# PALEONTOLOGICAL TECHNICAL STUDY

# DIAZ ROAD EXPANSION PROJECT

## City of Temecula

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PSI Report: CA20RiversideHEL03R

June 5, 2020

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# 1.0 EXECUTIVE SUMMARY

This report presents the results of the paleontological technical study conducted by Paleo Solutions, Inc. (Paleo Solutions), under contract to HELIX Environmental Planning, Inc. (HELIX), in support of the Diaz Road Expansion Project (Project) in the City of Temecula, Riverside County, California. This work was required by the City of Temecula to fulfill their responsibilities as the lead agency under the California Environmental Quality Act (CEQA).

The paleontological potential of the Project area was evaluated based on an analysis of existing paleontological data and a field survey. The three components of the analysis of existing data included a geologic map review, a literature search, and a museum records search at the Western Science Center (WSC) in Hemet, California. The analysis of existing data was supplemented with a pedestrian field survey. Geologic mapping by Kennedy et al. (2003) and Tan et al. (2000) indicates that the Project area is underlain by Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) and Pleistocene-age older alluvial flood plain deposits (Qoa). Geologic units present within a half mile buffer of the Project area may also be impacted at depth by ground-disturbing activities. These units are therefore included in this analysis and consist of Holocene-age active alluvial flood plain deposits (Qa), Holocene- and late Pleistocene-age young alluvial channel deposits (Qyaa), Holocene- and late Pleistocene-age young alluvial fan deposits (Qyfa), Holocene- and late Pleistocene-age young alluvial channel deposits (Qyag), Pleistocene-age Pauba Formation, Sandstone Member (Qp, Qpfs), Pleistocene-age Pauba Formation, Fanglomerate Member (Qpf, Qpff), Cretaceous-age tonalite undivided (Kt), and Cretaceous- and Jurassic-age metavolcanics and metasedimentary rocks (KJm). Although not mapped by Tan et al. (2000) and Kennedy et al (2003), recent artificial fill may be present within the bounds of the Project area. Thus, this unit is also included in the analysis of existing data for this Project.

The field survey was only able to confirm the presence of sediments interpreted as Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) due to vegetation and previous ground disturbances, such as the paved road and earthen drainage channel. However, the geologic units mapped by Kennedy et al. (2003) and Tan et al. (2000) are likely present at shallow depth within the bounds of the Project area. There are no documented paleontological localities within the boundaries of the Project area; however, fossils have been recovered from older sedimentary deposits in the vicinity of the Project area (Radford, 2020; Appendix A).

Prior to construction, a paleontological resource impact mitigation program (PRIMP) should be prepared. It should provide detailed recommended monitoring locations; a description of a paleontological resources worker environmental awareness program to inform construction personnel of the potential for fossil discoveries and of the types of fossils that may be encountered; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other project personnel. In the event that paleontological resources are discovered during the construction phase of the Project, a curation agreement from the WSC, or another accredited repository, will be obtained.

# 2.0 INTRODUCTION

This report presents the results of the paleontological technical study conducted by Paleo Solutions, under contract to HELIX, in support of the Diaz Road Expansion Project in the City of Temecula, Riverside County, California. (Figure 1). All paleontological work was completed in compliance with CEQA, local regulations, and best practices in mitigation paleontology (Murphey et al., 2019).

## 2.1 PROJECT DESCRIPTION AND LOCATION

The Project area is situated along Diaz Road in the City of Temecula between its intersection with Cherry Street in the northwest and its intersection with Rancho California Road in the south. It encompasses approximately 2.2 miles and is located in an unsectioned area of Townships 8 and 7 South and Range 3 West and is mapped on the United States Geologic Survey (USGS) Temecula (1975) and Murrieta (1976) 7.5' topographic quadrangles (Figure 2, Table 1).

The Project consists of widening the existing Diaz Road segment and extending the northwestern end of Cherry Street to meet the standard of a 76 feet wide roadway with a 14-foot raised median, and 12-foot parkways on each side of the road. This Project would complete the City's only north-south corridor west of Murrieta Creek.

Geologic mapping by Kennedy et al. (2003) and Tan et al. (2000) indicates that the Project area is underlain by Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) and Pleistocene-age older alluvial flood plain deposits (Qoa). Geologic units present within a half mile buffer of the Project area may also be impacted at depth by ground-disturbing activities. These units are therefore included in this analysis and consist of late Holocene-age active alluvial flood plain deposits (Qa), Holocene- and late Pleistocene-age young alluvial channel deposits (Qyaa), Holocene- and late Pleistocene-age young alluvial fan deposits (Qyfa), Holocene- and late Pleistocene-age young alluvial channel deposits (Qyag), Pleistocene-age Pauba Formation, Sandstone Member (Qp, Qpfs), Pleistocene-age Pauba Formation, Fanglomerate Member (Qpf, Qpff), Cretaceous-age tonalite undivided (Kt), and Cretaceous- and Jurassic-age metavolcanics and metasedimentary rocks (KJm). Although not mapped by Kennedy et al. (2003) and Tan et al. (2000), recent artificial fill may be present within the bounds of the Project area and is also included in this assessment.

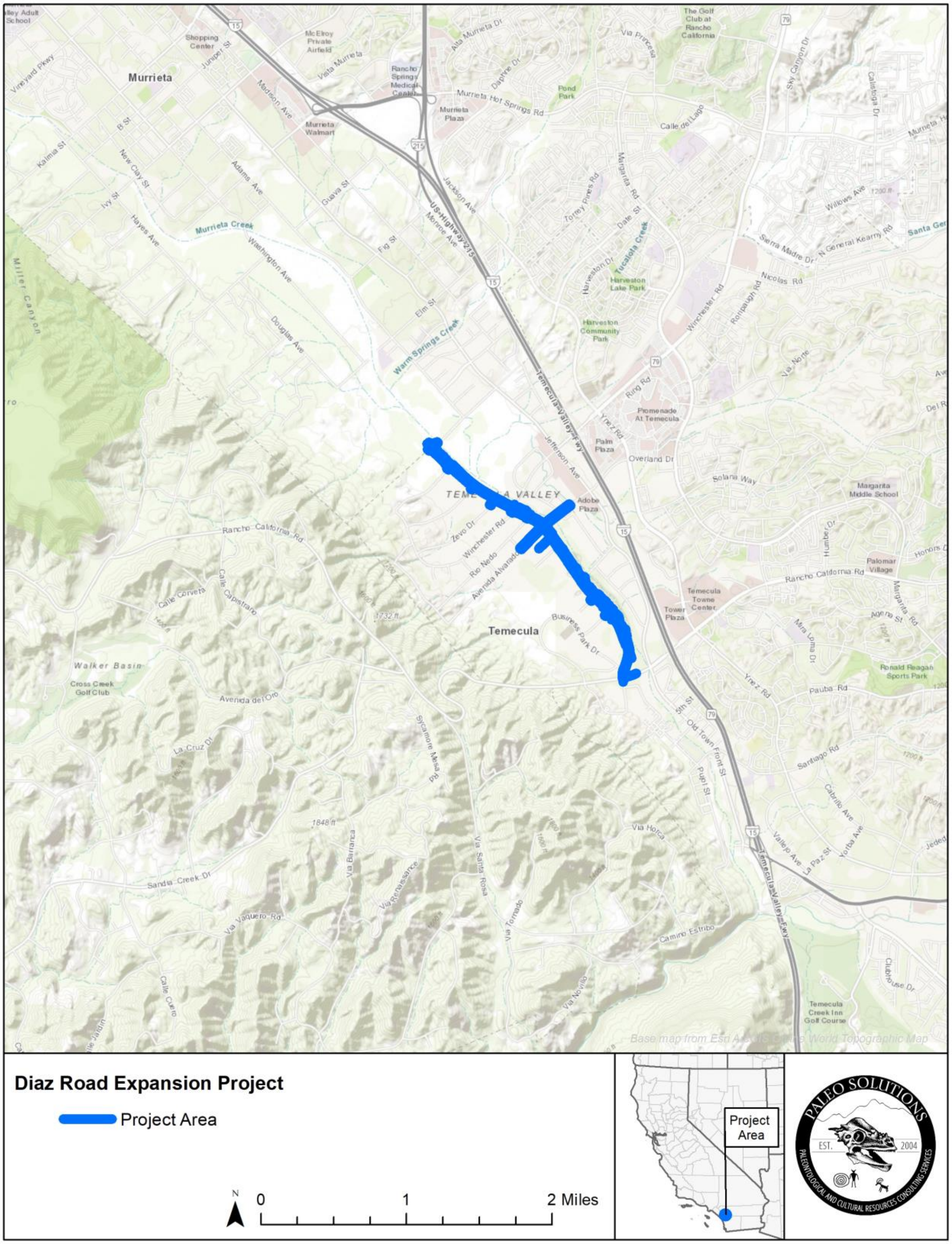


**Figure 1. Project location map.**

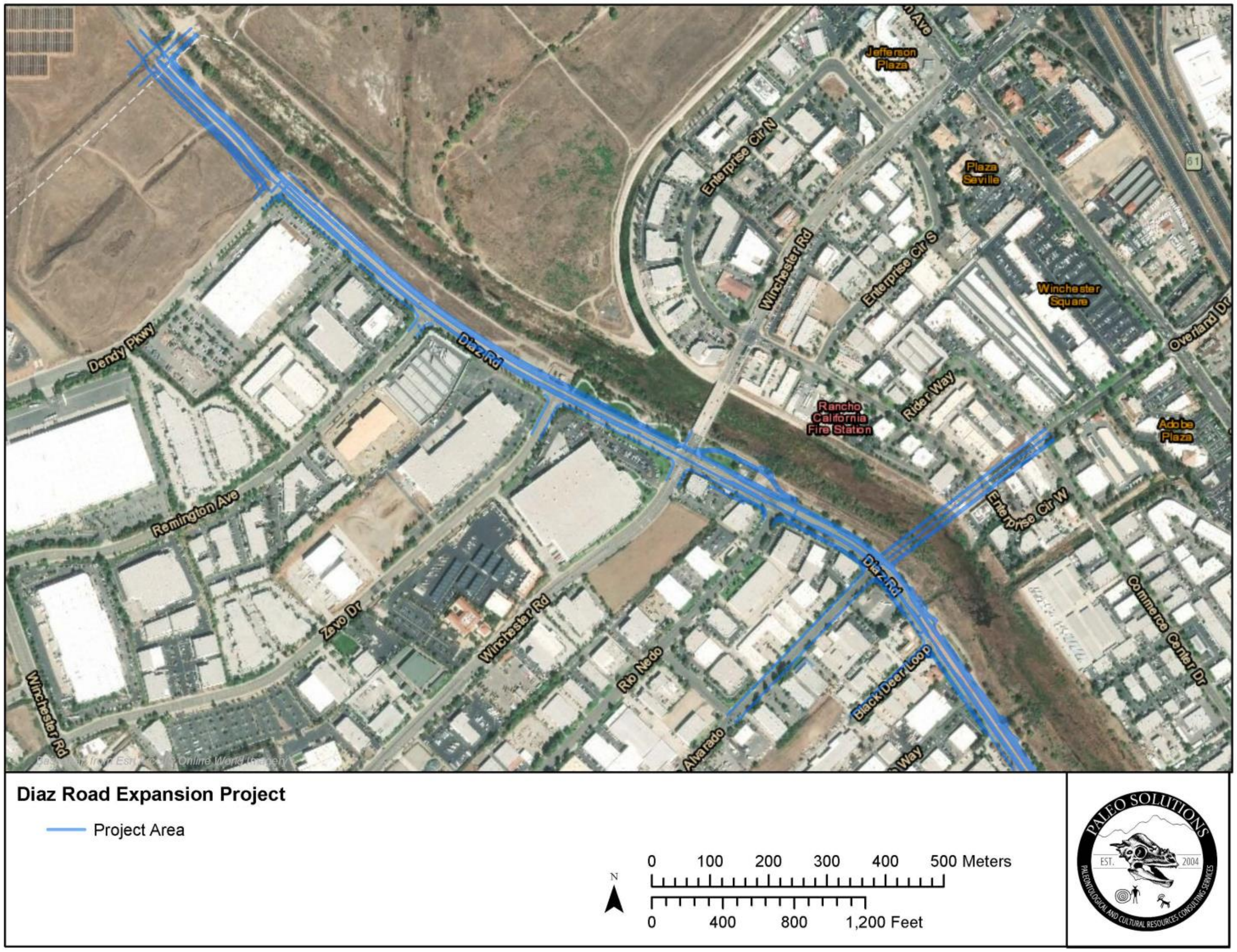


**Figure 2a. Project overview map 1 of 2.**

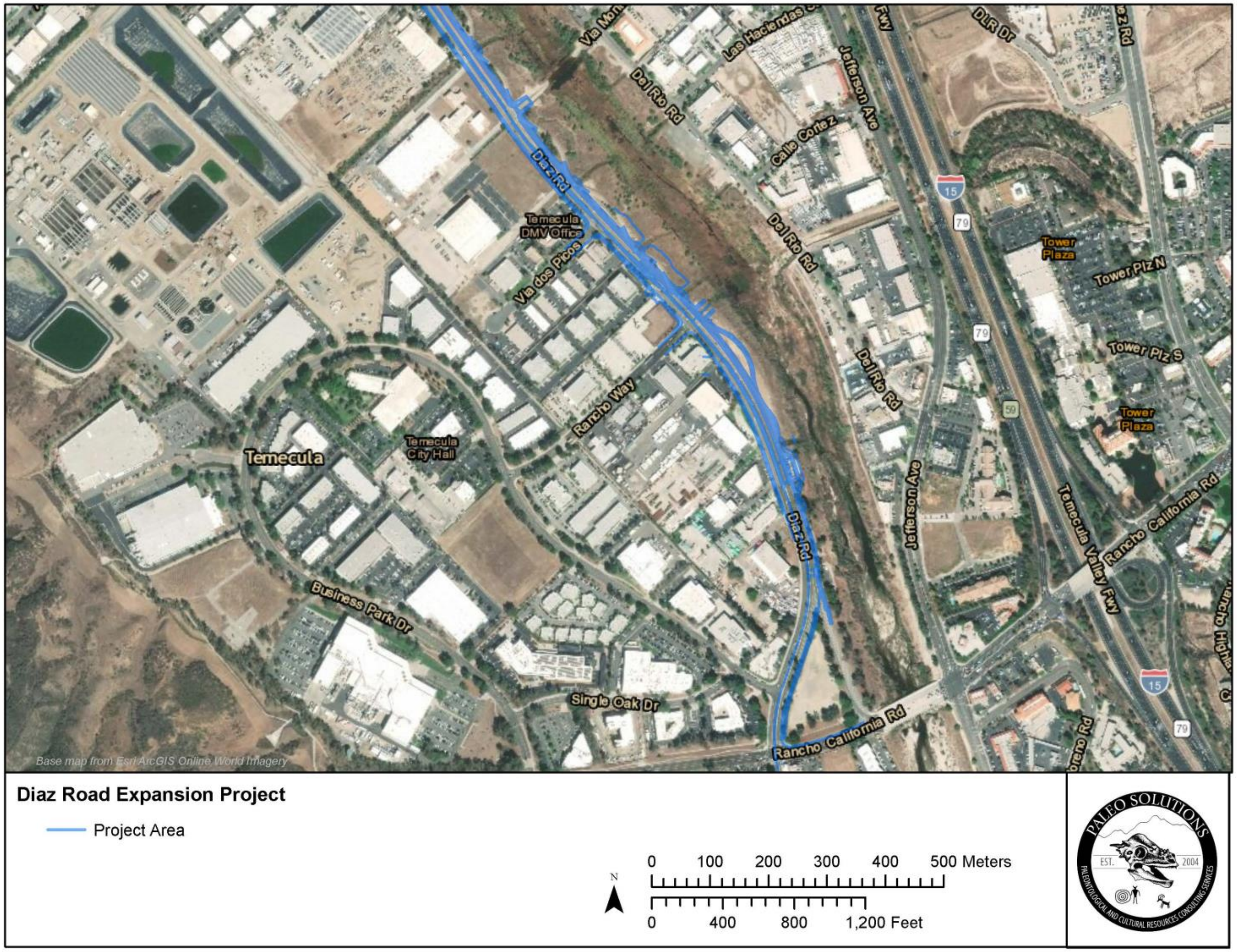


**Figure 3b. Project overview map 2 of 2.**

**Table 1. Diaz Road Expansion Project Summary**

<table>
<tr><td>Project Name</td><td colspan="4">Diaz Road Expansion Project</td></tr>
<tr><td>Project Description</td><td colspan="4">The Project consists of widening the existing Diaz Road segment and extending the northwestern end of Cherry Street to meet the standard of a 76 feet wide roadway with a 14-foot raised median, and 12-foot parkways on each side of the road. This Project would complete the City's only north-south corridor west of Murrieta Creek.</td></tr>
<tr><td>Project Area</td><td colspan="4">The Project area is situated along Diaz Road in the City of Temecula between its intersection with Cherry Street in the northwest and its intersection with Rancho California Road in the south.</td></tr>
<tr><td>Total Miles</td><td colspan="4">2.2</td></tr>
<tr><td rowspan="3">Location (PLSS)</td><td>Quarter-Quarter</td><td>Section</td><td>Township</td><td>Range</td></tr>
<tr><td rowspan="2">N/A - Unsectioned</td><td rowspan="2">N/A</td><td>7S</td><td rowspan="2">3W</td></tr>
<tr><td>8S</td></tr>
<tr><td>Land Owner</td><td colspan="4">Undetermined</td></tr>
<tr><td>Topographic Map(s)</td><td colspan="4">Temecula (1975) and Murrieta (1976) 7.5' Topographic Quadrangles</td></tr>
<tr><td>Geologic Map(s)</td><td colspan="4">Kennedy, M.P., Morton, D.M., Alvarez, R.M., and Morton, G., 2003, Preliminary Geologic Map of the Murrieta 7.5' Quadrangle, Riverside County, California: U.S. Geological Survey; Open-File Report OF-2003-189, scale 1:24,000.<br>Tan, S.S., Kennedy, M.P., Nelson, B., and Patt, G., 2000, Geologic Map of the Temecula 7.5' Quadrangle, San Diego and Riverside Counties, California: A Digital Database: California Geological Survey, Preliminary Geologic Maps; scale 1:24,000.</td></tr>
<tr><td rowspan="12">Mapped Geologic Unit(s) and age(s)</td><td>Geologic Unit</td><td>Map Symbol</td><td>Age</td><td>Paleontological Potential (PFYC)</td></tr>
<tr><td>Artificial fill</td><td>N/A – Not Mapped</td><td>Recent</td><td>2 (Low)</td></tr>
<tr><td>Active alluvial flood plain deposits</td><td>Qa</td><td>late Holocene</td><td>2 (Low)</td></tr>
<tr><td>Young alluvial channel deposits</td><td>Qyaa</td><td>Holocene to late Pleistocene</td><td>2 (Low)</td></tr>
<tr><td>Young alluvial fan deposits</td><td>Qyfa</td><td>Holocene to late Pleistocene</td><td>2 (Low)</td></tr>
<tr><td>Young alluvial valley deposits</td><td>Qyva</td><td>Holocene to late Pleistocene</td><td>2 (Low)</td></tr>
<tr><td>Young alluvial channel deposits</td><td>Qyag</td><td>Holocene to late Pleistocene</td><td>2 (Low)</td></tr>
<tr><td>Older alluvial flood plain deposits</td><td>Qoa</td><td>Pleistocene</td><td>3 (Moderate)</td></tr>
<tr><td>Pauba Formation, Sandstone Member</td><td>Qp/Qpfs</td><td>Pleistocene</td><td>4 (High)</td></tr>
<tr><td>Pauba Formation, Fanglomerate Member</td><td>Qpf/Qpff</td><td>Pleistocene</td><td>4 (High)</td></tr>
<tr><td>Tonalite undivided</td><td>Kt</td><td>Cretaceous</td><td>1 (Very Low)</td></tr>
<tr><td>Metavolcanic and metasedimentary rocks</td><td>KJm</td><td>Cretaceous and Jurassic</td><td>1 (Very Low)</td></tr>
<tr><td>Surveyor(s)</td><td colspan="4">Daniel Nolan, B.S.</td></tr>
<tr><td>Date(s) Surveyed</td><td colspan="4">May 15, 2020</td></tr>
<tr><td>Geologic Units Surveyed</td><td colspan="4">Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) and areas mapped as Pleistocene-age older alluvial flood plain deposits (Qoa)</td></tr>
<tr><td>Previously Documented Fossil</td><td colspan="4">According to the WSC, there are no previously recorded fossil localities within the Project area. However, numerous fossil localities have been recorded from within one mile of the Project area from older sedimentary deposits and include specimens of fossil mammoth</td></tr>
</table>

| | |
|---|---|
| **Localities within the Project area** | (*Mammuthus columbi*), ground sloth (*Paramylodon sp.*), bison (*Bison sp.*), and horse (*Equus sp.*) (Radford, 2020). |
| **Paleontological Results** | No paleontological resources were discovered during the survey. Therefore, no fossils were collected. |
| **Disposition of Fossils** | Not applicable; no fossils observed or collected during survey. |
| **Recommendation(s)** | Prior to construction, a PRIMP should be prepared. It should provide detailed recommended monitoring locations; a description of a paleontological resources worker environmental awareness program to inform construction personnel of the potential for fossil discoveries and of the types of fossils that may be encountered; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other project personnel. In the event that paleontological resources are discovered during the construction phase of the Project, a curation agreement from the WSC, or another accredited repository, will be obtained. |

# 3.0 DEFINITION AND SIGNIFICANCE OF PALEONTOLOGICAL RESOURCES

As defined by Murphey and Daitch (2007): "Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort 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. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. Paleontological resources include not only fossils themselves, but also the associated rocks or organic matter and the physical characteristics of the fossils' associated sedimentary matrix.

The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered non-renewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced. Fossils are important scientific and educational resources because they are 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 that forms the basis for biochronology and biostratigraphy, and which 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."

Fossil resources vary widely in their relative abundance and distribution and not all are regarded as significant. According to Bureau of Land Management (BLM) Instructional Memorandum (IM) 2009-011, a "Significant Paleontological Resource" is defined as:

> "Any paleontological resource that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils. A significant paleontological resource is considered to be of scientific interest if it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has an identified educational or recreational value. Paleontological resources that may be considered not to have scientific significance include those that lack provenience or context, lack physical integrity due to decay or natural erosion, or that are overly redundant or are otherwise not useful for research. Vertebrate fossil remains and traces

include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities" (BLM, 2008).

Vertebrate fossils, whether preserved remains or track ways, are classified as significant by most state and federal agencies and professional groups (and are specifically protected under the California Public Resources Code). In some cases, fossils of plants or invertebrate animals are also considered significant and can provide important information about ancient local environments.

The full significance of fossil specimens or fossil assemblages cannot be accurately predicted before they are collected, and in many cases, before they are prepared in the laboratory and compared with previously collected fossils. Pre-construction assessment of significance associated with an area or formation must be made based on previous finds, characteristics of the sediments, and other methods that can be used to determine paleoenvironmental and taphonomic conditions.

# 4.0 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

This section of the report presents the regulatory requirements pertaining to paleontological resources that apply to this Project.

## 4.1 STATE REGULATORY SETTING

### 4.1.1 California Environmental Quality Act (CEQA)

The procedures, types of activities, persons, and public agencies required to comply with the CEQA are defined in the Guidelines for Implementation of CEQA (State CEQA Guidelines), as amended on March 18, 2010 (Title 14, Section 15000 et seq. of the California Code of Regulations) and further amended January 4, 2013 and December 28, 2018. One of the questions listed in the CEQA Environmental Checklist is: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" (State CEQA Guidelines Appendix G, Section VII, Part F).

### 4.1.2 State of California Public Resources Code

The State of California Public Resources Code (Chapter 1.7), Sections 5097 and 30244, includes additional state level requirements for the assessment and management of paleontological resources. These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, and define the excavation, destruction, or removal of paleontological "sites" or "features" from public lands without the express permission of the jurisdictional agency as a misdemeanor. As used in Section 5097, "state lands" refers to lands owned by, or under the jurisdiction of, the state or any state agency. "Public lands" is defined as lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

## 4.2 LOCAL REGULATORY SETTING

### 4.2.1 Riverside County

The Riverside County General Plan requires consideration of paleontological resources under the Multipurpose Open Space Element of the general plan (County of Riverside, 2015). The Riverside

County General Plan recommendations are based on the Society of Vertebrate Paleontology (SVP) Guidelines (SVP, 2010) for the mitigation of paleontological resources. The Multipurpose Open Space Element of the general plan (County of Riverside, 2015) provides the following requirements for paleontological sensitive areas within the county:

- **OS 19.6** Whenever existing information indicates that a site proposed for development has high paleontological sensitivity as shown on Figure OS-8 [of the County of Riverside General Plan Multipurpose Open Space Element, 2015] , a paleontological resource impact mitigation program (PRIMP) shall be filed with the County Geologist prior to site grading. The PRIMP shall specify the steps to be taken to mitigate impacts to paleontological resources.
- **OS 19.7** Whenever existing information indicates that a site proposed for development has low paleontological sensitivity as shown on Figure OS-8, no direct mitigation is required unless a fossil is encountered during site development. Should a fossil be encountered, the County Geologist shall be notified and a paleontologist shall be retained by the project proponent. The paleontologist shall document the extent and potential significance of the paleontological resources on the site and establish appropriate mitigation measures for further site development.
- **OS 19.8** Whenever existing information indicates that a site proposed for development has undetermined paleontological sensitivity as shown on Figure OS-8, a report shall be filed with the County Geologist documenting the extent and potential significance of the paleontological resources on site and identifying mitigation measures for the fossil and for impacts to significant paleontological resources prior to approval of that department.
- **OS 19.9** Whenever paleontological resources are found, the County Geologist shall direct them to a facility within Riverside County for their curation, including the Western Science Center in the City of Hemet.

### 4.2.2 City of Temecula

The Open Space/Conservation Element of the City of Temecula General Plan (City of Temecula, 2005) contains one goal and two policies regarding paleontological resources. Goal 6 states that significant historical and cultural resources shall be preserved as a record of Temecula's heritage. Policies 6.1 and 6.5 require that the City:

- Maintain an inventory of areas with archaeological/paleontological sensitivity, and historic sites.
- Work to preserve or salvage potential archaeological and paleontological resources.

# 5.0 METHODS

This paleontological analysis of existing data included a geologic map review, a literature search, and museum records search. The analysis of existing data was supplemented with a pedestrian field survey. The goal of this report is to evaluate the paleontological potential of the Project area and make recommendations for the mitigation of adverse impacts on paleontological resources that may occur as a result of the proposed Project. Betsy Kruk, M.S., performed the background research and authored this report. Daniel Nolan, B.S., conducted the field survey. Elisa Barrios, B.S., created the GIS figures. Courtney Richards, M.S., oversaw all aspects of the Project as the Paleontological Principal Investigator.

Paleo Solutions will retain an archival copy of all Project information including field notes, maps, and other data.

## 5.1 ANALYSIS OF EXISTING DATA

Paleo Solutions reviewed geologic mapping of the Project area by Kennedy et al. (2003) and Tan et al. (2000). The literature reviewed included published and unpublished scientific papers. Paleontological museum records search results from the WSC were analyzed and incorporated into this paleontological investigation.

## 5.2 FIELD SURVEY

The field survey was conducted by Paleo Solutions' paleontologist Daniel Nolan, B.S. The paleontological survey was conducted to check for any exposures of native, previously undisturbed rock or sediments of the underlying geologic units, and if present, assess the potential for fossils. The Project area and surrounding areas were documented and photographed, with photographed areas spatially referenced with a GPS unit.

## 5.3 CRITERIA FOR EVALUATING PALEONTOLOGICAL POTENTIAL

The Potential Fossil Yield Classification (PFYC) system was developed by the BLM (BLM, 2016). Because of its demonstrated usefulness as a resource management tool, the PFYC has been utilized for many years for projects across the country, regardless of land ownership. It is a predictive resource management tool that classifies geologic units on their likelihood to contain paleontological resources on a scale of 1 (very low potential) to 5 (very high potential). This system is intended to aid in predicting, assessing, and mitigating paleontological resources. The PFYC ranking system is summarized in Table 2.

**Table 2. Potential Fossil Yield Classification (BLM, 2016)**

| BLM PFYC Designation | Assignment Criteria Guidelines and Management Summary (PFYC System) |
|---|---|
| 1 = Very Low Potential | Geologic units are not likely to contain recognizable paleontological resources. |
| | Units are igneous or metamorphic, excluding air-fall and reworked volcanic ash units. |
| | Units are Precambrian in age. |
| | Management concern is usually negligible, and impact mitigation is unnecessary except in rare or isolated circumstances. |
| 2 = Low Potential | Geologic units are not likely to contain paleontological resources. |
| | Field surveys have verified that significant paleontological resources are not present or are very rare. |
| | Units are generally younger than 10,000 years before present. |
| | Recent eolian deposits. |
| | Sediments exhibit significant physical and chemical changes (i.e., diagenetic alteration) that make fossil preservation unlikely. |
| | Management concern is generally low, and impact mitigation is usually unnecessary except in occasional or isolated circumstances. |
| 3 = Moderate Potential | Sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence. |
| | Marine in origin with sporadic known occurrences of paleontological resources. |
| | Paleontological resources may occur intermittently, but these occurrences are widely scattered. |
| | The potential for authorized land use to impact a significant paleontological resource is known to be low-to-moderate. |

| BLM PFYC Designation | Assignment Criteria Guidelines and Management Summary (PFYC System) |
|---|---|
| | Management concerns are moderate. Management options could include record searches, pre-disturbance surveys, monitoring, mitigation, or avoidance. Opportunities may exist for hobby collecting. Surface-disturbing activities may require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action could affect the paleontological resources. |
| 4 = High Potential | Geologic units that are known to contain a high occurrence of paleontological resources. |
| | Significant paleontological resources have been documented but may vary in occurrence and predictability. |
| | Surface-disturbing activities may adversely affect paleontological resources. |
| | Rare or uncommon fossils, including nonvertebrate (such as soft body preservation) or unusual plant fossils, may be present. |
| | Illegal collecting activities may impact some areas. |
| | Management concern is moderate to high depending on the proposed action. A field survey by a qualified paleontologist is often needed to assess local conditions. On-site monitoring or spot-checking may be necessary during land disturbing activities. Avoidance of known paleontological resources may be necessary. |
| 5 = Very High Potential | Highly fossiliferous geologic units that consistently and predictably produce significant paleontological resources. |
| | Significant paleontological resources have been documented and occur consistently. |
| | Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities. |
| | Unit is frequently the focus of illegal collecting activities. |
| | Management concern is high to very high. A field survey by a qualified paleontologist is almost always needed and on-site monitoring may be necessary during land use activities. Avoidance or resource preservation through controlled access, designation of areas of avoidance, or special management designations should be considered. |
| U = Unknown Potential | Geologic units that cannot receive an informed PFYC assignment |
| | Geological units may exhibit features or preservational conditions that suggest significant paleontological resources could be present, but little information about the actual paleontological resources of the unit or area is unknown. |
| | Geologic units represented on a map are based on lithologic character or basis of origin, but have not been studied in detail. |
| | Scientific literature does not exist or does not reveal the nature of paleontological resources. |
| | Reports of paleontological resources are anecdotal or have not been verified. |
| | Area or geologic unit is poorly or under-studied. |
| | BLM staff has not yet been able to assess the nature of the geologic unit. |
| | Until a provisional assignment is made, geologic units with unknown potential have medium to high management concerns. Field surveys are normally necessary, especially prior to authorizing a ground-disturbing activity. |

# 6.0 ANALYSIS OF EXISTING DATA

The Project area is located within the northwestern portion of the Peninsular Ranges Geomorphic Province, a region characterized by northwest-trending fault-bounded mountain ranges, broad intervening valleys, and low-lying coastal plains (Yerkes et al., 1965). The Peninsular Ranges extend approximately 920 miles from the Los Angeles Basin to the southern tip of Baja California and vary in width from approximately 30 to 100 miles. Bedrock units within the Peninsular Ranges include pre-Cretaceous- and Cretaceous-age igneous rocks of the Southern California Batholith, Late Cretaceous-age sedimentary rocks, and post-Cretaceous-age sedimentary rocks or sediment (Yerkes et al., 1965; Norris and Webb, 1976). All post-Cretaceous-age rocks lie unconformably on either the Cretaceous-age sedimentary rocks or on basement rocks (Norris and Webb, 1976). Pliocene-age nonmarine rocks and sediments and thick and widespread throughout the northern Peninsular Ranges, and Quaternary deposits include fluvial and lacustrine sediments within the inland interior of the province (Norris and Webb, 1976).

## 6.1 LITERATURE SEARCH

Geologic mapping by Kennedy et al. (2003) and Tan et al. (2000) indicates that the Project area is underlain by Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) and Pleistocene-age older alluvial flood plain deposits (Qoa). Within a half mile of the Project area, Holocene-age active alluvial flood plain deposits (Qa), Holocene- and late Pleistocene-age young alluvial channel deposits (Qyaa), Holocene- and late Pleistocene-age young alluvial fan deposits (Qyfa), Holocene- and late Pleistocene-age young alluvial channel deposits (Qyag), Pleistocene-age Pauba Formation, Sandstone Member (Qp, Qpfs), Pleistocene-age Pauba Formation, Fanglomerate Member (Qpf, Qpff), Cretaceous-age tonalite undivided (Kt), and Cretaceous- and Jurassic-age metavolcanics and metasedimentary rocks (KJm) are also present and may underlie the geologic units mapped at the surface within the Project area at shallow depth (Figure 3). Although not mapped by Kennedy et al. (2003) and Tan et al. (2000), recent artificial fill may be present within the bounds of the Project area. Thus, these units are also included in the analysis of existing data for this Project.

### 6.1.1 Artificial Fill (Unmapped)

Although Kennedy et al. (2003) and Tan et al. (2000) do not map fill within the Project area or its immediately vicinity, recent artificial fill may be present within the bounds of the Project area, particularly underlying built structures or areas, such as underlying the asphalt and gravel in the Right-Of-Way (ROW). These sediments consist of previously disturbed, reworked sediments and any fossils recovered from artificial fill have lost their stratigraphic and scientific significance. Therefore, artificial fill has a low paleontological potential (PFYC 2).

### 6.1.2 Younger Sedimentary Deposits (Qa, Qyaa, Qyfa, Qyva, Qyag)

Late Holocene-age active alluvial flood plain deposits (Qa); and Holocene- and late Pleistocene-age young alluvial channel deposits (Qyaa), young alluvial fan deposits (Qyfa), young alluvial valley deposits (Qyva), and young alluvial channel deposits (Qyag) were formed during the Holocene (approximately 11,700 years ago to present) and late Pleistocene (11,700 years ago to 129,000 years ago). Younger deposits are undissected, unconsolidated, and composed of clay, silt, sand, and gravel (Kennedy et al., 2003; Tan et al., 2000). Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) directly underlies the majority of the Project area, while late Holocene-age active alluvial flood plain deposits (Qa); and Holocene- and late Pleistocene-age young alluvial channel deposits (Qyaa), young alluvial fan deposits (Qyfa), and young alluvial channel deposits (Qyag) are mapped at the margins of the Project area

Holocene-age (less than 11,700 years old) sediments are typically too young to contain fossilized material (SVP, 2010), but they transition to, and may overlie sensitive older (e.g., Pleistocene- and Pliocene-age) deposits at variable depth. These deposits (Qa, Qyaa, Qyfa, Qyva, Qyag) are assigned low paleontological potential (PFYC 2) at the surface using BLM (2016) guidelines. However, they have an unknown paleontological potential in the subsurface since there is potential for these deposits to be conformably underlain by older, paleontologically sensitive geologic units.

It should be noted that while Kennedy et al. (2003) map the sediment underlying the Project area as Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) (PFYC 2), Tan et al. (2000) map the same sediments as Pleistocene-age older alluvial flood plain deposits (Qoa) (PFYC 3).

### 6.1.3 Older Alluvial Flood Plain Deposits (Qoa)

Pleistocene-age older alluvial flood plain deposits (Qoa) are mapped at the southern portion of the Project area (Tan et al., 2000; Figure 3). These deposits consist of moderately well consolidated, poorly sorted sand derived from flood plain deposits (Tan et al., 2000).

Taxonomically diverse and locally abundant Pleistocene-age fossil animals and plants have been collected from older alluvial deposits throughout southern California and include mammoth (*Mammuthus*), mastodon (*Mammut*), camel (Camelidae), horse (Equidae), bison (*Bison*), giant ground sloth (*Megatherium*), peccary (Tayassuidae), cheetah (*Acinonyx*), lion (*Panthera*), saber tooth cat (*Smilodon*), capybara (*Hydrochoerus*), dire wolf (*Canis dirus*), and numerous taxa of smaller mammals (e.g., Rodentia) (Blake, 1991; Jahns, 1954; Jefferson, 1991). According to the Paleobiology Database (PBDB), numerous Pleistocene-age fossil localities have been recorded within Riverside County, including those from the Diamond Valley Lake east and west dams, which yielded a new species of mastodon (*Mammut pacificus*), Columbian mammoth (*Mammuthus columbi*), fox (*Urocyon* sp.), rabbit (*Sylvilagus* sp.), mole (*Scapanus* sp.), rodent (*Dipodomys* sp., *Thomomys* sp., *Neotoma* sp., *Microtus* sp.), quail (*Callipepla* sp.), and snake (Colubridae) (Dooley et al., 2019; PBDB, 2020). The University of California Museum of Paleontology (UCMP) online fossil locality database also contains numerous records of Pleistocene-age fossils in Riverside County, including horse (*Equus* sp., *Equus bautistensis*, *Hipparionini*), tapir (*Tapirus merriami*), pronghorn (*Capromeryx* sp., *Antilocapra* sp.), deer (*Odocoileus*), giant ground sloth (*Megalonyx*), mammoth (*Mammuthus* sp.), rabbit (*Lepus* sp.), rodent (*Microtus* sp., *Microtus californicus*, *Neotoma* sp.), and tortoise (*Gopherus* sp., *Gopherus agassizii*), as well as invertebrates and plants (UCMP, 2020). Therefore, Pleistocene-age older alluvial flood plain deposits (Qoa) are assigned a moderate paleontological potential (PFYC 3).

It should be noted that while Tan et al. (2000) map the sediments within the Project area as Pleistocene-age older alluvial flood plain deposits (Qoa) (PFYC 3), Kennedy et al. (2003) map the same sediments as Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) (PFYC 2).

### 6.1.4 Pauba Formation, Sandstone and Fanglomerate Members (Qp/Qpfs, Qpf/Qpff)

Pleistocene-age Pauba Formation is divided into two informal members: a sandstone member (Qp/Qpfs) and a fanglomerate member (Qpf/Qpff) (Kennedy et al., 2003; Tan et al., 2000; Figure 3). Pleistocene-age Pauba Formation, Sandstone Member (Qp/Qpfs) and Fanglomerate Member (Qpf/Qpff) are mapped along the margins of the Project area and are likely present at unknown depth below younger sedimentary deposits. The Sandstone Member (Qp/Qpfs) is composed of light brown, moderately-well indurated and cross-bedded sandstone containing sparse cobble to boulder conglomerate beds (Kennedy et al., 2003; Tan et al., 2000). The Fanglomerate Member (Qpf/Qpff) is composed of grayish-brown, well indurated, poorly sorted fanglomerate, breccia, and mudstone (Kennedy et al., 2003; Tan et al., 2000).

Pleistocene-age Pauba Formation contains an extensive variety of late Irvingtonian and early Rancholabrean fossils that are primarily mammals (Kennedy et al., 2003; Morton and Miller, 2006; Pajak et al., 1996). The UCMP (2020) online database does not contain records for the Pauba Formation; however, the PBDB (2020) does contain numerous records of fossil localities from the

Pauba Formation of Riverside County. These fossil localities have yielded pronghorn (Antilocapridae, *Capromeryx* sp.), deer (*Odocoileus* sp.), sheep (*Ovis canadensis*), camel (*Camelops* sp., *Camelops hesternus*, *Hemiauchenia* sp., *Hemiauchenia macrocephala*), tapir (*Tapirus californicus*), horse (*Equus* sp., *Equus scotti*), mammoth (*Mammuthus* sp., *Mammuthus columbi*), mastodon (*Mammut americanum*), ground sloth (*Paramylodon* sp., *Paramylodon harlani*), saber tooth cat (*Smilodon fatalis*), coyote (*Canis latrans*), bat (Chiroptera), rabbit (Leporidae, *Lepus* sp., *Sylvilagus* sp.), mustelid (*Mustela* sp.), shrew (*Sorex* sp.), rodent (Cricetidae, *Dipodomys* sp., *Microtus* sp., *Microtus californicus*, *Neotoma* sp., Perognathinae, *Peromyscus* sp., Sciuridae, *Thomomys* sp., *Thomomys bottae*), and mole (*Scapanus* sp.) (PBDB, 2020). Therefore, Pleistocene-age Pauba Formation, Sandstone Member (Qp/Qpfs) and Fanglomerate Member (Qpf/Qpff) have a high paleontological potential (PFYC 4).

### 6.1.5 Igneous and Metamorphic Rocks (Kt, KJm)

On the southern end of the Project area, Cretaceous-age tonalite, undivided (Kt) and Cretaceous- and Jurassic-age metavolcanic and metasedimentary rocks (KJm) are mapped by Tan et al. (2000). Cretaceous-age tonalite, undivided (Kt) consists of light gray, coarse-grained hornblende-biotite tonalite, which is a plutonic igneous rock. Cretaceous- and Jurassic-age metavolcanic and metasedimentary rocks (KJm) consist of low grade, greenschist facies and are metamorphic rocks. Igneous rocks are crystalline or non-crystalline rocks that form through the cooling and subsequent solidification of magma or lava, while metamorphic rocks are preexisting rocks that transform from to intense heat or pressure. Both intrusive (plutonic) igneous rocks and metamorphic rocks form below the earth's surface due to increases in temperature, changes in pressure, or changes in geochemical composition. Extreme temperatures and pressures in the environments in which igneous and metamorphic rocks form generally prevent the preservation of fossils. Therefore, Cretaceous-age tonalite, undivided (Kt) and Cretaceous- and Jurassic-age metavolcanic and metasedimentary rocks (KJm) have a very low potential to produce scientifically important paleontological resources (PFYC 1).

## 6.2 PALEONTOLOGICAL RECORD SEARCH RESULTS

According to the WSC, there are no previously recorded fossil localities within the Project area. However, numerous fossil localities have been recorded from within one mile of the Project area from older sedimentary deposits. These fossil localities are associated with the Principe Salvage Collection, the Harveston I and II Projects, the Gafcon Project, and the Rancho California Water District Project. These localities produced fossil mammoth (*Mammuthus columbi*), ground sloth (*Paramylodon sp.*), bison (*Bison sp.*), and horse (*Equus sp.*) (Radford, 2020).

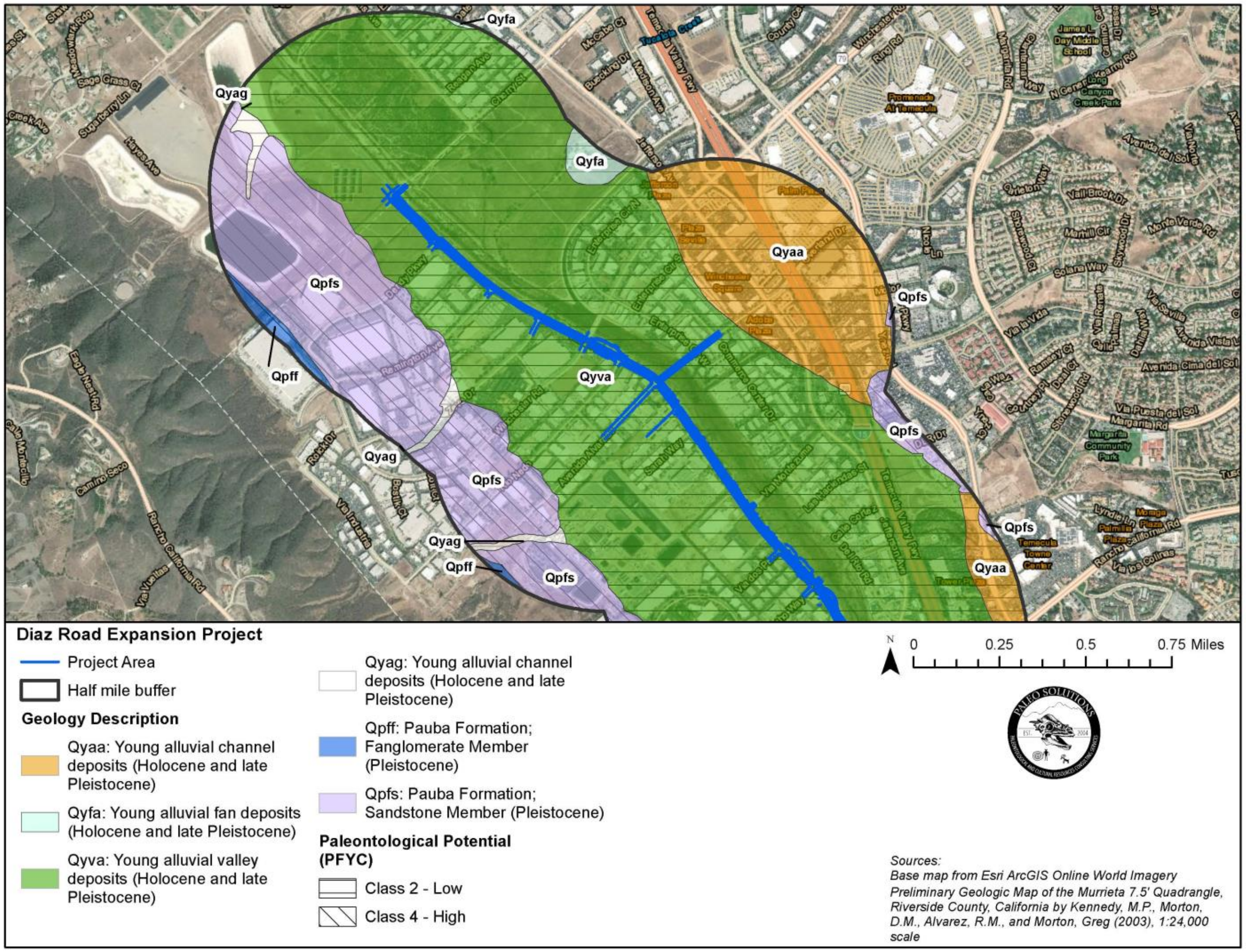


**Figure 3a. Project overview map 1 of 2.**

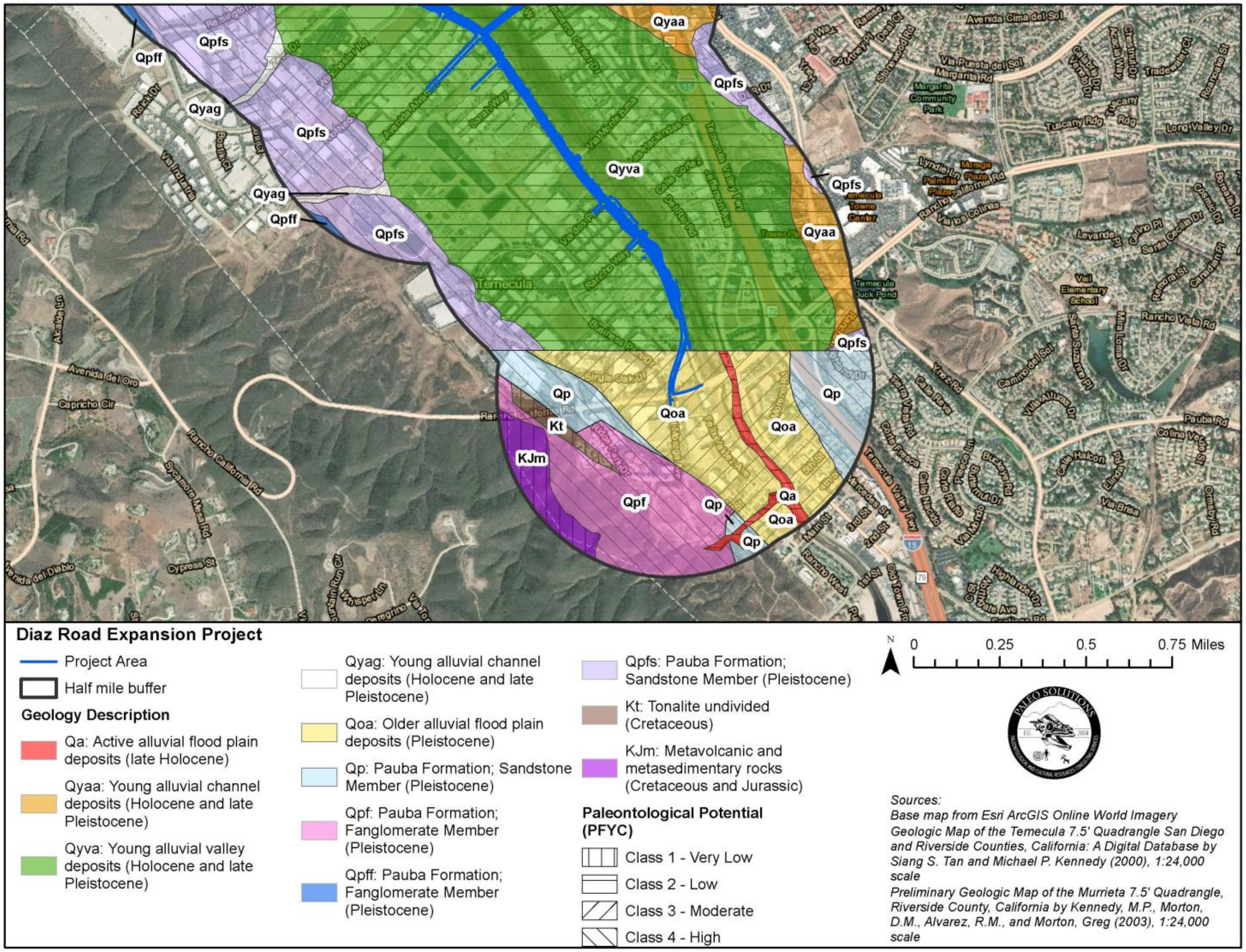


**Figure 3b. Project geologic map 2 of 2.**

# 7.0 FIELD SURVEY

Paleo Solutions' paleontologist, Daniel Nolan, B.S., surveyed the Project area on Friday, May 15, 2020. The survey consisted of a pedestrian reconnaissance of the Project area, safely inspecting the roadside and overall ROW for exposures of the geologic units mapped by Kennedy et al. (2003) and Tan et al. (2000). The Project area is situated along Diaz Road in the City of Temecula between its intersection with Cherry Street in the northwest and its intersection with Rancho California Road in the south. The Project area consists of paved and unpaved roads, which have low to flat topographic relief (Figures 4 and 6). A drainage channel runs parallel to Diaz Road with slopes on either side dipping moderately toward the channel base (Figures 5 and 8). Previous disturbances within the Project area include grading and associated spoils piles, paved asphalt, cement curbs, and an earthen drainage channel (Figures 4 and 7).

Sediments observed included previously disturbed sediments and sediments mapped as Holocene- to late Pleistocene-age young alluvial valley deposits (Qyva). Previously disturbed sediments were observed along the northeastern section of the Project area; however, the majority of the Project area is paved asphalt. Holocene- to late Pleistocene-age young alluvial valley deposits (Qyva), when not obscured by vegetation, was observed in the sidewalls and bases of the earthen drainage channel. Holocene- to late Pleistocene-age young alluvial valley deposits (Qyva) consist of pale yellowish-brown to buff yellowish-brown, moderately sorted, poorly to moderately compacted, medium- to coarse-grained sand (Figure 9).

No paleontological resources were observed or collected during the paleontological survey.

**Figure 4. Overview of the survey area along the northeastern end of Diaz Road, showing access road and current ground disturbances. View facing to the southeast.**

**Figure 5. Overview of the survey area overlooking the river channel along the riverbank opposite of Avenida Alvarado. View facing to the southwest.**

**Figure 6. Overview of the survey area along the southwestern side of Diaz Road, showing low relief on the paved road. View facing to the northwest.**

**Figure 7. Overview of the survey area along the northeastern side of Diaz Road, exposing a fill slope with vegetation. View facing to the southwest.**

**Figure 8. Earthen channel bank slope exposing pockets of Holocene- to late Pleistocene-age young alluvial valley deposits (Qyva), consisting primarily of sands. View facing to the north.**


**Figure 9. Weathered Holocene- to late Pleistocene-age young alluvial valley deposits (Qyva) as seen at and near the surface along the southwestern end Diaz Road, along the river channel bank. View facing down.**

# 8.0 CONCLUSIONS AND RECOMMENDATIONS

Due to conflicting information regarding the age of the sediments within the Project area and the limited exposures of native sediment observed during the survey, it is recommended that construction excavations in areas mapped as Holocene- and late Pleistocene-age young alluvial valley deposits (Qyva) and Pleistocene-age older alluvial flood plain deposits (Qoa) be initially spot-checked to better assess the age of the sediments and the subsurface conditions. If the sediments are determined to be entirely Holocene in age, spot-checking should be reduced in consultation with the City of Temecula. If sediments are determined to be Pleistocene in age, full-time monitoring should be implemented. If encountered in the subsurface, Pleistocene-age Pauba Formation, Sandstone Member (Qp/Qpfs) and Fanglomerate Member (Qpf/Qpff) should be monitored on a full-time basis by a professional paleontologist in order to reduce potential adverse impacts to scientifically important paleontological resources to a less than significant level. Additionally, if artificial fill, Holocene-age active alluvial flood plain deposits (Qa), Holocene- and late Pleistocene-age young alluvial channel deposits (Qyaa), Holocene- and late Pleistocene-age young alluvial fan deposits (Qyfa), or Holocene- and late Pleistocene-age young alluvial channel deposits (Qyag) are encountered, they should be initially spot-checked to determine if older, more paleontologically sensitive deposits are disturbed at depth. Lastly, Cretaceous-age tonalite, undivided (Kt) and Cretaceous- and Jurassic-age metavolcanic and metasedimentary rocks (KJm) have very low potential for paleontological resources, and thus, do not require paleontological monitoring if encountered in the subsurface of the Project area.

Prior to construction, a PRIMP should be prepared. It should provide detailed recommended monitoring locations; a description of a paleontological resources worker environmental awareness program to inform construction personnel of the potential for fossil discoveries and of the types of fossils that may be encountered; detailed procedures for monitoring, fossil recovery, laboratory analysis, and museum curation; and notification procedures in the event of a fossil discovery by a paleontological monitor or other project personnel. In the event that paleontological resources are discovered during the construction phase of the Project, a curation agreement from the WSC, or another accredited repository, will be obtained.

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# APPENDIX A. MUSEUM RECORDS SEARCH RESULTS

WESTERN SCIENCE CENTER

Paleo Solutions
Barbara Webster
911 S. Primrose Ave., Unit N
Monrovia, CA 91016

May 13, 2020

Dear Ms. Webster,

This letter presents the results of a record search conducted for the Helix Diaz Road Expansion Project in the city of Temecula, Riverside County, California. The project site is located along Diaz Road running roughly 2.15 miles from Date Street south to Rancho California Road with a a cross-section of roughly .5 miles east to west along Avenida Alvarado, in an un-sectioned portion of Township 7 South, Range 3 West on the Murrieta, CA USGS 7.5 minute quadrangle, and an un-sectioned portion of Township 8 South, Range 3 West on the Temecula, CA USGS 7.5 minute quadrangle.

The geologic unit underlying the project area is mapped entirely as alluvial flood and valley deposits dating from the Pleistocene to Holocene epochs (Kennedy & Morton, 1993; Tan & Kennedy, 2000). Alluvial units are considered to be of high paleontological sensitivity and while the Western Science Center does not have localities within the project area, it does have numerous localities within a 1 mile radius of the project. These nearby fossil localities are associated with the Principe Salvage Collection, the Harveston I and II Projects, The Gafcon Project, and the Rancho California Water District Project. These projects and localities contain numerous Pleistocene fossil specimens including those associated with mammoth (*Mammuthus columbi*), ground sloth (*Paramylodon sp.*), ancient bison (*Bison sp.*), and horse (*Equus sp.)*.

Any fossils recovered from the Helix Diaz Road Project area would be scientifically significant. Excavation activity associated with development of the area has the potential to impact the paleontologically sensitive Pleistocene alluvial units and it is the recommendation of the Western Science Center that a paleontological resource mitigation program be put in place to monitor, salvage, and curate any recovered fossils associated with the current study area.

If you have any questions, or would like further information about the Principe Salvage Collection, Harveston I and II Projects, Gafcon Project, or the Rancho California Water District Project, please feel free to contact me at dradford@westerncentermuseum.org

Sincerely,

Darla Radford
Collections Manager

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