PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

Paleontological Resource Assessment

Orion Center
City of Carlsbad
San Diego County, California

November 29, 2021

Prepared for:

RECON Environmental
3111 Camino del Rio North, Suite 600
San Diego, California 92108-5726

Prepared by:

Department of PaleoServices
San Diego Natural History Museum
P.O. Box 121390
San Diego, California 92112-1390

Katie M. McComas, M.S., Paleontological Report Writer & GIS Specialist
Thomas A. Deméré, Ph.D., Principal Paleontologist

thenat | SAN DIEGO NATURAL HISTORY MUSEUM

Executive Summary

This technical report provides an assessment of paleontological resources at the Orion Center project (Project) site in the City of Carlsbad, San Diego County, California. The purpose of this report is to identify and summarize paleontological resources that occur within and in the vicinity of the Project site, identify Project elements (if any) that may negatively impact paleontological resources, and provide recommendations to reduce any potential negative impacts to less than significant levels, if necessary. The report includes the results of an institutional records search conducted at the San Diego Natural History Museum (SDNHM).

The approximately 8.5-acre Project site is located in the eastern portion of the City of Carlsbad, and lies at the northeastern corner of the intersection of Orion Street and Orion Way. The site is bordered to the south by Orion Way and the Carlsbad Police Department headquarters, to the west by Orion Street and a charitable homeless housing facility, and to the north and east by undeveloped land consisting of north- and east-facing slopes along Los Monos Canyon. Proposed work at the Project site will include construction of a new two-story operations building, warehouse/shop buildings, a four-level parking structure, outdoor covered storage, a vehicle wash station, surface parking, fire access roads, hardscaping, and stormwater management facilities. Site-wide remedial grading is planned, with proposed cut depths of up to 11.5 feet.

Published geologic mapping and a geotechnical investigation report prepared for the Project site indicate the site is underlain by up to 11.5 feet of artificial fill deposits, which overlie strata of the late Cretaceous-age (approximately 80 million years old) Lusardi Formation. There are 62 recorded SDNHM fossil collection localities documented within a one-mile radius of the Project site—none of these localities are from the Lusardi Formation. However, an unmapped basal conglomerate of the Point Loma Formation located south of the Project site along Faraday Avenue previously produced fragmentary impressions of vascular plants, and such deposits may have been incorrectly mapped as the Lusardi Formation in this region. To date, no identifiable fossils have been recovered from undisputed strata of the Lusardi Formation.

The Lusardi Formation is assigned a moderate paleontological potential. This assignment is primarily based on its sedimentary origin, late Cretaceous age, and terrestrial depositional setting. Another contributing factor is the recovery of rare fossils of terrestrial organisms (e.g., leaves, stems, and wood of vascular plants and skeletal remains of dinosaurs) from marine strata of the Point Loma Formation, which suggests the potential presence of such fossils in the terrestrial deposits of the Lusardi Formation. In this regard, the presence of dozens of fossil collection localities from the Point Loma Formation in the vicinity of the Project site, including in areas depicted as the Lusardi Formation on published geologic maps, supports a high paleontological potential for late Cretaceous strata in this area. Artificial fill deposits located within the Project site are assigned a low paleontological potential due to the lack of stratigraphic and geographic context associated with any fossils that may be found in these deposits.

Construction of the proposed Project has the potential to impact paleontological resources during earthwork taking place within strata mapped as the Lusardi Formation (present as shallow as 6 inches to as deep as 11.5 feet below existing grade). Thus, implementation of a paleontological mitigation program centered around paleontological monitoring is recommended, as outlined in the provided Mitigation Measures 1–8. Implementation of the paleontological mitigation program will reduce any Project-related impacts to paleontological resources to a level that is less than significant.

Contents

1.0 Introduction

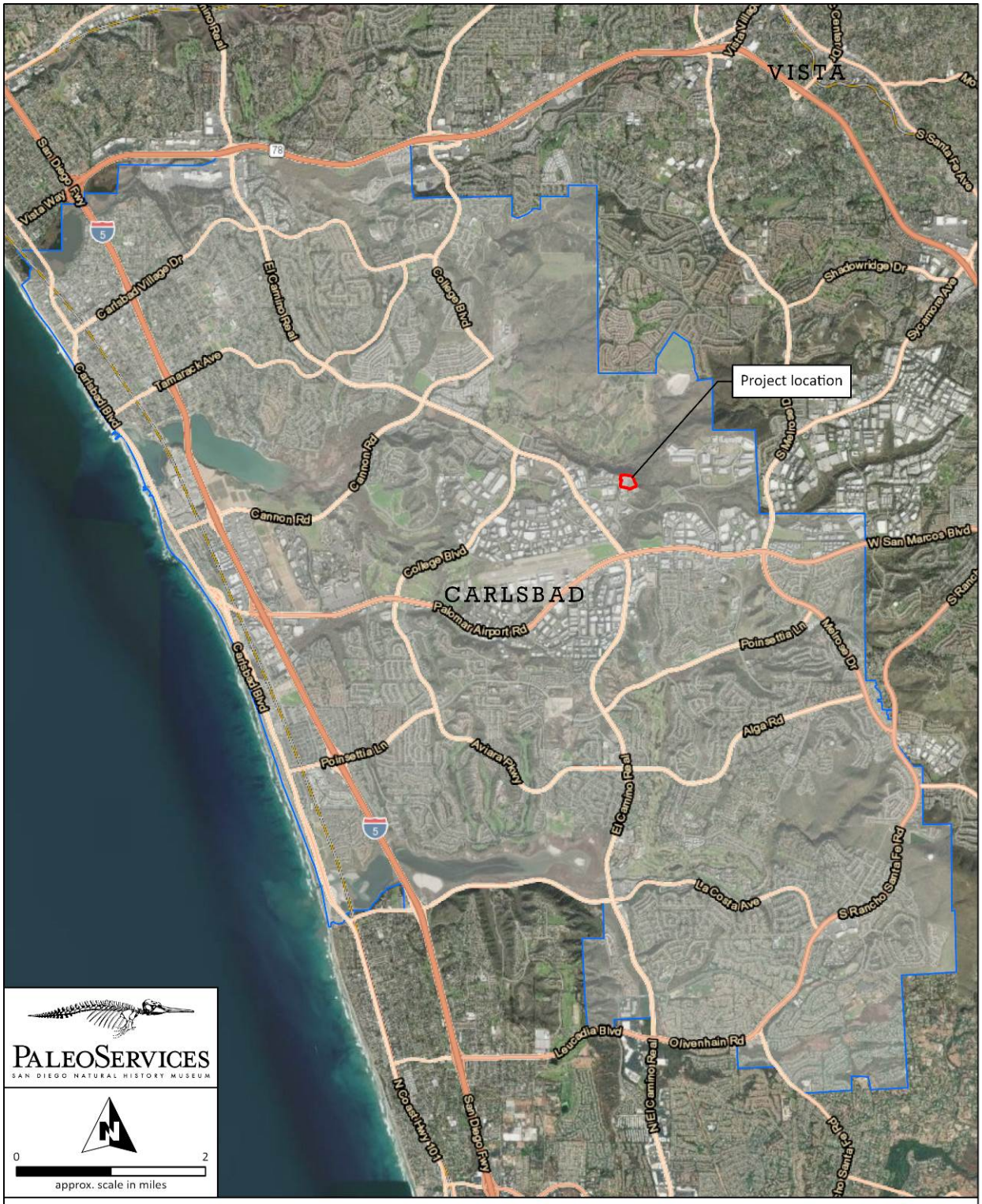
1.1 Project Description & Scope of Work

This technical report provides an assessment of paleontological resources at the Orion Center project (Project) site in the City of Carlsbad, San Diego County, California (Figure 1). The approximately 8.5-acre Project site is located in the eastern portion of the City of Carlsbad, and lies at the northeastern corner of the intersection of Orion Street and Orion Way. The site is bordered to the south by Orion Way and the Carlsbad Police Department headquarters, to the west by Orion Street and a charitable homeless housing facility, and to the north and east by undeveloped land consisting of north- and east-facing slopes along Los Monos Canyon. Proposed work at the Project site will include construction of a new two-story operations building, warehouse/shop buildings, a four-level parking structure, outdoor covered storage, a vehicle wash station, surface parking, fire access roads, hardscaping, and stormwater management facilities. Remedial grading in the area of the proposed buildings is planned, with proposed cut depths of up to 11.5 feet.

Because the Project site occurs in an area underlain by native sedimentary deposits, a paleontological resource assessment was conducted in order to evaluate whether construction of the proposed Project has the potential to negatively impact paleontological resources. A paleontological field survey was not conducted due to the extensive existing development at the site, the presence of artificial fill, and the lack of surface exposures of native sedimentary deposits. This assessment report is intended to summarize existing paleontological resource data at the Project site, discuss the significance of these resources, evaluate possible Project-related impacts to paleontological resources, and provide recommendations to reduce any impacts to paleontological resources to less than significant levels (if necessary). The assessment also presents the results of an institutional records search of the paleontological collections at the San Diego Natural History Museum (SDNHM). This report was prepared by Katie M. McComas and Thomas A. Deméré of the Department of PaleoServices, SDNHM.

1.2 Definition of Paleontological Resources

As defined here, paleontological resources (i.e., fossils) are the buried remains and/or traces of prehistoric organisms (i.e., animals, plants, and microbes). Body fossils such as bones, teeth, shells, leaves, and wood, as well as trace fossils such as tracks, trails, burrows, and footprints, are found in the geologic units/formations within which they were originally buried. The primary factor determining whether an object is a fossil or not is not how the organic remain or trace is preserved (e.g., “petrified”), but rather the age of the organic remain or trace. Although typically it is assumed that fossils must be older than ~11,700 years (i.e., the generally accepted end of the last glacial period of the Pleistocene Epoch), organic remains older than recorded human history and/or older than middle Holocene (about 5,000 radiocarbon years) can also be considered to represent fossils (SVP, 2010).



Sources: Terrain Hillshade, World Transportation and Imagery, Esri et al., 2021

Figure 1: Project overview map, Orion Center, City of Carlsbad, San Diego County, California

Fossils are considered important scientific and educational resources because they serve as direct and indirect evidence of prehistoric life and are used to understand the history of life on Earth, the nature of past environments and climates, the membership and structure of ancient ecosystems, and the pattern and process of organic evolution and extinction. In addition, fossils are considered to be non-renewable resources because typically the organisms they represent no longer exist. Thus, once destroyed, a particular fossil can never be replaced.

Finally, paleontological resources can be thought of as including not only the actual fossil remains and traces, but also the fossil collecting localities and the geologic units containing those localities. The locality includes both the geographic and stratigraphic context of fossils—the place on the earth and stratum (deposited during a particular time in earth's history) from which the fossils were collected. Localities themselves may persist for decades, in the case of a fossil-bearing outcrop that is protected from natural or human impacts, or may be temporarily exposed and ultimately destroyed, as is the case for fossil-bearing strata uncovered by erosion or construction. Localities are documented with a set of coordinates and a measured stratigraphic section tied to elevation detailing the lithology of the fossil-bearing stratum as well as overlying and underlying strata. This information provides essential context for any future scientific study of the recovered fossils.

1.2.1 Definition of Significant Paleontological Resources

The California Environmental Quality Act (CEQA, Public Resources Code Section 21000 et seq.) dictates that a paleontological resource is considered significant if it "has yielded, or may be likely to yield, information important in prehistory or history" (Section 15064.5, [a][3][D]). The Society of Vertebrate Paleontology (SVP) has further defined significant paleontological resources as consisting of "fossils and fossiliferous deposits[…]consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information" (SVP, 2010).

1.3 Regulatory Framework

Paleontological resources are considered scientifically and educationally significant nonrenewable resources; they are protected under a variety of laws, regulations, and ordinances. The Project site is located in the City of Carlsbad, San Diego County, California. As such, state and local regulations are applicable to the Project.

1.3.1 State

The **California Environmental Quality Act (CEQA, Public Resources Code Section 21000 et seq.)** protects paleontological resources on both state and private lands in California. This act requires the identification of environmental impacts of a proposed project, the determination of significance of the impacts, and the identification of alternative and/or mitigation measures to reduce adverse environmental impacts. The Guidelines for the Implementation of CEQA (Title 14, Chapter 3, California Code of Regulations: 15000 et seq.) outlines these necessary procedures for complying with CEQA. Paleontological resources are specifically included as a question in the CEQA Environmental Checklist (Section 15023, Appendix G): "Will the proposed project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature." Also applicable to paleontological resources

is the checklist question: “Does the project have the potential to… eliminate important examples of major periods of California history or pre-history.” If significant paleontological resources may be impacted within a given project site, CEQA provides that “a lead agency shall identify potentially feasible measures to mitigate significant adverse changes in the significance of an historical resource. The lead agency shall ensure that any adopted measures to mitigate or avoid significant adverse changes are fully enforceable through permit conditions, agreements, or other measures” (Section 15064.5, [b][4]).

Other state requirements for paleontological resource management are included in the **Public Resources Code (Chapter 1.7), Section 5097.5 and 30244**. These statutes prohibit the removal of any paleontological site or feature on public lands without permission of the jurisdictional agency, defines the removal of paleontological sites or features as a misdemeanor, and requires reasonable mitigation of adverse impacts to paleontological resources from developments on public (state) lands.

1.3.2 Local: City of Carlsbad

The **City of Carlsbad General Plan** (2015) includes several policies that specifically address the management of paleontological resources. Policy 4-P.32 suggests that open space areas be designated that “preserve historic, archaeological, paleontological, and educational resources,” where appropriate. Policies 7-P.7 and 7-P.8 call for the implementation of the **City of Carlsbad Tribal, Cultural, and Paleontological Resources Guidelines** (City of Carlsbad, 2017) to “avoid or substantially reduce impacts to archaeological and paleontological resources” and for the monitoring of “grading, ground-disturbing, and other major earth-moving activities in previously undisturbed areas or in areas with known archaeological or paleontological resources.” The Guidelines set forth the paleontological sensitivity model for the City, and outline procedures to be followed prior to, during, and after construction of a Project. In addition, while it does not specifically address paleontological resources, the **City of Carlsbad Grading Ordinance** requires the preservation of “significant cultural and archaeological sites” (Carlsbad, California, Municipal Code § 15.16.020).

2.0 Methods

2.1 Paleontological Literature Review and Records Search

A review was conducted of relevant published geologic maps (e.g., Kennedy and Tan, 2007), published geological and paleontological reports (e.g., Nordstrom, 1970; Kennedy and Moore, 1971), the site-specific geotechnical investigation report (SCST, LLC [SCST], 2019), and other relevant literature (e.g., field trip guidebooks, theses and dissertations, and unpublished paleontological mitigation reports). This approach was followed in recognition of the direct relationship between paleontological resources and the geologic formations within which they are entombed. Knowing the geologic history of a particular area and the fossil productivity of geologic formations that occur in that area, it is possible to predict where fossils will, or will not, be encountered.

A paleontological records search was conducted at the SDNHM in order to determine if any documented fossil collection localities occur within the Project site or immediate surrounding area. The SDNHM records search involved examination of the paleontological database for any records of known fossil

collection localities from sedimentary deposits similar to those underlying the Project site within an approximately one-mile radius.

2.2 Paleontological Resource Assessment Criteria

Potential impacts to paleontological resources are typically assigned a paleontological sensitivity rating based on the potential fossil yield of an impacted geologic unit. Following the City of Carlsbad Tribal, Cultural, and Paleontological Guidelines (City of Carlsbad, 2017), a three-tiered scale is used here that assigns each geologic unit underlying the Proposed Project site a High, Moderate, or Low Sensitivity rating. An expanded description of each potential rating is outlined below.

2.2.1 High Potential

Geologic units with high potential are known to contain paleontological localities with significant fossils comprising unique invertebrate fossil assemblages or unique vertebrate fossil remains.

2.2.2 Moderate Potential

Moderate potential is assigned to geologic units known to contain paleontological localities in localized outcrops. Formations that have not been adequately studied and yet have some proven potential to produce localities may also be assigned a moderate potential.

2.2.3 Low Potential

Low potential is assigned to geologic units that, based on their relatively young age and/or high-energy depositional history, are judged unlikely to produce important fossil remains. Typically, low potential units produce fossil remains in low abundance, or only produce common/widespread invertebrate fossils whose taphonomy, phylogeny, and ecology is already well understood. Also included in this category are geologic formations composed of volcaniclastic (derived from volcanic sources) or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain localized outcrops. Volcanic or plutonic igneous rocks that do not yield fossil remains are also assigned a low potential. Finally, undocumented fill materials also have low potential, because the stratigraphic and geologic context of any contained organic remains (i.e., fossils) has been lost.

2.3 Paleontological Impact Analysis

Direct impacts to paleontological resources occur when earthwork activities (e.g., mass grading, utility trenching) cut into the geologic units within which fossils are buried, and physically destroy the fossil remains. As such, only earthwork activities that will disturb potentially fossil-bearing sedimentary deposits (i.e., those rated with a high or moderate paleontological potential) have the potential to significantly impact paleontological resources. Paleontological mitigation typically is recommended to reduce any negative impacts to paleontological resources to less than significant levels.

The purpose of the impact analysis is to determine which (if any) of the proposed Project-related earthwork activities may disturb potentially fossil-bearing geologic units, and where and at what depths this earthwork will occur. The paleontological impact analysis involved analysis of available project documents, and comparison with geological and paleontological data gathered during the records searches and literature review.

3.0 Results

3.1 Results of the Records Search and Literature Review

The Project-specific geotechnical report (SCST, 2019) indicates that the Project site is underlain by undocumented artificial fill and strata of the late Cretaceous-age Lusardi Formation. The broader regional geologic setting of the Project site is outlined in Section 3.1.1 and the geologic units underlying the Project site are discussed in detail below in Section 3.1.2.

A records search of the SDNHM paleontological collection database indicates that there are 62 recorded SDNHM fossil collection localities within a one-mile radius of the Project site (Appendix A), all of which are from geologic units that do not occur within the Project site, as discussed in greater detail below (Section 3.1.3).

3.1.1 Regional Geologic Setting

The Project site is located along the coastal plain of San Diego County, within the Peninsular Ranges Geomorphic Province of California (Figure 2). Along the coastal plain, basement rocks of the Jurassic- to Cretaceous-age Santiago Peak Volcanics and the Cretaceous-age Peninsular Ranges Batholith are nonconformably overlain by a "layer cake" sequence of sedimentary strata of late Cretaceous, Eocene, Oligocene, Miocene, Pliocene, and/or Pleistocene age (Givens and Kennedy, 1979; Hanna, 1926; Kennedy, 1975; Kennedy and Moore, 1971; Kennedy and Peterson, 1975; Peterson and Kennedy, 1974; Walsh and Deméré, 1991).

3.1.2 Project Geology

Published geologic mapping by Kennedy and Tan (2007) reports that the Project site is entirely underlain by the Lusardi Formation (Figure 2). The Lusardi Formation was named by Nordstrom (1970) for exposures in Rancho Santa Fe, and consists predominantly of ancient alluvial fan deposits characterized by reddish-brown massive boulder and cobble conglomerate with thin lenses of medium-grained arkosic sandstone. These deposits are thought to have accumulated along the western margin of a rugged, coastal mountain range during the late Cretaceous, approximately 80 million years ago. The Lusardi Formation constitutes the basal portion of the late Cretaceous Rosario Group, which includes the overlying Point Loma and Cabrillo formations (Kennedy and Moore, 1971). There is some debate about the precise age of the Lusardi Formation and whether or not at least the upper part of this geologic unit is contemporaneous with the lower part of the Point Loma Formation (Nilsen and Abbott, 1979). If they are contemporaneous, it would suggest that the alluvial fan deposits of the Lusardi Formation represent the onshore facies of an east-to-west depositional system that includes the nearshore and deep water facies of the Point Loma Formation.

The site-specific geotechnical investigation report indicates that deposits of the Lusardi Formation underlying the Project site consist of silty to clayey sandstone and conglomerate, and are overlain throughout by previously placed artificial fill deposits measuring between 6 inches and 11.5 feet thick. Fill deposits are thickest in the southwestern portion of the site, where they measure between 7 and 11.5 feet thick.

3.1.3 Project Paleontology

To date, identifiable fossils have not been recovered from the Lusardi Formation. However, the Cretaceous age of this rock unit coupled with its terrestrial depositional setting suggest the potential that it may contain significant paleontological resources. The recovery of rare fossils of terrestrial organisms (e.g., leaves, stems, and wood of vascular plants and skeletal remains of dinosaurs) from marine strata of the possibly contemporaneous Point Loma Formation, suggests the potential presence of such fossils in the terrestrial deposits of the Lusardi Formation.

Artificial fill has been previously disturbed and may have been imported to its current location. Any fossils these deposits may contain have lost their original stratigraphic and geographic context, and are thus not considered to be scientifically significant.

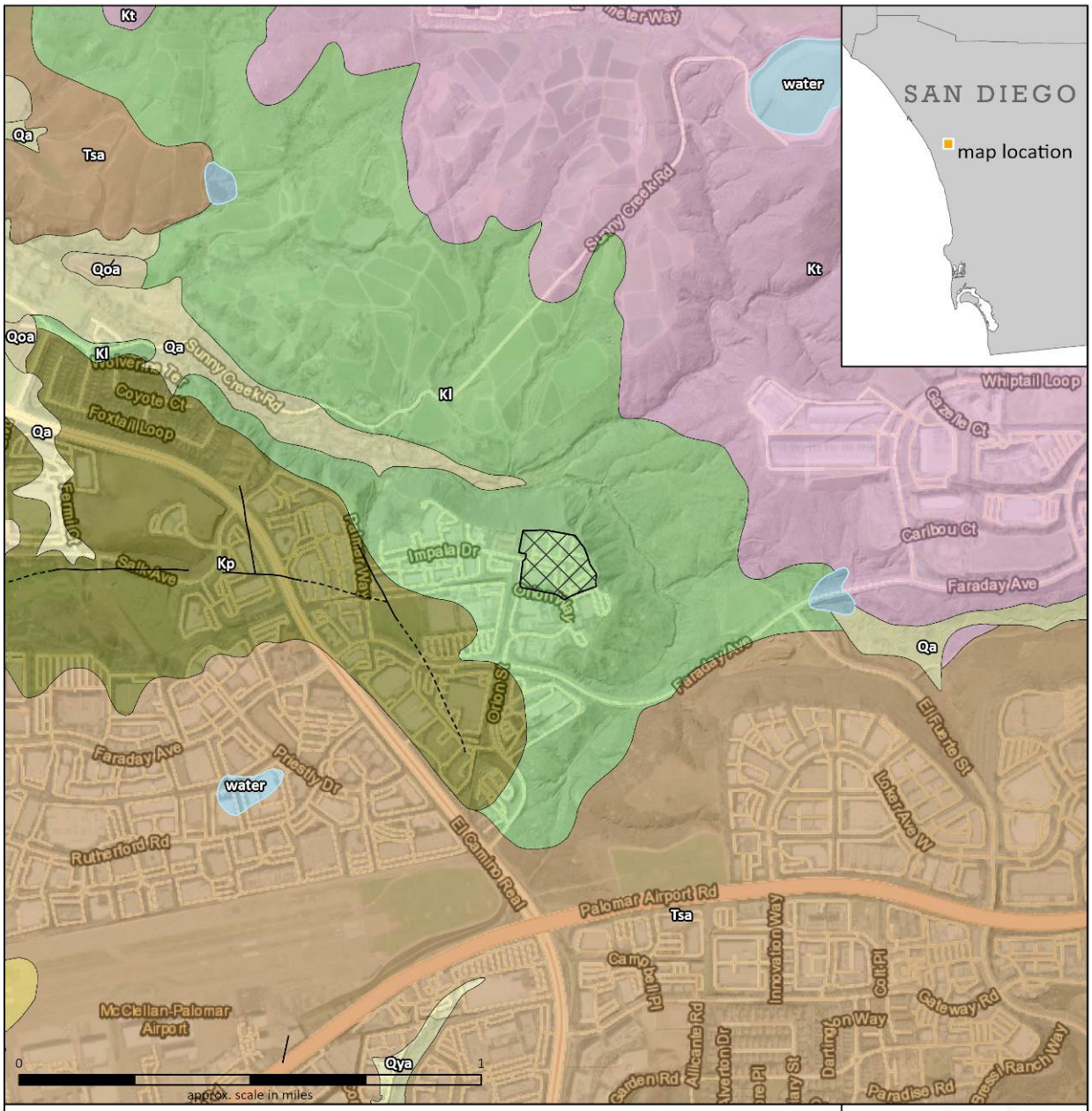
There are a total of 62 documented SDNHM fossil collection localities within a one-mile radius of the Project site (Appendix A). The vast majority of these localities are from the late Cretaceous-age (approximately 75 million years old) Point Loma Formation, which lies stratigraphically just above the Lusardi Formation and is mapped to the west and south of the Project site. Additional nearby SDNHM localities are from the middle Eocene-age Santiago Formation and Pleistocene-age nonmarine terrace deposits, neither of which occur within the Project site.

While published geologic mapping does not indicate that the Point Loma Formation underlies the Project site, previous paleontological monitoring conducted by PaleoServices staff during 2013–2014 construction of the Carlsbad Desalination Pipeline project documented fossil-bearing strata of the Point Loma Formation along Faraday Avenue in areas mapped as the Lusardi Formation. Specifically, fragmentary impressions of vascular plants (including a stem fragment of a member of the coniferous evergreen tree family Araucariaceae) were recovered from a series of collecting sites located along Faraday Avenue, approximately 0.2 miles due south of the Project site. These sites were recovered from an unusual basal conglomerate member of the Point Loma Formation consisting of a moderately indurated cobble conglomerate in a matrix of yellowish brown coarse-grained sandstone, with fossil-bearing horizons of blueish gray to greenish gray siltstones, sandy siltstones, and sandstones. Based on these previous observations, it is possible that the silty/clayey sandstone and gravel to boulder conglomerate strata encountered in geotechnical borings within the Project site could actually represent the Point Loma Formation. In general, the Lusardi Formation can be differentiated from the basal conglomerate of the Point Loma Formation based on the presence of larger and more weathered clasts of locally-derived plutonic and metavolcanic rock, a lack of siltstone/sandstone horizons, and its heavily indurated nature.

3.2 Results of the Paleontological Resource Assessment

Following the City of Carlsbad Tribal, Cultural, and Paleontological Guidelines (City of Carlsbad, 2017), as outlined in Section 2.2, the Lusardi Formation is assigned a moderate paleontological potential. This rating is based on its non-marine sedimentary origin, late Cretaceous age, and possible contemporaneity with the marine Point Loma Formation. It should also be kept in mind that the strata underlying the Project site may in fact represent sandstones and conglomerates at the base of the Point Loma Formation. In any event, the presence of dozens of fossil collection localities from the Point Loma

Formation in the vicinity of the Project site, including in areas depicted as the Lusardi Formation on published geologic maps, supports a high paleontological potential for all late Cretaceous strata in this area. In contrast, artificial fill deposits present within the Project site are assigned a low paleontological potential, because the stratigraphic and geologic context of any contained fossils has been lost.



Geologic Map Units

Qa	alluvial flood plain deposits
Qya	young alluvial flood plain deposits
Qoa	old alluvial flood plain deposits
Tsa	Santiago Formation
Kp	Point Loma Formation
Kl	Lusardi Formation
Kt	tonalite, undivided
Mzu	metasedimentary and metavolcanic rocks

Geologic Map Symbols

- contact, certain
- fault, approx. located
- fault, certain
- Project site

PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

Sources: Geology from Kennedy and Tan (2007); Terrain Hillshade, World Transportation and Imagery, Esri et al., 2021

Figure 2: Geologic map of the Project site, Orion Center, City of Carlsbad, San Diego County, California

3.3 Results of the Paleontological Impact Analysis

The site-specific geotechnical report (SCST, 2019) recommends that all artificial fill deposits on the Project site be removed to expose unweathered bedrock of the Lusardi Formation prior to the importation of compacted artificial fill for the creation of a level building pad. To achieve this, SCST (2019) indicates that remedial grading of the site is necessary and states that the proposed buildings should not be underlain by cut/fill transitions—instead, formational materials should be overexcavated at least 3 feet below finished pad elevation or 2 feet below the deepest footings and replaced with compacted fill. Remedial grading is anticipated to extend to a maximum depth of approximately 11.5 feet below existing grade in the southern portion of the site. The area of the proposed parking structure is underlain in the shallow subsurface by formational materials, and can be supported on spread footings supported on formational materials (SCST, 2019).

Artificial fill deposits, as documented by SCST (2019), are present at the surface over the entire Project site. These deposits will be impacted by remedial grading; however, because artificial fill is assigned a low paleontological potential, these impacts do not require paleontological mitigation.

Cretaceous-age strata mapped as the Lusardi Formation underlie artificial fill throughout the Project site at depths ranging from as little as 6 inches to as much as 11.5 feet below existing grade (Figure 3). Because remedial grading is planned to expose formational materials, these strata will be impacted at or near the maximum depths of remedial grading, and will also be impacted during footing excavations for the parking structure. Monitoring is recommended during earthwork that exceeds the depth of artificial fill in the vicinity of the proposed general services building and general services warehouse/shop (southern portion of the site), which ranges from 2 to 11.5 feet thick, and during earthwork extending at least 1 foot below existing grade elsewhere within the site, including for the proposed parking structure (eastern portion of the site).

Sources: Terrain Hillshade, World Transportation and Imagery, Esri et al., 2021

Figure 3: Paleontological potential map, Orion Center, City of Carlsbad, San Diego County, California

4.0 Recommendations & Conclusions

Implementation of a paleontological mitigation program, in the form of paleontological monitoring, is recommended for earthwork at the Project site that will directly impact previously undisturbed strata of mapped as the Lusardi Formation (or unmapped strata of the Point Loma Formation, if present). Implementation of the following mitigation measures will reduce any Project-related impacts to paleontological resources to a level that is less than significant.

4.1 Mitigation Measures

1. **Pre-construction (personnel and repository):** Prior to the commencement of construction, a qualified Principal Paleontologist shall be retained to oversee the mitigation program. The City defines a Principal Paleontologist as a person with a graduate degree in paleontology, geology, or related field, and who has at least one year of prior experience as a principal investigator. In addition, a regional fossil repository shall be designated to receive any discovered fossils. Because the Proposed Project is in San Diego County, the recommended repository is the San Diego Natural History Museum.
2. **Pre-construction (meeting):** The Principal Paleontologist should attend the pre-construction meeting to consult with the grading and excavation contractors concerning excavation schedules, paleontological field techniques, and safety issues.
3. **Pre-construction (training):** The Principal Paleontologist shall conduct a paleontological resource contractor awareness training workshop to be attended by earth excavation personnel.
4. **During construction (monitoring):** A paleontological monitor (working under the direction of the Principal Paleontologist) should be on-site on a full-time basis during all original cutting of previously undisturbed deposits mapped as the Lusardi Formation (moderate paleontological potential) and/or Point Loma Formation (high paleontological potential) to inspect exposures for unearthed fossils. Monitoring is recommended during earthwork that exceeds the depth of fill in the vicinity of the proposed general services building and general services warehouse/shop (southern portion of the site), which ranges from 2 to 11.5 feet thick, and during earthwork extending at least 1 foot below existing grade elsewhere within the site, including for the proposed parking structure (eastern portion of the site).
5. **During construction (fossil recovery):** If fossils are discovered, the Principal Paleontologist (or paleontological monitor) should recover them. Bulk sedimentary matrix samples may also be collected for stratigraphic horizons that appear likely to contain microscopic fossil remains. In most cases, this fossil salvage can be completed in a short period of time. However, some fossil specimens (e.g., a bone bed or a complete large skeleton) may require an extended salvage period. In these instances, the Principal Paleontologist (or paleontological monitor) has the authority to temporarily direct, divert, or halt grading to allow recovery of fossil remains in a timely manner.
6. **Post-construction (treatment):** Fossil remains collected during monitoring and salvage should be prepared (including washing of sediments to recover microfossils), repaired, sorted, and cataloged as part of the mitigation program.
7. **Post-construction (curation):** Prepared fossils, along with copies of all pertinent field notes, photos, and maps, should be deposited (as a donation) in the designated fossil repository. Donation of the fossils shall be accompanied by financial support for initial specimen storage.

8. **Post-construction (final report):** A final summary paleontological mitigation report should be completed that outlines the results of the mitigation program. This report should include discussions of the methods used, stratigraphic section(s) exposed, fossils collected, inventory lists of catalogued fossils, and significance of recovered fossils.

5.0 References

City of Carlsbad. 2015. Carlsbad General Plan. http://www.carlsbadca.gov/services/depts/planning/general.asp.

City of Carlsbad. 2017. Carlsbad Tribal, Cultural, and Paleontological Resources Guidelines. Prepared for the City of Carlsbad, California by ECORP Consulting, Inc. with contributions from Cogstone Resource Management, adopted October 2017.

Deméré, T.A., and Walsh, S.L. 1993. Paleontological Resources, County of San Diego. Prepared for the San Diego Planning Commission: 1–68.

Givens, C.R., and M.P. Kennedy. 1979. Eocene molluscan stages and their correlation, San Diego area, California. In, P.L. Abbott (ed.), Eocene Depositional Systems, San Diego. Geological Society of America, fieldtrip guidebook, pp. 81-95.

Hanna, M.A. 1926. Geology of the La Jolla quadrangle, California. University of California Publications in Geological Sciences, 16: 187–246.

Kennedy, M.P. 1975. Geology of the San Diego metropolitan area, California. Section A - Western San Diego metropolitan area. California Division of Mines and Geology, Bulletin 200:9-39.

Kennedy, M.P., and G.W. Moore. 1971. Stratigraphic relations of upper Cretaceous and Eocene formations, San Diego coastal area, California. American Association of Petroleum Geologists, Bulletin 55: 709–722.

Kennedy, M.P., and G.L. Peterson. 1975. Geology of the San Diego metropolitan area, California. Section B, Eastern San Diego metropolitan area. California Division of Mines and Geology, Bulletin 200: 45–56.

Kennedy, M.P., and S.S. Tan. 2007. Geologic map of the Oceanside 30' x 60' Quadrangle, California: A digital database. California Geological Survey, Regional Geologic Map No. 2, scale 1:100,000.

Nilsen, T.H., and P.L. Abbott. 1979. Turbidite sedimentology of the upper Cretaceous Point Loma and Cabrillo formations, San Diego, California. In, P.L. Abbott (ed.), Geological Excursions in the Southern California Area. San Diego State University, Department of Geological Sciences Fieldtrip Guidebook 139–166.

Nordstrom, C.E. 1970. Lusardi Formation: a post-batholithic Cretaceous conglomerate north of San Diego, California. Geological Society of America Bulletin 81(2): 601–606.

Peterson, G.L., and M.P. Kennedy. 1974. Lithostratigraphic variations in the Poway Group near San Diego, California. San Diego Society of Natural History, Transactions 17: 251–258.

San Diego Natural History Museum (SDNHM) unpublished paleontological collections data and field notes.

SCST. 2019. Updated geotechnical investigation, City of Carlsbad Orion Center. Prepared for Roesling Nakaruma Terada Architects, Inc. Dated 28 March 2019.

Society of Vertebrate Paleontology (SVP). 2010. Standard Procedures for the Assessment and Mitigation of Adverse Impacts to Paleontological Resources. Society of Vertebrate Paleontology, p. 1-11.

Walsh, S.L., and T.A. Deméré. 1991. Age and stratigraphy of the Sweetwater and Otay Formations, San Diego County, California. In, P.L. Abbott and J.A. May (eds.), Eocene Geologic History San Diego Region. Society of Economic Mineralogists and Paleontologists, Pacific Section 68: 131–148.