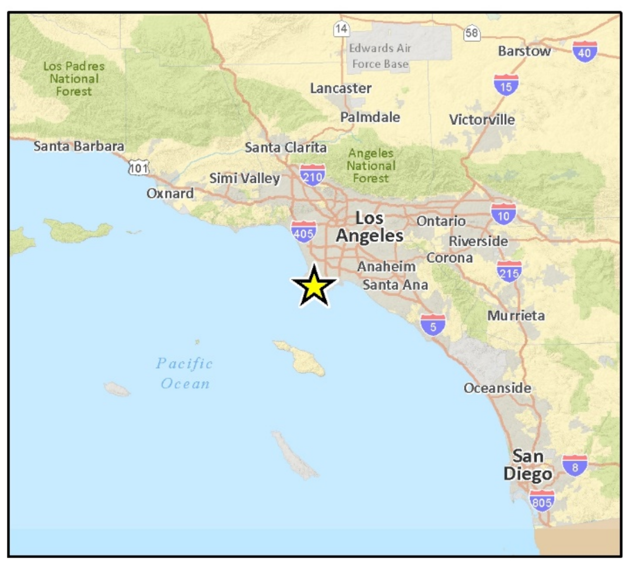
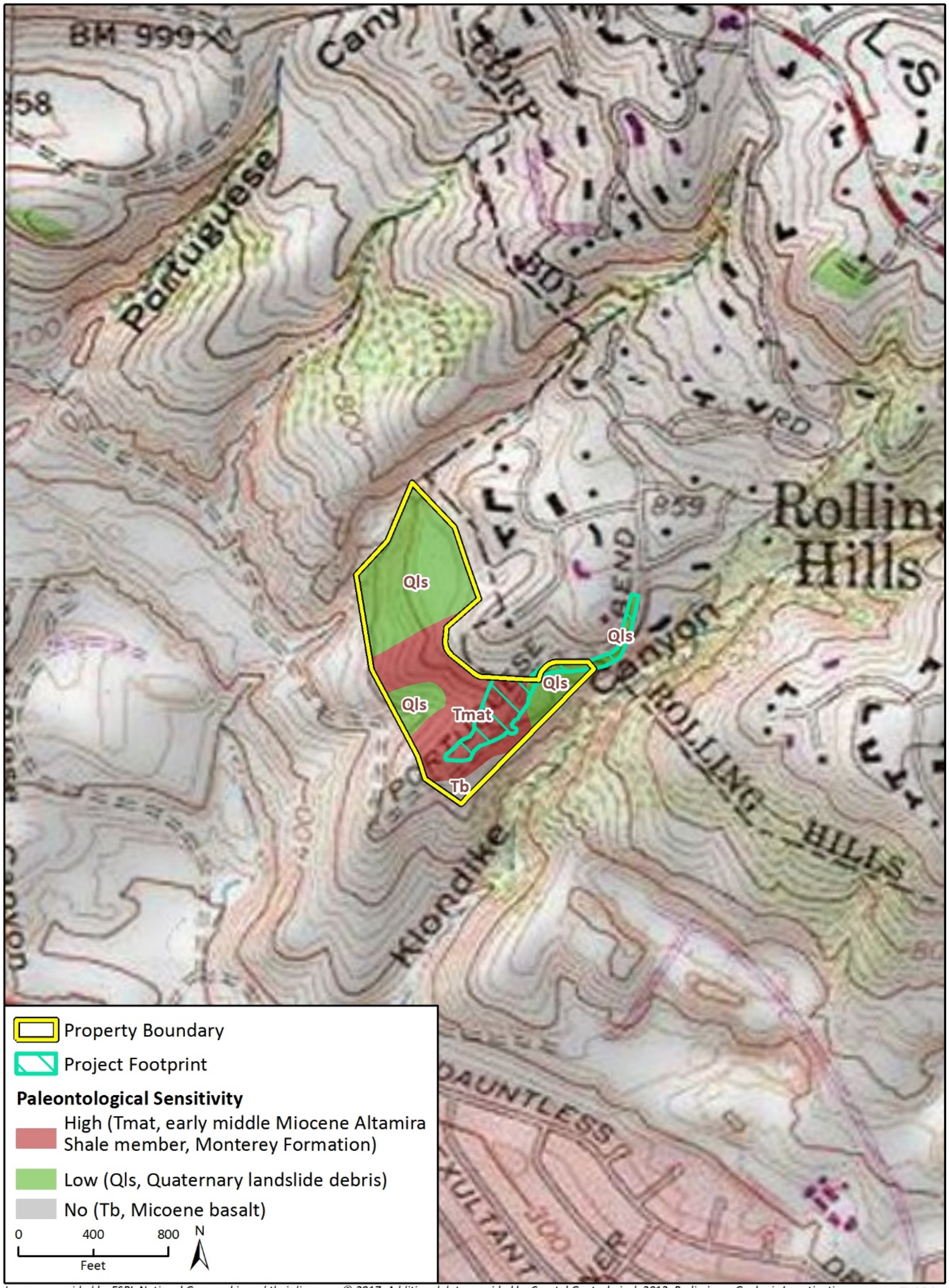


Figure 2 Geology and Paleontological Sensitivity of the Project Area



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