Appendix G5. Paleontological Resource Assessment

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PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM

Paleontological Resource Assessment

Fanita Ranch
City of Santee
San Diego County, California

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Executive Summary

This paleontological resource assessment was prepared for the Fanita Ranch Project (Project) site in the northwestern portion of the City of Santee, San Diego County, California. The approximately 2,638 acre Project site is located north of Mast Boulevard, east of Marine Corps Air Station Miramar, south of Sycamore Canyon Open Space Preserve, and west of the unincorporated community of Eucalyptus Hills. Within the Project site, approximately 731.6 acres located in the northern half of the property will be developed for residential, commercial/retail, agricultural, and civic purposes. The bulk of the remaining land in the southern half of the property will be placed in permanent open space, with the exception of a designated Special Uses Area that will remain available for development. In addition to development within the Project site, several roadways will be improved and extended to provide connectivity between the Fanita Ranch community and the surrounding area.

The paleontological resource assessment has been prepared to identify and summarize existing paleontological resource data in the vicinity of the Project site, classify and discuss the significance of these resources, evaluate and summarize any project-related construction activities that may impact paleontological resources, and outline mitigation measures to reduce any project-related impacts to paleontological resources to less than significant levels. The report includes the results of an institutional records search and a limited paleontological field survey.

The Project-specific geotechnical report indicates that the Project site is underlain by a variety of geological materials including recently imported artificial fill, Holocene-age alluvial deposits (less than approximately 11,700 years old), Pleistocene-age terrace deposits (approximately 500,000 to 11,700 years old), ancient landslide deposits (less than approximately 2.5 million years old), the Eocene-age Stadium Conglomerate (approximately 44 to 42 million years old), the Eocene-age Friars Formation (approximately 47 to 46 million years old), and Cretaceous-age plutonic rocks (approximately 125 to 95 million years old). This general sequence of strata and crystalline bedrock was confirmed during the paleontological field survey, although the prominent Eocene-age conglomerate could not be definitely confirmed to represent the Stadium Conglomerate, and may be more appropriately referred to the stratigraphically higher Pomerado Conglomerate or stratigraphically lower conglomerate tongue of the Friars Formation. The records search indicates that there are six known fossil localities within a 1-mile radius of the Project site and an additional 50 localities within a 2-mile radius of the Project site, all from geologic units mapped as either the "Stadium Conglomerate" or Friars Formation.

A paleontological potential rating was assigned to each geologic unit based on the surficial geology observed during the paleontological field survey, the subsurface lithology documented in the Project-specific geotechnical report, and the results of previous paleontological mitigation programs carried out in the vicinity of the Project site. The Friars Formation and "Stadium Conglomerate" are assigned a high paleontological potential, Pleistocene terrace deposits and ancient landslide deposits (derived from fine-grained strata of the Friars Formation) are assigned a moderate paleontological potential, Holocene alluvial deposits are assigned a low paleontological potential, and artificial fill and Cretaceous plutonic rocks are assigned no paleontological potential.

Typically, only those project components requiring earthwork have the potential to impact paleontological resources, and only impacts to geologic units with high or moderate paleontological potential ratings are considered to be significant and require mitigation. Based on these factors, areas to be monitored will include, but not be limited to: the majority of the Orchard Village and Vineyard Village footprints, and approximately the southern half of the Fanita Commons footprint; the eastern portion of the Special Uses Area; offsite improvements to Fanita Parkway in the vicinity of Ganley Road and northward; and the northern half and southernmost end of the offsite extension of Cuyamaca Street.

Included as part of the paleontological resource assessment are suggested mitigation measures that may be implemented prior to the start of construction (i.e., contracting a Qualified Project Paleontologist, attendance of the Qualified Project Paleontologist at pre-construction meetings, paleontological resource training provided for earth excavation personnel), during construction (i.e., paleontological monitoring of excavations into deposits of high or moderate paleontological potential, salvage of discovered fossils), and post-construction (i.e., preparation and curation of any salvaged fossils, completion of final paleontological mitigation report). Implementing the suggested mitigation measures will reduce any potential project-related impacts to paleontological resources to less than significant levels.

Contents

1.0 Introduction

1.1 Project Description

This technical report provides an assessment of the potential for paleontological resources at the Fanita Ranch Project (Project) site in the northwestern portion of the City of Santee, San Diego County, California (Figure 1). The approximately 2,638 acre Project site is located north of Mast Boulevard, east of Marine Corps Air Station Miramar, south of Sycamore Canyon Open Space Preserve, and west of the unincorporated community of Eucalyptus Hills.

Within the Project site, approximately 731.6 acres in the northern half of the property will be developed for residential, commercial/retail, agricultural, and civic purposes, while the bulk of the remaining land in the southern half of the property will be placed in permanent open space. The development is divided into three neighborhoods: the central Fanita Commons, Orchard Village to the south, and Vineyard Village to the east (Figure 2). As currently proposed, the combined residential development will include 1,203 single family units, 866 multi-family units, 435 mixed use residential units, and 445 active adult/assisted living units. Approximately 32 acres in the southwest corner of the property have been designated a Special Uses Area, which was previously graded. Another 1,650 acres, primarily located in the southern half of the property, will be dedicated as an open space ecological preserve and will not be developed. Overall, the proposed earthwork is anticipated to generate a cut and fill volume of about 27,000,000 cubic yards, with cut depths of up to 160 feet and fill depths of up to 145 feet. These metrics do not include the extensive amount of remedial grading required to address slope stability and compaction issues.

In addition to development of the Project site, several roadways will be improved and extended to provide connectivity between the Fanita Ranch community and the surrounding area, as follows:

- A segment of Fanita Parkway located north of Mast Boulevard and south of Ganley Street will be widened along its east side and additional embankments will be placed along its west side. The roadway will be also extended northward from Ganley Street to Orchard Village. Cut and fill depths generated during grading are anticipated to be generally less than 10 feet.
- Cuyamaca Street will be extended from Silver Country Estates to the southern boundary of Vineyard Village, with cut and fill slopes measuring up to 85 and 150 feet, respectively.
- Magnolia Avenue will be extended north and west to intersect Cuyamaca Street, with cut and fill slopes measuring up to 45 and 50 feet, respectively.

1.2 SDNHM Scope of Work

For the Project, the San Diego Natural History Museum (SDNHM) was contracted to complete a paleontological resource assessment, including a paleontological records search and literature review, and a pedestrian field survey of the Project site. The resource assessment is intended to identify and summarize existing paleontological resource data in the vicinity of the Project site, classify and discuss the significance of these resources, determine whether Project site improvements will impact paleontological resources, and outline suggested mitigation measures to reduce any potential Project-related impacts to paleontological resources to less than significant levels.

This report was prepared by Katie M. McComas, Shelly L. Donohue, and Thomas A. Deméré of the Department of PaleoServices, SDNHM.

1.3 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 geologic units composed of the sediments that originally buried them. The primary factor determining whether an object is a fossil is not how the organic remain or trace is preserved (e.g., "petrified"), but rather the age of the organic remain or trace. Although it is typically assumed that fossils must be older than approximately 11,700 years (i.e., the generally accepted end of the last glacial period of the Pleistocene Epoch), organic remains of early Holocene age can also be considered to represent fossils because they are part of the record of past life.

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 patterns and processes of organic evolution and extinction. In addition, fossils are considered to be non-renewable resources because typically the organisms they represent no longer exist. Once destroyed, a particular fossil can never be replaced. And finally, for the purposes of this report, 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.

1.4 Regulatory Framework

As discussed above, paleontological resources are scientifically and educationally significant nonrenewable resources, and as such are protected under federal, state, and local laws, regulations, and ordinances. The Project is located within the City of Santee, San Diego County, California. Therefore, state and local laws, ordinances, and regulations are applicable to the Project.

1.4.1 State

Notable state legislative protection for paleontological resources includes the California Environmental Quality Act and the Public Resources Code.

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 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."

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.

1.4.2 Local

The County of San Diego primarily addresses management of paleontological resources through CEQA. In addition, Section 87.430 of the County's Grading Ordinance specifically establishes procedures for the mitigation of potential impacts to paleontological resources during earthwork operations. Detailed guidelines for determining significance and mitigation procedures for paleontological resources are provided by the County's Department of Public Works (Stephenson et al., 2009).

The City of Santee has not developed separate procedures for the implementation of CEQA within the City's boundaries, but follows the guidance provided by CEQA and the County.

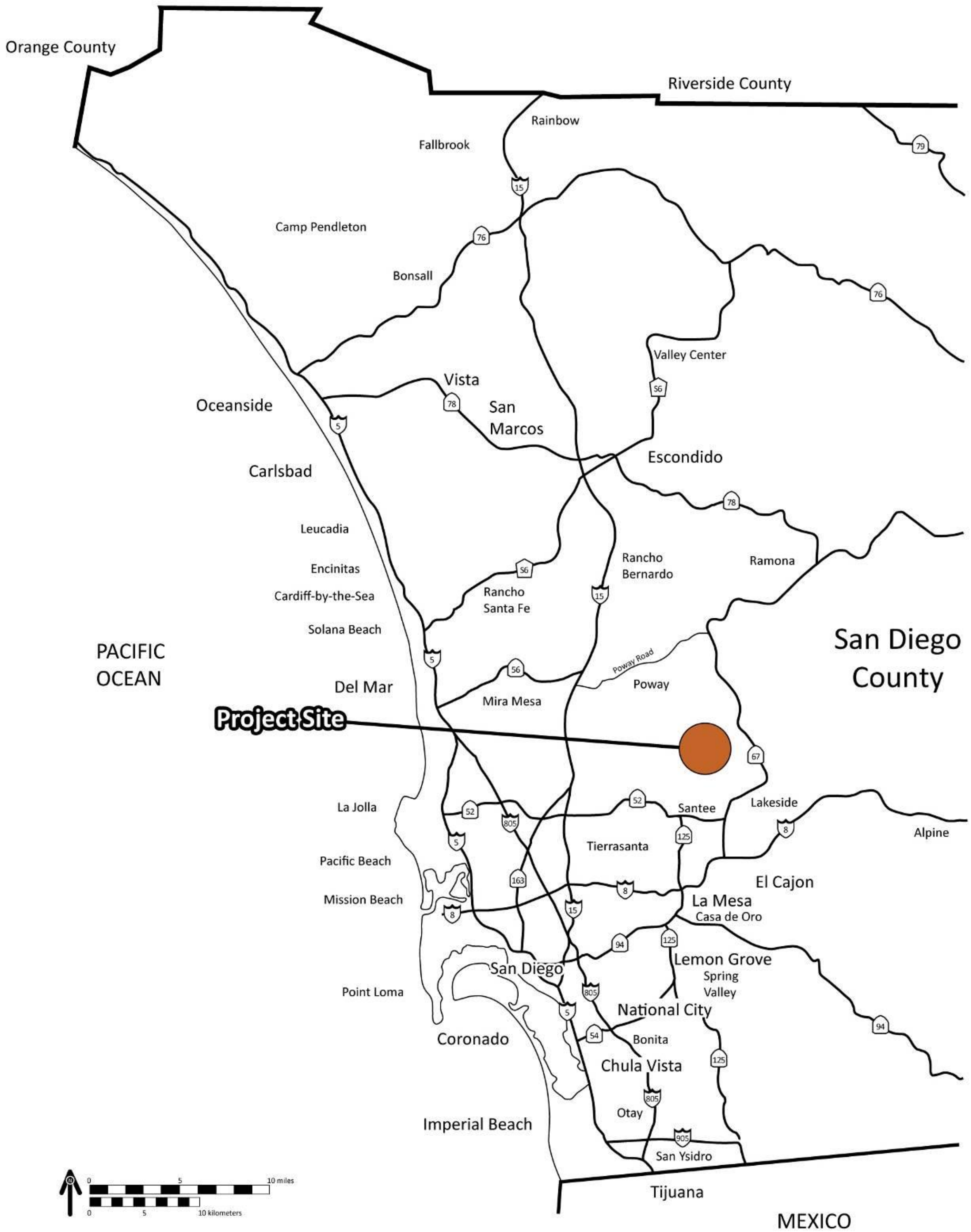
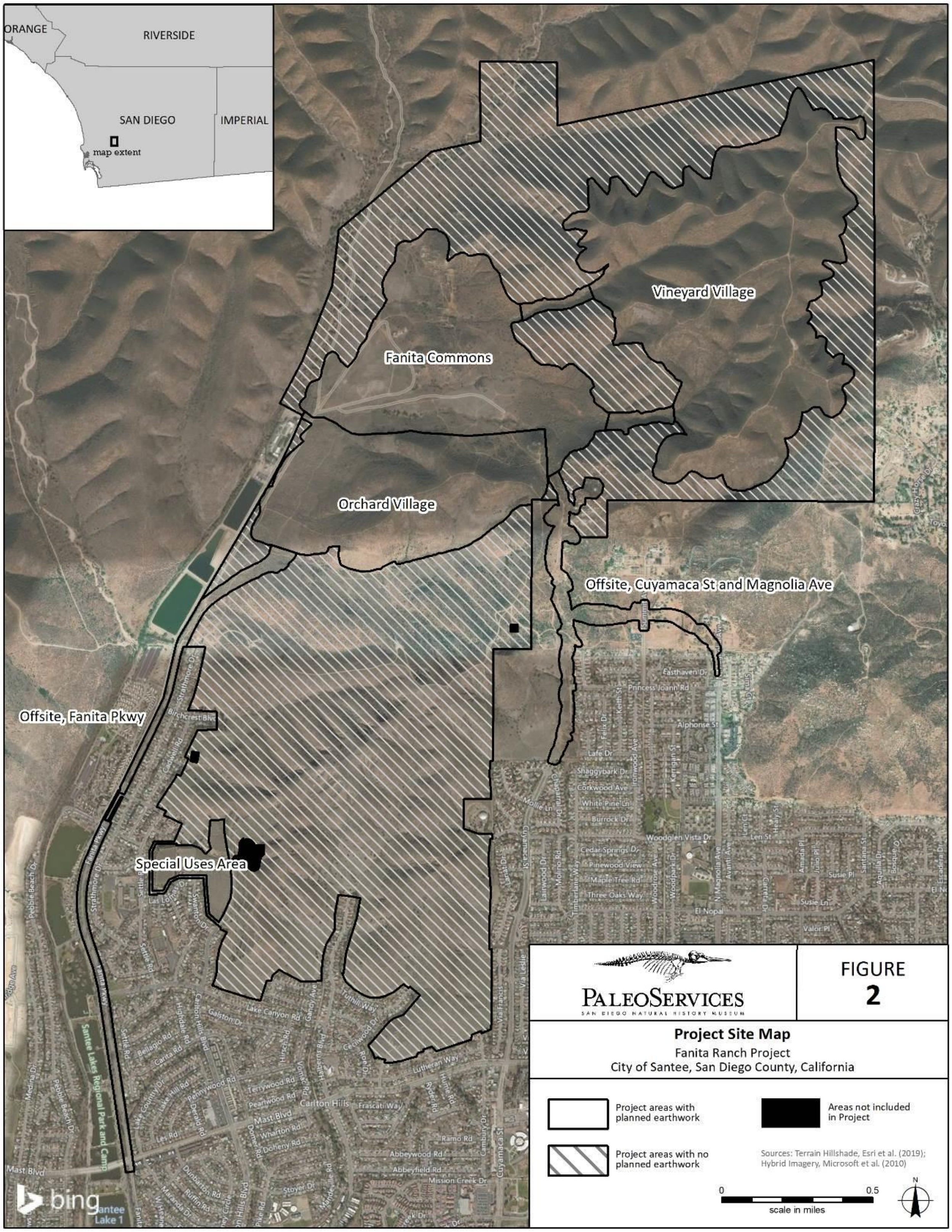


Figure 1. Vicinity map of western San Diego County showing approximate location of the Fanita Ranch Project site.


ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
map extent
Vineyard Village
Fanita Commons
Orchard Village
Offsite, Cuyamaca St and Magnolia Ave
Offsite, Fanita Pkwy
Special Uses Area
PALEOSERVICES
FIGURE
2
Project Site Map
Fanita Ranch Project
City of Santee, San Diego County, California
Project areas with planned earthwork
Areas not included in Project
Project areas with no planned earthwork
Sources: Terrain Hillshade, Esri et al. (2019); Hybrid Imagery, Microsoft et al. (2010)
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2.0 Methods

2.1 Paleontological Records Search and Literature Review

A paleontological records search was conducted at the SDNHM in order to determine if any documented fossil collection localities occur within the Fanita Ranch Project site or immediately surrounding area. The records search involved examination of the SDNHM paleontological database for any records of known fossil collection localities within a 2-mile radius of the Project site.

Additionally, a review was conducted of relevant published geologic maps (e.g., Kennedy and Tan, 2008; Todd, 2004), published geological and paleontological reports (e.g., Kennedy and Moore, 1971; Tomiya, 2013; Walsh et al., 1996), and other relevant literature (e.g., geologic 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.

2.2 Paleontological Field Survey

A limited paleontological field survey was conducted on February 21 and February 22, 2018 by Rodney M. Hubscher and Katie M. McComas of the Department of PaleoServices, SDNHM, in order to confirm the mapped geology, to field check the results of the literature and records searches, and to determine the paleontological potential of strata present in the vicinity of the Project site. The field survey involved inspection of available exposures of sedimentary rocks in order to collect stratigraphic data (e.g., bedding type, thickness, geologic contacts), lithologic descriptions of strata (e.g., color, sorting of grains, texture, sedimentary structures, and grain size of sedimentary rocks), and prospect for any fossil remains present at the surface. The field paleontologists were equipped with standard field equipment (e.g., rock hammer, camera, hand lens, tape measure), and a Garmin Handheld GPS unit.

The survey primarily focused on areas of planned development within the Project site, which were restricted to the northern half of the property (consisting of the planned neighborhoods of Orchard Village, Fanita Commons, and Vineyard Village), as well as areas of planned roadway widening. The planned offsite widening area along Fanita Parkway between Mast Boulevard and Ganley Road was successfully surveyed, but the planned offsite extension areas for Cuyamaca Street and Magnolia Avenue could not be accessed due to posted no trespassing signs.

2.3 Evaluation of Paleontological Potential

Procedures for evaluating the paleontological potential (or sensitivity) of a given project site involve assigning ranks to individual geologic rock units based on the relative abundance of vertebrate fossils or scientifically significant invertebrate or plant fossils they contain (e.g., Bureau of Land Management, 2007, 2016; Society of Vertebrate Paleontology [SVP], 2010). The County of San Diego has developed their own guidelines for assigning paleontological potential (Stephenson et al., 2009), which includes a five-tiered scale of High Potential, Moderate Potential, Low Potential, Marginal Potential, or No Potential ratings. An expanded description of each paleontological potential rating, as outlined by the County (Stephenson et al., 2009) is provided below.

2.3.1 High Potential

High potential is assigned to geologic units known to contain paleontological localities with rare, well preserved, critical fossil materials for stratigraphic or paleoenvironmental interpretation, and fossils providing important information about the paleoclimatic, paleobiological, and/or evolutionary history (phylogeny) of animal and plant groups.

2.3.2 Moderate Potential

Moderate potential is assigned to geologic units known to contain paleontological localities with fossil material that is poorly preserved, common elsewhere, or stratigraphically unimportant.

2.3.3 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.

2.3.4 Marginal Potential

Marginal potential is assigned to geologic units that are composed either of volcaniclastic (derived from volcanic sources) or metasedimentary rocks, but that nevertheless have a limited probability for producing fossils from certain formations at localized outcrops.

2.3.5 No Potential

Geologic units with no potential are either entirely igneous in origin and therefore do not contain fossil remains, or are moderately to highly metamorphosed and thus any contained fossil remains have been destroyed. Artificial fill materials also have no potential, because the stratigraphic and geologic context of any contained organic remains (i.e., fossils) has been lost.

2.4 Paleontological Impact Analysis

Direct impacts to paleontological resources occur when earthwork activities, such as grading or trenching, cut into the geologic units in which fossils are preserved and physically destroy the fossil remains. As such, only earthwork activities that will disturb potentially fossil-bearing sedimentary rocks (i.e., those rated with a high or moderate paleontological potential) have the potential to significantly impact paleontological resources. Paleontological mitigation typically is recommended as a means to reduce any negative impacts to paleontological resources to less than significant levels, though avoidance of paleontological resources may sometimes be a feasible alternative.

The purpose of the impact analysis is to determine which (if any) of the 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 and literature searches, as well as the surficial conditions observed during the field survey.

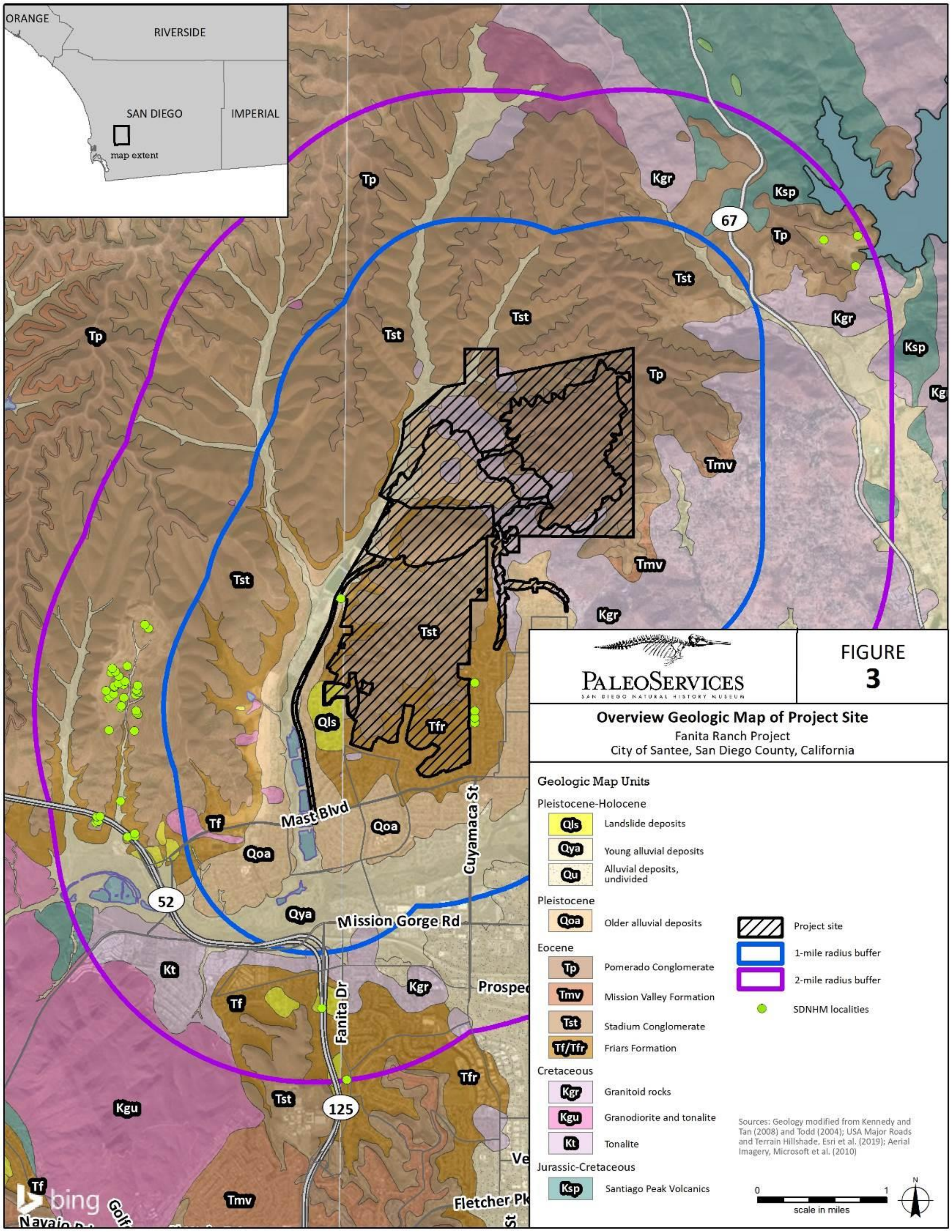
3.0 Regional Geological Setting

The Fanita Ranch Project site is located along the eastern edge of the coastal plain of San Diego County, within the Peninsular Ranges Geomorphic Province of California (Figure 3). 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). Kennedy and Moore (1971) divided the Eocene portion of this sequence into the early middle Eocene La Jolla Group and the late middle Eocene Poway Group, which together include nine geologic rock units or formations.

These Eocene formations record a series of intertonguing marine and terrestrial paleoenvironments deposited in, or adjacent to, a large depositional basin (the San Diego Embayment) that spanned a relatively short distance from east to west and was actively accumulating sediments over a period of approximately 10 million years (50 to 40 million years ago). The Project site is located in the eastern portion of this Eocene depositional system, within the large, conglomeratic Poway alluvial fan and braid delta. The alluvial fan was fed by the westward flowing Eocene Ballena River (Peterson and Kennedy, 1974), which drained the ancient Peninsular Ranges. The apex of this alluvial fan was located along the western flanks of the ancestral Peninsular Ranges (just to the northeast of the Project site, near the present-day San Vicente Reservoir), at the point where the Ballena River exited the Eocene mountain range and flowed out onto the Poway alluvial fan and braid delta. At this confluence, the fast-flowing waters of the mountain river slowed to a steady-flowing braided river, leading to deposition of large cobble to boulder sized clasts, while still transporting finer-grained materials to be deposited downstream in fluvial and subaerial deltaic settings, as well as estuarine, nearshore marine, continental shelf, and submarine canyon paleoenvironments.

Following deposition of the Eocene strata, the region surrounding the Project site experienced a period of erosion and/or non-deposition that lasted until the Pleistocene, approximately 40 million years later. During the Pleistocene, dramatic changes in global sea level, combined with regional uplift, created the flat mesas and deep valleys characteristic of the San Diego region today. During periods of high sea level, marine transgressions (coastal flooding) led to wave-erosion of planar marine abrasion platforms (ancient seafloors) into the soft Eocene rocks, and subsequent deposition of shallow marine and nonmarine sediments by prograding deltas from the east. During periods of low sea level, marine regressions resulted in the carving out of deep river valleys by the prehistoric rivers and streams of San Diego County. Subsequent marine transgressions caused flooding of the ancient river valleys and the formation of estuaries and small bays, which were eventually filled in by alluvium transported from the east by local rivers and streams. The repetition of sea level rise and fall, combined with localized uplift, led to the formation of the localized patches of old alluvial flood plain deposits now exposed along the Project site.

A final marine transgression at the beginning of the Holocene followed by stabilization of sea level during the late Holocene led to the formation of the modern alluvial flood plains observed in the central portions of the river valleys in the vicinity of the Project site.



ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
map extent
PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM
FIGURE
3
Overview Geologic Map of Project Site
Fanita Ranch Project
City of Santee, San Diego County, California
Geologic Map Units
Pleistocene-Holocene
Qls Landslide deposits
Qya Young alluvial deposits
Qu Alluvial deposits, undivided
Pleistocene
Qoa Older alluvial deposits
Eocene
Tp Pomerado Conglomerate
Tmv Mission Valley Formation
Tst Stadium Conglomerate
Tf/Tfr Friars Formation
Cretaceous
Kgr Granitoid rocks
Kgu Granodiorite and tonalite
Kt Tonalite
Jurassic-Cretaceous
Ksp Santiago Peak Volcanics
Project site
1-mile radius buffer
2-mile radius buffer
SDNHM localities
Sources: Geology modified from Kennedy and Tan (2008) and Todd (2004); USA Major Roads and Terrain Hillshade, Esri et al. (2019); Aerial Imagery, Microsoft et al. (2010)
0
1
scale in miles
N
Mast Blvd
Cuyamaca St
Mission Gorge Rd
Fanita Dr
Fletcher Pk
52
67
125
bing

3.1 Discussion of Eocene Stratigraphy

Published depositional models for Eocene strata in western San Diego County outline a straightforward transgressive-regressive depositional model, as described in Section 3.0, with fine-grained marine to estuarine rocks dominating the western exposures of Eocene strata, grading into and interfingering with coarse-grained terrestrial sandstones and conglomerates in eastern exposures (e.g., Kennedy, 1975; Kennedy and Moore, 1971; Kennedy and Peterson, 1975; Peterson and Kennedy, 1974). As part of this model, there are a number of depositionally similar conglomerate units that are distinguished partly on the presence of finer-grained sandstone units in between them. For example, the Stadium Conglomerate and Pomerado Conglomerate of the Poway Group are separated by marine sandstones of the Mission Valley Formation (Peterson and Kennedy 1974; Figure 4). However, this stratigraphic model becomes difficult to follow in the easternmost exposures of Eocene strata (i.e., in the vicinity of the Project site), where fine-grained sandstone units thin out and are not present. Further complicating this matter is the presence of extensive conglomerate bodies within formations of the La Jolla Group (e.g., Friars Formation), which have not been formally named, and in some instances are incorrectly mapped as the Stadium Conglomerate.

Biostratigraphic studies focusing on mammalian fossils can help resolve the stratigraphic and nomenclatural inconsistencies of San Diego's Eocene strata, as they provide the relative age control necessary for differentiating between different formations. Indeed, ongoing paleontological mitigation work at Sycamore Landfill to the west of the Project site has resulted in the recovery of mammalian fossils from strata mapped as the Stadium Conglomerate that are actually characteristic of older mammalian faunas known from the Friars Formation (Walsh, 1996; Walsh et al., 1996; SDNHM unpublished paleontological collections data). This suggests that the conglomerate strata mapped as the Stadium Conglomerate at the Project site (Kennedy and Tan, 2008; Todd, 2004) may represent the conglomerate tongue of the Friars Formation, at least in part. Clearly, the geologic mapping in this region of San Diego County requires additional academic studies that are outside the scope of paleontological or geotechnical investigations.

The geotechnical consultant working on the Fanita Ranch Project appears to have similarly identified the complexities of published geologic mapping in the vicinity of the Project site, as they have referred all conglomeratic strata of the Poway Group to the Stadium Conglomerate, and noted conglomeratic bodies within the Friars Formation (Geocon, 2020a–d; Appendix 1). For the purposes of consistency and simplicity, we follow Geocon (2020a–d) in referring Eocene conglomerate strata mapped as the Stadium Conglomerate and Pomerado Conglomerate to the "Stadium Conglomerate," but note that these exposures may represent a mixed sequence of the Friars Formation (conglomerate tongue), Stadium Conglomerate, and/or Pomerado Conglomerate. We also assume that strata mapped as the Friars Formation represent portions of the informally named lower sandstone tongue and middle conglomerate tongue of the Friars Formation (see Section 4.1.6).

From a paleontological resource management perspective, it should be noted that the precise identification of the conglomerate strata within the Project site will not alter treatment during any future paleontological mitigation programs implemented for the Project. The Friars Formation (conglomerate tongue), Stadium Conglomerate, and Pomerado Conglomerate all preserve similar, but age-distinct, types of fossils (e.g., Eocene terrestrial vertebrates) in similar abundances and under similar conditions (e.g., within fine-grained lenses or rip-up clasts). Therefore, all of these units have a similar, high paleontological potential and should be treated similarly during paleontological monitoring.

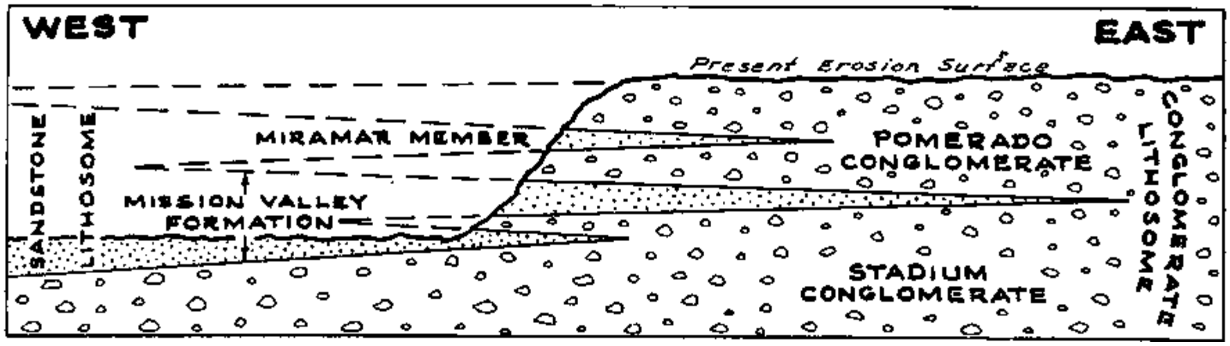


Figure 4. Generalized diagram of the relationship between the Pomerado Conglomerate, Mission Valley Formation, and Stadium Conglomerate, taken from Peterson and Kennedy (1974). The Fanita Ranch Project site falls in the eastern portion of this diagram, where the Mission Valley Formation pinches out. The Friars Formation is not depicted in this diagram, but would be present underlying the Stadium Conglomerate.

4.0 Results

4.1 Results of the Paleontological Records & Literature Searches

A records search of paleontological collections data at the SDNHM indicates there are six known fossil localities within a 1-mile radius of the Project site. By expanding the search radius to 2 miles, an additional 50 recorded fossil localities are known. All fossil localities within 2 miles of the Project site are from the "Stadium Conglomerate" or Friars Formation, and are described in greater detail below.

A summary of the geology and paleontology for each geologic unit that occurs within the Fanita Ranch Project site (as identified by Geocon, 2020a–d) is provided below. A detailed map of the geologic units underlying the Project site (as produced by Geocon, 2020a–d) is presented in Appendix 1.

4.1.1 Artificial fill (Qaf, Qudf)

Description: Though not formally mapped by Kennedy and Tan (2008) or Todd (2004), deposits of artificial fill may be present in previously developed portions of the Project site (e.g., along existing roadways). The Project-specific geotechnical report (Geocon, 2020a) additionally indicates that artificial fill is present north of the Padre Dam Municipal Water District's Water Recycling Facility along the southwest flank of Fanita Commons, in an area not anticipated to be developed, and within the previously graded Special Uses Area, which may be further developed. Artificial fill consists of previously disturbed deposits associated with human activities and is often composed of sedimentary materials mined in close vicinity to a project site (e.g., adjacent hillslopes), but artificial fill is also occasionally imported to a project site and may be from a distant location. Artificial fill is typically placed in order to change the topography of a location, such as during the creation of flat pads for new housing developments or to maintain level streets.

Paleontology: Because 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.

4.1.2 Young alluvial deposits (Qal, Qcol, Qdf)

Description: Young alluvial deposits occur along the northwestern margin of the Project site, along the floors of Sycamore and Clark canyons, and the smaller drainages that feed into them. As described by Kennedy and Tan (2008) and Todd (2004), these deposits consist of poorly consolidated, poorly sorted sand, silt, and gravels in modern stream beds. The deposits are primarily Holocene in age (less than about 11,700 years old), but may contain deposits of late Pleistocene age in deeper exposures (i.e., deposits mapped as Qcol/Qoa along the offsite Magnolia Avenue alignment).

On the pedestrian survey, alluvial deposits were observed to consist of high-energy, loose pebble to cobble gravels and coarse sands.

Paleontology: No fossils are currently known from young alluvial deposits in the vicinity of the Project site. The lack of recorded fossil collection localities is primarily due to the relatively young geologic age of these deposits (less than about ~11,700 years old).

4.1.3 Landslide deposits (Qls)

Description: Landslide deposits are mapped by Geocon (2020a) along the flanks of several east-west trending drainages feeding into Sycamore Canyon. The majority of the landslides appear to have originated from weak, claystone horizons within the Friars Formation (Geocon, 2020a), and thus are composed of displaced Friars Formation strata. Geocon (2020a) reports the presence of both deep-seated landslides that contain large slumped blocks with intact, recognizable stratigraphy, as well as shallow landslides that contain a chaotic mixture of upslope sediments.

The majority of the landslides in areas planned for development lie along the north-facing slope that divides the planned footprints of Fanita Commons and Orchard Village. Additional landslide deposits are located within the eastern portion of the Special Uses Area. While no rocky outcrops of landslide deposits were located during the pedestrian survey, the landslides were generally identifiable by their surface expression as gentle slope breaks below the more steeply-sided ridges formed by the "Stadium Conglomerate."

Paleontology: Typically, landslide deposits are considered to have low paleontological potential because the stratigraphic context of any entrained fossil remains is lost, making them of limited scientific value. However, deep-seated landslides with intact stratigraphy do have the potential to produce significant paleontological resources. Because the stratigraphy remains intact, discovered fossils may retain their gross stratigraphic context and are thus still significant. Previous work by SDNHM personnel has documented significant vertebrate and invertebrate fossil remains from deep-seated landslides in La Jolla and elsewhere in western San Diego County.

4.1.4 Older terrace deposits (Qt)

Description: Older terrace deposits are mapped above the active floodplain within Sycamore Canyon and within the large tributary in Fanita Commons. Deposits of Pleistocene-age nonmarine terraces are found along the margins of many of the larger coastal and mountain valleys in San Diego County. These fluvial deposits generally occur at levels above the active stream channels and represent the sediments of ancient river courses. At the Project site, the older terrace deposits accumulated along the margins of the ancient Sycamore Creek and its tributaries. The exact age of these deposits is presently uncertain, and varies geographically, but they are clearly related to late Pleistocene (500,000 to 11,700 years old) climatic events, which caused dramatic changes in sea level.

As described by Geocon (2020a–b), terrace deposits within the Project site consist of locally cemented, orange and grayish brown gravelly cobble conglomerate (with clasts up to 14 inches in diameter) and clayey sand, and were limited in extent. During the pedestrian survey, older terrace deposits were observed along the east side of Sycamore Canyon (in the western portions of the planned footprints of Fanita Commons and Orchard Village) and along the east side of Fanita Parkway. Terrace deposits and older alluvium consisted of matrix-supported, subrounded pebble to cobble conglomerates in a yellowish brown, poorly sorted, moderately indurated, angular, medium- to very coarse-grained sandstone matrix.

Paleontology: Fossils known from Pleistocene old alluvial flood-plain deposits in coastal San Diego County are somewhat rare, but have been collected at several locations. Recovered fossils include skeletal remains of reptiles and birds (e.g., pond turtle, lizard, passenger pigeon, and hawk), small bodied mammals (e.g., mole, shrew, mice, and squirrel), and large-bodied Pleistocene mammals (e.g., ground sloth, wolf, bear, tapir, horse, camel, deer, giant bison, mastodon, and mammoth) (Chandler, 1982; Deméré and Walsh, 1993; Deméré et al., 2013; Jefferson, 1991; Majors, 1993).

4.1.5 "Stadium Conglomerate" (Tp, Tst, Tf)

Description: As discussed in Section 3.1, the stratigraphy and mapping of Eocene conglomeratic strata in the vicinity of the Project site is complicated, and needs further study. For the purposes of consistency with the geotechnical consultant (Geocon, 2020a,c), we are calling strata mapped as the Pomerado Conglomerate and Stadium Conglomerate by Kennedy and Tan (2008) and Todd (2004) the "Stadium Conglomerate," but note that these exposures may represent a mixed sequence of the Pomerado

Conglomerate, Stadium Conglomerate, and/or Friars Formation (conglomerate tongue). Thus, we will briefly discuss the geology and paleontology of each of these units in this section.

The Pomerado Conglomerate (42–37 million years old) and the Stadium Conglomerate (44–42 million years old) are the upper and lower formations, respectively, within the Poway Group, separated by the marine sandstones of the Mission Valley Formation. The Friars Formation (47–46 million years old), which contains a conglomerate facies, is the uppermost unit of the La Jolla Group, and is unconformably overlain by the Stadium Conglomerate. Each of these conglomerate units are primarily fluvial units that were deposited at different intervals by the ancient Ballena River, as discussed in Section 3.0. Though there are subtle lithologic differences between each of these units, they all primarily consist of matrix- to clast- supported conglomerates that contain distinctive purple rhyolite “Poway Clasts” distinguishing the Eocene conglomerates from younger Pliocene, Pleistocene, and Holocene conglomerates that occur throughout the region. Fine-grained horizons or lenses of sandstone, siltstone, and claystone are commonly interspersed throughout the conglomerate units. The Pomerado Conglomerate contains a thin lower conglomerate member, a middle sandstone member (the Miramar Sandstone Member), and a thick upper conglomerate member. The Stadium Conglomerate contains a lower and upper member, and the Friars Formation contains a lower tongue, a middle conglomerate tongue, and an upper tongue. The Friars Formation is discussed in greater detail in Section 4.1.6 below.

Geocon (2020a,c) described the "Stadium Conglomerate" as a light brown to orange brown, sandy to clayey, gravel and cobble conglomerate with interbedded silty and clayey sands. The “Stadium Conglomerate” as mapped by Geocon (2020a,c) underlies major portions of Orchard Village and Vineyard Village. A single weathered in-place outcrop of "Stadium Conglomerate" was observed in the southwestern-most portion of the Vineyard Village footprint (near the highest point in the Project site, at approximately 1,200 feet above sea level), and consisted of a poorly sorted, clast- to near clast-supported cobble conglomerate in a matrix of very pale brown to pale yellow, massive, coarse-grained sandstone. The primary surface expression of “Stadium Conglomerate” within the Project site, however, was the presence of abundant loose subrounded to well-rounded cobbles (clasts generally 4–12 inches in diameter) along the jeep trails following steeply-sided ridgelines. Geocon (2020a,c) identified the contact between the "Stadium Conglomerate" and underlying Friars Formation across the Project site at elevations of between 620 and 670 feet above sea level.

Paleontology: The SDNHM also has 34 fossil localities from Eocene conglomeratic strata within a 2-mile radius of the Project site. No localities are known from the Pomerado Conglomerate, three are known from the Stadium Conglomerate (discussed below), and 31 are known from the conglomerate tongue of the Friars Formation (discussed in Section 4.1.6).

Three recorded fossil collection localities were discovered in channel sands within a conglomerate unit tentatively identified as the Stadium Conglomerate. These localities produced fossilized impressions or remains of terrestrial plants (e.g., wood fragments and leaf impressions of vascular plants, including willow). All three localities were discovered in 2012 during paleontological mitigation of work on the San Vicente Reservoir dam, located just under 2 miles northeast of the Project site.

Elsewhere in the metropolitan San Diego area, the Stadium Conglomerate and Pomerado Conglomerate have both produced well preserved remains of a variety of terrestrial mammals, including marsupials, insectivores, primates, rodents, carnivores, rhinoceroses, and artiodactyls (Walsh, 1996, 1997, 2010; Walsh and Gutzler, 1999; SDNHM unpublished paleontological collections data), as well as other terrestrial vertebrates (e.g., snakes, lizards, crocodiles, birds), terrestrial plants, and rare marine invertebrates (e.g., clams and snails) in fine-grained western exposures (Dusenbury, 1932; Milow and Ennis, 1961; Steineck et al., 1972; Givens and Kennedy, 1979; SDNHM unpublished paleontological collections data). Mammalian fossils from the Pomerado Conglomerate indicate a late Uintan to Duchesnean and/or Chadronian North American Land Mammal Age (NALMA), while fossils from the Stadium Conglomerate indicate an early Uintan to late Uintan NALMA.

Notably, within each of the conglomeratic units described above, the majority of fossil localities were discovered specifically within fine-grained sandstone or siltstone lenses that occurred within larger conglomeratic sequences, or from rip-up-clasts derived from such lenses.

4.1.6 Friars Formation (Tf)

Description: The middle Eocene-age (approximately 47 to 46 million years old) Friars Formation is a primarily terrestrial rock unit that consists mainly of light gray, medium-grained sandstones; greenish, reddish, and brown siltstones and mudstones; and common lenses of cobble conglomerate (Kennedy, 1975; Givens and Kennedy, 1979; Squires and Deméré, 1991). Walsh and colleagues (1996) divided the Friars into an informally named lower sandstone-mudstone tongue, a middle conglomerate tongue, and an upper sandstone-mudstone tongue. The regions mapped by Kennedy and Tan (2008), Todd (2004), and Geocon (2020a–c) as the Friars Formation within the Project site are assumed to primarily represent the lower tongue, and possibly the conglomerate tongue, in part (Figure 1, Appendix 1; see Section 3.1). These deposits crop out in the walls of Sycamore Canyon along the western margin of the Project site and sporadically throughout the footprints of Fanita Commons and Orchard Village, as well as along Fanita Parkway and at the southern end of the planned Cuyamaca Street extension. The conglomerate tongue of the Friars Formation may partially occur within the conglomerate strata referred to as the "Stadium Conglomerate" (see Section 3.1 and Section 4.1.5, above), while the upper tongue is not believed to occur within the Project site. The Friars Formation was deposited unconformably on plutonic bedrock within the Project site.

The lower tongue of the Friars Formation generally consists of light gray fine- to medium-grained sandstones with horizons of greenish to reddish siltstones and mudstones, while the conglomerate tongue consists mainly of light rusty brown and light gray cobble and boulder conglomerate, with common thin beds and rip-up clasts of multicolored siltstone and mudstone. Both tongues are primarily fluvial in origin, with lagoonal and marine facies to the west (Kennedy, 1975; Givens and Kennedy 1979; Squires and Deméré, 1991; Walsh et al., 1996). Based on borehole data from the Project's geotechnical report (Geocon, 2020a), the Friars Formation appears to consist of silty sandstones, pebble to cobble rich sandstones, and pebble to cobble conglomerates within the Project site. Finer-grained deposits of the Friars were not documented during the pedestrian survey, primarily due to dense vegetation and the origin of landslide deposits from within these deposits. A prominently exposed conglomerate facies of the Friars Formation, mapped by Geocon (2020a), was observed within the western portion of the Orchard Village footprint and along portions of Fanita Parkway. These deposits consisted of matrix- to near clast- supported pebble to cobble conglomerate with clasts measuring 2–6 inches in diameter, in a yellowish gray, poorly sorted, massive, well indurated, subangular, coarse-grained sandstone matrix.

Paleontology: The SDNHM has 53 recorded fossil collection localities from the Friars Formation within a 2-mile radius of the Project site—31 from the conglomerate tongue, 19 from the lower tongue, and 3 that have not been assigned to an informal member (Appendix 3).

The majority of the fossils discovered from the conglomerate tongue were discovered during ongoing excavations at Sycamore Landfill (see Section 3.1), located southwest of the Project site. These localities produced remains of plants, land snails, freshwater fish, birds, reptiles, and mammals. The mammalian assemblage is exceptionally diverse, and includes small opossums, dermopterans, insectivores, bats, primates, carnivorans, rodents, a uintathere, a brontothere, and an unidentified artiodactyl (SDNHM unpublished paleontological collections data).

Fossil localities discovered from the lower tongue of the Friars Formation were discovered during construction of the Silver Country Estates development, during excavation for the northern extension of SR 125 between Grossmont Summit and Santee Valley, and during excavation along State Route (SR) 52. These 19 localities produced silicified wood, leaf impressions, land snails, turtles, crocodiles, lizards, and a mammalian assemblage of marsupials, apatotheres, leptictids, pantolestids, dermopterans, insectivores, bats, primates, creodonts, carnivorans, rodents, artiodactyls, rhinoceroses, and brontotheres (SDNHM unpublished paleontological collections data).

The three remaining Friars Formation localities not assigned to an informal member produced fossilized impressions of plant fragments and a small collection of mammal teeth and postcranial elements.

As demonstrated by the record search results, all three members of the Friars Formation are rich in vertebrate fossils, especially terrestrial mammals (e.g., Colbert, 2006; Golz and Lillegraven, 1977; Mihlbachler and Deméré, 2009; Stock, 1934; Tomiya, 2011, 2013; Walsh, 1996, 1997, 2010; Wilson, 1940a, 1940b). The composite fossil mammal assemblage from the Friars Formation, referred to as the Poway Fauna, consists of about 53 genera of fossil mammals containing at least 61 species (Novacek and Lillegraven, 1979; Walsh, 1991, 1996). Fossils from the Friars Formation are entirely early Uintan in age (Walsh, 1996, 2010). The Poway Fauna represents the largest and most diverse middle Eocene mammalian assemblage known from California and serves as the regional standard for making informed comparisons with time equivalent assemblages from other regions in North America. Well-preserved remains of marine microfossils and macroinvertebrates, as well as impressions of fossil leaves, have also been reported from western exposures of the Friars Formation (Givens and Kennedy, 1979; Squires and Deméré, 1991).

4.1.7 Plutonic rocks (Kgb, Kgr)

Description: Plutonic rocks occur in the northwest to central portion of the Project site in areas of generally lower topographic relief where the overlying Eocene sedimentary deposits have eroded away. These Cretaceous-aged intrusive igneous rocks comprise part of the northern end of the Peninsular Ranges Batholith that extends from Riverside County several hundred miles south into Baja California, Mexico. Batholithic rocks in San Diego County range in composition from granite to gabbro, and formed during the Cretaceous Period (about 125 to 95 million years ago), which is coeval with formation of the Sierra Nevada Batholith to the north (Todd, 2004). These rocks formed due to the development of a major subduction zone off the west coast of the North American continent during the Mesozoic. Oceanic crust was thrust below continental crust, and as the cold, water-saturated oceanic crust descended into the earth’s mantle, it became superheated and melted into buoyant magma bodies called plutons, which then rose (intruded) through the overlying crust and slowly cooled several miles below the earth’s surface to form the plutonic rocks (granodiorite and gabbro) now exposed at the surface. The plutonic rocks are unconformably overlain by the Friars Formation and "Stadium Conglomerate" at the Project site.

Paleontology: Plutonic igneous rocks do not preserve fossils because they crystallize at extremely high temperatures and pressures several miles below the earth’s surface, in conditions that do not support complex life.

4.2 Results of the Paleontological Field Survey

As observed during the paleontological field survey, the Project site consists of previously undeveloped land exhibiting extreme topographic relief. The central Fanita Commons neighborhood primarily lies within a broad valley containing small rocky peaks. The Orchard Village neighborhood contains low lying areas to the west and high, gently sloping ridges to the east dissected by west-flowing drainages. The

Vineyard Village neighborhood contains high elevation ridgelines and steep-sided canyons. The entire property is crisscrossed by a network of worn jeep trails that primarily follow ridgelines. These dirt roadways were used to access the remote portions of the Project site, and were the only reliable areas of the site in which exposures of native formation were discovered. The majority of the Project site and areas along Fanita Parkway are covered by vegetation and topsoil, making the surface expressions of the underlying rock units rare and/or difficult to locate.

The geology presented in the geotechnical report (Geocon, 2020a–d) was generally confirmed during the survey. Light gray bouldery outcrops of granodiorite (Figure 5) and reddish-brown degraded outcrops of gabbro were observed within all three community footprints, but most extensively bordering the broad valley that lies within Fanita Commons. Unconformably overlying igneous rocks in the Project site are middle Eocene fluvial deposits of the Friars Formation and/or "Stadium Conglomerate" consisting of pebble to cobble conglomerates in massive, poorly sorted sandstone matrix (Figures 6–8). While finer-grained deposits of the Friars Formation were not observed, the landslides derived from this lithology were identifiable as slope breaks below the steep-sided ridges of the overlying "Stadium Conglomerate." These Eocene rocks were dissected by primarily west- and south-flowing drainages and their tributaries within Sycamore Canyon and Clark Canyon. Along the lower flanks of Sycamore Canyon, Pleistocene terrace deposits (Figure 9) were observed adjacent to and overlying the cobble facies of the Friars Formation. Finally, Holocene alluvium was observed to line modern drainages and hillsides, and was primarily composed of the pebbles, cobbles, and coarse-grained sands of the Eocene conglomerate units.

Figure 5. Overview of the Project site looking west from the southern portion of Vineyard Village, taken near the topographic high point of the Project site. In the foreground are cobbles eroded from the "Stadium Conglomerate" that caps the ridgelines in this area, while in the middle ground are large granodiorite boulders located at lower elevation. Photo taken by Katie M. McComas, 21 February 2018.

Figure 6. The cobble facies of the Friars Formation, consisting of matrix-supported pebble to cobble conglomerate in a massive, moderately sorted, cemented, coarse-grained sandstone matrix, as exposed in the southwest corner of Orchard Village. Photo taken by Katie M. McComas, 21 February 2018.

Figure 7. Native exposure of "Stadium Conglomerate" (bottom of photo, with scale bar) located along the jeep trail in the southern portion of Vineyard Village. The loose cobbles covering the trail were more typical indicators of areas underlain by "Stadium Conglomerate" deposits. Photo taken by Katie M. McComas, 21 February 2018.

Figure 8. "Stadium Conglomerate" deposits, as indicated in Figure 7, consisting of clast-supported cobble conglomerate in a matrix of very pale brown to pale yellow, massive, coarse-grained sandstone, as exposed in the southwest corner of Vineyard Village. Photo taken by Katie M. McComas, 21 February 2018.

Figure 9. Close-up of Pleistocene terrace deposits exposed just above the jeep trail in the northwest corner of Orchard Village, showing the poorly sorted nature of these deposits. Photo taken by Katie M. McComas, 21 February 2018.

4.3 Results of Paleontological Resource Potential Analysis

The paleontological resource potential of each geologic unit present within the Project site is assessed below, and is depicted in the paleontological potential map in Appendix 2.

4.3.1 Artificial fill

Artificial fill has no paleontological potential because of the disturbed nature of these sediments and any contained fossils.

Artificial fill, as documented by Geocon (2020a–d), may be encountered within the Special Uses area, and along Fanita Parkway and near existing roadways in the areas planned for the extension of Cuyamaca Street and Magnolia Avenue.

4.3.2 Young alluvial deposits

Holocene alluvial deposits within the Project site are assigned a low paleontological potential based on the high energy depositional environment of these strata and their relatively young geologic age (generally less than 11,700 years old).

Holocene alluvial deposits were documented in active drainages across the Project site, along Fanita Parkway, and crossing the planned footprints of Cuyamaca Street and Magnolia Avenue. Geocon (2020a–d) recommends remedial grading to remove these poorly consolidated sediments prior to placement of fill.

4.3.3 Landslide deposits

As discussed above, landslide deposits are typically assigned no paleontological potential because the stratigraphic context of any contained fossils has been disturbed. However, a portion of the landslides within the Project site were characterized by Geocon (2020a,c) as deep-seated landslides containing intact blocks of fine-grained sandstone/claystone deposits of the Friars Formation. Useful stratigraphic data may still be recovered for fossils discovered within these blocks, so these landslides are assigned a moderate paleontological potential.

Landslide deposits are located along the north- and south- facing flanks of the prominent ridgeline in Orchard Village, within the eastern portion of the Special Uses Area, and at the southern end of the planned Cuyamaca Street extension. Geocon (2020a,c) recommends remedial grading of landslide deposits prior to the placement of fill or development of these areas.

4.3.4 Older terrace deposits

As previously discussed, Pleistocene-age terrace deposits, in spite of their generally coarse-grained lithology and deposition in a high-energy setting, have the limited potential to yield scientifically important terrestrial vertebrate fossils, and are therefore assigned a moderate paleontological potential.

Terrace deposits were mapped by Geocon (2020a–b) in patchy distribution along the flanks of Sycamore Canyon in the western portions of Fanita Commons and Orchard Village, and also occur along Fanita Parkway from approximately Ganley Road and northward.

4.3.5 "Stadium Conglomerate"

The "Stadium Conglomerate" is assigned a high paleontological resource potential based on the recovery of scientifically significant fossils, particularly land mammals, in southern San Diego County and the presence of documented fossil localities from Eocene conglomerates in the vicinity of the Project site.

While the finer-grained deposits that typically yield fossils were not observed at the surface during the pedestrian survey, interbeds of silty and clayey sands within the "Stadium Conglomerate" were noted in the site-specific geotechnical report (Geocon, 2020a) and are likely to be encountered during removal of the large volume of these deposits that is planned within the Project site. "Stadium Conglomerate" is widely mapped across the Vineyard Village and Orchard Village footprints, and also crops out along the northern part of the planned Cuyamaca Street extension.

4.3.6 Friars Formation

The Friars Formation is assigned a high paleontological resource potential based on the diverse and scientifically important terrestrial mammalian fossils recovered from this geologic unit in southern San Diego County. The presence of abundant fossil localities from the Friars Formation in the vicinity of the Project site (Sycamore Landfill, SR 52 and SR 125 construction, and Silver Country Estates development) further support the high paleontological potential of these deposits.

While the fine-grained deposits that typically yield fossil localities were not observed during the pedestrian field survey, Geocon (2020a) documented the presence of claystone, laminated siltstone/claystone, and sandstone in exploratory boreholes within the Project site. These deposits also compose the landslides observed in the western portion of the Project site. While much of this area is planned for the emplacement of a large volume of artificial fill, the fine-grained claystones, siltstones, and weathered portions of the Friars Formation will require remedial grading to provide a suitable surface to support the fill material.

4.3.7 Plutonic rocks

The rocks mapped as granodiorite and gabbro within the Project site, as elsewhere in San Diego County, are assigned no paleontological potential. The conditions present during the formation of plutonic igneous rocks preclude the potential presence of fossils.

Granodiorite and gabbro are exposed along the western boundary and southernmost portion of Vineyard Village, throughout the central portion of Fanita Commons, and in the northwest and northeast corners of Orchard Village. These rocks also primarily underlie the planned offsite extensions of Cuyamaca Street and Magnolia Avenue.

4.4 Results of Paleontological Impact Analysis

Preliminary earthwork plans suggest that mass grading in the Fanita Commons neighborhood will primarily involve the importation of fill materials from the Orchard Village neighborhood to create large sheet-graded pads for residential development, the K-8 school, the community park, a working farm, and a mixed-use Village Center. Remedial grading to prepare areas for placement of fill materials and removal and recompaction of young alluvial deposits, ancient landslide deposits, and fine-grained portions of the Friars Formation is likely to be extensive. It appears that the majority of earthwork proposed in this neighborhood will primarily impact geologic units of no paleontological potential (i.e., plutonic rocks), such as those underlying the proposed community park site and the active adult community area. However, a portion of the proposed earthwork will impact geologic units of moderate (e.g., ancient landslides, older terrace deposits) and high paleontological potential (e.g., Friars Formation) occurring in the vicinity of the proposed fire station and the K-8 school.

Preliminary earthwork plans for the Orchard Village neighborhood indicate large areas of proposed cuts along east-west trending ridgelines to generate fill material for importation to other Fanita Ranch neighborhoods and to create level sheet-graded pads for single family and multi-family residential development, a local neighborhood park, and a mixed-use Village Center. Remedial grading to remove and stabilize a series of ancient landslides along the south side of Sycamore Creek is likely to be extensive. Mass grading in the Orchard Village neighborhood will primarily impact geologic units of high paleontological potential including the "Stadium Conglomerate" (along ridgelines generally above 675 feet in elevation) and the Friars Formation (along canyon slopes generally below 675 feet in elevation). It is likely that remedial grading associated with the ancient landslides will also impact high paleontological potential geologic units (e.g., Friars Formation) in those portions of landslides that have moved as large, intact blocks of unbroken strata.

Preliminary earthwork plans for the Vineyard Village neighborhood indicate significant excavations along ridgelines and large fills along canyon heads to create level sheet-graded pads for single family residential development, a local neighborhood park, two water tanks, and a mixed-use Village Center. Remedial grading for removal and recompaction of young alluvial deposits is likely to be relatively minor. Mass grading of the Vineyard Village neighborhood will largely impact geologic units of high paleontological potential (e.g., "Stadium Conglomerate") that compose the highest peaks in Fanita Ranch, but will also impact geologic units of no paleontological potential (e.g., plutonic rocks) that occur on the western flanks of these peaks.

Any further development of the Special Uses Area will likely involve remedial grading of previously placed artificial fill (no paleontological potential), as well as the landslide deposits located in the eastern portion of this area (moderate paleontological potential).

In addition to the proposed earthwork in the three main neighborhoods at Fanita Ranch, there will also be offsite mass grading activities associated with construction of the Cuyamaca Street and Magnolia Avenue extensions, which will require locally extensive cuts and fills to create the roadway alignment. The majority of this grading will impact geologic units of no paleontological potential (e.g., plutonic rocks). However, mass grading in the extreme northern and southern portions of the Cuyamaca Street alignment will impact geologic units of high paleontological potential (e.g., the "Stadium Conglomerate" in the north and the Friars Formation in the south). Finally, enhancement and northward extension of Fanita Parkway will involve relatively minor grading that will primarily impact geologic units of no paleontological potential (e.g., existing artificial fill) or low paleontological potential (e.g., young alluvial deposits), but may also impact units of moderate potential (e.g., older terrace deposits) and high potential (e.g., the Friars Formation) in the vicinity of Ganley Road and northward.

5.0 Recommended Mitigation Strategies

As discussed above, paleontologically sensitive strata will likely be impacted during mass grading within the northern half of the Project site, primarily within the planned footprints of Vineyard Village and Orchard Village, as well as the southern portion of Fanita Commons. In addition, offsite improvements to Fanita Parkway and Cuyamaca Street will likely also impact paleontologically sensitive strata. Finally, any further development of the eastern portion of the Special Uses Area would likely impact paleontologically sensitive strata. Therefore, paleontological mitigation is recommended for the Project. Paleontological mitigation may be accomplished through avoidance or paleontological monitoring, as summarized below.

Paleontological monitoring is recommended as the most feasible option for the Project.

5.1 General Strategies for Paleontological Mitigation

5.1.1 Avoidance/Establishment of an ESA

Avoidance of project impacts to paleontological resources can, in some instances, be achieved by project redesign so that paleontological resources are left completely outside the project's impact area (e.g., moving project components away from the resource, or developing a construction approach that does not involve excavations into potentially fossil-bearing strata).

Establishment of environmentally sensitive areas (ESAs) may be employed in conjunction with avoidance in order to protect resources within or immediately adjacent to certain parts of a project while concurrently allowing the project to proceed. Generally, ESAs involve some combination of avoidance, exclusionary fencing (or other physical protective barrier), and administrative protection measures as an alternative to excavation.

5.1.2 Paleontological Monitoring

Development and implementation of mitigation measures centered on paleontological monitoring can minimize impacts through recovery and conservation of fossils unearthed during construction, and is the most commonly employed paleontological mitigation strategy. Mitigation measures typically address pre-construction, during-construction, and post-construction activities. Pre-construction measures generally address professional qualifications, fossil repository selection, meeting attendance, and worker environmental awareness training (if applicable). During-construction measures generally address construction monitoring, data recovery, safety considerations, and fossil discovery and recovery. Post-construction measures generally address fossil preparation, fossil curation, fossil storage, and final reporting.

5.2 Recommendations for the Project

For the Project, paleontological monitoring is recommended as the most reasonable paleontological mitigation strategy.

Recommended mitigation measures for implementing a paleontological monitoring program are outlined below.

1. **Pre-Construction (personnel and repository):** Prior to the commencement of construction, a qualified Project Paleontologist shall be retained to oversee the mitigation program (a Project Paleontologist is a person with a Ph.D. or Master's Degree in Paleontology or related field, and who has knowledge of San Diego County paleontology and documented experience in

professional paleontological procedures and techniques). In addition, a regional fossil repository shall be designated to receive any discovered fossils (because the Project is in San Diego County, the recommended repository is the San Diego Natural History Museum).

2. **Pre-Construction (meeting):** The Project 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 Project Paleontologist shall conduct a paleontological resource training workshop to be attended by earth excavation personnel.
4. **During-Construction (monitoring):** A paleontological monitor (working under the direction of the Project Paleontologist) should be on-site on a full-time basis during all original cutting of previously undisturbed deposits of Pleistocene terrace deposits (moderate paleontological potential), ancient landslide deposits (moderate paleontological potential), the "Stadium Conglomerate" (high paleontological potential), and the Friars Formation (high paleontological potential) to inspect exposures for unearthed fossils. Areas to be monitored will include, but not be limited to: the majority of the Orchard Village and Vineyard Village footprints, and approximately the southern half of the Fanita Commons footprint; the eastern portion of the Special Uses Area; offsite improvements to Fanita Parkway in the vicinity of Ganley Road and northward; and the northern half and southernmost end of the offsite extension of Cuyamaca Street.
5. **During-Construction (fossil recovery):** If fossils are discovered, the Project Paleontologist (or paleontological monitor) should recover them. In most cases, fossil salvage can be completed in a short period of time. However, some fossil specimens (e.g., a bone bed or a complete large mammal skeleton) may require an extended salvage period. In these instances, the Project 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 cleaned, 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.

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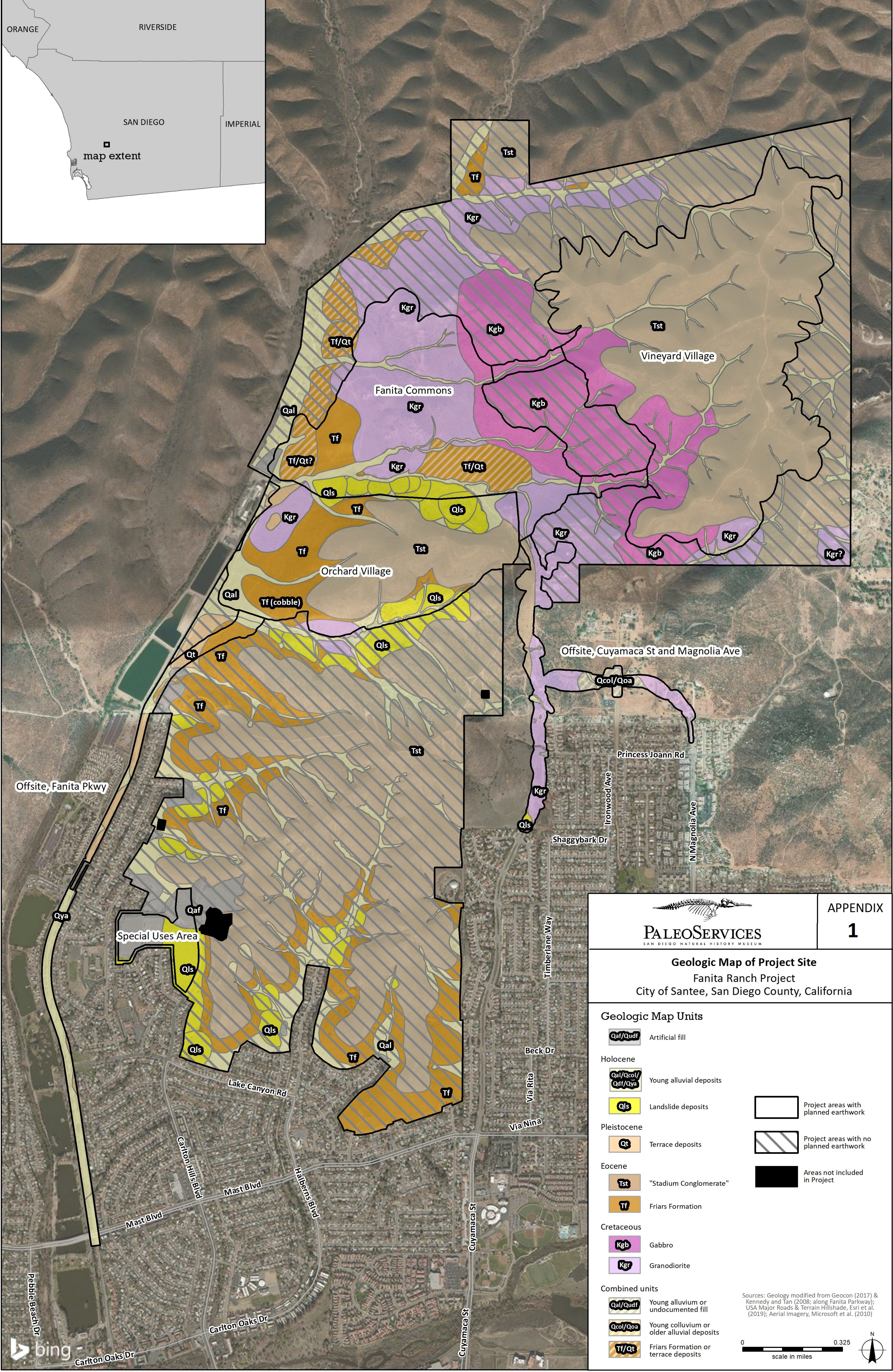
Appendices

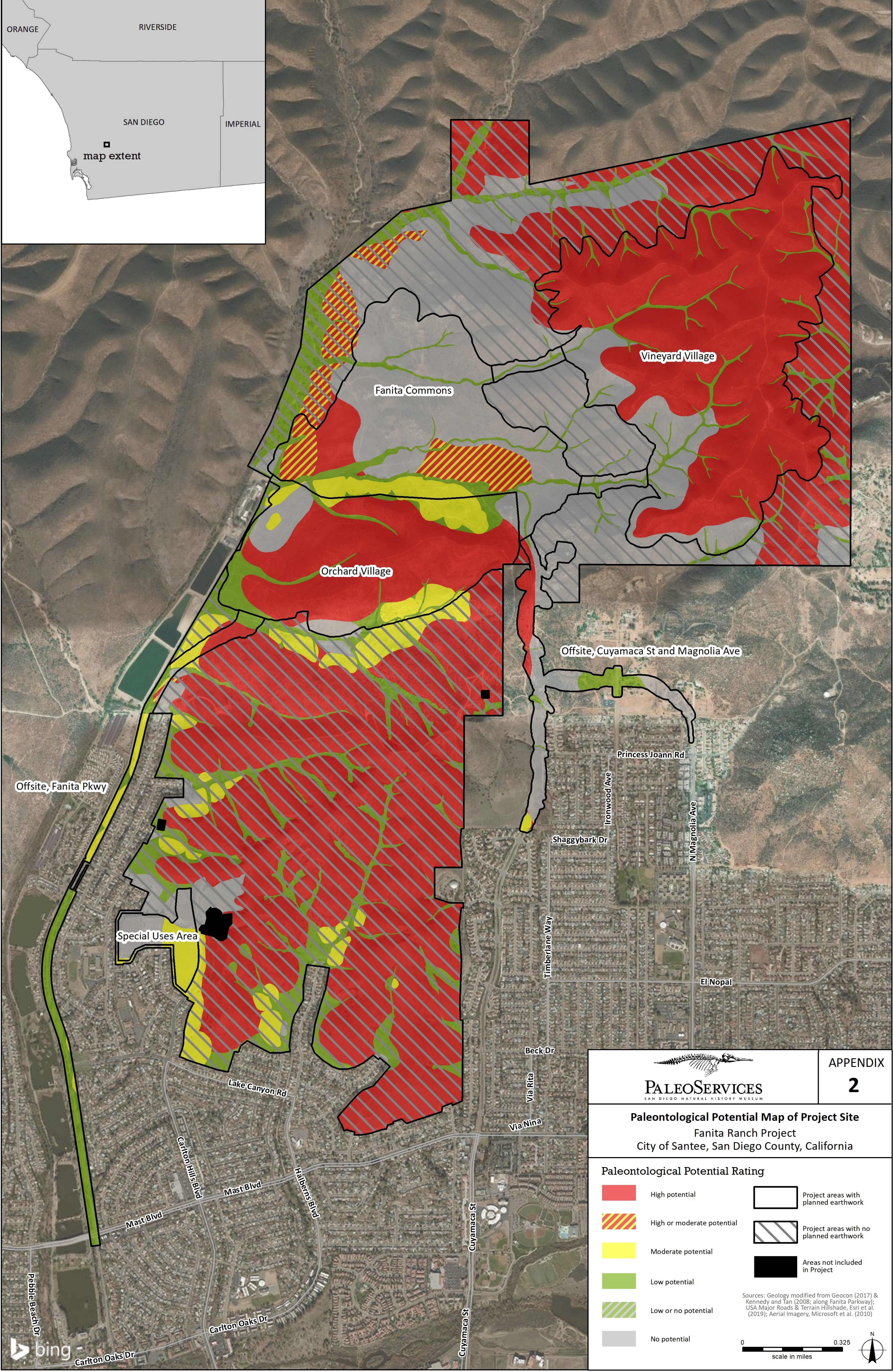
Appendix 1: Geologic Map of Project Site

Appendix 2: Paleontological Potential Map of Project Site

Appendix 3: SDNHM Fossil Localities within a 2-mile Radius of the Project



Geologic Map of Project Site
Fanita Ranch Project
City of Santee, San Diego County, California


ORANGE
RIVERSIDE
SAN DIEGO
IMPERIAL
map extent
Vineyard Village
Fanita Commons
Orchard Village
Offsite, Cuyamaca St and Magnolia Ave
Offsite, Fanita Pkwy
Special Uses Area
Princess Joann Rd
Ironwood Ave
N Magnolia Ave
Shaggybark Dr
Timberlane Way
El Nopal
Beck Dr
Via Rita
Via Nina
Lake Canyon Rd
Carlton Hills Blvd
Halberns Blvd
Mast Blvd
Cuyamaca St
Pebble Beach Dr
Carlton Oaks Dr
bing
PALEOSERVICES
SAN DIEGO NATURAL HISTORY MUSEUM
APPENDIX
2
Paleontological Potential Map of Project Site
Fanita Ranch Project
City of Santee, San Diego County, California
Paleontological Potential Rating
High potential
High or moderate potential
Moderate potential
Low potential
Low or no potential
No potential
Project areas with planned earthwork
Project areas with no planned earthwork
Areas not included in Project
Sources: Geology modified from Geocon (2017) & Kennedy and Tan (2008; along Fanita Parkway); USA Major Roads & Terrain Hillshade, Esri et al. (2019); Aerial Imagery, Microsoft et al. (2010)
0
0.325
scale in miles
N

Appendix 3: SDNHM Fossil Localities within a 2-mile Radius of the Project

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
6537	San Vicente Dam Raise	San Diego County, CA	740	Stadium Conglomerate	Cenozoic	Paleogene	middle Eocene
6538	San Vicente Dam Raise	San Diego County, CA	760	Stadium Conglomerate	Cenozoic	Paleogene	middle Eocene
6539	San Vicente Dam Raise	San Diego County, CA	856	Stadium Conglomerate	Cenozoic	Paleogene	middle Eocene
7172	Sycamore Landfill	City of San Diego, San Diego County, CA	698	Friars Formation	Cenozoic	Paleogene	middle Eocene
7173	Sycamore Landfill	City of San Diego, San Diego County, CA	657	Friars Formation	Cenozoic	Paleogene	middle Eocene
7328	SDGE Fanita Junction Enhancement	City of San Diego, San Diego County, CA	476	Friars Formation	Cenozoic	Paleogene	middle Eocene
5882	Sycamore Landfill	City of San Diego, San Diego County, CA	592	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5883	Sycamore Landfill	City of San Diego, San Diego County, CA	578	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5884	Sycamore Landfill	City of San Diego, San Diego County, CA	574	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5885	Sycamore Landfill	City of San Diego, San Diego County, CA	573	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5886	Sycamore Landfill	City of San Diego, San Diego County, CA	573	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5887	Sycamore Landfill	City of San Diego, San Diego County, CA	560	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5888	Sycamore Landfill	City of San Diego, San Diego County, CA	738	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5889	Sycamore Landfill	City of San Diego, San Diego County, CA	547	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5890	Sycamore Landfill	City of San Diego, San Diego County, CA	480	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
5891	Sycamore Landfill	City of San Diego, San Diego County, CA	466	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7155	Sycamore Landfill	City of San Diego, San Diego County, CA	532	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7156	Sycamore Landfill	City of San Diego, San Diego County, CA	526	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7157	Sycamore Landfill	City of San Diego, San Diego County, CA	532	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7158	Sycamore Landfill	City of San Diego, San Diego County, CA	534	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7159	Sycamore Landfill	City of San Diego, San Diego County, CA	537	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7160	Sycamore Landfill	City of San Diego, San Diego County, CA	527	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7161	Sycamore Landfill	City of San Diego, San Diego County, CA	0	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7162	Sycamore Landfill	City of San Diego, San Diego County, CA	593	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7163	Sycamore Landfill	City of San Diego, San Diego County, CA	608	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7164	Sycamore Landfill	City of San Diego, San Diego County, CA	598	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7165	Sycamore Landfill	City of San Diego, San Diego County, CA	598	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7166	Sycamore Landfill	City of San Diego, San Diego County, CA	591	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7167	Sycamore Landfill	City of San Diego, San Diego County, CA	593	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7168	Sycamore Landfill	City of San Diego, San Diego County, CA	0	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7169	Sycamore Landfill	City of San Diego, San Diego County, CA	602	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7170	Sycamore Landfill	City of San Diego, San Diego County, CA	645	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene

Appendix 3: SDNHM Fossil Localities within a 2-mile Radius of the Project

San Diego Natural History Museum
Department of Paleontology

Locality Number	Locality Name	Location	Elevation (feet)	Geologic Unit	Era	Period	Epoch
7171	Sycamore Landfill	City of San Diego, San Diego County, CA	650	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7175	Sycamore Landfill	City of San Diego, San Diego County, CA	549	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7176	Sycamore Landfill	City of San Diego, San Diego County, CA	484	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7177	Sycamore Landfill	City of San Diego, San Diego County, CA	489	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
7178	Sycamore Landfill	City of San Diego, San Diego County, CA	482	Friars Formation, conglomerate tongue	Cenozoic	Paleogene	middle Eocene
3653	State Route 52 East Site 3	City of San Diego, San Diego County, CA	505	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3654	State Route 52 East Site 4	City of San Diego, San Diego County, CA	467	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3655	State Route 52 East Site 5	City of San Diego, San Diego County, CA	454	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3656	State Route 52 East Site 6	City of San Diego, San Diego County, CA	414	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3657	State Route 52 East Site 7	City of San Diego, San Diego County, CA	415	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3658	State Route 52 East Site 8	City of San Diego, San Diego County, CA	410	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3659	State Route 52 East Site 9	City of San Diego, San Diego County, CA	379	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3661	State Route 52 East site 11	City of San Diego, San Diego County, CA	485	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3662	State Route 52 East Site 12	City of San Diego, San Diego County, CA	352	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3664	State Route 52 East Site 14	City of San Diego, San Diego County, CA	481	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3665	State Route 52 East Site 15	City of San Diego, San Diego County, CA	491	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3666	State Route 52 East Site 16	City of San Diego, San Diego County, CA	465	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3891	Silver Country Estates Site 1	City of Santee, San Diego County, CA	515	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3892	Silver Country Estates Site 2	City of Santee, San Diego County, CA	492	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3893	Silver Country Estates Site 3	City of Santee, San Diego County, CA	496	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
3894	Silver Country Estates Site 4	City of Santee, San Diego County, CA	500	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
4034	SR 125 North (Unit I) Grossmont Summit	City of San Diego, San Diego County, CA	454	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
4035	SR 125 North (Unit I) Grossmont Summit	City of El Cajon, San Diego County, CA	516	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene
4060	Silver Country Estates #5	City of Santee, San Diego County, CA	521	Friars Formation, lower tongue	Cenozoic	Paleogene	middle Eocene