5.6 GEOLOGY AND SOILS, AND PALEONTOLOGICAL RESOURCES

This section of the Draft Environmental Impact Report (DEIR) evaluates the potential for implementation of the Proposed Project to impact geological and soil resources, paleontological resources, or unique geologic features. The analysis in this section is based in part on the following technical reports:

- *Geotechnical Exploration Report Proposed Residential Development 6501-6513 East Serrano Avenue, Anaheim, California*, Leighton and Associates, Inc., October 9, 2017. (Appendix G)
- *Response to Review Comments Regarding Leighton's Geotechnical Exploration Report for the Proposed Residential Development 6501-6513 East Serrano Avenue, Anaheim, California*, Leighton and Associates, Inc., August 10, 2018. (Appendix G)
- *6501-6513 East Serrano Avenue, Anaheim, California, Residential Grading Plan Review*, ENGEO Inc., for Santiago Geologic Hazard Abatement District, June 29, 2018. (Appendix G)
- *Re: Paleontological Records Search for the proposed 6501–6513 Serrano Avenue Project, in the City of Anaheim, Orange County*, Natural History Museum of Los Angeles County, December 27, 2018. (Appendix H)

Complete copies of these studies are included in the Appendices G and H to this Draft EIR.

5.6.1 Environmental Setting

5.6.1.1 REGULATORY BACKGROUND

California Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was signed into state law in 1972. Its primary purpose is to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault. The act delineates "Earthquake Fault Zones" along faults that are "sufficiently active" and "well defined." The act also requires that cities and counties withhold development permits for sites within an earthquake fault zone until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. Pursuant to this act, structures for human occupancy are not allowed within 50 feet of the trace of an active fault.

Seismic Hazard Mapping Act

The Seismic Hazard Mapping Act (SHMA) was adopted by the state in 1990 to protect the public from the effects of nonsurface fault rupture earthquake hazards, including strong ground shaking, liquefaction, seismically induced landslides, or other ground failure caused by earthquakes. The goal of the act is to minimize loss of life and property by identifying and mitigating seismic hazards. The California Geological Survey prepares seismic hazard zone maps that identify areas susceptible to amplified shaking, liquefaction, earthquake-induced landslides, and other ground failures. SHMA requires responsible agencies to only approve projects within seismic hazard zones following a site-specific investigation to determine if the hazard is present, and if

so, the inclusion of appropriate mitigation. In addition, the SHMA requires real estate sellers and agents at the time of sale to disclose whether a property is within one of the designated seismic hazard zones.

California Building Code

Current law states that every local agency enforcing building regulations, such as cities and counties, must adopt the provisions of the California Building Code (CBC) within 180 days of its publication. The publication date of the CBC is established by the California Building Standards Commission, and the code is also known as Title 24, Part 2 of the California Code of Regulations. The most recent building standard adopted by the legislature and used throughout the state is the 2016 version of the CBC (effective January 1, 2017), often with local, more restrictive amendments that are based on local geographic, topographic, or climatic conditions. These codes provide minimum standards to protect property and public safety by regulating the design and construction of excavations, foundations, building frames, retaining walls, and other building elements to mitigate the effects of seismic shaking and adverse soil conditions. The CBC contains provisions for earthquake safety based on factors including occupancy type, the types of soil and rock onsite, and the strength of ground shaking with specified probability of occurring at a site.

Soils Investigation Requirements

Requirements for soils investigations for subdivisions requiring tentative and final maps and for other specified types of structures are in California Health and Safety Code, Sections 17953 to 17955, and in Section 1802 of the CBC. Testing of samples from subsurface investigations is required, such as from borings or test pits. Studies must be done as needed to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on load-bearing capacity, compressibility, liquefaction, differential settlement, and expansiveness.

Paleontological Resources Preservation Act

The Paleontological Resources Preservation Act was enacted as Public Law 111-11, Title VI Subtitle D of the Omnibus Public Land Management Act of 2009 (16 U.S. Code §§ 470aaa–470aaa-11) and directs the Department of Agriculture (US Forest Service) and the Department of the Interior (National Park Service, Bureau of Land Management, Bureau of Reclamation, and Fish and Wildlife Service) to implement comprehensive paleontological resource management programs. The US Forest Service published the Department of Agriculture version of the Preservation Act regulations in the Federal Register in April 2015.

5.6.1.2 EXISTING CONDITIONS

Regional Geologic Setting

The City of Anaheim is situated in the Peninsular Ranges Geomorphic Province, which extends approximately 900 miles from the Transverse Ranges and the Los Angeles Basin in the north to the southern tip of Baja California (Norris and Webb 1990). The province varies in width, from approximately 30 to 100 miles. In general, the province consists of a northwest-southeast-oriented complex of blocks separated by similarly trending faults. The basement bedrock complex includes Jurassic-age metavolcanic and metasedimentary rocks, and Cretaceous-age igneous rocks of the Southern California batholith.

The Project Site is in the Santa Ana Mountains in the eastern portion of the Peralta Hills. These low-lying hills extend westward from the Santa Ana Mountains toward the Los Angeles Basin and are primarily underlain by Tertiary-age (between about 2.6 to 65 million years old), mostly marine sediments, deposited in the Los Angeles Basin spanning the Miocene to Pliocene Epoch (about 2.6 to 23.3 million years ago). The project site is in an area mapped to be underlain by Miocene-age Puente Formation bedrock (Soquel and La Vida Members) primarily consisting of sandstone and siltstone (NHMLA 2018).

Subsurface Soil Conditions

The Project Site is underlain by previously placed artificial fill overlying Tertiary-age sandstone and siltstone bedrock materials.

Artificial Fill: The previously placed artificial fill soil is on the order of less than a foot to over 76.5 feet thick across the Project Site, consisting primarily of orange brown to gray brown, moist to very moist, medium dense to dense silty sand and clayey sand interlayered with medium stiff to very stiff clay, silty clay, and sandy clay. The artificial fill materials encountered at the Project Site are associated with the previous mass/rough grading of the area.

Puente Formation Bedrock: Upper Miocene-age marine sedimentary rocks of the Puente Formation Encountered was encountered below the artificial fill in some of the borings at various depths. The La Vida Member (Map Symbol: Tplv) was encountered, consisting of orange brown to light grey brown, laminated, brittle shaley siltstone with lesser amounts of slightly well cemented sandstone. The sandstone content increases as the La Vida Member grades into the Soquel Member (Map Symbol: Tpsq), which is below a majority of the Project Site. The Soquel Member consists of orange brown, massive, fine to medium grained pebbly sandstone with interbedded grey brown moderately fractured fissile siltstone. Based on blow counts and visual classification, the bedrock materials encountered were generally characterized as dense, hard, and moderately oxidized.

Groundwater Conditions

Groundwater was not encountered during borings to a maximum depth of approximately 76.5 feet below ground surface during drilling.

Infiltration Capacity

In-situ percolation testing was performed to evaluate the infiltration capacity of the on-site soils in general accordance with the Orange County Technical Guidance Document for the Preparation of Conceptual/Preliminary and/or Project Water Quality Management Programs. Based on the testing result, it was determined that artificial fill soils beneath the Project Site within the zones tested generally do not provide adequate infiltration potential as indicated by the very low infiltration rates. Therefore, direct infiltration to the on-site soils was not recommended.

Liquefaction

Liquefaction refers to loose, saturated sand or gravel deposits that lose their load supporting capability when subjected to intense shaking. Any buildings or structures on these sediments may float, sink, or tilt as if on a body of water.

Based on a review of the Seismic Hazard Zones map for the Orange Quadrangle, the entire Project Site is not within an area that has been identified as being potentially susceptible to liquefaction.

Earthquake-Induced Landslides

Landslides are perceptible downward movements of a mass of earth (soil and/or debris), rock, or a combination of the two under the influence of gravity. Landslide materials are commonly porous and very weathered in the upper portions and along the margins of the slide. They may also have open fractures or joints. Slope failures can occur during or after intense rainfall or in response to strong seismic shaking. Areas of high topographic relief, such as steep canyon walls, are most likely to be impacted by slope failure. As shown in the State of California Seismic Hazard Zones, Anaheim Quadrangle map, the Project Site is not in an area likely to have earthquake-induced landslides (CGS 1998).

The Project Site is located approximately 0.4 mile to the west of the Santiago Landslide that occurred in Anaheim Hills in 1993. Topographic features expressive of landsliding were observed in the foothills to the south and east of the Project Site. These landslides have occurred primarily within the Vaqueros Sespe Formation Sandstone and the La Vida Member of the Puente Formation.

The landslides in the Vaqueros Sespe Formation likely involve highly fractured and sheared siltstone beds. Landslides in the La Vida Member are primarily located on north-facing slopes and involve bedding plain failures where local stream incision has undercut weak bedding planes. Other landslides mapped in the hills to the south and east could involve failures along faults or fault-derived fractures.

Paleontological Resources Setting

Paleontology is a science dealing with the life of past geological periods as known from fossil remains. It is a natural science closely associated with geology and biology. In geologically diverse California, vertebrate, invertebrate, and plant fossils are usually found in sedimentary and metasedimentary deposits.

The project site is located within the Peninsular Ranges geomorphic province of California along the eastern margins of the Los Angeles Basin, in the Santa Ana Mountains in the eastern portion of the Peralta Hills. These low-lying hills extend westward from the Santa Ana Mountains toward the Los Angeles Basin and are primarily underlain by Tertiary-age (between about 2.6 to 65 million years old) mostly marine sediments, deposited in the Los Angeles Basin spanning the Miocene to Pliocene Epoch (about 2.6 to 23.3 million years ago).

The City is mostly built out, and very few areas contain rock outcroppings with potential for presence of fossils. The oldest sedimentary rocks belong to the upper Cretaceous Holz Shale and the Schulz Ranch Member of the Williams Formation. These strata are confined to the southeastern corner of the Hill and Canyon Area in the eastern portion of the City, and no fossils have been reported.

According to the Natural History Museum of Los Angeles County, the Project Site and its vicinity have exposures of the marine late Miocene Puente Formation, consisting of the lower members of the Puente Formation: the Soquel Member and the La Vida Member. The closest vertebrate fossil from the Puente Formation (La Vida Member) is in Limestone Canyon south of Santiago Canyon Road, which produced fossil specimens of tonguefish, *Symphurus*. Limestone Canyon south of Santiago Canyon Road is over three miles southeast of the Project Site.

5.6.2 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would:

G-1 Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. (Refer to Division of Mines and Geology Special Publication 42.)

ii) Strong seismic ground shaking.

iii) Seismic-related ground failure, including liquefaction.

iv) Landslides.

G-2 Result in substantial soil erosion or the loss of topsoil.

G-3 Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

G-4 Be located on expansive soil, as defined in Table 18-1B of the Uniform building Code (1994), creating substantial direct or indirect risks to life or property.

G-5 Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

G-6 Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

The Initial Study, included as Appendix A, substantiates that impacts associated with the following thresholds would be less than significant:

- Threshold G-1(i)
- Threshold G-1(ii)
- Threshold G-1(iii)

- Threshold G-1(iv)
- Threshold G-3
- Threshold G-4
- Threshold G-5

Further analysis of these impacts is not warranted in the EIR. Although Threshold G-3 was determined to have less than significant impact in the Initial Study, considering overwhelming comments related to historic landslide and unstable soils in the area from residents during the scoping period, additional analysis concerning landslide and unstable soils is provided. It should be noted that Threshold G-2, impact related to soil erosion or the loss of topsoil, is discussed in Section 5.9, *Hydrology and Water Quality*, under Impact 5.9-2.

5.6.3 Plans, Programs, and Policies

Regulatory Requirement

RR GEO-1 The Proposed Project is required to be constructed in compliance with California Building Code, Title 24, Part 2 of the California Code of Regulations.

5.6.4 Environmental Impacts

5.6.4.1 IMPACT ANALYSIS

The applicable thresholds are identified in brackets after the impact statement.

Impact 5.6-1: The Project Site is not located on a geologic unit or soil that is unstable or that would become unstable as a result of the Proposed Project and potentially result in on- or off-site landslide. [Threshold G-3])

The Project Site is not in an area likely to have earthquake-induced landslides based on the State of California Seismic Hazard Zones, Anaheim Quadrangle map (CGS 1998). In 1993, the Santiago landslide located in the Anaheim Hills area of the northern Santa Ana Mountain produced extensional deformation within the adjacent part of the upslope bounding ridgeline. Initial investigations concluded that elevated groundwater conditions triggered landslide movement. The Project Site is approximately 0.4 mile to the west of the 1993 Santiago landslide. Based on the location of the Santiago Landslide and consideration of the geologic and topographic conditions of the Project Site and immediate vicinity, the Geotechnical Report determined that the potential for land sliding associated with the 1993 Santiago Landslide to occur at the site is considered low. The Project Site is in close proximity to, but is not within the Santiago Geologic Hazard Abatement District (GHAD) assessment boundaries. Santiago GHAD was formed by the Anaheim City Council on January 5, 1999, to stabilize past, present, and future land movement of the Santiago landslide. Since 1996, stabilization of the Santiago landslide has been accomplished by continual removal of groundwater through actively pumping wells and horizontals drains pursuant to the Plan of Control and Addendum for the Santiago GHAD (GHAD 2019). Although the Project Site is not within the Santiago GHAD boundaries, ENGEO, acting as the Santiago GHAD Manager, reviewed the Geotechnical Report and grading plan prepared for the Proposed Project. ENGEO confirmed that the Project Site is not located within the Santiago GHAD or the mapped "limit of

surface damage" area. ENGEO further stated that the formation on the Santiago landslide was caused by four primary factors:

- North-facing hillside topography
- Geologic structure as north-dipping strata and south-ancient faults
- Geologically weak materials along critical sedimentary beds and faults
- Rising groundwater

However, based on the review of the Geotechnical Exploration Report for the Proposed Project, ENGEO, acting as a manage for the Santiago GHAD determined that construction of the Proposed Project, including biofiltration improvements for controlling stormwater, would not affect the Santiago landslide or the ongoing mitigation efforts by the Santiago GHAD.

As recommended by the Geotechnical Report, the existing artificial fill and bedrock materials should be removed and replaced with engineered fill to provide support for the proposed building and other structural improvements. Standard engineering techniques and CBC compliance would ensure that a uniform support is provided and reduce the potential for differential settlement. The potential for unusual soil instability to cause landslide due to rising groundwater is considered low, as the groundwater was not encountered during borings to a maximum depth of approximately 76.5 feet below ground surface. The Proposed Project would not adversely affect soil stability to cause landslide or groundwater rising. Impacts would be less than significant.

Level of Significance Before Mitigation: Less than significant.

Impact 5.6-2: The Proposed Project could destroy paleontological resources or a unique geologic feature. [Threshold G-6]

A paleontological records search was performed through the Los Angeles County Natural History Museum. It was determined that there are no known vertebrate fossil localities within the boundaries of the Project Site. However, the records search indicated that fossils have been identified in the same sedimentary deposits that occur approximately three miles from the Project Site.

The Project Site is underlain by previously placed artificial fill overlying Tertiary age sandstone and siltstone bedrock materials. The previously placed artificial fill soil as encountered on the Project Site is on the order of less than a foot to over 76.5 feet thick across the site, consisting primarily of orange brown to gray brown, moist to very moist, medium dense to dense silty sand and clayey sand interlayered with medium stiff to very stiff clay, silty clay and sandy clay. The artificial fill materials encountered at the Project Site are associated with the previous mass/rough grading of the area. Surficial sediments at the Project Site consist of Puente Formation (Soquel and La Vida Members) could uncover vertebrate fossil remains. Therefore, any substantial excavation in Puente Formation within the Project Site shall be monitored closely to recover any fossil remains while not impeding development. Also, sediment samples shall be collected and processed to determine the small fossil potential in the Project Site. Therefore, a mitigation measure has been incorporated to reduce impacts.

Level of Significance Before Mitigation: Potentially Significant.

5.6.5 Cumulative Impacts

Geology and Soils

Geology and soils impacts related to the Proposed Project would be specific to that site and its users and would not be common or contribute to the impacts (or shared with, in an additive sense) on other sites. Compliance with applicable state and local building regulations would be required of all development in the City of Anaheim. Individual projects would be designed and built in accordance with applicable standards in the CBC and the individual site-specific recommendations per project-specific geotechnical investigation that includes pertinent seismic design criteria. Compliance with applicable state and local building regulations and standard engineering practices related to seismic and geologic hazard reduction would prevent significant cumulative adverse impacts associated with geologic and seismic hazards. Impacts of the Proposed Project and other development projects on geology and soils would not be cumulatively considerable with compliance with existing regulations.

Paleontological Resources

The Project Site is already developed with neighborhood commercial uses, and most of the City is built out. However, because ground disturbance could potentially unearth previously unidentified cultural resources, site-specific impacts would require mitigation measures to minimize impacts to a less than significant level. Provided that site-specific impacts for development projects in the City are reduced to a less than significant level, no cumulatively significant impacts are anticipated. No additional mitigation would be necessary.

Level of Significance Before Mitigation: Less than significant.

5.6.6 Level of Significance Before Mitigation

Upon implementation of regulatory requirements and standard conditions of approval, Impact 5.6-1 would be less than significant.

Without mitigation, the following impact would be **potentially significant**:

- **Impact 5.6-2** The Proposed Project could destroy paleontological resources or a unique geologic feature if grading beyond artificial fill.

5.6.7 Mitigation Measures

Impact 5.6-2

GEO-1 Prior to the beginning of ground disturbances, the City of Anaheim shall require the Project Applicant/developer to retain a qualified paleontologist to monitor ground-disturbing activities that occur in deposits that could potentially contain paleontological resources (e.g., Puente Formation, the Soquel Member and the La Vida Member). Before ground-disturbing activities begin, a qualified paleontologist shall prepare a monitoring plan specifying the frequency, duration, and methods of monitoring. Sediment samples shall be collected in the

deposits and processed to determine the small-fossil potential in the Project Site, and any fossils recovered during mitigation should be deposited in an accredited and permanent scientific institution.

5.6.8 Level of Significance After Mitigation

The Mitigation Measure GEO-1 would reduce potential impacts associated with paleontological resources to a level that is less than significant, and no mitigation measures associated with geology and soils have been identified. Therefore, no significant unavoidable adverse impacts would occur.

5.6.9 References

California Geological Survey (CGS), 2017a. Alquist-Priolo Earthquake Fault Zone Maps website located at http://www.quake.ca.gov/gmaps/WH/regulatorymaps.htm.

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Leighton and Associates, Inc. 2018, September 21. Phase I Environmental Site Assessment, 6501 Through 6513 East Serrano Avenue, Anaheim, California.

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Natural History Museum of Los Angeles County (NHMLA). 2018, December 27. re: Paleontological Records Search for the proposed 6501–6513 Serrano Avenue Project, in the City of Anaheim, Orange County, project area.

ENGEO Inc., for Santiago Geologic Hazard Abatement District (SGHAD). 2018, June 29. 6501-513 East Serrano Avenue, Anaheim, California, Residential Grading Plan Review.

5. Environmental Analysis
GEOLOGY AND SOILS

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