

Appendix D Paleontological Resources Assessment



LSA ASSOCIATES, INC.
20 EXECUTIVE PARK, SUITE 200
IRVINE, CALIFORNIA 92614

949.553.0666 TEL
949.553.8076 FAX

BERKELEY
CARLSBAD

FRESNO
PALM SPRINGS
PT. RICHMOND

RIVERSIDE
ROCKLIN
SAN LUIS OBISPO

June 15, 2016

Brianna Pilkinton
Burns & McDonnell
4225 Executive Square, Suite 500
La Jolla, California 92037

Subject: Paleontological Resources Assessment for the Park Drive Slope and Drainage Improvement Project in the City of Carlsbad, County of San Diego, California

Dear Ms. Pilkinton:

LSA Associates, Inc. (LSA) conducted a paleontological resources assessment for the proposed Park Drive Slope and Drainage Improvement Project (project) in the City of Carlsbad (City), County of San Diego, California. The purpose of the assessment was to determine whether any paleontological resources that may be present within the proposed project site might be impacted by project development and to make recommendations to mitigate any potential impacts to those resources. This assessment was conducted in accordance with industry best practices as described by the Society of Vertebrate Paleontology (SVP, 2010).

PROJECT DESCRIPTION AND LOCATION

The City proposes to implement slope stabilization and drainage repairs for a property generally located on the northeast side of Park Drive between Cove Drive and Bayshore Drive. Design alternatives are being developed and may include the following activities: grading; extension of the existing retaining wall; removal and replacement of existing retaining wall; installation of slope protection; improvements to existing storm drains; installation of water quality best management practices (BMPs); and pavement and sidewalk replacement or improvements.

The project site is generally located along the northeastern side of Park Drive near its intersection with Marina Drive. It is depicted on the United States Geological Survey (USGS) *San Luis Rey, California* 7.5-minute topographic quadrangle map (USGS, 1975) in unsectioned lands of the Agua Hedionda Land Grant (Attachment A).

REGULATORY ENVIRONMENT

State of California

Under State law, paleontological resources are protected by the California Environmental Quality Act (CEQA) and Public Resources Code (PRC) Section 5097.5.

California Environmental Quality Act (Public Resources Code 21000 et seq.). The purpose of CEQA is to provide a Statewide policy of environmental protection. As part of this protection, State

and local agencies are required to analyze, disclose, and, when feasible, mitigate the environmental impacts of, or find alternatives to, proposed projects. The *State CEQA Guidelines* (California Code of Regulations [CCR] 15000 et seq.) provide regulations for the implementation of CEQA and include more specific direction on the process of documenting, analyzing, disclosing, and mitigating environmental impacts of a project. To assist in this process, Appendix G of the *State CEQA Guidelines* provides a sample checklist form that may be used to identify and explain the degree of impact a project will have on a variety of environmental aspects, including paleontological resources (Section V[c]). As stated in Section 15002(b)(1-3) of the *State CEQA Guidelines*, CEQA applies to governmental action, including activities that are undertaken by, financed by, or require approval from a governmental agency.

California Public Resources Code, Section 5097.5. This law protects historic, archaeological, and paleontological resources on public lands within California and establishes criminal and civil penalties for violations. Specifically, PRC Section 5097.5 states that “No person shall knowingly or willfully excavate upon, remove, destroy, injure, or deface any … paleontological or historical feature, situated on public lands” and that public lands includes lands “… under the jurisdiction of the state, or any city, county, district, authority, or public corporation, or any agency thereof.”

City of Carlsbad

Paleontological resources are addressed in City General Plan (City of Carlsbad, 2013) and Municipal Code, relevant excerpts of which are included below.

City of Carlsbad General Plan. The Arts, History, Culture, and Education Element of the General Plan for the City of Carlsbad (City of Carlsbad, 2013), includes the following policies regarding paleontological resources:

7-P.7. Implement the City of Carlsbad Cultural Resources Guidelines to avoid or substantially reduce impacts to archaeological and paleontological resources.

7-P.8. During construction of specific development projects, require monitoring of grading, ground-disturbing, and other major earth-moving activities in previously undisturbed areas or in areas with known archaeological or paleontological resources by a qualified professional, as well as a tribal monitor during activities in areas with cultural resources of interest to local Native American tribes. Both the qualified professional and tribal monitor shall observe grading, ground-disturbing, and other earth-moving activities.

7-P.9. Ensure that treatment of any cultural resources discovered during site grading complies with the City of Carlsbad Cultural Resource Guidelines.

7-P.11. Prior to occupancy of any buildings, a cultural resource monitoring report identifying all materials recovered shall be submitted to the City Planner.

City of Carlsbad Municipal Code. The City’s Municipal Code, Chapter 22, applies to all historic resources, publicly and privately owned, within the corporate limits of the City. According to Chapter 22.02.020, *Purpose and Intent*, the chapter was developed to:

- A. Effect and accomplish the protection, enhancement and perpetuation of historic resources (that include paleontological resources) that represent or reflect elements of the City's cultural, social, economic, political and architectural history
- B. Safeguard the City's historic heritage by encouraging preservation of its historic resources
- C. Stabilize and improve property values
- D. Foster civic pride in the character and accomplishments of the past
- E. Protect and enhance the City's historic attractions for residents, tourists and visitors and serve as a support and stimulus to business and industry
- F. Strengthen the economy of the City
- G. Promote the use of historic districts and landmarks for the education, pleasure and welfare of the people of the City (Ord. NS-433 § 2 (part), 1997: Ord. 9776 § 1 (part), 1985)

Chapter 22.02.050 states that as part of the environmental review of development projects affecting historic structures or archaeological or paleontological sites, as shown on the historic resources inventory or as identified in the environment study, the environment documents shall be referred to the historic preservation commission for review. The commission may review and comment on the environment documents of the referral. The commission shall comment within the public review time limits established by the California Environmental Quality Act (Ord. NS-433 § 2 (part), 1997: Ord. NS-141 § 2, 1991: Ord. 9776 § 1 (part), 1985).

METHODS

LSA examined geologic maps of the project site and reviewed relevant geological and paleontological literature to determine which geologic units are present within the project site and whether fossils have been recovered within the project site or from those or similar geologic units elsewhere in the region. A fossil locality search request was submitted to the San Diego Natural History Museum (SDNHM) in order to determine the status and extent of previously recorded paleontological resources within and surrounding the project site. LSA Senior Cultural Resources Manager Natalie Brodie conducted a pedestrian field survey of the project site on February 22, 2011, for a previous cultural resources assessment. The project site was resurveyed for this assessment on May 13, 2016. Both surveys involved walking linear transects over the project site to note the sediments at the surface and document and collect any cultural and/or paleontological resources that may have been present.

RESULTS

Literature Review

The project site is located at the northern end of the Peninsular Ranges Geomorphic Province, a 900-mile long northwest-southeast trending structural block that extends from the Transverse Ranges to the tip of Baja California and includes the Los Angeles Basin (California Geological Survey, 2002; Norris and Webb, 1976). The total width of this province is approximately 225 miles, extending from the Colorado Desert in the east, across the continental shelf to the Southern Channel Islands (Santa Barbara, San Nicolas, Santa Catalina, and San Clemente) in the west (Sharp, 1976). This region is

characterized by a series of mountain ranges separated by northwest-trending valleys subparallel to faults branching from the San Andreas Fault (California Geological Survey, 2002; Norris and Webb, 1976). The geology of this province is similar to that of the Sierra Nevada, with granitic rock intruding into the older metamorphic rocks (California Geological Survey, 2002). It contains extensive pre-Cretaceous (older than 145 million years ago [Ma]) igneous and metamorphic rocks covered by limited exposures of post-Cretaceous (younger than 66 Ma) sedimentary deposits (Norris and Webb, 1976).

Geologic mapping by Kennedy and Tan (2007) indicates the project site contains the Santiago Formation, which dates to the middle Eocene, specifically 40.2–47.8 Ma (Prothero, 2001). In addition, the geotechnical report prepared for the project indicates the project site contains Artificial Fill to the depths of up to approximately 5 feet (ft) next to and beneath Park Drive (Ninyo and Moore, 2008). The geology of the project site is shown on Figure 2 (Attachment B).

Artificial Fill. Artificial Fill consists of sediments that have been removed from one location and transported to another location by human activity, rather than by natural means. The transportation distance can vary from a few feet to many miles, and composition is dependent on the source and purpose. Artificial Fill will sometimes contain modern debris (e.g., asphalt, wood, bricks, concrete, metal, glass, plastic, and plant material).

While Artificial Fill may contain fossils, these fossils have been removed from their original location and are out of stratigraphic context. Therefore, they are not considered important for scientific study. As such, Artificial Fill has no paleontological sensitivity.

Santiago Formation. The Santiago Formation was named for deposits in the northwestern Santa Ana Mountains, where it is composed of marine to nonmarine sediments up to 2,460 ft thick (Kennedy and Tan, 2007; Morton and Miller, 2006; Morton et al., 1976; Woodring and Popenoe, 1945). This formation may be divided into three informal units: a lower unit, member A; a middle unit, member B; and an upper unit, member C (Kennedy and Tan, 2007; Morton et al., 1976; Prothero, 2001; Woodring and Popenoe, 1945). The member A beds are buff and brownish-gray, massive, poorly sorted, and coarse-grained sandstone and conglomerate (Kennedy and Tan, 2007). The middle member B unit consists of gray and brownish-gray, soft, medium-grained, moderately well-sorted sandstone but is not always present (Kennedy and Tan, 2007). The upper member C beds are gray, coarse-grained sandstone (Kennedy and Tan, 2007).

According to the County of San Diego Guidelines for Determining Significance: Paleontological Resources (County of San Diego, 2009), member C of the Santiago Formation has produced “some of the best preserved assemblages of middle Eocene terrestrial mammals in California” (p. 5). Exposures of this formation around Oceanside, Carlsbad, and Vista contain “a diverse fossil record consisting of marine, estuarine, and terrestrial fossils and fossil assemblages” (p. 6–7). Fossils recovered from this formation in San Diego County include bony fish, frogs, lizards, snakes, turtles, crocodiles, birds, marsupials, insectivores, primates, rodents, rabbits, creodonts, carnivores, condylarths, perissodactyls, and artiodactyls (Golz and Lillegraven, 1977; Mihlbachler and Deméré, 2009; Moscato, 2013; Tomiya, 2011, 2013). Because the Santiago Formation is known to contain scientifically significant paleontological resources, this formation is considered to have high paleontological sensitivity.

Fossil Locality Search

According to the locality search conducted by the SDNHM, there are no known fossil localities within the boundaries of the project. However, the museum has records of three localities (3279, 4659, and 4925) from the Santiago Formation within 1 mile of the project site. These localities produced fossils of various plants (e.g., palms, mangroves, and flowering plants), marine invertebrates (e.g., snails, clams, and mussels), trace fossils (e.g., coprolites), marine vertebrates (e.g., rays, sharks, sea turtles), and terrestrial vertebrates (e.g., tortoises, lizards, crocodiles, birds, marsupials, insectivores, artiodactyls, tapirs, carnivores, bats, arboreal gliding mammals, rodents, and primates). The museum also notes that deposits of member C of the Santiago Formation from the nearby Laguna Riviera community have produced an abundance of scientifically important fossils, the majority of which are housed in the collections at the University of California Museum of Paleontology at the University of California, Berkeley. Because scientifically important fossils are known from the Santiago Formation, the museum considers it to have high paleontological sensitivity and recommends implementation of a complete paleontological resource mitigation program for any ground-disturbing activities that may occur in this formation. The results letter from the SDNHM is provided in Attachment C.

Field Survey

Approximately 80 percent of the project site is situated on a steep (40 percent slope) west-facing slope. Three concrete brow ditches are situated in the central and northern portions of the project area. Most of the surface of the project site is covered by vegetation, including native and introduced species. In the areas where the surface was visible, the sediments are consistent with the Santiago Formation mapped in the project site (Kennedy and Tan, 2007). No paleontological resources were observed during the survey.

RECOMMENDATIONS

The results of the locality search and literature review indicate that the project site contains Artificial Fill, which has no paleontological sensitivity, and the Santiago Formation, which has high paleontological sensitivity. No paleontological mitigation is recommended for excavation that remains only in the Artificial Fill, which is located next to and beneath Park Drive and extends to depths of up to approximately 5 ft. However, if excavation will occur in deposits of the Santiago Formation, which may be encountered at the surface throughout the project area except for where it is covered by Artificial Fill, there is a potential to encounter scientifically significant paleontological resources, and LSA recommends the following mitigation measure:

- PALEO-1** If excavation activities will occur in deposits of the Santiago Formation, the Applicant shall retain a qualified paleontologist to prepare a Paleontological Resources Impact Mitigation Program (PRIMP) for the proposed project. The PRIMP should be consistent with the guidelines of the Society of Vertebrate Paleontology (SVP) and include, but not be limited to, the following:
1. The paleontologist, or his/her representative, shall attend a preconstruction meeting.

2. Excavation and grading activities in deposits with high paleontological sensitivity (Santiago Formation) shall be monitored by a paleontological monitor following a PRIMP.
3. If paleontological resources are encountered during the course of ground disturbance, the paleontological monitor shall have the authority to temporarily redirect construction away from the area of the find in order to assess its significance.
4. Collected resources shall be prepared to the point of identification, identified to the lowest taxonomic level possible, cataloged, and curated into the permanent collections of a scientific institution.
5. At the conclusion of the monitoring program, a report of findings shall be prepared to document the results of the monitoring program.
6. In the event that paleontological resources are encountered when a paleontological monitor is not present, work in the immediate area of the find shall be redirected and a paleontologist should be contacted to assess the find for significance. If determined to be significant, the fossil shall be collected from the field.

By following the above procedures, potential impacts to significant nonrenewable paleontological resources would be avoided.

Sincerely,

LSA ASSOCIATES, INC.



Sarah Rieboldt, Ph.D.
Senior Paleontological Resources Manager
Cultural and Paleontological Resources Group

Attachments:

- A. Figure 1: Project Location and Vicinity Map
- B. Figure 2: Geology Map
- C. Results of the Locality Search at the San Diego Natural History Museum

REFERENCES

California Geological Survey

- 2002 *California Geomorphic Provinces*. California Geologic Survey Note 36. California Department of Conservation.

City of Carlsbad

- 2013 *Open Space and Conservation Element, City of Carlsbad General Plan*. Website: <http://www.carlsbadca.gov/services/departments/planning/pages/general-plan.aspx>. Accessed May 2016.

County of San Diego

- 2009 *County of San Diego Guidelines for Determining Significance: Paleontological Resources*. Prepared by the Land Use and Environment Group of the Department of Planning and Land Use in the Department of Public Works. Approved March 19, 2007. Modified January 15, 2009. Website: <http://www.sdcounty.ca.gov/pds/procguid.html>.

Golz, David J., and Jason A. Lillegraven

- 1977 *Summary of Known Occurrences of Terrestrial Vertebrates from Eocene Strata of Southern California*. University of Wyoming Contributions to Geology 15(1):43–64.

Kennedy, Michael P., and Siang S. Tan

- 2007 *Geologic Map of the Oceanside 30' × 60' Quadrangle, California*. Digital Preparation by Kelly R. Bovard, Rachel M. Alvarez, Michael J. Watson, and Carlos I. Gutierrez. Prepared by the California Geological Survey in cooperation with the United States Geological Survey Southern California Area Mapping Project. Map Scale 1:100,000.

Mihlbachler, Matthew C., and Thomas A. Deméré

- 2009 *A New Species of Brontotheriidae (Perissodactyla, Mammalia) from the Santiago Formation (Duchesnean, Middle Eocene) of Southern California*. Proceedings of the San Diego Society of Natural History 41, p. 1–36.

Morton, Douglas, and Fred K. Miller

- 2006 *Geologic Map of the San Bernardino and Santa Ana 30' x 60' Quadrangles, California*. Version 1.0. Digital Preparation by Pamela M. Cossette and Kelly R. Bovard. Prepared by the United States Geologic Survey in cooperation with the California Division of Mines and Geology. Open File Report 2006-1217. Map Scale 1:100,000.

Morton, Paul K., Russell V. Miller, and James R. Evans

- 1976 *Environmental Geology of Orange County, California*. California Division of Mines and Geology Open File Report 79-8 LA. 474 pp.

Moscato, David

- 2013 *A Glyptosaurine Lizard from the Eocene (late Uintan) of San Diego, California and Implications from Glyptosaurine Evolution and Biogeography*. Unpublished Master's thesis, East Tennessee State University. 63 pp.

Ninyo and Moore.

- 2008 Geotechnical Evaluation, Drainage, Retaining Wall, and Pavement Improvements, Park Drive at Marina Drive, Carlsbad, California. Prepared for the City of Carlsbad. September 24, 2008. Ninyo and Moore Project No. 106394001.

Norris, R.M., and R.W. Webb

- 1976 *Geology of California*. New York: John Wiley and Sons, Inc. 379 pp.

Prothero, Donald R.

- 2001 *Magnetic Stratigraphy of the Middle Eocene Santiago Formation, San Diego and Orange Counties, California*. In Dr. R. Prothero, ed., Magnetic Stratigraphy of the Pacific Coast Cenozoic, Pacific Section of the Society for Sedimentary Geology (SEPM) Book 91, p. 107–118.

Sharp, R.P.

- 1976 *Geology: Field Guide to Southern California*, Kendall/Hunt Publishing Company, Second Edition: 181 pp.

Society of Vertebrate Paleontology (SVP)

- 2010 *Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources* Society of Vertebrate Paleontology. Impact Mitigation Guidelines Revision Committee, pp. 1–11.

Tomiya, Susumu

- 2011 *A New Basal Caniform (Mammalia: Carnivora) from the Middle Eocene of North America and Remarks on the Phylogeny of Early Carnivorans*. PLoS One 6(9):e24146.

- 2013 *New Carnivoraforms (Mammalia) from the Middle Eocene of California, USA and Comments on the status of 'Miacis' gracilis*. Palaeontologica Electronica Vol. 16, Issue 2, 14A. 29 pages.

United States Geological Survey (USGS)

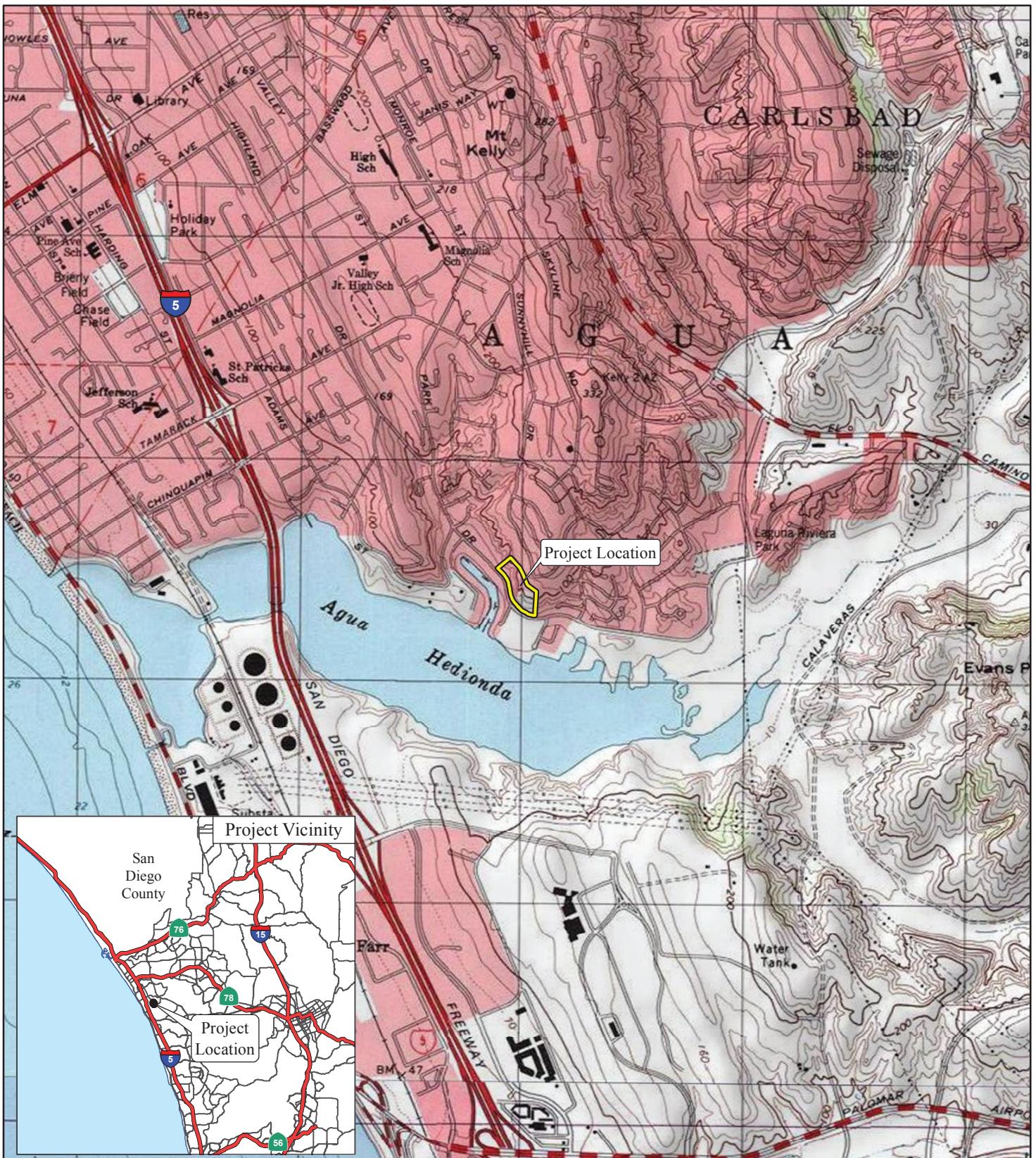
- 1975 *San Luis Rey, California* 7.5-minute topographic quadrangle. United States Geological Survey, Denver, Colorado.

Woodring, W. P., and W. P. Popenoe

- 1945 *Paleocene and Eocene Stratigraphy of the Northwestern Santa Ana Mountains, Orange County, California*. United States Geological Survey Oil and Gas Investigations, Preliminary Chart 12.

ATTACHMENT A

FIGURE 1: PROJECT LOCATION AND VICINITY MAP



LSA



0 1000 2000
FEET

SOURCE: USGS 7.5' Quad - San Luis Rey (1975), CA

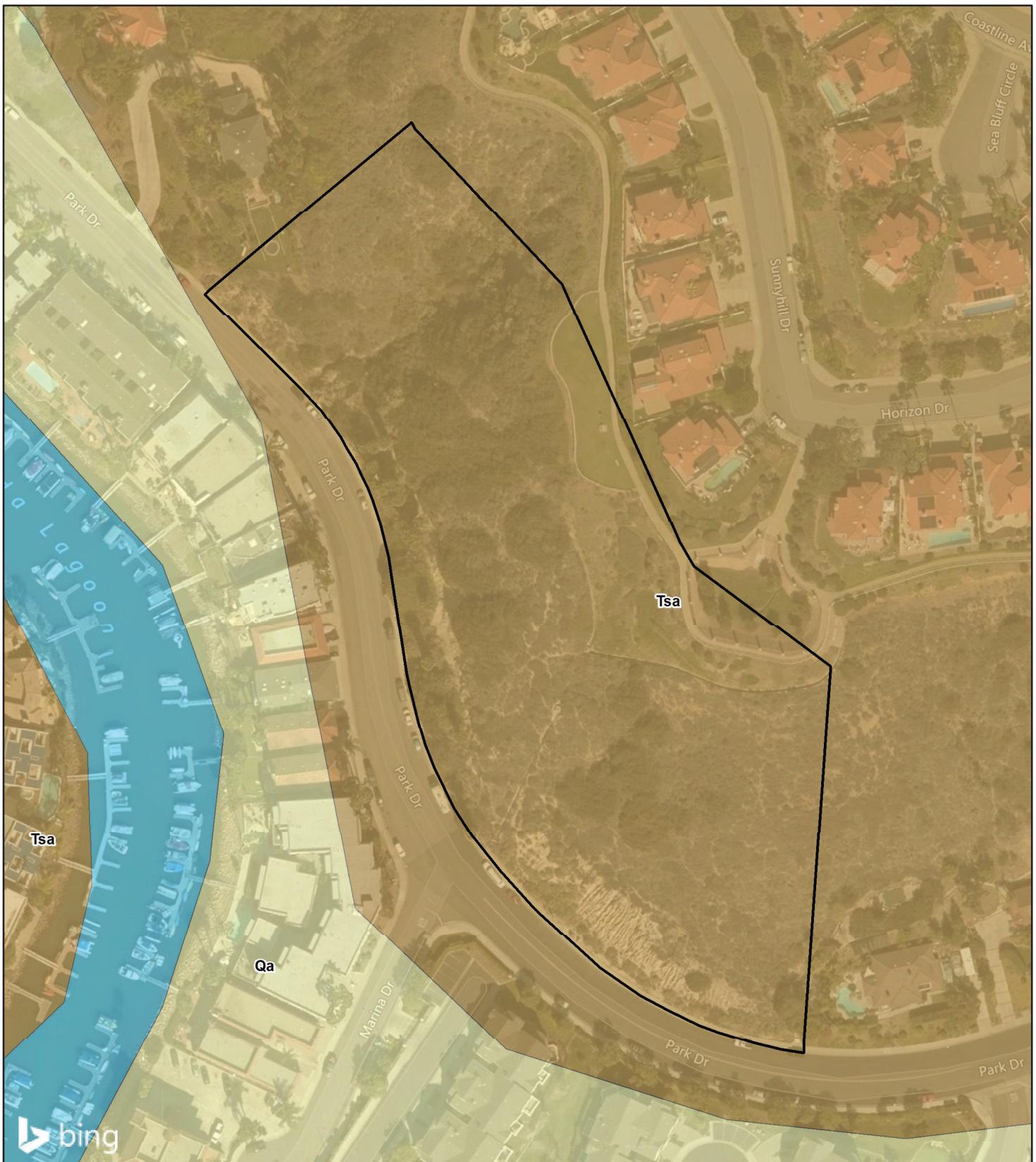
R:\BUM1601\GIS\ProjectLocation_USGS.mxd (5/23/2016)

Park Drive Slope and Drainage Improvement Project
Project Location and Vicinity

FIGURE 1

ATTACHMENT B

FIGURE 2: GEOLOGY MAP



LSA

LEGEND

Project Location

Geologic Unit

Qa - Alluvial flood-plain deposits

Tsa - Santiago Formation

Water

0 62.5 125
FEET

SOURCE: Bing Maps (2014); Kennedy and Tan (2007)

R:\BUM1601\GIS\Geology.mxd (5/24/2016)

*Park Drive Slope and Drainage Improvement Project
Geology Map*

FIGURE 2

ATTACHMENT C

RESULTS OF THE LOCALITY SEARCH AT THE SAN DIEGO NATURAL HISTORY MUSEUM



SAN DIEGO NATURAL HISTORY MUSEUM

BALBOA PARK - SAN DIEGO SOCIETY OF NATURAL HISTORY - ESTABLISHED 1874

25 May 2016

Dr. Sarah Rieboldt
LSA Associates, Inc.
20 Executive Park, Suite 200
Irvine, CA 92614

RE: Paleontological Record Search – Park Drive Slope and Drainage Improvements Project
(LSA Proj. No. BUM1601)

Dear Dr. Rieboldt:

This letter presents the results of a paleontological record search conducted for the Park Drive Slope and Drainage Improvements project. The project site is bounded to the south and west by Park Drive, and to the north and east by residential development. The project site is approximately 0.44 miles in perimeter and 5.9 acres in area, and is located in the northwest portion of the City of Carlsbad. Published geological reports (Kennedy and Tan, 2005) that cover the entirety of the project area reveal that the proposed project is underlain by the middle Eocene-age (approximately 40 to 49 million years old) Santiago Formation.

The San Diego Natural History Museum (SDNHM) has four recorded fossil localities (see attached descriptions) within a one-mile radius of the project site (see attached map). Three of these localities occur within fluvial and marine deposits of the middle Eocene-age Santiago Formation. These localities produced fossilized impressions of terrestrial plants (e.g., palms, flowering plants, and mangroves), shells and internal molds of marine invertebrates (e.g., snails, clams, and mussels), trace fossil remains (e.g., coprolites), fossilized remains of marine vertebrates (e.g., rays, sharks, softshell turtles), and fossilized remains of terrestrial vertebrates (e.g., tortoises, lizards, crocodiles, birds, marsupials, insectivores, artiodactyls, tapirs, carnivores, bats, arboreal gliding mammals, rodents, and primates). An additional locality within one mile of the project site is from the Pleistocene-age (approximately 85,000 to 500,000 years old) Bay Point Formation; this formation is unlikely to be impacted by the project.

It should be noted that Member "C" of the Santiago Formation (Wilson, 1972) is known to produce abundant vertebrate fossils, and is particularly significant for its diverse and well-preserved mammalian fossil assemblages (Deméré and Walsh, 1993). In fact, deposits of Member "C" in the vicinity of the Laguna Riviera community have been the focus of intensive paleontological study and excavation (e.g., Golz, 1976; Golz and Lillegraven, 1977; Walsh 1991) by researchers from a variety of institutions (e.g., University of California, Riverside; University of California, Berkeley; San Diego State University; Natural History Museum of Los Angeles County [LACM]; SDNHM). As a result, the majority of the fossils from the Laguna Riviera local fauna reside in the paleontological collections at the University of California Museum of Paleontology (UCMP) at Berkeley, and thus are not captured in this record search.

The Laguna Riviera local fauna is an important biostratigraphic marker for correlating the mammalian faunas of Member “C” with the latest Uintan to Duchesnean North American Land Mammal Ages, and placing them in broader context with other mammalian faunas of San Diego County.

Given the high paleontological sensitivity of the Santiago Formation in San Diego County (Deméré and Walsh, 1993), particularly in the Laguna Riviera area, any proposed excavation activities that extend deep enough to encounter previously undisturbed deposits of the Santiago Formation have the potential to impact paleontological resources preserved in these deposits. For these reasons, implementation of a complete paleontological resource mitigation program during ground-disturbing activities is recommended.

The information contained within this paleontological record search should be considered private and is the sole property of the San Diego Natural History Museum. Any use or reprocessing of information contained within this document beyond the scope of the Park Drive Slope and Drainage Improvements project is prohibited.

If you have any questions concerning these findings please feel free to contact me at 619-255-0231 or kmccomas@sdnhm.org.

Sincerely,



Katie McComas
Paleontology Collections Assistant
Department of Paleontology

Enc: Figure 1
Appendix

Literature Cited:

- Deméré, T.A. and Walsh, S.L. 1993. Paleontological Resources, County of San Diego. Prepared for the San Diego Planning Commission: 1-68.
- Golz, D.J. 1976. Eocene Artiodactyla of southern California. Natural History Museum of Los Angeles County, Science Bulletin 26: 1-85.
- Golz, D.J., and J.A. Lillegraven. 1977. Summary of known occurrences of terrestrial vertebrates from Eocene strata of southern California. University of Wyoming, Contributions to Geology 15: 43-65.
- Kennedy, M.P. and Tan, S.S. 2005. Geologic Map of the Oceanside 30' X 60' Quadrangle, California. California Geological Survey.
- Walsh, S.L. 1991. Eocene mammal faunas of San Diego County. In, P.L. Abbott and J.A. May (eds.), Eocene Geologic History San Diego Region. Society of Economic Mineralogists and Paleontologists, Pacific Section 68: 161-178.
- Wilson, K. L. 1972. Eocene and Related Geology of a Portion of the San Luis Rey and Encinitas Quadrangles, San Diego County, California. Unpublished Master of Arts Thesis, Geological Sciences, University of California, Riverside, 135 p.

