5.9 Paleontological Resources

This section evaluates the potential impacts on paleontological resources of the PHPP. The assessment is based a comprehensive literature review, museum records search and fieldwork at the plant site, as well as along the Project's linear facilities. The evaluation summarizes applicable LORS, discusses the paleontological sensitivity of the Project area and vicinity, evaluates potential Project-related impacts on the paleontological resources identified, and provides recommendations for mitigating potential impacts.

This assessment was conducted in accordance with the professional standards of the Society of Vertebrate Paleontology (SVP). The assessment was performed by qualified paleontological professionals. Additional details of the assessment, including personnel qualifications, are provided in Appendix J.

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. The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered nonrenewable resources because the organisms they represent no longer exist. Once destroyed, a fossil can never be replaced.

5.9.1 LORS Compliance

Fossils are classified as nonrenewable scientific resources and are protected by various laws, ordinances, regulations, and standards (LORS) across the country. These LORS are summarized in Table 5.9-1, and the following paragraphs. The Project will comply with the applicable LORS during both construction and operation.

Table 5.9-1 Summary of LORS for Paleontological Resources

LORS	Applicability	Where Discussed in AFC
Federal:		
Antiquities Act of 1906 (16 United States Code (USC) 431 et seq.)	Requires protection of historic and prehistoric structures, and other objects of historic or scientific interest on Federal lands (no Federal lands are involved in the BSEP Project).	Section 5.9.1
State:		
California Environmental Quality Act (CEQA), PRC Section 21000 et seq.	Addresses project construction that encounters paleontological resources	Sections 5.9.1, 5.9.3, and 5.9.4.

LORS	Applicability	Where Discussed in AFC
PRC Section 5097.5 - 5097.9	Prohibits unauthorized removal of paleontological resources from sites located on public lands; not applicable unless project lands have been acquired by the State, which is not the case.	Section 5.9.1
Local:		
Los Angeles County General Plan	Addresses the preservation of paleontological resources in accordance to CEQA guidelines and sets forth a policy to preserve paleontological resources where feasible	Section 5.9.1 Section 5.9.4
City of Palmdale General Plan	Addresses the preservation of paleontological resources, and establishes requirements for appropriate mitigation for adverse impacts on paleontological resources	Section 5.9.1 Section 5.9.4
Professional Standards		
Society of Vertebrate Paleontology (1995)	Establishes standards for paleontological assessments and for mitigation of adverse impacts on paleontological resources	Sections 5.9.3 and 5.9.4

5.9.1.1 Federal LORS

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 the protection of historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest on federally administered lands. Federal protection for significant paleontological resources would apply to the Project if any construction or other related project impacts occurred on federally owned or managed lands. No Federal protection of paleontological resources pertains to the PHPP.

5.9.1.2 State LORS

The CEC environmental review under the Warren-Alquist Act is legally a CEQA-equivalent process. Guidelines for the Implementation of CEQA, as amended March 29, 1999 (Title 14, Chapter 3, California Code of Regulations: Sections 15000 et seq.) define procedures, types of activities, persons, and public agencies required to comply with CEQA, and include as one of the questions to be answered in the Environmental Checklist (Section 15023, Appendix G, Section XIV, Part a) the following: "Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?"

Other state requirements for paleontological resources management are included in Public Resources Code (Chapter 1.7), Sections 5097.5 and 30244. These statutes prohibit the removal of any paleontological site or feature on public lands without permission of the jurisdictional agency, define the removal of paleontological sites or features as a misdemeanor, and require reasonable mitigation of adverse impacts to paleontological resources from developments on public (state) lands. These protections would apply to the Project only if the State were to obtain ownership of Project lands during the term of its license.

5.9.1.3 Local LORS

Los Angeles County

The County is in the process of comprehensively updating the existing Los Angeles General Plan, adopted in 1980. In 2007, a Draft Preliminary General Plan was released in which paleontological resources are addressed under Conservation and Open Space, Section VII Historical, Cultural, and Paleontological Resources. Programs for Cultural and Historical Resources for CEQA indicate the following:

> "CEQA provides guidelines for the identification and protection of archaeological sites, artifacts, and paleontological resources. If a project threatens an archaeological or paleontological resource, the project is required to provide mitigation measures to protect the site or enable study and documentation of the site. Assessment of these resources requires a survey prepared by a qualified archaeologist or paleontologist."

City of Palmdale

Under the Environmental Resources Element of the City of Palmdale's 1993 General Plan, the following goal (ER7.1) is to "Protect historic and culturally significant resources which contribute to the community's sense of history" under which Objective ER7.1 states "Promote the identification and preservation of historic structures, historic sites, archaeological sites, and paleontological resources in the City." Policy ER7.1.3 requires that "new development protect significant historic, paleontological, or archaeological resources, or provide for other appropriate mitigation." In 1990, a paleontologic sensitivity study of the City of Palmdale Planning Area (Reynolds, 1990) identified five sedimentary rock units with a high potential to produce such significant paleontological resources: the Punchbowl Formation, the Anaverde Formation, the Harold Formation, the Nadeau Gravel, and Pleistocene-age old alluvial, lacustrine, and fluvial sediments. Two additional units, the Vasquez Formation and younger alluvium, were assigned unknown potential to produce paleontological resources.

5.9.1.4 Involved Agencies

Agency contacts for Project paleontological resources issues are shown in Table 5.9-2.

Table 5.9-2 Agencies and Agency Contacts

Agency Contact	Phone/E-mail	Permit/Issue
Asoka Herath City of Palmdale Planning Department 38250 Sierra Highway Palmdale, CA 93550	661-267-5200 aherath@cityofpalmdale.org	None required

5.9.1.5 Required Permits and Permit Schedule

No permits are required that are related to paleontological resources

5.9.2 Affected Environment

The following subsections discuss existing conditions with respect to paleontological resources in the PHPP area.

5.9.2.1 Records Search and Field Survey

The vertebrate paleontology section of the Natural History Museum of Los Angeles County (LACM) (McLeod, 2008), the Department of Earth Sciences at the San Bernardino County Museum (SBCM) (Scott, 2008), and the Museum of Paleontology at the University of California, Berkeley (UCMP) (Erwin, 2008) performed a detailed review of museum collections records for the purposes of: determining whether there are any known fossil localities in or near the PHPP plant site and linear facilities; identifying the geologic units present in the Project area; and determining the paleontological sensitivity ratings of those geologic units in order to assess potential impacts to non-renewable paleontological resources. Published and unpublished literature and geologic maps were reviewed, and paleontological sensitivity maps were created for the Project area using these data. Additionally, the San Diego Natural History Museum (SDNHM) performed a cursory review of their database to determine if they have records in the area. A full records review was not completed by SDNHM staff since they determined that they do not own collections in the Palmdale vicinity. The paleontological sensitivity maps are included in Appendix J.

A reconnaissance field survey of the entire PHPP plant site and buffer area, transmission line routes, water pipeline, and natural gas pipeline route was performed between May 13 and June 27, 2008. A windshield survey of the sanitary wastewater line was performed on June 27, 2008. The linear surveys included a 100-foot buffer (50 foot buffer on either side of the centerlines). The purpose of the fieldwork was to inspect the survey area for surface fossils and exposures of potentially fossil-bearing geologic units and to determine areas in which fossil-bearing geologic units could be exposed during Project-related ground disturbances.

5.9.2.2 Paleontological Sensitivity

Due to the nature of the fossil record, paleontologists cannot know either the quality or the quantity of fossils present in a given geologic unit prior to natural erosion or human-caused exposure. Therefore, in the absence of surface fossils, it is necessary to assess the sensitivity of rock units based on their known potential to produce scientifically significant fossils elsewhere within the same geologic unit (both within and outside of the study area) or a unit representative of the same depositional environment.

Paleontological sensitivity is defined as the potential for a geologic unit to produce scientifically significant fossils. This is determined by rock type, past history of the geologic unit in producing significant fossils, and fossil localities recorded from that unit. Paleontological sensitivity is derived from the known fossil data collected from the entire geologic unit, not just from a specific survey. In its “Standard Guidelines for the Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources,” the SVP (1995:23) defines three categories of paleontological sensitivity (potential) for sedimentary rock units: high, low, and undetermined:

- **High Potential.** Rock units from which vertebrate or significant invertebrate fossils or suites of plant fossils have been recovered and are considered to have a high potential for containing significant nonrenewable fossiliferous resources. These units include, but are not limited to, sedimentary formations and some volcanic formations that contain significant nonrenewable paleontologic resources anywhere within their geographical extent and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Sensitivity comprises both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical, and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, ecologic, or stratigraphic data. Areas that contain potentially datable organic remains older than Recent, including deposits associated with nests or middens, and areas that may contain new vertebrate deposits, traces, or trackways are also classified as significant.

- **Low Potential.** Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow determination that some areas or units have low potentials for yielding significant fossils. Such units will be poorly represented by specimens in institutional collections.
- **Undetermined Potential.** Specific areas underlain by sedimentary rock units for which little information is available are considered to have undetermined fossiliferous potentials.

It should be noted that highly metamorphosed rocks and granitic rock units do not generally yield fossils and therefore have low potential to yield significant nonrenewable fossiliferous resources.

In general terms, for geologic units with high potential, full-time monitoring typically is recommended during any project-related ground disturbance. For geologic units with low potential, protection or salvage efforts typically are not required. For geologic units with undetermined potential, field surveys by a qualified paleontologist are usually recommended to specifically determine the paleontologic potential of the rock units present within the study area.

5.9.2.3 Regional Geologic Setting

California is naturally divided into the following twelve geomorphic provinces, each distinguished from one another by having unique topographic features and geologic formations: (1) the Sierra Nevada, (2) the Klamath Mountains, (3) the Cascade Range, (4) the Modoc Plateau, (5) the Basin and Range, (6) the Mojave Desert, (7) the Colorado Desert, (8) the Peninsular Ranges, (9) the Transverse Ranges, (10) the Coast Ranges, (11) the Great Valley, and (12) the Offshore area. The PHPP area is located in the Antelope Valley, in the western-most region of the Mojave Desert geomorphic province. The proposed transmission line route for the PHPP extends south into the Transverse Ranges province and then veers west, crossing the San Andreas Fault zone.

The Antelope Valley is a wedge-shaped fault block bound by the Garlock and San Andreas fault zones (Norris and Webb, 1976). The Garlock, forming the northern boundary, trends roughly northeast-southwest. The San Andreas forms the southern boundary of the western Mojave Desert and trends southeast-northwest along the northern foothills of the San Gabriel Mountains until it crosses the range at Cajon Pass. The large fault zone was created by the relative tectonic movement of the North American and Pacific plates.

During the Miocene, about 25 to 29 million years ago (Ma), the Pacific and North American plates were moving towards each other. The Pacific plate became completely overridden, creating a subduction zone along the western coast of what is now the United States. The plates continued to converge until the Pacific plate's mid-ocean ridge reached the subduction zone and the ridge became a transform fault known today as the San Andreas. The Pacific plate began moving northwest in relation to the North American plate and today it is believed that about 350 mi (560 km) of total displacement has occurred. In addition to displacement, the strike-slip movement of the Pacific and North American plates has created dramatic topography. As the Pacific plate pushes north into the North American plate, the compressional forces trap sediments and push them upward. In northern Los Angeles County along the San Andreas fault, this mechanism created the San Gabriel Mountains; along the Garlock fault, similar geologic processes created the Tehachapi Mountains. Trapped between the two mountain ranges and the two fault systems, the Antelope Valley serves as a depositional basin. As the mountains to the north and south are pushed up, they also slowly erode away and alluvial sediments are deposited on top of the fault zones and on the valley floor.

The southwestern Antelope Valley today is characterized by three major rock groups. The first is the basement complex of intrusive igneous rock consisting of a pre-Tertiary granitoid batholith believed to be an extension of the Sierra Nevada batholith (Dibblee, 1967). These basement rocks, typically varieties of dioritic gneiss or gneissic diorite, can be found to both the north and south sides of the fault zone (Barrows et al., 1985). Because these rocks were present before the formation of the San Andreas, they are, in places, metamorphosed by the extensive uplift, faulting and offset near and within the fault zone. These rocks often serve as the source material for younger sedimentary and alluvial deposits.

The second major rock group is Tertiary-age sedimentary and volcanic rocks mostly of terrestrial origin and consisting of conglomerates, sandstones, shales, carbonates, tuffs and breccias, lava flows, and basaltic and rhyolitic plugs (Barrows et al., 1985; Dibblee, 1967). These rocks were deposited previous to, simultaneous with, and after the formation of the San Andreas and the patterns of metamorphism and displacement along the fault zone and in the San Gabriel Mountains have been useful in studying the geologic history of the area.

The third major rock assemblage (3) in the western Mojave Desert is composed of Quaternary alluvial, fluvial, and playa, or lake bed, deposits (Dibblee, 1967). These alluvial sediments are largely derived from the uplifted and subsequently eroded San Gabriel Mountains. With over 40 separate alluvial units identified, the sediments are differentiated by their specific source material, a combination of clasts from basement igneous rocks and recycled material from Tertiary-age sedimentary and volcanic units (Barrows et al., 1985; Dibblee, 1967; Ponti et al., 1981). These sediments were deposited conformably and, more commonly, unconformably on top of Tertiary- and pre-Tertiary–age rocks throughout the western Mojave Desert. In the Antelope Valley, where the deposition is the thickest, the depth of Quaternary-age alluvial sediments ranges from a few feet to possibly several thousand feet in thickness.

5.9.2.4 Geologic Setting of the Project Site and Vicinity

Geologic mapping by Dibblee (1959; 1960), Dibblee and Ehrenspeck (2001), and Jennings and Strand (1969) indicate that the PHPP plant site and associated linear facility routes are underlain by the following geologic units, in approximate ascending age: (1) Mesozoic granitic rocks, (2) Vasquez Formation (Oligocene to Early Miocene), (3) Punchbowl Formation (Late Miocene), (4) Anaverde Formation (Pliocene), (5) Older Quaternary deposits including the Harold Formation and the Nadeau Gravel (Pleistocene), and (6) Younger surficial alluvium (Holocene).

Table 5.9-3 Geologic Units Underlying the PHPP Project and their Paleontological Sensitivity Ratings

Geologic Unit	Geologic Map Abbreviation	Age	Types of Species	Sensitivity Rating
Younger surficial alluvium	Qa, Qya	Holocene to Latest Pleistocene	None	Low to High (increases with depth)
Nadeau Gravel	Qn	Pleistocene	Vertebrates	High
Harold Formation	Qh	Pleistocene	Vertebrates	High
Older Alluvium	Qoa, Qos	Pleistocene	Vertebrates	High
Anaverde Formation	Tas, Tau, Tal	Pliocene	Plants	High
Punchbowl Formation	Tpm, Tpu	Late Miocene	Vertebrates	High
Vasquez Formation	Tvs,Tvv	Oligocene to Early Miocene	None	Undetermined
Granitic Rocks	gr	Mesozoic	None	Low
Lowe Granodiorite	lgdb	Mesozoic	None	Low

Granitic Rocks

Granitic rocks of Mesozoic age (250 to 65 Ma) including granite, quartz monzonite, quartz diorite, and the Lowe Granodiorite are found intermittently along the east-west trending southern portion of the proposed transmission line route (Dibblee and Ehrenspeck, 2001; McLeod, 2008). These rocks, mapped as “gr,” are typically massive, medium grained, and light colored, are dominated by plagioclase feldspar, potassic feldspar, and quartz. The Lowe Granodiorite (“lgdb”) also contains abundant biotite and hornblende. These granitic rocks are plutonic in origin and do not have the potential for significant paleontological resources; therefore, they have been assigned a low paleontological sensitivity.

Vasquez Formation

The Vasquez Formation, late Oligocene to early Miocene in age (25 to 21 Ma), is a semi-lithified terrestrial unit of predominantly sedimentary rocks which outcrops throughout the Soledad basin in the central Transverse Ranges geomorphic province (Dibblee and Ehrenspeck, 2001; Hendrix and Ingersoll, 1987; McLeod, 2008). In the eastern portion of the Soledad basin, where the PHPP area crosses the Vasquez Formation, volcanic rocks are also abundant. Two distinct lithologies can be found along the southwestern portion of the proposed transmission line route. The lower member, mapped as “Tvs,” is composed of maroon-red sandstone interbedded with pebble and cobble conglomerate of granitic origin. The more prominent upper member, mapped as “Tvv,” is composed of various volcanic rocks including andesite, basalt lava flows, dacite, and rhyolite interbedded with tuff, breccia, and ash (Noble, 1953). The sediments of the Vasquez Formation are not known to produce scientifically significant paleontological resources and the unit has been assigned an undetermined paleontological sensitivity.

Punchbowl Formation

Fluviatile, lacustrine, and alluvial fan deposits known as the Punchbowl Formation are late Miocene in age (11 to 5 Ma) and are found along the San Andreas fault zone discontinuously from Cajon Valley west to the Palmdale area (Barrows et al., 1985; Dibblee and Ehrenspeck, 2001; McLeod, 2008; Woodburne, 1975). Within the PHPP area, the Punchbowl Formation is found south of the San Andreas fault, along the southern portion of the proposed transmission line route. Here the formation is divided into three members: the upper, middle, and lower. The upper and lower members are fan and stream deposits and share similar lithologies. Both mapped as “Tpu,” by Noble (1953), these members are composed of pink, red, and brown conglomeratic sandstone and siltstone with rounded pebbles and cobbles. The middle member, composed of playa deposits mapped as “Tpm,” consists of gypsiferous brown shale and thin beds of fine-grained, platy, brown, quartzose sandstone (Noble, 1953). This western facies is sometimes referred to and mapped as the Juniper Hills Formation and may represent a later, Pleistocene-age, depositional period than the type area of the Punchbowl Formation located at Devil’s Punchbowl in the Valyermo quadrangle (Barrows et al., 1985; Woodburne, 1975).

Although no previously recorded fossil localities from this unit are known from within one mile of the PHPP area, the Punchbowl Formation has been known to produce scientifically significant vertebrate fossil remains (McLeod, 2008). The type area of the Punchbowl Formation has produced fossil specimens of early horse, camel, antelope, dog, and mustelid (Noble, 1953; McLeod, 2008; Woodburne, 1975; Woodburne, 2005; Woodburne, 2007). One Devil’s Punchbowl specimen of *Cormohipparion*, a Miocene age horse, documents the westernmost extent of the species and is the only occurrence known from California (Woodburne, 2005). To the east, the Cajon Valley exposures of the Punchbowl Formation have produced the fossil remains of early horse, antelope, camel, oreodont, and peccary (Woodburn, 1975). The Punchbowl Formation has a proven potential to produce scientifically significant paleontological resources and is therefore assigned a high paleontological sensitivity rating.

Anaverde Formation

The Anaverde Formation of late Miocene to very early Pliocene age (9 to 5 Ma) is a terrestrial unit deposited by rivers and lakes and is present only north of the San Andreas fault (Dibblee and Ehrenspeck, 2001; McLeod, 2008). Within the PHPP area, this unit is found along the southern portion of the proposed transmission line route. Two informal members are recognized and mapped. The upper member, “Tau” (Noble, 1953) and “Tac” (Dibblee and Ehrenspeck, 2001), is composed of well-bedded conglomeratic arkosic sandstone and clay shale. The lower member, referred to as “Tal” (Noble, 1953) and “Tas” (Dibllee and Ehrenspeck (2001), is composed of interbedded calcareous sandstone containing some granitic pebbles and cobble lenses and minor amounts of clay shale (Axelrod, 1950; Dibblee and Ehrenspeck, 2001; Noble, 1953).

The Anaverde Formation is known to produce an abundance of well-preserved fossil leaves and its diverse flora has been useful in the reconstruction of the late Miocene Antelope Valley paleoenvironment (Axelrod, 1950). The Anaverde flora has helped paleobotanists to analyze the history and evolution of modern desert flora and, by comparing Miocene vegetation and climate in the western Mojave to other bordering regions, it has allowed for a more complete look at plant paleogeography and floral succession in the western United States. The flora was first discovered in 1941 by Dr. Robert Wallace and first analyzed and published by Daniel Axelrod in 1950. From the initial locality, 283 leaf impressions were recovered representing 21 species, 17 genera, 12 families and numerous vegetative communities including live oak woodland, conifer woodland, chaparral, coastal sage, grassland, desert-border, and arid sub-tropical scrub.

Although no fossil localities from this unit are known from within one mile of the Project area, there are two known nearby localities that have produced abundant plant and vertebrate material including mastodon, horse, birds, carnivores, rabbits, and rodents (McLeod, 2008b; Erwin, 2008; City of Palmdale, 1993). The plant locality described above (UCMP P4139), which produced the original Anaverde flora studied by Axelrod (1950), is only two miles from the Project area (Erwin, 2008). Therefore, the Anaverde Formation has great potential to further produce scientifically significant paleontological resources and has been assigned a high paleontological sensitivity.

<u>Older Quaternary Deposits</u>

Harold Formation

The Harold Formation, of mid-Pleistocene age (1.2 Ma to 500,000 years BP [before present]), occurs both north and south of the San Andres fault zone (Barrows et al., 1985). Within the PHPP area, it is found along the southern east-west trending portion of the proposed transmission line route (Noble, 1953). The unit is composed of poorly to moderately consolidated, massive, white, light brown, light to dark gray, and reddish brown, fluvial, alluvial fan, and lacustrine, well-stratified, interbedded deposits of clay, silt, sand, and gravel (Barrows et al., 1985; Noble, 1953). Although there are no known fossil localities from within the PHPP area, numerous vertebrate specimens from six localities have been recovered from the Harold Formation including mammoth, mastodon, horse, camel, rodents, and reptiles (Noble, 1953; City of Palmdale,1993). Therefore, the Harold Formation has been assigned a high paleontological sensitivity.

Nadeau Gravel

The Nadeau Gravel unconformably overlies the sediments of the Harold Formation and likely date to the late Pleistocene (500,000 years BP to 10,000 years BP) (Barrows et al., 1985; Noble 1953). Within the PHPP area, it is found along the southern east-west trending portion of the proposed transmission line route (Noble, 1953). The unit is composed of poorly consolidated, poorly sorted, dark gray, angular to subrounded cobble to boulder clasts of Pelona Schist and locally Vasquez Formation in a dark reddish-brown matrix with interbedded micaceous sand (Barrows et al., 1985; Noble 1953). Although there are no known fossil localities from the Nadeau Gravel within the PHPP area, numerous localities are known from the nearby Edwards Air Force Base including four that have produced vertebrate remains (Barrows, et al., 1985; City of Palmdale, 1993). Therefore, the Nadeau Gravel has been assigned a high paleontological sensitivity.

Quaternary Alluvium

Quaternary alluvium of Pleistocene age (1.8 Ma to 10,000 years BP) is found subsurface throughout the majority of the PHPP area, underlying younger surficial alluvial deposits throughout the proposed plant site, along the majority of the water and gas pipeline routes, and along the northern and eastern portions of the transmission line route (Dibblee, 1959; Dibblee, 1960; Dibblee and Ehrenspeck, 2001; Jennings and Strand, 1969; McLeod, 2008; Scott, 2008). Surficial deposits can be found along the southern portion of the proposed gas pipeline route and along the southwestern portion of the transmission line route. Older alluvium is composed of unconsolidated stream deposits of gravel and sand of plutonic rock and mica schist detritus. Pleistocene-aged alluvial sediments have proven to yield scientifically significant vertebrate fossils both within the region and throughout southern California and are thus determined to have a high potential for paleontological resources (Jefferson, 1989; McLeod, 2008; Reynolds, 1989; Scott, 2008; Whistler, 1990).

Quaternary age sediments are difficult to date because material which can be dated using radiometric methods is rare and only a rough chronology is evident through stratification. However, some fossil finds can be used to correlate sediments with more precise dates; for example, Rancholabrean mammalian fossils from the Harold Formation suggest that the oldest Quaternary deposits from the Antelope Valley are from around 400,000 years BP (Ponti et al., 1981). Additionally, because of the erosional nature of alluvial deposition, specific climatic events which induced large fluctuations in the amount of erosion can be correlated with specific units. Ponti et al. (1981) suggest that alluvial units in the Antelope Valley correlate with pulses of increased sedimentation during known climatic shifts from periods of glaciation to interglacial times. Despite these methods, older Pleistocene-age sediments which have the potential to produce paleontologic resources are difficult to distinguish from surficial alluvial sediments of Holocene-age which do not.

Younger Alluvium

The youngest geologic unit found within the PHPP area is Quaternary alluvium of Holocene age (10,000 years BP to Recent) (Dibblee, 1959; Dibblee, 1960; Dibblee and Ehrenspeck, 2001; Jennings and Strand, 1969; McLeod, 2008; Scott, 2008). This unit is found surficially throughout the proposed plant site, along the majority of the water and gas pipeline routes, and along the northern and eastern portions of the transmission line route. It is also found intermittently along the southwestern portion of the proposed transmission line route. Younger alluvium is composed of unconsolidated valley and stream deposits of gravel, sand, silt, and clay. Although these Holocene-aged sediments often contain the remains of modern organisms, they are too young to contain significant paleontological resources. Therefore, younger alluvium is assigned a low paleontological sensitivity.

Sensitive Geologic Units

The majority of the PHPP plant site and linear facilities are immediately underlain by Quaternary younger alluvium of Holocene age that is considered to have a low paleontological sensitivity. Quaternary older alluvium, which dates to the Pleistocene, is present only in the subsurface throughout the plant site, water, sewer and gas pipeline routes. The southern portion of the transmission line is considered an area of high sensitivity as it is underlain by the Anaverde Formation, Punchbowl Formation, Nadeau Gravel, Harold Formation, and Vasquez Formation. The locations of paleontologically sensitive geologic units underlying the PHPP plant site and linear facilities are identified on Figure 5.9-1.

Paleontological Resources Assessment

A comprehensive review of museum collections records at the SBCM, LACM, UCMP, and SDNHM confirmed that no fossil localities have been previously recorded within the PHPP plant site or within a one-mile radius. However, at least 30 vertebrate fossil localities and two plant localities have been previously recorded within a radius of one-half mile to more than two miles radius from the boundaries of the transmission line route and gas and water supply line routes (McLeod, 2008; Erwin, 2008; Scott, 2008). Fossils of thirty -eight different species previously recovered from fourteen different localities in Pleistocene or Quaternary older alluvium, Harold Formation, Anaverde Formation, and Punchbowl Formation sediments. These fossil localities yielded lizards, snakes, birds, rabbits, skunks, gophers, rats, mice, mammoth, mastodon, camels, horse, oak, pine, cottonwood, avocado, squaw apple, willow, and sycamore.

During the pedestrian survey, one previously undocumented significant fossil locality was observed and recorded. SWCA Locality Number LES052008-01 was discovered on an exposed bedrock outcrop in the Punchbowl Formation along the southern portion of the proposed transmission line route, adjacent to an existing power pole. Locality Number LES052008-01 yielded numerous poorly to moderately preserved fossil plant impressions encased within a brownish gray, well indurated, highly weathered and fractured claystone.

5.9.3 Environmental Impacts

The following paragraphs address the potential impacts on paleontological resources of the PHPP.

5.9.3.1 Construction and Operation Impacts

Construction of the Project has the potential to result in the destruction of surface or sub-surface paleontological resources via breakage and crushing related to ground disturbing activities; ground disturbance has the potential to adversely impact an unknown quantity of fossils that may occur on or underneath the surface in areas containing paleontologically sensitive geologic units. The majority of the Project area is immediately underlain by a surface that is considered to have a low paleontological sensitivity. The subsurface of most of the Project area and the surface of the southern portion of the transmission line are considered areas of high sensitivity (Figure 5.9-1). Shallow excavations in much of the Project area are unlikely to result in adverse impacts to significant palentological resources, but deeper excavations into the subsurface (six feet or more in depth) and any excavations (even shallow) in the southern portion of the transmission line route potentially may have an adverse impact on paleontological resources without proper mitigation measures.

One significant fossil locality was discovered in the Project area during the Project field survey. It is recommended that this locality should be salvaged (collected) for further study and analysis prior to start of ground disturbance associated with construction of the PHPP transmission line in order to mitigate any adverse impacts to this resource to a less than significant level. Details of this salvage plan will be outlined in the Paleontological Resources Monitoring and Mitigation Plan (PRMMP) that will be prepared and submitted to CEC staff for approval prior to ground disturbance. All significant fossils recovered during the pre-construction salvage of LES052008-01 will be prepared, stabilized, identified, and permanently curated in an approved repository or museum. Additionally, implementation of measures described in Section 5.9.4 below (e.g., proper planning, employee training, monitoring by a professional paleontologist in areas of high paleontological sensitivity), will ensure that any unknown fossils that may be encountered would not be adversely impacted (destroyed), rendering them permanently unavailable. With these measures in place, impacts during construction will be less than significant.

Operational impacts to paleontological resources typically include those effects related to the continuing implementation of activities within a specific project area. The operation of the PHPP will not result in an adverse impact to paleontological resources because no substantial new ground disturbance is expected as part of operations. Additionally, the PHPP plant site will be fenced, thereby decreasing public access and opportunities for the loss of paleontological resources through vandalism and unlawful collecting.

5.9.3.2 Cumulative Impacts

Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In general, for scientifically significant paleontological resources that are present within the Project area, the potential for the Project to contribute to significant cumulative impacts would be low with the implementation of measures to avoid or salvage the resources. The mitigation measures listed below would effectively recover the value to science and society of significant fossils that would otherwise have been destroyed by surface disturbing actions. Further, just like the PHPP, other projects in the same vicinity as the PHPP would be required to comply with the same laws and regulations that protect paleontological resources.

5.9.4 Mitigation Measures

The following mitigation measures have been developed to ensure that the potential adverse impacts of PHPP ground disturbance on paleontological resources are less than significant. The measures are based on the SVP standard guidelines and meet the requirements of CEQA. These mitigation measures have been used throughout California and have been demonstrated to be successful in protecting paleontological resources while allowing timely completion of construction projects in paleontologically sensitive areas.

PAL -1 Prior to the start of any Project related construction (defined as construction related vegetation clearing, ground disturbance and preparation, and site excavation activities), the project owner will ensure that the designed paleontological resource specialist approved by the CEC Compliance Project Manager (CPM) is available for field activities and prepared to implement the conditions of certification. The designated paleontological resource specialist will be responsible for implementing all the paleontological conditions of certification and for using qualified personnel to assist in this work.

PAL -2 Prior to the start of construction, a Paleontological Resource Monitoring and Mitigation Plan (PRMMP) drafted by the designated paleontological resource specialist will be submitted to the CEC CPM for approval. The plan will identify general and specific measures to minimize potential impacts to sensitive paleontological resources. The project's paleontological resource specialist will implement the PRMMP as needed.

The PRMMP will include, but not be limited to, the following elements and measures.

- A discussion of the sequence of Project-related tasks, such as any preconstruction surveys, fieldwork, flagging or staking; construction monitoring; mapping and data recovery; fossil preparation and recovery; identification and inventory; preparation of final reports; and transmittal of materials for curation;

- A treatment plan (salvage plan) for the pre-construction salvage of fossil locality LES052008-01. All fossils recovered should be prepared, stabilized, identified, and permanently curated in an approved repository or museum.

- Identification of the person(s) expected to assist with each of the tasks identified within this condition, and a discussion of the mitigation team leadership and organizational structure, and the interrelationship of tasks and responsibilities;

- Where monitoring of Project construction activities is deemed necessary, the extent of the areas where monitoring is to occur and a schedule for the monitoring.

- An explanation that the designated paleontological resource specialist shall have the authority to halt or redirect construction in the immediate vicinity of a vertebrate fossil find until the significance of the find can be determined;

- A discussion of the equipment and supplies necessary for the recovery of fossil materials and any specialized equipment needed to prepare, remove, load, transport, and analyze large-sized fossils or extensive fossil deposits;

- Inventory, preparation and delivery for curation info a retrievable storage collection in a public repository or museum, which meets the SVP standards and requirements for the curation of paleontological resources; and

- Identification of the institution (expected to be the Natural History Museum of Los Angeles County) that has agreed to receive any data and fossil materials recovered during Project-related monitoring and mitigation work, discussion of any requirements of specifications for materials delivered for curation and how they will be met, and the name and phone number of the contact person at the institution.

PAL- 3 Prior to the start of construction, the designated paleontological resource specialist will prepare a Worker Environmental Awareness Program (WEAP) for review and approval by the CPM. Prior to and throughout the project and as needed, the paleontological resource specialist will conduct training for the project owner, project managers, construction supervisors, equipment operators and all new employees in accordance with the CPM approved training plan. Contractor briefings will also be videotaped and used for education for new employees.

The paleontological WEAP will address the potential to encounter paleontological resources in the field, the sensitivity and importance of these resources, and the legal obligations to preserve and protect such resources. The training program will also include the set of reporting procedures that workers are to follow if paleontological resources are encountered during project activities. The training program will be presented by the designated paleontological resource specialist and may be combined with other training programs prepared for cultural and biological resources, hazardous materials or any other areas of interests or concerns.

PAL- 4 During construction, the designated paleontological resource specialist or paleontological monitor shall be present at all times he or she deems appropriate to monitor construction-related grading, excavation, trenching, and/or augering in areas with a significant potential for fossil-bearing sediments to occur. All ground-disturbing activities in areas determined to have a high paleontological sensitivity shall be monitored on a full-time basis. All subsurface disturbance in areas determined to have a paleontological sensitivity increasing from low to high with depth shall be monitoring full-time when the depth of disturbance reaches six feet or greater. All ground disturbances at depths less than six feet that occur in these areas and/or areas with an "undetermined" sensitivity will be spot-checked by paleontological monitors. No monitoring is recommended in areas underlain by geologic units determined to have a low sensitivity. The frequency of the spot checks shall be determined by the paleontological resource specialist and will be based on factors such as the extent of ground disturbance and the location of those disturbances in relation to paleontologically sensitive sediments. Paleontological monitoring will include inspection of exposed rock units and collection of matrix to be testing for the presence of microscopic fossils. Paleontological monitors will have authority to temporarily divert excavations or drilling away from exposed fossils in order to efficiently and professionally recover the fossil specimens and collect associated data.

PAL – 5 The project owner, through the designated paleontological resource specialist, will ensure recovery, preparation for analysis, analysis, identification and inventory, the preparation for curation, and the delivery for curation of all significant paleontological resource materials encountered and collected during the monitoring, data recovery, mapping, and mitigation activities related to the project.

PAL - 6 The project owner will ensure preparation of a Paleontological Resources Report by the designated paleontological resource specialist following the analysis of the recovered fossil materials and related information. The Paleontological Resources Report will be submitted to the CPM for approval. The report will include a description and inventory list of recovered fossil materials; a map showing the location of paleontological resources found in the field; determinations of sensitivity and significance; and a statement by the paleontological resource specialist that project impacts to paleontological resources have been mitigated.

5.9.5 References

Axelrod, D.I., 1950, The Anaverde Flora of southern California. Carnegie Institution of Washington Publication 590:119-158.

Barrows, A.G., Kahle, J.E., and D.J. Beeby, 1985, Earthquake hazards and tectonic history of the San Andreas fault zone, Los Angeles County, California. California Department of Conservation, Division of Mines and Geology. Open File Report 85-10. 139 p.

California Energy Commission, 2000, Energy Facility Licensing Process: Developers Guide of Practices and Procedures. Staff Report, 67 p.

City of Palmdale, 1993, City of Palmdale General Plan. Resolution 93-10, Adopted by City Council January 25, 1993.http://www.cityofpalmdale.org/departments/planning/general_plan /general_plan.pdf

Dibblee, T.W., Jr., 1959, Geologic Map of the Alpine Butte Quadrangle, California. Mineral Investigations Field Studies Map MF-222. U.S. Geological Survey. Scale: 1:62,500.

Dibblee, T.W., Jr., 1960, Geologic Map of the Lancaster Quadrangle, Los Angeles County, California. Mineral Investigations Field Studies Map MF-76. U.S. Geological Survey. Scale: 1:62,500.

Dibblee, T.W., Jr., and H.E. Ehrenspeck, 2001, Geologic Map of the Pacifico Mountain and Palmdale (South Half) Quadrangles, Los Angeles County, California. Dibblee Geological Foundation Map DF-76. Scale 1:24,000.

Erwin, D., 2008, Unpublished paleontological specimen and locality data. University of California Museum of Paleontology.

Hendrix, E.D., and R.V. Ingersoll, 1987, Tectonics and alluvial sedimentation of the upper Oligocene/lower Miocene Vasquez Formation, Soledad basin, southern California. Geological Society of America Bulletin, v. 98, p. 647-663.

Jefferson, G.T., 1989, Late Pleistocene and earliest Holocene fossil localities and vertebrate taxa from the western Mojave Desert. In J. Reynolds (ed.), The west-central Mojave Desert: Quaternary studies between Kramer and Afton Canyon. Redlands: SBCM Association Special Publication, p. 27-40.

Jennings, C.W., and R.G. Strand, 1969, Geologic Map of California: Los Angeles Sheet. California Division of Mines and Geology. Scale: 1:250,000.

McLeod, S.A., 2008, Unpublished paleontological specimen and locality data. Natural History Museum of Los Angeles County, Los Angeles, California, 2 p.

Murphey, P.C., and Daitch, D., 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).

Noble, L.F., 1953, Geology of the Pearland quadrangle, California. U.S. Geological Survey Geologic Quadrangle Map GQ-24. Scale: 1:24,000.

Norris, R.M. and R.W. Webb, 1976, Geology of California, second edition. John Wiley & Sons, New York, p. 277–300.

Ponti, D.J., Burke, D.B., and Hedel, C.W., 1981, Map showing Quaternary geology of the central Antelope Valley and vicinity, California: U.S. Geological Survey Open-File Report 81-737, scale 1:62,500.

Randall, K., 2008, Unpublished paleontological specimen and locality data. San Diego County Natural History Museum.

Reynolds, R.E., 1989, Mid-Pleistocene faunas of the west-central Mojave Desert. In J. Reynolds (ed.), The west-central Mojave Desert: Quaternary studies between Kramer and Afton Canyon. Redlands: SBCM Association Special Publication, p. 44-50.

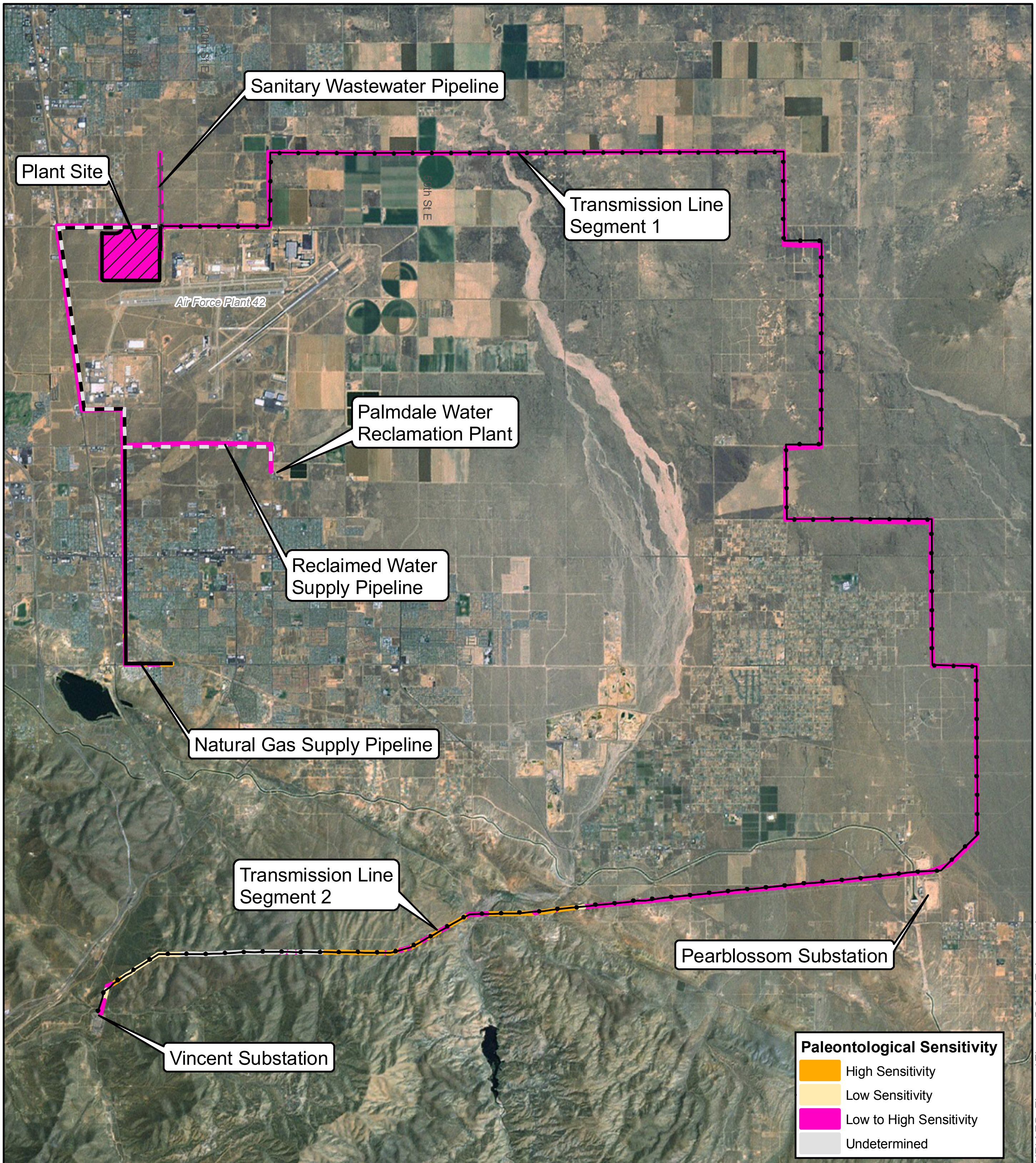
Scott, E., 2008, Unpublished paleontological specimen and locality data. San Bernardino County Museum, Redlands, California, 3 p.

Society of Vertebrate Paleontology (SVP), 1995, Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources: Standard Guidelines. Society of Vertebrate Paleontology News Bulletin. v. 163, p. 22–27.

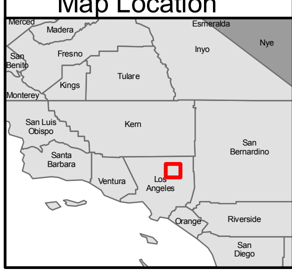
Whistler, D.P., 1990, A Late Pleistocene (Rancholabrean) fossil assemblage from the northwestern Mojave Desert, California. San Bernardino County Museum Association Quarterly, 37(2):1-17.

Woodburne, M.O., 2005, A new occurrence of Cormohipparion, with implications for the Old World Hippotherium Datum. Journal of Vertebrate Paleontology, 25(1):256-257.

Woodburne, M.O., 2007, Phyletic diversification of the Cormohipparion occidentale complex (Mammalia; Perissodactyla, Equidae), Late Miocene, North America, and the origin of the Old World Hippotherium datum. Bulletin of the American Museum of Natural History, 306:1-138.



Map Location



Legend

- Plant Site
- Natural Gas Supply Pipeline
- Reclaimed Water Supply Pipeline
- Sanitary Wastewater Pipeline
- Transmission Line

N W E S

Palmdale Hybrid Power Project

Figure 5.9-1
Paleological Sensitivity

1:120,000

0 1 2 Miles

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