Google Caribbean Campus Project Paleontological Resources Technical Report, Sunnyvale, Santa Clara County, California

MARCH 2019

PREPARED FOR

Kimley-Horn

PREPARED BY

SWCA Environmental Consultants

GOOGLE CARIBBEAN CAMPUS PROJECT PALEONTOLOGICAL RESOURCES TECHNICAL REPORT, SUNNYVALE, SANTA CLARA COUNTY, CALIFORNIA

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ABSTRACT/EXECUTIVE SUMMARY

Purpose and Scope: Kimley-Horn retained SWCA Environmental Consultants (SWCA) to prepare a paleontological resources technical report in support of the proposed Google Caribbean Campus Project (project) located at 100 and 200 Caribbean Avenue, within the Moffett Park Specific Plan (MPSP) area in the city of Sunnyvale, Santa Clara County, California. Google proposes to redevelop the site to facilitate construction of the new Google campus on approximately 40.44 acres within 10 existing assessor's parcels (project area).

SWCA conducted the following study to determine the paleontological sensitivity of geologic units within the project area and make recommendations for avoiding impacts to those resources as a result of project implementation. The study included the following tasks: (1) paleontological resources records search from the Natural History Museum of Los Angeles County (LACM); (2) a review of the online collections database of the University of California Museum of Paleontology (UCMP); and (3) a review of geologic mapping and the scientific literature.

Regulatory Setting: This evaluation was completed under the provisions of CEQA and Public Resources Code (PRC) Chapter 1.7, Section 5097.5. Alyssa Bell, Ph.D., conducted the paleontological sensitivity assessment and authored this report. Mandi Martinez, M.A. provided oversight. Cultural Resources Principal Investigator Heather Gibson, Ph.D., RPA, provided technical review.

Dates of Investigation: SWCA requested a records search from the UCMP on January 29, 2019, with a follow-up request on February 7. When no reply was received the UCMP search was cancelled and the online collections database was reviewed on February 20, 2019. A records search was requested from the LACM on February 14, with the results returned on February 20, 2019.

Findings: Geologic mapping by Dibblee and Minch (2007) indicates that the project area is underlain by silty clay dating to the middle or early Holocene. Museum collections records maintained by the LACM and the UCMP online database indicate that fossil localities have been recorded from similar geologic units in the vicinity of the project area. The combined results of the museum records searches and literature review indicate that the geologic unit underlying the project area has high paleontological sensitivity.

Recommendations: Recommendations to avoid significant impacts to fossil resources are provided that include worker environmental awareness program (WEAP) training and the development of a paleontological monitoring and mitigation plan by a qualified paleontologist that will include monitoring of ground-disturbing activities. Should any significant fossils be encountered, they should be salvaged and curated at an approved repository.

Disposition of Data: The final paleontological resources assessment report and any subsequent related reports will be filed with (the city of Sunnyvale) and with SWCA's Pasadena, California, office.

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CONTENTS

Appendices

Figures

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INTRODUCTION

Kimley-Horn retained SWCA Environmental Consultants (SWCA) to prepare a paleontological resources technical report in support of the proposed Google Caribbean Campus Project (project) located at 100 and 200 Caribbean Avenue (project area; Figure 1). The project area is within the Moffett Park Specific Plan (MPSP) area in the city of Sunnyvale on approximately 40.44 acres within 10 existing assessor's parcels (Figure 2 and Figure 3). Google proposes to redevelop the site to facilitate construction of the new Google campus. The study included the following tasks: (1) paleontological resources records search from the Natural History Museum of Los Angeles County (LACM); (2) a review of the online collections database of the University of California Museum of Paleontology (UCMP); and (3) a review of geologic mapping and the scientific literature.

This evaluation was completed under the provisions of CEQA and Public Resources Code (PRC) Chapter 1.7, Section 5097.5. Alyssa Bell, Ph.D., conducted the paleontological sensitivity assessment and authored this report. Mandi Martinez, M.A. provided oversight. Paleontological Resources Principal Investigator Russell Shapiro, Ph.D., provided technical review.

Project Description

Google proposes to redevelop the project area (located at 100 and 200 Caribbean Avenue), in the city of Sunnyvale, California, on 40.44 acres within 10 existing assessor's parcels. The project area currently contains 13 single-story structures, which are used as commercial business, research and development, and for industrial uses. The area also contains parking lots, access roads, sidewalks, and landscaped areas. Redevelopment of this area would include demolition of the existing structures, removal of materials, excavation, and grading to facilitate construction of the new Google campus.

Once the site is prepared, the construction phase would be implemented, and as proposed, the site would be developed with two new main buildings. The buildings would be readdressed and designated as 100 West Caribbean Drive and 200 West Caribbean Drive. The site is currently bisected roughly in half from south to north by the Santa Clara Valley Water District's (SCVWD) West Channel. The buildings would be on either side of the West Channel; the project applicant is working closely with SCVWD on enhancements. Improvements to the West Channel are proposed as part of the project, but its function would not be changed. The two sides of the campus would be connected by pedestrian bridges as part of the pedestrian circulation plan for the project site.

Figure 1. Project area and vicinity.

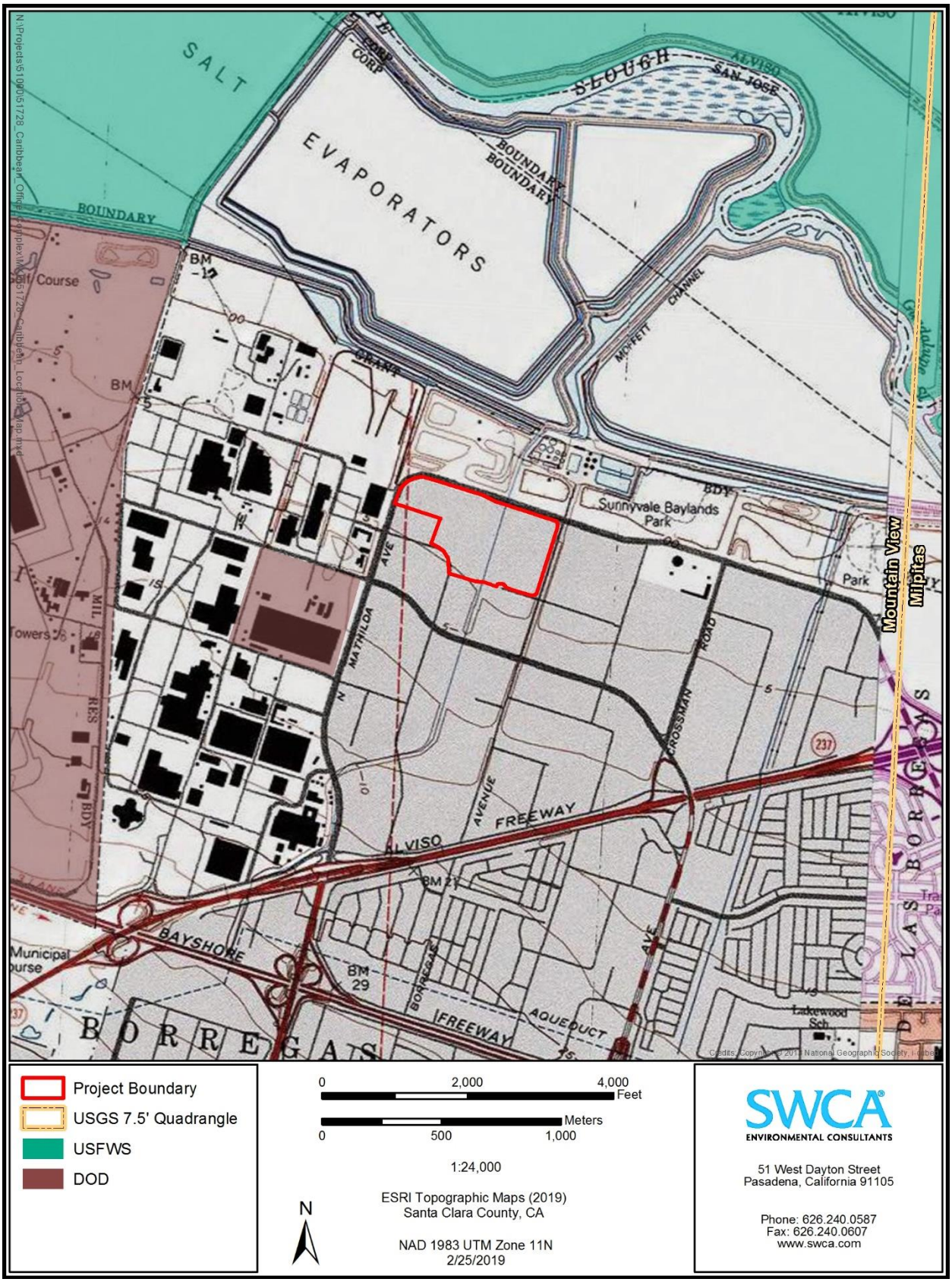

Figure 2. Project location on topographic map.

Figure 3. Project location on aerial photograph.

REGULATORY FRAMEWORK

This section includes a discussion of the applicable state and local laws, ordinances, regulations, and standards informing the identification of eligible historic resources.

State Regulations

California Environmental Quality Act

CEQA is the principal statute governing environmental review of projects occurring in the state and is codified at Public Resources Code (PRC) Section 21000 et seq. CEQA requires lead agencies to determine if a proposed project would have a significant effect on the environment, including significant effects on paleontological resources. Guidelines for the Implementation of CEQA, as amended March 29, 1999 (Title 14, Chapter 3, California Code of Regulations 15000 et seq.), define procedures, types of activities, persons, and public agencies required to comply with CEQA, and include as one of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section VII, Part a) the following: "Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?"

California Public Resources Code (PRC) Section 5097.5

Requirements for paleontological resource management are included in the PRC Division 5, Chapter 1.7, Section 5097.5, and Division 20, Chapter 3, Section 30244, which states:

> No person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor.

These statutes prohibit the removal, without permission, of any paleontological site or feature from lands under the jurisdiction of the state or any city, county, district, authority, or public corporation, or any agency thereof. Consequently, local agencies are required to comply with PRC 5097.5 for their own activities, including construction and maintenance, as well as for permit actions (e.g., encroachment permits) undertaken by others. PRC Section 5097.5 also establishes the removal of paleontological resources as a misdemeanor, and requires reasonable mitigation of adverse impacts to paleontological resources from developments on public (state, county, city, and district) lands.

Local Regulations

Although the following regulations are applicable to the project area, none directly addresses paleontological resources requirements: city of Sunnyvale General Plan, city of Sunnyvale Municipal Code, and Moffett Park Specific Plan.

METHODS

Records Search

SWCA requested a museum records search for the current project area and vicinity from the University of California Museum of Paleontology (UCMP) on January 29, 2019, with a follow-up request on February 7. When no reply was received the UCMP search was cancelled and the online collections database was reviewed on February 20, 2019. A records search was requested from the LACM on February 14, with the results returned on February 20, 2019.

Archival Research

SWCA examined the most recent geological mapping as well as the relevant scientific literature in order to assess the potential for geologic units present in the project area to preserve paleontological resources.

Paleontological Sensitivity Assessment

Definition and Significance of Paleontological Resources

Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments (Murphey and Daitch, 2007). Therefore, a wide range of material is represented in the fossil record, including bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains, which may vary in their degree of mineralization. The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered nonrenewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced (Murphey and Daitch, 2007). Fossils are important scientific and educational resources and can be used to:

- study the phylogenetic relationships amongst extinct organisms, as well as their relationships to modern groups;
- elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record;
- reconstruct ancient environments, climate change, and paleoecological relationships;
- provide a measure of relative geologic dating, which forms the basis for biochronology and biostratigraphy, and is an independent and corroborating line of evidence for isotopic dating;
- study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;
- study patterns and processes of evolution, extinction, and speciation; and
- identify past and potential future human-caused effects to global environments and climates (Murphey and Daitch, 2007).

Resource Assessment Guidelines

The loss of any identifiable fossil that could yield information important to prehistory, or that embodies the distinctive characteristics of a type of organism, environment, period of time, or geographic region, would be a significant environmental impact. Direct impacts on paleontological resources primarily concern the potential destruction of nonrenewable paleontological resources and the loss of information associated with these resources. This includes the unauthorized collection of fossil remains. If potentially fossiliferous bedrock or surficial sediments are disturbed, the disturbance could result in the destruction of paleontological resources and subsequent loss of information (a significant impact). At the project-specific level, direct impacts can be mitigated to a less-than-significant level through the implementation of paleontological mitigation.

The CEQA threshold of significance for a significant impact to paleontological resources is reached when a project is determined to "directly or indirectly destroy a significant paleontological resource or unique geologic feature" (Appendix G, State CEQA Guidelines). In general, for project areas underlain by paleontologically sensitive geologic units, the greater the amount of ground disturbance, the higher the potential for significant impacts to paleontological resources. For project areas directly underlain by geologic units with no paleontological sensitivity, there is no potential for impacts on paleontological resources unless sensitive geologic units that underlie the non-sensitive unit are also affected.

Numerous paleontological studies have developed criteria for the assessment of significance for fossil discoveries (e.g., Eisentraut and Cooper, 2002; Murphey and Daitch, 2007; Scott and Springer, 2003). In general, these studies assess fossils as significant if one or more of the following criteria apply:

1. The fossils provide information on the evolutionary relationships and developmental trends among organisms, living or extinct;
2. The fossils provide data useful in determining the age(s) of the rock unit or sedimentary stratum, including data important in determining the depositional history of the region and the timing of geologic events therein;
3. The fossils provide data regarding the development of biological communities or interaction between paleobotanical and paleozoological biotas;
4. The fossils demonstrate unusual or spectacular circumstances in the history of life; or
5. The fossils are in short supply and/or in danger of being depleted or destroyed by the elements, vandalism, or commercial exploitation, and are not found in other geographic locations.

Professional Standards

The Society of Vertebrate Paleontology (SVP) has established standard guidelines that outline professional protocols and practices for conducting paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation (1995, 2010). Most practicing professional vertebrate paleontologists adhere closely to the SVP's assessment, mitigation, and monitoring requirements as specifically provided in its standard guidelines. Most state regulatory agencies with paleontological laws, ordinances, regulations, and standards accept and use the professional standards set forth by the SVP.

As defined by the SVP (2010:11), significant paleontological resources are defined 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).

A geologic unit known to contain significant fossils is considered sensitive to adverse impacts if there is a high probability that earth-moving or ground-disturbing activities in that rock unit will either disturb or destroy fossil remains directly or indirectly. This definition of sensitivity differs fundamentally from the definition for archaeological resources as follows:

> It is extremely important to distinguish between archaeological and paleontological (fossil) resource sites when defining the sensitivity of rock units. The boundaries of archaeological sites define the areal extent of the resource. Paleontological sites, however, indicate that the containing sedimentary rock unit or formation is fossiliferous. The limits of the entire rock formation, both areal and stratigraphic, therefore define the scope of the paleontological potential in each case (SVP, 1995).

Many archaeological sites contain features visually detectable on the surface. In contrast, fossils are often contained within surficial sediments or bedrock, and are therefore not observable or detectable unless exposed by erosion or human activity.

In summary, paleontologists cannot know either the quality or quantity of fossils prior to natural erosion or human-caused exposure. As a result, even in the absence of fossils on the surface, it is necessary to assess the sensitivity of rock units based on their known potential to produce significant fossils elsewhere within the same geologic unit (both within and outside the study area), a similar geologic unit, or based on whether the unit in question was deposited in a type of environment known to be favorable for fossil preservation. Monitoring by experienced paleontologists greatly increases the probability that fossils will be discovered during ground-disturbing activities and that, if these remains are significant, successful mitigation and salvage efforts may be undertaken to prevent adverse impacts to these resources.

Paleontological Sensitivity

Paleontological sensitivity is defined as the potential for a geologic unit to produce scientifically significant fossils. This is determined by rock type, history of the geologic unit in producing significant fossils, and fossil localities recorded from that unit. Paleontological sensitivity is derived from the known fossil data collected from the entire geologic unit, not just from a specific survey. In its "Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources," the SVP (2010:1–2) defines four categories of paleontological sensitivity (potential) for rock units: high, low, undetermined, and no potential:

High Potential. "Rock units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources. Rocks units classified as having high potential for producing paleontological resources include, but are not limited to, sedimentary formations and some volcaniclastic formations (e.g., ash or tephra), and some low-grade metamorphic rocks which contain significant paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils (e.g., middle Holocene and older, fine-grained fluvial sandstone, argillaceous and carbonate-rich paleosols, cross-bedded point bar sandstone, fine-grained marine sandstone, etc.). Paleontological potential consists of both a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, plant, or trace fossils and b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data. Rock units which contain potentially datable organic remains older than late Holocene, including deposits associated

with animal nests or middens, and rock units which may contain new vertebrate deposits, traces, or trackways are also classified as having high potential."

Low Potential. "Reports in the paleontological literature or field surveys by a qualified professional paleontologist may allow determination that some rock units have low potential for yielding significant fossils. Such rock units will be poorly represented by fossil specimens in institutional collections, or based on general scientific consensus only preserve fossils in rare circumstances and the presence of fossils is the exception not the rule, e.g. basalt flows or Recent colluvium. Rock units with low potential typically will not require impact mitigation measures to protect fossils."

Undetermined Potential. "Rock units for which little information is available concerning their paleontological content, geologic age, and depositional environment are considered to have undetermined potential. Further study is necessary to determine if these rock units have high or low potential to contain significant paleontological resources. A field survey by a qualified professional paleontologist to specifically determine the paleontological resource potential of these rock units is required before a paleontological resource impact mitigation program can be developed. In cases where no subsurface data are available, paleontological potential can sometimes be determined by strategically located excavations into subsurface stratigraphy."

No Potential. "Some rock units have no potential to contain significant paleontological resources, for instance high-grade metamorphic rocks (such as gneisses and schists) and plutonic igneous rocks (such as granites and diorites). Rock units with no potential require no protection or impact mitigation measures relative to paleontological resources" (SVP, 2010:1–2).

SETTING

Geological Setting

The project area is located in the San Francisco Bay, which is in the Coastal Ranges Geomorphic Province. The Coast Ranges consist of relatively young (3.5 million years ago, Ma) northwest-trending mountain ranges and valleys that run along the Pacific coast from Santa Barbara to the Oregon border, coincident with the Pacific-North American plate boundary (Page et al., 1998). The Coast Ranges preserve a thick sequence of sedimentary strata dating back to the Mesozoic (~251 Ma) overlying granitic and metamorphic bedrock (Norris and Webb, 1990). Although elevations are moderate within the Coast Ranges, the relief of these mountains is often considerable, with peaks rising around 1,000 meters just a few kilometers from the coast (Norris and Webb, 1990). These sedimentary rocks have a rich fossil history in central California, recording the filling of offshore basins dating to the Mesozoic followed by the progressively shallowing sea and the emergence of terrestrial environments in the Pliocene and Pleistocene (Page et al., 1998). This sedimentary sequence is dominated by Miocene rocks that are primarily marine in origin, such as the well-known Monterey Formation (Norris and Webb, 1990). More recently, the Pleistocene history of the region (2.6 million – 10,000 years ago) is marked by glacially controlled sea level fluctuations and tectonic uplift during which the shoreline advanced and retreated as much as 30 miles across the continental shelf, carving a series of marine terraces along the coast (Norris and Webb, 1990).

Locally, the project is on the southern margin of the San Francisco Bay, where the Sacramento and San Juan Rivers empty and form the largest estuary on the west coast of North America (Foxgrover et al., 2004). The San Francisco Bay formed approximately 650,000 years ago as a result of motion along the San Andreas Fault, where the Pacific Plate is moving laterally past the North American Plate (Atwater et al., 1977). Water levels in the Bay have fluctuated since the broad structural depression formed, with

marine highstands occurring 100,000 and just under 10,000 years ago (Atwater et al., 1977). Fluctuations in sea level has left a record of alternating estuarian, salt marsh, freshwater marsh, and terrestrial sediments, with the most recent highstand resulting in thick deposits of Bay muds in the vicinity of the project area.

RESULTS

Paleontological Sensitivity

Geologic mapping by Dibblee and Minch (2007) indicates the surficial geology of the project area consists of silty clay (mapped as Qac in Figure 4). This unit and its paleontological sensitivity are discussed below.

Silty Clay (Qac). These sediments consist of silty and organic clay deposited in between alluvial fans during the early and middle Holocene, as determined by the presence of invertebrate fossils in this unit (Dibblee and Minch, 2007). The SVP defines fossils as being older than 5,000 years in age, which correlates roughly to the middle Holocene and older. The San Francisco Bay area has a rich history of early Holocene and Pleistocene fossils from sediments of this age (Jefferson, 1991a, 1991b). Most famously, the fossil beds used to define the Irvingtonian North American Land Mammal Age are from the Irvington District of Fremont, California (Stirton, 1939; Savage, 1951). Iconic Ice Age fossils such as mammoths, horses, saber-toothed cats, and wolves, as well as smaller animals such as rodents, reptiles, fish, and birds are known from Pleistocene alluvium in this area (Atwater et al., 1977; Atwater et al., 1981; Baskin, 2016; Bell and Bever, 2006; Bell et al., 2004; Cabanatuan, 2012; Casteel and Adam, 1977; Tomiya et al., 2011). The UCMP online collections search returned records of 32 vertebrate fossils from Pleistocene sediments collected from Santa Clara County (UCMP, 2019). The closest LACM fossil locality is northeast of the project area near Martinez, California, where a fossil horse specimen was recovered and identified as the holotype of a new species, *Equus pacificus* (McLeod, 2019). Given the record of fossil preservation in these sediments, silty clay (Qac) is determined to have high paleontological sensitivity.

RECOMMENDATIONS

To demonstrate CEQA compliance, a response is required to the following question in the Environmental Checklist, based on the results of the paleontological analysis: “Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?” With the implementation of the following recommendations, construction associated with the project will be mitigated against directly or indirectly destroying unique paleontological resources or sites or unique geologic features. The intent of these recommendations is to ensure that potential adverse impacts to paleontological resources as a result of project implementation are reduced to a less-than-significant level.

The following mitigation measures have been developed in accordance with the SVP (2010) standards and meet the paleontological requirements of CEQA. Similar mitigation measures have been used

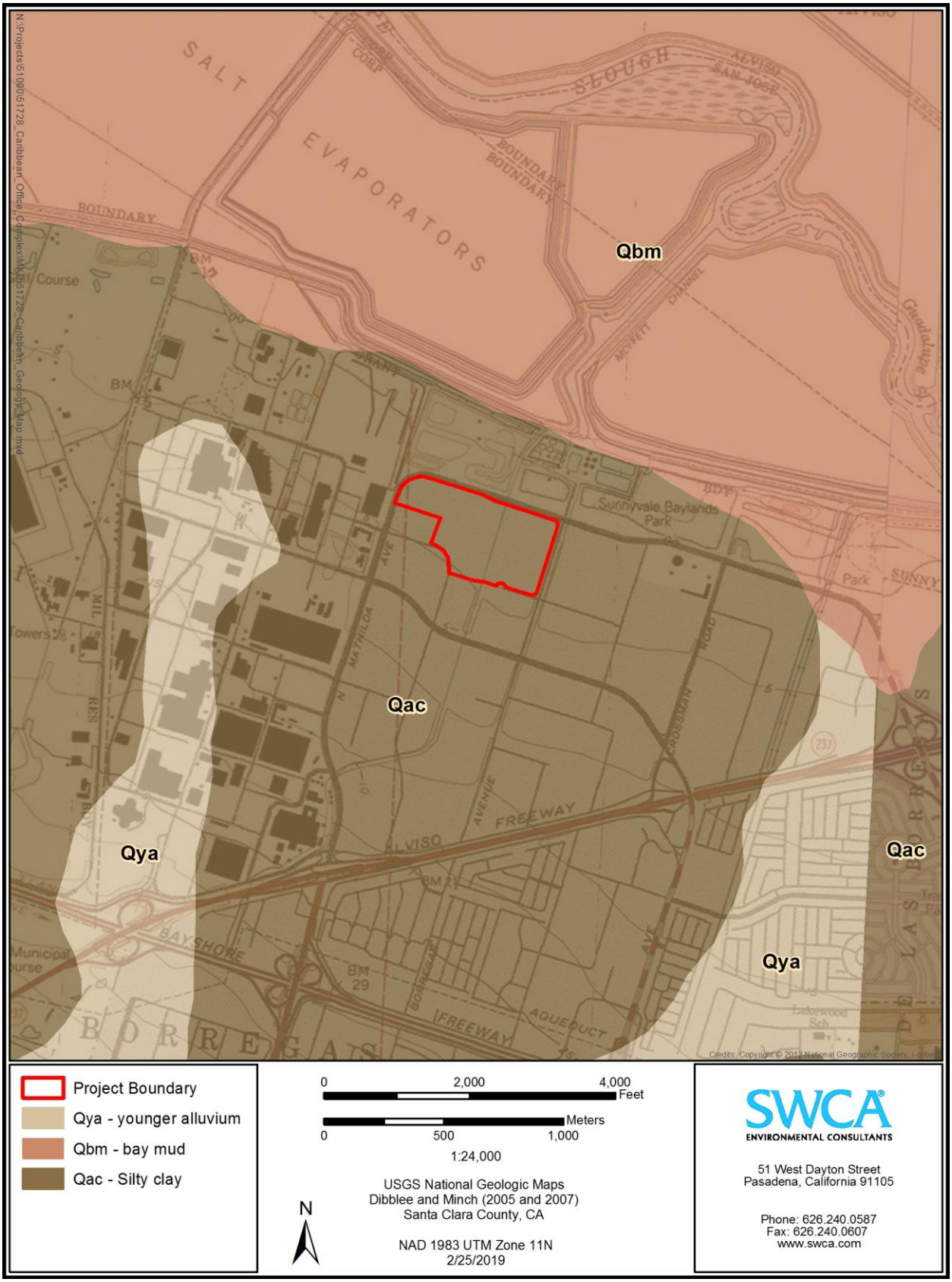

Figure 4. Geologic map of the project area.

throughout California and have been successful in protecting paleontological resources while allowing timely completion of construction.

PAL-1, Worker Training: A qualified paleontologist will develop a Worker's Environmental Awareness Program (WEAP) to train the construction crew on the legal requirements for preserving fossil resources as well as procedures to follow in the event of a fossil discovery. This training program will be given to the crew before ground-disturbing work commences and will include handouts to be given to new workers as needed.

PAL-2, Paleontological Monitor: A qualified paleontologist shall be retained to prepare a Paleontological Resources Monitoring and Mitigation Plan (PRMMP). This plan will address specifics of monitoring and mitigation and comply with the recommendations of the Society of Vertebrate Paleontology's 2010 Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources. All ground disturbances in the project area that occur in previously undisturbed sediment with high paleontological sensitivity will require monitoring. This includes all depths of ground disturbance in areas mapped as silty clay (Qac). The Project Paleontologist may periodically inspect construction activities to adjust the level of monitoring in response to subsurface conditions. In the event that any potentially significant paleontological resources are discovered, the paleontological monitor shall stop work inside a zone designated by him/her where additional paleontological resources could be found. A plan for the evaluation of the resource shall be submitted to the Community Development Director for approval.

PAL-3, Halt Construction and Evaluate Resource: In the event that a paleontological resource (fossilized invertebrate, vertebrate, plan or micro-fossil) is found during construction, excavation within 50 feet of the find shall be temporarily halted or diverted until the discovery is evaluated. Upon discovery, the Community Development Director shall be notified immediately and a qualified paleontologist shall be retained to document and assess the discovery in accordance with Society of Vertebrate Paleontology's 2010 Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources, and determine procedures to be followed before construction is allowed to resume at the location of the find. If determined to be significant, the paleontologist will prepare an excavation plan for mitigating the Project's impact on this resource, including preparation, identification, cataloging, and curation of any salvaged specimens.

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CONFIDENTIAL APPENDIX A:

LACM Results

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