Applied EARTHWORKS Inc.

133 N. San Gabriel Blvd., Suite 201
Pasadena, CA 91107-3414
(626) 578-0119

August 2, 2018

Ms. Cynthia Gibbs
Senior Environmental Analyst
Albert A. Webb Associates
3788 McCray Street
Riverside, CA 92506
Transmitted via email to cynthia.gibbs@webbassociates.com

RE: Paleontological Resource Assessment for the Duke - Alabama & Palmetto Project, Northwest Redlands, San Bernardino County, California.

Dear Ms. Gibbs,

Albert A. Webb Associates (WEBB) retained Applied EarthWorks, Inc. (Æ) to complete a paleontological resource assessment for the proposed Duke - Alabama and Palmetto Project (Project) in Northwest Redlands, an unincorporated area surrounded by the City of Redlands in San Bernardino County, California.

Æ's scope of work included a museum records search, a literature and geologic map review, and preparation of this technical memorandum (memo). This memo, which serves as a summary of our findings, was written in accordance with the guidelines set forth by the Society of Vertebrate Paleontology (SVP, 2010) and satisfies the requirements of the California Environmental Quality Act (CEQA). The lead agency for CEQA compliance is San Bernardino County (County).

Project Description and Background

The Project Area is west of Highway 210, between Interstate 10 (I-10) and the Santa Ana River, in the "Donut Hole" area of San Bernardino County. Specifically, the Project Area is on the northwest corner of the Palmetto Avenue and Alabama Street intersection, with Palmetto Avenue the south boundary and Alabama Street the east boundary. The present channel of the Santa Ana River is less than 0.13 miles north of the Project Area.

The Project proposes development of an approximate 1,192,671 square-foot high-cube, warehouse building on approximately 54.76 acres with a maximum depth of ground disturbance of 13 feet. The Project will include approximately 831,784 square feet of asphalt paving in the parking area and 360,887 square feet of landscaping. The Project's sewer, water, and storm water drainage lines will connect to existing lines along the frontages of the Project within Alabama Street and Palmetto Avenue. The Project also will construct off-site road improvements consisting of partial-width improvements to the ultimate cross-section (an additional 12 feet) of Alabama Street and Palmetto Avenue along the Project frontage.

Regulatory Context

Paleontological resources cannot be replaced once they are destroyed and are considered nonrenewable scientific resources protected under the CEQA. Specifically, in Section V(c) of Appendix G of the CEQA Guidelines, the "Environmental Checklist Form," the question is posed: "Will the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?"

In order to determine the uniqueness of a given paleontological resource, it must first be identified or recovered (i.e., salvaged). Therefore, mitigation of adverse impacts to paleontological resources is mandated by CEQA. Consequently, the County addresses paleontological resources in Policy CO 3.4 of the County's General Plan (County of San Bernardino, 2007):

> 4. In areas of potential but unknown sensitivity, field surveys prior to grading will be required to establish the need for paleontological monitoring.
>
> 5. Projects requiring grading plans that are located in areas of known fossil occurrences or demonstrated in a field survey to have fossils present, will have all rough grading (cuts greater than 3 feet) monitored by trained paleontological crews working under the direction of a qualified professional, so that fossils exposed during grading can be recovered and preserved. Fossils include large and small vertebrate fossils, the latter recovered by screen washing of bulk samples.
>
> 6. A report of findings with an itemized accession inventory will be prepared as evidence that monitoring has been successfully completed. A preliminary report will be submitted and approved prior to granting of building permits, and a final report will be submitted and approved prior to granting of occupancy permits. The adequacy of paleontological reports will be determined in consultation with the Curator of Earth Science, San Bernardino County Museum [V-18–V-19].

Paleontological Resource Potential

Most professional paleontologists in California adhere to the guidelines set forth by the SVP (2010) to determine the course of paleontological mitigation for a given project on private lands. These guidelines establish protocols for the assessment of the paleontological resource potential of underlying geologic units and outline measures to mitigate adverse impacts that could result from project development. Using baseline information gathered during a paleontological resource assessment, the paleontological resource potential of the geologic unit(s) (or members thereof) on the ground surface and beneath a Project Area can be assigned to one of four categories. These categories include high, undetermined, low, and no paleontological resource potential. Geologic units are considered to be "sensitive" for paleontological resources and have a high paleontological resource potential if they are known to contain significant fossils anywhere in their extent, even if outside the Project Area.

Methodology

To assess the paleontological sensitivity of geologic units exposed at the ground surface and thought to underlie the Project Area, Æ reviewed published geologic maps and retained the Natural History Museum of Los Angeles County (NHMLAC) to conduct a records search of fossil localities recorded in

its collection (McLeod, 2018) . Æ supplemented the NHMLAC records search by reviewing the online database of the University of California Museum of Paleontology (UCMP), one of the largest paleontological collections of any university museum in the world.

Resource Context

The Project Area is in the Peninsular Ranges, a major physiographic province distinguished from others nearby by its geologic structures, geomorphic features, and lithologic assemblage (Morton and Miller, 2006). The Peninsular Ranges are oriented northwest-southeast and consist of fault-bounded blocks that extend 125 miles from the Transverse Ranges and Los Angeles Basin to the tip of Baja California. The Peninsular Ranges are bounded to the east by the Colorado Desert and range in width from 30 to 100 miles (Norris and Webb, 1976).

The Project Area is within the Perris Block. This geologic structure is a relatively stable, rectangular unit positioned between the Santa Ana Mountains to the west and the San Jacinto Mountains to the east. The Perris Block can be separated into distinct northern and southern geographic sections. The Project Area is in the northern section of the Perris Block, which is dominated by alluvial valley deposits of the Santa Ana River over earlier Holocene and Late Pleistocene alluvial fan deposits emanating from the San Gabriel Mountains. These alluvial fans consist of boulder deposits that grade to sandy deposits distally from the mountains. The geology in the vicinity of the Project Area is dominated by Cretaceous plutonic rocks of the Peninsular Ranges Batholith, local Mesozoic metasedimentary rocks, and the aforementioned widespread Pleistocene-age alluvial fan and valley deposits (Morton and Miller, 2006). In contrast, the southern geographic section of the Perris block consists of widespread exposures of basement rock and a series of interconnected alluviated valley areas. Several erosional surfaces developed on bedrock in the southern Perris Block expose the deeply and intensely weathered Paleocene or older Santa Rosa Plateau surface, the Paleocene Silverado Formation, and the Miocene Lake Mathews Formation (Morton and Miller, 2006).

According to Morton and Miller (2006), surficial geologic units in the Project Area are mapped as Young Axial-Channel deposits (Qya_3), Very Young Axial-Channel deposits (Qa), and Very Young Wash deposits (Qw). Deposited during the Middle Holocene, the Young Axial-Channel deposits are found in fluvial terrace risers and consist of pale brown and very pale brown fine- to coarse-grained sand and pebbly sand that coarsen upstream to poorly sorted fine- to coarse-grained sand and sandy pebble to small-cobble gravel (Morton and Miller, 2006). The thickness of the Young Axial-Channel deposits likely varies from local differences in fluvial aggradation versus erosion; however, the deposits are probably less than 20 feet thick (Morton and Miller, 2006).

Very Young Axial-Channel deposits are unconsolidated Late Holocene silty, sandy, and cobbly alluvium deposited by streams in through-going valleys (Morton and Miller, 2006). According to Dibblee (2004), these deposits are covered with gray clay soils. Also Late Holocene in age, Very Young Wash deposits are unconsolidated sands and gravels in active washes, ephemeral river channels of axial-valley streams, and in channels on active surfaces of alluvial fans (Morton and Miller, 2006). As a result of active flood-scouring, these deposits essentially have no soil development and are subject to localized reworking.

According to McLeod (2018), the alluvial deposits derived predominantly from the Crafton Hills and San Bernardino Mountains to the east via the Santa Ana River. Beneath the surficial Young and Very Young alluvium lie Older Quaternary alluvial deposits dating to the Early Holocene and Pleistocene. Recent investigations in the western San Bernardino Basin have confirmed that Pleistocene vertebrates are common from subsurface Pleistocene sediments throughout this region (Springer et al., 2009).

Records Search Results

The UCMP online paleontological database revealed thousands of fossil localities in San Bernardino County, but the majority of them were found in either Mescal Cave or Silver Creek Canyon (UCMP, 2018). The rest of the fossil localities derived from the Manix Formation, which is not mapped in or close to the Project Area. The results of the museum records search are presented in Table 1.

McLeod (2018) reports no known fossil localities in the Project Area. However, there are several known vertebrate localities north and south of the Santa Ana River in the vicinity of the Project Area. The closest vertebrate fossil locality, LACM 4540, is southeast of the Project Area on the northeastern side of the San Jacinto Valley just west of Jack Rabbit Trail. This locality yielded a specimen of *Equus* sp. (extinct horse) from older Quaternary deposits. The depth of the recovery was not reported. Another locality, LACM 7811, is west-southwest of the Project Area in the Jurupa Valley north of Norco and west of Mira Loma. This second locality produced a specimen of *Masticophis flagellum* (whip snake) from older Quaternary deposits at a depth of 9 to 11 feet below the surface. Also, according to McLeod (2018), older Quaternary alluvial deposits presumed to underlie the Project Area have the potential to yield scientifically significant fossils.

As reported by Springer et al. (2009), a diverse Terminal Pleistocene assemblage was recovered from depths as shallow as 15 feet at a locality south of the Project Area, near the town of Lakeview. The assemblage includes *Mammuthus* sp. (mammoth), *Smilodon* sp. (sabre-toothed cat), extinct horse, *Bison* sp. cf. *B. antiquus* (bison), and numerous small mammals, reptiles, invertebrates, and plant remains. Almost due-west of the Lakeview locality and farther to the southwest of the Project Area, specimens of *Ustatochoerus* cf. *californicus* (ground dwelling herbivore) and fossilized camel remains were recovered within Pliocene fluvial and alluvial deposits at Lake Matthews near the city of Corona (Woodford et al., 1971).

Table 1
Vertebrate Localities Reported from within Older Quaternary Alluvial Deposits in the Vicinity of the Project Area

Locality No.	Geologic Unit	Age	Taxa
LACM 7811	Older Quaternary sedimentary deposits (9-11 feet below the ground surface)	Pleistocene	*Masticophis* (whipsnake)
LACM 4540	Older Quaternary sedimentary deposits (likely present at unknown depth beneath the Project Area's ground surface)	Pleistocene	*Equus* (horse)

Source: McLeod (2018)

Findings and Recommendations

Æ used SVP's (2010) sensitivity scale to determine the paleontological potential of the Project Area. The Very Young and Young alluvial deposits in the Project Area have a Low paleontological resource potential, because they are generally too young to preserve fossilized remains. McLeod (2018) reports that significant vertebrate fossils probably will not be encountered in shallow excavations in the younger Quaternary alluvial deposits. Fossils in these younger Quaternary deposits, if any, may be the result of redeposition from elsewhere. However, these younger deposits may overlie intact older Quaternary fossiliferous alluvial deposits at depths as shallow as 9–11 feet. For instance, Very Old Axial-Channel deposits ($Qvoa_3$) dating to the Late to Middle Pleistocene would have a High potential for significant paleontological resources and they may underlie the younger Quaternary deposits in the Project Area since they crop out of the north slope of the foothills of the Box Springs Mountains to the south.

The thickness of the younger Quaternary deposits with Low sensitivity for paleontological resources is unknown at this time within the Project Area. Therefore, a field survey prior to grading to establish the need for paleontological monitoring (see above, County of San Bernardino Policy 3.4.4) is not recommended. Project-related ground disturbance to a maximum depth of 13 feet may impact buried older Quaternary deposits with potentially significant paleontological resources. Therefore, *Æ* recommends paleontological monitoring under the direction of a Qualified Professional Paleontologist, as defined in SVP (2010), during any grading or other excavation activities at depths of 3 feet and below in accordance with County of San Bernardino Policy 3.4.5 (see above).

The several specific management recommendations described below are intended to mitigate potential adverse impacts to significant paleontological resources, if present. These measures have been used by professional paleontologists for many years and have proven to be effective in reducing or eliminating adverse impacts to paleontological resources as a result of private and public development projects throughout California:

- **Worker's Environmental Awareness Training.** Prior to the start of construction within a given development site within the Project Area, all field personnel should be briefed regarding the types of fossils that could be found and the procedures to follow should paleontological resources be encountered. Specifically, the training should provide a description of the fossil resources that may be encountered, outline steps to follow in the event that a fossil discovery is made, and provide contact information for the Qualified Professional Paleontologist and on-site monitor(s). The training should be developed by the Qualified Professional Paleontologist and provided as hand-outs or a Power Point Presentation that can be presented concurrently with other environmental training (e.g., cultural and natural resources awareness training, safety training, etc.).

- **Construction Monitoring**. In areas where construction grading may reach depths of 3 feet or more, a Qualified Paleontological Resource Monitor will be retained to monitor in accordance with qualifications standards and procedures set forth by SVP (2010). Monitoring is not required in areas of previous disturbance or in surface or near-surface younger alluvial deposits as determined in consultation with the Qualified Professional Paleontologist.

Monitoring should include the visual inspection of excavated or graded areas, trench sidewalls, spoils, and any other disturbed sediment. In the event that a paleontological resource is discovered, the approved paleontological monitor will have the authority to divert temporarily the construction equipment around the find until it is assessed for scientific significance and collected. In areas of high sensitivity, monitoring efforts can be reduced or eliminated at the discretion of the Qualified Professional Paleontologist if no fossil resources are encountered after 50 percent of the excavations are completed.

- **Fossil Preparation and Curation.** Upon completion of fieldwork, all significant fossils collected, if any, will be prepared in a properly equipped paleontology laboratory to a point ready for curation. Preparation will include the careful removal of excess matrix from fossil materials and stabilizing and repairing specimens, as necessary. Following laboratory work, all fossils specimens will be identified to the lowest taxonomic level, cataloged, analyzed, and delivered to a regionally-accredited museum repository, such as the SBCM in Redlands or the NHMLAC in Los Angeles, for permanent curation and storage. The cost of curation is assessed by the repository and is the responsibility of the landowner (County of San Bernardino).

- **Reporting.** A final report should be prepared to describe the results of the paleontological mitigation monitoring efforts. The report will include a summary of the field methods, laboratory methods (if any), an overview of the geology and paleontology of the construction site, a list of taxa recovered (if any), an analysis of fossils recovered (if any) and their scientific significance, and recommendations. If the monitoring efforts produce fossils, then a copy of the report also will be submitted to the curation facility.

It has been a pleasure assisting you with this Project. If you have any questions, please do not hesitate to contact us.

Sincerely,

Christopher Shea
Staff Paleontologist
Applied EarthWorks, Inc.

Reviewed By: _____
Scott Rohlf, MS, Qualified Professional Paleontologist

Edited and Approved By: _____
Amy Ollendorf, PhD, RPA (#12588), Paleontology Program Manager

References

County of San Bernardino, 2007. Section V-C2, Cultural/Paleontological Resources, County of San Bernardino 2007 General Plan. Prepared by the URS Corporation for the County of San Bernardino Land Use Services Division, San Bernardino. http://www.sbcounty.gov/Uploads/lus/GeneralPlan/ FINALGPtext20130718.pdf (accessed October 2016).

Dibblee, Thomas W., Jr., 2004. Geologic map of the Harrison Mountain/North ½ of Redlands Quadrangle, San Bernardino County, California. Dibblee Foundation Map DF-126 published at 1:24,000 scale. Accessed June, 2018 at https://ngmdb.usgs.gov/Prodesc/proddesc_71761.htm

McLeod, Samuel A., 2018. Unpublished museum collections records. Natural History Museum of Los Angeles County.

Morton, D. M., and Miller, F. K., 2006. Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California. U.S. Geological Survey, Open-File Report OF-2006-1217, scale 1:100,000. Accessed June, 2018 at https://pubs.usgs.gov/of/2006/1217/of2006-1217_pamphlet_nophotos.pdf

Norris, R. M., and Webb, R. W., 1976. Geology of California. John Wiley & Sons, New York.

Society of Vertebrate Paleontology (SVP), 2010. Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources. Society of Vertebrate Paleontology Impact Mitigation Guidelines Revision Committee.

Springer, K., Scott, E., Sagebiel, J.C., and Murray, L.K., 2009. The Diamond Valley Lake Local Fauna - Late Pleistocene Vertebrates from Inland Southern California, *in* Albright, L.B., III, ed., Papers on Geology, Vertebrate Paleontology, and Biostratigraphy in Honor of Michael O. Woodburne. Museum of Northern Arizona Bulletin 65, Flagstaff, Arizona.

University of California Museum of Paleontology (UCMP), 2018. Unpublished online museum records search. University of California, Berkeley.

Woodford, A. O., Shelton, J. S., Doehring, D. O., and Morton, R. K., 1971. Pliocene-Pleistocene History of the Perris Block, Southern California. Geological Society of America Bulletin, v. 82.