Paleontological Resource Assessment for the Brookfield Menifee Valley Project, City of Menifee, Riverside County, California

Applied EarthWorks, Inc.
133 North San Gabriel Boulevard, Suite 201
Pasadena, CA 91107-3414

Prepared For
Albert A. Webb Associates
3788 McCray Street
Riverside, CA 92506

April 2019

Romoland, CA USGS 7.5-min. quadrangle
598 acres
Results: No paleontological resources were recovered from the Project area

SUMMARY OF FINDINGS

At the request of Albert A. Webb Associates (WEBB), Applied EarthWorks Inc. (Æ) performed a paleontological resource assessment for the Brookfield Menifee Valley Project (Project) located in the city of Menifee, Riverside County, California. The Project is a proposed amendment to remove the Project from the Menifee Ranch Specific Plan and propose a new specific plan per City of Menifee (City) policies. This report summarizes the methods and results of the paleontological resource assessment and provides Project-specific management recommendations and will satisfy the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). The City of Menifee (City) is the lead agency for the purposes of CEQA and the U.S. Army Corps of Engineers (USACE) is anticipated to be the lead agency for NEPA.

This assessment included a comprehensive review of published and unpublished literature and museum collections records maintained by the Natural History Museum of Los Angeles County. The purpose of the literature review and museum records search was to identify the geologic units underlying the Project area and to determine whether previously recorded paleontological localities occur either within the Project boundaries or within the same geologic units elsewhere. The museum records search was followed by a field survey, during which the ground surface of the Project area was visually inspected for exposed fossils and the geologic exposures were evaluated for their potential to contain preserved fossil material at the subsurface. Using the results of the museum records search and field survey, the paleontological resource potential of the Project area was determined in accordance with Society of Vertebrate Paleontology guidelines (2010).

Published geologic mapping indicates that the Project area is underlain by Cretaceous plutonic igneous rocks and Quaternary alluvial fan deposits. Museum records found no previously recorded paleontological localities directly within Project boundaries; however, at least two previously documented fossil localities have been reported nearby in Riverside County from within geologic units that are similar to those that underlie the Project area. No paleontological resources were found during the course of the field survey.

As a result of this study, portions of the Project area are determined to have high paleontological resource potential; therefore, the likelihood of impacting scientifically significant vertebrate fossils as a result of Project development is high. As a result, it is recommended that a qualified paleontologist be retained to develop and implement a Paleontological Resource Impact Mitigation Program during construction. At the conclusion of all Project-related ground disturbances, all significant fossils found during the course of on-site monitoring should be permanently curated at the Western Science Center and a final technical report of findings should be drafted and submitted to the City. By implementing these mitigation measures during Project development, adverse impacts to paleontological resources can be reduced to a less than significant level pursuant to the requirements of CEQA and NEPA.

CONTENTS

1
INTRODUCTION

At the request of Albert A. Webb Associates (WEBB), Applied EarthWorks Inc. (Æ) performed a paleontological resource assessment for the Brookfield Menifee Valley Project (Project) located in the city of Menifee, Riverside County, California (Figure 1-1). The study consisted of a museum records search, a comprehensive literature and geologic map review, and a field reconnaissance survey. This report summarizes the methods and results of a paleontological resource assessment and provides Project-specific management recommendations. This assessment was performed to satisfy the requirements of the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA) and was conducted in accordance with Riverside County regulations and the professional standards and guidelines set forth by the Society of Vertebrate Paleontology (SVP) (2010). The City of Menifee (City) is the lead agency for the purposes of CEQA and the U.S. Army Corps of Engineers (USACE) is anticipated be the lead agency for NEPA.

1.1 PROJECT BACKGROUND AND DESCRIPTION

The Project is located within the approved Menifee Valley Ranch Specific Plan, which encompasses 1,548 acres in the northeastern portion of the city of Menifee, in Riverside County, California. The Project is a proposed amendment to remove the Project from the Menifee Ranch Specific Plan and propose a new specific plan for this area to provide for future development of residential housing, commercial, and public facility land uses.

The Project encompasses approximately 594 acres containing Assessor Parcel Numbers (APNs) 331-260-005, 331-260-006, 331-260-007, 331-260-008, 331-260-009, 331-260-012, 331-270-005, 331-280-005, 331-290-004, 331-300-002, 331-300-004, 331-300-005, 331-300-007, 331-300-009, 333-170-006, 333-170-011, 333-170-012, and 333-170-013, in addition to an approximately 4.4-acre off-site improvement area. The Project area is bound by State Route 74 to the north, Case Road to the south, Menifee Road to the west and Briggs Road to the east and is depicted on the U.S. Geological Survey (USGS) Romoland, California 7.5-minute topographic quadrangle map, in Sections 13 and 24, Township 5 South, Range 3 West, of the San Bernardino Baseline and Meridian (Figure 1-2). Elevation ranges from 453 to 495 meters (1,487 to 1,623 feet) above mean sea level (amsl). Two small, unlined drainages run across the Project area in a northeast-to-southwest direction. A 500 kV substation is located northwest of the Project area with a high school situated to the northeast.

1.2 PURPOSE OF INVESTIGATION

The purpose of this paleontological resource assessment is to (1) identify the geologic units within the Project area, (2) assess their paleontological resource potential (i.e., "sensitivity"), (3) evaluate whether the Project has the potential to adversely impact scientifically significant

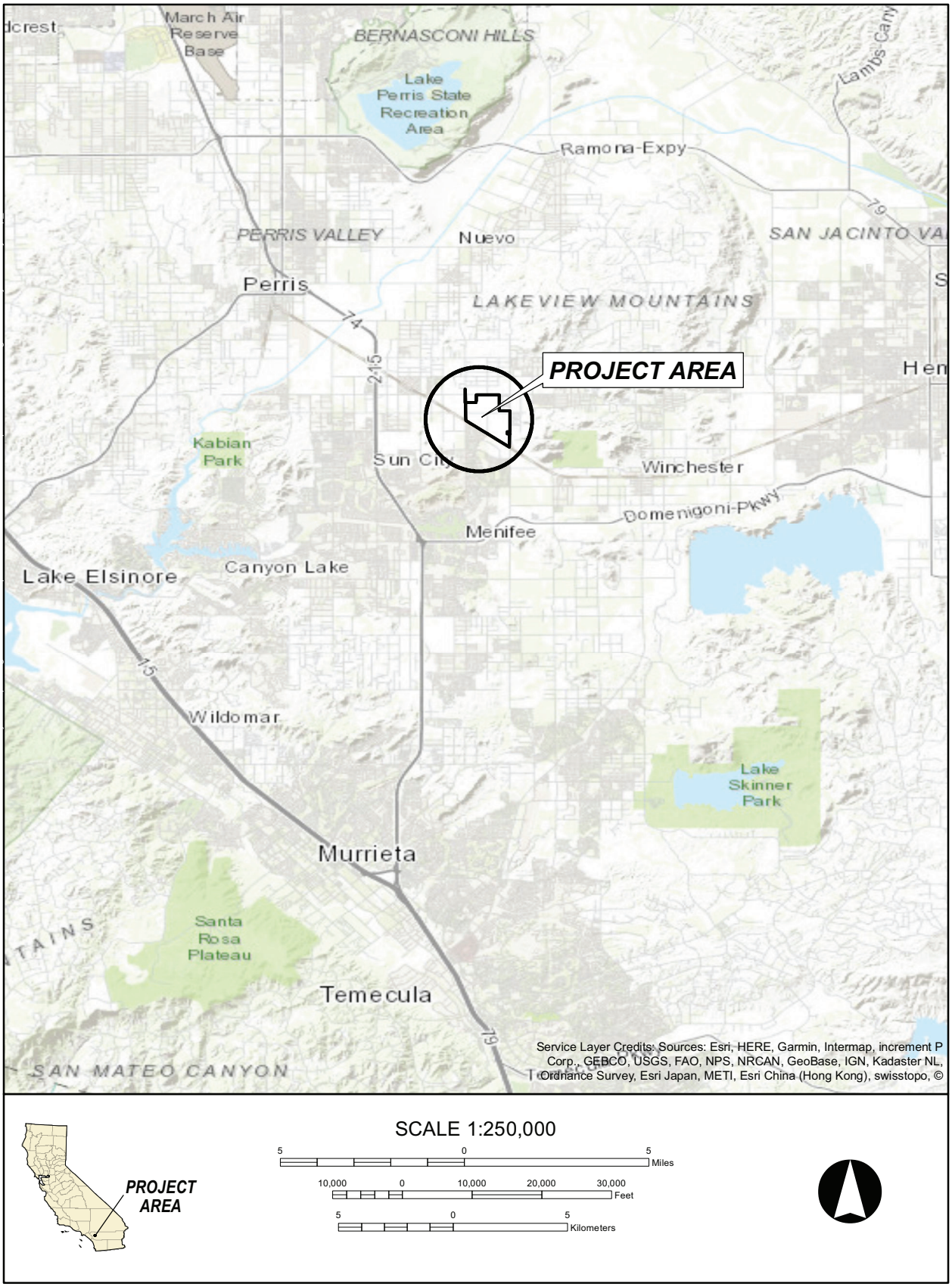


Figure 1-1 Project vicinity map.

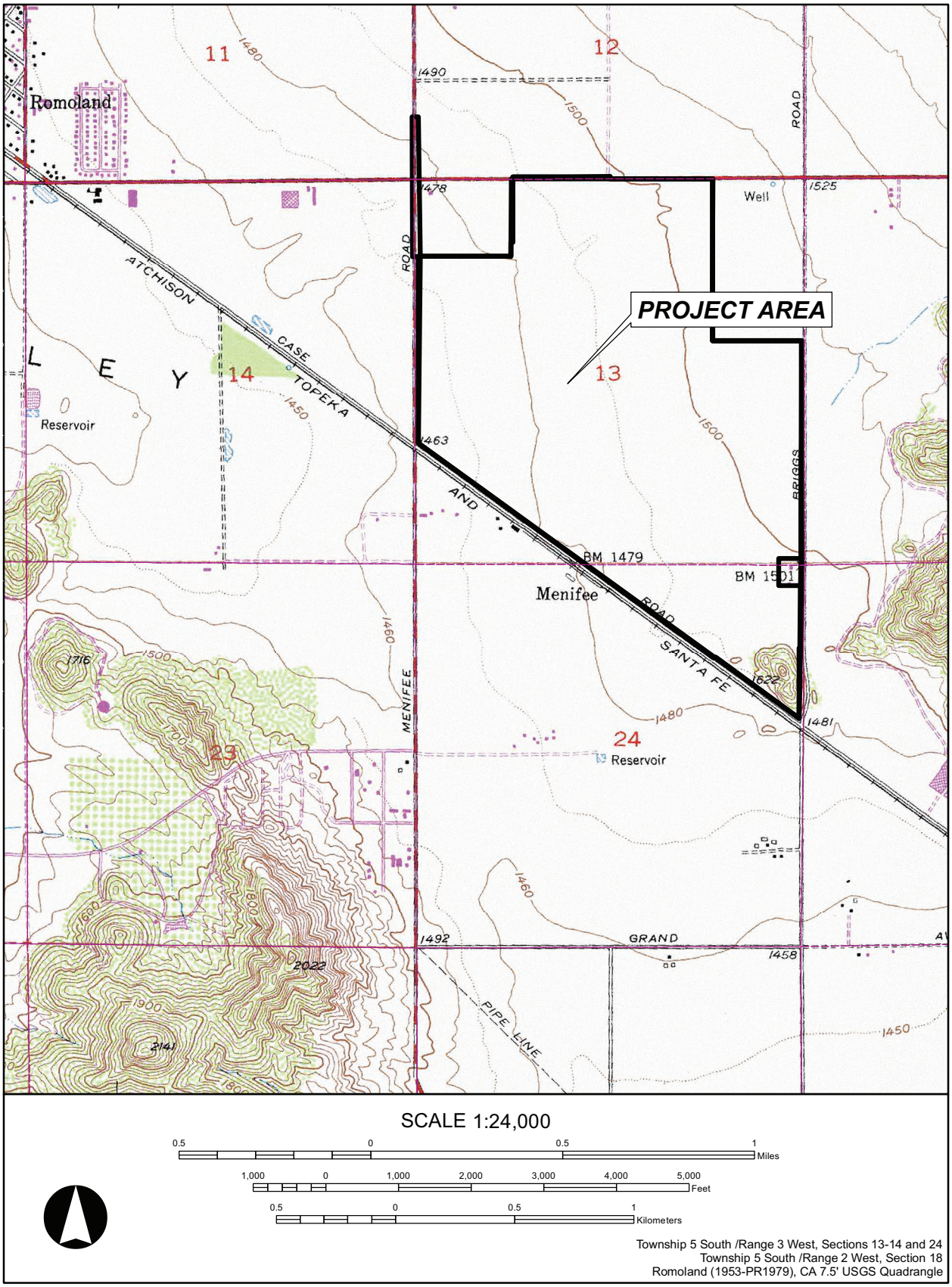


Figure 1-2. Project Location map.

paleontological resources, and (4) provide Project-specific mitigation measures to be implemented during Project development (as necessary).

1.3 REPORT ORGANIZATION

This report documents the results of Æ's paleontological resource assessment of the Project area. Chapter 1 has introduced the scope of work, identified the Project location, described the Project, and defined the purpose of the investigation. Chapter 2 outlines the regulatory framework governing the Project. Chapter 3 presents the paleontological resource guidelines and professional standards used for this assessment, and Chapter 4 presents the methods. The geology and paleontology of the Project area are discussed in Chapter 5, and the results of the field survey are presented in Chapter 6. Chapter 7 provides analysis, and management recommendations are provided in Chapter 8. The conclusions are discussed in Chapter 9, followed by a list of references in Chapter 10.

2
REGULATORY FRAMEWORK

Paleontological resources (i.e., fossils) are considered to be nonrenewable scientific resources because once destroyed, they cannot be replaced. As such, paleontological resources are afforded protection under the various federal, state, and local laws and regulations briefly discussed in this chapter.

2.1 FEDERAL LAWS

Federal laws and regulations apply only when projects are located on federal lands or federally managed lands, or when they are federally funded. Federal laws pertinent to paleontological resources include the NEPA of 1969, the Federal Land Policy and Management Act of 1976, Statute 23 USC 305 Archaeological and Paleontological Salvage, and the Antiquities Act of 1906. Additionally, the Paleontological Resources Protection Act (PRPA) was recently enacted as a result of the passage of the Omnibus Public Lands Management Act of 2009. The PRPA requires federal land management agencies to manage and protect paleontological resources and affirms the authority of existing policies already in place. Caltrans is both the CEQA and federal lead agency for this Project; therefore, State and local regulations will apply.

2.2 STATE LAW, REGULATIONS, AND GUIDELINES

2.2.1 California Environmental Quality Act of 1970 (Public Resources Code [PRC] Section 21000 et seq.)

Paleontological resources cannot be replaced once they are destroyed. Therefore, paleontological resources are considered nonrenewable scientific resources and are protected under the CEQA. Specifically, in Section V(c) of Appendix G of the CEQA Guidelines, the "Environmental Checklist Form," the question is posed: "Will the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" In order to determine the uniqueness of a given paleontological resource, it must first be identified or recovered (i.e., salvaged). Therefore, mitigation of adverse impacts to paleontological resources is mandated by CEQA.

2.2.2 Public Resources Code Section 5097.5

No person shall knowingly and willfully excavate upon, or remove, destroy, injure or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor. As used in this section, "public lands" means lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

2.3 CITY OF MENIFEE

Paleontological resources are addressed under the Open Space and Conservation Element OSC-5 of the City of Menifee General Plan, Goal OSC-5, which aims to "protect" cultural resources, including paleontological resources. Specifically, Policy OCS-5.1 mandates that City (2013) "preserve and protect archaeological and historic resources and cultural sites, places, districts, structures, landforms, objects and native burial sites, traditional cultural landscapes and other features, consistent with state law and any laws, regulations or policies which may be adopted by the city to implement this goal and associated policies."

3
PALEONTOLOGICAL RESOURCE ASSESSMENT GUIDELINES

3.1 DEFINITION OF PALEONTOLOGICAL RESOURCES AND SIGNIFICANCE CRITERIA

Paleontological resources are the evidence of once-living organisms as preserved in the rock record. They include both the fossilized remains of ancient plants and animals and the traces thereof (trackways, imprints, burrows, etc.). In general, fossils are considered to be greater than 5,000 years old (older than Middle Holocene) and are typically preserved in sedimentary rocks. Although rare, fossils can also be preserved in volcanic rocks and low-grade metamorphic rocks formed under certain conditions (SVP, 2010).

Significant paleontological resources are defined as "identifiable" vertebrate fossils and uncommon invertebrate, plant, and trace fossils that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, or biochronological data (SVP, 2010). These data are important because they are used to examine evolutionary relationships, provide insight on the development of and interaction between biological communities, establish time scales for geologic studies, and for many other scientific purposes (Scott and Springer, 2003; SVP, 2010).

3.2 PROFESSIONAL STANDARDS AND PALEONTOLOGICAL RESOURCE SENSITIVITY

Absent specific agency guidelines, most professional paleontologists in California adhere to guidelines set forth by SVP in "Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources" (SVP, 2010). These guidelines establish detailed protocols for the assessment of the paleontological resource potential (i.e., "sensitivity") of a project area and outline measures to follow in order to mitigate adverse impacts to known or unknown fossil resources during project development. In order to prevent project delays, SVP highly recommends that the owner or developer retain a qualified professional paleontologist in the advanced planning phases of a project to conduct an assessment and to implement paleontological mitigation during construction, as necessary.

Using baseline information gathered during a paleontological resource assessment, the paleontological resource potential of the geologic unit(s) (or members thereof) underlying a project area can be assigned to one of four categories defined by SVP (2010). These categories include high, undetermined, low, and no potential. The criteria for each sensitivity classification, and the corresponding mitigation recommendations, are summarized in Table 3-1 below.

If a project area is determined to have high or undetermined potential for paleontological resources following the initial assessment, then SVP recommends that a paleontological resources mitigation plan be developed and implemented during the construction phase of a project. The mitigation plan describes, in detail, when and where paleontological monitoring will take place and establishes communication protocols to be followed in the event that an unanticipated fossil discovery is made during project development. If significant fossil resources are known to occur within the boundaries of the project and have not been collected, then the

plan will outline the procedures to be followed prior to the commencement of construction (i.e., preconstruction salvage efforts or avoidance measures, including fencing off a locality). Should microfossils be known to occur in the geologic unit(s) underlying the project area or suspected to occur, then the plan will describe the methodology for matrix sampling and screening.

Table 3-1
Paleontological Sensitivity Categories

Resource Potential	Criteria	Mitigation Recommendations
No Potential	Rock units that are formed under or exposed to immense heat and pressure, such as high-grade metamorphic rocks and plutonic igneous rocks.	No mitigation required.
Low Potential	Rocks units that have yielded few fossils in the past, based upon review of available literature and museum collections records. Geologic units of low potential also include those that yield fossils only on rare occasion and under unusual circumstances.	Mitigation is not typically required.
Undetermined Potential	In some cases, available literature on a particular geologic unit will be scarce and a determination of whether or not it is fossiliferous or potentially fossiliferous will be difficult to make. Under these circumstances, further study is needed to determine the unit's paleontological resource potential (i.e., field survey).	A field survey is required to further assess the unit's paleontological potential.
High Potential	Geologic units with high potential for paleontological resources are those that have proven to yield vertebrate or significant invertebrate, plant or trace fossils in the past or are likely to contain new vertebrate materials, traces, or trackways. Rock units with high potential also may include those that contain datable organic remains older than late Holocene (e.g., animal nests or middens).	Typically, a field survey as well as onsite construction monitoring will be required. Any significant specimens discovered will need to be prepared, identified, and curated into a museum. A final report documenting the significance of the finds will also be required.

Adapted from SVP (2010).

The paleontological mitigation plan should be prepared by a qualified professional paleontologist and developed using the results of the initial paleontological assessment and survey. Elements of the plan can be adjusted throughout the course of a project as new information is gathered and conditions change, so long as the lead agency is consulted and all parties are in agreement. For example, if after 50 percent of earth disturbing activities have occurred in a particular unit or area, and no fossils whatsoever have been discovered, then the project paleontologist can reduce or eliminate monitoring efforts in that unit or area.

4
METHODS

4.1 LITERATURE REVIEW AND RECORDS SEARCH

Paleontological resources are not found in "soil" but are contained within the geologic deposits or bedrock that underlies the soil layer. Therefore, in order to ascertain whether a particular study area has the potential to contain significant fossil resources at the subsurface, it is necessary to review relevant scientific literature and geologic mapping to determine the geology and stratigraphy of the area. Further, to delineate the boundaries of an area of paleontological sensitivity, it is necessary to determine the extent of the entire geologic unit because paleontological sensitivity is not limited to surface exposures of fossil material. To determine whether fossil localities have been previously discovered within the Project area or a particular rock unit, a search of pertinent local and regional museum repositories for paleontological localities within and near the Project was performed. For this Project, a museum records search was conducted at the Natural History Museum of Los Angeles County (LACM).

4.2 FIELDWORK

A field visit to the Project area was conducted on June 1-2, 2016 by Heather Clifford and May 24, 2018 by Patrick Moloney. The purpose of the field survey was to inspect the ground surface visually for exposed fossils and to evaluate geologic exposures for their potential to contain preserved fossil material at the subsurface.

5
GEOLOGY AND PALEONTOLOGY

5.1 REGIONAL GEOLOGY

The Project area is located in the Menifee-Perris Valley within the northern part of the geologically complex Peninsular Ranges geomorphic province. A geomorphic province is a region of unique topography and geology that is distinguished from other regions based on its landforms and diastrophic history. The Peninsular Ranges are a northwest-southeast oriented complex of blocks that extend 125 miles from the Transverse Ranges and Los Angeles Basin to the tip of Baja California. The Peninsular Ranges are bounded to the east by the Colorado Desert and range in width from 30 to 100 miles (Norris and Webb, 1976). The Project area is situated approximately 13 miles east of the Santa Ana Mountains and 2 miles southwest of the Lakeview Mountains, within the central part of the Perris Block, a relatively stable rectangular structural unit positioned between the Elsinore and San Jacinto fault zones (Morton, et al., 2003). The geology in the vicinity of the Project area includes Mesozoic metasedimentary rocks intruded by Cenozoic igneous rocks, which are unconformably overlain by Neogene to Quaternary sedimentary deposits (Figure 5-1) (Morton and Miller, 2006).

5.2 GEOLOGY AND PALEONTOLOGY OF THE PROJECT AREA

The Project area is mapped at a scale of 1:24,000 by Morton et al. (2003) and a scale of 1:100,000 by Morton and Miller (2006). According to published geologic mapping, the geologic units underlying the Project area include Cretaceous igneous granitic bedrock and Quaternary alluvial fan deposits (Figure 5-2).

5.2.1 Cretaceous Granodiorite to Tonalite (Kdvg)

Cretaceous granitic bedrock is exposed in a weathered outcrop along the southeastern Project boundary, near the intersection of Case (Matthews) Road and Briggs Road. The composition of the intrusive igneous rock grades from medium-grained biotite-hornblende granodiorite into tonalite, with moderately abundant mafic inclusions (Morton and Miller, 2006). The granitic rock belongs to the Domenigoni Valley pluton of the Peninsular Ranges Batholith. Plutonic igneous rocks do not contain fossils due to their high heat of formation deep below the surface of the Earth.

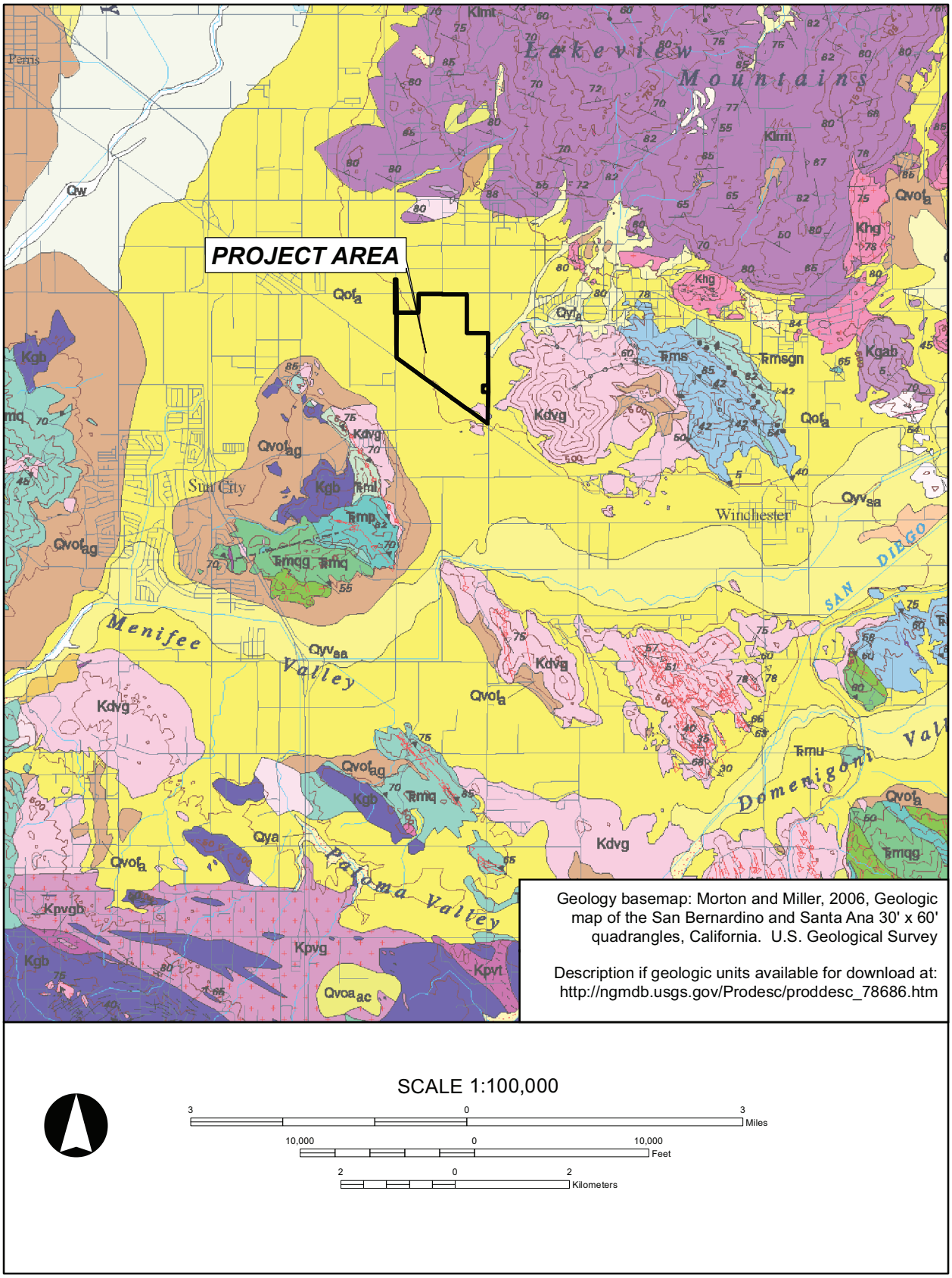


Figure 5-1 Regional geology in the vicinity of the Project area.

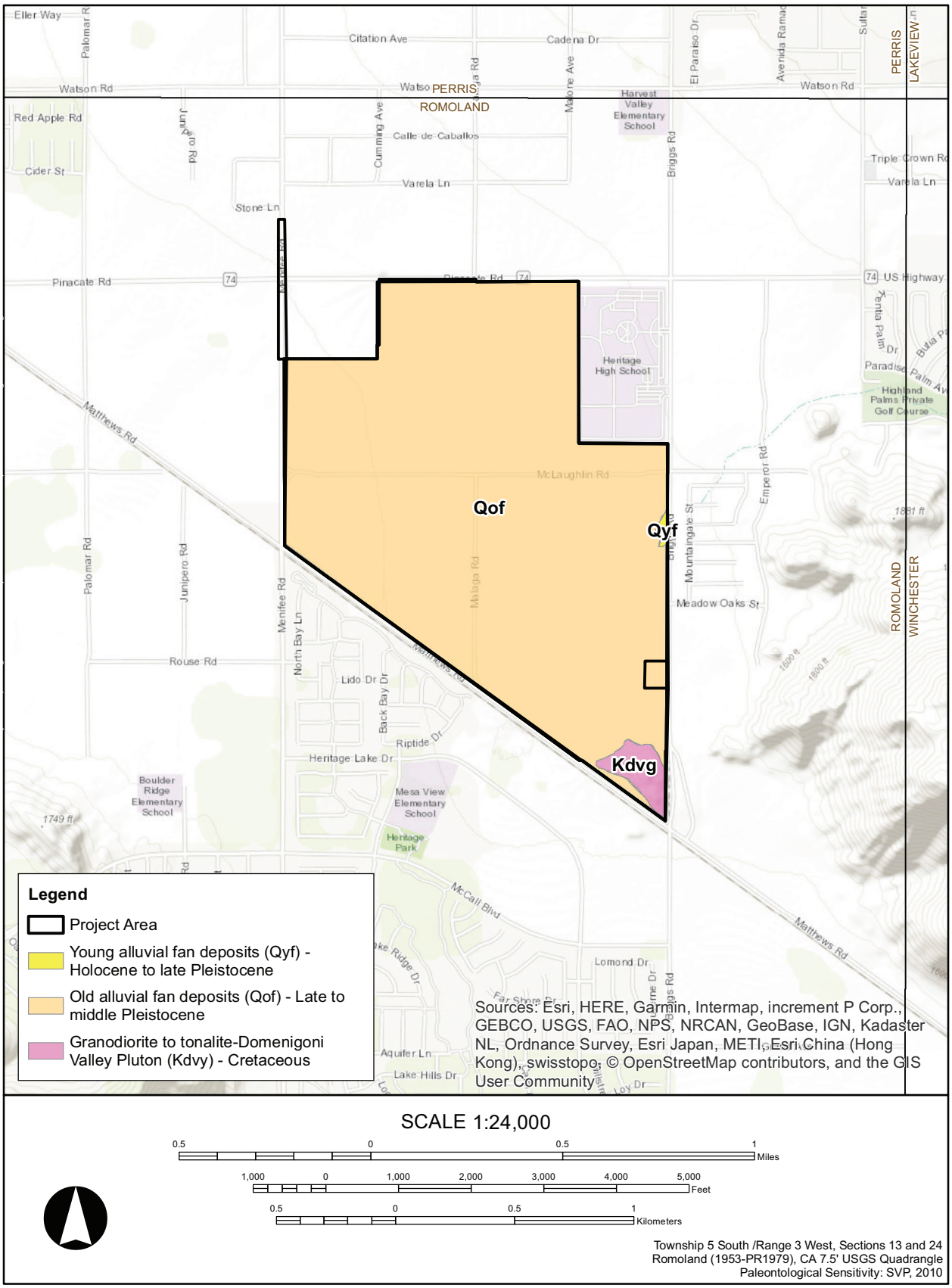


Figure 5-2 Geologic units in the Project area.

5.2.2 Old Alluvial Fan Deposits (Qof)

The Project area is immediately underlain by middle to late Pleistocene alluvial fan deposits. The Quaternary older alluvial fan deposits (Qof) disconformably overlie the granodiorite to tonalite bedrock at an unknown but likely relatively shallow depth (McLeod, 2016). The surficial sediments are composed of tan to reddish-brown sandstone and siltstone that was deposited in alluvial fan and local channel environments during the Pleistocene. The deposits are moderately consolidated and poorly indurated, with angular to subangular clasts, local pebble conglomerate lenses, moderate soil formation, and abundant dissection (Morton et al., 2003; Morton and Miller, 2006).

Pleistocene age alluvial, fluvial, and lacustrine deposits have proven to yield scientifically significant paleontological resources throughout Southern California from the coastal areas to the inland valleys. Just northeast of the Project area, in the vicinity of Lakeview, a diverse assemblage of fossil resources has been recovered including Mammuthus sp. (mammoth), Smilodon sp. (sabre-toothed cat), Equus sp. (extinct horse), Bison sp. cf. B. antiquus (bison), and numerous small mammals, reptiles, invertebrates, and plant remains (Springer et al., 2009). Southeast of the Project area, the largest known open-environment non-asphaltic late Pleistocene fossil assemblage has been documented in Diamond and Domenigoni valleys. Discovered during excavations of the Diamond Valley Lake, this locality has yielded nearly 100,000 identifiable fossils representing over 105 vertebrate, invertebrate, and plant taxa. The vertebrate taxa recovered includes reptiles such as frogs, turtles, and lizards; birds such as robins, swallows, jays, ravens, hawks, and ducks; small mammals such as rabbit, squirrel, mice, and weasels; and large mammals such as fox, bear, coyote, deer, bison, mammoths, mastodons, and ground sloths (Springer et al., 2009). The invertebrate taxa recovered includes ostracodes, snails, termites, slugs, beetles, and bivalves and the plant taxa recovered includes well preserved diatoms, pollen, and wood debris (Anderson et al., 2002). Northwest of the Project area near Lake Mathews, Ustatochoerus cf. californicus (ground dwelling herbivore) and fossilized camel remains were recovered within late Cenozoic fluvial and alluvial deposits (Woodford et al., 1971).

5.2.3 Young Alluvial Fan Deposits (Qyf)

Holocene alluvial fan deposits (Qya), derived from nearby highlands, are restricted to a small western portion of the Project area where they overlie the older Quaternary alluvium. These deposits consist of unconsolidated, moderately dissected, sand, silt, and clay-bearing alluvium (Morton et al., 2003). Holocene age alluvial sediments are typically too young to contain fossilized material (SVP, 2010), but they may overlie sensitive older deposits at an unknown but potentially shallow depth.

6
PALEONTOLOGICAL FIELD RECONNAISSANCE

A field survey of the Project area and vicinity was conducted by Æ Associate Paleontologist Clifford on June 1-2, 2016. During the course of fieldwork, a pedestrian walkover was performed in areas of high paleontological sensitivity within the Project area, published geologic maps were verified, and the ground surface within the Project boundary was visually examined for the evidence of paleontological resources. Special attention was paid to areas where the underlying geologic deposits were exposed (e.g., within the drainage channels). Project areas obscured at the surface or deemed to have no sensitivity for paleontological resources (e.g., granitic outcrops with no paleontological resource potential), were not comprehensively examined; however, the majority of the Project area was subject to an intensive pedestrian walkover. A windshield survey of the geology and topography surrounding the Project area was accomplished, and rock outcrops were examined for surface fossils. Project areas underlain by Quaternary sedimentary units were found to be 99 percent obscured by vegetation, soil development, refuse and spoils piles, previous tilling and grading, and unpaved road construction. In the field, Clifford utilized a tablet computer equipped with Global Positioning System (GPS), topographic maps, and aerial photographs to locate geologic formation and Project area boundaries. Notes were taken on the regional geology and lithology of exposed sediments, and photographs were taken to document the survey (Figure 6-1).

Figure 6-1 Overview of the Project area from the southwestern corner, near Menifee Road, view to the northeast.

The topography of the Project area consists of a relatively flat agricultural plain, bisected by ephemeral drainages, and bounded in the southeast corner by a steep granitic outcrop, which rises approximately 120 feet from the valley floor (Figure 6-2). In the central to northern Project area, Quaternary older alluvial fan (Qof) deposits are exposed along ephemeral drainage channels, though not well. These late Pleistocene sediments are overlain by 2 – 4 feet of poorly developed soil, composed of organic-poor tan to light brown loamy soil with scant rounded granule-, subangular pebble-, and angular cobble-sized clasts of granitic rock fragments. Based on field observations made along the drainage channel cutbanks (Figure 6-3), the Quaternary older alluvial fan deposits in the Project area are composed of unconsolidated to poorly consolidated, tan to brown, coarse sand and silt, with 50 percent angular granitic clasts of predominately fine pebble size (2 – 10 millimeter [mm], average). Bedding is massive to indistinct, and no other sedimentary structures are visible in the older alluvial fan deposits, which are exposed below approximately 2 – 4 feet of soil development (Figure 6-4). Elsewhere in the Project area, the Quaternary older alluvial fan deposits underlying the Project area are completely obscured by vegetation, soil development, and previous anthropogenic ground disturbances, including irrigation pipelines and tilling to an approximate depth of 2 – 3 feet below ground surface (bgs) (Figure 6-5). Vegetation consists of dense grasses and shrubs, approximately 1 – 2 feet in height.

Figure 6-2 Granodiorite outcrop in the southeastern Project area that rises approximately 120 feet above the valley floor, view to the east.

Figure 6-3 Drainage channel bisects the central portion of the Project area, view to the southwest.

Figure 6-4 Quaternary older alluvial fan deposits in the Project area, composed of poorly consolidated, tan to brown, coarse granitic gravel, sand, and silt. Poorly exposed below approximately 2 – 4 feet of soil development, view to the south.

Figure 6-5 Quaternary older alluvial fan deposits underlying the Project area are nearly completely obscured by soil development, vegetation, and previous anthropogenic ground disturbances, including tilling to a depth of 2 – 3 feet bgs. View to the northwest.

No fossil resources were discovered during the course of fieldwork. However, nearly 100 percent of the survey area was obscured by vegetation, soil development, or anthropogenic disturbances, which limited surface visibility. The Pleistocene sedimentary deposits that underlie the majority of the Project area are characterized by fine- to medium-grained sediments that have proven to be conducive to the preservation of vertebrate remains in Riverside County; therefore, these rock units may contain an unknown number of fossil resources at the subsurface.

7
ANALYSIS AND RESULTS

7.1 MUSEUM RECORDS SEARCH RESULTS

To determine whether fossil localities have been previously discovered within the Project area, a museum records search was performed at the LACM on May 31, 2016. The LACM reports that there are no previously recorded vertebrate fossil localities directly within Project boundaries; however, McLeod (2016) reports that locality LACM 5168, recorded southwest of the Project area on the western margin of Menifee Valley near the Railroad Canyon Reservoir, yielded fossil remains of horse from similar Quaternary older alluvium. Additionally, McLeod (2016) reports that another vertebrate fossil locality, LACM 6059, was identified relatively near the Project area in the vicinity of Lake Elsinore. LACM 6059 yielded a specimen of fossil camel from similar Pleistocene alluvial deposits. The results of the museum records and database search are summarized below in Table 7-1 and provided in Appendix B.

Table 7-1
Vertebrate Localities Reported in the Vicinity of the Project Area in Riverside County

Locality No.	Geologic Unit	Age	Taxa
LACM 5168	Quaternary older alluvium	Pleistocene	*Equus* sp.
LACM 6059	Quaternary older alluvium	Pleistocene	*Camelops* sp. (camel)

Source: McLeod, 2016

7.2 DETERMINATION OF PALEONTOLOGICAL RESOURCE POTENTIAL FOR GEOLOGIC UNITS WITHIN THE PROJECT AREA

Based on the literature review, museum records search results, and field survey, the majority of the Project area is underlain by geologic units determined to have a low to high paleontological sensitivity, in accordance with criteria set forth by SVP (2010). The Quaternary older alluvial fan deposits have a high potential for paleontological resources because similar deposits in the vicinity of the Project area and throughout Riverside County have proven to yield significant vertebrate fossils; however, near the surface, the Quaternary older alluvium has been disturbed by previous agricultural activities and soil development to a depth of 2 – 4 feet bgs. Therefore, the Quaternary older alluvium in the Project area has a low to high paleontological resource potential, dependent on depth. Further, the Riverside County General Plan (2008), which identifies the paleontological sensitivity of the surficial geologic deposits within the County, shows that the Project area has a high potential (High B; Hb) for buried paleontological resources, which indicates that fossil resources may occur at depths as shallow 4 feet bgs.

The younger Quaternary alluvial fan deposits, restricted to a very small area of the central-eastern Project area, have a low paleontological resource potential, because they are generally too young to preserve fossilized remains; however, they may shallowly overlie older intact Pleistocene alluvium. Cretaceous igneous plutonic rock (e.g., granodiorite to tonalite) has no paleontological resource potential due to the high heat of formation deep below the surface.

As a result of the high paleontological sensitivity of the Project area, further paleontological resource management is recommended during Project development. Refer to Figure 7-1 for the sensitivity rating of the geologic unit underlying the Project area. In addition, Figure 7-2 presents the paleontological sensitivity of the Project area as shown on Riverside County's (2008) paleontological sensitivity map.

Table 7-2
Paleontological Sensitivity of the Geologic Units Underlying the Project Area

Age	Geologic Unit	Typical Fossil Specimens	Paleontological Resource Potential (SVP, 2010)
Cretaceous	Granodiorite to tonalite (Kdvg)	None	None
Middle to early Pleistocene	Quaternary older alluvial fan deposits (Qof)	Vertebrates; terrestrial mammals	Low to high; high paleontological sensitivity 4 feet or greater bgs
Holocene	Quaternary alluvial fan deposits (Qya)	None	Low

Geology from Morton et al. (2003) and Morton and Miller (2006).

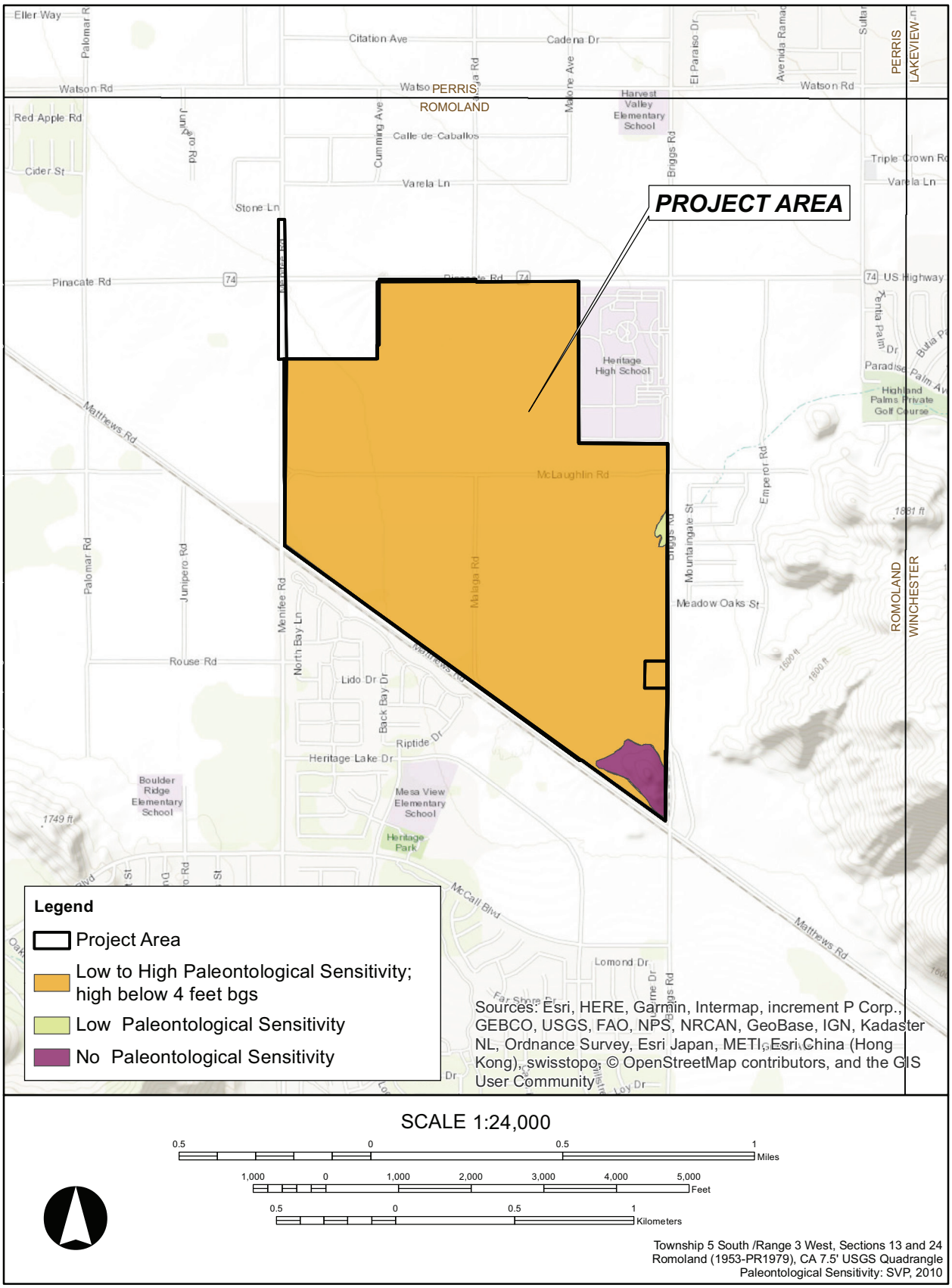


Figure 7-1 Paleontological Sensitivity in the Project Area.

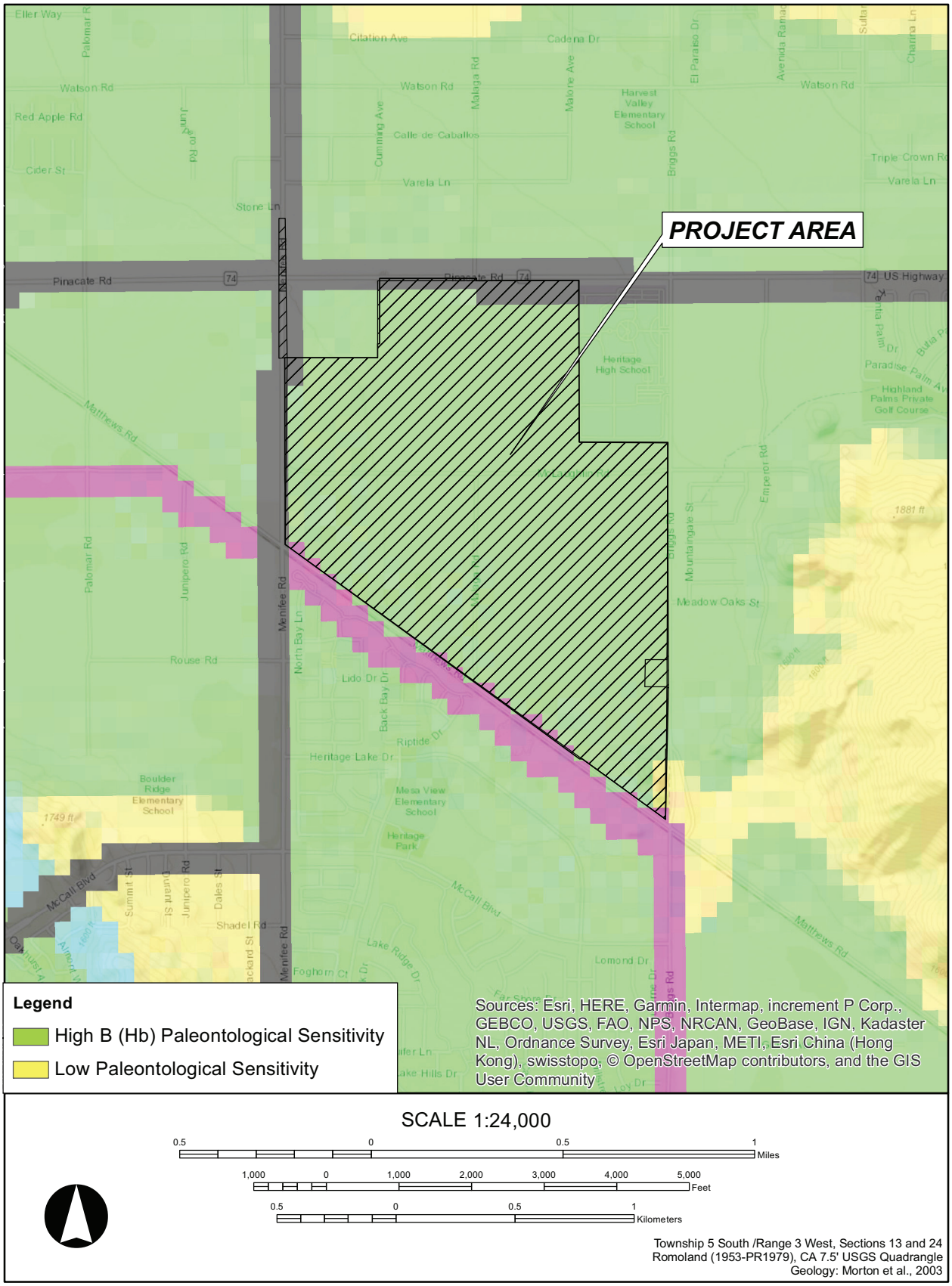


Figure 7-2 Paleontological Sensitivity of the Project Area, as depicted in the Riverside County General Plan (2008).

8
FINDINGS AND MANAGEMENT RECOMMENDATIONS

In general, the potential for a given project to result in adverse impacts to paleontological resources is directly proportional to the amount of ground disturbance associated with the project. Since this Project entails the development of residential housing, new ground disturbances are anticipated. Ground disturbance is planned for portions of the Project area that are underlain by sedimentary deposits with a low to high potential for buried paleontological resources. Based on published USGS geologic maps, available literature, and the Paleontological Sensitivity Resources map in the Multipurpose Open Space Element of the Riverside County General Plan (2008), ground disturbances of depths 4 feet and greater bgs, below the moderately developed soil, may adversely impact paleontological resources in the Project area; therefore, the following management recommendations are set forth. By implementing the management recommendations outlined in the following sections, including worker's environmental awareness training and on-site construction monitoring, adverse impacts to paleontological resources can be reduced to a less than significant level pursuant to the requirements of CEQA and NEPA. These measures have been used by professional paleontologists for many years and have proven to be effective in reducing or eliminating adverse impacts to paleontological resources as a result of private and public development projects throughout California and elsewhere.

8.1 WORKER'S ENVIRONMENTAL AWARENESS TRAINING

Prior to the start of construction, all field personnel should be briefed regarding the types of fossils that could be found in the Project area and the procedures to follow should paleontological resources be encountered. This training should be accomplished at the pre-grade kick-off meeting or morning tailboard meeting and should be conducted by the Project Paleontologist or his/her representative. Specifically, the training should provide a description of the fossil resources that may be encountered in the Project area, outline steps to follow in the event that a fossil discovery is made, and provide contact information for the Project Paleontologist and on-site monitor(s). The training should be developed by the Project Paleontologist and may be conducted concurrent with other environmental training (e.g., cultural and natural resources awareness training, safety training, etc.).

8.2 PALEONTOLOGICAL MITIGATION MONITORING

Prior to the commencement of ground-disturbing activities, a qualified professional paleontologist will be retained to prepare and implement a Paleontological Resource Impact Mitigation Program (PRIMP) for the Project. Initially, full-time monitoring is recommended for grading and excavation activities 4 feet bgs that will disturb previously undisturbed Quaternary older alluvium (Qof), according to criteria set forth by SVP (2010). Due to soil development and previous agricultural disturbances, monitoring will not be required in Project areas where construction activities disturb native sediments at depths less than 4 feet bgs.

Spot-checking may occur in previously undisturbed young alluvial deposits (Qya) in order to determine if Project activities are impacting the underlying highly sensitive Pleistocene units.

Monitoring will not be required in Project areas underlain by geologic units with no paleontological resource potential (i.e., the granodiorite to tonalite, Kdvg).

Monitoring will entail the visual inspection of excavated or graded areas and trench sidewalls. In the event that a paleontological resource is discovered, the monitor will have the authority to divert temporarily the construction equipment around the find until it is assessed for scientific significance and collected. In areas of high sensitivity, monitoring efforts can be reduced or eliminated at the discretion of the Project Paleontologist if no fossil resources are encountered after 50 percent of the excavations are completed.

8.3 FOSSIL PREPARATION, CURATION, AND REPORTING

Upon completion of fieldwork, all significant fossils collected will be prepared in a properly equipped paleontology laboratory to a point ready for curation. Preparation will include the careful removal of excess matrix from fossil materials and stabilizing and repairing specimens, as necessary. Following laboratory work, all fossils specimens will be identified to the lowest taxonomic level, cataloged, analyzed, and delivered to the Western Science Center for permanent curation and storage. The cost of curation is assessed by the repository and is the responsibility of the Project owner.

At the conclusion of laboratory work and museum curation, a final report will be prepared describing the results of the paleontological mitigation monitoring efforts associated with the Project. The report will include a summary of the field and laboratory methods, an overview of the Project area geology and paleontology, a list of taxa recovered (if any), an analysis of fossils recovered (if any) and their scientific significance, and recommendations. If the monitoring efforts produced fossils, then a copy of the report will also be submitted to the Western Science Center.

9
CONCLUSIONS

This assessment is based on the results of a museum records search, review of available geologic and paleontologic literature, and a pedestrian survey of exposed geologic units within the Project area. No fossils were observed during the field survey; therefore, only fossils that have already been inventoried or collected are available for this analysis. Based on this analysis, the Project area is in part underlain by geologic units determined to have high paleontological sensitivity with a high potential for buried fossils resources. These nonrenewable scientific resources may be at risk of being adversely impacted by earth-disturbing activities during the development of the Project. By implementing the management recommendations presented in Chapter 8, adverse impacts to paleontological resources can be reduced to a less than significant level pursuant to the requirements of CEQA and NEPA.

10
REFERENCES CITED

Anderson, R.S., Power, M.J., Smith, S.J., Springer, K., and Scott, E., 2002, Paleoecology of a middle Wisconsin deposit from southern California: Quaternary Research, v. 58, p. 310-317.

City of Menifee, 2013, City of Menifee General Plan, Open Space and Conservation Element. Electronic document available at: https://www.cityofmenifee.us/250/Open-Space-Conservation-Element (accessed February 9, 2016).

County of Riverside, 2008, County of Riverside General Plan, Updated 2008, General Plan Amendment No. 960, Public Review Draft, March 2014. Riverside County Planning Department, Electronic document available at: planning.rctlma.org/ZoningInformation /GeneralPlan.aspx (accessed February 10, 2015).

McLeod, S.A., 2016, Unpublished museum collections records. Los Angeles County Museum of Natural history.

Morton, D.M., Bovard, K.R., and Morton, G., 2003, Geologic map and digital database of the Romoland 7.5' quadrangle, Riverside County, California. U.S. Geological Survey, Open-File Report OF-2003-102, scale 1:24,000.

Morton, D.M. and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: U.S. Geological Survey, Open-File Report OF-2006-1217, scale 1:100,000.

Norris, R.M., and Webb, R.W., 1976, Geology of California: New York, John Wiley & Sons, 378p.

Riverside County Planning Department, 2008, County of Riverside General Plan, Updated 2008, General Plan Amendment No. 960, Public Review Draft, March 2014,

Scott, E., and Springer, K., 2003, CEQA and Fossil Preservation in California: The Environmental Monitor Fall 2003, Association of Environmental Professionals, Sacramento, California.

Society of Vertebrate Paleontology, 2010, Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources: Society of Vertebrate Paleontology Impact Mitigation Guidelines Revision Committee, http://vertpaleo.org/PDFS/8f/8fe02e8f-11a9-43b7-9953-cdcfaf4d69e3.pdf.

Springer, K., Scott, E., Sagebiel, J.C., and Murray, L.K., 2009, The Diamond Valley Lake Local Fauna - Late Pleistocene Vertebrates from Inland Southern California, *in* Albright, L.B., III, ed., Papers on Geology, Vertebrate Paleontology, and Biostratigraphy in Honor of Michael O. Woodburne, Museum of Northern Arizona Bulletin 65, Flagstaff, Arizona.

Woodford, A.O., Shelton, J.S., Doehring, D.O., and Morton, R.K., 1971, Pliocene-Pleistocene History of the Perris Block, Southern California: Geological Society of America Bulletin, v. 82, p. 3421-3448.

APPENDIX A

LACM Record Search Results

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

tel 213.763.DINO
www.nhm.org

NATURAL HISTORY MUSEUM
LOS ANGELES COUNTY

Vertebrate Paleontology Section
Telephone: (213) 763-3325
Fax: (213) 746-7431
e-mail: smcleod@nhm.org

31 May 2016

Applied EarthWorks, Inc.
133 North San Gabriel Boulevard, Suite 201
Pasadena, CA 91107-3414

Attn: Heather Clifford, Associate Paleontologist / Geologist

re: Paleontological resources for the proposed Brookfield Minor Ranch Project, near Romoland, Riverside County, project area

Dear Heather:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for the proposed Brookfield Minor Ranch Project, near Romoland, Riverside County, project area as outlined on the portion of the Romoland USGS topographic quadrangle map that you sent to me via e-mail on 16 May 2016. We do not have any vertebrate fossil localities that lie directly within the proposed project area, but we do have localities farther afield from sedimentary deposits similar to those that may occur subsurface in the proposed project area.

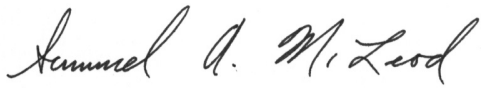
The hill in the very southeastern corner of the proposed project area is composed of plutonic igneous rocks that will not contain recognizable fossils. These rocks probably underlie the remainder of the proposed project area at unknown depth. Most of the proposed project area though has surface sediments that consist of older Quaternary Alluvium, derived as alluvial fan from the Lakeview Mountains to the northeast and from Double Butte just to the east. These Quaternary alluvial fan deposits typically do not contain significant vertebrate fossils, at least in the uppermost layers, and we have no fossil vertebrate localities very nearby from these types of deposits, but they may have pockets of finer-grained sediments, particularly at depth, that may well contain significant vertebrate fossil remains. Our closest vertebrate fossil localities in somewhat similar older Quaternary deposits are LACM 5168, southwest of the proposed project

area on the western margin of Menifee Valley around the Railroad Canyon Reservoir, that contained a fossil specimen of horse, *Equus*, and LACM 6059, further southwest of the proposed project area around Lake Elsinore, that produced a specimen of fossil camel, *Camelops*.

Excavations in the igneous rocks exposed on the hill in the southeastern-most portion of the proposed project area will not encounter any recognizable fossils. Grading or shallow excavations in the Quaternary alluvial fan deposits exposed in the rest of the proposed project area are unlikely to encounter significant vertebrate fossils. Deeper excavations that extend down into older and finer-grained deposits in those latter areas, however, may well uncover significant fossil vertebrate remains. Any substantial excavations in the sedimentary deposits in the proposed project area, therefore, should be monitored closely to quickly and professionally recover any fossil remains while not impeding development. Also, sediment samples should be collected and processed to determine the small fossil potential in the proposed project area. Any fossils collected should be placed in an accredited scientific institution for the benefit of current and future generations.

This records search covers only the vertebrate paleontology records of the Natural History Museum of Los Angeles County. It is not intended to be a thorough paleontological survey of the proposed project area covering other institutional records, a literature survey, or any potential on-site survey.

Sincerely,



Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: invoice