Paleontological Resources Inventory Memo

BRIGHTLINE WEST CAJON PASS

High-Speed Rail Project

OCTOBER 2022

Prepared for:

Federal Railroad Administration

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Subject: Paleontological Resources Inventory Memorandum for the Brightline West Cajon Pass High-Speed Rail Project

Dudek conducted a paleontological resources inventory for the Brightline West Cajon Pass High-Speed Rail Project through the Cajon Pass in San Bernardino County, California (Project) for the construction of a high-speed railroad connecting Victor Valley to Rancho Cucamonga, California. This memorandum provides the paleontological resources inventory for the approximately 49-mile (79.5 km) alignment, encompassing 17,730.26 acres, of which the limits of disturbance (LOD) covers 2,897.8 acres. Brightline West retained Dudek to complete a paleontology resources inventory for the Federal Railroad Administration (FRA).

In accordance with federal, state California Environmental Quality Act (CEQA), and the Society of Vertebrate Paleontology (SVP 2010) guidelines, Dudek performed a paleontological resources inventory for the Project. The inventory included a Natural History of Los Angeles County (LACM) paleontological records search, a review of geological mapping and geological and paleontological literature, and an intensive pedestrian survey of the Project site. No surficial paleontological resources were observed during the pedestrian survey of the Project alignment. The results of the paleontological records search indicated that there are previously recorded fossil localities that appear directly within the proposed Project area and therefore a potential to impact paleontological resources within the Project site during construction-related ground disturbance. Additionally, the LACM reported fossil localities nearby from the same geological units that underlie the Project site.

As portions of the Project site have never been developed, there is a potential to encounter intact subsurface paleontological resources in those areas. As such, a paleontological monitoring program, which includes the preparation and implementation of a Paleontological Resources Impact Mitigation Plan (PRIMP), is necessary to reduce impacts to any potential paleontological resources onsite in those areas underlain by sediments with a moderate to high potential to yield significant paleontological resources. This memorandum was prepared by Michael Williams, Ph.D. and Sarah Siren, M.Sc., qualified Principal Investigators (PIs) for Paleontology, with assistance from Jason Collins, B.A., in accordance with federal and state CEQA guidelines and SVP (2010) standards.

1 Project Description

DesertXpress Enterprises, LLC (dba "Brightline West") proposes to construct and operate the Cajon Pass High-Speed Rail Project (Project), a 49-mile train system reaching a top speed of approximately 140 miles per hour (mph) between Victor Valley and Rancho Cucamonga, California. The Project includes two new railway stations—one in Hesperia, and one in Rancho Cucamonga. The connecting station in Victor Valley would be constructed as part of a separate project that was evaluated in the *DesertXpress Final Environmental Impact Statement* (Federal Railroad Authority [FRA] 2011).

The Project would be constructed within the Interstate 15 (I-15) right-of-way (ROW) for 48 miles and on existing transportation corridors for the last mile into the proposed Rancho Cucamonga station. The Project would be powered by overhead electric catenary and require construction of one new traction power substation (TPSS) in the

Hesperia area. The maintenance facility that was evaluated with the Brightline West Victor Valley High-Speed Rail (HSR) Passenger Project would provide the primary maintenance functions, although layover tracks are anticipated at the Rancho Cucamonga station, which could include light maintenance capability, such as interior cleaning and daily inspection.

Trains are expected to operate daily on 45-minute headways between Victor Valley and Rancho Cucamonga. The trip between Victor Valley and Rancho Cucamonga would be approximately 35 minutes. Service would be coordinated with existing and planned Metrolink service at the Rancho Cucamonga station to provide a convenient connection between the HSR and commuter rail systems.

The Project would be constructed and operated under a lease agreement with the California Department of Transportation (Caltrans) for the use of the I-15 ROW and the station at Hesperia. Brightline West would secure additional agreements with Caltrans for Right-of-Way Use; Design & Construction Oversight and Reimbursement; and Operations & Maintenance, as necessary. For the last mile of the Project from I-15 to the Rancho Cucamonga Station, there will be Agreements with the City of Rancho Cucamonga and the San Bernardino County Transportation Authority (SBCTA) for land rights, construction, operations and maintenance.

2 Project Location

This project is located between Victor Valley and Rancho Cucamonga, California (Figure 1) (Figures are provided at the end of this memorandum). The Project APE encompasses 17,838 acres and is 49 miles long. The Area of Potential Effects-Area of Direct Impact (APE-ADI) is a subset of this, covering approximately 2,897.8 acres. Geographic Information System (GIS) parcel/land ownership data were obtained from the San Bernardino County and Bureau of Land Management (BLM) websites. The Federal Highway Administration (FHWA) represented by the California Department of Transportation (Caltrans) has jurisdiction over the I-15 corridor as identified by rights-of-ways issued under 23 USC 317. Caltrans has entered into agreements with Brightline West for lands within the I-15 corridor. FRA is the lead agency for compliance with Section 106 of the National Historic Preservation Act (NHPA) for the Project with the FHWA and Caltrans serving as the responsible resource agencies for land within the I-15 ROW.

2.1 Area of Potential Effects (APE)

The Area of Potential Effects (APE), as defined in 36 Code of Federal Regulations (CFR) 800.16(d), is

> the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking.

Consistent with 36 CFR Part 800, FRA defined the APE in consideration of where potential effects resulting from the Project could occur. The APE totals 17,838 acres along 49 linear miles.

FRA then considered where certain project activities would occur within the APE. Based on preliminary design and engineering plans, FRA identified where physical impacts (e.g., ground-disturbing activities) from the Project would occur and labeled this area the “Area of Direct Impact” (APE-ADI). In addition, FRA considered where non-physical impacts (e.g., visual intrusion) from the Project would likely occur and labeled this area the “Area of Indirect Impact” (APE-AII). The terms APE-ADI and APE-AII do not have any regulatory standing nor do these terms denote where

Project “effects” may occur within the APE. FRA used the terms APE-ADI and APE-AII for investigation purposes only to inform its identification efforts. While the entire APE was investigated through various means, FRA focused its intensive pedestrian survey efforts to those areas where physical impacts from the Project may occur (i.e., within the APE-ADI).

2.2 Area of Direct Impact (APE-ADI)

The current APE-ADI is 2,897.8 acres and 49 linear miles. For the purposes of this inventory, the APE-ADI is defined as the Project’s Limits of Disturbance (LOD) and considers where paleontological resources may be directly impacted by construction and operational activities. The APE-ADI includes the footprint of the alignment, facility features, and ancillary features. Facility features consist of station locations; substations; and operations, maintenance, and service facilities. Ancillary features include temporary construction easements, staging areas, roadway reconstruction locations, emergency crossovers, utility corridors, and autotransformers. The APE-ADI also includes all areas proposed for eventual double-tracking. Table 2-3 summarizes the delineation values for the Project’s APE-ADI.

The APE-ADI for the Project takes into consideration the vertical depth of ground disturbance. FRA defined the vertical depth of the APE-ADI based on revised plan and profile designs prepared for the Project. It accounts for the final depths necessary to construct rail bed and footings or foundations of structural components. The APE-ADI depth is expected to range from a few feet (ft) for at-grade work, up to 8 ft (2.43 m) below grade to account for support pilings, and more than 100 ft (30.4 m) for footings associated with waterway crossings. In parts of the alignment, fill would be used to build the tracks with limited (2-3 ft or 0.61-0.91 m) of over excavation for compaction, while other project features, such as underpasses and pilings/footings, require extensive excavation to depths of up to 100 feet (30.4 m). To account for varying depths of project components and provide flexibility for minor project changes, FRA delineated the maximum depth of the Project APE-ADI as up to 120 ft (36.6 m) below current grade.

2.2 Area of Indirect Impact (APE-AII)

The APE-AII is all areas within the APE not including the APE-ADI, for a total of 14,940.2 acres along 49 linear miles. The APE-AII is a larger area than the APE-ADI to account for potential effects to historic properties of religious or cultural significance to Tribes that extend past the APE-ADI. This report focuses on paleontological resources that intersect or are within the APE-ADI and paleontological localities nearby from the same geological units mapped within the APE-ADI .

3 Paleontological Resources

Paleontological resources are the remains or traces of plants and animals that are preserved in earth’s crust, and per the SVP (2010) guidelines, are older than written history or older than approximately 5,500 years. They are limited, nonrenewable resources of scientific and educational value, which are afforded protection under state laws and regulations. This analysis also complies with guidelines and significance criteria specified by SVP (2010). Table 1 provides definitions for high, low, undetermined, and no paleontological resource potential, or sensitivity, as set forth in and by the SVP (2010) guidelines.

Table 1. Paleontological Resource Sensitivity Criteria

Resource Sensitivity / Potential	Definition
High	Rock units from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources. Rock units classified as having high potential for producing paleontological resources include, but are not limited to, sedimentary formations and some volcaniclastic formations (e.g., ashes or tephras), and some low-grade metamorphic rocks that contain significant paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils (e.g., middle Holocene and older, fine-grained fluvial sandstones, argillaceous and carbonate-rich paleosols, cross-bedded point bar sandstones, fine-grained marine sandstones). Paleontological potential consists of both (1) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, plant, or trace fossils and (2) the importance of recovered evidence for new and significant taxonomic, phylogenetic, paleoecologic, taphonomic, biochronologic, or stratigraphic data. Rock units that contain potentially datable organic remains older than late Holocene, including deposits associated with animal nests or middens, and rock units that may contain new vertebrate deposits, traces, or trackways are also classified as having high potential.
Low Potential	Reports in the paleontological literature or field surveys by a qualified professional paleontologist may allow determination that some rock units have low potential for yielding significant fossils. Such rock units will be poorly represented by fossil specimens in institutional collections or, based on general scientific consensus, only preserve fossils in rare circumstances and the presence of fossils is the exception not the rule; e.g., basalt flows or Recent colluvium. Rock units with low potential typically will not require impact mitigation measures to protect fossils.
Undetermined Potential	Rock units for which little information is available concerning their paleontological content, geologic age, and depositional environment are considered to have undetermined potential. Further study is necessary to determine whether these rock units have high or low potential to contain significant paleontological resources. A field survey by a qualified professional paleontologist to specifically determine the paleontological resource potential of these rock units is required before a paleontological resource impact mitigation program can be developed. In cases where no subsurface data are available, paleontological potential can sometimes be determined by strategically located excavations into subsurface stratigraphy.
No Potential	Some rock units have no potential to contain significant paleontological resources; for instance, high-grade metamorphic rocks (such as gneisses and schists) and plutonic igneous rocks (such as granites and diorites). Rock units with no paleontological resource potential require neither protection nor impact mitigation measures relative to paleontological resources.

Source: SVP (2010)

4 Regulatory Framework

Paleontological resources are considered non-renewable resources with scientific and educational value and thus are protected by several federal, state and local laws and regulations.

4.1 Federal Laws

Paleontological Resources Preservation Act of 2009

The Omnibus Public Land Management Act, Paleontological Resource Preservation Subtitle (16 U.S.C. 470aaa et seq.) directs the Secretaries (Interior and Agriculture) to manage and protect paleontological resources on federal land using scientific principles and expertise. (This act is known by its common name, the Omnibus Act or the Paleontological Resources Preservation Act [PRPA].) The PRPA incorporates most of the recommendations of the report of the Secretary of the Interior titled "Assessment of Fossil Management on Federal and Indian Lands" to formulate a consistent paleontological resources management framework. In passing the PRPA, Congress officially recognized the scientific importance of paleontological resources on some federal lands by declaring that fossils from these lands are federal property that must be preserved and protected. The PRPA codifies existing policies of the BLM, National Park Service (NPS), U.S. Forest Service (USFS), Bureau of Reclamation, and the U.S. Fish and Wildlife Service, and provides the following:

- Uniform criminal and civil penalties for illegal sale and transport, and theft and vandalism of fossils from federal lands.
- Uniform minimum requirements for paleontological resource-use permit issuance (terms, conditions, and qualifications of applicants).
- Uniform definitions for "paleontological resources" and "casual collecting."
- Uniform requirements for curation of federal fossils in approved repositories.

Federal legislative protections for scientifically significant fossils apply to projects that take place on federal lands (with certain exceptions, such as the Department of Defense, which continue to protect paleontological resources under the Antiquities Act). Such protections involve federal funding, require a federal permit, or involve crossing state lines.

Antiquities Act of 1906 (16 U.S.C. 431-433)

The Antiquities Act of 1906 states, in part:

> ... any person who shall appropriate, excavate, injure or destroy any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the Government of the United States, without the permission of the Secretary of the Department of the Government having jurisdiction over the lands on which said antiquities are situated, shall upon conviction, be fined in a sum of not more than five hundred dollars or be imprisoned for a period of not more than ninety days, or shall suffer both fine and imprisonment, in the discretion of the court.

Although there is no specific mention of natural or paleontological resources in the Antiquities Act, or in the act's uniform rules and regulations (43 Code of Federal Regulations [CFR] 3]), "objects of antiquity" has been interpreted to include fossils by the NPS, BLM, USFS, and other federal agencies. Permits to collect fossils on lands administered by federal agencies are authorized under this act. Therefore, projects involving federal lands will require permits for both paleontological resource evaluation and mitigation efforts.

Archaeological and Paleontological Salvage (23 U.S.C. 305)

Statute 23 U.S.C. 305 amends the Antiquities Act of 1906. Specifically, it states:

> Funds authorized to be appropriated to carry out this title to the extent approved as necessary, by the highway department of any State, may be used for archaeological and paleontological salvage in that state in compliance with the Act entitled "An Act for the preservation of American Antiquities," approved June 8, 1906 (PL 59-209; 16 U.S.C. 431-433), and State laws where applicable.

This statute allows funding for mitigation of paleontological resources recovered pursuant to federal aid highway projects, provided that "excavated objects and information are to be used for public purposes without private gain to any individual or organization" (Federal Register [FR] 46[19]: 9570).

National Registry of Natural Landmarks (16 U.S.C. 461-467)

The National Natural Landmarks (NNL) program, established in 1962, is administered under the Historic Sites Act of 1935. Regulations were first published in 1980 under 36 CFR 1212 and the program was re-designated as 36 CFR 62 in 1981. A National Natural Landmark is defined as:

> … an area designated by the Secretary of the Interior as being of national significance to the United States because it is an outstanding example(s) of major biological and geological features found within the boundaries of the United States or its Territories or on the Outer Continental Shelf (36 CFR 62.2).

National significance describes:

> … an area that is one of the best examples of a biological community or geological feature within a natural region of the United States, including terrestrial communities, landforms, geological features and processes, habitats of native plant and animal species, or fossil evidence of the development of life (36 CFR 62.2).

Federal agencies and their agents should consider the existence and location of designated NNLs, and of areas found to meet the criteria for national significance, in assessing the effects of their activities on the environment under Section 102(2)(c) of the National Environmental Policy Act (NEPA) (42 U.S.C. 4321). The NPS is responsible for providing requested information about the National Natural Landmarks Program for these assessments (36 CFR 62.6[f]). However, other than consideration under NEPA, NNLs are afforded no special protection. Furthermore, there is no requirement to evaluate a paleontological resource for listing as an NNL. Finally, project proponents (state and local) are not obligated to prepare an application for listing potential NNLs, should such a resource be encountered during project planning and delivery.

Examples of geological and paleontological NNLs in California include:

- *Imperial Sand Hills*: Imperial Sand Hills is one of the largest dune patches in the United States. It is an outstanding example of dune geology and ecology in an arid land. (Designated: 1966. Ownership: federal, private.)
- *Eureka Dunes*: Eureka Dunes, located within Death Valley National Park, is an excellent example of aeolian (wind) geological processes. It is the tallest dune complex in the Great Basin biophysiographic province. The site contains an endangered grass genus, one species of which is the only plant capable of surviving on and stabilizing the steep dune slopes. (Designated: 1983. Ownership: federal.)

- *Amboy Crater*: Amboy Crater is an excellent example of a recent volcanic cinder cone with an unusually flat crater floor. (Designated: 1973. Ownership: federal, private.)
- *Rainbow Basin*: Comprised of deep erosion canyons with rugged rims, Rainbow Basin is an outstanding example of geologic processes. The site also contains significant fossil remains and traces (e.g., footprints) of Miocene plants, insects, and land mammals. (Designated: 1966. Ownership: federal.)

National Historic Preservation Act of 1966 (NHPA; 16 U.S.C. 470)

Section 106 of the NHPA does not apply to paleontological resources unless the paleontological specimens are found in culturally related contexts (e.g., fossil shell included as a mortuary offering in a burial or a culturally related site such as petrified wood locale used as a chipped stone quarry). In such instances the materials are considered cultural resources and are treated in the manner prescribed for the site in question; mitigation being almost exclusively limited to sites determined eligible for, or listed on, the National Register of Historic Places. Cooperation between the cultural resource and paleontological disciplines is expected in such instances.

4.2 State Laws

California Environmental Quality Act

Paleontological resources are afforded protection under CEQA, which require lead agencies to disclose the potential environmental impacts of their discretionary actions. One of the screening questions in Appendix G of the CEQA Guidelines asks: “Would the project directly or indirectly destroy a unique paleontological resource or site or a unique geologic feature?”

Public Resources Code Section 5097.5

California’s Public Resources Code (PRC) Section 5097.5 states that:

> No person shall knowingly and willfully excavate upon, or remove, destroy, injure, or deface, any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, rock art, or any other archaeological, paleontological or historical feature, situated on [lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof], except with the express permission of the public agency having the jurisdiction over the lands. Violation of this section is a misdemeanor.

California Code of Regulations

Two sections of the California Code of Regulations (14 CCR Division 3, Chapter 1), applicable to lands administered by State Parks, address paleontological resources:

Section 4307: Geological Features—

> “No person shall destroy, disturb, mutilate, or remove earth, sand, gravel, oil, minerals, rocks, paleontological features, or features of caves.”

Section 4309: Special Permits—

[California Department of Parks and Recreation] may grant a permit to remove, treat, disturb, or destroy plants or animals or geological, historical, archaeological or paleontological materials; and any person who has been properly granted such a permit shall to that extent not be liable for prosecution for violating the foregoing.

5 Methods

This section describes the techniques employed to identify and evaluate paleontological resources within the Project site and determine the potential for paleontological resources to be recovered during Project implementation. All methods conform to federal and state regulations and SVP (2010) guidelines for assessment and mitigation of impacts to significant paleontological resources.

5.1 Geological Map and Literature Review

Published geological mapping (listed from north to south along the alignment) (Dibblee 1960a,b; Dibblee 1965; Dibblee and Minch 2003a,b; Morton and Miller 2006a) and published and unpublished reports and paleontological literature were reviewed to identify geological units on the site, glean information on their stratigraphic sequence, and determine their paleontological sensitivity.

5.2 Paleontological Records Search

A paleontological records search request was sent to the LACM on August 23, 2022, and the results were received on September 25, 2022. The purpose of the museum records search is to determine whether there are any known fossil localities in or near the Project site, assist in determining the potential for the Project to destroy paleontological resources, and aide in determining whether a paleontological mitigation program is warranted to avoid or minimize potential adverse effects of construction on paleontological resources.

5.3 Field Survey

Dudek paleontological field lead, Jason Collins, with paleontological field technicians, Sam Allen and Chris Boyd, conducted a pedestrian survey of the Project site from April 4, 2022 to April 7, 2022. The survey was conducted to determine if any surficial paleontological resources are present within the Project site and to confirm geological mapping. The survey utilized standard paleontological survey procedures and consisted of systematic surface inspection of exposed geological units with moderate to high paleontological sensitivity. The ground surface was examined for the presence of exposed surficial fossils. Ground disturbances such as road cuts, burrows, and eroded hillsides were also visually inspected for exposed fossils and sediments. Survey transects were spaced 15-meters wide and oriented south–north across accessible areas of the project site. Where transects were not feasible (such as on slopes greater than 25 degrees), a mixed approach (opportunistic survey) was used, selectively examining terraces, ridges, and potential rock outcrops where possible.

Formal transects were not used for the majority of the Project site just south, going through, and just north of the Cajon Pass. These areas, approximately 65% of the Project site, consist of undisturbed sediments and numerous slopes greater than 25 degrees. Due to the steep slopes, the mixed survey approach was used. Formal survey transects were used for approximately 35% of the Project site, in the southern and northern portions of the Project site which did not have steep slopes.

6 Results

6.1 Geological Map and Literature Review

From north to south, the Project alignment lies within the Mojave Desert Geomorphic Province, the Transverse Ranges Geomorphic Province, and the northernmost Peninsular Ranges Geomorphic Province. The Mojave Desert Geomorphic Province is characterized by rugged mountain ranges with intervening alluvial fans, bajadas, and valleys that have no drainage to the ocean (California Geological Survey [CGS] 2002). There are two important fault trends that control topography in this province and define the southern and northern boundaries: a prominent northwest-southeast trend (the San Andreas Fault Zone defining the southern boundary of the province) and a northeast-southwest trend (the Garlock Fault defining the northern boundary of the province). The Mojave province is wedged in a sharp angle between the Garlock Fault and the San Andreas Fault Zone, where it bends east from its northwest trend. The northern boundary of the Mojave is separated from the prominent Basin and Range by the eastern extension of the Garlock Fault.

The Transverse Ranges Geomorphic Province, which extends from Point Conception in the west to the San Bernardino Mountains in the east. The province also includes the San Gabriel, Santa Monica, and Santa Ynez Mountains and the offshore San Miguel, Santa Rosa, and Santa Cruz Islands. (CGS 2002; Morton and Miller 2006b). This geomorphic province structure is east-west trending and is oblique to the normal northwest trend of coastal California.

The Peninsular Ranges Geomorphic Province (CGS 2002) extends from the tip of the Baja California Peninsula to the Transverse Ranges and includes the Los Angeles Basin, offshore islands (Santa Catalina, Santa Barbara, San Nicholas, and San Clemente), and the continental shelf. The eastern boundary is the Colorado Desert Geomorphic Province (California Geological Survey 2002; Morton and Miller 2006b). The ancestral Peninsular Ranges were formed by uplift of plutonic igneous rock resulting from the subduction of the Farallon Plate underneath the North American Plate during the latter portion of the Mesozoic era (approximately 90 to 125 million years ago [mya]) (Abbott 1999).

The Cajon Pass was created by tectonic activity along the San Andreas Fault at the margins of the Pacific Oceanic Plate and North American Continental Plate. The pass effectively separates two mountain ranges: the San Gabriel Mountains on the west side and the San Bernardino Mountains on the east. These mountains are part of the Transverse Ranges of southern California, that run generally east/west. The Cajon Pass also marks the juncture of the central and eastern segments of the Transverse Range with the San Gabriel Mountains in the central segment and the San Bernardino Mountains in the east segment. These mountains are steep and fragmented fault blocks further affected by fault zones and erosional forces that have resulted in lateral displacement of rock and sediment between the two segments (Morton and Miller 1975; Basgall and True 1985). The approach to the Cajon Pass from the Mojave Desert to the north is over a significant alluvial fan with a gradual rise in elevation to the crest of the pass. Descent into the San Bernardino valley to the south is more rugged, but still formed by significant erosion and deposition processes. These processes have draped the lower elevations of the pass with variable sediments including low percentages of clay and silt and much higher percentages of medium and coarse sands (Basgall and True 1985).

More specifically, geological mapping indicates the Project alignment is underlain by sedimentary, igneous, and metamorphic geological units and formations ranging in age from recent (approximately 11.700 years ago - present) to the Precambrian Period (approximately 538 million years ago [mya] – 4.6 billion years ago). The geological units mapped within the Project alignment are discussed below from youngest to oldest. Geological ages are from the international chronostratigraphic chart of Cohen et at. (2022).

Holocene Sedimentary Deposits (Map Units Qa, Qw, Qrs, Qg, Qf, Qyf_3)

Holocene (recent) alluvial, wash, river, alluvial gravel, and alluvial fan deposits are mapped in the northern and southernmost portions of the Project alignment and interspersed through the central portion of the alignment (Figure 2 – Geological Map). Holocene sedimentary deposits typically consist of variable amounts of clays, silts, sands, and gravels that are unconsolidated. Given their young age, they do not usually preserve fossils and are assigned low paleontological sensitivity on the surface, increasing with depth, where they may be underlain by older, fossiliferous geological units (Table 2).

Pleistocene Sedimentary Deposits (Map Units Qoa, Qof, Qoh)

Pleistocene (approximately 11,700 years ago – 2.6 mya) alluvial deposits are mapped intermittently in the northern and central portions of the Project alignment and comprise a large portion of the Victorville Fan, which dominates the northern section of the Project alignment from the Cajon Pass to Victorville. According to Cox and Hillhouse (2000), the stratigraphic succession of the Victorville Fan from youngest to oldest (deepest where not exposed on the surface) includes Noble's older alluvium, Shoemaker Gravel, and Harold Formation. Pleistocene alluvial deposits are lithologically similar to Holocene alluvial deposits, but are generally elevated and dissected, have a greater degree of induration, are more oxidized, and often underlie Holocene alluvial deposits at variable depths. Areas of the Project alignment in the vicinity of and north of Cajon Summit are mapped as alluvial gravel of inface bluffs (map unit Qof) by Dibblee and Minch (2003a) and comprise much of the Victorville Fan. These deposits are equivalent to the Shoemaker Gravel of Noble (1954) (Figure 2 – Geological Map). The Shoemaker Gravel consists of weakly indurated, San Gabriel Mountain detrital gravels that are subrounded. The Pleistocene and possibly late Pliocene (approximately 2.58 – 3.6 mya) Harold Formation (map unit Qoh) is mapped by Dibblee and Minch (2003a) just west of Cajon Summit, where it intersects the Project alignment. Lithologically, sediments of the Harold Formation are similar to the Shoemaker Gravel and the Crowder Formation but are light gray in color and consist of pebbly sand where exposed in the west becoming coarser grained where exposed in the east (Dibblee and Minch 2003a).

Pleistocene alluvial deposits, the Shoemaker Gravel, and the Harold Formation have produced significant "Ice-Age" amphibians, reptiles, bird, and large and small mammals in the vicinity of the Project alignment. Jefferson (1991) and Harris (2014) reported the following from unnamed Pleistocene sedimentary units near the Project: mammoth (*Mammuthus*) from Hesperia and horse (*Equus*) and camel (Camelidae?) from Lucerne Dry Lake. The Shoemaker Gravel (not differentiated from Noble's older alluvium) produced the following taxa from Victorville: tortoise (*Gopherus* sp.), rodent (Rodentia and *Dipodomys* sp.), rabbit (*Lepus* sp.) horse (*Equus* sp.), Camel (Camelidae and *Hemiauchenia* sp.), and mammoth (*Mammuthus*) (Jefferson 1991). The Harold Formation has also produced significant paleontological resources, including rodents (*Neotoma* sp., *Microtus* sp., *Peromyscus* sp., *Thomomys* sp., *Sigmodon*, cf. *minor*, *Dipodomys* sp.), rabbit (*Sylvilagus* sp.), horse (*Equus conversidens*) (Fossilworks 2022). Given Pleistocene alluvial deposits, the Shoemaker Gravel, and the Harold Formation have produced significant paleontological resources in the vicinity of the Project, they are considered to have high paleontological sensitivity throughout their geographic and stratigraphic extent.

Miocene Sedimentary Deposits (Map Units Tcr, Tcr5, Tcv, Tcvc)

Miocene (approximately 5.3 – 23 mya) sedimentary rocks are mapped by Dibblee and Minch (2003a) in the central portion of the Project alignment within Cajon Pass (Figure 2 – Geological Map). The middle Miocene (approximately 7.25 – 15.97 mya) Crowder Formation consists of light tan to off white, bedded, coarse to fine-grained sandstone with pebbles, in addition to conglomerate lenses (Dibblee and Minch 2003a; Morton and Miller 2006). The middle Miocene (approximately 7.25 – 15.97 mya) Cajon Valley Formation (Punchbowl Formation of some authors) underlies the Crowder Formation or is coeval with it and consists of an upper gray to white to tan and pink, arkosic sandstone unit with thick beds and a lower conglomerate unit containing pebbles and cobbles in a sandstone matrix (Dibblee and Minch 2003a; Morton and Miller 2006a).

The Crowder Formation has a record of producing significant vertebrate fossil remains near the Project alignment. Reynolds (1984) reported two fossil faunas from the lower Crowder Formation in the vicinity of the Project alignment: the Wye local fauna and the Crowder 4.4 local fauna. Fossils recovered from these faunas include, but are not limited to, specimens of shrew (*Paradomnina* sp. cf. *P. relictus*, Soricidae) rodent (*Sciuropterus* sp. cf. *S. mathewsi*, *Protosphermophilus* sp., *Citellus* sp., *Miospermophilus* sp. cf. *M. wyomingensis*, *Tamias* sp., *Mookomys* sp. cf. *M. altifluminus*, *Proheteromys sulculus*, *Cupidinimus nebraskensis*, *Cupidinimus* sp., *Copemys* sp. cf. *C. dentalis*, *Copemys* sp. cf. *C. esmeraldensis*, *Peromyscus* sp. cf. *P. Pliocenicus*, *Perognathus furlongi*, Thomoyinae), peccary (*Dyseohyus* sp.), camel (cf. *Michenia* sp., cf. *Miolabis* sp., cf. *Procamelus* sp., cf. *Aepycamelus* sp.), and horse (*Archaeohippus* sp. cf. *A. mourningi*, *Merychippus* sp. cf. *M. carrizoensis*). The Wye local fauna yielded 29 taxa from 16,000 pounds of screened sediments while preliminary analysis of the Crowder 4-4 local fauna indicated nine taxa were present (Reynolds 1984). In addition, Lofgren and Absersek (2018) reported a fossil weasel (*Miomustela* sp.) from the Wye local fauna. Given the Crowder Formation has produced significant paleontological resources in the vicinity of the Project, it is considered to have high paleontological sensitivity throughout its geographic and stratigraphic extent.

Similar to the Crowder Formation, the Cajon Valley (Punchbowl) Formation has an extensive record of producing significant vertebrate fossil specimens in the vicinity of the Project alignment. Wagner and Reynolds (1983) reported the first occurrence in California of the fossil mustelid (weasel family), *Leptarctus ancipidens*, from Cajon Valley Formation deposits in the Cajon Pass, approximately one mile south of the intersection of California State Highway 138 and Interstate 15. The specimen was salvaged by paleontological monitors during a Santa Fe Railroad right-of-way realignment project. Chalicothere specimens (*Moropus* sp.) were discovered and collected from Cajon Valley Formation sediments in the Cajon Pass area. Chalicotheres are an extinct group of herbivorous perissodactyls (odd-toed ungulates) that are unlike other perissodactyls in possessing claws instead of hooves. Further to the east of the Project alignment, a fossil specimen of horse, *Cormohipparion* sp., from Devils Punchbowl County Park was described by Woodburne (2005). Given the Cajon Valley Formation has produced significant paleontological resources in the vicinity of the Project, it is considered to have high paleontological sensitivity throughout its geographic and stratigraphic extent.

Paleocene Sedimentary Deposits (Map Unit Tsf)

The Paleocene (approximately 56 – 66 mya), marine San Francisquito Formation was mapped by Dibblee and Minch (2003a) further south in the Cajon Pass (Figure 2 – Geological Map). Morton and Miller (2006a) described the lithology of the formation as conglomerate, conglomeratic sandstone, sandstone, and shale with a general fining upward trend. Dibblee and Minch (2003a) indicated the formation is not fossiliferous; however, Morton and Miller (2006a,b) stated the massive to thick-bedded sandstone contains fossils. In addition, Prothero and Vacca (2001) refer to fossil turretillids from the formation in the vicinity of Devil's Punchbowl. Given the San Francisquito Formation has produced significant paleontological resources in the vicinity of the Project, it is considered to have high paleontological sensitivity.

Cretaceous Igneous and Metamorphic Rocks (Map Units Gqm, qd, grdi, ps, db)

Dibblee (1960a,b) and Dibblee and Minch (2003a,b) mapped Cretaceous (approximately 66 – 145 mya), plutonic igneous rocks within the Project alignment sporadically from the northern terminus of the Project alignment in Sidewinder valley south to just north of Devore and metamorphic rocks sporadically further south (Figure 2 – Geological Map). These rocks consist of igneous quartz diorites and monzonites, granodiorites, and metamorphic schists that do not preserve fossils and therefore are considered to have no paleontological sensitivity.

Precambrian Metamorphic Rocks (Map Units gn, ml)

Dibblee (1960b) mapped one small area of marble (limestone on geological map) within the Project alignment just north of Victorville (Figure 2 – Geological Map). South of Cosy Dell, the Project alignment intersects a small outcropping of Precambrian (> approximately 538.8 mya) gneiss and marble lenses in gneiss (Dibblee and Minch 2003a) (Figure 2 – Geological Map). Due to the high temperatures and pressures associated with medium- to high-grade metamorphic rocks such as gneisses, they do not preserve fossils and are considered to have no paleontological sensitivity.

Table 2. Geological Units, Paleontological Sensitivities, and LACM Localities within a 1-Mile Radius Buffer Zone of the Project Site

Geological Unit	Epoch, Period, or Era	Approximate Geological Age (Millions of Years)	Paleontological Sensitivity	Number of Reported LACM Localities
Holocene Sedimentary Deposits	Holocene	<0.0117	Low*	1
Noble's Older Alluvium	Middle Pleistocene	.774,000 – .129,000	High	0
Shoemaker Gravel	Early to Middle Pleistocene	.774,000 – 2.6	High	3
Harold Formation	Early to Middle Pleistocene	.774,000 – 2.6	High	0
Crowder Formation	Middle Miocene	7.25 – 15.97	High	1
Cajon Valley (Punchbowl) Formation	Middle Miocene	7.25 – 15.97	High	3
Vaqueros Formation	Early Miocene	5.3-23.03	High	1
San Francisquito Formation	Paleocene	56 – 66	High	0
Igneous and Metamorphic Rocks	Cretaceous	66 – 145	None	0

Table 2. Geological Units, Paleontological Sensitivities, and LACM Localities within a 1-Mile Radius Buffer Zone of the Project Site

Geological Unit	Epoch, Period, or Era	Approximate Geological Age (Millions of Years)	Paleontological Sensitivity	Number of Reported LACM Localities
Metamorphic Rocks	Precambrian	>538.8	None	0

*Sensitivity increases with depth below the surface

6.2 Paleontological Records Search

The LACM records search results letter was received on September 25, 2022. Three fossil locality records were found within the boundaries of the Project site. These fossil localities include LACM VP (Vertebrate Paleontology) 3352, LACM IP (Invertebrate Paleontology) 7673, and LACM VP 4184 and are detailed in Table 3 below. LACM IP 7673 likely lies within APE-AII since the Vaqueros Formation is not mapped within the APE-ADI but very nearby. Additionally, the LACM reported 18 nearby fossil localities, including two from the Shoemaker Gravel, three from the Punchbowl Formation, one from the Crowder Formation, two from Pleistocene alluvial deposits, two from unknown Pleistocene age deposits, and nine from unknown Holocene age deposits (Confidential Appendix A). The LACM localities are detailed in Table 3 below.

Table 3. LACM Paleontological Records Search Results

Locality Number	Location	Formation	Taxa	Depth
LACM VP 3352	West bank of the Mojave River, north end of Victorville	Shoemaker Gravel	Horse (*Equus*)	Unknown
LACM IP 7673	Spur on southwest side of the Cajon Pass	Vaqueros Formation	Invertebrates (unspecified)	Surface
LACM VP 4184	Southeast wall of a railroad cut southwest of Alray	Cajon Valley (Punchbowl) Formation	Primitive Horse (*Archaeohippus mourningi)*	Surface
LACM VP 3353	Near Second Street near top of bluff west bank of the Mojave River	Shoemaker Gravel	Horse (*Equus*)	Unknown
LACM VP 3498	West of Portland Cement Co. plant in bluffs on west side of Mojave River, between I-15 and Air Expressway Road	Shoemaker Gravel	Horse (*Equus*); deer (Cervidae); antelope (Antilocapridae)	Unknown
LACM VP 7786	Southern California Logistics Airport	Alluvium (Pleistocene, moderately indurated fine to medium grained silty sandstone)	Vole (*Microtus mexicanus*)	10-11 feet bgs

Table 3. LACM Paleontological Records Search Results

Locality Number	Location	Formation	Taxa	Depth
LACM VP 5942-5950	Along Avenue S from Palmdale to Lake Los Angeles	Unknown formation (Holocene)	Kingsnake (*Lampropeltis*), Lizard (Lacertilia), leopard lizard (*Gambelia*); snake (Ophidia), gopher snake (*Pituophis*); rabbit (Lagomorpha), rodent (Rodentia), pocket gopher (*Thomomys*), pocket mouse (*Chaetodippus*), kangaroo rat (*Dipodomys*); birds (Aves)	0-9 feet bgs
LACM VP (CIT) 401	Vicinity of Alray & Cajon Pass at Cajon Camp	Cajon Valley (Punchbowl) Formation	Mammalia (unspecified)	Unknown
LACM VP (CIT) 400, LACM IP 5288	Northwest end of Cajon Valley; ½ mile southwest of Highway 138 leading to Bing Pines Recreation Area; approximately one mile southeast of Horse Canyon	Cajon Valley (Punchbowl) Formation	Reptilia (unspecified), Mammalia (unspecified). terrestrial gastropods	Unknown
LACM VP (CIT) 402	North of Cajon Junction (Hwy 138 and I-5) along Crowder Canyon Road	Crowder Formation	Reptilia (unspecified); Mammalia (unspecified)	Unknown
LACM VP 4619	Wineville Ave, Eastvale, CA	Unknown Formation (Pleistocene)	Mammoth (*Mammuthus*)	100 feet bgs
LACM VP 7811	West of Orchard Park, Chino Valley	Unknown formation (eolian, tan, silt; Pleistocene)	Whip snake (*Masticophis*)	9-11 feet bgs

VP, Vertebrate Paleontology; IP, Invertebrate Paleontology, CIT, California Institute of Technology

6.3 Paleontological Survey

The survey area covered the approximately 17,730.26 acre, 49-mile-long Project site, which is located at the foothills of the San Gabriel Mountains, through the Cajon Pass, and into the Mojave Desert. Survey photos are included in Attachment A. The survey was conducted as a pedestrian survey using 15 meter transects in areas where feasible and where not feasible, an opportunistic survey was conducted based on mapped geology and perceived or visible exposures in road cuts, access roads, or areas mapped without built environment. The southern terminus of the Project area is in Rancho Cucamonga, just south of the San Gabriel Mountains in a largely urban area. In this area, a pedestrian survey was conducted; however, much of the area was developed, consisting of commercial properties and parking lots and two vacant lots with construction projects occurring along Haven Avenue continuing east to the Interstate 15. From this point, the survey continued north, but was limited to off ramps and on ramps for Interstate 15 mapped as less sensitive Holocene alluvial deposits and fill (Attachment A - Photos 1-2). The survey continued north until the Brentwood and Coyote Canyon areas where the area of direct impacts (ADI) expanded and included the foothills of the San Gabriel Mountains. Exposures of gneissic Precambrian rock and Cretaceous quartz diorite were documented (Attachment A - Photos 3-4). From this point, the survey continued into the Cajon Pass, which made pedestrian surveying difficult due to the area being mainly valleys, steep hills, and washes. Access to outcroppings and exposed strata were limited on the east side of the Cajon Pass within the ADI; exposures of the Miocene Crowder Formation were observed and a fault line buttress unconformity between the Crowder and Cajon Valley Formations were documented. The west side of the Cajon Pass had more access to exposures of sensitive mapped geology including the Cajon Valley Formation due to electrical maintenance roads, fire roads, and railroad access roads (Attachment A - Photos 5-10). Continuing north out of the Cajon Pass, the Project alignment enters the Mojave Desert, heading through Victorville and Hesperia, and a narrowing of the ADI which then follows Interstate 15 again making on ramps and off ramps providing the best geological exposures within the Project ADI. These areas consisted of Holocene and Pleistocene sedimentary deposits (Attachment A - Photos 11-12). No paleontological resources were observed during the pedestrian survey.

7 Summary and Management Recommendations

As a result of this paleontological inventory, which included an LACM paleontological records search, a pedestrian survey of the Project APE-ADI, and a desktop geological map and geological and paleontological literature review, a total of three paleontological resource localities were identified in the Project APE-ADI and paleontological sensitivities of the geological units mapped within the Project APE-ADI were determined. In addition to the three fossil localities identified within the APE-ADI, 18 paleontological resource localities were identified nearby from the same sedimentary deposits mapped within the Project APE-ADI.

- Fossil localities reported from within the APE-ADI (n=3)
    - 3 localities reported by the LACM: (LACM VP 3352, LACM IP 7673, and LACM VP 4184
        - LACM VP 3352 from the Shoemaker Gravel located on the west bank of the Mojave River in Northern Victorville
        - LACM IP 7673 from the Vaqueros Formation located on west side of Cajon Pass
        - LACM VP 4184 from the Cajon Valley (Punchbowl) Formation located on the southeast wall of a railroad cut southwest of Alray
- Fossil localities reported nearby the APE-ADI (n=19)
    - 19 localities nearby from the same geological units that intersect the APE-ADI: LACM VP 3353, LACM VP 3498, LACM VP 7786, LACM VP 5942-5950, LACM VP (CIT) 401, LACM VP (CIT) 400, LACM IP 5288, LACM VP (CIT) 402, LACM VP 4619, LACM VP 7811
        - LACM VP 3353 from the Shoemaker Gravel located near second Street near top of bluff west bank of the Mojave River
        - LACM VP 3498 from the Shoemaker Gravel located west of Portland Cement Company plant in bluffs on west side of Mojave River, between I-15 and Air Expressway Road
        - LACM VP 7786 from Pleistocene alluvium located at the Southern California Logistics Airport
        - LACM VP 5942-5950 from Holocene deposits located along Avenue S from Palmdale to Lake Los Angeles

- LACM VP (CIT) 401 from the Cajon Valley (Punchbowl) Formation located in the vicinity of Alray & Cajon Pass at Cajon Camp
- LACM VP (CIT) 400 and LACM IP 5288 from the Cajon Valley (Punchbowl) Formation located northwest end of Cajon Valley; ½ mile southwest of Highway 138 leading to Bing Pines Recreation Area; approximately one mile southeast of Horse Canyon
- LACM VP (CIT) 402 from the Crowder Formation located north of Cajon Junction (Hwy 138 and I-5) along Crowder Canyon Road
- LACM VP 4619 from an unknown Pleistocene deposit located along Wineville Avenue in Eastvale, California
- LACM VP 7811 from an unknown Pleistocene deposit located west of Orchard Park, Chino Valley

Geological units mapped within the Project APE-ADI (Figure 2 – Geological Map) were determined to have no, low, and high paleontological sensitivity in accordance with SVP (2010) guidelines.

- Holocene sedimentary deposits: low paleontological sensitivity increasing with depth
- Pleistocene sedimentary deposits (Noble's older alluvium, Shoemaker Gravel, and the Harold Formation): high paleontological sensitivity
- The Crowder Formation: high paleontological sensitivity
- Cajon Valley (Punchbowl) Formation: high paleontological sensitivity
- San Francisquito Formation: high paleontological sensitivity
- Igneous and metamorphic rocks: no paleontological sensitivity

Based on the records search results, survey results, and map and literature review, the Project site has high potential to produce scientifically significant paleontological resources during future construction activities. If intact paleontological resources are present on the surface or buried within Project site, ground-disturbing activities associated with construction of the Project, such as grading and augering during site preparation and trenching for utilities, have the potential to destroy a unique paleontological resource or site. Without protection through the implementation of a paleontological monitoring plan, the potential damage to scientifically significant paleontological resources during construction would be a potentially significant impact.

Therefore, prior to any construction project involving ground disturbance within the Project APE-ADI, it is recommended that the applicant provide a letter from a qualified professional paleontologist (QPP) that demonstrates that the QPP has been retained to prepare and implement a paleontological monitoring plan. A QPP is defined as a person who has a Ph.D. or M.S. or equivalent in paleontology or closely related field (e.g., sedimentary or stratigraphic geology, evolutionary biology), has a demonstrated knowledge of Southern California paleontology and geology, expertise in determining fossil significance, and has documented experience performing professional paleontological procedures and techniques. The monitoring plan shall be submitted to the lead agency prior to the preconstruction meeting and include the following performance standards at a minimum:

1. Attendance to preconstruction meetings with representatives of the lead agency, the developer or project proponent, and contractors to explain the importance of fossils, the laws protecting fossils, the need for mitigation, the types of fossils that might be discovered during excavation work, and the procedures that should be followed if fossils are discovered.

2. Requirements for a QPP or a paleontological resource monitor under the direction and supervision of the QPP, to be on site during earthmoving activities in Pleistocene sedimentary deposits (e.g., unnamed Pleistocene alluvial deposits, Shoemaker Gravel, and Harold Formation), the Crowder Formation, the Cajon Valley (Punchbowl) Formation, the Vaqueros Formation (if encountered), and the San Francisquito Formation.

3. Procedures for adequate sampling of sediments deemed by the QPP to have the potential for significant microvertebrate recovery as outlined in SVP (2010).

4. Procedures for the QPP to reduce or terminate monitoring of a given geological unit after 50% of excavations are complete in either an area or rock unit and no fossils of any kind have been discovered.

5. Procedures for the QPP or paleontological resource monitor to temporarily halt or redirect construction activities in the discovery area to allow recovery in a timely manner (typically on the order of one hour to two days, depending on the size of the discovery).

6. Procedures for adequate paleontological field and laboratory methods, collections management, final reporting.

All collected fossil remains shall be cleaned, sorted, cataloged, and deposited in an appropriate paleontological repository as defined by the Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources (SVP 2010) at the applicant’s expense.

A Final Monitoring Report (with a map showing fossil site locations) summarizing the results, analyses, and conclusions of the above-described monitoring/recovery program shall be submitted to the Lead Agency. The final report should emphasize the discovery of any new or rare taxa and/or palaeoecological or taphonomic significance of the fossils. A complete set of field notes, geologic maps, stratigraphic sections, and a list of identified specimens must be included in or accompany the final report. The report should be finalized only after all aspects of the mitigation program are completed, including preparation, identification, cataloging, and curatorial inventory. The final report (with any accompanying documents) and repository curation of specimens and samples constitute the goals of a successful paleontological resource protection program. Full copies of the final report should be deposited with both the lead agency and the designated fossil repository with the request that all locality data remain confidential and not made available to the public.

Upon implementation of these recommendations, project-related impacts would be reduced to less than significant.

Should you have any questions relating to this report and its findings please contact Michael Williams (mwilliams@dudek.com) or Sarah Siren (ssiren@dudek.com).

Respectfully Submitted,

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Att.: *Figure 1, Regional Location Map*
Figure 2, Geological Map
Attachment A, Survey Photos
Attachment B, Confidential LACM Paleontological Records Search Results

cc: *Micah Hale, Dudek*
Mark Lathram, Dudek
Jason Collins, Dudek

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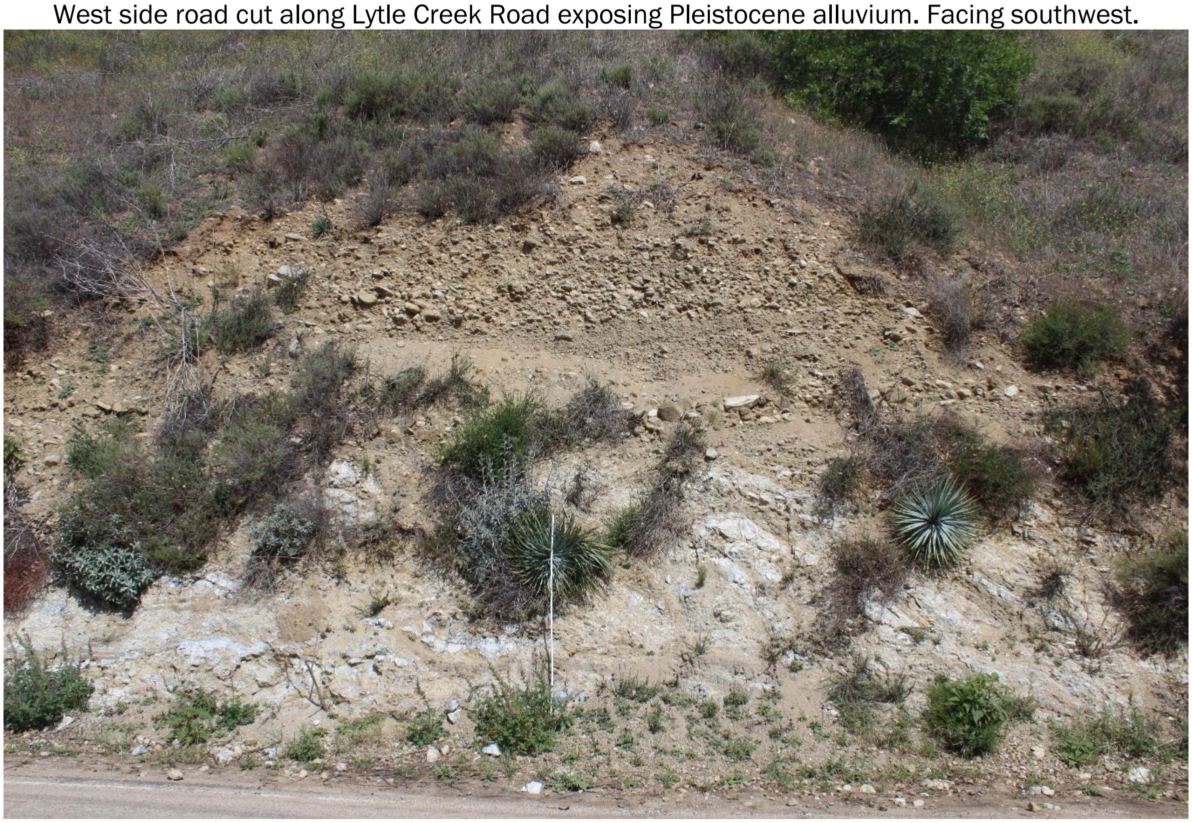
Attachment A
Survey Photos

Interstate 15 north off-ramp at Baseline Avenue. Facing southwest

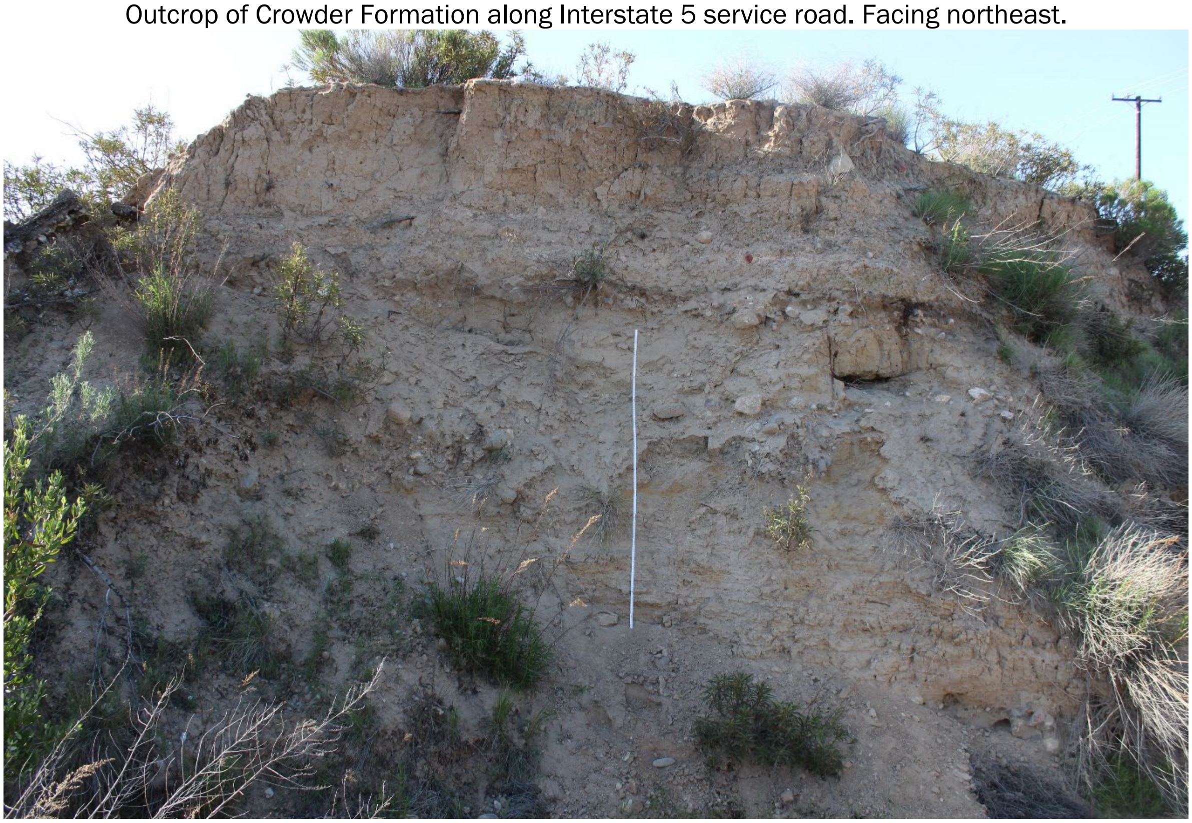
Beech Avenue off-ramp from interstate 15 north. Facing east

West side road cut along Lytle Creek Road exposing Pleistocene alluvium. Facing southwest.

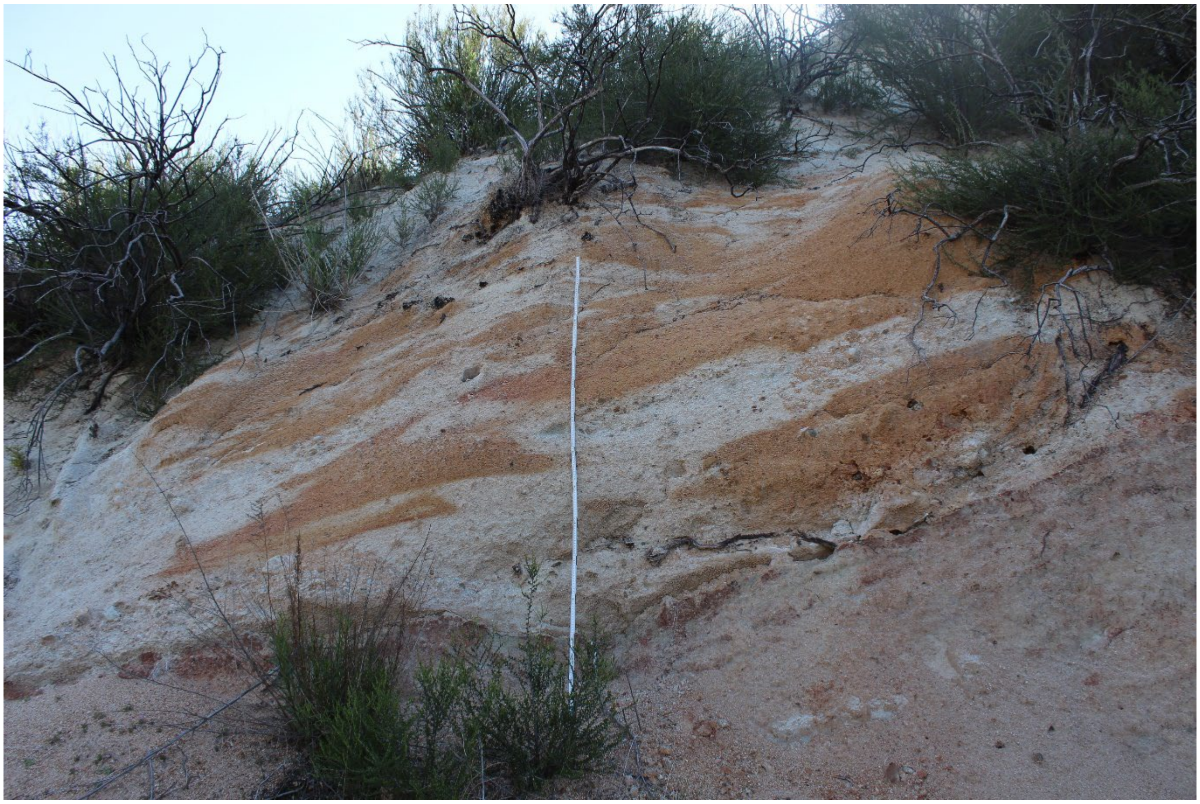


Contact between Pleistocene alluvium & gneissic rock north side of Lytle Creek Road. Facing northwest

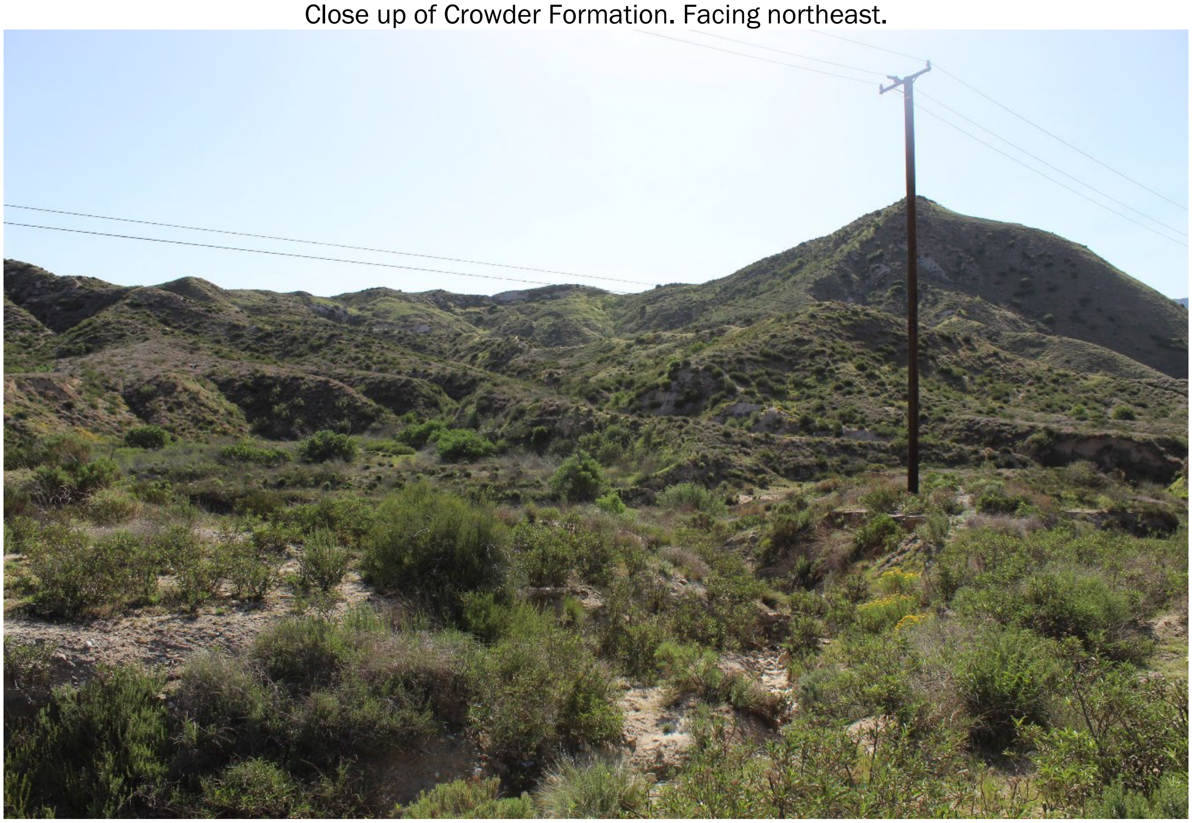
Outcrop of Crowder Formation along Interstate 5 service road. Facing northeast.



Overview of laminated Pleistocene alluvial exposure. Facing southeast.



Close up of Crowder Formation. Facing northeast.



Overview of alluvium from the fire road adjacent to Interstate 15 North. Facing east.

Close up of wall of road cut, contact point. Contact between coarse grain pebbly sandstone to a fine grain sandstone, showing two distinct layers of Crowder Formation. Facing northeast,

Overview of Interstate 15 through the Cajon Pass. Facing southeast,

Overview of wash. Facing southwest,

Overview of area adjacent to concrete quarry. Facing northeast,