Appendix G

Paleontology Study

CALIFORNIA
STATE
UNIVERSITY,
FRESNO

December 28, 2005

Barry Price
Applied EarthWorks, Inc.
5090 N. Fruit Ave., Suite 101
Fresno, CA 93711-3064

Dear Mr. Price,

Paleontological Resource Assessment Santa Margarita Ranch Ag Cluster

I. Project description

California State University, Fresno (CSUF) has completed a paleontological resource assessment for the Santa Margarita Ranch Agricultural Cluster EIR in San Luis Obispo County, California. The objectives were to identify specific fossil localities and paleontologically sensitive geologic formations within the project area outlined in a map sent to CSUF by Applied EarthWorks on November 15, 2005. Additionally, CSUF assessed the paleontological resource sensitivity within the project area and made recommendations regarding project related impacts to the paleontological resources. The project area covers portions of the Atascadero, San Luis Obispo, Santa Margarita, and Lopez Mountain USGS 7.5" topographic quadrangle maps (Appendix A).

II. Findings

We reviewed pertinent geologic maps and conducted a literature search to identify stratigraphic units in the project area (Appendices B & C). Stratigraphic units within the project map area include the Jurassic-Cretaceous Franciscan assemblage, Jurassic-Early Cretaceous marine Toro Formation, Cretaceous granitics, Late Cretaceous marine Atascadero Formation, Oligocene-Miocene nonmarine Simmler Formation, Early Miocene marine Vaqueros Formation, Miocene igneous Obispo Formation, Late Miocene marine Santa Margarita Formation, Late Miocene marine Monterey Formation, Plio-Pleistocene nonmarine Paso Robles Formation, and Quaternary alluvium (Appendix B). Exposures of unnamed geologic units also occur in the project area (Hart 1976). Hart (1976) provides an excellent synopsis of the geology of the Santa Margarita area, including a geologic map (Hart, 1974) illustrating the surficial geology; see also McLean (1994). McLeod (2005) (Appendix D) provides a written description of the distribution of the stratigraphic units within the project area, therefore it is not repeated here.

A record search for fossil sites within the project area was conducted at the University of California Museum of Paleontology at Berkeley (UCMP) and the Los Angeles County Museum of Natural History (LACM). Neither the UCMP nor the LACM (Appendix D) have fossil localities within the project map area. However, both the LACM and UCMP have vertebrate sites elsewhere in the region from the stratigraphic units in the project area. See Appendix D for a discussion of the LACM sites.

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The UCMP has one vertebrate locality from the Paso Robles Formation, Metz NW (V5406), in Monterey County which yielded a specimen of horse (*Equus simplicidens*). The UCMP has 28 vertebrate localities from the Monterey Formation in California, six of which occur in San Luis Obispo County. The San Luis Obispo County sites of Ramage Ranch (V3214) and Atascadero (V2805), both northwest of the project area, have yielded whale (Cetacea) remains and Windmill Creek (V3950), east of the project area, produced a desmostylian (*Desmostylus hesperus*) specimen. The other three sites in San Luis Obispo County (Abbot Canyon V72233, Wilson Corner V79069, Richfield Well Rrv77-23 V81251) do not have catalogued specimens. There also are several hundred invertebrate fossil localities from the Monterey Formation in the UCMP collections. There are 54 vertebrate localities in the UCMP records from the Santa Margarita Formation within California, three of which occur in San Luis Obispo County; Atascadero (3873) which yielded whale (Cetacea) remains, Cammatta Ranch (V5125), northeast of the project area, which produced fish (e.g. *Myliobatis*, *Isurus*, *Galeocerdo*, *Squatina*), reptile (e.g. Testudines), and mammal (e.g. Cetacea (whale, dolphin), Sirenia (sea cow), Felidae (cat), *Merycodus* (antelope), Equidae (horse), *Hipparion* (horse), Camelidae (camel)) specimens, and Shell Creek (V5811), northeast of the project area, which has no catalogued specimens. There are also several hundred UCMP invertebrate fossil localities and one fossil plant locality within Santa Margarita Formation in California. The UCMP has 11 vertebrate localities in California from the Vaqueros Formation, one of which, La Panza 2 (V65169), east of the project area in San Luis Obispo County, has yielded desmostylian remains (*Desmostylus hesperus*). There are several hundred UCMP invertebrate fossil localities from the Vaqueros Formation in California. There are no vertebrate localities from the Simmler Formation or Atascadero Formation in the UCMP collection. While the UCMP has no vertebrate localities from the Toro Formation, the museum does have 13 invertebrate fossil localities from this unit. There are two vertebrate localities from the Franciscan in the UCMP collections; Oakley Ranch (V4958) in San Luis Obispo County, southeast of the project area, which produced a plesiosaur type specimen (*Plesiosaurus hesternus*) and the Corral Hollow I (V3531) site in San Joaquin County with yielded an ichthyosaur type specimen (*Ichthyosaurus franciscanus*). The UCMP also has invertebrate and plant fossil localities from the Franciscan.

III. Recommendations

The stratigraphic units in the project area have a range of sensitivity levels relative to the potential of yielding significant fossil resources. Most sensitive are stratigraphic units that yield vertebrate remains. In the project map area, the older Quaternary Alluvium, Paso Robles Formation, Monterey Formation, Santa Margarita Formation, and Vaqueros Formation are highly sensitive, having yielded significant vertebrate fossils in the past. Any significant excavations into these units should be professionally monitored. It is undetermined whether the Simmler Formation, Atascadero Formation and Toro Formation will yield significant vertebrate remains, although any vertebrate remains from these units would be significant. The coarse clastic nature of the Simmler Formation, and the lack of fossils generated from the unit to date, suggest that it is unlikely to yield significant fossil remains. While the Franciscan assemblage has produced significant vertebrate remains in the past, these fossils are rare and it is unlikely that significant fossils will be recovered from this assemblage in the project area. The Obispo Formation and Cretaceous granitic rocks are not sensitive because they are devoid of fossils.

We recommend monitoring where excavation or road cuts will disturb sensitive in situ sedimentary rock below the upper soil layers (i.e. upper few feet). The areas covered by late Quaternary strata should be monitored if excavation is undertaken below the uppermost few feet

of sediment, because these strata have yielded vertebrate remains elsewhere in San Luis Obispo County (Appendix D). Shallow excavations in the Quaternary deposits are unlikely to yield significant fossils and do not need monitoring. Any excavation into in situ older Quaternary Alluvium, Paso Robles Formation, Monterey Formation, Santa Margarita Formation, and Vaqueros Formation should be monitored.

The goal of monitoring is to reduce the adverse impact on paleontological resources within the project area by collecting scientifically significant vertebrate fossils. The contractor undertaking monitoring should develop a paleontological resource impact mitigation plan that addresses in detail the procedures for collecting vertebrate fossils, including recording pertinent geographic and stratigraphic information, stabilization (preservation) methods for the specimens, and make provisions for the remains to be accessioned into the collections of an appropriate repository (such as the LACM or UCMP) and catalogued for future scientific study. Following completion of monitoring, collection, and specimen processing, the contractor should generate a final report detailing the results of the mitigation program.

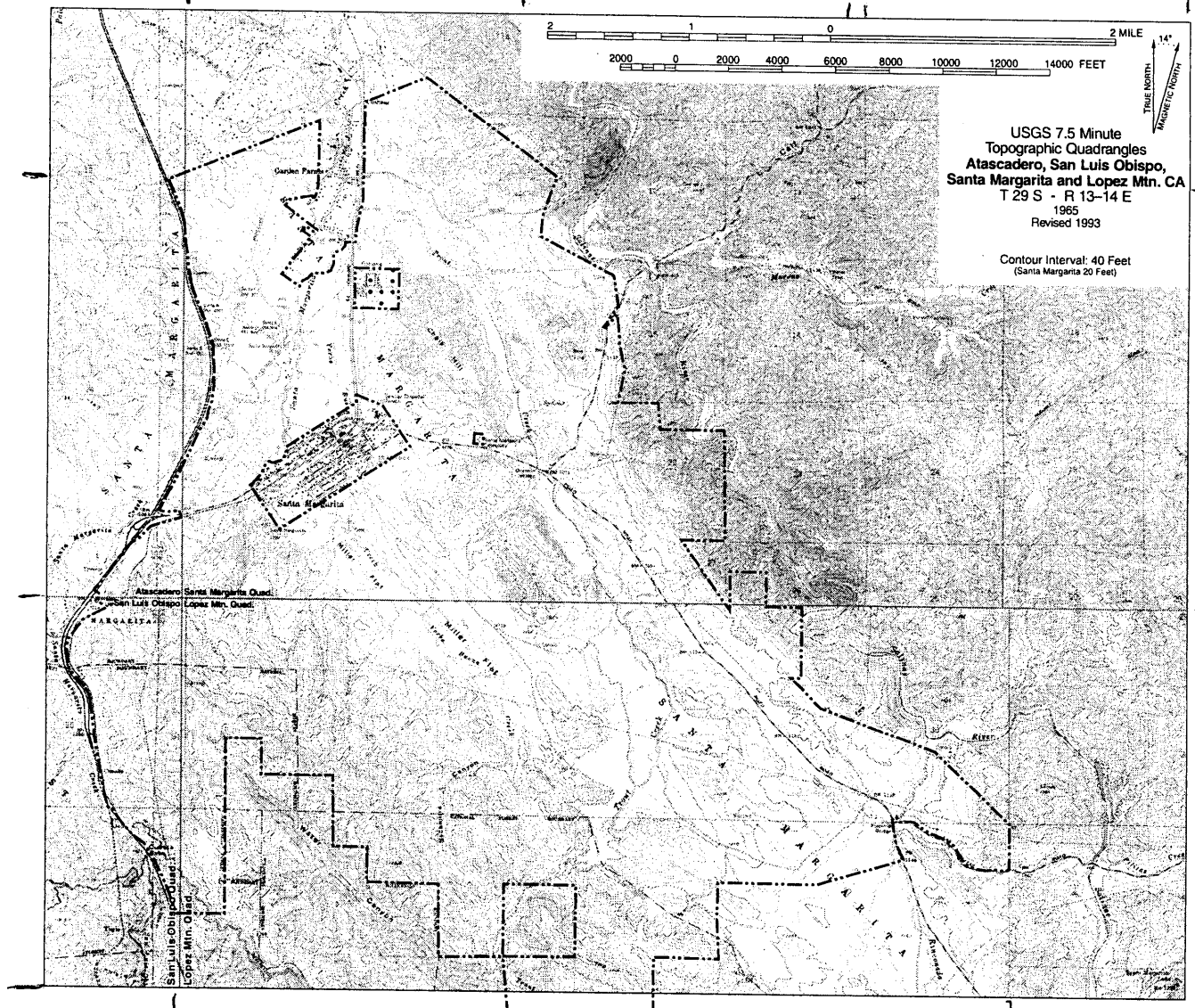
Sincerely,

Robert G. Dundas, Ph.D.
Vertebrate Paleontologist

enclosure: invoice

APPENDIX A

Map of the Santa Margarita Ranch Agricultural Cluster Area, San Luis Obispo County, California


120°37'30"
35'
120°32'30"
120°30'
35°25'
35°22'30"
35°20'
120°37'30"
120°31'30"
2 1 0 2 MILE
2000 0 2000 4000 6000 8000 10000 12000 14000 FEET
14°
TRUE NORTH
MAGNETIC NORTH
USGS 7.5 Minute
Topographic Quadrangles
Atascadero, San Luis Obispo,
Santa Margarita and Lopez Mtn. CA
T 29 S - R 13-14 E
1965
Revised 1993
Contour Interval: 40 Feet
(Santa Margarita 20 Feet)
Garden Farms
Santa Margarita
Atascadero Santa Margarita Quad.
San Luis Obispo Lopez Mtn. Quad.
SANTA MARGARITA
MARGARITA
San Luis Obispo Quad.
Lopez Mtn. Quad.

APPENDIX B

Stratigraphic units in the Santa Margarita Ranch project map area

Stratigraphic unit	Age	Environment of formation
Alluvium	Quaternary	nonmarine sedimentary
Paso Robles Formation	Plio-Pleistocene	nonmarine sedimentary
Monterey Formation	Late Miocene	marine sedimentary
Santa Margarita Formation	Late Miocene	marine sedimentary
Obispo Formation	Miocene	igneous
Vaqueros Formation	Early Miocene	marine sedimentary
Simmler Formation	Oligo-Miocene	nonmarine sedimentary
Atascadero Formation	Late Cretaceous	marine sedimentary
Toro Formation	Jur-Early Cretaceous	marine sedimentary
Franciscan assemblage	Jurassic-Cretaceous	complex

APPENDIX C

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APPENDIX D

NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY LETTER REPORT ON FOSSIL LOCALITIES

Vertebrate Paleontology Section
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1 December 2005

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Attn: Dr. Robert G. Dundas

re: Vertebrate Paleontology Records Check for the paleontological resources assessment for the area around Santa Margarita in San Luis Obispo County, project area

Dear Bob:

I have conducted a thorough search of our vertebrate paleontological records for the paleontological resources assessment for the area around Santa Margarita in San Luis Obispo County, project area as indicated on the map attachment in your e-mail to me on 20 November 2005, covering portions of the Atascadero, San Luis Obispo, Santa Margarita, and Lopez Mountain USGS topographic quadrangle maps. We have no fossil vertebrate localities that lie directly within the project area, but we do we have vertebrate fossil localities from some of the same sedimentary rock units that are exposed in the proposed project area.

In the small portion of the southeastern part of the Atascadero quadrangle covered by the proposed project area, there are exposures of mostly Late Miocene marine Santa Margarita Sandstone in the northern section southwest of Garden Farms, but some surficial deposits of younger Quaternary Alluvium in the lower lying areas east of Highway 101. In the very southeastern corner of the Atascadero quadrangle the lower lying areas around Highway 101 and the intersection with Highway 58 have surficial deposits mostly of younger Quaternary Alluvium with the elevated areas east of Highway 101 mostly having exposures of the Late Cretaceous marine Atascadero Formation. On top of the ridge near the southeastern corner of the Atascadero quadrangle there are exposures of the basalts of the Miocene Obispo Formation with small exposures of the Early Miocene marine Vaqueros Formation below that.

In the small portion of the northeastern part of the San Luis Obispo quadrangle covered by the proposed project area, there are surficial deposits of younger Quaternary Alluvium around Highway 101, at least down to about Questa Pass, with some surficial deposits of older

Quaternary Alluvium northeast of Tassajara Creek Road. East of the intersection of Tassajara Creek Road and Highway 101 in the very northeastern part of the San Luis Obispo quadrangle there are some non-contiguous exposures of the Late Cretaceous marine Atascadero Formation and the Early Cretaceous marine Toro Formation. East of Highway 101 the exposures consist mostly of basalts of the Miocene Obispo Formation with small exposures of the Early Miocene marine Vaqueros Formation ringing the northeastern part of the Obispo Formation exposures. In the eastern part of this portion of the San Luis Obispo quadrangle, and around Highway 101 from about Questa Pass southward, there are exposures of the Late Miocene marine Monterey Formation.

In the northwestern part of the Lopez Mountain quadrangle covered by the proposed project area there are exposures of the Late Miocene marine Monterey Formation surrounding Water Canyon, with small exposures of the basaltic Miocene Obispo Formation near the very northwestern corner of the quadrangle and some small exposures of Oligo-Miocene terrestrial conglomeratic sediments on the eastern side of the Monterey Formation exposures. Northeastward towards the Santa Margarita Valley these elevated areas have exposures of the Late Cretaceous marine Atascadero Formation up to the area between the Lucia and Old Coast Range Faults where the rocks are composed the Jurassic-Cretaceous Franciscan complex assemblage. In the elevated areas on the northeastern side of the faults there are additional exposures of the Atascadero and Monterey Formations. The more elevated areas within the Santa Margarita Valley have exposures of the Late Miocene marine Santa Margarita Formation overlain by the Plio-Pleistocene terrestrial Paso Robles Formation. The lower lying areas of the Santa Margarita Valley mostly have surficial deposits of younger Quaternary Alluvium, including up the drainages of Trout Creek and near the Salinas River, with pockets of older Quaternary Alluvium and more expansive deposits of older Quaternary Alluvium on the east side of the Santa Margarita Valley around the Rinconada Fault, particularly east of Pozo Road. In the very eastern part of the proposed project area on the Lopez Mountain quadrangle, along and north of Las Pilitas Road, there are some exposures of the Early Miocene marine Vaqueros Formation and of the Late Cretaceous marine Atascadero Formation. In the elevated areas of the very northeastern part of the proposed project area on the Lopez Mountain quadrangle, northeast of the Rinconada Fault around the Salinas River, the bedrock is composed of basement complex granitics.

In the southeastern portion of the proposed project area covered on the southwestern part of the Santa Margarita quadrangle, the bedrock is likewise composed of basement complex granitics, particularly in Section 22, T 29 S, R 13 E. In the northeastern portion of the proposed project area east of the Rinconada Fault but before the basement complex granitics, there are exposures of the Late Miocene marine Monterey Formation, the Early Miocene marine Vaqueros Formation, and Oligo-Miocene terrestrial Simmler Formation conglomeratic breccia. In the elevated portions of the Santa Margarita Valley there are large exposures of the Late Miocene marine Santa Margarita Formation overlain by the Plio-Pleistocene terrestrial Paso Robles

Formation. The lower lying portions of the Santa Margarita Valley, and all the drainages leading into it, mostly having surficial deposits of younger Quaternary Alluvium, with pockets of older Quaternary Alluvium and an expanse of older Quaternary Alluvium around Pozo Road and east of Trout Creek. In the southwestern portion of the proposed project area on this part of the Santa Margarita quadrangle the elevated areas have exposures of the Late Cretaceous marine Atascadero Formation. On the northeast side of Yerba Buena Creek south of Santa Margarita there are exposures of the Late Miocene marine Monterey Formation and pockets of Franciscan complex rocks between the faults immediately west of there.

The basaltic igneous rocks of the Obispo Formation, exposed in the proposed project area around the juncture of the Atascadero, San Luis Obispo, and Lopez Mountain quadrangles, will be devoid of fossils. Likewise, the granitic igneous rocks exposed on the eastern margin of the proposed project area on the Lopez Mountain and Santa Margarita quadrangles will be devoid of fossils. It is highly unlikely that recognizable vertebrate fossils would be discovered among the heterogeneous assemblage of the Jurassic-Cretaceous Franciscan Complex of rocks exposed around the Lucia and Old Coast Range faults in the proposed project area on the Lopez Mountain and Santa Margarita quadrangles. It's also unlikely that significant vertebrate fossils would be recovered from the Oligo-Miocene conglomeratic Simmler Formation exposed in the proposed project area east of the Rinconada fault on the Santa Margarita quadrangle or from the Oligo-Miocene terrestrial sediments found in the proposed project area around the exposures of the Monterey Formation on the Lopez Mountain quadrangle. Although the Jurassic-Cretaceous marine Toro Formation, exposed in the proposed project area around Highway 101 on the San Luis Obispo quadrangle, may contain fossils, we have neither vertebrate nor invertebrate fossils recorded as being from the Toro Formation. We have no vertebrate fossil localities from the Late Cretaceous marine Atascadero Formation, exposed in the proposed project area around the juncture of the Atascadero, San Luis Obispo, Lopez Mountain, and Santa Margarita although it does contain invertebrate fossils.

There are exposures of the Early Miocene marine Vaqueros Formation in the proposed project area on the Atascadero, San Luis Obispo, Lopez Mountain, and Santa Margarita quadrangles. Our closest vertebrate fossil localities in the Vaqueros Formation are LACM 5846 and 5920, north-northwest of the proposed project area near Templeton. These localities have produced a rich and diverse assemblage of fossil marine vertebrates including bull shark, *Carcharhinus*, tiger shark, *Galeocerdo aduncas*, snaggle-tooth shark, *Hemipristis serra*, hammerhead shark, *Sphyrna*, chimaera, *Chimaera*, cow shark, Hexanchidae, thresher shark, *Alopias*, sandtiger shark, *Odontaspis*, white shark, *Carcharocles megalodon*, bonito sharks, *Isurus desori*, *Isurus hastalis*, *Isurus oxyrinchus*, and *Isurus planus*, eagle ray, *Myliobatis*, saw shark, *Pristiophorus*, dogfish, *Squalus*, angel shark, *Squatina*, surgeonfish, *Prionurus*, sheepshead, *Semicossyphus*, knifejaws, Oplegnathidae, parrotfish, Scaridae, porgies, Sparidae, triggerfish, Balistidae, pufferfish, Diodontidae, wrasse, *Trigonodon*, sea lion, Enaliarctinae, dolphin, Odontoceti, extinct four-legged marine mammal, Paleoparadoxidae.

There are exposures of the Late Miocene marine Monterey Formation in the proposed project area on the San Luis Obispo, Lopez Mountain, and Santa Margarita quadrangles. Our closest vertebrate fossil localities in the Monterey Formation are LACM 5838, north-northwest of the proposed project area southwest of Templeton, LACM 5940-5941, north-northwest of the proposed project area west of Templeton, and LACM 6189-6190, northwest of the proposed project area south of Adelaida. These localities together produced a composite suite of fossil marine vertebrates including white shark, *Carcharocles megalodon*, herrrings, *Etringus scintillans*, *Ganolytes cameo*, and *Xyne*, cod, *Eclipes*, jack, *Decapterus*, mackerel, *Scomber*, rockfish, Scorpaenidae, pipefish, *Syngnathus*, extinct false-toothed birds, Pelagornithidae, shearwater, *Puffinus*, and baleen whale, Mysticeti.

There are exposures of the Late Miocene marine Santa Margarita Formation in the proposed project area on the Lopez Mountain and Santa Margarita quadrangles. Our only vertebrate fossil locality from the Santa Margarita Formation in San Luis Obispo County is LACM (CIT) 194, southeast of the proposed project area east of Lopez Lake, that produced as specimen of fossil sea lion, Otariidae. We have numerous other localities from the Santa Margarita Formation in the surrounding counties, however, that have produced an extensive fossil marine vertebrate fauna including numerous specimens of fossil sea cows, *Dusisiren*.

There are exposures of the Plio-Pleistocene terrestrial Paso Robles Formation in the proposed project area on the Lopez Mountain and Santa Margarita quadrangles. We have a few fossil vertebrate localities from the Paso Robles Formation including LACM 5799, north of the proposed project area on the northeast side of Atascadero; LACM 4964, directly north of the proposed project area and directly east of Paso Robles; LACM 5840, just north of due east of the northernmost portion of the proposed project area west-southwest of Wilson Corner; and LACM 5659, due east of the proposed project area west of Simmler. These localities have produced a composite fossil fauna of terrestrial vertebrates including giant tortoise, *Geochelone*, extinct elephantoid, Gomphotheriidae, mastodon, *Mammut*, horse, Equidae, camel, *Camelops hesternus*, and bison, *Bison latifrons*.

There are pockets of older Quaternary Alluvium throughout the proposed project area, but wide exposures on the northeast side of the Santa Margarita Valley on the Lopez Mountain and Santa Margarita quadrangles. Additionally the older Quaternary Alluvium probably underlies the extensive surficial deposits of younger Quaternary Alluvium throughout the Santa Margarita Valley. We have numerous fossil vertebrate localities from equivalent deposits throughout San Luis Obispo County but particularly localities LACM 5791, north-northwest of the proposed project area on the north side of Paso Robles, and 5800-5802, southwest of the proposed project area along the coast west of Point San Luis, that produced fossil specimens of terrestrial vertebrates including ground sloth, *Glossotherium harlani*, horse, *Equus occidentalis*, camel, *Camelops hesternus*, and bison, *Bison antiquus*, published in the scientific literature by G.T. Jefferson, H.L. Fierstine, J. R. Wesling and Teh-Lung Ku (1992. Pleistocene Terrestrial

Vertebrates from near Point San Luis, and Other Localities in San Luis Obispo County, California. Bulletin of the Southern California Academy of Sciences, 91(1):26-38).

Excavations in the basaltic igneous rocks of the Obispo Formation and the granitic igneous rocks exposed on the eastern margin of the proposed project area will not encounter any fossils. Excavations in the Franciscan Assemblage of rocks, the Simmler Formation, and the Oligo-Miocene terrestrial sediments found in the proposed project area are highly unlikely to encounter significant vertebrate fossils. Although the vertebrate fossil potential of the Toro Formation and the Atascadero Formation in unclear, any vertebrate fossils discovered in those rock units would be highly significant. Shallow excavations in the younger Quaternary Alluvium in the proposed project area are unlikely to encounter significant vertebrate fossils, but deeper excavations that extend into deposits of older Quaternary Alluvium or even older sedimentary deposits may well uncover significant vertebrate fossils. Excavations in the Early Miocene marine Vaqueros Formation, the Late Miocene marine Monterey Formation, the Late Miocene marine Santa Margarita Formation, the Plio-Pleistocene terrestrial Paso Robles Formation, or the terrestrial older Quaternary Alluvium, have a good chance of recovering significant vertebrate fossils. Therefore, any substantial excavations in the Vaqueros Formation, the Monterey Formation, the Santa Margarita Formation, the Paso Robles Formation, or the older Quaternary Alluvium deposits in the proposed project area should be monitored closely to professionally collect any vertebrate fossils discovered without impeding development. Additional records of fossil localities in the area may be available through the California State University at San Luis Obispo. Any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution for the benefit of current and future generations.

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

Sincerely,

Samuel A. McLeod

Samuel A. McLeod, Ph.D.
Vertebrate Paleontology

enclosure: invoice