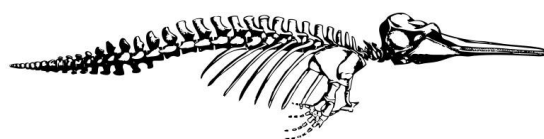


Appendix F

Paleontological Resources

**PALEONTOLOGICAL RESOURCE ASSESSMENT
BUENA VISTA HILLS
MASTER DEVELOPMENT PLAN
KERN COUNTY, CALIFORNIA**



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EXECUTIVE SUMMARY

This Paleontological Resource Assessment was prepared for the Buena Vista Hills Master Development Plan (MDP) of southwestern Kern County, California. The project encompasses roughly 19 square miles primarily in the Buena Vista Oil Field, near the cities of Taft and Fellows. The purpose of this report is to identify and summarize paleontological resources within the MDP area, and to provide recommendations for future development activities that may impact significant paleontological resources. This report also provides a recommended paleontological mitigation plan to be implemented in the event that future development will require earthwork impacting paleontologically sensitive strata.

Rock units that occur within the MDP area include Holocene-aged surficial sediments, Pleistocene-aged older alluvial deposits, and the Pleistocene-aged Tulare Formation. Following the Potential Fossil Yield Classification System (PFYC) of the Bureau of Land Management (BLM), the Holocene-aged surficial sediments have been assigned a PFYC of Low (Class 2), as they are too young to contain significant paleontological resources. Pleistocene-aged older alluvial deposits have been assigned a PFYC of Unknown (Class 3b), based on the sparse collections of terrestrial vertebrate and invertebrate fossils known from these deposits, as well as the alluvial and fluvial depositional environments represented by these strata which suggests the potential for preservation of more diverse fossil assemblages. Finally, the Tulare Formation has been assigned a PFYC of High (Class 4) based on the known occurrence of significant remains of terrestrial vertebrates (primarily mammals) and invertebrates in the upper portion of the formation, as well as the remains of freshwater vertebrates and invertebrates in the lower portion of the formation. Although no fossil localities are currently known from within the boundaries of the Buena Vista Hills MDP, the strong potential exists for the discovery of new localities.

Paleontological mitigation is recommended for any future development within the Buena Vista Hills MDP that will include earthwork anticipated to impact previously undisturbed strata of Pleistocene-aged older alluvial deposits or the Tulare Formation. Additionally, earthwork extending 10 or more feet below grade in areas underlain by Holocene surficial sediments is recommended for mitigation based on the potential that deeper layers or shallowly buried older alluvial deposits of Tulare Formation strata may be impacted. A notable exception is applied to drilling operations using an auger with a diameter smaller than about 24 inches. Such drilling-related earthwork is not recommended for paleontological mitigation, because it typically pulverizes any encountered paleontological resources, and this destruction cannot be avoided or mitigated.

Implementation of the provided paleontological mitigation plan during any future development that may impact Pleistocene-aged older alluvial deposits or the Tulare Formation will reduce impacts to paleontological resources to less than significant levels, and will fulfill any paleontological resource compliance requirements issued by the BLM. The mitigation plan includes mitigation measures to be implemented prior to the start of construction (contracting a Project Paleontologist and designating a professional repository, attendance of Project Paleontologist at pre-construction meetings, paleontological resource training provided for earth excavation personnel), during construction (paleontological monitoring of designated earthwork, salvage of discovered fossils), and post-construction (preparation and curation of any salvaged fossils, completion of final paleontological mitigation report).

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1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION AND SCOPE OF WORK

This report summarizes the results of a paleontological resource investigation for the Buena Vista Hills Master Development Plan (MDP) of southwestern Kern County, California. The project site encompasses approximately 19 square miles that are scattered in a checkerboard pattern along the axis of the Buena Vista Oil Field, with some areas in the Midway-Sunset Oil Field to the west. The MDP area is generally bordered to the west by State Route (SR) 33, and is bisected by SR-119 (Figure 1). The City of Taft and the town of Fellows are located immediately west of the MDP area, with the town of McKittrick located about 4.5 miles to the north. Buena Vista Creek generally flows along the northeast and eastern borders of the MDP area. The MDP area primarily occurs on federal lands managed by the Bureau of Land Management (BLM).

The purpose of this paleontological resource assessment is to provide baseline data on the paleontological resources of the Buena Vista Hills MDP area. The assessment will summarize existing paleontological resource data within the MDP area, discuss the significance of these resources, and examine potential impacts to paleontological resources that may occur during activities on the oil and gas fields. The assessment will highlight specific areas within the MDP that are paleontologically sensitivity, as well as specific types of earthwork operations that may negatively impact paleontological resources in sensitive areas.

Because paleontologically sensitive areas occur within the Buena Vista Hills MDP area, a paleontological mitigation plan (PMP) is also provided as an appendix. The PMP includes specific mitigation measures to be implemented prior to the start of earthwork, during construction, and post-construction. The plan also includes detailed, step-by-step instructions for implementing each of the mitigation measures. Implementing the guidelines provided in the PMP will reduce any project-related impacts to paleontological resources to less than significant levels, and will fulfill paleontological resource compliance requirements issued by the BLM.

This report was written by Shelly L. Donohue and Thomas A. Deméré, Ph.D. of the Department of PaleoServices, SDNHM.

1.2 DEFINITION OF PALEONTOLOGICAL RESOURCES

As defined here, paleontological resources (i.e., fossils) are the buried remains and/or traces of prehistoric organisms (i.e., animals, plants, and microbes). Body fossils such as bones, teeth, shells, leaves, and wood, as well as trace fossils such as tracks, trails, and burrows, are found in the geological deposits (formations) within which they were originally buried. The primary factor determining whether an object is a fossil or not isn't how the organic remain or trace is preserved (e.g., "petrified"), but rather the age of the organic remain or trace. Although typically it is assumed that fossils must be older than ~10,000 years (i.e., the generally accepted end of the last glacial period of the Pleistocene Epoch), organic remains of early Holocene age can also be considered to represent fossils because they are part of the record of past life.

Fossils are considered important scientific and educational resources because they serve as direct evidence of prehistoric life and are used to understand the history of life on Earth, the nature of past environments and climates, the membership and structure of ancient ecosystems, and the pattern and process of organic evolution and extinction. In addition, fossils are considered to be non-renewable resources because typically the organisms they represent no longer exist. Thus,

once destroyed, a particular fossil can never be replaced. And finally, for the purposes of this report, paleontological resources can be thought of as including not only the actual fossils, but also the collecting localities and the geological deposits containing those localities.

2.0 METHODS

2.1 PALEONTOLOGICAL RECORDS SEARCH

Formal paleontological records searches of the collections at the SDNHM and the University of California Museum of Paleontology (UCMP) were conducted for an area encompassing a 2-mile radius around the Buena Vista Hills MDP.

In addition to institutional record searches, a review was conducted of relevant published geologic maps and geologic and paleontological reports (e.g, Woodring et al., 1932; Dibblee, 1973; Dibblee and Minch, 2005), peer-reviewed papers (e.g., Merriam, 1903; Maher et al., 1975; Boessenecker and Poust, 2015), and any other relevant literature (e.g., field trip guidebooks, unpublished theses and dissertations, paleontological mitigation final reports). This approach was followed in recognition of the direct relationship between paleontological resources and the geologic formations within which they are entombed. Knowing the geologic history of a particular area and the fossil productivity of geologic formations that occur in that area, it is possible to predict where fossils will, or will not, be encountered.

2.2 RESOURCE ASSESSMENT CRITERIA: POTENTIAL FOSSIL YIELD CLASSIFICATION (PFYC)

In recognizing the fact that paleontological resources are considered to include not only actual fossil remains and traces, but also the fossil collecting localities and the geologic formations containing those fossils and localities, the Bureau of Land Management (BLM) developed a procedure for evaluating the paleontological resource potential of individual geologic rock units. This procedure utilizes the Potential Fossil Yield Classification (PFYC) system to assign ranks to rock units based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils (BLM, 2007). Under this system, geologic formations with a higher potential are assigned a higher class number. The PFYC system is outlined below:

2.2.1 PFYC CLASS 5 – VERY HIGH

Very high potential (PFYC Class 5) is assigned to geologic formations that consistently and predictably produce vertebrate fossils or scientifically significant invertebrate or plant fossils.

2.2.2 PFYC CLASS 4 – HIGH

High potential (PFYC Class 4) is assigned to geologic formations containing a high occurrence of significant fossils. Vertebrate fossils or scientifically significant invertebrate or plant fossils are known to occur and have been documented within these deposits, but may vary in occurrence and predictability.

2.2.3 PFYC CLASS 3A – MODERATE

Moderate potential (PFYC Class 3a) is assigned to geologic formations that are known to contain vertebrate fossils or scientifically significant non-vertebrate fossils, but these occurrences are widely scattered. These formations may contain common invertebrate or plant fossils.

2.2.4 PFYC CLASS 3B –UNKNOWN

Unknown potential (PFYC Class 3b) is assigned to geologic formations that exhibit geologic features and preservational conditions that suggest significant fossils could be present, but little information about the paleontological resources of the unit or the area is known. This may indicate the unit or area is poorly studied, and field surveys may uncover significant finds. The units in this Class may eventually be placed in another Class when sufficient survey and research is performed.

2.2.5 PFYC CLASS 2 –Low

Low potential (PFYC Class 2) is assigned to geologic formations that are not likely to contain vertebrate fossils or scientifically significant non-vertebrate fossils.

2.2.6 PFYC CLASS 1 –VERY LOW

Very Low potential (PFYC Class 1) is assigned to geologic formations that are not likely to contain recognizable fossil remains.

2.3 PALEONTOLOGICAL IMPACT ANALYSIS

Direct impacts to paleontological resources occur when earthwork activities (e.g., mass grading, trenching, sump excavation), cut into the geological rock units within which fossils are buried, and physically destroy the fossil remains. As such, only earthwork activities that will disturb potentially fossil-bearing sedimentary rocks (i.e., those rated with a PFYC of 3 or greater) have the potential to significantly impact paleontological resources. Paleontological mitigation typically is recommended to reduce any negative impacts to paleontological resources to less than significant levels.

The purpose of the impact analysis is to determine which (if any) of the proposed project-related earthwork activities may disturb potentially fossil-bearing sedimentary rocks, and where and at what depths this earthwork will occur. The paleontological impact analysis involved analysis of potential earthwork operations that may occur on an oil and gas field, and comparison with geological and paleontological data gathered during the record search and literature search.

3.0 EXISTING CONDITIONS: REGIONAL GEOLOGIC SETTING

Geographically, the Buena Vista Hills MDP region occurs in the Buena Vista and Midway valleys, surrounded by the Elk Hills to the northeast, the Temblor Range to the southwest, and the Buena Vista Lake Bed to the east. The low-lying Buena Vista Hills crop out in the southwestern portion of the MDP area. Published geologic maps and reports (e.g., Dibblee, 1973; Dibblee and Minch, 2005; Bedrossian et al., 2012) indicate that the Buena Vista Hills MDP occurs in an area underlain by deformed (folded and faulted) Pleistocene deposits of the Tulare Formation that are overlain in adjacent low lying areas by alluvial sediments of Pleistocene to Holocene age. Prior to deposition of the Tulare Formation, a late Cenozoic inland sea that was intermittently connected to the Pacific Ocean occupied the southern San Joaquin Valley. This inland sea receded during Pliocene to Pleistocene times as the adjacent Coast Ranges were being uplifted. Eventually the area became the site of a large freshwater lake, which deposited strata that make up the lower portion of the Tulare Formation. The Tulare Formation records the

eventual desiccation of this lake, and its replacement with rivers and streams, which deposited strata that make up the upper portion of the formation. Following deposition of the Tulare Formation, the western side of the San Joaquin Valley was deformed into a series of generally northwest trending anticlines and synclines, represented today by the folded strata exposed in the Elk Hills and Temblor Range adjacent to the MDP area (Woodring et al., 1932; Dibblee, 1973). During Pleistocene-time and extending to the present day (Holocene), the uplifted hills were incised by streams flowing, carving out river terraces while also depositing alluvial sediments.

3.1 HOLOCENE SURFICIAL SEDIMENTS

Holocene-aged surficial sediments in the form of alluvial valley deposits, alluvial fan deposits, and alluvial wash deposits can be found in the flat, low-lying areas of the MDP area. For the purposes of this report, all of these surficial sediments will be discussed together. Holocene surficial sediments are primarily composed of unconsolidated or poorly consolidated, poorly sorted clays, silts, sands, gravels, and cobbles that have been eroded from older formations (e.g., Tulare Formation, Monterey Formation) and transported downstream (Woodring et al., 1932; Dibblee, 1973; Dibblee and Minch, 2005). The most common clast types are white, subrounded, siliceous shales derived from the Monterey Formation (Woodring et al., 1932). The majority of the surficial sediments are the products of alluvial fans that are actively building outwards from the uplands of the Elk Hills, Buena Vista Hills, and Temblor Range. Streams and rivers dissecting the MDP area also contain finer-grained wash deposits or alluvial valley deposits. The most extensive alluvial valley deposits are located in the northern and eastern portions of the MDP area, adjacent to Buena Vista Creek, which drains into the former Buena Vista Lake (Figure 1).

The thickness of Holocene surficial sediments within the Buena Vista Hills MDP area is not precisely known. Dibblee (1973) estimated that the maximum thickness of Holocene sediments in the greater San Joaquin Valley is approximately 100 feet. However, in some areas these surficial sediments occur as veneers that may be as thin as one to ten feet. Underlying Holocene surficial sediments are old alluvial deposits of Pleistocene-age and/or the Tulare Formation.

3.2 PLEISTOCENE OLDER ALLUVIAL DEPOSITS

Pleistocene-aged older alluvial deposits are mapped on the flanks of the uplands in the vicinity of the Buena Vista Hills MDP area. These sediments primarily consist of alluvial fan deposits that were deposited during the Pleistocene and were subsequently uplifted by regional tectonic activity. The composition of older alluvial fan deposits is similar to that of the younger, Holocene-aged surficial sediments, with clasts derived from the Monterey Formation and other older formations in the surrounding uplands (Woodring et al., 1932; Dibblee, 1973). The older alluvial fans are typically distinguished from younger, Holocene-aged alluvial fans based on the greater number of erosional features (e.g., gullies and badland topography) in the former (Woodring et al., 1932). Additionally, older alluvial fan deposits may have a greater degree of induration and/or caliche formation than the Holocene-aged deposits.

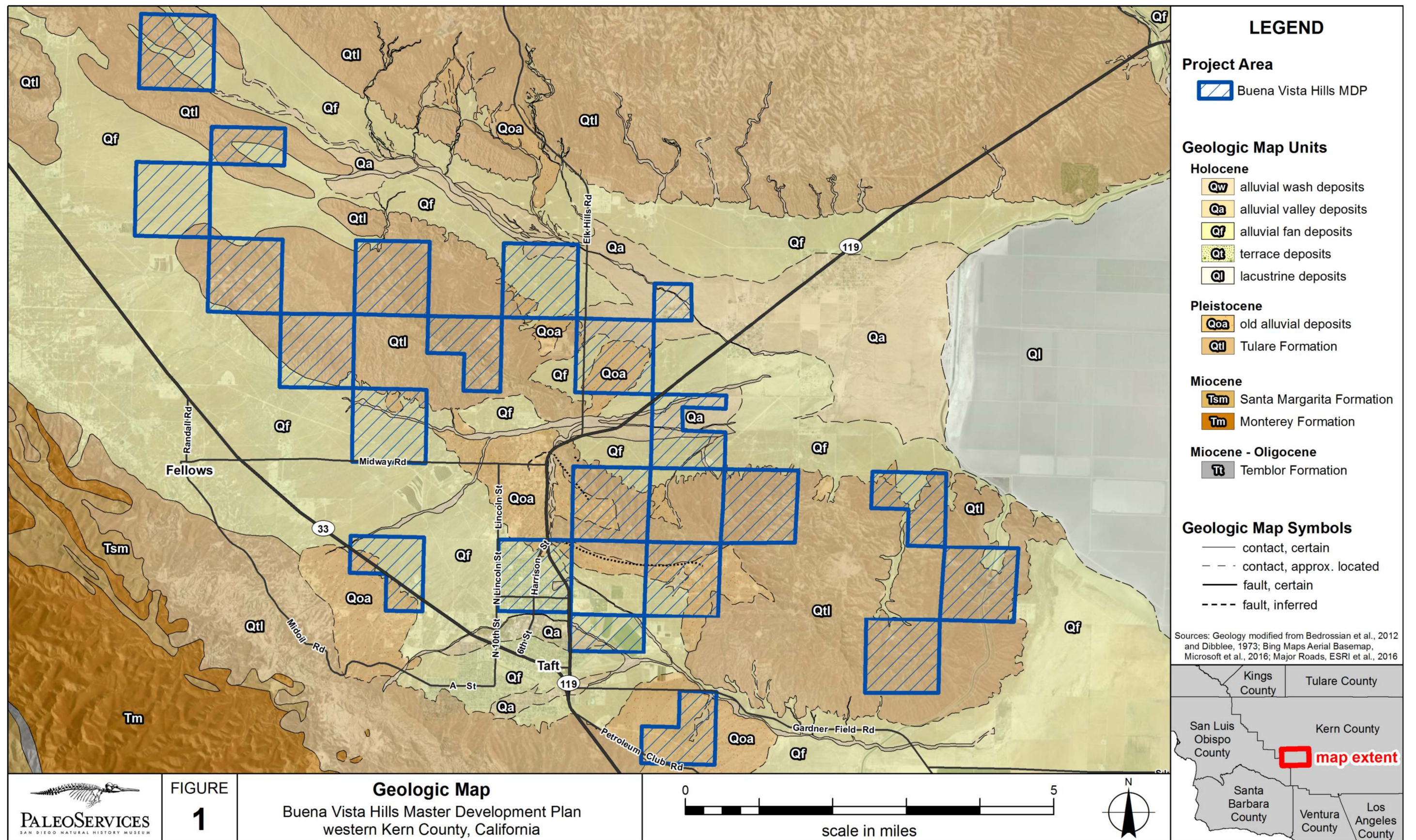
Pleistocene-aged older alluvial deposits are estimated to reach thicknesses of up to 400 feet (Dibblee, 1973), but these deposits may be much thinner within the MDP area, particularly where they are lapped onto deposits of the underlying Tulare Formation. When not exposed at the surface, older alluvial deposits may be overlain by thin veneers of Holocene-aged surficial sediments (Dibblee, 1973).

3.3 TULARE FORMATION

The majority of the Buena Vista Hills MDP is underlain by Pleistocene-aged nonmarine deposits of the Tulare Formation (Figure 1). This rock unit was first named by Anderson (1905) for exposures in the Kettleman Hills North Dome near the former shoreline of Tulare Lake (Woodring et al., 1940). Broadly speaking, strata of the Tulare Formation record the transition from the marine conditions that dominated the Miocene and Pliocene history of the San Joaquin basin and the estuarine, lacustrine, fluvial, and alluvial fan conditions that characterized the Quaternary history of the basin. As such, the basal strata of the Tulare Formation contain an abundance of fine-grained lake deposits, while the upper strata are predominantly fluvial in origin. In the MDP area, the exposures of the Tulare Formation represent the upper portion of the formation (Dibblee and Minch, 2005). Overall, the Tulare Formation consists of poorly to moderately consolidated claystones, siltstones, sandstones, and conglomerates (Woodring et al., 1932; Dibblee, 1973). The clasts composing the Tulare Formation are largely derived from the siliceous shales of the Monterey Formation, though clasts derived from the Temblor Formation are present in the deposits adjacent to the Temblor Range. In the upper portion of the Tulare Formation along the eastern flanks of the Elk Hills, the formation is dominated by alternating sequences of massive, light buff-colored mudstones, and cross-bedded, pebbly sandstones to conglomerates that range in thickness from 10 to 40 feet (Woodring et al., 1932; Page, 1983; Dibblee and Minch, 2005). However, laterally extensive, finely bedded claystones and siltstones, and occasional freshwater limestones representing former lake beds, also occur infrequently in the upper portion of the formation (Woodring et al., 1932; Page, 1983; Maher et al., 1975).

In the Elk Hills, immediately north of the MDP area, at least 800 feet of Tulare Formation strata are exposed on the eroded flanks of the Elk Hills, with reports of another 400 feet in the subsurface (Maher et al., 1975). It is believed that deposits of the Tulare Formation were much thicker prior to the period of Holocene uplift and erosion (Woodring et al., 1940; Page, 1983). In the vicinity of the MDP, the Tulare Formation conformably overlies the Pliocene-aged San Joaquin Formation. Where it is not directly exposed at the surface, the Tulare Formation is overlain by thin veneers of Pleistocene- or Holocene-aged alluvial deposits.

The age of the Tulare Formation is estimated to range from 2.5 to 0.6 million years old based on dating of several volcanic tuffs near the base of the formation, a prominent clay horizon (the Corcoran Clay) at the top of the formation, as well the molluscan fossils recovered from the base of the formation (Maher et al., 1975; Bowersox, 2006). Although traditionally the Tulare Formation has been considered to straddle the Pliocene-Pleistocene boundary, in light of the recent revision of the international geologic time scale which places the Pliocene-Pleistocene boundary at 2.5 Ma (Gradstein et al., 2012) the formation is now considered to be entirely Pleistocene in age. Further, because the Tulare Formation within the MDP area represents the upper portion of the formation, it is most certainly Pleistocene in age.



4.0 RESULTS: PALEONTOLOGICAL RESOURCE ASSESSMENT

4.1 RESULTS OF PALEONTOLOGICAL RECORD AND LITERATURE SEARCHES

Search results of the paleontological collections housed at the UCMP and SDNHM indicate there are no known recorded fossil localities from Pleistocene-aged older alluvial deposits or the Tulare Formation within a 2-mile radius of the Buena Vista Hills MDP area. However, results of the literature search indicate that fossils are known from these rock units elsewhere in the San Joaquin Valley, particularly within the Elk Hills to the north of the MDP area. The paleontological results for each rock unit within the MDP area are outlined below.

4.1.1 HOLOCENE SURFICIAL SEDIMENTS

No fossils are known from Holocene surficial sediments in the proximity of the Buena Vista Hills MDP, nor from other areas of the southern San Joaquin Valley. Generally, Holocene-aged deposits do not produce scientifically significant fossils due to their young geologic age (less than about 10,000 years old).

Some Holocene lake deposits contain organic remains that are considered scientifically significant due to their ability to answer important questions concerning climatic and environmental changes during Holocene time (e.g., pollen from Holocene Tulare Lake; Davis, 1999). However, no extensive Holocene lacustrine deposits occur within the MDP area.

4.1.2 PLEISTOCENE OLDER ALLUVIAL DEPOSITS

Paleontological resources in alluvial deposits of Pleistocene-age are broadly known from the San Joaquin Valley, as well as other inland valleys of southern California, but are only sparsely known in close proximity to the MDP area. A paleontological mitigation report summarizing work completed in the 1990s at the Midway-Sunset Oil Field indicates that a small fauna of terrestrial animals was recovered from older alluvial deposits similar to those within the MDP area. This fauna includes freshwater snails, insects, lizards, finches, rabbits and hares, pocket mice, kangaroo rats, geomyid rodents, and unidentified small mammals (Reynolds, 1990).

Elsewhere in the San Joaquin Valley and other inland valleys of southern California, a large diversity of terrestrial vertebrate fossils are known, particularly large-bodied mammals such as mammoth, mastodon, horse, bison, ancient camel, short-faced bear, dire wolf, and saber-toothed cat (e.g., Jefferson 1991; Reynolds and Reynolds 1991, Scott and Cox 2008; Springer et al. 2009; 2010; UCMP and LACM online collections databases).

Based on the discovery of the small fauna from the Midway-Sunset Oil Field, as well as the depositional environment of the older alluvium within the MDP area, it is the suggestion of SDNHM paleontologists that the rarity fossils in Pleistocene-aged older alluvial deposits in the southern San Joaquin Valley is due to a lack of paleontological fieldwork rather than a true absence of fossils.

4.1.3 TULARE FORMATION

Strata of the Tulare Formation have yielded numerous scientifically significant vertebrate and invertebrate fossils from exposures in the Elk Hills, and elsewhere in the southwestern San Joaquin Valley (e.g., the Kettleman Hills) (e.g., Woodring et al., 1932; 1940).

The most significant fossils known from the upper portion of the Tulare Formation include remains of Pleistocene land mammals. In the Elk Hills, immediately north of the MDP area, recovered mammalian fossils include remains of horses, camels, deer, ground sloths, coyotes, rabbits, rodents, and moles (Woodring et al., 1932; LACM unpublished paleontological collections data; SBCM unpublished paleontological collections data). Other notable early Pleistocene mammals have been recovered to the northwest of the MDP area in the Cymric-McKittrick Oil Field, and include the holotype specimens of an extinct bone-crushing dog (*Hyaenognathus pachyodon*) and an extinct saber-toothed cat (*Ischyrosmilus ischynus*) (Merriam 1903; 1905; Woodring et al., 1932). Paleontological mitigation activities conducted in the 1990s during construction of a cogeneration facility in the Midway-Sunset Oil Field resulted in the discovery and salvage of fossils from the Tulare Formation. These fossils primarily represented nonmarine animals including fresh water snails, freshwater fish, lizards, snakes, finches, rabbits, a variety of rodents, and unidentified carnivores and artiodactyls (Reynolds, 1990). Other fossils known from the upper portion of the Tulare Formation include silicified wood and pond weed algae (*Chara*) (Woodring et al., 1932).

The lower portion of the Tulare Formation generally is more fossiliferous than the upper portion, and has produced abundant fossils of freshwater organisms including diatoms, ostracods, clams, mussels, snails, and bony fishes (e.g., Woodring et al., 1932; 1940; Pilsbry, 1935; Lohman, 1938; Fitch et al., 1983; LACM unpublished paleontological collections data). In particular, the molluscan fossils are considered to represent one of the largest and most diverse freshwater molluscan assemblage from the Pacific Coast (Pilsbry, 1935). Other notable fossils from the lower portion of the Tulare Formation include bones of the extinct river dolphin *Parapontoporia* sp. (Boessenecker and Poust, 2015).

4.2 RESULTS OF PFYC ANALYSIS

4.2.1 HOLOCENE SURFICIAL SEDIMENTS

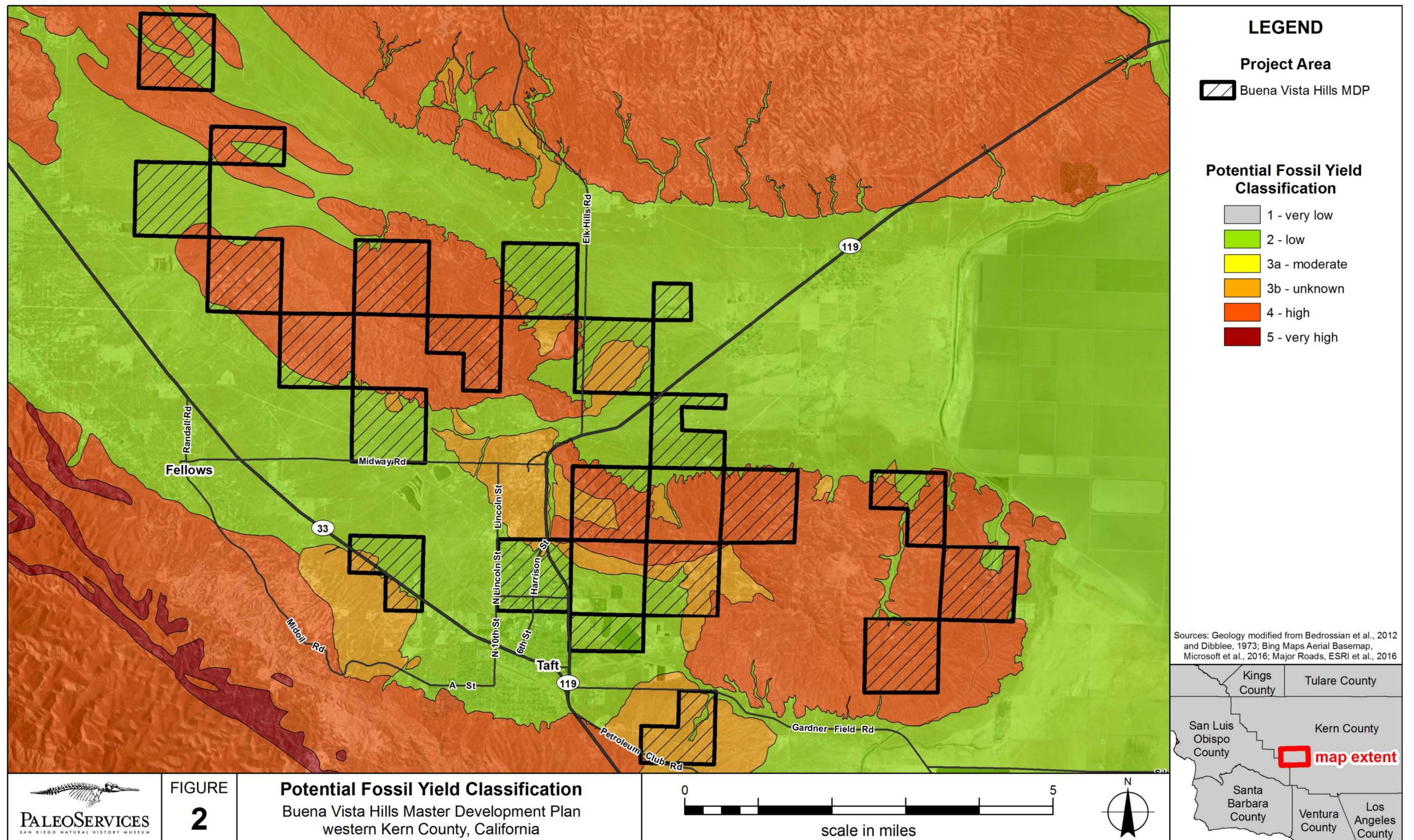
A PFYC ranking of Low (PFYC Class 2) is assigned to Holocene-aged surficial sediments based on their relatively young age, and lack of known, scientifically significant paleontological resources (Figure 2).

4.2.2 PLEISTOCENE OLDER ALLUVIAL DEPOSITS

A PFYC ranking of Unknown (PFYC Class 3b) is assigned to deposits of Pleistocene-aged older alluvium based on the sparse fossils known from the southwestern San Joaquin Valley, but depositional setting suggesting the potential for the preservation of fossils (Figure 2). As discussed above in Section 4.1.2, it is likely that the lack of known fossils in the vicinity of the MDP area is a result of limited paleontological exploration, rather than a true absence of paleontological resources.

4.2.3 TULARE FORMATION

A PFYC ranking of High (PFYC Class 4) is assigned to deposits of the Tulare Formation, based on the discovery of significant vertebrate fossils in the upper portions of the Formation in the Elk Hills and Cymric-McKittrick oil fields, as well as the depositional environment of the Tulare Formation at the Buena Vista Hills MDP (Figure 2).



4.3 RESULTS OF PALEONTOLOGICAL IMPACT ANALYSIS

4.3.1 FUTURE WORK THAT MAY IMPACT PALEONTOLOGICAL RESOURCES

It is presumed that the majority of future earthwork within the Buena Vista Hills MDP area will be related to oil and gas extraction. As such, the types of necessary earthwork may include mass grading (e.g., for well pads, building pads, access roads), trenching, (e.g., for pipelines or underground utilities), drilling (e.g., for wells, utility pole foundations), and other miscellaneous operations. All of these earthwork operations have the potential to impact paleontological resources, but only if they occur in areas underlain by paleontologically sensitive strata (Figure 2).

A notable exception to earthwork requiring paleontological mitigation is drilling operations using an auger with a diameter of less than about 24 inches. Small-diameter augers typically pulverize any macrofossil remains that are encountered during the drilling process. Even though small-diameter drilling operations in areas underlain by paleontologically sensitive strata have the potential to impact paleontological resources, these activities cannot be reasonably avoided nor mitigated, and thus are not recommended for paleontological mitigation.

4.3.2 MDP AREAS CONTAINING PALEONTOLOGICAL RESOURCES

The above listed potential earthwork operations at the Buena Vista Hills MDP will only significantly impact paleontological resources if they disturb strata with a PFYC of 3 or greater, i.e., strata of Pleistocene-aged older alluvial sediments (PFYC Class 3b, Unknown Potential) and the Tulare Formation (PFYC Class 4, High Potential) (Figures 1 and 2). Further, although Holocene surficial sediments have a PFYC of 2, there is potential that areas within the MDP may have only thin veneers (less than 10 feet) of these deposits. Thus, deep earthwork operations in areas mapped as Holocene surficial sediments may impact paleontological resources if they extend into underlying Pleistocene-aged older alluvial deposits or the Tulare Formation. Because the precise thickness of Holocene surficial sediments is not well established within the MDP area, earthwork that extends greater than about 10 feet below existing grade in areas mapped as Holocene surficial sediments is recommended for paleontological mitigation.

An exception to the mapped areas recommended for paleontological mitigation are areas containing artificial fill (i.e., previously disturbed deposits). Artificial fill is typically assigned a PFYC Class 2 (Low Potential), because even though these deposits may contain fossils, the fossils have lost their original stratigraphic and geographic context and thus are not considered to be scientifically significant. Many areas of artificial fill are not shown on published geological maps, and thus are not included in Figures 1 and 2. If earthwork is anticipated to impact only areas of known artificial fill, then paleontological mitigation is not recommended.

Table 1. Summary of paleontological mitigation recommendations for the Buena Vista Hills MDP. Earthwork operations are outlined on the x-axis, and areas to be monitored (as mapped in Figures 1 and 2) are outlined on the y-axis.

Rock Unit	Type of Earthwork			
		Grading, Trenching, Miscellaneous	Drilling, Auger >24"	Drilling, Auger <24"
	Holocene surficial sediments (PFYC Class 2, Low)	Recommended at depths >10 ft below grade	Recommended at depths >10 ft below grade	Not recommended
	Pleistocene older alluvial deposits (PFYC Class 3b, Unknown)	Recommended at all depths	Recommended at all depths	Not recommended
	Tulare Formation (PFYC Class 4, High)	Recommended at all depths	Recommended at all depths	Not recommended

5.0 RECOMMENDED MITIGATION MEASURES

The following mitigation measures are recommended for future development in areas of the Buena Vista Hills MDP that will involve earthwork operations impacting Pleistocene-aged older alluvial deposits or the Tulare Formation. See Table 1 and Figures 1 and 2 for a summary of the areas underlain by these deposits, and the types of earthwork operations that may require mitigation.

1. Prior to the start of earthwork, a qualified Project Paleontologist should be retained to monitor ground disturbance activities, and a professional repository should be designated to receive any discovered fossils.
2. The Project Paleontologist should attend any pre-construction meetings to consult with the grading and excavation contractors concerning excavation schedules, paleontological field techniques, and safety issues. If requested, the Project Paleontologist will present a Worker's Environmental Awareness training program for construction personnel.
3. The Project Paleontologist shall submit a paleontological monitoring exhibit and a list of qualified paleontological monitors that may work on the project to the BLM Bakersfield Office.
4. A paleontological monitor, under the guidance of the Project Paleontologist, should be on-site to inspect designated earthwork operations (see Section 4.3.1 and Table 1) in areas underlain by Pleistocene-aged older alluvial deposits or the Tulare Formation, and

earthwork that will extend greater than 10 feet below grade in areas underlain by Holocene surficial sediments (Figures 1 and 2). The monitor should take appropriate field notes to document stratigraphical and paleontological data. Paleontological monitoring may be reduced (e.g., part-time monitoring; spot-checking) or increased, at the discretion of the qualified paleontologist and in consultation with appropriate agencies (e.g., project proponent, BLM). Changes to the paleontological monitoring schedule shall be based on results of the mitigation program to date, and current and anticipated conditions in the field.

5. If fossils are discovered, they should be salvaged by the paleontological monitor and/or the Project Paleontologist. In most cases this fossil salvage can be completed in a short period of time. However, some fossil specimens (e.g., a large mammal skeleton) may require an extended salvage period. In these instances the paleontological monitor should be allowed to temporarily direct, divert, or halt grading to allow recovery of fossil remains in a timely manner. Because of the potential for the recovering of small fossil remains, such as isolated mammal teeth, it may be necessary to collect a bulk matrix sample and/or set up a screen-washing operation on the site.
6. In the event that fossils are discovered during a period when a paleontological monitor is not on site (an inadvertent discovery), earthwork within the vicinity of the discovery site shall temporarily halt, and the qualified paleontologist contacted to evaluate the significance of the discovery. If the inadvertent discovery is determined to be significant, the fossils shall be recovered, as outlined in mitigation measure 3.
7. Fossil remains collected during monitoring and salvage should be cleaned, repaired, sorted, identified, and cataloged as part of the mitigation program. Fossil preparation may also include screen-washing for microfossils or other laboratory analyses (e.g., radiometric carbon dating), if applicable. Fossil preparation and curation activities may be conducted at the laboratory of the contracted Project Paleontologist (if so equipped), at an appropriate outside agency, and/or at the designated repository, and shall follow the standards of the designated repository.
8. Prepared fossils, along with copies of all pertinent field notes, photos, and maps, should be deposited (as a donation) or housed in a regional scientific repository with permanent paleontological collections (e.g., Natural History Museum of Los Angeles County, San Diego Natural History Museum, University of California Museum of Paleontology). Donation of the fossils should be accompanied by financial support for initial specimen storage (e.g., purchase of storage cabinets).
9. A final summary report should be completed that outlines the results of the mitigation program. This report should include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and significance of recovered fossils. This report shall be submitted to appropriate agencies (e.g., project proponent, BLM), as well as to the designated repository (if fossils are recovered).

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APPENDIX: PALEONTOLOGICAL MITIGATION PLAN

The following sections provide a detailed paleontological mitigation plan (PMP) recommended for future development within the Buena Vista Hills Master Development Plan (MDP). This mitigation program has been divided into sections outlining steps to be taken prior to the commencement of construction (e.g., contracting a qualified Project Paleontologist, attendance of Project Paleontologist at pre-construction meetings, paleontological resource training provided for earth excavation personnel), during construction (paleontological monitoring of excavations into Pleistocene older alluvial deposits or the Tulare Formation, salvage of discovered fossils), and post-construction (preparation and curation of any salvaged fossils, completion of final paleontological mitigation report). All steps taken in the mitigation program are in accordance with industry standards (e.g., SVP, 2010; Murphey et al., 2014). Adopting the recommendations outlined in this PMP will reduce impacts to paleontological resources from ground disturbance during construction to less than significant levels.

A1.0 PRECONSTRUCTION

Prior to commencement of construction activities, some or all of the following actions will be necessary.

A1.1 RETAINMENT OF QUALIFIED PROJECT PALEONTOLOGIST

Prior to the start of construction, a qualified Project Paleontologist (as defined below) shall be retained and approved by the lead agency to monitor ground disturbance activities. The Project Paleontologist will oversee the Paleontological Mitigation Program, including serving as supervisor to any retained qualified paleontological monitors (as defined below).

A1.1.1 QUALIFICATIONS

The qualified Project Paleontologist will have a Master's Degree or Ph.D. in paleontology, and will have proven knowledge of local paleontology and geology and professional experience with paleontological procedures and techniques. In turn, the qualified paleontological monitor(s) will have a BA or BS in Geology or Paleontology and a minimum of 1 year of monitoring experience in local sedimentary rocks. Other experience may be substituted on approval from the BLM and/or County of Kern.

A1.2 DESIGNATION OF REPOSITORY

For paleontological resources recovered from BLM managed lands, a professional repository approved by the BLM should be contracted prior the start of construction, to curate and store any discovered fossils. Such an institution should be a recognized paleontological specimen repository with a permanent curator, such as an AAM-accredited museum or university (e.g., Natural History Museum of Los Angeles County, San Diego Natural History Museum, or University of California Museum of Paleontology). The repository shall be capable of storing fossils in a facility with adequate security against theft, loss, damage, fire, pests, and adverse climate conditions.

The designated repository will understand that though they will assume the professional and financial responsibilities associated with curation and storage in perpetuity, ownership of the fossils will be retained by the BLM. A curation agreement outlining this relationship, as well as funds required for initial curation and storage needs, shall be submitted to the Bakersfield Field Office for approval prior to beginning any work. Reasonable costs may include necessary curatorial supplies (e.g., archival specimen trays, glass vials, foam), as well as a one-time fee for initial specimen storage, which is generally calculated based on the actual or prorated purchase price of steel drawers and cabinets, and a prorated cubic foot volume charge for the collection room.

For paleontological resources recovered from private lands, the land owner is strongly encouraged to donate fossils to a professional repository. The project proponent will work with the private land owner to coordinate with the designated repository.

A1.3 ATTENDANCE AT PRE-CONSTRUCTION MEETING

The Project Paleontologist shall attend the pre-construction meeting to consult with the grading and excavation contractors concerning excavation schedules, paleontological field techniques, and safety issues.

A1.4 WORKER ENVIRONMENTAL AWARENESS PROGRAM (WEAP)

Prior to the start of construction, the Project Paleontologist shall present a Worker's Environmental Awareness training program on paleontological resources to insure that all construction personnel understand paleontological monitoring requirements, the roles and responsibilities of paleontological monitors, and the appropriate action to be taken in the event of a discovery of paleontological resources. The penalties associated with the unauthorized collection of or intentional disturbance of any paleontological resources, as well as the penalties for noncompliance with paleontological mitigation requirements shall be clearly communicated. Training shall include a definition of paleontological resources and an overview of potential resources that could be encountered during ground disturbing activities, which will help to facilitate worker recognition, avoidance, and immediate notification to the Project Paleontologist, or paleontological monitor. All construction personnel will be required to attend a WEAP workshop.

A1.5 SUBMISSION OF LIST OF MONITORS AND PALEONTOLOGICAL MONITORING EXHIBIT

Prior to the start of earthwork, a Paleontological Monitoring Exhibit should be submitted to the BLM Bakersfield Field Office by the contracted Project Paleontologist. The monitoring exhibit shall highlight the areas to be monitored on available construction/grading plans. The names of any qualified paleontological monitors that may work on the Project Area shall also be submitted to the Bakersfield Field Office for approval prior to beginning any earthwork.

A1.6 RESEARCH DESIGN

There are specific research themes associated with the sedimentary rock units present within a given project, which will direct the types of data collection made during paleontological mitigation. These research themes would be applied during the implementation of a research design/discovery phase, as appropriate. Research themes related to Pleistocene-aged older alluvial deposits and the Tulare Formation include:

- Pleistocene land mammal diversity including "Ice-Age" megafauna

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- Pleistocene non-marine paleoenvironments of the southern San Joaquin Valley
 - Distribution and stratigraphy of marine and nonmarine deposits of the Tulare Formation
 - Paleoecological structure of Pleistocene land mammal assemblages
 - Pleistocene land mammal and aquatic vertebrate evolution and systematics
 - Preservation of fossils in older alluvial deposits

A2.0 DURING CONSTRUCTION

Commencement of construction related excavation activities marks the time when potential impacts to paleontological resources will begin. To mitigate these potential impacts, some or all of the following actions are required:

A2.1 EXCAVATION MONITORING: DUTIES AND AREAS TO BE MONITORED

A qualified paleontological monitor(s) working under the direction of the Project Paleontologist shall be present full-time during all relevant ground disturbance activities (i.e., grading for new well pads and excavation of well sumps) associated with the well pad preparation phase of construction. Paleontological monitoring of well site drilling is not required.

It is the Construction Manager's responsibility to keep the Project Paleontologist and paleontological monitor(s) up-to-date with current earthwork plans and any construction or scheduling changes. The monitor(s) will coordinate with Construction Management to determine the timing for monitoring in the identified areas of concern. It will be the paleontological monitor's responsibility to maintain communication and coordination with the construction team. Paleontological monitoring may be reduced (e.g., weekly spot-checking), at the discretion of the Project Paleontologist, based on the conditions in the field (e.g., only weathered deposits are impacted by construction).

A paleontological monitor will observe and inspect any temporarily exposed outcrops (e.g., graded pad surfaces, cutslopes, sump sidewalls) for paleontological remains. Spoils produced from excavation activities (e.g., trenching, augering) may also be inspected. Ideally, inspection involves the examination of every newly exposed surface, but operationally this is often impossible. The pace and quantity of equipment in the cut may determine how often and where paleontological monitors can inspect. When active excavations are too dangerous to enter because of a narrow cut, short haul, and/or heavy equipment traffic, monitoring may be conducted from an elevated vantage point.

It is important to emphasize that paleontological monitors should avoid interference with, or delay of, construction operations.

A2.1.1 DATA RECOVERY (STRATIGRAPHY)

Recording of stratigraphic data will be an on-going aspect of excavation monitoring to provide context for any eventual fossil discoveries, and to gain a greater understanding of the stratigraphy and geology of Kern County and the southern San Joaquin Valley. Outcrops exposed in active cuts and finished slopes should be examined and observed geologic features recorded on grading plans and field notes. The goal of this work is to delimit the nature of

fossiliferous sedimentary rock units in the Project Area, determine their areal distribution and depositional contacts, and record any evidence of structural deformation that may affect determination of the stratigraphic position of recovered fossils. Standard geologic and stratigraphic data collected include lithologic descriptions (color, sorting, texture, structures, and grain size), stratigraphic relationships (bedding type, thickness, and contacts), and topographic position. Measurement of stratigraphic sections will be routinely done and areas containing exposures of fossiliferous sedimentary deposits will be studied in detail and fossil localities recorded on measured stratigraphic sections.

A2.1.2 SAFETY PROCEDURES

Safety of paleontological field personnel is of paramount concern during the construction phase. Safety procedures to be followed by field personnel will include wearing appropriate clothing (e.g., high-visibility safety vests, hard hats, steel-toed boots), carrying large handheld orange flags, securing equipment operators attention before entering an active cut, notifying grading personnel before beginning a salvage excavation, marking fossil discovery sites with surveyor's flagging, and using caution while driving on haul roads. Attendance at the preconstruction meeting (section A1.3) and daily or weekly tailgate meetings are important for discussing mutual safety issues between paleontological field personnel and construction personnel.

A2.2 PROCEDURES FOR PALEONTOLOGICAL DISCOVERIES

The goal of paleontological monitoring is to observe excavation activities and to be onsite in the event that fossils are unearthed by excavation activities. When fossils are discovered the procedures outlined below will be followed. Recovery methods, as well as time needed for fossil recovery, may vary to some degree depending on the types of fossils discovered (e.g., macrofossils, microvertebrate fossils, or plant fossils) and the nature of the enclosing sedimentary deposits.

A2.2.1 DISCOVERY PROCESS AND WORK STOPPAGE

In the event of a fossil discovery, the qualified paleontological monitor may immediately initiate recovery or choose to temporarily stop construction or grading work at the discovery location to consult with the Project Paleontologist. When work is stopped, the Project Paleontologist will notify the project superintendent and appropriate agency representatives (e.g., BLM and Kern County staff members). The monitor, under direction of the Project Paleontologist, will divert, direct, or temporarily halt ground disturbing activities in the area of discovery to allow for preliminary evaluation of potentially significant paleontological resources and to determine if additional measures (i.e., collection and curation) are required.

A2.2.2 DETERMINATION OF SIGNIFICANCE

The significance of the discovered paleontological resources will be determined by the Project Paleontologist. For significant paleontological resources, a data recovery program will be initiated that will follow the general steps outlined below with some refinements based on the type and nature of the specific discovery.

The data recovery program will largely be driven by the research themes (see Section A1.6) and will incorporate appropriate field methods for data collection to answer specific questions, as well as develop plans for the preparation, curation, and storage of recovered fossils, and data collection and post-collection phases of fossil recovery.

A2.2.3 MACROFOSSIL RECOVERY

Many fossil specimens discovered during excavation monitoring are readily visible to the naked eye and large enough to be easily recognized and removed. Upon discovery of such macrofossils, the qualified paleontological monitor will temporarily flag the discovery site for avoidance and evaluation as described above. Actual recovery of unearthed macrofossils can involve several techniques including “pluck-and-run,” hand quarrying, plaster-jacketing, and/or large-scale quarrying. The “pluck-and-run” technique will be used when equipment activity in the vicinity of the discovery area is heavy and immediate action is required to remove an isolated specimen so as not to slow the progress of construction operations. “Pluck-and-run” recovery involves exploratory probing around a partially exposed fossil specimen to determine its dimensions, the application of consolidants (Acryloid, Butvar, or Vinac) to stabilize any damaged or weakened areas of the fossil, and removal of the specimen in a block of matrix. Hand quarrying typically consists of site specific “mining” of fossil-rich sedimentary rock layers without establishment of a geographic grid framework. Fragile fossils are stabilized as described above. Hand quarrying and the “pluck-and-run” techniques can typically be carried out in several minutes, to an hour, thus minimizing the duration of any work stoppage.

Particularly large and/or articulated vertebrate fossils require special handling because of their size and/or fragility and are typically recovered in a process called “plaster-jacketing.” The process begins by isolating a partially exposed specimen from the temporary exposure in a matrix-supported sedimentary pedestal. The pedestal is then slightly undercut at its base to form an overhanging lip and a layer of damp newsprint or tissue paper is placed on the upper surface of the block. Strips of burlap fabric are then soaked in a mixture of Plaster-of-Paris and laid across the matrix block to dry. Depending upon the volume of the block, one, two, or more layers of plaster-soaked burlap strips are formed on the block. Especially large blocks (over two feet in length) are reinforced with wooden or metal splints. Once the plaster hardens, the supporting pedestal is undercut and the block turned over. Hand tools are then used to remove any excess matrix from the bottom of the block and a plaster and burlap cap constructed on the inverted bottom of the block using the same methods described above. When all layers of plaster are dry and hard, the completed plaster “jacket” is then labeled with a field number and north arrow and removed from the field. Depending on the size, complexity, and number of plaster jackets, recovery may require several hours to several days to complete. The discovery of a concentration of large vertebrate fossils (e.g., a bone bed) would require more time (e.g., several days) for recovery.

A2.2.4 MICRO-VERTEBRATE FOSSIL RECOVERY

Many significant fossils often are too small to be readily visible in the field (e.g., small mammal teeth, fish otoliths, lizard limb bones), but are nonetheless significant and worthy of attention because of their potential to provide information concerning paleoenvironments, paleoclimates, and geologic age. If sedimentary horizons are observed that either contain micro-vertebrate fossils, or appear to have high potential to contain such fossils, these horizons shall be sampled by collecting bulk quantities of sedimentary matrix. These bulk matrix samples then undergo laboratory processing in order to isolate the microfossils. Specific procedures for recovery of micro-vertebrates are described below. It should be emphasized that once a bulk matrix sample has been collected and removed from the Project Area, construction activities can resume.

For micro-vertebrate fossils (e.g., small mammal, bird, reptile, amphibian, or fish remains) guidelines developed by the Society of Vertebrate Paleontology (SVP, 2010) define an adequate sample as comprising "...4.0 cubic meters (6,000 lbs. or 2,500 kg) of matrix for each site, horizon or paleosol." However, the uniqueness of the micro-vertebrate fossils recovered may justify screen washing even larger amounts... as determined by the Project Paleontologist." It is understood that conditions in the field may be such that recovery of 6,000 lbs. matrix samples is not possible, and a smaller matrix sample may be warranted at the discretion of the Project Paleontologist. Ideally, micro-vertebrate fossil sites will occur within a layered sequence of strata from which several successive strata may yield individual micro-vertebrate fossil horizons. A maximum of one bulk matrix sample per fossil horizon shall be collected. This sample shall be assumed to contain a representative assemblage of fossils preserved in that fossil horizon. For each sample collected, it is recommended that a 200 lb. (90 kg) subsample be initially processed to determine the fossil productivity of the larger sample. Generally, if five or more complete mammal teeth are recovered from the subsample, the remainder of the sample should be processed. If fewer teeth are recovered, processing should cease.

A2.2.5 PALEOBOTANICAL FOSSIL RECOVERY

Paleobotanical specimens typically occur in fine-grained, laminated strata (e.g., shale) and will require special recovery techniques. When fossil plant sites are discovered, they initially should be evaluated in terms of fossil preservation, specimen abundance, and taxonomic diversity to determine the level of sampling. For sites with well-preserved and relatively complete leaves, an adequate sample would aim to recover at least 20 specimens of each recognized leaf type (species or morphotypes). Large blocks (>2 feet in diameter) of sedimentary rock typically can be hand quarried from the temporary outcrop and then split along bedding planes to reveal compressed fossil plant material (e.g., leaves, stems, and flowers). Individual slabs are then wrapped in tissue paper or newsprint to minimize destruction of the fossils during desiccation. In some cases, specimens that are delaminating or flaking may need to be coated with special consolidants (e.g., Vinac or Butvar). It should be emphasized that once an adequate sample has been collected and removed from a paleobotanical discovery site, construction activities can resume.

A2.2.6 TIME REQUIRED FOR FOSSIL RECOVERY

As discussed above in Section A2.2.4, the vast majority of fossil salvages can be accomplished relatively quickly, requiring a few minutes to a few hours of focused recovery work to complete. However, recovery of large vertebrate fossils or concentrations of vertebrate fossils may require several days to weeks to complete. In many cases, fossil recovery may be expedited through the temporary use of one-site heavy equipment to remove sedimentary overburden, collect bulk matrix samples, and/or lift plaster jackets. It should also be emphasized that avoiding or minimizing construction delays can be achieved by diverting earthwork operations to other areas of the project area while fossil recovery work is under way.

A3.0 POST CONSTRUCTION

In the event fossils are discovered and salvaged, the fossils will be prepared, identified, catalogued, and stored in a recognized professional repository and a Final Paleontological

Mitigation report written that summarizes the results of pre-construction, during-construction, and post-construction activities (if applicable) and findings. If no fossils are salvaged over the course of monitoring, an abbreviated Final Paleontological Mitigation report shall be prepared.

A3.1 FOSSIL PREPARATION

Fossil remains collected during the monitoring and salvage portion of the project will be cleaned, repaired, and/or screenwashed as described below. Fossil preparation may be conducted at the laboratory of the contracted Project Paleontologist or the designated repository, and shall follow the standards of the designated repository. Prior to commencement of work, an estimate of fossil preparation costs should be developed based on number and type of specimens, preparation labor rates, preparation supply needs.

A3.1.1 SPECIMEN PREPARATION

Preparation of fossil specimens will involve removal of extraneous and concealing sedimentary matrix from specimens using various mechanical methods including pneumatic air scribes, micro-sandblasters, and simple hand tools (hammers, chisels, X-acto knives, brushes, dental picks, and pin vices). Fossil preparation will also involve consolidation of weak or porous specimens by the application of specialized media including polyvinyl acetate resins (e.g., Vinac), acrylic resins (e.g., Acryloid), or polyvinyl butyral resins (e.g., Butvar). Repair of broken/damaged specimens will require the use of various adhesives including cyanoacrylate glues (e.g., Zap) polyvinyl acetate emulsions (e.g., carpenter's glue), and polyvinyl butyral resins (e.g., Butvar).

A3.1.2 SCREENWASHING

Recovery of micro-vertebrate fossils will be accomplished by screenwashing bulk samples of fossil-bearing sedimentary matrix. The process begins by breaking large blocks into 2-3 cm cubes to facilitate air-drying of the matrix. Once dry, the matrix is placed into water-filled 5 gallon plastic buckets to soak for no less than 15 minutes with stirring. The slurry is then poured onto nested 20 (0.84 mm openings) and 30 (0.59 mm) mesh stainless steel screens placed in water-filled troughs. Manual agitation of the screens forces the fine clays and silts through the mesh and concentrates the coarser sand and fossil material on the screens. The screens are then placed at a tilt facing the sun to dry. Once dry, the coarse concentrate is transferred into plastic sample bags and labeled with all pertinent site locality data.

A3.1.3 HEAVY LIQUID FLOATATION

Screenwashed concentrates can be further concentrated by the use of heavy liquids (e.g., zinc bromide and/or tetrabromoethane) to concentrate particles of equal density. Generally, fossil bones and teeth sink along with heavy mineral grains (e.g., magnetite) while lighter quartz and feldspar mineral grains float. This separation process produces a very rich concentration of fossil remains, typically isolated teeth of small mammals (e.g., rodents).

A3.1.4 PALEOBOTANICAL PREPARATION

Preparation of plant fossils will involve first splitting slabs of mudstone/siltstone matrix along laminations to reveal individual or composite leaf impressions. Any remaining matrix still obscuring the impressions will then be removed with X-acto knives. The exposed impressions may require stabilization with specialized media (e.g., Vinac or Butvar).

A3.2 FOSSIL CURATION

Following preparation of salvaged fossil remains the specimens will be sorted/picked, identified, and catalogued as described below. Fossil curation may be overseen by the contracted Project Paleontologist, or by the designated repository, and shall follow the standards of the designated repository. Prior to commencement of work, an estimate of fossil curation costs should be developed based on number and type of specimens, curation labor rates, curation supply needs.

A3.2.1 SORTING/PICKING

Fossils require sorting/picking to group together specimens of the same taxon (e.g., species and/or genus) into individual taxon lots.

A3.2.2 IDENTIFICATION

Once sorted, individual taxon lots will then be identified to the lowest taxonomic level practical (e.g., family, genus, and/or species).

A3.2.3 CATALOGUING

Sorted and identified specimens are then assigned unique specimen catalogue numbers and entered into an electronic catalogue database. A specimen number may represent a single fossil specimen or a batch of specimens belonging to a single species. Catalogue numbers are written on individual specimens using India ink on a patch of white acrylic paint. Curation also involves placement of taxon lots into archival specimen trays with labels containing relevant taxonomic, geologic, and geographic information.

A3.2.4 LOCALITY DATA

Formal descriptions of fossil collection locality records, including geographic, geologic, taphonomic, and collection data, need to be compiled and stored electronically with the specimen catalogue data.

A3.3 FOSSIL STORAGE

For any recovered fossils from the Buena Vista Hills MDP, the fossils are recommended for donation at a professional repository, as outlined in Section A1.2. The repository will professionally curate and adequately store the donated fossils. Adequate storage shall include conservation of specimens in a stable environment away from flammable liquids, corrosive chemicals, organic materials subject to mildew, and sources of potential water damage. Typically, this is accomplished by placing curated specimens in archival quality, steel drawers and cabinets, which are housed in climate-controlled collection rooms. Specimens shall be available for study by future researchers, students, and citizen scientists, and thus shall be stored in a fashion that allows for retrieval of individual specimens and associated collection data. Specimen storage should be accompanied by supporting data (e.g., field notes, GPS data, photographs, geologic maps, stratigraphic reports), and fossil preparation data (e.g., description of preparation techniques and materials used for individual specimens).

A3.4 FINAL PALEONTOLOGICAL MITIGATION REPORT

A Final Paleontological Mitigation report (PMR) will be completed that presents the results of the implementation of this paleontological mitigation plan, for projects that recover fossils and also for projects where no fossils are discovered. For projects that recover fossils, the report will include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, and

significance of the recovered fossils relative to the research themes and questions. A complete inventory of salvaged, prepared, and curated fossils will be included. For projects where no fossils are recovered, an abbreviated technical report that summarizes the field methods used and stratigraphy exposed should be completed. All PMR's will be submitted to the BLM Bakersfield Field Office for review and approval.



Environmental Awareness Training

California Resources Corporation (CRC)

OVERVIEW

- Biological Resources: Laws, BMPs and Sensitive Species
- Cultural and Paleontological Resources
- Hazardous Materials and Emergency Response
- Valley Fever



BIOLOGICAL RESOURCE LAWS

- Laws Protecting Plants and Wildlife
 - Federal Endangered Species Act (FESA)
 - California Endangered Species Act (CESA)
 - Migratory Bird Treaty Act
 - Bald Eagle and Golden Eagle Protection Act
 - Native Plant Protection Act
- State and Federal Endangered Species Acts
 - CESA is administered by the California Department of Fish and Wildlife (CDFW).
 - FESA is administered by the U.S. Fish and Wildlife Service (USFWS).
 - No incidental take of any species listed as threatened or endangered under the FESA or CESA, rare or endangered in the California Native Plant Protection Act or designated as fully-protected by CA Fish and Game Code may occur unless written authorization is obtained from the appropriate state and federal agencies.



BEST MANAGEMENT PRACTICES

- A Biological Pre-Activity Survey (Bio-PAS) must be conducted no more than 30-days prior to ground-disturbing activities.
- Adhere to buffers established by the qualified biologist.
- The use of herbicides and rodenticides is prohibited.
- Dispose of any trash, micro-trash, or potential food on-site in animal proof containers, and empty trash receptacles daily to avoid attracting wildlife to the area.
- No vehicles or construction equipment shall be parked or staged within a dry streambed or other waterbody. All spoil storage areas must be located at least 50 feet away from dry streambeds or waterbodies.
- Existing disturbances shall be used to the maximum extent feasible (vehicle, equipment or material storage must be limited to previously disturbed areas).
- All pipes 1.5 inches in diameter or greater stored overnight must be capped (i.e. pipe caps, tape or other barrier), or elevated on a pipe rack to prevent wildlife from entering. If pipes are open, check before moving.
- Do not feed wildlife.



BEST MANAGEMENT PRACTICES

- Leave existing berms around wellsite and facilities in place.
- All vehicles shall observe a 20-mile-per-hour speed limit in all areas of disturbance and on unpaved roads unless otherwise posted.
- All disturbance activities, except emergency situations or drilling that may require continuous operations, shall only occur during daylight hours.
- No plants or wildlife shall be collected, taken, or removed from the site or any adjacent locations.
- All open trenches or excavations shall be covered at the end of each workday to prevent wildlife entrapment. If an excavation is too large to cover, escape ramps shall be installed at an incline ratio of no greater than 2:1.
- All trenches and pipes shall be inspected for the presence of wildlife each day prior to the commencement of work.
- Follow dust control mitigation measures.



BEST MANAGEMENT PRACTICES

- All concrete and asphalt debris should be removed from the site for recycling or disposal.
- Tracked vehicles and other construction equipment must be washed or maintained to be weed-free prior to entering and working within areas of new disturbance.
- All washing of trucks, paint, equipment, or similar activities should occur in areas where runoff is fully contained for collection and offsite disposal.
- No pets or firearms shall be allowed on site.
- No smoking may occur except in designated areas.



SENSITIVE SPECIES

- Kern County Most Common Special-Status Species:
 - San Joaquin Kit Fox
 - Blunt-nosed Leopard Lizard
 - Giant Kangaroo Rat
 - Tipton Kangaroo Rat
 - Buena Vista Lake Shrew
 - San Joaquin Antelope Squirrel
 - Western Burrowing Owl
 - Le Conte's Thrasher
 - Bakersfield Cactus
 - California Jewelflower
 - San Joaquin Woolly-threads
 - Kern Mallow
 - Longhorn Beetle

SAN JOAQUIN KIT FOX

- Status
 - Federal – Endangered
 - State – Threatened
- Appearance
 - Cat-sized with large, conspicuous ears
 - Bushy, black-tipped tail
 - Grey or tan colored



BLUNT-NOSED LEOPARD LIZARD

- Status
 - Federal – Endangered
 - State – Endangered (fully-protected)
- Appearance
 - Broad, triangle-shaped head
 - Leopard-like pattern, with a lighter-colored underside



GIANT KANGAROO RAT

- Status
 - Federal – Endangered
 - State – Endangered
- Appearance
 - Large head
 - Long hind legs
 - Long tail with tuft at the end



TIPTON KANGAROO RAT

- Status
 - State – Endangered
 - Federal – Endangered
- Appearance
 - Dark, yellowish-buff fur
 - White stripe across the hips
 - Long tail with a tuft at the end



Buena Vista Lake Shrew



- Status
 - Federal – Not listed
 - State – Species of Special Concern
- Appearance
 - Mouse sized animal
 - Black fur, with buff/brown specks
 - Long snout, small eyes, and ears that are concealed or nearly concealed by fur

SAN JOAQUIN ANTELOPE SQUIRREL

- Status
 - Federal – Species of Concern
 - State – Threatened
- Appearance
 - Buff-colored ground squirrel
 - White line on each side of its back
 - Often holds its tail over its back while running





WESTERN BURROWING OWL

- Status
 - Federal – Not listed
 - State – Species of Special Concern
- Appearance
 - Small, ground-dwelling owl
 - Brown colored with white breast

LE CONTE'S THRASHER

- Status
 - Federal – Not listed
 - State – Species of Special Concern
- Appearance
 - Plain grey, or brown
 - Medium sized song bird, with a long dark tail
 - Black, down curved bill



BAKERSFIELD CACTUS

- Status
 - Federal – Endangered
 - State – Endangered
- Appearance
 - Low growing cactus
 - Often grows to form extensive thickets
 - Produces magenta flowers



CALIFORNIA JEWELFLOWER

- Status
 - Federal – Endangered
 - State – Endangered
- Appearance:
 - Stems are hairless and range from 4-20 inches tall
 - Maroon buds are clustered at the tip of the stem
 - White flowers further down the stem



SAN JOAQUIN WOOLLY-THREADS

- Status
 - Federal - Endangered
 - State Status - Rare
- Appearance:
 - Many long, trailing stems covered with hairs
 - May also be small (< 3 inches) with a single stem
 - Yellow flower heads clustered at the tips of stems and branches



KERN MALLOW

- Status
 - Federal – Endangered
 - State – Rare
- Appearance
 - Single, or multiple stems
 - Central stem upright, with lateral stems running along the ground
 - White or pink flower with five petals



RECURVED LARKSPUR

- Status
 - Federal – Not listed
 - State – Rare
- Appearance:
 - Stems is generally narrower than root, firmly attached.
 - Generally light blue, lower petals are white





VALLEY ELDERBERRY LONGHORN BEETLE

- Status
 - Federal – Threatened
 - State – Threatened
- Appearance:
 - Adult males have red orange wing covers with four black spots
 - Adult females have dark colored wing covers
 - Long tubed like body with long antennae



BIOLOGICAL RESOURCES

- Your Responsibilities
 - Never begin work without all required approvals.
 - Implement BMPs and avoidance measures outlined in this training.
 - Know how to recognize sensitive species.
 - If sensitive species are identified within the project area, stop work and notify the qualified biologist IMMEDIATELY.
 - If an injured or dead animal is found, leave in place and notify the qualified biologist IMMEDIATELY.
 - If you are unsure of your responsibilities, contact your CRC Regulatory and HSE Representative.



Areas of Concern

- 11Z
- Coles Levee
- Elk Hills
- BV Hills
- Asphalto
- Midway-Sunset
- BLM Lands

CULTURAL AND PALEONTOLOGICAL RESOURCES

- If *potential* archaeological, historical, or vertebrate fossil materials are discovered, stop all work within 50 feet of the find and contact a Regulatory Representative ***immediately***.
- The unauthorized collection or disturbance of fossils is unlawful. All persons responsible for damaging, altering, excavating or removing any archaeological, historical, or vertebrate fossil object or site shall be subject to prosecution.



HAZARDOUS WASTE AND EMERGENCY RESPONSE

CRC Safety Manual



2019

- General Requirements
 - It is your responsibility to comply with hazardous and emergency response policies as noted in CRC's Waste Management and Safety Handbook.
 - Requirements for handling and disposal of hazardous wastes are provided in the CRC Waste Management Plan.
 - Requirements for reporting and clean-up of spills are provided in the CRC's incident reporting and emergency response procedures.
 - Requirements for the use of hand tools, tractors and explosives should comply with CRC's Fire Fighting Policy found in the CRC Safety Handbook.
- **Report all emergencies, releases of hazardous materials, and spills immediately to the Communications Operation Center (COC):**
 - Emergency Number – 661-763-6911
 - Non-Emergency Number – 661-763-6363



VALLEY FEVER

- Symptoms
 - Cough
 - Fever
 - Chest pain
 - Shortness of breath
 - Fatigue
 - Flu-like symptoms that last for weeks or a month
- Report suspected symptoms of valley fever to your supervisor immediately.
- Workers exposed to fugitive dust must be provided with the option to use a filter:
 - The filter (or mask) provided must fit over the nose and mouth.
 - The filter must be secured by a strap.

What is Valley Fever?

The technical name for Valley Fever is *Coccidioidomycosis*, or "cocci" for short. It is caused by *Coccidioides immitis*, a fungus somewhat like yeast or mildew which lives in the soil in the southwestern United States and northwestern Mexico. The tiny seeds, or spores, become wind-borne and are inhaled into the lungs, where the infection starts. About 60 percent of the people who breathe in the spores do not get sick at all. For some, it may feel like a cold or flu. For those sick enough to go to the doctor, it can be serious, with pneumonia-like symptoms that require medication and bed rest. Of all the people infected with cocci, about one out of 200



will develop the disseminated form, which is devastating and can be fatal. These are cases in which the disease spreads beyond the lungs through the blood stream—typically to the skin, bones, and the membranes surrounding the brain, causing meningitis. Cocci is not contagious from person to person. It appears that after one exposure, the body develops immunity.

Who Gets Valley Fever?

The disease may occur in any resident of the infected areas—or a visitor, often offering a diagnostic puzzle to the doctor back home. People most likely to be exposed are those in dusty occupations, such as farm workers, earth movers and archaeologists. However, the more serious or disseminated form of cocci is many times more frequent in non-white people, and those with impaired immune systems. Persons between the ages of 25 and 55 are most likely to develop symptoms of the disease—although people of all ages can have symptoms. In its simple form, with the flu-like symptoms, cocci affects both men and women equally. But the serious form of the disease is found more often in men than in nonpregnant women. Pregnant women seem to be more susceptible to the serious form.

How the Spores Affect the Body

Floating freely in clouds of dust, the tiny cocci spores enter the body when we breathe air into our lungs.

Most never get anywhere. The body's wonderful defense system works too well: the spores get caught in sticky mucus inside the air tubes and are moved back up into the throat where they are either spit out or swallowed harmlessly.

But a few cocci spores do continue the invasion. They work their way down the air tubes to the end of the passage: the little air sacs of the lung, where the air ends up when it is inhaled.

Deep in the lung, the spores begin to grow. They

develop into pods that are filled with even tinier seeds. The pods burst open, the seeds pour out and spread in the lung and sometimes to other parts of the body.

Wherever the spores settle down, the body reacts with inflammation. In the lungs, little patches of pneumonia develop around the spores. Cavities or scars may result, and eventually deposits of calcium.

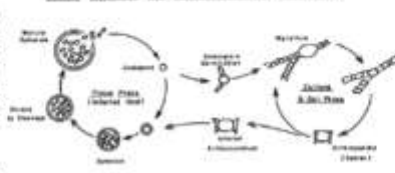
When the spores stay in the lungs, the disease is said to be in its primary form. When the fungus spreads throughout the body—to the internal organs, bones, brain, and even the skin—cocci is in its disseminated form.

Symptoms

Perhaps as many as 60 to 70 percent of all people infected with cocci develop no symptoms at all. Some 30 to 40 percent do get sick—usually within one to three weeks after the cocci spores invade the body. Fever may go as high as 104 degrees. There are usually aches and pains and a cough. A week or two after the fever develops some patients get a rash that resembles the measles. There may also be tender red spots on the shins and pain in the joints. Usually symptoms disappear within a month or so, though full return of energy may take some months.

The disseminated form of the disease is a

LIFE CYCLE OF COCCIDIODES IMMITIS



great deal more serious—with very high fever and extreme fatigue. It has been estimated that about one percent of white patients develops the disseminated form of the disease. However in ten to twenty percent of

dark-skinned patients, cocci progresses to its disseminated form, which can be fatal.

It is wise always to check with a doctor—because only he or she can tell.

Diagnosis

Usually diagnosis is made on the basis of one or more of the following tests: recovery of the cocci organisms from sputum (phlegm) or some other body fluid or by blood tests that reflect the body's reaction to the presence of the fungus. In some cases a biopsy may be needed.

These tests are quite reliable, but they may fluctuate according to the stage of the disease. The tests are not positive in every case of cocci. In some instances, the diagnosis may rest on circumstantial evidence, particularly for people living in an area of the Southwest where much cocci is found. In most cases, however, these tests are helpful.

Chest X-rays reveal some of the abnormalities associated with cocci, but the shadows may be mistake for those of tuberculosis or some other lung disease.

Treatment

Patients suffering from the flu-like symptoms of cocci in its primary form will probably be sent to bed by the doctor. Symptoms, such as cough and fever, will be treated.

For the disseminated form of the disease, a number of drugs are now available.

Occasionally surgery is recommended to remove a diseased portion of the lung, bone or skin.

The Future

There are many mysteries—yet unraveled—about cocci.

Better methods both to prevent and treat the disease remain to be found.

Simple avoidance of infected areas is probably best for newcomers among black, Mexican and Filipino adults. Those who have lived there since childhood may well have developed a kind of immunity to the disease that newcomers do not have.

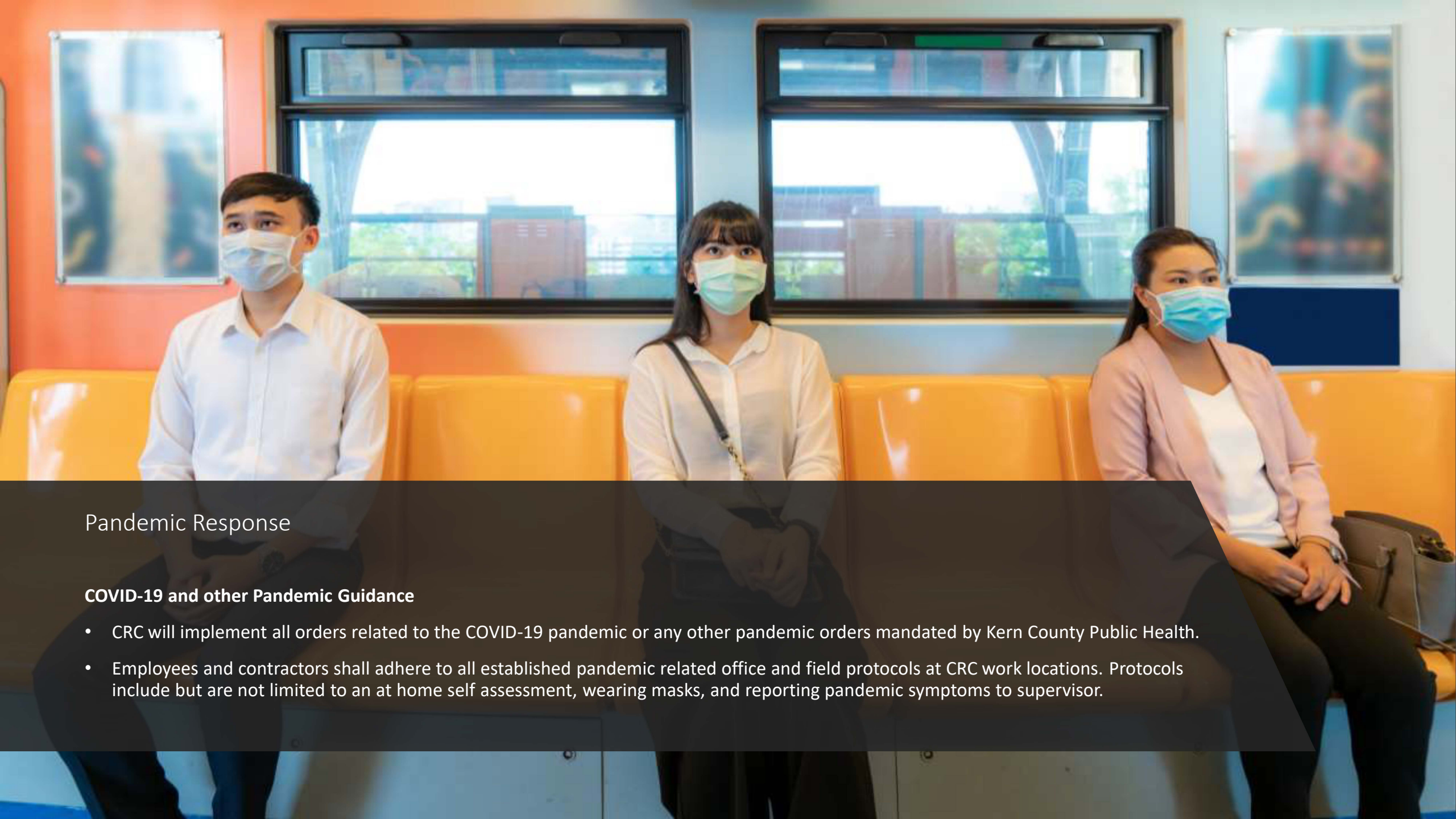
Methods for the control and sterilization of dust are being studied and improved.

Some research, including work on a vaccine, is now being done on ways to make people immune to cocci.

VALLEY FEVER

Download a copy of this handout at

<http://kerncountyvalleyfever.com/>.



Pandemic Response

COVID-19 and other Pandemic Guidance

- CRC will implement all orders related to the COVID-19 pandemic or any other pandemic orders mandated by Kern County Public Health.
- Employees and contractors shall adhere to all established pandemic related office and field protocols at CRC work locations. Protocols include but are not limited to an at home self assessment, wearing masks, and reporting pandemic symptoms to supervisor.

CONTACTS

Regulatory Representatives

- Daniel Padilla, 661-412-5941
- Lauren Gillespie, 661-412-5938
- Palmira Hernandez, 661-335-2664

Qualified Biologists

- Matthew Perry – 661-768-8987 (County & Federal)
- Daniel Padilla – 970-412-2776 (County & Federal)
- Charlotte Campbell – 661-477-1520 (Federal)
- Palmira Hernandez – 661-335-2664 (Federal)

For emergencies or spills, call the COC:

- Non-Emergency – 661-763-6363
- Emergency – 661-763-6911