

**PALEONTOLOGICAL RESOURCES MONITORING AND
MITIGATION PLAN**

SANGER SUBSTATION EXPANSION PROJECT

Pacific Gas and Electric Company



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1.0 EXECUTIVE SUMMARY

This Paleontological Resources Monitoring and Mitigation Plan (PRMMP) was prepared by Paleo Solutions, Inc. (Paleo Solutions) under contract to Parsons. The purpose of this document is to provide a description of the work procedures that will be used to reduce potential impacts of the Pacific Gas and Electric Company (PG&E) Sanger Substation Expansion Project (Project) activities on paleontological resources (fossils) to below the level of significance pursuant to the California Environmental Quality Act (CEQA). In particular, this document provides a description of the work that will be completed in accordance with the mitigation measures that are required by the California Public Utilities Commission (CPUC) in order to fulfill their responsibilities as the lead agency under CEQA. All work will be conducted in compliance with applicable state and local regulations, PG&E guidelines, Applicant Proposed Measure (APM) PAL-1, and mitigation measures (MM) CUL-3 and MM CUL-4 of the Project's Mitigation Monitoring Compliance and Reporting Program (MMCRP).

The Project is located southeast of the City of Fresno in unincorporated Fresno County and includes substation expansion, substation equipment removal, power line reconfiguration, and existing substation changes at Sanger Substation, and installation of telecommunication receivers at the Fence Meadow Repeater Station (see Figures 1 and 2). The work at the Fence Meadow Repeater Station will not involve ground disturbance; therefore, the paleontological measures described in this report are not applicable to that portion of the Project.

The PRMMP for the Project is based on a review of geologic maps, proposed construction activities, and the Project's Initial Study/Mitigated Negative Declaration (IS/MND, 2017); and addresses the requirements of Applicant Proposed Measure (APM) PAL-1, MM CUL-3, and MM CUL-4. The Project area is mapped entirely as high paleontological potential (Potential Fossil Yield Classification [PFYC] 4) Riverbank Formation. However, during pre-construction surveys, the surface of the Project area was observed to be obscured by low paleontological potential (PFYC 2) recent alluvial soil and disturbed sediments to a depth of at least 5 feet below the ground surface.

Full time monitoring should initially be conducted during ground disturbance in areas mapped at the surface as high paleontological potential (PFYC 4) Riverbank Formation during excavations greater than 5 feet in depth. The level of monitoring should be modified throughout the life of the Project based on field observations and in consultation with PG&E and the CPUC. In the event of unanticipated paleontological resource discoveries during Project related activities, work must be halted within 100 feet of the discovery until it can be evaluated by the CPUC-approved paleontological resource specialist.



2.0 INTRODUCTION

This PRMMP was prepared by Paleo Solutions under contract to Parsons. The purpose of this document is to provide a description of the work procedures that will be used to reduce potential impacts of the PG&E Sanger Substation Expansion Project activities on paleontological resources (fossils) to below the level of significance pursuant to CEQA. In particular, this document provides a description of the work that will be completed in accordance with the mitigation measures that are required by the CPUC in order to fulfill their responsibilities as the lead agency under CEQA. All work will be conducted in compliance with applicable state and local regulations, PG&E guidelines, APM PAL-1, and MM CUL-3 and MM CUL-4 of the Project's MMCRP.

2.1 PROJECT DESCRIPTION AND LOCATION

The Project is located southeast of the City of Fresno in unincorporated Fresno County, at the northwest corner of the intersection of East Jensen Avenue and South McCall Avenue (see Figures 1 and 2). The Project includes:

- **Substation Expansion:** PG&E would install equipment, including circuit breakers, switches/disconnects, steel support structures for disconnect switches, bus supports and Capacitor Coupling Voltage Transformer equipment, two Modular Protection Automation Control buildings, and a microwave tower for communications. PG&E would also elevate the existing transfer bus and make alterations to interconnect reconfigured power lines.
- **Substation Equipment Removal:** PG&E would remove obsolete circuit breakers, switches, steel support structures, and the concrete control building at the existing substation.
- **Power Line Reconfiguration:** PG&E would rearrange existing power lines leading to the substation by removing 17 existing lattice steel towers (LSTs) and 18 wood poles and installing 28 tubular steel poles (TSPs) and two wood poles in a different alignment. Existing power lines would be relocated to change their angle.
- **Existing Substation Changes:** On transformer bank 1, PG&E would remove wood poles that support a temporary line from the dead-end structure and would replace them with a new TSP to terminate the new 115-kilovolt (kV) line for bank 1. On transformer bank 3, PG&E would relocate the existing dead-end structure to terminate at the new 115 kV line for bank 3 using new TSPs.
- **Telecommunications Receiver:** PG&E would install two antenna dishes on an existing microwave tower at the Fence Meadow Repeater Station. PG&E is proposing the project to accommodate a new breaker-and-a-half bus configuration.
 - The telecommunications receiver installation will not include ground-disturbance, and will not impact paleontological resources. Therefore, it is not discussed in detail in this PRMMP, and the paleontological procedures described in this report are not applicable to this Project component.

The Project is integral to the Central Valley 115 kV transmission system because it serves as a strategic hub for routing Fresno's hydroelectric and natural gas-generated electricity to the Manchester, Barton, Airways, California, Malaga, McCall, and Reedley substations. Sanger Substation's twelve 115 kV power lines have the capacity to carry approximately 200 megawatts of generation annually, providing a critical energy path between Fresno metropolitan north and south



areas. The new breaker-and-a-half bus configuration would provide maximum reliability for power lines coming into and out of the substation.

Construction is anticipated to begin as early as fall of 2018 and will be constructed in five phases. Construction would last over a period of up to approximately 35 months. The upgraded Sanger Substation would be in service in April of 2021, and the Project would be completed by August 2021 under the anticipated schedule (see Table 1).

TABLE 1. CONCEPTUAL CONSTRUCTION SCHEDULE

Construction Activity	Work Duration* (months)	Maximum Period Over Which Work Will Occur (months)	Estimated Schedule
Phase 1: Substation Site Grading, Access, and Security Fencing	5-6	6	October 2018 – March 2019
Phase 2: Substation Foundation and Footing	3-4	3-4	February 2019 – April 2019
Phase 3: Substation Equipment and Footing	12-15	24	May 2019 – April 2021
Phase 4: Power Line Reconfiguration	6**	24	
Phase 5: Existing Substation Equipment Removal and Post-Construction Cleanup	4-5	4-5	May 2021 – August 2021
Total	30	35	October 2018 – August 2021

*Work duration does not include potential periods of inactivity during construction phases.

**Phase 4 would occur at the same times as Phase 3, and would take approximately 6 months.

2.2 METHODS

This mitigation plan for the Project is based on a review of geologic maps, proposed construction activities, and the Project’s IS/MND (2017). The results of these reviews were used to develop this paleontological mitigation plan in accordance with the requirements of APM PAL-1, MM CUL-3, and MM CUL-4.

Courtney Richards, M.S. authored this report, and Geraldine Aron, M.S., performed the technical review. Barbara Webster, M.S., prepared the GIS maps (see Appendix A for qualifications). Copies of this report will be submitted to the CPUC, PG&E, and Parsons. Paleo Solutions will retain an archival copy of all Project information.

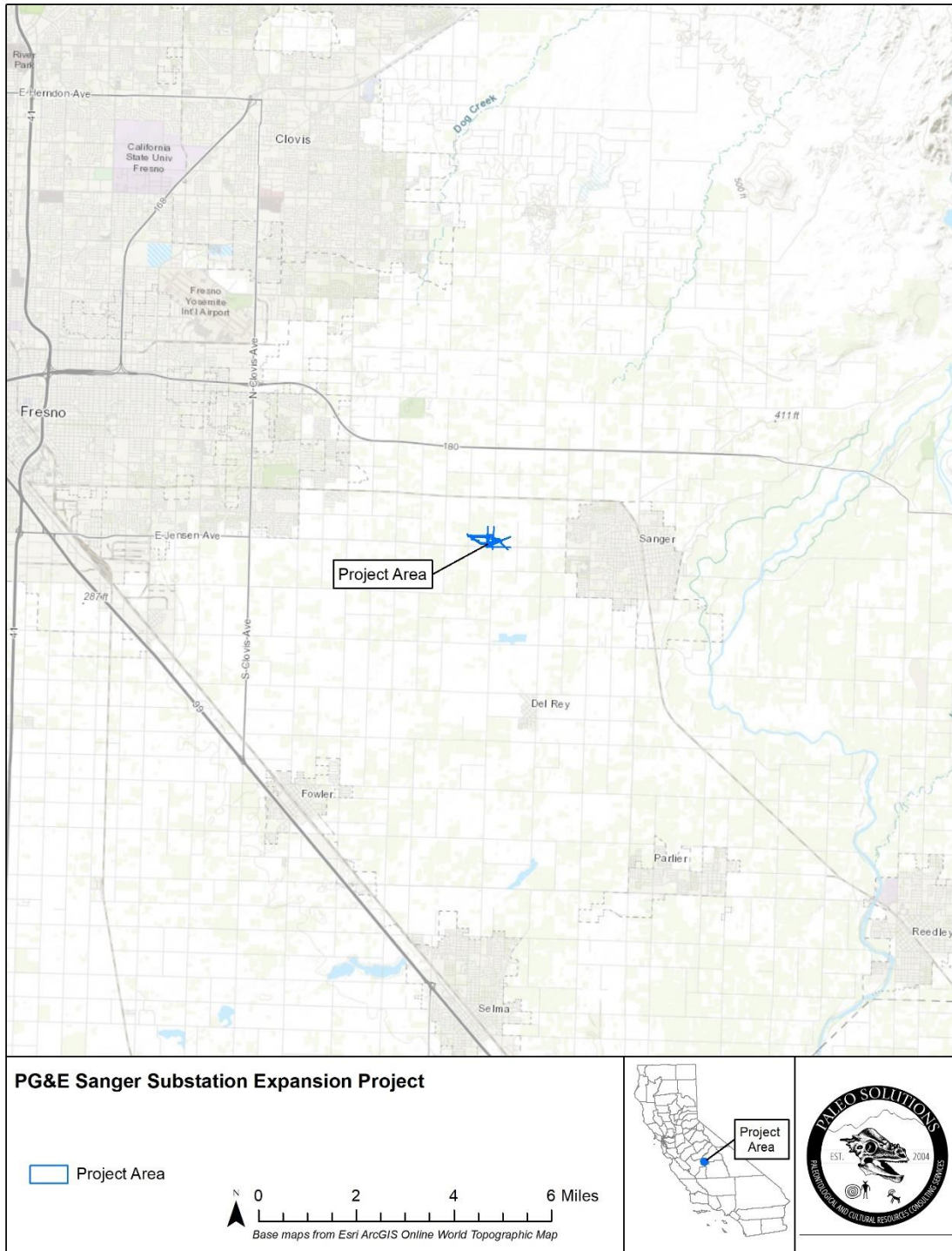


Figure 1. Project Overview Map.

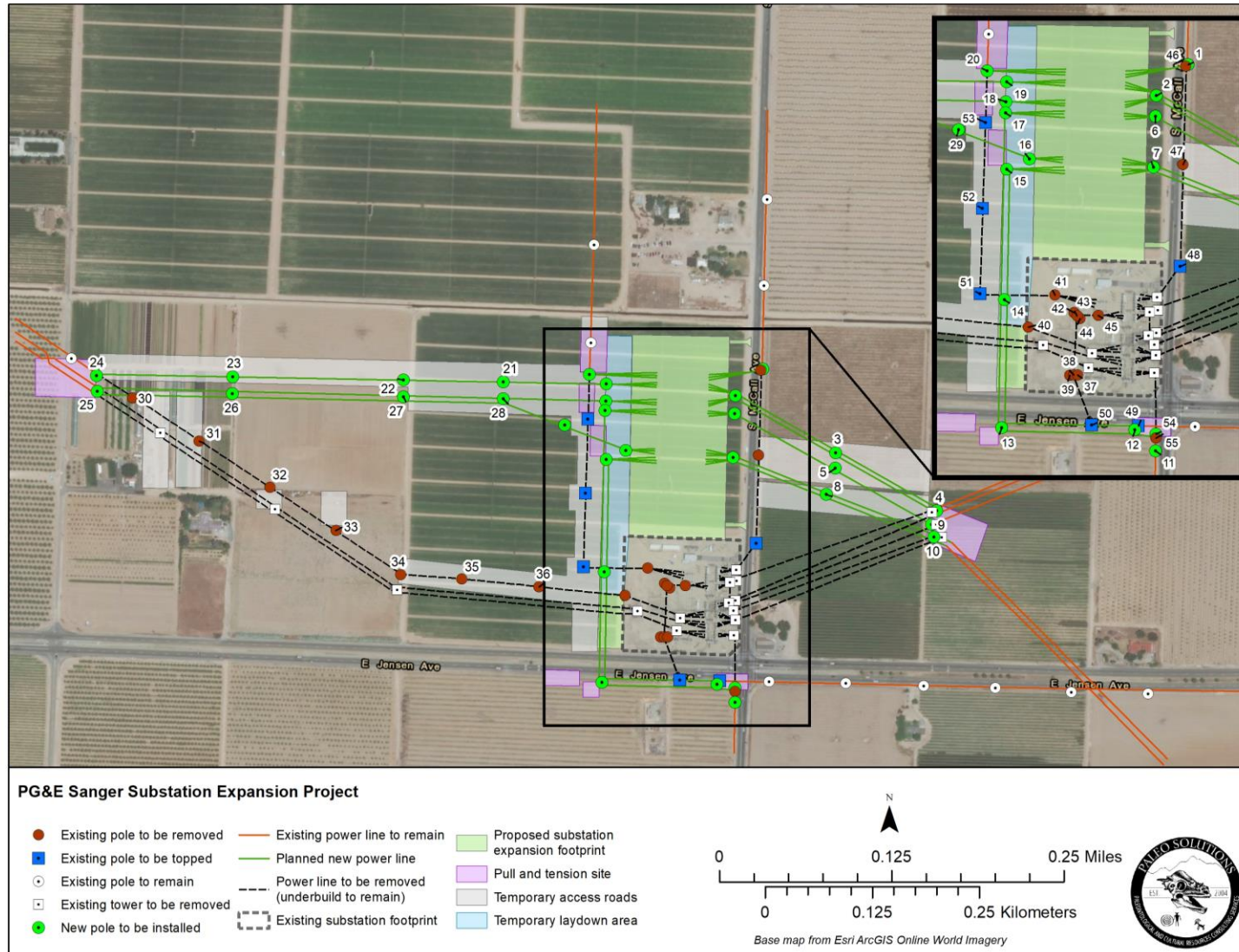


Figure 2. Project Location Map.



3.0 DEFINITION AND SIGNIFICANCE OF PALEONTOLOGICAL RESOURCES

As defined by Murphey and Daitch:

Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. Paleontological resources include not only fossils themselves, but also the associated rocks or organic matter and the physical characteristics of the fossils' associated sedimentary matrix.

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

- Study the phylogenetic relationships amongst extinct organisms, as well as their relationships to modern groups;
- Elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record;
- Reconstruct ancient environments, climate change, and paleoecological relationships;
- Provide a measure of relative geologic dating that forms the basis for biochronology and biostratigraphy, and which is an independent and corroborating line of evidence for isotopic dating;
- Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;
- Study patterns and processes of evolution, extinction, and speciation; and
- Identify past and potential future human-caused effects to global environments and climates (Murphey and Daitch, 2007).

Fossil resources vary widely in their relative abundance and distribution and not all are regarded as significant. According to the Society of Vertebrate Paleontology (SVP), "Significant Paleontological Resources" are defined as:

Fossils and fossiliferous deposits... consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years (SVP, 2010).

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



significance is also subject to the CEQA criterion that the resource constitutes a “unique paleontological resource or site.”

Unfortunately, CEQA does not outright define what constitutes a “unique paleontological resource”, leaving it to agencies and proponents to determine appropriate criteria. PG&E has developed a paleontology guidance document (PG&E, 2013) in consultation with paleontologists working in California. Per PG&E guidance (2013) (see Section 7.1 for further information) with respect to CEQA, paleontological resources are important if they are scientifically judged to provide important data concerning key research interests in the study of taxonomy, evolution, biostratigraphy, paleoecology, or taphonomy.

For the purpose of this project, scientifically significant fossils are generally defined as those that are identifiable to taxon and/or element, and thus are potentially useful for scientific purposes by the receiving institution.

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

4.0 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

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

4.1 STATE REGULATORY SETTING

4.1.1 California Environmental Quality Act (CEQA)

The procedures, types of activities, persons, and public agencies required to comply with the CEQA are defined in the Guidelines for Implementation of CEQA (State CEQA Guidelines), as amended on March 18, 2010 (Title 14, Section 15000 et seq. of the California Code of Regulations [i.e., 14 CCR Section 15000 et seq.]) and further amended January 4th, 2013. One of the questions listed in the CEQA Environmental Checklist is: “Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?” (State CEQA Guidelines Section 15064.5 and Appendix G, Section V, Part C).

4.1.2 State of California Public Resources Code

The State of California Public Resources Code Chapter 1.7 Sections 5097-5097.6 includes additional state level requirements for the assessment and management of paleontological resources, specifically, vertebrate paleontological sites, fossilized footprints, and paleontological features, all of which have the potential to be encountered during Project construction. These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, and define the excavation, destruction, or removal of paleontological “sites” or “features” from public lands without the express permission of the jurisdictional agency as a misdemeanor. As used in Section 5097, “state lands” refers to lands owned by, or under the jurisdiction of, the state or any state agency. In Section 5097.5(b) “Public lands” is defined as lands owned by, or under the



jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

5.0 BACKGROUND AND DESCRIPTION OF RESOURCE

The Project area is located in central California within the Great Valley Geomorphic Province. The Great Valley is a 400 mile long and 50 mile wide alluvial plain that has been experiencing almost continual sediment deposition for the last 160 million years. It is made up of the Sacramento Valley in the north and San Joaquin Valley in the south (Wagner, 2002). The Project area is specifically located in the low alluvial plains and fans of the San Joaquin Valley, in an area comprised of sediments derived from the Sierra Nevada Mountains to the east (Croft and Gordon, 1968).

5.1 GEOLOGIC CONTEXT

Geologic mapping by Matthews and Burnett (1965) indicates that the Project area is underlain by Pleistocene-age nonmarine sedimentary deposits of the Riverbank Formation. However, during a survey of the Project area conducted on March 19, 2015, it was observed that the Riverbank Formation was completely obscured by alluvial soil and sediments disturbed by agricultural activities to a depth of approximately 5 feet below the ground surface.

5.1.1 Riverbank Formation, Pleistocene

The Riverbank Formation formed during the middle Pleistocene and is believed to have been deposited between 130 and 450 thousand years ago (ka) (Marchand and Allwardt, 1981). The Riverbank Formation is interpreted as glacial outwash from the Sierra Nevada Range (Atwater and Marchand, 1980), and it forms arkosic alluvial terraces and fans consisting of weathered, reddish gravel, sand, silt, and clay (Helley and Harwood, 1985).

The University of California Museum of Paleontology (UCMP) database contains several records of fossil localities from the Riverbank Formation throughout the central valley of California. Recorded fossils from the Riverbank Formation include horse (*Equus*) from Fresno County and sloth (*Glossotherium harlani*) from Stanislaus County (UCMP, 2018). Fossils have also been recovered from the Riverbank Formation in Sacramento County, including fish, such as perch (*Archoplites*) and blackfish (*Orthodon*); amphibians, such as frog (*Rana*) and toad (*Scaphiopus*); reptiles, such as snake (*Thamnophis*); birds (*Aves*); and mammals, such as mole (*Scapanus latimanus*), shrew (*Sorex*), vole (*Microtus*), packrat (*Neotoma*), pocket gopher (*Thomomys*), harvest mouse (*Reithrodontomys*), ground squirrel (*Spermophilus*), rabbit (*Sylvilagus*), sloth (*Glossotherium harlani*), mammoth (*Mammuthus columbi*), dire wolf (*Canis dirus*), coyote (*Canis latrans*), horse (*Equus*), camel (*Camelops hesternus*), and bison (*Bison*) (UCMP, 2018). The UCMP database also attributes the fossils from the Fairmead Landfill locality in Madera County to the Riverbank Formation (UCMP, 2018), which matches surficial mapping of the Fairmead Landfill area by Marchand and Allwardt (1981). However, correlations between the lithologic units observed at the locality and regional stratigraphy of Marchand and Allwardt (1981) indicate that the fossils were actually recovered from the underlying Turlock Lake Formation (Dundas et al., 1996), which is not expected to be encountered within the Project area.

The types of processes that formed the Riverbank Formation and led to the preservation of fossils within it are similar throughout the central valley of California, and the geographic range of the Pleistocene fauna (and therefore types of fossils) covered the entirety of the region. Therefore, the paleontological assessment covered the central valley region as a whole, not just known fossils within



the small geographic area surrounding the Project. In accordance with the guidelines for implementing the PFYC system (BLM, 2016), the paleontological potential was assigned to the entirety of the Riverbank Formation. However, it should be noted that not all lithologies within the Riverbank Formation are conducive to fossil preservation. For example, fossils are unlikely to be recovered from coarse grained sediments deposited in high energy environments or sediments that are heavily oxidized, which indicates long sediment exposure at the surface. Fossils are most likely to be preserved in low energy (fine grained) sediments that were buried quickly and are not oxidized. Determination of specific sediment characteristics within the Project area cannot be made until excavation exposes the subsurface; however, the observed lithologies should be taken into account when making paleontological resource management decisions throughout the life of the Project.

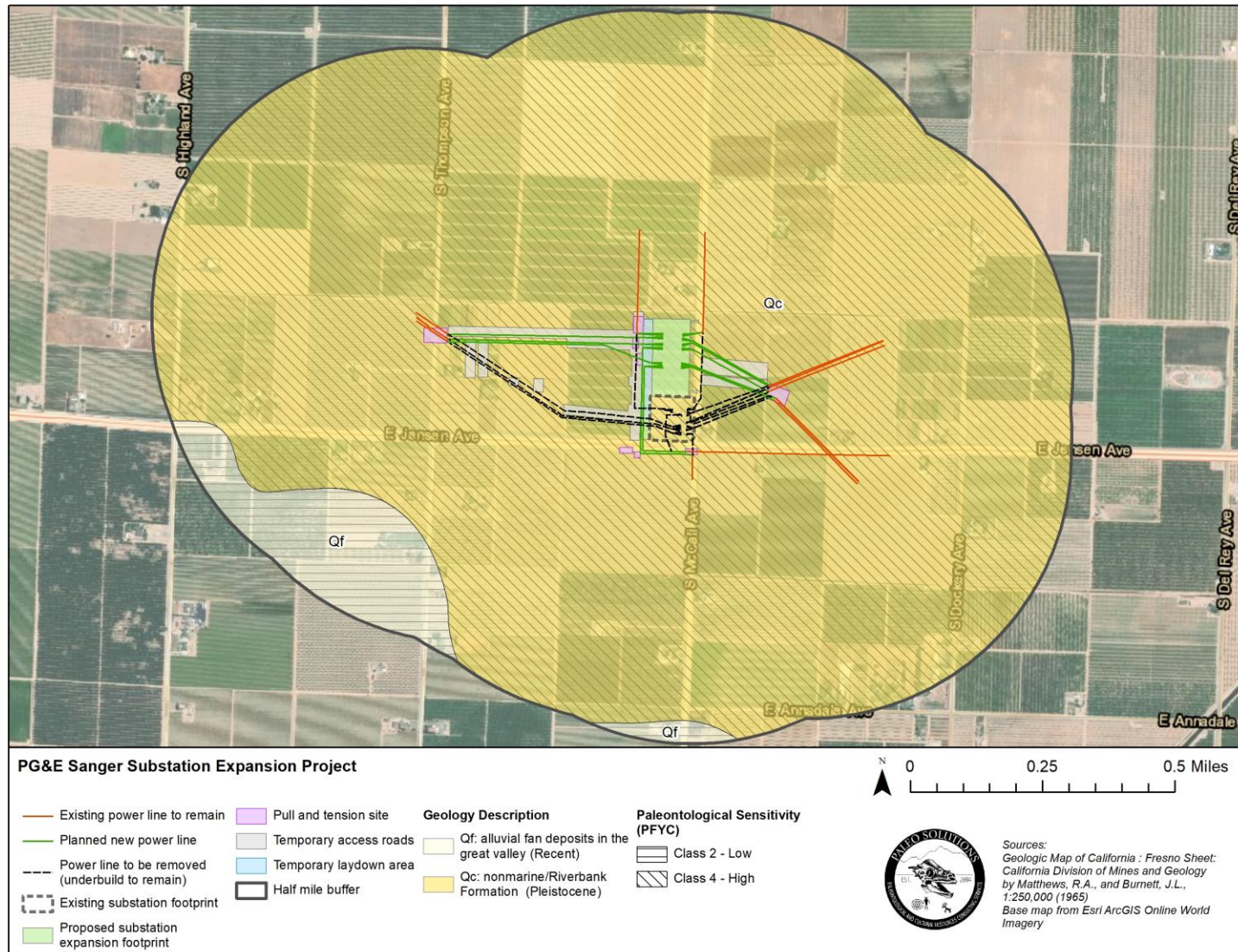


Figure 3. Project Geology Map.



5.2 PALEONTOLOGICAL RECORD SEARCH

Searches of records maintained by the UCMP were conducted to support the IS/MND. The results indicated that there are no fossils known from within the Project area. However, three fossil localities have been recorded from the Riverbank Formation from southeast of Visalia, Tulare County; northeast of Chowchilla, Madera County; and Laguna Seca Ranch, Fresno County (IS/MND, 2017; Clifford and DeBusk, 2015).

6.0 PALEONTOLOGICAL POTENTIAL AND IMPACT ANALYSIS

6.1 POTENTIAL FOSSIL YIELD ANALYSIS

Based on the results of the geologic map review and field survey and museum record searches conducted as part of the Project's IS/MND (2017), the potential fossil yield of the geologic units within the Project area were ranked using the federal PFYC system (BLM, 2016), and an impact analysis was performed.

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

TABLE 2. POTENTIAL FOSSIL YIELD CLASSIFICATION (BLM, 2016)

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



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

* “Land use activities” is a BLM term that is used to describe activities such as minerals production or renewable energy generation and transmission. For the purposes of this project, it is considered to mean ground-disturbing activities related to construction.

6.1.1 Potential Fossil Yield Analysis Results

Pleistocene deposits of the Riverbank Formation are considered to have a high potential fossil yield (PFYC 4) using BLM (2016) guidelines since they have produced scientifically significant vertebrate fossils in the Project region. However, as discussed in Section 5.1.1, while this ranking is applied to the Riverbank Formation as a whole, the actual potential for fossil preservation will depend on the sediment types present in the subsurface of the Project area. In addition, the recent alluvial soil and disturbed sediments that overlie the Riverbank Formation within the Project area have a low



paleontological potential (PFYC 2). Reworked (i.e., *ex situ*) paleontological material may be present in these low potential sediments, but would not meet significance criteria for the purposes of CEQA, as the material would lack critical contextual information (i.e., they lack stratigraphic and biochronologic information and are not potentially useful for scientific purposes by the receiving institution).

6.2 IMPACT ANALYSIS

Ground disturbance in geologic units and geographic areas known to contain scientifically significant fossils may produce adverse impacts to nonrenewable paleontological resources (State CEQA Guidelines, 14 CCR Sections 15064.5[3] and 15023; State CEQA Guidelines Appendix G, Section V, Part C).

Assessments of impacts on paleontological resources are based on the likelihood that fossils will be encountered during ground disturbance, in combination with the probable scientific importance of the affected fossils. Impact thresholds have not been formulated under CEQA for paleontological resources because the loss of a single scientifically important non-renewable paleontological resource is considered significant. Paleontological resources are non-renewable, and consistent with the emphasis on context as a factor, any loss results in the permanent unavailability of the fossil specimen and associated data to science and education, as well as the loss of information about Earth's history that it could have potentially provided. Direct impacts to paleontological resources concern the physical destruction of fossils, usually by human-caused ground disturbance. Indirect impacts to paleontological resources typically concern the loss of resources to theft and vandalism resulting from increased public access to paleontologically sensitive areas. Cumulative impacts to paleontological resources concern incremental loss of these nonrenewable resources to society as a whole.

There are no documented paleontological localities within the boundaries of the Project area; however, the Project may impact native sediments of the high paleontological potential Riverbank Formation at depth. While the exact depth of native Riverbank Formation is uncertain, it is anticipated to be present 5 feet or greater beneath the current ground surface. This formation is known to contain significant paleontological resources in the Project region, and therefore requires active paleontological mitigation in accordance with the Project's MMCRP, provided herein.

7.0 PALEONTOLOGICAL MITIGATION PLAN

7.1 GOALS FOR RECOVERY

One of the questions listed in the CEQA Environmental Checklist is: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" However, CEQA does not include a definition for "unique paleontological resource." Therefore, for the purposes of this project, and per SVP (2010) and PG&E guidance (2013) (see Section 3), paleontological resources are considered to be important ("unique") if they are scientifically judged to provide important data concerning key research interests in the study of taxonomy, evolution, biostratigraphy, paleoecology, or taphonomy. The following is a discussion of the potential scientific importance and research interests of fossils that could be recovered during excavation into the Pleistocene Riverbank Formation.

Pleistocene fossils found in California provide critically important paleoecological and paleoenvironmental data. They provide direct evidence of the composition and phylogenetic



diversity of the paleobiota, paleobiologic features of individual taxa, and evolutionary relationships of the fauna and flora through time. In combination, the fossil assemblages at individual localities, together with the sediments in which they are preserved, also provide indirect evidence of the nature of paleo climates and environments, and importantly, the geographic distributions of different paleoenvironment types such as the fluctuating ocean shorelines, locations of inland lakes and swamps, upland habitats, and lowland habitats, such as basin floors. It is important to bear in mind that the type of paleontological goals that can be accomplished by the receiving institution or others, is entirely dependent upon the types and numbers of fossils that are discovered and their sedimentological context.

Fossils recovered from the Riverbank Formation could be of particular interest, from a scientific standpoint, due to the potential information they could provide on the timing of the transition from the Irvingtonian to the Rancholabrean North American Land Mammal Age (NALMA), which is poorly documented and hence not well understood. For example, the first appearance (stratigraphically lowest) of the bison marks the beginning of the Rancholabrean NALMA, but there are few identifiable and stratigraphically well documented specimens of bison known from California, and those that do exist are not associated with reliable age dates. Thus, the timing of the beginning of the Rancholabrean is in question, and it may be older or younger than the estimate of 300,000 years before present (BP) that has traditionally been accepted by paleontologists. In addition to the timing of the Irvingtonian-Rancholabrean transition, the composition of the faunal assemblages that comprise these biochronologic intervals and the finer details of faunal composition and change within them is also not well understood and remains problematic. Traditionally, larger mammals have been designated as index fossils and have been the focus of biostratigraphic efforts since the provincial NALMA system was codified by the Wood Committee in 1941. However, more recent work, especially on the Eocene biostratigraphy and biochronology of San Diego and Ventura counties (e.g., Walsh, 1996; Whistler and Lander, 2003), has demonstrated the value of utilizing small mammals because of their phylogenetic diversity and the potential to obtain statistically larger samples of specimens via screenwashing of bulk matrix samples.

The recovery of scientifically important (“unique” under CEQA) fossils from Project excavations as the result of implementation of the mitigation measures outlined below, would add to existing paleontological data and help better document the prehistory of California. The recovered fossils will provide important scientific information that may be useful in more accurately and precisely determining the ages of the sedimentary units in which they were preserved depending upon the biostratigraphic utility of the fossil specimens and potential for radiometric dating. Depending upon the types of fossils that are recovered from Project excavations and the quality of their preservation, the existing fossil record of California will be enhanced by the addition of new specimens of known taxa, the discovery of taxa that have not been previously reported from the general area, and possibly the discovery of previously unknown taxa. In combination, the fossil assemblage from the Project area would have the potential to add new paleoecologic and paleoenvironmental information to our existing knowledge of the Pleistocene of California.

7.2 SCOPE OF WORK

The mitigation and fossil recovery plan is designed to reduce Project impacts on paleontological resources to below the level of significance pursuant to CEQA. The proposed mitigation plan consists of the following six components that will be more fully described below:

1. Worker Training
 2. Construction Monitoring
 3. Fossil Salvage
-



4. Screenwashing of Bulk Matrix Sampling
5. Laboratory Preparation, Analysis, and Museum Curation
6. Reporting

All paleontological work will be conducted under the direction of a paleontological resource specialist (also known as a Principal Paleontologist, Lead Paleontologist, or Qualified Professional Paleontologist) who meets PG&E criteria (PG&E, 2013) and is approved by the CPUC. Per PG&E guidelines, the paleontological resource specialist shall have:

- A graduate degree in paleontology, geology, or related field with demonstrated experience in the vertebrate, invertebrate, or botanical paleontology of California or related topical or geographic areas;
- At least one year full time professional experience, or equivalent specialized training in paleontology research;
- At least one year of supervised field and analytic experience in general North American paleontology; and
- Demonstrated ability to carry research to completion.

All monitoring personnel (equivalent to a BLM qualified paleontologist) will have a minimum of a Bachelor's degree in geology, paleontology, or related field and be approved by the CPUC prior to commencing work on the Project.

7.2.1 Worker Training

Prior to the start of ground disturbing activities, and in accordance with APM PAL-1, a workers environmental resources training on paleontological resources will be developed by the CPUC-approved paleontological resources specialist for the project and presented to all construction crew members to inform them of fossil/paleontological resource identification, discovery guidance, and the contact information of the paleontological monitor and CPUC-approved paleontological resource specialist. The program will also inform personnel of the types of fossils that may be encountered and monitor's authority to temporarily halt or redirect work to evaluate discoveries, penalties for disturbing paleontological resources, and the procedures to be followed if potential fossils are unearthed at the Project site and a paleontological monitor is not present. The training program can be presented in person through a safety tailboard, or in some other format, such as a brochure or videotape. Verification of this training will be submitted to PG&E, who will in turn provide it to the CPUC.

7.2.2 Construction Monitoring

In accordance with the stipulations of MM CUL-4, Paleo Solutions will conduct initial full time monitoring of excavation occurring in areas mapped as high paleontological potential Pleistocene Riverbank Formation that is greater than 5 feet deep, including augering that is both 5 feet deep and 3 feet or more in diameter, which will determine the need for subsequent monitoring. Monitoring is not recommended for pile driving or drilling with augers bits that are less than 3 feet in diameter, regardless of depth or previous observations, since any recovered fossil resources would likely be heavily damaged due to the excavation methods.

The 5-foot depth at which monitoring should be triggered will initially be implemented for the first five days of qualifying excavations in each Project phase, to determine whether the Project area is likely to yield significant paleontological resources and if subsequent monitoring is necessary. Monitoring efforts may be reduced or suspended following initial monitoring, if it is determined that the site is unlikely to yield significant paleontological resources (e.g., only recent alluvial soils or



previously disturbed sediments are being impacted, or if sediments are deemed to be non-conductive to fossil preservation). The results of the initial monitoring of each phase of the Project shall be submitted to CPUC for review and approval. CPUC will review and either request revisions or approve the memo within two business days, during which time monitoring will not be reduced or stopped. In the event that monitoring is reduced or suspended, Paleo Solutions will continue to be retained to go to the work site as needed if the construction crew identifies likely fossils. In consultation with the CPUC, continued monitoring may also be implemented in the event that significant paleontological resources are discovered, or if the Project area is later determined to be likely to yield significant paleontological resources. Per MM CUL-4, the decision to continue monitoring will take into account the nature, location, and geologic context of the fossils, as well as the potential for further disturbance.

The recommendations for subsequent monitoring or monitoring reduction will be based on the sediment types, depths, and distributions observed during initial monitoring (see Section 7.3 for a discussion on circumstances in which monitoring may be reduced or suspended). Furthermore, Phase 1, 2, and 3 of the Project all involve work within the Sanger Substation. If it is determined during Phase 1 or 2 that those portions of the Riverbank Formation likely to contain fossils will not be impacted during substation excavations, then monitoring within the substation during subsequent phases should be reduced to periodic spot-checks or suspended, pending CPUC approval. Phase 4 will involve excavation outside of the substation and should be initially monitored regardless of the monitoring results in previous phases. Phase 5 involves removal of existing substation equipment and clean-up, which is expected to be within previously disturbed sediments that does not require paleontological monitoring.

Paleontological resource monitoring of construction excavations involves field inspections (including on site matrix screening) of cut slopes, trenches, spoils piles, and all graded surfaces in accordance with Project safety requirements for occurrences of freshly exposed fossil remains. The primary responsibility of paleontological monitors should always be to adhere to all Project safety requirements, and to only inspect and evaluate fossil discoveries when conditions are safe to do so.

In accordance with MM CUL-3, if a fossil is discovered by a monitor in a construction excavation, the monitor must immediately notify the equipment operator and site project manager to stop work within 100 feet of the discovery and put measures in place to prevent further impacts to the resource, including marking the area surrounding the site with a protective barrier of flagging. The paleontological monitor shall immediately notify the CPUC-approved paleontological resource specialist and PG&E Cultural Resource Specialist. The CPUC-approved paleontological specialist shall evaluate if the discovery is scientifically important (“unique”) under CEQA and SVP (2010) standards, and shall submit the results of the evaluation to the CPUC for concurrence. The CPUC must respond in writing within seven days stating whether the resource is scientifically important (“unique”) and provide their reasoning, if the CPUC disagrees with the conclusion.

If the resource is determined to be not scientifically important (“unique”), work may commence in the area. If the resource is significant and can be avoided and thus not impacted, the resource will be documented in accordance with professional standards, and the area will remain flagged for avoidance during construction. No further action will be required. However, if the resource is unique and cannot feasibly be avoided, PG&E shall consult with the CPUC to determine appropriate mitigation measures. Per MM CUL-3, mitigation methods may include ensuring that fossils are recovered, prepared, identified, catalogued, and analyzed according to current professional standards under the direction of the CPUC-approved paleontological resource specialists. Methods of recovery, testing, and evaluation shall adhere to current professional standards (e.g., SVP, 2010) for recovery, preparation, identification, analysis, and curation and will be conducted in consultation with



the CPUC (see Sections 7.2.3 to 7.2.5 and 7.5 for a discussion of methods to be utilized for this Project). Work may commence after data recovery (if undertaken) and upon approval by the CPUC.

Construction activities can continue outside of an appropriate buffer to the discovery site based on the size of the fossil and in consultation with the CPUC-approved paleontological resource specialist, PG&E Cultural Resource Specialist, and site project manager. All scientifically important fossils should be salvaged and fully documented within a detailed stratigraphic framework as construction conditions and safety considerations permit. Significance criteria and salvage procedures are discussed below.

All paleontological monitors will be trained in commercially reasonable construction site safety protocols by the paleontological consultant prior to entering any construction site. Additional safety training may be provided to paleontological monitors by PG&E or the contractor and required prior to entry to the Project site. Paleontological monitors should always wear hard hats and safety vests, and attend any required safety meetings. Monitors should be equipped with flagging, survey stakes, and tools for fossil exploration and salvage including x-acto knives, awls, brushes, picks, chisels, and shovels. Other essential tools for monitors include chemical preservatives such as vinac or butvar, cyanoacrylate glue, specimen containers such as vials and plastic bags, a GPS receiver, a field notebook, data recording forms, a digital camera, and a plaster kit. In addition to criteria established herein, all paleontological monitors will have sufficient paleontological training and field experience to demonstrate acceptable knowledge of fossil identification, collection methods, paleontological techniques, and stratigraphy.

Unanticipated Discoveries

In the event of unanticipated discoveries when a monitor is not onsite, and per PG&E guidelines (2013) and MM CUL-3, workers should immediately cease all activity within a 100-foot radius of the discovery site, the designated project inspector and PG&E Cultural Resource Specialist will be contacted, and the CPUC-approved paleontological resource specialist will be contacted to examine and evaluate the find. If necessary, appropriate salvage measures will be developed in consultation with the responsible agencies and in conformance with PG&E guidelines (2013) and best practices in mitigation paleontology (Murphey et al., 2014). The CPUC needs to approve any fossil treatment for “unique” resources before the CPUC-approved paleontological resource specialist and PG&E Cultural Resource Specialist can authorize earthmoving to continue.

7.2.3 Fossil Salvage

When scientifically significant fossil discoveries are made by construction monitors, they will be quickly and professionally explored and evaluated in order to minimize construction delays. Additional paleontologists should be brought to assist with the salvage as needed. Salvages may consist of the relatively rapid removal of small isolated fossils from an active cut, to hand-quarrying of larger fossils over several hours, to excavations of large fossils or large numbers of smaller fossils from a bone bed over several days. The duration of each excavation is determined by the size, preservation, and number of fossils at each locality, and all excavations must be carried out in compliance with all stipulations of MM CUL-3 and in consultation with the site project manager.

At each paleontological locality, data recorded will minimally include the field number, date of discovery and date of collection, geographic coordinates, elevation, formation, stratigraphic provenance, lithologic description of sediment that produced the fossil(s), type(s) of fossils and type(s) of element(s), taphonomic and paleoenvironmental interpretations, associations with other fossils, photograph(s), and collector(s). All fossils must be properly labeled prior to removal from the locality where they were discovered.



7.2.4 Screenwashing of Bulk Matrix Samples

Scientifically significant fossils of microscopic or small macroscopic size consisting of vertebrates, invertebrates, plants, or trace fossils, may be identified during monitoring. Monitors will perform on site test screening of the sediments as part of their daily tasks to assist with determining whether the Project area is likely to yield significant paleontological resources as required by MM CUL-4, which requires the inspection of the matrix for fossils. This is included in the daily monitoring rates. If microfossils or small macrofossils are discovered during test screening, or discovered in association with a larger fossil discovery, the locations of these discoveries should be bulk sampled and later screenwashed and picked in the paleontological laboratory in order to mitigate project impacts pursuant to CEQA, and to fully document the microfaunal or microfloral diversity. The collection and processing of bulk matrix samples may require additional funding, and the CPUC-approved paleontological resource specialist shall notify PG&E and the CPUC if such sampling is recommended based on fossil discoveries of field observations. For a project of this size, it is recommended that a 200 to 1,000 pound matrix sample be quickly collected from the locality and removed from the site in order to avoid impeding construction. The size of the sample should be based on the extent of the fossil-bearing horizon or deposit; however, per SVP guidelines (2010), the sample size shall not exceed 6,000 pounds. Construction equipment can often expedite this process by assisting with the removal of matrix from the excavation and establishment of a stockpile in an area removed from construction equipment in order to permit the paleontological monitor to transfer the matrix from the stockpile to buckets and remove them from the site.

7.2.5 Laboratory Preparation, Analysis, and Museum Curation

All fossils and bulk matrix samples collected at the Project site will be removed to a secure paleontological laboratory for preparation to the point of identification and curation. Fossil preparation involves the removal of any sedimentary rock matrix or sediment from the fossil remains, treatment with archival chemical stabilizers, gluing of broken fragments, and construction of a supporting storage cradle as appropriate (mostly for large specimens). Preparation of small fossils may require the use of a binocular microscope. Fossil-rich concentrate from bulk matrix samples may require heavy liquid separation prior to picking under a microscope.

Following preparation, all fossils should be inventoried and identified to taxon and element by a technical specialist, as necessary. Identification should be to the lowest taxonomic level possible. All fossils should be labeled with field locality number, collector, date of collection, taxon, and element description at a minimum. The properly inventoried fossil collection should then be analyzed taxonomically, taphonomically, biostratigraphically, and as appropriate depending upon the nature of the fossil collection. All data, including the results of the analysis on the fossil collection, should be compiled along with the fossil specimen inventory and detailed paleontological locality forms, maps and photos for inclusion in a paleontological mitigation report.

7.2.6 Reporting

A paleontological mitigation report will be delivered to PG&E, CPUC, and, if fossils are recovered, the repository within 30 days of the completion of field work, or as negotiated on consultation. The report shall include dates of field work, results of monitoring, fossil analyses, significance evaluation, conclusions, locality forms, and an itemized list of specimens.

7.3 DECISION THRESHOLDS

Paleontological monitoring should cease when the potential for construction disturbance of undisturbed native Pleistocene-aged Riverbank Formation sediments concludes. Paleontological monitoring is not recommended in recent alluvial soil or previously disturbed sediments.



Additionally, monitoring and spot checking efforts may be reduced, at the discretion of the CPUC-approved paleontological resource specialist in consultation with PG&E and the CPUC if it is determined that only recent or previously disturbed sediments are being impacted, or if sediments are deemed to be non-conducive to fossil preservation (e.g., high energy [very coarse grained], heavily oxidized [indicating long sediment exposure at the surface], etc.).

For the purpose of this project, scientifically significant fossils are generally defined as those that are identifiable to taxon and/or element, and thus are potentially useful for scientific purposes by the receiving institution. However, unidentifiable fossils may also be collected if they are potentially useful to the overall analysis (see Section 3). For example, an unidentifiable bone fragment may be suitable for radiocarbon dating by the receiving institution depending upon the preservation state of the bone. Rock or sediment samples may also be collected if they provide information necessary for depositional and paleoenvironmental interpretations.

Paleontological monitors should always use caution when making decisions about significance in the field, and collect fossils if they are unsure of their significance. For example, when monitoring construction sites, it is often difficult to see the full extent of a fossil being salvaged because it is collected partially encased in sedimentary matrix and as a result it may not be possible to determine the significance of a fossil specimen until it has been partially prepared. Generally, bone fragments with no articular surfaces that are not associated with other fragments to which they might be re-assembled in the laboratory should not be collected, or should be discarded if they are found to be non-significant once they have been partially prepared in the laboratory.

7.4 SCHEDULE

The construction manager or PG&E will notify the CPUC-approved paleontological resource specialist at least 24 hours in advance, and up to 48 hours in advance when possible, when a monitor is needed on the construction site, after the initial monitoring conducted for each phase of the project and per coordination with the CPUC regarding the subsequent monitoring needs. It is not possible to predict the number and type(s) of fossils that might be discovered and salvaged during construction.

7.5 CURATION

If paleontological resources are recovered, they will be curated at the Natural History Museum of Los Angeles County or other appropriate repository. The paleontological consultant will help make arrangements for fossil curation if needed; however, storage fees will be negotiated and paid for by the Project owner.

7.6 PERMITS

No paleontological permits are required for this Project.



8.0 BIBLIOGRAPHY

- Atwater, B.F. and D.E. Marchand. 1980. Preliminary maps showing Late Cenozoic deposits of the Bruceville, Elk Grove, Florin, and Galt, 7.5-minute quadrangles, Sacramento and San Joaquin Counties, California. U.S. Geological Survey Open-File Report OF-80-849.
- Bureau of Land Management (BLM). 2016. Potential Fossil Yield Classification system: BLM Instruction Memorandum No. 2016-124 (PFYC revised from USFS, 2008).
- Clifford, H.L. and J.L. DeBusk. 2015. Paleontological Inventory and Evaluation for the Sanger Substation Expansion Project, Fresno County, California. Report prepared by Applied EarthWorks, Inc. for Cardo Inc. and PG&E, dated September 2015.
- County of Fresno, 2000, Fresno County General Plan, Available online at:
<http://www.co.fresno.ca.us/departments/public-works-planning/divisions-of-public-works-and-planning/development-services-division/planning-and-land-use/general-plan-maps>
- Croft, M.G. and G.V. Gordon. 1968. Geology, Hydrology, and Quality of Water in the Hanford-Visalia Area, San Joaquin Valley, California. United States Department of the Interior Geological Survey: Water Resources Division. Open File Report 68-67, dated April 10, 1968.
- Dundas, R.G., Smith, R.B., and Verosub, K.L. (1996). The Fairmead Landfill Locality (Pleistocene, Irvingtonian), Madera County, California: preliminary report and significance. *PaleoBios*. 17 (2-4).
- Helley, E.J. and Harwood, D.S. 1985. Geologic map of the Late Cenozoic deposits of the Sacramento Valley and northern Sierran foothills, California: U.S. Geological Survey Miscellaneous Field Studies Map MF-1790, scale 1:62,500.
- Initial Study/Mitigated Negative Declaration (IS/MND). 2017. Final IS/MND for the Sanger Substation Expansion Project. Prepared by Ecology and Environment, Inc. Dated March 2017.
- Marchand, D.E. and A. Allwardt. 1981. Late Cenozoic Stratigraphic Units, Northeastern San Joaquin Valley, California, U.S. Geological Survey Bulletin 1470.
- Matthews, R.A., and Burnett, J.L. 1965. Geologic Map of California, Fresno Sheet: California Division of Mines and Geology, scale 1:250,000.
- Murphey, P.C. and D. Daitch. 2007. Paleontological overview of oil shale and tar sands areas in Colorado, Utah and Wyoming: U.S. Department of Energy, Argonne National Laboratory Report Prepared for the U.S. Department of Interior Bureau of Land Management, 468 p. and 6 maps (scale 1:500,000).
- Murphey, P.C., G.E. Knauss, L.H. Fisk, T.A. Demere, R.E. Reynolds, K.C. Trujillo, and J.J. Strauss. 2014. A foundation for best practices in mitigation paleontology. Proceedings of the 10th Conference in Fossil Resources. Rapid City, SD. May 2014. *Dakoterra* Vol. 6:243-285.
- Pacific Gas and Electric Company (PG&E). 2013. Paleontological Resources Standards and Procedures. Pacific Gas and Electric Company. September 2013.



- Society of Vertebrate Paleontologists (SVP). 2010. Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources. 11 p. Online: <http://vertpaleo.org/PDFS/68/68c554bb-86f1-442f-a0dc-25299762d36c.pdf>
- University of California Museum of Paleontology (UCMP). 2018. Online search of the University of California Museum of Paleontology database, accessed June 2018.
- Wagner, D.L. 2002. California Geomorphic Provinces. California Geologic Survey Note 36, online at: http://www.conservation.ca.gov/cgs/information/publications/cgs_notes/note_36/Documents/note_36.pdf
- Walsh, S.L. 1996. Middle Eocene mammal faunas of San Diego County, California; pp. 75-119 in D.R. Prothero and R.J. Emry (eds), *The Terrestrial Eocene-Oligocene Transition in North America*. Cambridge University Press, Cambridge, U.K.
- Whistler, D.P. and E.B. Lander. 2003. New Late Uintan to Early Hemingfordian Land Mammal Assemblages from the Undifferentiated Sespe and Vaqueros Formation, Orange County, and from the Sespe and Equivalent Marine Formations in Los Angeles, Santa Barbara, and Ventura Counties, Southern California. In *Vertebrate fossils and their context: Contributions in honor of Richard H. Tedford*, Bulletin American Museum of Natural History, No. 279:231-268.



APPENDIX A. QUALIFICATIONS



GERALDINE ARON

PRINCIPAL PALEONTOLOGIST



PROFILE

Ms. Aron is President and Program Director at Paleo Solutions. She has more than 19 years of experience as a professional paleontologist in natural resources management. She meets the professional standards as a Principal Investigator for the Society of Vertebrate Paleontologists, Bureau of Land Management (BLM), United States Forest Service (USFS), San Bernardino County, Orange County, Riverside County, San Diego County, and other agencies that retain a professional list for qualified paleontologists. Ms. Aron has produced hundreds of technical reports, which include paleontological assessments, DEIRs, EIR/EIS, Paleontological Mitigation and Monitoring Plans, document reviews, and survey reports for CEQA/NEPA compliance. Geraldine has worked on well over 400 projects throughout California, Montana, Wyoming, New Mexico, Utah, and Colorado. She is responsible for maintaining the overall scientific integrity and oversight of all projects. Her areas of expertise include: paleontological resources project scoping and management; compliance with Federal and State of California laws; Federal and California State agency consultation; preparing and implementing research designs; serving as Principal Investigator for surveys, significance evaluations and data recovery excavations; development of Paleontological Resources Management Plans and Treatment Plans; public outreach and involvement.

EXPERIENCE & EDUCATION

Years of Experience
19 years

Education
M.S. Geological Sciences
California State University, Long Beach

B.S. Geological Sciences
California State University, Long Beach

Cartography and GIS Systems
California State University, Long Beach

CERTIFICATIONS & TRAINING

- Orange County Certified Paleontologist
- San Diego County and City Qualified Principal Paleontologist
- Riverside County Certified Paleontologist
- CPUC Qualified Paleontologist
- First Aid/CPR Certified
- Bureau of Land Management Paleontological Use Permits: CA, AZ, NV
- United States Forest Service Paleontology Permit: Angeles National Forest
- 4x4 Vehicle Training
- Defensive Driver Training, CA DGS

AFFILIATIONS

- Society of Vertebrate Paleontology
- Geological Society of America
- Association for Women Geoscientists
- Society for Sedimentary Geology (SEPM)

PROJECT EXPERIENCE

Palermo-East Nicolaus 115 kV Transmission Line
Pacific Gas & Electric | Butte, Sutter, Yuba Counties, CA

Principal Investigator and Project Manager. PG&E proposes to construct about 314 new poles and/or metal lattice tower supporting a 115-kV transmission line along an approximately 40-mile transmission line segment. The project route would follow the existing Palermo–East Nicolaus 115-kV Transmission Line between PG&E’s Palermo and East Nicolaus substations within unincorporated areas of Butte, Sutter, and Yuba Counties. Ms. Aron conducted a desktop level review of the Paleontological Monitoring Plan (PMP), including geologic maps and taking into account PG&E’s Paleontological Resource Standards and Procedures. The review was conducted to determine if additional studies are needed for the project.

Stockton-Weber 60 kV Project
Pacific Gas & Electric | San Joaquin County, CA

Principal Investigator/Project Manager. Ms Aron oversaw a Paleontological Resources Study and co-authored the Paleontological Resource Inventory Letter Report for PG&E’s proposed project to reconductor approximately 4.5 miles of the existing Santa Fe Junction to Weber and the Santa Fe Junction to Stockton “A” sections of the Weber 60 kV Line 1, and sections of the Santa Fe Junction to Weber section of the Weber 60 kV Line 2 in order to provide additional electric capacity and improve service reliability in the project area. Up to 150 existing wood poles will be replaced as part of the project. Paleontological research for this project included a geologic map review, GIS mapping, literature search, institutional records search, pedestrian survey, and a sensitivity evaluation using the Potential Fossil Yield Classification (PFYC) system. The geology underlying the project study area was reviewed. The literature reviewed included published and unpublished scientific papers, and available online databases. A paleontological records search was conducted at the University of California Museum of Paleontology. The search included fossil localities occurring within a one-mile radius of the proposed project. Paleo Solutions performed a combination pedestrian and windshield survey.



Petaluma Line 021 Pipeline Replacement Project

Pacific Gas & Electric | Sonoma County, CA

Principal Investigator/Project Manager. Ms. Aron was the project manager and principal investigator who oversaw the preparation of mitigation recommendations, a paleontological inventory report, and managed planned survey of proposed pipeline locations. She also oversaw construction monitoring and WEAP training. This project was completed in accordance with CEQA and Sonoma County requirements.

Jefferson to Stanford No. 2 60 kV Transmission Line Routing Assessment Project

Pacific Gas & Electric | San Mateo County, CA

Principal Investigator/Project Manager. Ms. Aron co-authored a Paleontological Inventory Report (PIR) and paleontological section of the Proponent's Environmental Assessment (PEA) for PG&E's proposed project to upgrade the 60kV electric transmission line between Jefferson and Stanford substations from a single-to-double-circuit with a new 60kV service to the Stanford substation. Several potential routes were assessed for this project, and the feasibility and paleontological potential was determined for this project. The report and PIR were prepared according to CEQA guidelines.

Line 107/131 Projects

Pacific Gas & Electric | Alameda County, CA

Principal Investigator/Project Manager. Ms. Aron was the project manager and principal investigator who oversaw the preparation of mitigation recommendations, a paleontological inventory report, managed planned survey of proposed pipeline locations, and oversaw construction monitoring including WEAP training. The work conducted for these projects was completed in accordance with CEQA and Alameda County requirements.

Line 300A/MP 147.7 and 180.8 Projects

Pacific Gas & Electric | San Bernardino County, CA

Principal Investigator/Project Manager. Ms. Aron managed the preparation of mitigation recommendations and a paleontological inventory report for this project, as well as managing planned surveys on BLM and United States Marine Corps lands, along with production of technical reports. All project related work was in accordance with CEQA, San Bernardino County and Federal requirements. This project was located in several locations throughout the Mojave Desert extending from Rosamond to Adelanto. Part of the project required gaining security clearances to access Edwards Air Force Base.

Topock Compressor Station

Pacific Gas & Electric | San Bernardino County, CA

Principal Investigator/Project Manager. Ms. Aron provided a memorandum summarizing the results that included the understanding of CERCLA. Paleo Solutions provided third party review of paleontological documents to ensure adequacy of use in preparation of environmental documents. Documents included a report titled Paleontological Resources Management Plan, Topock Groundwater Remediation Project, San Bernardino County California and Mohave County, Arizona, prepared for Pacific Gas and Electric.

Vierra Reinforcement Project

Pacific Gas & Electric | San Joaquin County, CA

Principal Investigator/Project Manager. Ms. Aron oversaw and co-authored a Paleontological Constraints Memorandum in support of PGE's proposed Vierra Reinforcement Project to increase transmission capacity and reliability for the electric consumers in San Joaquin County. The goal of the report is to identify the level of paleontological potential of the geological units underlying the proposed project study area and identify any fossil resources within the project study area.

Wheeler Ridge Junction 230 kV Substation Project

Pacific Gas & Electric | Kern County, CA

Principal Investigator/Project Manager. Ms. Aron is overseeing a Paleontological Resource Impact Evaluation Report to support the Routing and Constraints Analysis and the Proponent's Environmental Assessment (PEA) for PG&E's proposed project to construct a new 230/115 kV substation and electric transmission line system upgrades in the Kern Division of the PG&E service territory due to anticipated load increases from agricultural, oil production, and industrial demand in the City of Bakersfield and surrounding areas.

Contra Costa-Moraga 230 kV Reconductoring Project

Pacific Gas & Electric | Contra Costa County, CA

Principal Investigator/Project Manager. Ms. Aron established the database of a very complex paleontological survey which had approximately 29 different rock formations over 32 miles. She shortened an extensive survey that could have taken 2-3 weeks to 5 days by strategizing which rock formations to focus survey on. This investigation was conducted in compliance with CEQA. The tasks required to accomplish the inventory include pre-field research, GIS and geologic mapping tasks, published literature research, paleontological surveys, and preparation of the technical report.

Gates I and II Solar Projects

Pacific Gas & Electric | Fresno County, CA

Principal Investigator/Project Manager. Ms. Aron was the project manager and principal investigator who oversaw the paleontological inventory reviews for both the Gates I and Gates II Solar Projects in Fresno County, California. Paleontological work for this project met an aggressive planning and execution schedule. The report was written in accordance with CEQA, and Fresno County requirements.



COURTNEY RICHARDS

PRINCIPAL PALEONTOLOGIST



PROFILE

Ms. Richards earned her Master’s degree in Biological Sciences (Paleontology) from Marshall University in 2011 and a Bachelor’s degree in Earth and Space Science from the University of Washington in 2006. She is a qualified Principal Paleontologist with broad research, field, and laboratory experience throughout California and across the western United States. She maintains a comprehensive understanding of CEQA and NEPA regulations as they related to paleontology, including Caltrans Standard Environmental Reference – Chapter 8, Federal Highway Administration (FHWA), Federal Transit Administration (FTA), Bureau of Land Management (BLM), California High Speed Rail Authority (CHSRA), and other various laws (federal, state, and local) and regulations governing paleontological resources. Ms. Richards has conducted paleontological field work in Mesozoic, Eocene, and Oligocene rock units in Montana, Utah and Wyoming; and Pliocene, Miocene, and Pleistocene surficial deposits throughout California; and Paleocene and Eocene Coalmont Formation, the Eocene and Oligocene White River Formation, and the Miocene North Park Formation in Colorado. Her previous professional experiences include appointments as the vertebrate paleontology collection assistant at the Burke Museum of Natural History and Culture and Paleontology Field Director at a cultural resources firm in southern California.

EXPERIENCE & EDUCATION

Years of Experience
13 years

Education
M.S. Biological Sciences
Marshall University

B.S. Earth and Space Science
University of Washington

CERTIFICATIONS & TRAINING

- Orange County Certified Paleontologist
- San Diego County and City Qualified Principal Paleontologist
- CPUC Qualified Paleontologist
- First Aid/CPR Certified
- The Principal Academy 2.0, ZweigWhite
- Mine Safety and Health Administration 24-Hour Training for New/Inexperienced Metal/Non-Metal Surface Miners Certifications - 30 CFR Part 48

PUBLICATIONS

Murphey, P.C., Zubin-Stathopoulos, K.D., Richards, C.D., and Fontana, M.A., 2015, Paleontological resource overview of the Royal Gorge Field Office Planning Area, Colorado: U.S. Department of Interior Bureau of Land Management Report, 178 p., and standalone confidential fossil locality geodatabase.

Richards, C. D., 2011. Plesiosaur Body Shape and its Impact on Hydrodynamic Properties: Master’s thesis, Marshall University, 68 pp.

PROJECT EXPERIENCE

Betty Drive Interchange
Caltrans District 6 | Tulare County, CA

Principal Investigator. Ms. Richards co-authored a Paleontological Mitigation Plan (PMP) that complied with CEQA, NEPA, and other applicable local laws, ordinances, rules, and statutes enacted to protect existing or potential paleontological resources that could be encountered during qualifying excavation for Caltrans District 6’s proposed project to replace the existing Gosh Overcrossing structure with the Betty Drive Overcrossing, a structure designed to have two through lanes in each direction, with a left-turn lane for eastbound traffic to enter the northbound on-ramp to State Route 99. The PMP and cost estimate were prepared in accordance with the content and format guidance contained in the Caltrans Standard Environmental Reference, Volume I, Chapter 8 (Paleontology).

Freeman Gulch Widening Segment 1
Caltrans District 6 | Kern County, CA

Principal Investigator. Ms. Richards co-authored a Project-specific Final Paleontological Mitigation Plan (PMP) that complies with CEQA, NEPA, and other applicable local laws, ordinances, rules, or statutes enacted to protect existing or potential paleontological resources that could be encountered during qualifying excavation. Caltrans District 6 is proposing safety and operation improvements along SR 14 between post miles 58.2 and 62.3 in Kern County, California. The Project will convert the existing 2-lane conventional highway into a 4-lane, divided, controlled-access expressway. Improvements will include asphalt/concrete overlay, flattening cut slopes, widening fill slopes, and widening paved shoulders.

Vedder Pipeline Project
Aera Energy, LLC | Bureau of Land Management | Kern County, CA

Principal Paleontologist. Ms. Richards co-authored the Paleontological Resources Report for Aera Energy’s proposed development of a new area on the Vedder Lease within the Midway-Sunset Oil Field, including clean up of an existing oil field prior to development, construction of a fluids pipeline, a steam line, and a power transmission line to a tie-in to existing infrastructure.

North Sky Wind River

Southern California Edison | Kern County, CA

Paleontologist. Ms. Richards prepared key project information, including project background, for monitors to utilize during paleontological monitoring for the construction of transmission tower foundations, road construction and augering for the placement of transmission towers located on a 35-acre parcel.

Springbok 1 Solar Farm Project

8minutenergy Renewables, LLC | Kern County, CA

Principal Investigator. Ms. Richards is overseeing paleontological monitoring and co-author the final Paleontological Technical Report for this 951-acre solar farm facility in the western Mojave desert in the vicinity of California City. She completed a paleontological Workers' Environmental Awareness Training that was presented to construction workers prior to breaking ground on construction.

Springbok 2 Solar Farm Project

8minutenergy Renewables, LLC | Kern County, CA

Principal Investigator. Ms. Richards is overseeing paleontological monitoring and co-author the final Paleontological Technical Report for this 1,350-acre 350 MW solar photovoltaic electrical generating facility in Kern County.

Wheeler Ridge Junction 230 kV Substation Project

Pacific Gas & Electric | Kern County, CA

Principal Investigator. Ms. Richards is assisting with a Paleontological Resource Impact Evaluation Report to support the Routing and Constraints Analysis and the Proponent's Environmental Assessment (PEA) for PG&E's proposed project to construct a new 230/115 kV substation and electric transmission line system upgrades in the Kern Division of the PG&E service territory due to anticipated load increases from agricultural, oil production, and industrial demand in the City of Bakersfield and surrounding areas.

Programmatic SPANS

Pacific Gas & Electric | Tulare County, CA

Paleontologist. Ms. Richards oversaw and took part in a pedestrian survey to check for the presence of significant paleontological resources and to confirm the project geology as mapped on Bureau of Land Management land. She was the co-author of the Final Paleontological Resources Report.

Tehachapi Renewable Transmission Project

Southern California Edison | California Public Utilities Commission | Kern, San Bernardino, Los Angeles Counties, CA

Assistant Project Manager. Ms. Richards has conducted paleontological monitoring, field supervision, and is the co-author for the Final Paleontological Monitoring Compliance Report for one of the largest green-energy projects in North America, involving the reconstruction of existing transmission facilities and new construction of 500 kV transmission lines to carry electricity from wind generation sites in the Tehachapi Mountains to the greater Los Angeles area, Kern County, and San Bernardino County covering more than 250 miles.

Tehachapi Renewable Transmission Project - Antelope Transmission Project Segment 3B

Southern California Edison | California Public Utilities Commission | Los Angeles and Kern Counties, CA

Principal Investigator. Ms. Richards co-authored the Paleontological Compliance Report for this project that involved construction of a new 9.6-mile 220 kV transmission line (Segment 3B) and construction of a new substation (Highwind Substation).

California High Speed Rail Project: Bakersfield to Palmdale Segment EIR/EIS

California High Speed Rail Authority | Los Angeles County and Kern County, CA

Paleontologist. Ms. Richards conducted a five-day paleontological survey of the project study area that was determined to be sensitive for fossils. The survey aided the preparation of the paleontology section of the Bakersfield to Palmdale Segment EIR/EIS. This assessed the potential environmental effects associated with the construction, operation, and maintenance of the High Speed Track system, including track and ancillary facilities along the State Route 58/14 corridor from Bakersfield to Palmdale.

Caltrans FOSIL Sensitivity Mapping for Central California

Caltrans Districts 6, 9, & 10 | Central California, CA

Paleontologist. Ms. Richards evaluated geological rock units for paleontological resources with a 0.5-mile buffer on either side of the major highways and conducted comprehensive research on geological maps available, fossil localities and types of fossils known for over 3,000 miles of proposed construction activities. A comprehensive GIS based paleontology database application using ESRI's ArcGIS software was created. A sensitivity ranking, using a federally defined system, for each rock unit was then linked to the GIS map layer for the buffer.

Kettleman City Rehabilitation Improvement Project

Caltrans District 6 | Kings County, CA

Paleontologist. Ms. Richards prepared and identified fossils recovered from construction monitoring of this project funded by the State Highway Operation and Protection Program, including grinding, cold planning, and shoulder widening of the existing asphalt concrete of approximately nine miles of existing roadway from Kettleman City at Quail Avenue to south of Interstate 5 at Utica Avenue.



BARBARA WEBSTER

ARCHAEOLOGIST & GIS SPECIALIST



PROFILE

Ms. Webster earned her Master's degree in Geographic Information Systems from the University of Redlands and a Bachelor's in History and Spanish from Gonzaga University. As Paleo Solutions GIS Specialist, she specializes in GIS applications, spatial density analysis, database creation and management, spatial modeling, and geospatial project management. She creates innovative map products that synthesize and communicate complex information with clarity and elegance. In addition, she implements and regulates field data collection solutions and provides staff personnel with GIS/GPS technologies support, including Trimble and iPad management. Furthermore, Ms. Webster has monitoring experience on archaeological and paleontological projects, including historical and prehistoric archaeology. She manages Paleo Solutions deteriorated pole replacement projects throughout Southern California Edison's territory and is especially adapt at managing record search projects that span hundreds of miles across numerous Information Centers and museums. Finally, she gained paleontological excavation and lab experience as a volunteer at the Page Museum (La Brea Tar Pits). Other work experience includes work at the Smithsonian and with the US National Park Service.

EXPERIENCE & EDUCATION

Years of Experience
8 years

Education
M.S. Geographic Information Systems
University of Redlands

B.A. History and Spanish
Gonzaga University

Graduate Level Archaeology Field School
Utah State University

CERTIFICATIONS & TRAINING

- 40-Hour HAZWOPER
- First Aid/CPR Certified
- Orange County Certified Archaeologist

AFFILIATIONS

- Society for American Archaeology
- Society for California Archaeology

PUBLICATIONS

Webster, B. 2014. Emergency Siren Sound Propagation and Coverage Optimization Analysis. Master's Thesis, University of Redlands. Retrieve from http://inspire.redlands.edu/gis_gradproj/223.

PROJECT EXPERIENCE

TLRR Licensing Projects: Pre-Planning Phase (Archaeological Resources)
Southern California Edison | San Bernardino, Kern, Los Angeles, Inyo & Mono Counties, CA

Archaeologist III. Ms. Webster assisted in performing a large-scale record search at multiple CHRIS information centers. The record search was for over 400 linear miles of transmission lines, and Ms. Webster collected data at the information center, coordinated with the project investigator about project needs, and organized and processed the data that was collected.

Coolwater-Lugo Transmission Line and Supplemental Surveys
Southern California Edison | San Bernardino County, CA

Archaeological Survey Crew. Ms. Webster performed archaeological survey for more than two months in the Mojave Desert. She performed intensive pedestrian survey, recorded historic and prehistoric archaeological resources on DPR forms, and used a Trimble XT unit to navigate and to record sites.

Burro Creek Lithic Procurement Area

Arizona State Lands Office of Mineral Management | Bagdad, AZ
Senior Archaeologist. Ms. Webster co-authored a Cultural Resources Management and Testing Plan and performed a cultural resources survey to support a mining lease application renewal. The project sponsor plans to conduct test borings and trenching to determine if sufficient amounts of lithium existing for future mining operations. Ms. Webster's survey verified a 1984 cultural resources survey, updated the condition of the recorded sites, and recorded additional resources.

On Call Deteriorated Pole Replacement

Southern California Edison | Southern California Territory, CA

GIS Specialist and Archaeologist III. Ms. Webster assisted with creating budgets, obtained permits, performed the archaeological records searches at the California Historical Resources Information System (CHRIS) information centers, performed the archaeological surveys, wrote the archaeological survey reports, completed DPR forms, produced the field maps, report maps, and DPR form maps, and was responsible for sending the completed reports and GIS to the client, info centers, and appropriate parks.

Vedder Pipeline Project

Bureau of Land Management | Kern County, CA

GIS Specialist. Ms. Webster produced the paleontological records search map and requested the records search. She also produced field maps and report maps that depict the project area, land ownership information, Public Land Survey System data, geologic formations, and paleontological sensitivity.

Royal Gorge Field Office Paleo Class I Report

Bureau of Land Management | Central and Eastern Colorado

GIS Specialist. Ms. Webster provided GIS support for a paleontological resource overview for a 35 million acre area of central and eastern Colorado. The project included the synthesis of previously recorded fossil locality GIS data from multiple data sources.

Tehachapi Renewable Transmission Project: 500kV Underground

Southern California Edison | Los Angeles County, CA

Paleontological Field Monitor. Ms. Webster performs paleontological monitoring on this project, including working in areas of high activity where multiple monitors are required, as well as monitoring ESA's.

Tehachapi Renewable Transmission Project: Segment 8

Southern California Edison | Los Angeles County, CA

Paleontological Field Monitor. Ms. Webster performs paleontological monitoring on this project, including working in areas of high activity where multiple monitors are required, as well as monitoring ESA's and working with helicopter-based construction crews.

Tehachapi Renewable Transmission Project: Segment 6

Southern California Edison | Los Angeles County, CA

Archaeological Field Monitor. Ms. Webster performed archaeological monitoring on this project in very archaeologically sensitive areas. Her responsibilities included monitoring ESAs and communicating with construction crews and Native American monitors. She completed Worker Environmental Awareness Program (WEAP) training and OneTouch PM training.

Tehachapi Renewable Transmission Project: Segment 11

Southern California Edison | Los Angeles County, CA

Archaeological Field Technician. Ms. Webster performed archaeological excavation of thermal features on the Angeles National Forest. This work included laying out, excavating, and documenting shovel test pits and 1m x 1m units.

West of Devers Transmission Line

Southern California Edison | Riverside County

Paleontological Field Surveyor. Ms. Webster performed paleontological surveys and provided GIS support for a proposed transmission line that is located in a mostly-developed area.

Valley South Subtransmission Line

Southern California Edison | Riverside County

Assistant Geospatial Analyst. Ms. Webster produced maps to facilitate the record search for this project.

Line 107/131 Projects

Pacific Gas & Electric | Alameda County, CA

Assistant GIS Specialist/Paleontological Survey Crew. Ms. Webster performed paleontological survey for a proposed pipeline. She also provided project maps and GIS support for this project.

Line 131 Direct Examination

Pacific Gas & Electric | Alameda & Contra Costa Counties, CA

Assistant GIS Specialist/Paleontological Survey Crew Ms. Webster managed and processed the GIS data both from the client and from field collection. She produced field and report maps and assisted with paleontological survey.

Replacement of One Deteriorated H-Frame Structure

Southern California Edison | Inyo County, CA

GIS Specialist. Ms. Webster post processed geospatial data collected in the field. She also produced report maps and DPR form maps depicting the project area and resources discovered during monitoring.

Aliso Canyon Turbine Replacement Natural Substation

Southern California Edison | Los Angeles County, CA

GIS Specialist, Archaeological and Paleontological Field Technician. Ms. Webster produced field maps and reports maps that depict the project area, geologic formations, and paleontological sensitivity. She also conducted the archaeological and paleontological survey and wrote the paleontological and archaeological survey reports.