CARLSBAD
CLOVIS
IRVINE
LOS ANGELES
PALM SPRINGS
POINT RICHMOND
RIVERSIDE
ROSEVILLE
SAN LUIS OBISPO

April 12, 2024

Eric Perez
City Project Manager
City of Orange
300 East Chapman Avenue
Orange, CA 92866

Subject: Paleontological Resources Assessment for the Cannon Street Widening Project, City of Orange, Orange County, California (LSA Project No. 20230893)

Dear Mr. Perez:

LSA is under contract to Mark Thomas to conduct a paleontological resources assessment for the proposed Cannon Street Widening Project (project) in the City of Orange (City), Orange County, California. The purpose of the assessment was to determine whether paleontological resources may be present within the proposed project area, whether they might be impacted by development of the project, and to make recommendations to mitigate any potential impacts to paleontological resources.

This assessment was prepared to ensure that the project is in compliance with all applicable State and City regulations and requirements regarding paleontological resources, as well as the standards of the Society of Vertebrate Paleontology (SVP, 2010). The applicable regulations and requirements include the California Environmental Quality Act (CEQA): Public Resources Code (PRC) Division 13, Chapter 2.6; the *State CEQA Guidelines*: California Code of Regulations, Title 14, Chapter 3, Appendix G; and PRC §5097.5. The City is the Lead Agency for CEQA compliance.

## PROJECT LOCATION AND DESCRIPTION

The proposed project would be located on Cannon Street between Santiago Canyon Road and Serrano Avenue. Figure 1 (all figures are provided in Attachment B) depicts the location of the proposed project on the *Orange, California* 7.5-minute United States Geological Survey (USGS) topographic map in Township 4 South, Range 9 West, in unsectioned land of the Santiago de Santa Ana Land Grant, San Bernardino Baseline and Meridian (USGS, 1981).

The proposed project will widen the roadway to accommodate a third northbound lane from approximately 500 feet north of Santiago Canyon Road to Serrano Avenue where it will join the existing dedicated right-turn lane to eastbound Serrano Avenue. This additional lane will function as an auxiliary lane to improve traffic operations. South of Santiago Creek, additional pavement will be constructed to the east to widen the roadway to meet minimum standard horizontal curve radii. North of Santiago Creek, the roadway will be widened to the west by approximately 6 feet. In the southbound direction, bicyclists and pedestrians will cross Santiago Creek on a new bridge just west of the existing vehicular bridge. The new bridge will clear span the creek and is expected to consist of a prefabricated steel truss, approximately 170 feet long and 12 feet wide. The new bridge will carry two-way traffic for pedestrians and southbound traffic for bicyclists. Existing pavement delineation will be reconfigured and portions of the painted median will be replaced with a raised landscaped median. A traffic signal modification is required at Taft Avenue.

Development of the project would involve demolition of previous improvements followed by new grading to prepare for road widening, construction of the new pedestrian bridge, and installation of new wet and dry utilities, hardscaping, landscaping, and lighting.

### Excavation Parameters

The deepest excavation associated with the project is expected to be for the bridge foundation, which will extend to a maximum of 8 feet for abutments and which will reach a maximum depth of approximately 40 feet for the cast-in-drilled hole (CIDH) piles (personal communication, Pat Somerville, Mark Thomas & Company, Inc., February 12, 2024). The excavation depths of the various components of the project are listed in Table A below.

**Table A: Anticipated Maximum Excavation Depths for Components of the Cannon Street Widening Project**

| Project Component | Depth (ft)[1] |
|---|---|
| Road widening | 2 |
| New Santiago Creek Bridge Foundation | 3–40 ft |
| Traffic Signal Poles | 8–15 |
| New Pavement | 1 |

Source:
[1] Personal communication, Pat Somerville, Mark Thomas & Company, Inc., February 12, 2024
ft = foot/feet

## 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 (PRC 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."

## METHODS

LSA examined geologic maps of the project site and reviewed relevant geological and paleontological literature to determine which geologic units are present in the project site and whether fossils have been recovered in the project site or from similar geologic units elsewhere in the region. A search for known fossil localities was also conducted through the Natural History Museum of Los Angeles County (NHMLA) to determine the status and extent of previously recorded paleontological resources within and surrounding the project site. On February 23, 2024, a pedestrian field survey of the project site was conducted by LSA Paleontologist, Paul Alms, M.Sc.

## RESULTS

### Literature Review

The project site is in the Peninsular Ranges Geomorphic Province, a 900-mile-long northwest-southeast trending structural block with similarly trending faults that extends from the Transverse Ranges in the north to the tip of Baja California in the south and includes the Los Angeles Basin (California Geological Survey, 2002; Norris and Webb, 1976). The total width of this province is 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 province is characterized by a series of mountain ranges and valleys that trend in a northwest-southeast direction roughly parallel to the San Andreas Fault Zone (Norris and Webb, 1976; Sharp, 1976). It contains extensive pre-Cenozoic (more than 66 million years ago [Ma]) igneous and metamorphic rocks covered by Cenozoic (less than 66 Ma) sedimentary deposits (Norris and Webb, 1976).

Geologic mapping by Morton and Miller (2006) indicates that the project site contains Young Alluvial Fan Deposits; Old Alluvial Fan Deposits, Unit 3; El Modeno Volcanics, Tuff and Tuff Breccia; and the Sespe and Vaqueros Formations, Undifferentiated (Figure 2). Artificial Fill is likely also present in the project site from the previous construction of Cannon Street. These geologic units and their relative paleontological sensitivities are described in more detail below. The dates for the geologic time intervals are based on the *International Chronostratigraphic Chart* prepared by the International Commission on Stratigraphy (Cohen et al., 2023).

#### *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 such as asphalt, wood, bricks, concrete, metal, glass, plastic, and even plant material.

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

### *Young Alluvial Fan Deposits*

The Young Alluvial Fan Deposits are Holocene to late Pleistocene in age (less than 129,000 years ago) and consist of unconsolidated silt, sand, and gravel (Morton and Miller, 2006). Cobble- and boulder-size clasts are also present and become more abundant closer to the hills and mountains (Morton and Miller, 2006). These sediments were eroded from higher elevations, carried by flooding streams and debris flows, and deposited in a fan or lobe shape at the base of the hills. They show slight to moderate dissection by erosional gullies (Morton and Miller, 2006).

Although Holocene (less than 11,700 years ago) deposits can contain remains of plants and animals, only those from the middle to early Holocene (4,200 to 11,700 years ago) are considered scientifically important (SVP, 2010), and fossils from this time interval are not common. However, the older, Pleistocene sediments in this geologic unit have produced scientifically important fossils elsewhere in the region (Jefferson, 1991a, 1991b; Miller, 1971; Reynolds and Reynolds, 1991; Springer et al., 2009). These older, Pleistocene deposits span the end of the Rancholabrean North American Land Mammal Age (NALMA), which dates from 11,000 to 240,000 years ago (Sanders et al., 2009) and was named for the Rancho La Brea fossil site in central Los Angeles. The presence of *Bison* defines the beginning of the Rancholabrean NALMA (Bell et al., 2004), but fossils from this time also include other large and small mammals, reptiles, fish, invertebrates, and plants (Jefferson, 1991a, 1991b; Miller, 1971; Reynolds and Reynolds, 1991; Springer et al., 2009). There is a potential to find these types of fossils in the older sediments of this geologic unit, which may be encountered below a depth of approximately 10 feet. Therefore, these deposits are assigned a low paleontological sensitivity above a depth of 10 feet and a high sensitivity below that mark.

### *Old Alluvial Fan Deposits, Unit 3*

The Old Alluvial Fan Deposits, Unit 3 are late to middle Pleistocene in age (11,700–774,000 years ago). They consist of moderately to well consolidated sand and gravel (Morton and Miller, 2006). Like the Young Alluvial Fan Deposits, these sediments were eroded from higher elevations, carried by flooding streams and debris flows, and deposited in a fan or lobe shape at the base of the hills. These deposits have been moderately dissected by erosional gullies and may be capped by soil horizons up to several feet thick (Morton and Miller, 2006).

These deposits span the latest two NALMAs: the Rancholabrean (11,700–240,000 years ago) and the Irvingtonian (240,000–1.8 million years ago) (Bell et al., 2004; Sanders et al., 2009). Fossils are known in similar Rancholabrean and Irvingtonian deposits from excavations for roads, housing developments, and quarries, as well as scientific investigations in the southern California area (Jefferson, 1991a, 1991b; Miller, 1971; Pajak et al., 1996; Reynolds and Reynolds, 1991; Springer et al., 2009). These fossils include mammoths, mastodons, horses, bison, camels, saber-toothed cats, coyotes, deer, and sloths, as well as smaller animals like rodents, rabbits, birds, reptiles, and fish. These deposits are considered to have high paleontological sensitivity.

### *Very Old Alluvial Fan Deposits*

Like the Young Alluvial Fan Deposits and the Old Alluvial Fan Deposits, the Very Old Alluvial Fan Deposits formed from sediment carried by rivers and streams down higher elevations and deposited in a fan or lobe shape at the base of the hills. However, these deposits accumulated during the middle to early Pleistocene (126,000 years ago to 2.588 Ma) and consist of a moderately to well consolidated mixture of silt, sand, gravel, and conglomerate (Morton and Miller, 2006). They were deposited at the mouths of canyons, along the sides of hills flanking river and stream valleys, and within the valleys themselves. These deposits consist of moderately to well consolidated silt, sand, gravel, and conglomerate (Morton and Miller, 2006). They show some soil development and dissection by erosional gullies (Morton and Miller, 2006).

The Very Old Alluvial Fan Deposits formed during an interval that spans three North American Land Mammal Ages: the Rancholabrean (11,000–240,000 years ago), the Irvingtonian (240,000–1.8 Ma) and the Blancan (1.8–4.75 Ma) and (Bell, 2004; Sanders et al., 2009). Fossils are known in similar Rancholabrean, Irvingtonian, and Blancan deposits from excavations for roads, housing developments, and quarries, as well as scientific investigations within the Southern California area (Bell et al., 2004; Jefferson, 1991a, 1991b; Miller, 1971; Pajak et al., 1996). These fossils include mammoths, mastodons, horses, camels, saber-toothed cats, coyotes, deer, peccaries, and sloths, as well as smaller animals like rodents, rabbits, birds, reptiles, and fish. As such, these deposits are considered to have high paleontological sensitivity.

### *El Modeno Volcanics, Tuff and Tuff Breccia*

The El Modeno Volcanics, Tuff and Tuff Breccia formed during the middle Miocene (11.63–15.98 Ma) and were named by Schoellhamer et al. (1954) for volcanic rocks exposed 5 kilometers east of settlement of El Modeno on the northwestern side of the Santa Ana Mountains. These rocks consist of clastic volcanic palagonite tuff and tuff breccia that formed as a result of volcanic eruptions (Morton and Miller, 2006). Because these igneous rocks formed as a result of active volcanism, they will not contain fossils. Therefore, these rocks have no paleontological sensitivity.

### *Sespe and Vaqueros Formations, Undifferentiated*

Although the Sespe and Vaqueros Formations were recognized and described separately at their respective type localities, in many places throughout Southern California, these two formations are so tightly interbedded that geologists have mapped them together as the Sespe and Vaqueros Formations, Undifferentiated (Morton and Miller, 2006). Combined, these formations range in age from the early Miocene to the late middle Eocene (15.97 to 41.3 Ma) and include a wide range of lithologies deposited in a variety of environments (Prothero and Donohoo, 2001; Whistler and Lander, 2003).

The continental Sespe Formation consists of coarse sandstone, medium to coarse clayey and silty sandstone, and conglomeratic sandstone, with local conglomerate and paleosol intervals (Morton and Miller, 2006; Morton et al., 1976; Whistler and Lander, 2003). Although known for its red- and maroon-colored beds, it also contains deposits that range in color from pale orange and pale yellowish gray to light gray (Morton and Miller, 2006; Morton et al., 1976). These deposits accumulated in river channel and floodplain environments (Bown, 1994).

The predominantly marine Vaqueros Formation is composed of white, pale yellow brown, yellowish green, reddish, and greenish-gray interbedded sandstone, sandy siltstone, siltstone, mudstone, and shale, with minor conglomerates and local coquina beds (Daniel-Lyle, 1995; Morton et al., 1976). These deposits accumulated in shallow to deep marine environments, as well as river-dominated (delta front through delta plain), wave-dominated (lower shoreface through backshore), and tide-dominated (interdistributary bay) environments (Daniel-Lyle, 1995).

From the Sespe and Vaqueros Formations, Undifferentiated in the northern Santa Ana Mountains, Schoellhamer et al. (1981) reported 26 invertebrate localities, which produced a variety of gastropods, bivalves, echinoids, and barnacles, as well as one vertebrate locality that yielded shark, ray, turtle, horse, and camel specimens. Significant fossil discoveries also have been made from this undifferentiated unit during paleontological mitigation monitoring for various projects in the Santa Ana Mountains and San Joaquin Hills, including during construction of State Route 241. These fossils include echinoids, bivalves, gastropods, barnacles, sharks, bony fish, whales, a possible crocodile, a possible desmostylid, lizards, snakes, birds, rodents, lagomorphs, oreodonts, carnivores, camels, marsupials, insectivores, artiodactyls, rhinoceros, and many different plant taxa (Conkling et al., 1997, 1999; Lander, 2003; Morgan et al., 1991; Raschke, 1988; Smith and Conkling, 2005). Based on the quantity, quality, and scientific significance of the fossils these formations have yielded, the Sespe and Vaqueros Formations, Undifferentiated are considered to have high paleontological sensitivity.

### Fossil Locality Search

The fossil locality search through the NHMLA indicated that no fossil localities are present within the boundaries of the project site. The locality search noted several fossil localities near the project site from geologic units similar to those found within the project site. LACM VP 1652, located near Rio Vista Avenue south of Lincoln Avenue, yielded remains of sheep (*Ovis*) from unknown Pleistocene age sediments. LACM VP localities 6927-6930 are all located in the Peralta Hills northeast of Serrano Avenue and Cannon Street within the undifferentiated Sespe and Vaqueros Formations. Fossils found from these localities include horse relative (*Parahippus*), unidentified artiodactyl (Artiodactyla), pig-like mammal (Tayassuidae), camel family (Camelidae), oreodont (Merycoidodontidae), weasel family (Mustelidae), and rabbit and hare family (Leporidae). A copy of the fossil locality search results through the NHMLA is included in Attachment C.

### Field Survey

On February 23, 2023, the project area was surveyed by Paul Alms. The survey consisted of an intensive pedestrian investigation of all areas of exposed ground surface. Much of the project area was completely developed, paved, and landscaped except for the western portion of the north and south sides of Santiago Creek next to the existing bridge. The south side included a small gravel parking lot which served as the entrance for the trailhead. Both areas were covered with sand and gravel. Sediments in landscaped areas have been disturbed. All visible native sediments were consistent with mapping by Morton and Miller (2006). No paleontological resources were observed during the survey.

## CONCLUSIONS AND RECOMMENDATIONS

The project site contains Artificial Fill and El Modeno Volcanics, which has no paleontological sensitivity. The Young Alluvial Fan Deposits have low paleontological sensitivity from the surface to a

depth of 10 feet and high paleontological sensitivity below 10 feet. The Old Alluvial Fan Deposits, Very Old Alluvial Fan Deposits and the Sespe and Vaqueros Formations, Undifferentiated, all of which have high paleontological sensitivity. Excavation for the various project components will extend to depths of 3.5 to 30 feet across the project site, development of this project is expected to extend into paleontologically sensitive sediments and has the potential to impact scientifically significant paleontological resources. To mitigate potential impacts to these resources, LSA recommends the following mitigation measures:

**PALEO-1** A paleontologist who meets the qualifications established by the Society of Vertebrate Paleontology (SVP) shall be retained to develop a Paleontological Resources Impact Mitigation Program (PRIMP) for this project. The PRIMP shall be consistent with the standards of the SVP and include the methods that will be used to protect paleontological resources that may exist within the project site, as well as procedures for monitoring, fossil preparation and identification, curation into a repository, and preparation of a report at the conclusion of grading.

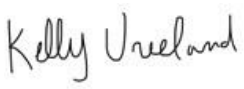
**PALEO-2** Excavation and grading activities in deposits with high paleontological sensitivity (i.e., Old Alluvial Fan Deposits, Unit 3; Very Old Alluvial Fan Deposits; and the Sespe and Vaqueros Formations, Undifferentiated) shall be monitored by a qualified paleontological monitor following a PRIMP. No monitoring is required for excavations in deposits with no or low paleontological sensitivity (i.e., Artificial Fill Young Alluvial Fan Deposits above a depth of 10 feet, and El Modeno Volcanics). If paleontological resources are encountered during ground disturbance, the paleontological monitor shall have the authority to temporarily redirect construction away from the area of the find. If paleontological resources are encountered when a paleontological monitor is not present, work in the immediate area of the find shall be redirected, and the paleontologist or paleontological monitor shall be contacted to assess the find for scientific significance. If determined to be scientifically significant, the fossil shall be collected from the field.

**PALEO-3** 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 museum repository. At the conclusion of the monitoring program, a report of findings shall be prepared to document the results of the monitoring program.

Implementation of Mitigation Measures PALEO-1 through PALEO-3 will ensure that project impacts on paleontological resources will be reduced to a level that is less than significant.

Sincerely,

**LSA Associates, Inc.**



Kelly Vreeland, M.Sc.
Senior Paleontologist

Attachments: A: References
B: Figures
C: Fossil Locality Search Results from the Natural History Museum of Los Angeles County

# ATTACHMENT A

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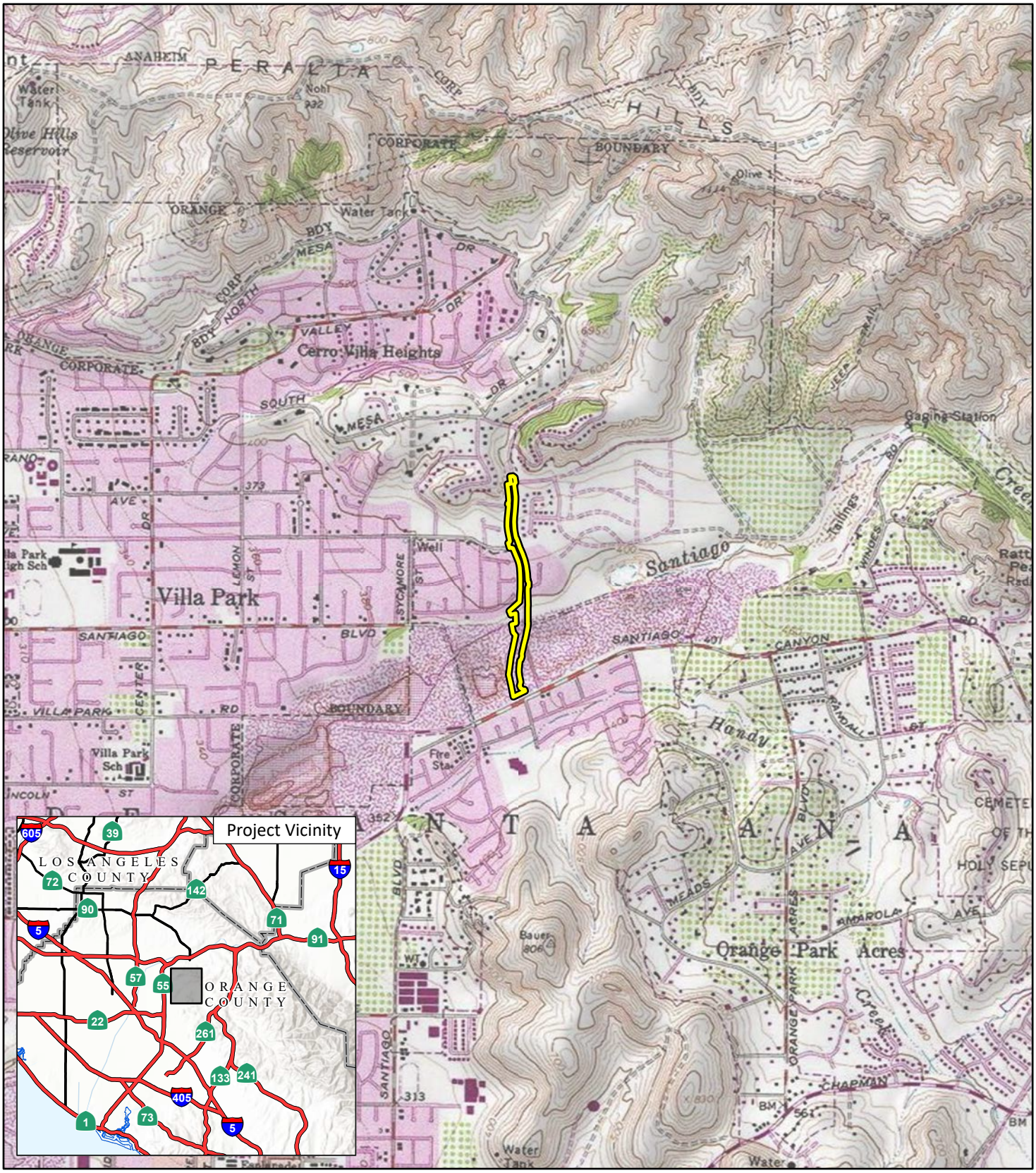
# ATTACHMENT B

# FIGURES




LSA

FIGURE 1

N

0 1000 2000
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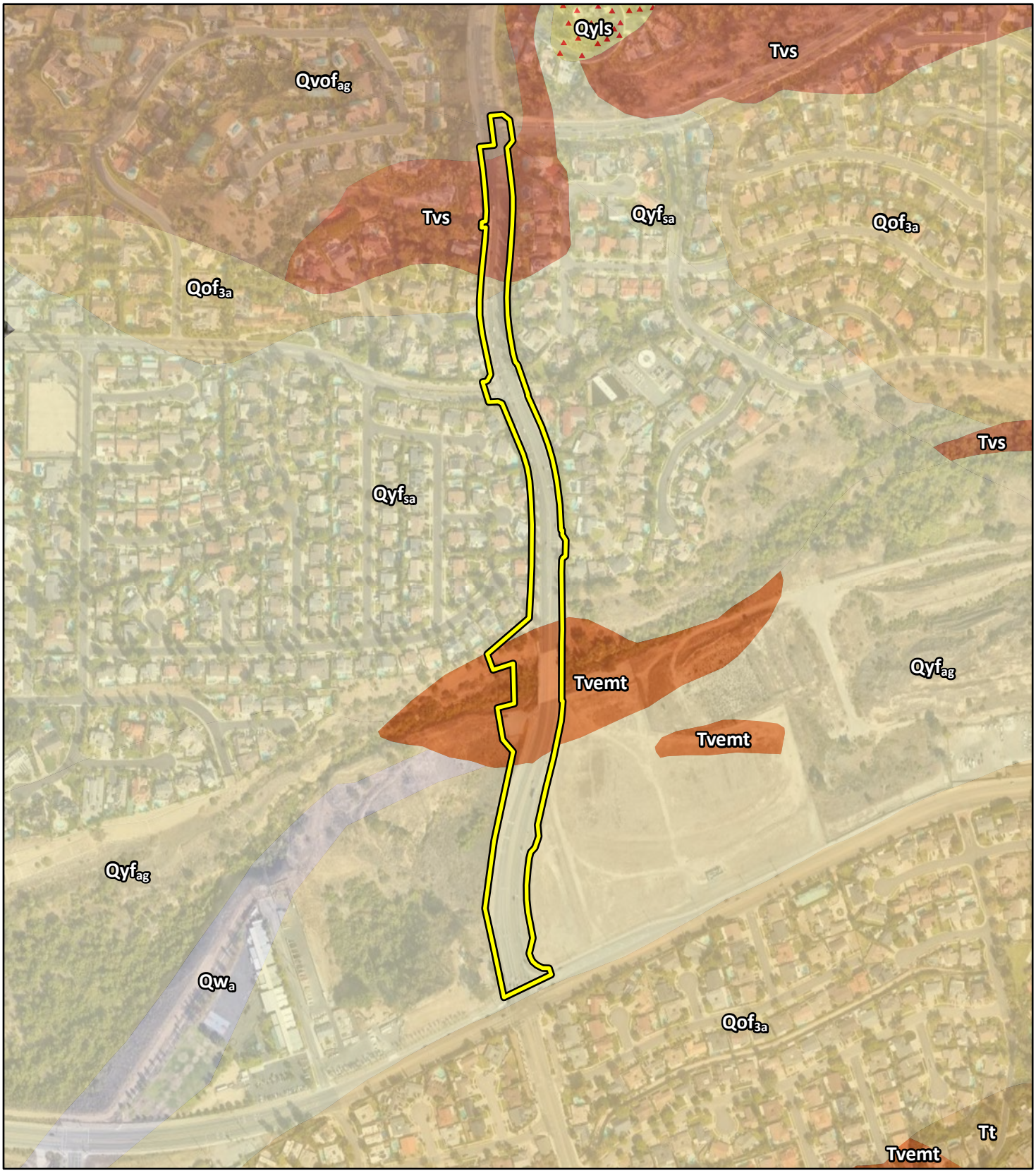
SOURCE: USGS 7.5' Quad - *Orange (1981)*, CA

J:\20230893\GIS\Pro\Cannon Street Widening Project.aprx (3/2/2023)

*Cannon Street Widening Project*

Project Location




LSA

Project Location

Units

Qw - Very Young Wash Deposits

Qyf - Young Alluvial Fan Deposits

Qyls - Young Landslide Deposits

Qof$_3$ - Old Alluvial Fan Deposits, Unit 3

Qvof - Very Old Alluvial Fan Deposits

Tt - Topanga Group

Tvemt - El Modeno Volcanics, Tuff and Tuff Breccia

Tvs - Sespe and Vaqueros Formations, Undifferentiated

a - arenaceous
g - gravel
sa - silty sand

FIGURE 2

*Cannon Street Widening Project*

Geology Map

N

0 250 500

FEET

SOURCE: Morton and Miller (2006)

J:\20230893\GIS\Pro\Cannon Street Widening Project.aprx (6/20/2023)

# ATTACHMENT C

# FOSSIL LOCALITY SEARCH RESULTS FROM THE NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY

Natural History Museum
of Los Angeles County
900 Exposition Boulevard
Los Angeles, CA 90007

tel 213.763.DINO
www.nhm.org

Research & Collections

e-mail: paleorecords@nhm.org

April 16, 2023

LSA

Attn: Sarah Rieboldt

re: Paleontological resources for the Cannon Street Widening Project (LSA Proj. # 20230893)

Dear Sarah:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for proposed development at the Cannon Street Widening project area as outlined on the portion of the Orange USGS topographic quadrangle map that you sent to me via e-mail on April 14, 2023. We do not have any fossil localities that lie directly within the proposed project area, but we do have fossil localities nearby from the same sedimentary deposits that occur in the proposed project area, either at the surface or at depth.

The following table shows the closest known localities in the collection of the Natural History Museum of Los Angeles County (NHMLA).

| Locality Number | Location | Formation | Taxa | Depth |
|---|---|---|---|---|
| LACM VP 6927-6930 | Peralta Hills, NE of Serrano Ave and Cannon St. | Sespe / Vacqueros Formation (sandy claystone and clay) | Horse relative (*Parahippus*), unidentified artiodactyl (Artiodactyla), pig-like mammal (Tayassuidae), camel family (Camelidae), oreodont (Merycoidodontidae),weasel family (Mustelidae), rabbit and hare family (Leporidae) | Unknown (recovered during grading) |
| LACM IP 21274 - 21286 | Peralta Hills | Puente Formation (coarse sandstone, highly micaceous) | Invertebrates (unspecified) | Unknown |
| LACM IP 16158 | 1 1/2 miles west of Olive Post Office | Fernando Formation | Invertebrates | 3198-3200 foot depth (Well #1) |
| LACM VP 1652 | Rio Vista Avenue south of Lincoln Avenue | Alluvium (Pleistocene) | Sheep (*Ovis*) | Unknown (excavations for housing project) |
| LACM VP 1033 | La Veta Ave & Esplanade St, | Puente Formation (chalky | Snapper (*Lutianus*), mackerel (*Tunita*), bony fish (*Eclipes*), | Unknown |

| | | | |
|---|---|---|---|
| | Hews Park, La Modena | diatomaceous shales) | pipefish (*Syngnathus*), sauries (*Scomberesox*) |

*VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface*

This records search covers only the records of the NHMLA. It is not intended as a paleontological assessment of the project area for the purposes of CEQA or NEPA. Potentially fossil-bearing units are present in the project area, either at the surface or in the subsurface. As such, NHMLA recommends that a full paleontological assessment of the project area be conducted by a paleontologist meeting Bureau of Land Management or Society of Vertebrate Paleontology standards.

Sincerely,

Alyssa Bell, Ph.D.
Natural History Museum of Los Angeles County

enclosure: invoice