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Paleontological Resources Technical Report

Mission San Marcos Industrial
City of San Marcos
San Diego County, California

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Executive Summary

This paleontological resources technical report provides an assessment of paleontological resources at the proposed Mission San Marcos Industrial project (Project) site in the central portion of the City of San Marcos, San Diego County, California. The purpose of this report is to identify and summarize paleontological resources that occur in the vicinity of the Project site and identify proposed Project components (if any) that may negatively impact paleontological resources. The report includes the results of a review of the relevant paleontological and geological literature, an institutional records search conducted at the San Diego Natural History Museum (SDNHM), and a paleontological field survey of the Project site.

The approximately 10.83 acre Project site consists of a single parcel (Assessor's Parcel Number 220-210-26-00) located at 528 East Mission Road. The Project site is bordered to the north by residential development and undeveloped land, to the east and west by existing commercial development, and to the south by East Mission Road. The Project proposes to construct three concrete tilt-up warehouse buildings totaling 132,310 square feet. Associated site improvements are proposed to include a biofiltration basin, surface parking, landscaping, hardscaping, and subgrade utilities. The northwestern portion of the Project site would remain as open space.

Published geologic mapping for the Project site indicates the site is primarily underlain at the surface by late Pleistocene- to Holocene-age (less than approximately 129,000 years old) young alluvial flood plain deposits. The northwestern portion of the Project site is underlain by metavolcanic rocks attributed to the early Cretaceous-age (approximately 128 to 110 million years old) Santiago Peak Volcanics. According to the preliminary site-specific geotechnical evaluation report, artificial fill is also present at the surface in localized areas of the Project site. During the paleontological field survey of the Project site conducted on October 24, 2023, native exposures of sedimentary deposits were unavailable for direct inspection due to the flat-lying topography of the portions of the site underlain by alluvium, as well as the presence of vegetation and artificial fill.

The results of the paleontological records search and literature review indicate that fossils have not been documented from Holocene-age or Pleistocene-age sedimentary deposits within a one-mile radius of the Project site. However, fossils are known from Pleistocene-age sedimentary deposits at numerous locations in coastal San Diego County, and have yielded impressive collections of terrestrial vertebrates including pond turtle, passenger pigeon, hawk, mole, rabbit, gopher, squirrel, capybara, wolf, horse, camel, deer, bison, mastodon, mammoth, and ground sloth.

Based on the lack of documented fossil localities in the vicinity of the Project site, the alluvium underlying the Project site is assigned a Low paleontological sensitivity at depths of less than 10 feet below ground surface (bgs) (where they are assumed to be Holocene in age; less than 11,700 years old) and a Moderate paleontological sensitivity at depths greater than 10 feet bgs (where they may transition to older, Pleistocene-age deposits). Artificial fill and rocks of the Santiago Peak Volcanics are assigned Zero paleontological sensitivity. Project-related earthwork that would extend greater than 10 feet bgs in areas where alluvial deposits exceed 10 feet in thickness has the potential to impact paleontological resources. Implementation of a paleontological mitigation program, in the form of paleontological monitoring, is recommended for those portions of earthwork at the Project site that may directly impact previously undisturbed alluvial deposits at depths of 10 feet or greater bgs, as outlined in the provided Mitigation Measures 1–7. Implementation of the paleontological mitigation program will reduce Project-related impacts to paleontological resources to a level that is less than significant.

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1.0 Introduction

1.1 Project Description

This paleontological resources technical report provides an assessment of paleontological resources for the proposed Mission San Marcos Industrial project (Project) site, located in the central portion of the City of San Marcos, San Diego County, California (Figure 1). The approximately 10.83 acre Project site consists of a single parcel (Assessor's Parcel Number 220-210-26-00) located at 528 East Mission Road. The Project site is bordered to the north by residential development and undeveloped land, to the east and west by existing commercial development, and to the south by East Mission Road. The Project proposes to construct three concrete tilt-up warehouse buildings totaling 132,310 square feet. Associated site improvements are proposed to include a biofiltration basin, surface parking, landscaping, hardscaping, and subgrade utilities. The northwestern portion of the Project site would remain as open space.

1.2 Scope of Work

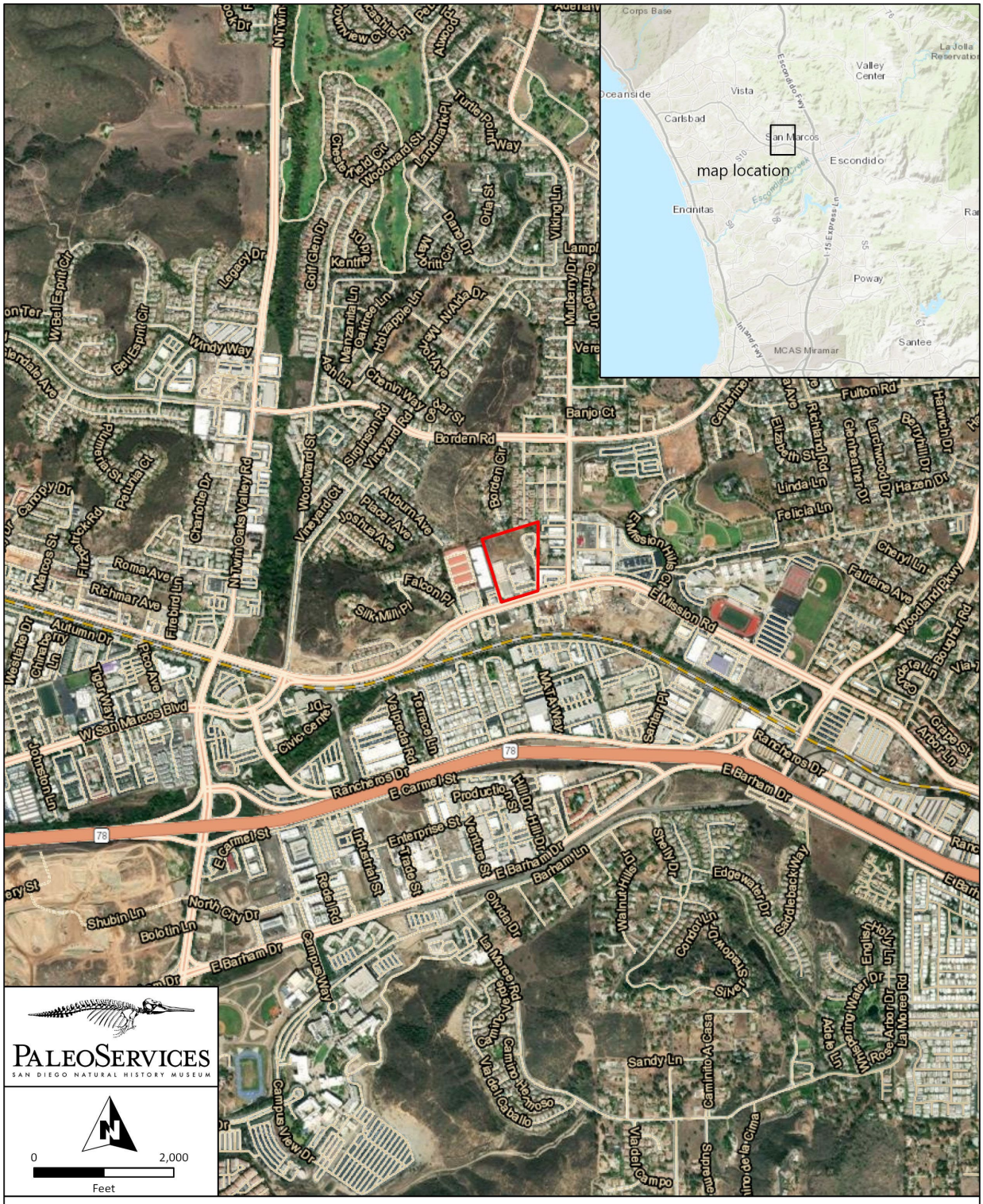
This report is being prepared due to a review of maps that indicate the Project site may be underlain at depth by sedimentary deposits assigned a Moderate paleontological sensitivity (Deméré and Walsh, 1993; County of San Diego, 2009). The report is intended to summarize existing paleontological resource data at the Project site, discuss the significance of these resources, determine whether construction of the Project will impact paleontological resources, and develop measures to mitigate any potential impacts to paleontological resources.

The technical report includes the results of a literature review of relevant published and unpublished geological and paleontological reports, an institutional records search of the paleontological collections at the San Diego Natural History Museum (SDNHM), and a paleontological field survey of the Project site. This report was prepared by Kirstin L. Mueller, Katie M. McComas, and Thomas A. Deméré of the Department of PaleoServices, SDNHM.

1.3 Definition of Paleontological Resources

As defined here, paleontological resources (i.e., fossils) are the buried remains and/or traces of prehistoric organisms (i.e., animals, plants, and microbes). Body fossils such as bones, teeth, shells, leaves, and wood, as well as trace fossils such as tracks, trails, burrows, and footprints, are found in the geologic units/formations within which they were originally buried. The primary factor determining whether an object is a fossil or not is not how the organic remain or trace is preserved (e.g., "petrified"), but rather the age of the organic remain or trace. Although typically it is assumed that fossils must be older than ~11,700 years (i.e., the generally accepted end of the last glacial period of the Pleistocene Epoch), organic remains older than recorded human history and/or older than middle Holocene (about 5,000 radiocarbon years) can also be considered to represent fossils (SVP, 2010).

Fossils are considered important scientific and educational resources because they serve as direct and indirect evidence of prehistoric life and are used to understand the history of life on Earth, the nature of past environments and climates, the membership and structure of ancient ecosystems, and the pattern and process of organic evolution and extinction. In addition, fossils are considered to be non-renewable resources because typically the organisms they represent no longer exist. Thus, once destroyed, a particular fossil can never be replaced.



Sources: Terrain Hillshade, World Imagery, World Topographic Map, Esri, 2024

Figure 1: Project overview map, Mission San Marcos Industrial Project, City of San Marcos, San Diego County, California

Finally, paleontological resources can be thought of as including not only the actual fossil remains and traces, but also the fossil collecting localities and the geologic units containing those localities. The locality includes both the geographic and stratigraphic context of fossils—the place on the earth and stratum (deposited during a particular time in earth's history) from which the fossils were collected. Localities themselves may persist for decades, in the case of a fossil-bearing outcrop that is protected from natural or human impacts, or may be temporarily exposed and ultimately destroyed, as is the case for fossil-bearing strata uncovered by erosion or construction. Localities are documented with a set of coordinates and a measured stratigraphic section tied to elevation detailing the lithology of the fossil-bearing stratum as well as overlying and underlying strata. This information provides essential context for any future scientific study of the recovered fossils.

1.3.1 Definition of Significant Paleontological Resources

The California Environmental Quality Act (CEQA, Public Resources Code Section 21000 et seq.) dictates that a paleontological resource is considered significant if it "has yielded, or may be likely to yield, information important in prehistory or history" (Section 15064.5, [a][3][D]). The Society of Vertebrate Paleontology (SVP) has further defined significant paleontological resources as consisting of "fossils and fossiliferous deposits[…]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" (SVP, 2010).

1.4 Regulatory Framework

Paleontological resources are considered scientifically and educationally significant nonrenewable resources; they are protected under a variety of laws, regulations, and ordinances. The Project site is located in the City of San Marcos, San Diego County, California. As such, state and local regulations are applicable to the Project.

1.4.1 State

The **California Environmental Quality Act (CEQA, Public Resources Code Section 21000 et seq.)** protects paleontological resources on both state and private lands in California. This act requires the identification of environmental impacts of a proposed project, the determination of significance of the impacts, and the identification of alternative and/or mitigation measures to reduce adverse environmental impacts. The Guidelines for the Implementation of CEQA (Title 14, Chapter 3, California Code of Regulations: 15000 et seq.) outlines these necessary procedures for complying with CEQA. Paleontological resources are specifically included as a question in the CEQA Environmental Checklist (Section 15023, Appendix G): "Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature." Also applicable to paleontological resources is the checklist question: "Does the project have the potential to… eliminate important examples of major periods of California history or pre-history." If significant paleontological resources may be impacted within a given project site, CEQA provides that "a lead agency shall identify potentially feasible measures to mitigate significant adverse changes in the significance of an historical resource. The lead agency shall ensure that any adopted measures to mitigate or avoid significant adverse changes are fully enforceable through permit conditions, agreements, or other measures" (Section 15064.5, [b][4]).

Other state requirements for paleontological resource management are included in the **Public Resources Code (Chapter 1.7), Section 5097.5 and 30244**. These statutes prohibit the removal of any paleontological site or feature on public lands without permission of the jurisdictional agency, defines the removal of paleontological sites or features as a misdemeanor, and requires reasonable mitigation of adverse impacts to paleontological resources from developments on public (state) lands.

1.4.2 Local: City of San Marcos

The Conservation and Open Space Element of the **City of San Marcos General Plan** (2012) addresses the management of paleontological resources through Policy CO-2.5, which calls for the continued review of "future development proposals to ensure that cultural resources (including […] paleontological […] resources) are analyzed and conserved in compliance with CEQA requirements." In addition, Goal COS-11 is to "continue to identify and evaluate cultural, historic, archeological, paleontological, and architectural resources for protection from demolition and inappropriate actions."

2.0 Methods

2.1 Paleontological Literature Review and Records Search

A review was conducted of relevant published geologic maps (e.g., Kennedy and Tan, 2007), published geological and paleontological reports (e.g., Deméré et al., 2013; Guthrie, 2012), the site-specific geotechnical investigation report (Geocon, Inc., 2020), and other relevant literature (e.g., field trip guidebooks, theses and dissertations, and unpublished paleontological mitigation reports). This approach was followed in recognition of the direct relationship between paleontological resources and the geologic formations within which they are entombed. Knowing the geologic history of a particular area and the fossil productivity of geologic formations that occur in that area, it is possible to predict where fossils will, or will not, be encountered.

A paleontological records search was conducted at the SDNHM in order to determine if any documented fossil collection localities occur within the Project site or immediate surrounding area. The SDNHM records search involved examination of the paleontological database for any records of known fossil collection localities from sedimentary deposits similar to those underlying the Project site within an approximately one-mile radius.

2.2 Paleontological Field Survey

A paleontological field survey was conducted on October 24, 2023 by Katie M. McComas and Kirstin L. Mueller of the Department of PaleoServices, SDNHM, in order to confirm the mapped geology, to field check the results of the literature review and records search, and to evaluate the paleontological sensitivity of strata present in the vicinity of the Project site. The field survey included inspection of available exposures within the Project site in order to record detailed lithologic descriptions of strata (e.g., color, sorting of grains, texture, sedimentary structures, and grain size of sedimentary rocks) and prospecting for any fossilized remains present at the surface.

During the survey, standard field equipment (e.g., rock hammer, hand lens, tape measure) was on hand and an iPhone loaded with Esri's Field Maps app was used to view relevant maps and collect field data. Collected field data included waypoints that were keyed to field notes and photographs.

2.3 Paleontological Resource Assessment Criteria

Impacts to paleontological resources are typically assigned a paleontological sensitivity rating based on the resource potential of an impacted geologic unit. The County of San Diego has developed its own guidelines for assigning paleontological sensitivity (County of San Diego, 2009), which includes a five-tiered scale of High Sensitivity, Moderate Sensitivity, Low Sensitivity, Marginal Sensitivity, or Zero Sensitivity ratings. An expanded description of each paleontological sensitivity rating, as outlined by the County is provided below.

2.3.1 High Sensitivity

Geologic units with high sensitivity have produced, or are likely to produce, significant vertebrate, invertebrate, or paleobotanical remains. High sensitivity geologic units may contain fossil materials that are rare, well-preserved, critical for stratigraphic or paleoenvironmental interpretation, and/or provide important information about the paleobiology and evolutionary history (phylogeny) of animal and plant groups.

2.3.2 Moderate Sensitivity

Moderate sensitivity is assigned to geologic units known to contain paleontological localities with fossil material that is poorly preserved, common elsewhere, or stratigraphically unimportant.

2.3.3 Low Sensitivity

Low sensitivity is assigned to geologic units that, based on their relatively young age and/or high-energy depositional history, are judged unlikely to produce important fossil remains. Typically, low sensitivity units produce fossil remains in low abundance, or only produce common/widespread invertebrate fossils whose taphonomy, phylogeny, and ecology is already well understood.

2.3.4 Marginal Sensitivity

Marginal sensitivity is assigned to geologic units that are composed either of volcaniclastic (derived from volcanic sources) or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain formations at localized outcrops.

2.3.5 Zero Sensitivity

Geologic units with Zero sensitivity are either entirely igneous in origin and therefore do not contain fossil remains, or are moderately to highly metamorphosed and thus any contained fossil remains have been destroyed. Artificial fill materials also have Zero sensitivity, because the stratigraphic and geologic context of any contained organic remains (i.e., fossils) has been lost.

2.4 Paleontological Impact Analysis

Direct impacts to paleontological resources occur when earthwork activities (e.g., mass grading, trenching), cut into the geologic units within which fossils are buried, and physically destroy the fossil remains. As such, only earthwork activities that will disturb potentially fossil-bearing sedimentary deposits (i.e., those rated with a high or moderate paleontological sensitivity) have the potential to significantly impact paleontological resources. Paleontological mitigation typically is recommended to reduce any negative impacts to paleontological resources to less than significant levels.

The purpose of the impact analysis is to determine which (if any) of the proposed Project-related earthwork activities may disturb potentially fossil-bearing geologic units, and where and at what depths this earthwork will occur. The paleontological impact analysis involved analysis of available project documents, and comparison with geological and paleontological data gathered during the records search, literature review, and field survey.

3.0 Results

3.1 Results of the Records Search and Literature Review

3.1.1 Regional Geologic Setting

The Project site lies within the western foothills of the Peninsular Ranges, only a few miles east of the main body of the San Diego Coastal Plain. This area is characterized by crystalline basement rocks, including plutonic igneous rocks (e.g., Peninsular Ranges Batholith) and metavolcanic rocks (e.g., Santiago Peak Volcanics), with younger sedimentary deposits blanketing the lower-lying topography.

Geologists have subdivided the geologic history of the greater southern California and northern Baja California region into three major intervals: “pre-batholithic,” “batholithic,” and “post-batholithic.” Pre-batholithic events are represented by a deformed sequence of Triassic and Jurassic metasedimentary and metavolcanic rocks that document an early period of marine sedimentation and volcanic activity in a forearc basin offshore of the Mesozoic North American continental margin. A younger series of undeformed pre-batholithic metavolcanic flow and ejecta rocks document the early growth of a Mesozoic magmatic arc that eventually extended almost the full length of the continental margin from Alaska to Mexico (Hildebrand and Whalen, 2014).

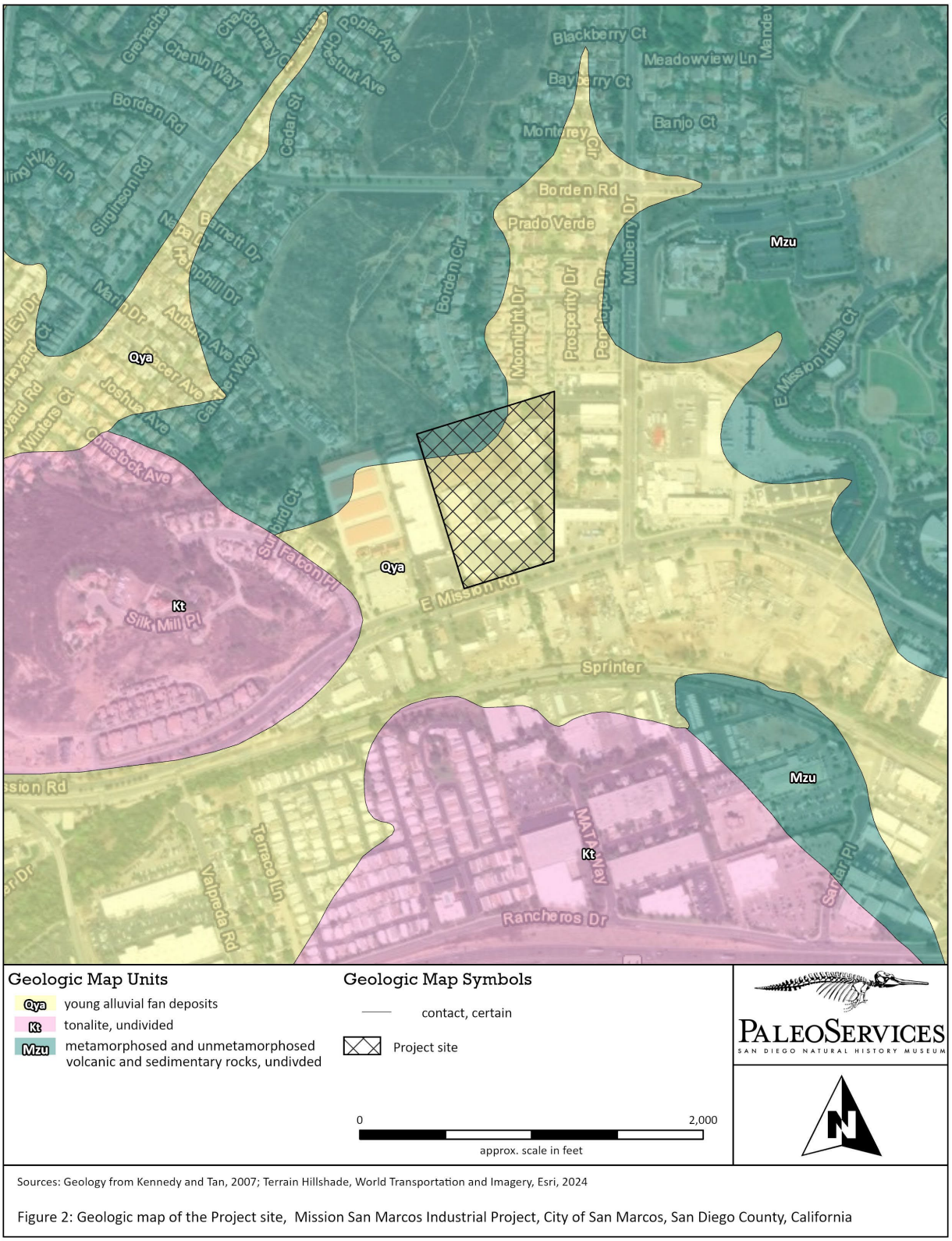
Batholithic events are represented by a massive volume of plutonic igneous rocks (which together compose a local portion of the Peninsular Ranges Batholith) that document an extended period of subduction-related arc magmatism and metamorphism that characterized the region until around 80 million years ago (Ma). Although this magmatism initially began in the mid Jurassic (~180 Ma), the truly massive accumulations of magma responsible for formation of the batholith did not really get started until the early Cretaceous (~120 Ma). This prolonged period of subduction-driven plutonism lasted until the late Cretaceous (~80 Ma), and it was during this ~40 million year period that the great Sierra Nevada Batholith of northeastern and east-central California and its southern extension, the Peninsular Ranges Batholith of southern California and Baja California, were forming in the earth’s crust at depths of up to 20 miles below the surface.

Post-batholithic events are represented by a layer cake sequence of sedimentary strata of late Cretaceous, Eocene, Oligocene, Miocene, Pliocene, and/or Pleistocene age (Givens and Kennedy, 1979; Hanna, 1926; Kennedy, 1975; Kennedy and Moore, 1971; Kennedy and Peterson, 1975; Peterson and Kennedy, 1974; Walsh and Deméré, 1991). The Eocene portion of this geologic record is exposed western San Marcos, while more recent alluvial flood plain deposits that accumulated during the late Pleistocene and Holocene blanket the majority of the low-lying areas of downtown San Marcos.

3.1.2 Project Geology

As mapped by Kennedy and Tan (2007), late Pleistocene- to Holocene-age (less than 129,000 years old) young alluvial flood plain deposits underlie the majority of the Project site at the surface (Figure 2). These deposits are generally considered to be Holocene in age (less than about 11,700 years old), but presumably transition at depth (estimated as shallow as 10 feet below ground surface; bgs) into older, Pleistocene-age deposits. The northwestern portion of the Project site is underlain by metavolcanic rocks attributed to the early Cretaceous-age (approximately 128 to 110 million years old) Santiago Peak Volcanics. The site-specific geotechnical investigation report indicates that the alluvial deposits underlying the site consist of reddish brown to dark brown clay, and reddish brown, gravelly, fine- to coarse-grained sandstone. These deposits rest directly on the metavolcanic rocks and are present to a maximum depth of 21 feet bgs in the southeastern portion of the site and 16 feet bgs in the northeastern portion of the site, but measure less than 10 feet thick in other portions of the site

(Geocon, Inc., 2020). Also present in localized areas within the Project site are previously placed fill deposits and aggregate base, which measure between 2 and 4 feet thick (Geocon, Inc., 2020).



Sources: Geology from Kennedy and Tan, 2007; Terrain Hillshade, World Transportation and Imagery, Esri, 2024

Figure 2: Geologic map of the Project site, Mission San Marcos Industrial Project, City of San Marcos, San Diego County, California

3.1.3 Project Paleontology

No fossil localities have been documented within a one-mile radius of the Project site. Holocene alluvial deposits are typically not considered to have the potential to preserve fossils remains due to their relatively young geologic age and the recognition that organic remains preserved in such deposits are conspecific with organisms living in the area today. However, fossils have been collected from older, Pleistocene-age alluvial sediments at numerous locations in coastal San Diego County (e.g., Otay River Valley Sweetwater River Valley, the South Bay Freeway [State Route 54], Mission Valley, San Dieguito River Valley, Aqua Hedionda Creek, Buena Vista Creek, and San Luis Rey River Valley), and have yielded impressive collections of terrestrial vertebrates including pond turtle, passenger pigeon, hawk, mole, rabbit, gopher, squirrel, capybara, wolf, horse, camel, deer, bison, mastodon, mammoth, and ground sloth (Chandler, 1982; Deméré et al., 2013; Guthrie, 2012; Jefferson, 1991; Majors, 1993; SDNHM unpublished paleontological collections data).

3.2 Results of the Paleontological Field Survey

As observed during the paleontological field survey, the majority of the Project site is generally flat-lying with existing buildings and parking lots located in the southern portion of the site (Figure 3). The northeastern portion of the site is being used for storage of materials, and is covered by gravel. The northwestern portion of the site consists of an undeveloped slope covered with dry grasses and shrubs. This hilly areas appears to be entirely underlain by metavolcanic rocks of the Santiago Peak Volcanics, which consist of weathered, light gray to blueish gray, lightly to moderately metamorphosed microcrystalline rocks of volcanic origin (Figure 4). No exposures of previously undisturbed sedimentary deposits were observed within the site.

No fossils were encountered during the paleontological field survey.

Figure 3. Overview of the existing conditions at the Project site, taken looking southeast from the top of the undeveloped slope in the northwestern portion of the site. The majority of the site is flat, with existing buildings visible in the background to the right.

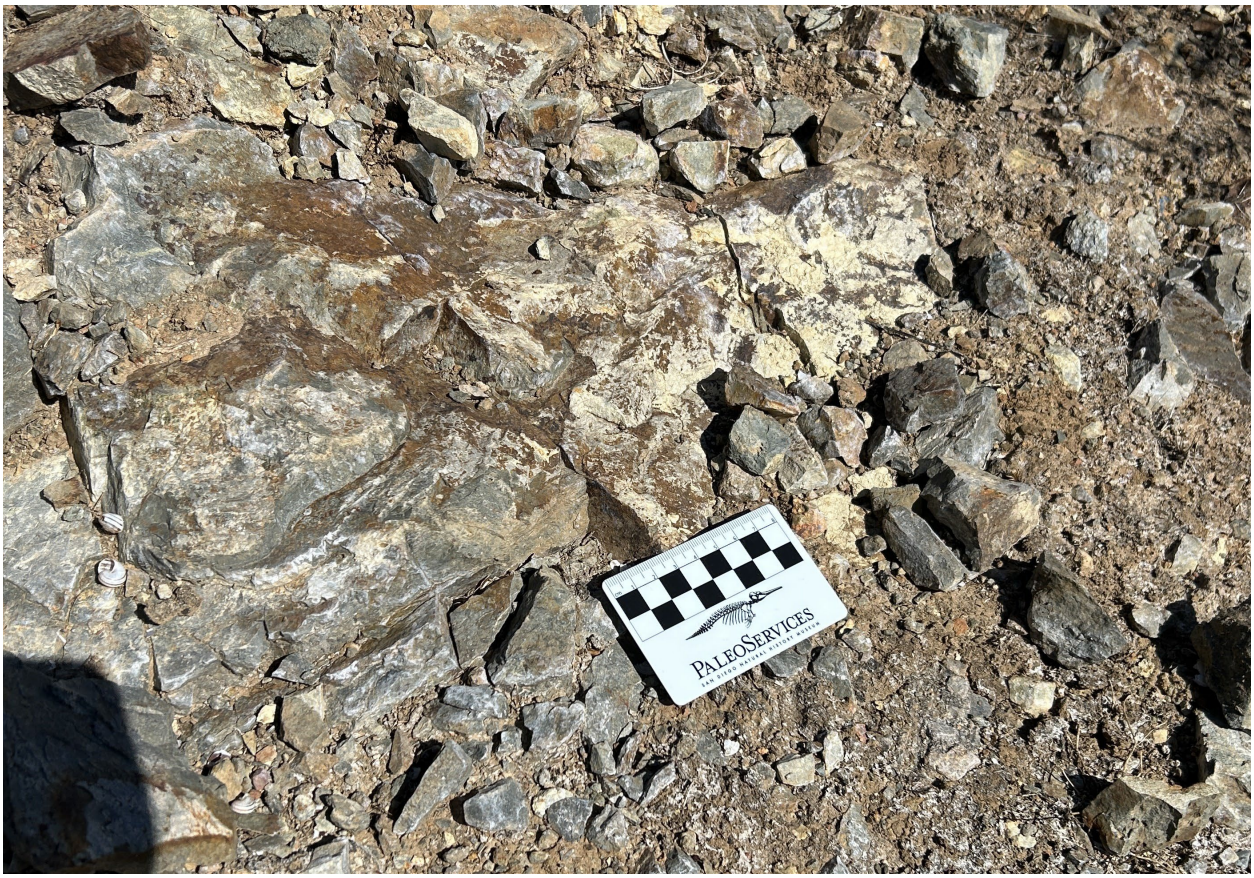


Figure 4. Metavolcanic rocks exposed in the northwestern portion of the Project site. Scale bar measures 8 centimeters.

3.3 Results of the Paleontological Resource Assessment

Following the County of San Diego paleontological sensitivity guidelines, as outlined in Section 2.3, Holocene-age alluvial flood plain deposits underlying the Project site are assigned a Low paleontological sensitivity. This rating is based on the relatively young age of these deposits and the recognition that organic remains preserved in such deposits are conspecific with organisms living in the area today. A further lack of recorded fossil localities in the vicinity of the Project site supports a Low paleontological sensitivity for these deposits. As mentioned above, however, the Holocene-age sediments likely transition in the deeper subsurface into older, Pleistocene-age deposits, at depths that may be as shallow as 10 feet bgs (see Section 3.1.2). Pleistocene sedimentary deposits that may be located in the subsurface of the Project site are assigned a Moderate paleontological sensitivity (Figure 5) based on the occurrence of scientifically significant vertebrate fossils in similar deposits elsewhere in western San Diego County (SDNHM paleontological collection records).

3.4 Results of the Paleontological Impact Analysis

Remedial grading of the site is anticipated to extend to depths of approximately 3 to 5 feet bgs. The depth of excavation for the biofiltration basin and trenching for subgrade utilities is currently unknown. The majority of the site will be reserved for light industrial buildings and surface parking. Based on the above assessment (Section 3.3), only Project-related earthwork that would extend greater than 10 feet bgs in areas where alluvial sediments measure more than 10 feet thick (i.e., in the southern and eastern portions of the site, as depicted in Figure 5) has the potential to impact paleontological resources.

Sources: Terrain Hillshade, World Transportation and Imagery, Esri, 2024; Geology based on Geocon, 2020

Figure 5: Paleontological sensitivity map, Mission San Marcos Industrial Project, City of San Marcos, San Diego County, California

4.0 Recommendations & Conclusions

The Project site is underlain at the surface by geologic units ranging from Zero paleontological sensitivity (Santiago Peak Volcanics, artificial fill/aggregate base) to Low paleontological sensitivity (young alluvial flood plain deposits); however, the young alluvial flood plain deposits may transition at depth into a unit with Moderate paleontological sensitivity (e.g., Pleistocene-age alluvial flood plain deposits). Only excavation activities within the Pleistocene-age alluvial flood plain deposits have the potential to result in impacts to paleontological resources; it is anticipated that such deposits may be impacted during earthwork extending deeper than 10 feet bgs in areas where alluvium measures more than 10 feet thick. If such excavation is planned, implementation of a paleontological mitigation program, in the form of limited paleontological monitoring, is recommended. Implementation of the following mitigation measures will reduce any Project-related impacts to paleontological resources to a level that is less than significant. The steps outlined below are based on established industry best practices (SVP, 2010; Murphey et al., 2019).

1. **Pre-construction (personnel and repository):** Prior to the commencement of construction, a qualified Project Paleontologist shall be retained to oversee the limited paleontological mitigation program (a Project Paleontologist is a person with a Ph.D. or Master's Degree in Paleontology or related field, and who has knowledge of San Diego County paleontology and documented experience in professional paleontological procedures and techniques). In addition, an appropriate regional fossil repository shall be designated to receive any discovered fossils (e.g., the San Diego Natural History Museum).
2. **Pre-construction (meeting):** The Project Paleontologist should attend the Project preconstruction meeting to consult with the grading and excavation contractors and City environmental and engineering staff concerning excavation schedules, paleontological field techniques, and safety issues.
3. **During construction (monitoring):** A paleontological monitor (working under the direction of the Project Paleontologist) should initially be on-site on a full-time basis during any excavations extending more than 10 feet bgs in the eastern and southern portions of the site only, where previously undisturbed deposits of Moderate paleontological sensitivity (e.g., old alluvial flood plain deposits) may be present, in order to inspect exposures for unearthed fossils. Monitoring may be reduced or terminated at the discretion of the Project Paleontologist based on the results of initial monitoring.
4. **During construction (fossil recovery):** If fossils are discovered, the Project Paleontologist (or paleontological monitor) should recover them. In most cases, fossil salvage can be completed in a short period of time. However, some fossil specimens (e.g., a bone bed or a complete large mammal skeleton) may require an extended salvage period. In these instances, the Project Paleontologist (or paleontological monitor) has the authority to temporarily direct, divert, or halt grading to allow recovery of fossil remains in a timely manner.
5. **Post-construction (treatment):** Fossil remains collected during monitoring and salvage should be cleaned, repaired, sorted, and cataloged as part of the mitigation program.
6. **Post-construction (curation):** Prepared fossils, along with copies of all pertinent field notes, photos, and maps, should be deposited (as a donation) in the designated fossil repository. Donation of the fossils shall be accompanied by financial support for initial specimen storage.
7. **Post-construction (final report):** A final summary paleontological mitigation report should be completed that outlines the results of the mitigation program. This report should include

discussions of the methods used, stratigraphic section(s) exposed, fossils collected, inventory lists of catalogued fossils, and significance of recovered fossils.

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