5.8 Paleontological Resources

5.8.1 Introduction

This section evaluates the potential effect to paleontological resources (fossils) from the construction and operation of the Lodi Energy Center (LEC). The project will be sited within the boundaries of the area previously disturbed during the construction and operation of the present White Slough Water Pollution Control Facility (WPCF) immediately to the east. The existing Northern California Power Agency's (NCPA) Combustion Turbine Project #2 (STIG plant) lies to the west of the proposed LEC (see Figure 1.1-3).

Section 5.8.2 discusses applicable LORS, while Section 5.8.3 considers the potential for sediments containing significant fossil remains to be within the area of potential effect from earth moving associated with construction of LEC. Operation of LEC will not involve any additional new ground-disturbing activities, and therefore no impacts to paleontological resources would occur during the operational phase of this project.

This section of the AFC meets all Siting Regulations of the California Energy Commission (CEC) (2000, 2007) and conforms with the recommendations of the Society of Vertebrate Paleontology (SVP, 1991; 1995; 1996) that address mitigating impacts to paleontological resources resulting from earth moving activities. This paleontological resources inventory and impact assessment was conducted by W. Geoffrey Spaulding, Ph.D. a senior paleontologist with CH2M HILL. Dr. Spaulding has advanced degrees in geology with emphases in paleobiology, and is a recognized expert on the Pleistocene environments of the American West. He previously has completed paleontological resource surveys and prepared paleontological resource impact assessments in support of energy generation and other large construction projects in central California, including projects in the San Joaquin Valley where the current project is located.

5.8.2 Affected Environment

5.8.2.1 Physiographic Setting

The proposed site of LEC is within the northern and lowest portion of the San Joaquin Valley of California, and lies along the eastern margin of the vast San Joaquin/Sacramento Delta area. The Coast Ranges lie about 20 miles to the west and south. The Great Valley (also known as the Central Valley) physiographic province includes elongated northwest- to southeast-trending basins: the Sacramento basin to the northwest and the San Joaquin basin to the southeast (Fenneman, 1931). The Great Valley describes the surface of a geologically long-lived structural trough approximately 435 miles (700 kilometers) long and 44 to 56 miles (70 to 90 km) wide. The present-day basin evolved from a late Jurassic to late Cretaceous (85–170 million years ago) marine fore-arc basin. During the early Cenozoic marine sediments continued to accumulate in this basin until, in the late Tertiary (25–30 million years ago), a change in the relative motion between the Pacific and North American plates resulted in the gradual uplift of the Coast Ranges and the eventual isolation of the basin from the ocean. More recent Miocene and lower Pliocene sediments were derived from the neighboring Coast Ranges and the Sierra Nevada. By the late Pliocene (2–3 million years ago), subaerial depositional conditions prevailed

and Sierra Nevada–derived sediments were deposited in the basin east of the valley axis (Wahrhaftig and Birman, 1965).

While the sedimentary sequence of the Great Valley is commonly thought to be relatively continuous, this is not necessarily the case for the project area. Glacioeustatic lowering of sea level by as much as 400 feet during Quaternary glacial advances over the last approximately 700,000 years (e.g., Bloom, 1983) caused stream entrenchment and hydrographic isolation of the current floodplains (Shlemon, 1971). Concurrent with this entrenchment was the westward expansion of the Sierran alluvial fans, and concurrent western retreat of delta systems. A general lack of glacial-age sedimentation on the interglacial floodplains was the result (ibid.). Conversely, during interglaciations such as the current Holocene (the last 10,000 years), sea-level rises to near present elevations, and the fan-delta system extend farther to the east, inland. Fluvial sedimentation in the project area occurred during overbank floods and from simple river meander after sea level had reached near its present elevation, and before the historic channelization of the delta (Lettis and Unruh, 1991). Marchand and Atwater (1979) mapped the historic limit of the autumnal high-tides of the delta only about 0.7 mile west of the project area.

5.8.2.2 Resource Inventory Methods

To develop a baseline paleontological resource inventory of the project area and surrounding lands, and to assess the potential paleontological productivity of the stratigraphic units that may be present, published as well as available unpublished geological and paleontological literature was reviewed. Sources included geological maps, satellite and aerial photography, and technical and scientific reports. For LEC, an updated paleontological resources records review was conducted for the project using the on-line database maintained by the University of California Museum of Paleontology at Berkeley (UCMP). Field reconnaissance of the project area and off-site lateral was conducted on June 3, 2008 by the project paleontological resources specialist, Dr. W. Geoffrey Spaulding.

5.8.2.3 Resource Inventory Results

5.8.2.3.1 Geological Units in the Vicinity

Below a layer of as much as 10 feet of Holocene eolian deposits and alluvium, Late Quaternary sediments beneath the project area are chiefly of fluvial origin, attributable to the Mokelumne River, and perhaps the San Joaquin as well (Marchand and Atwater, 1979; Kleinfelder, 1993). As appropriate to a site near the margin of the great Sacramento-San Joaquin Delta, the lay of the land is nearly flat with the surface sloping very gently at less than a one percent grade to the west. Local drainage is currently directed by a complex series of canals and drains that usually terminate in one of the sloughs of the delta system. The elevation of the site varies from about 5 to 6 feet amsl at the plant area.

The local area is underlain by a complex series of sedimentary and volcanic rocks ranging in age from Jurassic to Tertiary. A thick sequence of fluvial deposits and some estuarine clays and silts comprises the shallower sedimentary package of the Great Valley province in the Lodi area. These sedimentary deposits consist of interbedded sand, silt, and clay. A brief description of the stratigraphy of the project area is presented here.

The most detailed mapping of the surficial geology of the project area was completed by Marchand and Atwater (1979) and they recognized five mapping units of the Modesto

Formation within the area. These mapping units, which are considered here to be facies of the Modesto Formation, are identified by symbols alone:

Geological units identified by Marchand and Atwater (1979) within two miles of the project site, are the following:

Qm	Undifferentiated Modesto Formation. Moderately consolidated silty clay, silt, sand and gravel deposits of alluvial origins.
Qm_1	Lower member of the Modesto Formation consisting of arkosic alluvium of the Mokelumne River alluvial fan; chiefly sand; probably glacial outwash
Qm_2	Upper member of the Modesto Formation, undifferentiated

The mapped distribution of these geological units following Marchand and Atwater (1979) is displayed in Figure 5.8-1.

Throughout the project area there also an overburden of disturbed soils and artificial fill that relates to the long history of agricultural as well as industrial development in the area. These disturbed soils and fill extend to varying depths depending on the activity area, but normally undisturbed sediment is not encountered above a depth of approximately 4 feet.

5.8.2.3.2 Results of the Resource Inventory

A search of the UCMP database on May 25, 2008 yielded records of 81 fossil localities within San Joaquin County; 25 of these are invertebrate collections or microfossil samples. The rest of the localities have yielded vertebrate fossils. Many are from the fossiliferous Tertiary units exposed in the Coast Range foothills more than 20 miles to the southwest; additional records come from the foothills of the Sierra Nevada that start to rise about 10 miles to the east. Very few records appear to come from the axial portion of the Great Valley at these low elevations immediately adjacent to the Delta. All identifiable paleontological localities are more than one mile distant from the project site.

No known paleontological sites occur within one mile of the project site including its linears.

5.8.2.3.3 Paleontological Sensitivity of the Project Site

Paleontological sensitivity is the qualitative assessment made by a professional paleontologist taking into account the paleontological potential of the stratigraphic units present, the local geology and geomorphology, and any other local factors that may be germane. According to SVP (1995) standard guidelines sensitivity comprises (1) the potential for a geological unit to yield abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or paleobotanical remains, and (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecological, or stratigraphic data (Table 5.8-1).

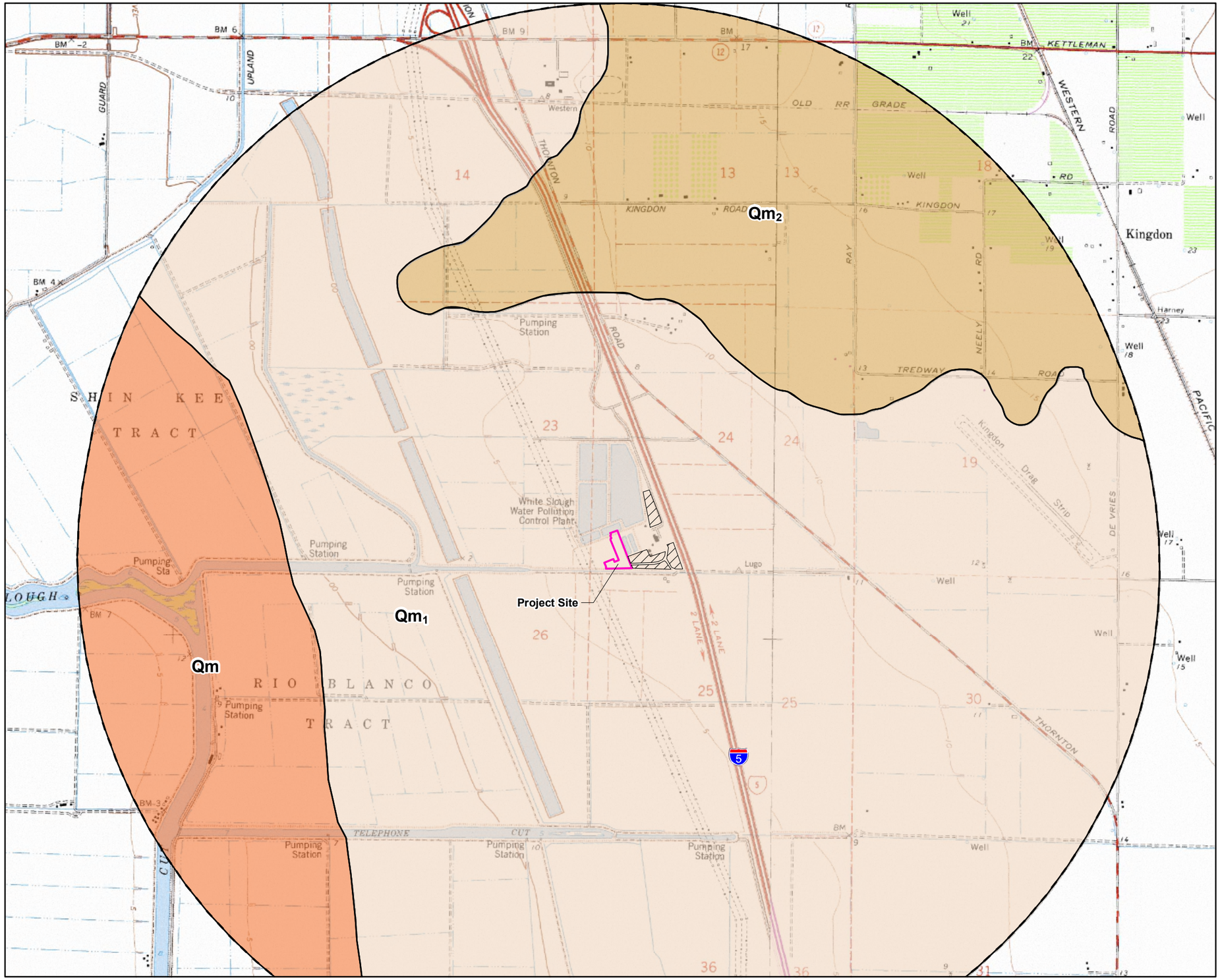
TABLE 5.8-1
Paleontological Sensitivity Ratings Employed

	Definition
High	Assigned to geological formations known to contain paleontological resources that include rare, well-preserved, and/or fossil materials important to on-going paleoclimatic, paleobiological and/or evolutionary studies. They have the potential to produce, or have produced vertebrate remains that are the particular research focus of many paleontologists, and can represent important educational resources as well.
Moderate	Stratigraphic units that have yielded fossils that are moderately well-preserved, are common elsewhere, and/or that are stratigraphically long-ranging would be assigned a moderate rating. This evaluation can also be applied to strata that have an unproven but strong potential to yield fossil remains based on its stratigraphy and/or geomorphologic setting.
Low	Sediment that is relatively recent, or that represents a high-energy subaerial depositional environment where fossils are unlikely to be preserved. A low abundance of invertebrate fossil remains, or reworked marine shell from other units, can occur but the paleontological sensitivity would remain low due to their lack of potential to serve as significant scientific or educational purposes.
Marginal and Zero	Stratigraphic units with marginal potential include pyroclastic flows and soils that might preserve traces or casts of plants or animals. Most igneous rocks, however, have zero paleontological potential. Other stratigraphic units deposited subaerially in a high energy environment (such as alluvium) may also be assigned a marginal or zero sensitivity rating. Manmade fill is also considered to possess zero (no) paleontological potential.

As noted above, within one mile of the project area there is a limited suite of geological units, restricted to different facies of the Modesto Formation and overlying disturbed sediment, and no paleontological localities have been recorded within a mile of the site.

No paleontological localities are known from the Modesto Formation in San Joaquin County; although some vertebrate localities from undifferentiated Quaternary sediments could in fact be in the Modesto Formation. Nevertheless, based on the absence of fossils records from this unit, the Modesto Formation in this area is assigned low paleontological sensitivity. The low paleontological sensitivity of the Modesto Formation in this area is also supported by the recent geomorphic history of the fan-delta region. Due to drastically lower sea level during the last glacial age (Bloom, 1983), sediments did not begin aggrading at present elevations until after about 10,000 B.P. (Schlemon, 1976), while the end of the Rancholabrean Land Mammal Age can now be rather precisely dated at about 10,900 B.P. (Martin, 2006). Therefore, megafaunal remains of the Rancholabrean would not be expected in the sediments mapped as Modesto Formation in the project area.

Further demonstrating the low paleontological sensitivity of the Modesto Formation are excavations in sediments mapped as the Modesto within 20 feet of river level on the south bank of the San Joaquin River, about 21 miles west-southwest of the LEC near Antioch. These have yielded no scientifically significant paleontological materials despite more than three years of episodic monitoring (CH2M HILL, n.d.). Approximately 50 miles to the southeast, near Turlock, in Stanislaus County, recent investigations found the Modesto Formation to be devoid of fossils. The underlying upper Riverbank Formation did yield vertebrate fossils (Spaulding and Naidu, 2006). The Riverbank Formation has not been



LEGEND

- Proposed Lay Down and/or Parking
- Proposed Plant Site
- Two Mile Buffer
- Geologic contact (approximate)

Geology Type

- Qm_1- Quaternary Modesto Formation
- Qm_2 - Lower member
- Qm - Upper member

Notes:

1. No Paleontological sites are recorded within one mile of the project site, or within the maps coverage shown here.
2. Source: Perliminary Geologic Map Showing Quaternary Deposit fo Lodi Quadrangle, California. USGS OFR 79-932. D.E. Marchard and B.F. Atwater, 1979.

This map was compiled from various scale source data and maps and is intended for use as only an approximate representation of actual locations.

N

0 1,200 2,400
Feet

FIGURE 5.8-1
GEOLOGY WITHIN TWO MILES OF SITE
LODI ENERGY CENTER
LODI, CALIFORNIA

CH2MHILL

SAC\\ZION\SACGIS\PROJ\LODIENERGYCENTER_371322\MAPFILES\CULTURAL_GEOLOGYTYPE.MXD MHASKELL 8/22/2008 10:09:18

mapped in the vicinity of the LEC, and given the project's location at the toe of the Mokelumne River alluvial fan the Riverbank is expected at depths far exceeding what construction related excavations would reach (e.g. >80 feet; Atwater et al., 1986).

The surface of LEC is entirely occupied by previously disturbed sediment and artificial fill (sediment transported from elsewhere or fill that is a mix of materials). The depth to undisturbed sediment is variable from place to place but, generally in this area, extends at least to the bottom of the "plow zone" or about 4 feet below the surface. This material has no potential to yield scientifically important materials, and therefore possesses no paleontological sensitivity.

5.8.3 Environmental Analysis

The environmental impacts on paleontological resources from both construction and operation of LEC are presented in the following sections.

5.8.3.1 Paleontological Resource Significance Criteria

In its standard guidelines for assessment and mitigation of adverse impacts to paleontological resources, the SVP (1995) notes that an individual fossil specimen is considered scientifically important and significant if it is: (1) identifiable, (2) complete, (3) well preserved, (4) age-diagnostic, (5) useful in paleoenvironmental reconstruction, (6) a type or topotypic specimen, (7) a member of a rare species, (8) a species that is part of a diverse assemblage, or (9) a skeletal element different from, or a specimen more complete than, those now available for that species. For example, identifiable land mammal fossils are considered scientifically important because of their potential use in determining the age and providing input to paleoenvironmental reconstructions for the sediments in which they occur. Moreover, vertebrate remains are comparatively rare in the fossil record. Fossil plants are also important in this regard and, as sedentary organisms, are actually more sensitive indicators of their paleoenvironment and, thus, more important than mobile mammals for paleoenvironmental reconstructions. For marine sediments, invertebrate fossils, including marine microfossils, are scientifically important for the same reasons that land mammal and/or land plant fossils are valuable in terrestrial deposits. The value or importance of different fossil groups varies depending on the age and depositional environment of the stratigraphic unit that contains the fossils, their abundance in the record, and their degree of preservation.

Using the criteria of the SVP (1995) and the sensitivity ratings provided above, the significance of potentially adverse impacts of earth moving on the paleontological resources was assessed. Any unmitigated impact on a fossil site or a fossil-bearing rock unit of high or moderate sensitivity would be considered significant.

5.8.3.2 Paleontological Resource Impact Assessment

The significance of potential adverse impacts of project-related activities on the paleontological resources of each stratigraphic unit anticipated to be present at the project site is provided in this section. This assessment includes the entirety of the project area.

- **Artificial Fill and Previously Disturbed Sediment –** Construction-related excavations within artificial fill or previously disturbed sediment will not result in any adverse

impacts to paleontological resources. Reworked and disturbed fossil material may be present in the artificial fill and previously disturbed sediment, but lack of stratigraphic context and likely mechanical damage would compromise all scientific values. This would apply to all excavations within 4 feet of current ground surface.

- **Modesto Formation –** Excavations including drilling and trenching extending to depths below 4 feet are likely to affect alluvium of the Modesto Formation. For the reasons described above, this unit has low paleontological sensitivity. Identifiable and *in situ* fossils of scientific significance are unlikely to be present at depth in this unit, and therefore excavations within this unit would not constitute an adverse impact.

Therefore, significant impacts to paleontological resources are not expected to occur from subsurface excavations associated with construction of LEC, nor are they expected from the operation of the LEC.

5.8.4 Cumulative Effects

Widespread development in the San Francisco Bay and Delta areas has resulted in proportionately extensive impacts to paleontological resources, and this is anticipated to continue. The extensive nature of these cumulative impacts is due to this extensive development combined with the widespread presence of a number of fossiliferous sedimentary units in the area. However, measures typically implemented pursuant to State statutes serve to mitigate these impacts through the recovery of the scientific and educational potential of the affected paleontological resources. Although not all projects are subject to CEQA review, and only a small proportion of those incorporate paleontological protection measures, application of paleontological monitoring and mitigation measures is common and therefore mitigates the cumulative as well as direct impacts of continued development.

The potential contribution to cumulative impacts to paleontological resources from project-related ground disturbance would be limited, given the limited extent of the current project and the locally unproven paleontological potential of the Quaternary alluvium at the project site. Thus, the proposed project is not expected to contribute measurably to cumulative negative impacts to paleontological resources in the absence of mitigation. With the mitigation described below, however, the contribution of LEC to cumulative negative impacts to paleontological resources would indeed be negligible. Moreover, the application of controlled scientific recovery methods to discovered paleontological resources is typically thought of constituting a beneficial impact to the extent that new scientific specimens and knowledge are generated.

5.8.5 Mitigation Measures

Guidelines for the Implementation of CEQA (Public Resources Code Sections 15000 *et seq.*) include among the questions to be answered in the Environmental Checklist (Section 15023, Appendix G) the following: "*Would the project directly or indirectly destroy a unique paleontological resource or site*?" and "*Does the project have the potential to . . . eliminate important examples of the major periods of California . . . pre-history*?" These questions are answered in the negative based on the data and considerations provided above. Because

construction of LEC does not have appreciable potential to adversely impact significant paleontological resources, mitigation measures beyond worker education are not necessary.

5.8.5.1 Construction Personnel Education

Prior to working on the site for the first time, all personnel involved in earth-moving activities will be provided with Paleontological Resources Awareness Training. This training would ideally be provided as a module in their worker environmental awareness training. They will be informed that, while fossils are unlikely to be encountered, they are nevertheless of scientific importance and should be reported immediately if indeed they are encountered. The training will provide information on the appearance of fossils, their importance in understanding the prehistory of California, and on proper notification procedures. This worker training will be prepared and initially presented by the Paleontological Resource Specialist. Subsequent training may be conducted using recorded and hard copy training materials.

5.8.5.2 Significant Unavoidable Adverse Impacts

No significant unavoidable adverse impacts on paleontological resources are anticipated as a result of the construction and/or operation of LEC.

5.8.6 Laws, Ordinances, Regulations, and Standards

Paleontological resources (fossils) are the remains or traces of prehistoric plants and animals. They may range from the actual bones and shells of ancient organisms, to mineral replacements of a once-living organism, to simple impressions of plants or animals in soft sediments later transformed to rock. They range in size and abundance from many thousands per cubic centimeter for microfossils such as pollen, diatoms, and radiolaria, to very rare large-mammal bones exceeding a meter in length. Fossils are important scientific and educational resources because of their use in (1) documenting the presence and evolutionary history of particular groups of now-extinct organisms, (2) reconstructing the environments in which these organisms lived, and (3) in determining the relative ages of the strata in which they occur and the geologic events that resulted in the deposition of the sediments that formed these strata. In the project area, the fossils of marine organisms as well as those of terrestrial animals and plants are important in the paleontological record. They have helped define the age and sequences of deposition and uplift along the Great Valley, where fossiliferous marine and terrestrial sedimentary rock provide important data on the development and tectonics of California's complex geology.

Paleontological resources are non-renewable scientific resources and are protected by several federal and state statutes (California Office of Historic Preservation 1983; see also Marshall 1976, Fisk and Spencer 1994), most notably by the 1906 Federal Antiquities Act and other subsequent federal legislation and policies, and by State of California's environmental regulations (CEQA, Section 15064.5). Professional standards for assessment and mitigation of adverse impacts to paleontological resources have been established by the Society of Vertebrate Paleontology (1991, 1995, 1996). Design, construction, and operation of LEC will be conducted in accordance with all laws, ordinances, regulations, and standards (LORS) applicable to paleontological resources. Federal, state, and local LORS applicable to paleontological resources are summarized in Table 5.8-2 and discussed briefly below, along with professional standards for paleontological resources assessment and impact mitigation.

TABLE 5.8-2
Laws, Ordinances, Regulations, and Standards for Paleontological Resources

LORS	Applicability	AFC Reference	Project Conformity
Antiquities Act of 1906	Not applicable – No federal land involved, or federal entitlement required	—	—
National Environmental Policy Act of 1969	Not applicable – No federal land involved, or federal entitlement required	—	—
CEQA, Appendix G	Applicable – Fossil remains may be encountered by earth-moving activities	Sections 5.8.3, 5.8.4, and 5.8.6	Yes
Public Resources Code, Sections 5097.5/5097.9	Not applicable – Applies to state-owned land	—	—

AFC = Application for Certification

5.8.6.1 Federal LORS

Federal protection for significant paleontological resources would apply to LEC only if any construction or other related project impacts occur on federally owned or managed lands, or if a federal entitlement or other permit were required. Federal legislative protection for paleontological resources stems from the Antiquities Act of 1906 (PL 59-209; 16 United States Code 431 et seq.; 34 Stat. 225), which calls for protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federal lands. In addition, the National Environmental Policy Act of 1969 (United States Code, section 4321 et seq.; 40 Code of Federal Regulations, section 1502.25), as amended, requires analysis of potential environmental impacts to important historic, cultural, and natural aspects of our national heritage. Because no federally owned or managed lands will be affected by this project, and no federal entitlement or other permit is required, these statutes to not extend to paleontological resources (see Table 5.8-2).

5.8.6.2 State LORS

The CEC environmental review process under the Warren-Alquist Act is considered functionally equivalent to that of the California Environmental Quality Act (CEQA; Public Resources Code Sections 21000 et seq.). CEQA requires that public agencies and private interests identify the environmental consequences of their proposed projects on any object or site of significance to the scientific annals of California (Division I, California Public Resources Code: 5020.1 [b]). *Guidelines for the Implementation of CEQA* (Public Resources Code Sections 15000 et seq.) defines procedures, types of activities, persons, and public agencies required to comply with CEQA. Appendix G in Section 15023 provides an Environmental Checklist of questions that a lead agency should normally address if relevant to a project's environmental impacts. One of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section V, part c) is the following: "Would the project directly or indirectly destroy a unique paleontological resource or site…?"

Although CEQA does not define what is "a unique paleontological resource or site," Section 21083.2 defines "unique archaeological resources" as "…any archaeological artifact, object, or site about which it can be clearly demonstrated that, without merely adding to the

current body of knowledge, there is a high probability that it meets any of the following criteria:

- Contains information needed to answer important scientific research questions and that there is a demonstrable public interest in that information
- Has a special and particular quality such as being the oldest of its type or the best available example of its type.
- Is directly associated with a scientifically recognized import prehistoric or historic event."

With only slight modification, this definition is equally applicable to recognizing "a unique paleontological resource or site." Additional guidance is provided in CEQA Section 15064.5 (a)(3)(D), which indicates "generally, a resource shall be considered historically significant if it has yielded, or may be likely to yield, information important in prehistory or history."

Section XVII, part a, of the CEQA Environmental Checklist asks a second question equally applicable to paleontological resources: "Does the project have the potential to . . . eliminate important examples of the major periods of California history or pre-history?" To be in compliance with CEQA, impact assessments must answer both these questions in the Environmental Checklist. If the answer to either question is "yes" or "possibly", a mitigation and monitoring plan must be designed and implemented to protect significant paleontological resources. The answer to these questions is "possibly" if not "yes", and therefore CEQA does apply to this project (Table 5.8-2).

The CEQA lead agency having jurisdiction over a project is responsible to ensure that paleontological resources are protected in compliance with CEQA and other applicable statutes. The lead agency with the responsibility to ensure that fossils are protected during construction of the proposed LEC is the CEC. California Public Resources Code Section 21081.6, entitled Mitigation Monitoring Compliance and Reporting, requires that the CEQA lead agency demonstrate project compliance with mitigation measures developed during the environmental impact review process.

Other state requirements for paleontological resource management are in California Public Resources Code Chapter 1.7, Section 5097.5/5097.9 (Stats. 1965, c. 1136, p. 2792), entitled Archaeological, Paleontological, and Historical Sites. This statute defines any unauthorized disturbance or removal of a fossil site or remains on public land as a misdemeanor and specifies that state agencies may undertake surveys, excavations, or other operations as necessary on state lands to preserve or record paleontological resources. Public Resources Code, Sections 5097.5/5097.9 does not apply to LEC because construction or other related project impacts will not occur on state owned or managed lands and no state agency is intended to obtain ownership of project lands during the term of the project license (Table 5.8-2).

5.8.6.3 Local LORS

Title 9 of the Development Title of San Joaquin County (n.d.) places emphasis on the preservation of historic and cultural resources, including heritage resources, but does not address paleontological resources *per se*.

5.8.6.4 Professional Standards

The Society of Vertebrate Paleontology (SVP), an international organization of professional paleontologists, has established standard guidelines (SVP, 1991; 1995; 1996) that outline acceptable professional practices in the conduct of paleontological resource assessments and surveys, monitoring and mitigation, data and fossil recovery, sampling procedures, and specimen preparation, identification, analysis, and curation. Most practicing paleontologists in the nation adhere to the SVP's guidelines, and extend those to address other types of fossils of scientific significance, such as invertebrate fossils and paleobotanical specimens. Many federal and state regulatory agencies, including the CEC, have informally adopted the SVP standard guidelines.

5.8.7 Agencies and Agency Contacts

There are no agencies having blanket jurisdiction over paleontological resources. The CEC has jurisdiction over paleontological resources for this project. Title 9 of the Development Code of San Joaquin County (n.d.) places emphasis on the preservation of historic and cultural resources, including heritage resources, but does not address paleontological resources *per se*.

The City of Lodi Community Development Department and the San Joaquin County Community Development Department were contacted regarding the existence of regulations pertaining to paleontological resources. Neither City of Lodi nor San Joaquin County have specific regulations; both follow CEQA and Federal regulations relevant to paleontological resources.

In the event paleontological resources are encountered during construction activities, both the City of Lodi and San Joaquin County should be contacted.

TABLE 5.8-3
Agency Contacts for Paleontological Resources

Issue	Agency	Contact
City of Lodi Paleontological Resources Regulations	City of Lodi Community Development Department	Kari Chadwick 221 West Pine Street P.O. Box 3006 Lodi, California 95241 (209)333-6711
San Joaquin County Paleontological Resources Regulations	San Joaquin County Community Development Department	Jason Jones 1810 E. Hazelton Ave. Stockton, CA 95205 (209) 468-3124 Phone
Paleontological Resources Documentation	University of California Museum of Paleontology Berkeley, CA	Dr. Patricia Holroyd Curator of Vertebrate Paleontology 1101 Valley Life Sciences Building Berkeley, CA 94720-4780 (510) 642-3733 pholroyd@berkeley.edu

5.8.8 Permits and Permit Schedule

No state, county, or city agency requires a paleontological collecting permit to allow for the recovery of fossil remains discovered as a result of construction-related earth moving on this project site.

5.8.9 References

Bloom, A. L., 1983. Sea Level and Coastal Morphology of the United States through the Late Wisconsin Glacial Maximum. In *Late Quaternary Environments of the United States, Volume 1, The Late Pleistocene*, edited by S. C. Porter, pp. 215-229. University of Minnesota Press, Minneapolis.

California Energy Commission (CEC). 2000. Paleontological Resources: in Regulations Pertaining to the Rules of Practice And Procedure & Power Plant Site Certification, 3 p.

California Energy Commission (CEC). 2007. Paleontologic Resources: in Complete Text of the Energy Commission's Proposed Amendments to the Power Plant Siting Regulations, 1 p.

California Office of Historic Preservation. 1983. Summary of State/Federal Laws Protecting Cultural Resources, 10 p.

CH2M HILL, n.d. Monthly Paleontological Resources monitoring reports for the Gateway and Contra Costa Energy Centers. On file at CH2M HILL, Natomas Office, Sacramento.

Fenneman. N. M., 1931. *Physiography of Western United States*. McGraw-Hill Book Company, New York, NY, 534 p.

Fisk, L. H., and L. A. Spencer. 1994. Highway Construction Projects Have Legal Mandates Requiring Protection of Paleontological Resources (fossils). p. 213-225, in: Scott F. Burns (editor), *Proceedings of the 45th Highway Geology Symposium, Portland, Oregon*, 258 p.

Kleinfelder, Inc. 1993. *report geotechnical investigation proposed Combustion Turbine Project No. 1, Lodi, California.* Kleinfelder, Inc., Stockton, CA.

Lettis, W.R., and J.R. Unruh, 1991. Quaternary Geology of the Great Valley, California. In *The Geology of North America, Volume K-2, Quaternary Non-Glacial Geology: Conterminous U. S.*, edited by R.B. Morrison, pp. 164-176. Geological Society of America, Boulder, CO.

Marchand, D. E., and B. F. Atwater. 1979. Preliminary Geologic Map showing Quaternary deposits of the Lodi Quadrangle, California. U.S. Geological Survey Open-file Report OF-79-933.

Marshall, L. G. 1976. "Paleontological Salvage And Federal Legislation." *Journal of Paleontology*. vol. 50, p. 346-348.

Martin, P. S. 2005. *Twilight of the Mammoths.* University of California Press, Berkeley.

San Joaquin County (n.d.). Title 9 of the Development Code, Chapter 9-1053. *Historic Resources Preservation*. Stockton, CA.

Shlemon, R. J., 1971. The Quaternary deltaic and channel system in the central Great Valley, California. *Annals of the Association of American Geographers* 61: 427-440.

Society of Vertebrate Paleontology. 1991. "Standard Measures for Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontological Resources." *Society of Vertebrate Paleontology News Bulletin*. 152: 2-5.

Society of Vertebrate Paleontology. 1995. "Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontological Resources: Standard Guidelines." *Society of Vertebrate Paleontology News Bulletin*. 163: 22-27.

Society of Vertebrate Paleontology. 1996. "Conditions of Receivership for Paleontological Salvage Collections." *Society of Vertebrate Paleontology News Bulletin*. 166: 31-32.

Spaulding, W. G., and R. B. G.-Naidu. 2006. *Paleontological Resources Report Walnut Energy Center Stanislaus County, California.* Prepared for the Walnut Energy Center Authority. CH2M HILL, Sacramento.

Wahrhaftig, Clyde, and J. H. Birman 1965 The Quaternary of the Pacific mountain system in California. In The Quaternary of the United States, edited by H. E. Wright, Jr., and D. G. Frey, pp. 299-340. Princeton University Press, New Jersey.

Woodburne, M. O. (editor). 2004. Late Cretaceous and Cenozoic Mammals of North America Biostratigraphy and Geochronology. Columbia University Press, New York.