

5.4 Geology and Soils

5.4.1 INTRODUCTION

This section addresses potential environmental effects of the proposed Project related to geology, soils, seismicity, and paleontological resources. The impacts examined include risks related to geologic hazards such as earthquakes, landslides, liquefaction, expansive soils; impacts on the environment related to soil erosion and sedimentation; and impacts related to paleontological resources. Information within this section is based on the following:

- *City of Santa Ana General Plan Update*
- *City of Santa Ana General Plan FEIR*
- *City of Santa Ana Municipal Code*
- *Preliminary Geotechnical Investigation Report (Geotechnical Report) (Appendix G)*
- *Paleontological Resources Assessment Report (Appendix H).*

5.4.2 REGULATORY SETTING

Earthquake Hazards Reduction Act

The Earthquake Hazards Reduction Act was enacted in 1997 to “reduce the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards and reduction program.” To accomplish this, the Act established the National Earthquake Hazards Reduction Program that provides characterization, and prediction of hazards and vulnerabilities; improvement of building codes and land use practices; risk reduction through post-earthquake investigations and education; development and improvement of design and construction techniques; improvement of mitigation capacity; and accelerated application of research results. This Act designated the Federal Emergency Management Agency (FEMA) as the lead agency of the program and assigns it several planning, coordinating, and reporting responsibilities. Programs under this Act provide building code requirements such as emergency evacuation responsibilities and seismic code standards such as those to which development under the proposed Project would be required to adhere to.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act was passed in 1972 to mitigate the hazard of surface fault rupture to structures used for human occupancy. The main purpose of the Act is to prevent the construction of buildings for human occupancy on top of the traces of active faults. It was passed into law following the February 1971 magnitude 6.5 San Fernando (Sylmar) Earthquake that resulted in over 500 million dollars in property damage and 65 deaths. Although the Act addresses the hazards associated with surface fault rupture, it does not address other earthquake-related hazards, such as seismically induced ground shaking, liquefaction, or landslides.

This Act requires the State Geologist to establish regulatory zones, now referred to as Earthquake Fault Zones, around the mapped surface traces of active faults, and to publish appropriate maps that depict these zones. Earthquake Fault Zone maps are publicly available and distributed to all affected cities, counties, and state agencies for their use in planning and controlling new or renewed construction. The Act requires local agencies to regulate development within Earthquake Fault Zones. Before a development project can be permitted within an Earthquake Fault Zone, a geologic investigation is required to demonstrate that proposed buildings would not be constructed across active faults. A site-specific evaluation and written report

must be prepared by a licensed geologist. If an active fault is found, a structure for human occupancy cannot be placed over the trace of the fault and must be set back a minimum of 50 feet from the fault.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act, which was passed by the California legislature in 1990, addresses earthquake hazards related to liquefaction and seismically induced landslides. Under the Act, seismic hazard zones are mapped by the State Geologist in order to assist local governments in land use planning. The Act states “it is necessary to identify and map seismic hazard zones in order for cities and counties to adequately prepare the safety element of their general plans and to encourage land use management policies and regulations to reduce and mitigate those hazards to protect public health and safety.” Section 2697(a) of the Act states that “cities and counties shall require, prior to the approval of a project located in a seismic hazard zone, a geotechnical report defining and delineating any seismic hazard... Each city and county shall submit one copy of each approved geotechnical report, including the mitigation measures, if any, that are to be taken, to the State Geologist within 30 days of its approval of the report.”

California Building Code

The California Building Code (CBC) is included in Title 24 of the California Code of Regulations. The CBC incorporates the International Building Code, a model building code adopted across the United States. Current state law requires every city, county, and other local public agency enforcing building regulations to adopt the provisions of the CBC within 180 days of its publication. The publication date of the CBC is established by the California Building Standards Commission. The current CBC was adopted by the City and is included in Title 8 of the City’s Municipal Code. These codes provide standards to protect property and public safety. They regulate the design and construction of excavations, foundations, building frames, retaining walls, and other building elements, and thereby mitigate the effects of seismic shaking and adverse soil conditions. The codes also regulate grading activities, including drainage and erosion control.

California Construction General Permit

The State of California adopted a Statewide National Pollutant Discharge Elimination System (NPDES) Permit for General Construction Activity (Construction General Permit) on September 2, 2009 (Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ). The last Construction General Permit amendment became effective on July 17, 2012. The Construction General Permit regulates construction site storm water management. Dischargers whose projects disturb one or more acres of soil, or whose projects disturb less than one acre but are part of a larger common plan of development that in total disturbs one or more acres, are required to obtain coverage under the general permit for discharges of storm water associated with construction activity.

To obtain coverage under this permit, project operators must electronically file Permit Registration Documents, which include a Notice of Intent, a Storm Water Pollution Prevention Plan (SWPPP), and other compliance-related documents, including a risk-level assessment for construction sites, an active storm water effluent monitoring and reporting program during construction, rain event action plans, and numeric action levels (NALs) for pH and turbidity, as well as requirements for qualified professionals to prepare and implement the plan. The Construction General Permit requires the SWPPP to identify Best Management Practices (BMPs) that will be implemented to reduce soil erosion. Types of BMPs include preservation of vegetation and sediment control (e.g., fiber rolls).

California Public Resources Code Section 5097.5 and Section 30244

California Public Resources Code Sections 5097.5 and 30244 prohibit the removal of any paleontological site or feature from public lands without permission of the jurisdictional agency, define the removal of paleontological sites or features as a misdemeanor, and require reasonable mitigation of adverse impacts to paleontological resources.

City of Santa Ana General Plan

The existing General Plan Historic Preservation Element and Safety Element includes the following policies related to geology and soils:

Historic Preservation Element

- POLICY HP-1.4** Support land use plans and development proposals that actively protect historic and cultural resources. Preserve tribal, archeological, and paleontological resources for their cultural importance to communities as well as their research and educational potential.

Safety Element

- POLICY S-3.2** Ensure that all new development abides by the current City and state seismic and geotechnical requirements and that projects located in areas with potential for geologic or seismic hazards prepare a hazards study.

City of Santa Ana Municipal Code

Municipal Code Chapter 8, Article 2, Division 1; California Building Code: The CBC has been amended and adopted as Chapter 8, Article 2, Division 1 of the City's Municipal Code (Building Code). This regulates all building and construction projects within the City limits and implements a minimum standard for building design and construction. These minimum standards include specific requirements for seismic safety, excavation, foundations, retaining walls and site demolition. It also regulates grading activities including drainage and erosion control.

Section 18-156; Control of Urban Runoff: This code section states that all new development and significant redevelopment within the City shall be undertaken in accordance with the County Drainage Area Management Plan (DAMP), including but not limited to the development project guidance; and any conditions and requirements established by City agencies related to the reduction or elimination of pollutants in storm water runoff from the project site. Prior to the issuance by the City of a grading permit, building permit or nonresidential plumbing permit for any new development or significant redevelopment, City agencies are required to review the project plans and impose terms, conditions and requirements on the project. The owner of a new development or significant redevelopment project shall implement and adhere to the terms, conditions and requirements of the new development or significant redevelopment project.

5.4.3 ENVIRONMENTAL SETTING

Regional Setting

The Project region is located within the Los Angeles Basin which is part of the Peninsular Range Geomorphic Province of California. The Peninsular Ranges are characterized by a series of northwest trending mountain ranges separated by valleys. Range geology consists of granitic rock intruding the older metamorphic rocks. Valley geology is characterized by shallow to deep alluvial basins consisting of gravel, sand, silt, and clay (Appendix G).

The Project region is located at the southern margin of the Los Angeles Basin, which ends abruptly with the Newport-Inglewood uplift. The uplift is characterized by coastal mesas of late Miocene to early Pleistocene marine sediments and late Pleistocene marine terrace deposits.

Faults and Ground Shaking

In 1972, the Alquist-Priolo Special Studies Zones Act was signed into law. In 1994, it was renamed the Alquist-Priolo Earthquake Fault Zoning Act (A-P Act). The primary purpose of the A-P Act 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 A-P Act requires the State Geologist (Chief of the California Geology Survey) to delineate “Earthquake Fault Zones” along with faults that are “sufficiently active” and “well-defined.” The boundary of an “Earthquake Fault Zone” is generally about 500 feet from major active faults and 200 to 300 feet from well-defined minor faults. The A-P Act dictates that cities and counties withhold development permits for sites within an Alquist-Priolo Earthquake Fault Zone until geologic investigations demonstrate that the site zones are not threatened by surface displacements from future faulting. Seismic activity has been known to cause surface rupture, or ground displacement, along a fault or within the general vicinity of a fault zone.

As described by the GPU FEIR, the City is located within the Peninsular Ranges Geomorphic Province that is traversed by a group of subparallel and fault zones trending roughly northwest. Major active fault systems—San Andreas, San Jacinto, Whittier-Elsinore, and Newport-Inglewood fault zones—form a regional tectonic framework consisting primarily of right-lateral, strike-slip movement. Santa Ana is situated between two major active fault zones—the Whittier-Elsinore Fault Zone to the northeast and the Newport-Inglewood Fault to the southwest. Other potentially active faults near Santa Ana include the Elysian Park blind thrust; Chino-Central Avenue, San Joaquin Hills blind thrust, and San Jose, Cucamonga, Sierra Madre, and Palos Verdes faults. The GPU FEIR describes that Newport-Inglewood Fault is the dominant active fault that could significantly impact the City.

The Project site is not located within an Alquist-Priolo Fault Zone and no active faults are known to cross the site. The closest known active faults are associated with the San Joaquin Hills Fault, located approximately 1.3 miles northeast of the site and the Newport-Inglewood Fault Zone, approximately 4.1 miles southwest of the site (Appendix G).

However, all of Southern California is seismically active. The amount of motion expected at a building site can vary from none to forceful depending upon the distance to the fault, the magnitude of the earthquake, and the local geology. Greater movement can be expected at sites located on poorly consolidated material such as alluvium located near the source of the earthquake epicenter or in response to an earthquake of great magnitude.

Onsite Soils

Based on geologic maps, the Project site is situated on Holocene alluvial soils. The near surface soils are characterized by young axial channel deposits (Appendix G). The Geotechnical Report describes that the site is generally comprised of three distinct soil zones to the maximum depth explored to 115 feet below ground surface (bgs) that include:

- Soil Zone 1 – From a depth of 0 to 30 feet, which consists predominantly of medium stiff to stiff lean clay and fat clay with medium high plasticity;
- Soil Zone 2 – From a depth of 30 to 80 feet, which consists of a mixed soil condition with interbedded silty sand, poorly-graded sands and lean clays;
- Soil Zone 3 – From a depth of 80 to 100 feet, which consists of very dense poorly graded sands.

Groundwater

The Geotechnical Report (Appendix G) describes that historic highest groundwater at the site has been mapped at a depth of about 5 feet bgs, and that groundwater during the geotechnical site investigation was encountered at a depth of between 12 feet and 16 feet bgs. However, that groundwater levels measured during the geotechnical investigation is a “snapshot” of the groundwater level and does not account for potential fluctuations in groundwater level due to seasonal and tidal variations.

Liquefaction and Settlement

Liquefaction occurs when vibrations or water pressure within a mass of soil cause the soil particles to lose contact with one another. As a result, the soil behaves like a liquid, has an inability to support weight, and can flow down very gentle slopes. This condition is usually temporary and is most often caused by an earthquake vibrating water-saturated fill or unconsolidated soil. Soils that are most susceptible to liquefaction are clean, loose, saturated, and uniformly graded fine-grained sands that lie below the groundwater table within approximately 50 feet below ground surface. Clayey (cohesive) soils or soils which possess clay particles in excess of 20 percent are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table. Lateral spreading refers to spreading of soils in a rapid fluid-like flow movement similar to water.

As shown in GPU FEIR Figure 5.6-2, *Liquefaction Zones*, a majority of the City is mapped by the California Geological Survey as being potentially susceptible to liquefaction. The Geotechnical Report identifies that the Project site has a low liquefaction potential due to the underlying soil composition. Onsite soils include clayey soils to a depth of approximately 30 feet below the existing ground surface. Underlying soils are mixed soil with interbedded dense to very dense silty sand, poorly-graded sands, and lean clays. Due to the density of cohesive nature of the soils in the upper 50 feet, liquefaction potential is considered low even though the depth of groundwater is in the range of 12 to 16 feet bgs with a historic high of 5 feet bgs (Appendix G).

Settlement is the vertical compression of soil due to load-bearing stress. The GPU FEIR describes that potential hazard posed by seismic settlement and/or collapse in the City is considered moderate based on the compressibility of the underlying alluvial soils and the presence of shallow groundwater. Strong ground shaking can cause settlement of alluvial soils and artificial fills if they are not adequately compacted. Based on the onsite soils and groundwater conditions, the Geotechnical Report determined that static and seismic settlement is a potential concern of the Project site. The seismic settlement potential is estimated to be at least 2 inches (Appendix G).

Lateral Spreading

Lateral spreading is a type of liquefaction induced ground failure associated with the lateral displacement of surficial blocks of sediment resulting from liquefaction in a subsurface layer. Once liquefaction transforms the subsurface layer into a fluid mass, gravity plus the earthquake inertial forces may cause the mass to move downslope towards a free face (such as a river channel or an embankment). Lateral spreading may cause large horizontal displacements and such movement typically damages pipelines, utilities, bridges, and structures. As described previously, the Project site contains relatively dense clayey layers that are not susceptible to liquefaction (Appendix G).

Subsidence

Ground subsidence is the gradual settling or sinking of the ground surface with little or no horizontal movement. Subsidence typically occurs in areas with subterranean oil, gas, or groundwater, and is most commonly associated with overdraft of groundwater. Effects of subsidence include fissures, sinkholes, depressions, and disruption of surface drainage. The GPU FEIR describes that there is no pattern of lowering

of the ground surface in Santa Ana and the risk of subsidence due to overdraft is generally low, with areas along the margins of the Santa Ana River and Santiago Creek most susceptible. Additionally, as described in the General Plan Seismic Safety Element, the potential for area and focal ground subsidence due to earthquakes is relatively low in Santa Ana. The Project site is not located within or near a potential subsidence area, as shown in Exhibit 4, *Potential Subsidence Areas*, in the General Plan Seismic Safety Element.

Landslides

Landslides and other slope failures are secondary seismic effects that are common during or soon after earthquakes. Areas that are most susceptible to earthquake induced landslides are steep slopes underlain by loose, weak soils, and areas on or adjacent to existing landslide deposits.

The Geotechnical Report describes that the existing elevation of the Project site is approximately 34 feet above mean sea level (msl) and that the site is not located within a mapped area considered potentially susceptible to seismically induced slope instability (Appendix G). In addition, the Project site is not adjacent to any hills or slopes that could be subject to a landslide.

Expansive Soils

Expansive soils are soils containing water-absorbing minerals that expand as they take in water. These soils can damage buildings due to the force they exert as they expand. Expansive soils contain certain types of clay minerals that shrink or swell as the moisture content changes; the shrinking or swelling can shift, crack, or break structures built on such soils. Arid or semiarid areas with seasonal changes of soil moisture experience a much higher frequency of problems from expansive soils than areas with higher rainfall and more constant soil moisture. The proposed Project is in a semiarid region with marked seasonal changes in precipitation; most rain falls in winter, and there is a long dry season in summer and autumn. Therefore, the City's climate is such that a relatively high incidence of soil expansion is expected where soils contain the requisite clay minerals.

The GPU FEIR describes that due to the presence of alluvial materials in the City, there is some potential for expansive soils throughout Santa Ana and that expansive soils testing prior to grading is required as part of a soil engineering report, per the CBC and the City of Santa Ana development and permitting requirements.

Expansion index testing was conducted on soil samples collected from the Project site, which determined that moderately to highly expansive soils are present onsite (Appendix G).

Paleontological Resources

Paleontological resources include any fossilized remains, traces, or imprints of organisms preserved in or on the earth's crust that are of paleontological interest and that provide information about the history of life on earth, except that the term does not include any materials associated with an archaeological resource or any cultural item defined as Native American human remains. Significant paleontological resources are defined as fossils or assemblages of fossils that are unique, unusual, rare, uncommon, or important to define a particular time frame or geologic strata, or that add to an existing body of knowledge in specific areas, in local formations, or regionally.

As described in the GPU FEIR, the City of Santa Ana is underlain by Holocene and Pleistocene alluvial deposits and early Pleistocene marine deposits. Below these deposits lie Miocene and late Cretaceous sedimentary rocks. Pleistocene sediments have a rich fossil history in Southern California. The most common Pleistocene terrestrial mammal fossils include the bones of mammoth, horse, bison, camel, and small mammals, but other taxa, including lion, cheetah, wolf, antelope, peccary, mastodon, capybara, and giant ground sloth, have been reported, as well as birds, amphibians, and reptiles such as frogs, salamanders, snakes, and

turtles. In addition to illuminating the striking differences between southern California in the Pleistocene and today, this abundant fossil record has been vital in studies of extinction, ecology, and climate change. Throughout Orange County, extinct Pleistocene animals are well known from alluvial sediments.

The Natural History Museum of Los Angeles County database search completed for the proposed Project identified records of six recorded fossil localities in the general Project vicinity; however, none of these were documented in the Project site. The localities in the vicinity are associated with units mapped as uplifted older (Pleistocene) marine terraces (Qop).

The Project site is underlain by Holocene-aged axial channel deposits (Qya) dating from the Holocene to perhaps the Late Pleistocene era. These soils are assigned a low paleontological resource sensitivity due to their relatively recent age. The Geotechnical Report details that only alluvium was encountered to a depth of 70 feet. However, a sedimentological shift was noted between 27 to 32 feet bgs. It is not known if the sedimentological shift indicates a presence of fossil-bearing older alluvium. Based on these findings, the Paleontological Resources Assessment determined that there is a low potential for paleontological resources near the ground surface, and that potential increases with depth.

5.4.4 THRESHOLDS OF SIGNIFICANCE

Appendix G of State CEQA Guidelines indicates that a project could have a significant effect if it were to:

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

- GEO-1i 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 4),
- GEO-1ii Strong seismic ground shaking,
- GEO-1iii Seismic-related ground failure, including liquefaction;
- GEO-1iv Landslides;
- GEO-2 Result in substantial soil erosion or the loss of topsoil;
- GEO-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;
- GEO-4 Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial direct or indirect risks to life or property;
- GEO-5 Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater; or
- GEO-6 Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.

5.4.5 METHODOLOGY

A Geotechnical Report was prepared for the Project site (Appendix G), which included field exploration, exploratory soil borings, acquisition of representative soil samples, laboratory testing, engineering analysis, and pertinent geological literature review. The laboratory testing determined the characteristics of the geology and soils that underlie the site. These subsurface conditions were then analyzed to identify potential significant impacts resulting from Project construction and operation in relation to geology and soils.

In determining whether a geotechnical related impact would result from the proposed Project, the analysis includes consideration of state law, including the California Building Code that is integrated into the City's Municipal Code, and implemented/verified during Project permitting approvals. In general, existing state law, building codes, and municipal codes that are implemented by the approving agency provide for an adequate level of safety or reduction of potential effects such that projects developed and operated to code reduce potential of impacts.

In determining whether a paleontological related impact would result from the proposed Project, the analysis includes consideration of the types of soils that exist on the Project site, the paleontological sensitivity of those soils, the past disturbance on the site, and the proposed excavation. Existing conditions and sensitivity were also determined through a fossil locality search conducted at the Natural History Museum of Los Angeles County on August 14, 2022. The purpose of the locality search was to identify previously recorded or otherwise known fossil localities in or adjacent to the Project area. The analysis combines these factors to identify the potential of Project construction to impact any unknown paleontological resources on the site.

5.4.6 ENVIRONMENTAL IMPACTS

Summary of Impacts Identified in the GPU FEIR

The GPU FEIR addressed impacts related to geology and soils in Chapter 5.6. The GPU FEIR determined that the location and underlying geology of the City make it likely to experience seismic hazards, including strong seismic ground shaking, and secondary hazards, such as liquefaction. No active surface faults are mapped and zoned under the Alquist-Priolo Earthquake Fault Zoning Act in the City. All structures that would be constructed in accordance with the GPU would be designed to meet or exceed current design standards as found in the latest CBC. With compliance to CBC regulations, impacts related to seismic hazards and geologic conditions including earthquakes, liquefaction, lateral spreading, subsidence, and expansive soils would be less than significant.

No significant impacts would occur as a result of slope stability hazards or installation of septic tanks (not proposed). The City of Santa Ana is mostly flat; therefore, landslides and debris flow would not affect the area. Additionally, the City prohibits the installation of septic tanks, and all future development would require connection to the City's sewer system.

Unstable geologic unit or soils conditions, including soil erosion, could result from development of the GPU. Mandatory compliance with existing regulations, including the preparation and submittal of a SWPPP and a soil engineering evaluation, would reduce soil erosion impacts to a less than significant level.

The GPU FEIR determined that grading and construction activities of undeveloped areas or redevelopment that require intensive soil excavation may potentially disturb paleontological resources. Therefore, the GPU FEIR included Mitigation Measures GEO-1 through GEO-3, which prescribe requirements for monitoring based on the sensitivity of sites for paleontological resources. Under GEO-1, areas that range from high to low sensitivity are required to prepare a Paleontological Resources Monitoring and Mitigation Plan. With adherence to Mitigation Measures GEO-1 through GEO-3, impacts to paleontological resources would be less than significant.

Proposed Specific Plan Project

IMPACT GEO-1i: THE PROJECT WOULD NOT DIRECTLY OR INDIRECTLY CAUSE POTENTIAL SUBSTANTIAL ADVERSE EFFECTS, INCLUDING THE RISK OF LOSS, INJURY, OR DEATH INVOLVING 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 EARTHQUAKE FAULT.

No Impact. As described previously, the Project site is not located within an Alquist-Priolo Earthquake Fault Zone and no active faults are known/recorded to cross the site. The closest known active faults are associated with the San Joaquin Hills Fault, located approximately 1.3 miles northeast of the site; and the Newport-Inglewood Fault Zone, approximately 4.1 miles southwest of the site (Appendix G). The San Joaquin Hills fault does not rupture at the ground surface. Because no known faults exist on the site, the proposed Project would not expose people or structures to potential substantial adverse effects from rupture of a known earthquake fault that is delineated on an Alquist-Priolo Earthquake Fault Zoning Map or other evidence of a fault, and impacts would not occur. Therefore, impacts related to Project buildout of the site would be consistent with the impact conclusions set forth in the GPU FEIR, which determined that impacts related to surface rupture of a fault would be less than significant.

IMPACT GEO-1ii: THE PROJECT WOULD NOT DIRECTLY OR INDIRECTLY CAUSE POTENTIAL SUBSTANTIAL ADVERSE EFFECTS, INCLUDING THE RISK OF LOSS, INJURY, OR DEATH INVOLVING STRONG SEISMIC GROUND SHAKING.

Less than Significant Impact. The proposed Project would add residents, employees, and development within the Project site. The proposed Project site is within a seismically active region, with numerous faults capable of producing significant ground motions. The closest known active faults are associated with the San Joaquin Hills Fault, located approximately 1.3 miles northeast of the site; and the Newport-Inglewood Fault Zone, approximately 4.1 miles southwest of the site (Appendix G). Therefore, Project implementation could subject people and structures to hazards from ground shaking. However, seismic shaking is a risk throughout Southern California, and the Project site is not at greater risk of seismic activity or impacts as compared to other areas within the region.

The CBC includes provisions to reduce impacts caused by major structural failures or loss of life resulting from earthquakes or other geologic hazards. For example, Chapter 16 of the CBC contains requirements for design and construction of structures to resist loads, including earthquake loads. The CBC provides procedures for earthquake resistant structural design that include considerations for onsite soil conditions, occupancy, and the configuration of the structure including the structural system and height.

As described previously, the City of Santa Ana has adopted the CBC as part of the Municipal Code Chapter 8, Article 2, Division 1, which regulates all building and construction projects within the City and implements a minimum standard for building design and construction that includes specific requirements for seismic safety, excavation, foundations, retaining walls and site demolition. Structures built in the City are required to be built in compliance with the CBC. The proposed Project would be required to adhere to the provisions of the CBC as part of the building plan check and development review process. Compliance with the requirements of the CBC for structural safety would reduce hazards from strong seismic ground shaking. Because the proposed Project would be required to be constructed in compliance with the CBC and the City's Municipal Code, which would be verified through the City's plan check and permitting process and is included as PPP GEO-1, the proposed Project would result in a less than significant impact related to strong seismic ground shaking. Therefore, impacts related to Project buildout of the site would be consistent with the impact

conclusions set forth in the GPU FEIR, which determined that impacts related to ground shaking would be less than significant.

IMPACT GEO-1iii: THE PROJECT WOULD NOT DIRECTLY OR INDIRECTLY CAUSE POTENTIAL SUBSTANTIAL ADVERSE EFFECTS, INCLUDING THE RISK OF LOSS, INJURY, OR DEATH INVOLVING SEISMIC-RELATED GROUND FAILURE, INCLUDING LIQUEFACTION.

Less than Significant Impact. As described by the Geotechnical Report (Appendix G), the Project site consists of subsurface soils that consist of clayey soils that exist to a depth of approximately 30 feet bgs. Underlying soils include dense to very dense silty sand, poorly-graded sands, and lean clays. The highest historic groundwater on the Project site was encountered at approximately 5 feet bgs. Groundwater was encountered within onsite borings at depths between 12 feet and 16 feet bgs. However, due to the nature of the soils in the upper 50 feet, the Geotechnical Report determined that the liquefaction potential is considered low.

As described previously, structures built in the City are required to be built in compliance with the CBC, as included in the City's Municipal Code as Chapter 8, Article 2, Division 1 (and herein as PPP GEO-1), which regulates all building and construction projects within the City and implements a minimum standard for building design and construction that includes specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. Compliance with the CBC (included as PPP GEO-1) would require proper construction of building footings and foundations so that it would withstand the effects of potential ground movement, including liquefaction and settlement. The CBC also includes provisions to reduce impacts caused by potential major structural failures or loss of life resulting from geologic hazards. For example, the CBC requires that a California Certified Engineering Geologist or California-licensed civil engineer provide site-specific engineering data to demonstrate the satisfactory performance of proposed structures. The City requires the Project specific engineering design recommendations be incorporated into grading plans and building specifications as a condition of construction permit approval. Therefore, the development of the proposed Project would be required to conform to the seismic design parameters of the CBC, as included as PPP GEO-1, which are reviewed by the City for appropriate inclusion as part of the building plan check and development review process. Compliance with the requirements of the CBC and City's Municipal Code for structural safety (included as PPP GEO-1) would reduce hazards from seismic-related ground failure, including liquefaction and settlement to a less than significant level. Therefore, impacts related to Project buildout of the site would be consistent with the impact conclusions set forth in the GPU FEIR, which determined that impacts related to seismic-related ground failure would be less than significant.

IMPACT GEO-1iv: THE PROJECT WOULD NOT DIRECTLY OR INDIRECTLY CAUSE POTENTIAL SUBSTANTIAL ADVERSE EFFECTS, INCLUDING THE RISK OF LOSS, INJURY, OR DEATH INVOLVING LANDSLIDES.

No Impact. The proposed Project site is located in a seismically active region subject to strong ground shaking. However, as described previously, the Geotechnical Report describes that the Project site is generally level and no hills or slopes are adjacent to the site. In addition, the site is not within a seismically induced landslide hazard zone area and is not considered potentially susceptible to seismically-induced slope instability. Thus, the Project site is not located within or adjacent to an earthquake-induced landslide area, and the proposed Project would not expose people or structures to substantial adverse effects involving landslides, and impacts related to landslides would not occur. Therefore, impacts related to Project buildout of the site would be consistent with the impact conclusions set forth in the GPU FEIR, which determined that impacts related to landslides would be less than significant.

IMPACT GEO-2: THE PROJECT WOULD NOT RESULT IN SUBSTANTIAL SOIL EROSION OR THE LOSS OF TOPSOIL.

Less than Significant Impact. Construction of the proposed Project has the potential to contribute to soil erosion and the loss of topsoil. Grading and excavation activities that would be required for the proposed Project would expose and loosen topsoil, which could be eroded by wind or water.

The City's Municipal Code Chapter 18-156, Control of Urban Runoff implements the requirements of the Orange County Municipal NPDES Storm Water Permit (Order No. R8-2016-0001). All projects in the City are required to conform to the permit requirements, which includes installation of BMPs in compliance with the NPDES permit, which establishes minimum stormwater management requirements and controls that are required to be implemented for the proposed Project. To reduce the potential for soil erosion and the loss of topsoil, a Stormwater Pollution Prevention Plan (SWPPP) is required by the Regional Water Quality Control Board (RWQCB) regulations to be developed by a QSD (Qualified SWPPP Developer). The SWPPP is required to address site-specific conditions related to specific grading and construction activities. The SWPPP is required to identify potential sources of erosion and sedimentation loss of topsoil during construction, identify erosion control BMPs to reduce or eliminate the erosion and loss of topsoil, such as use of silt fencing, fiber rolls, or gravel bags, stabilized construction entrance/exit, hydroseeding. With compliance with the City's Municipal Code, RWQCB requirements, and the BMPs in the SWPPP that is required to be prepared to implement the proposed Project, construction impacts related to erosion and loss of topsoil would be less than significant.

In addition, the proposed Project includes installation of landscaping, such that during operation of the proposed Project substantial areas of loose topsoil that could erode would not exist. In addition, as described in Section 5.7, *Hydrology and Water Quality*, the onsite drainage features that would be installed by the proposed Project have been designed to slow, filter, and slowly discharge stormwater into the offsite drainage system, which would also reduce the potential for stormwater to erode topsoil during Project operations. Furthermore, implementation of the proposed Project requires City approval of a site-specific Water Quality Management Plan (WQMP), which would ensure that the City's Municipal Code, RWQCB requirements, and appropriate operational BMPs would be implemented to minimize or eliminate the potential for soil erosion or loss of topsoil to occur. As a result, potential impacts related to substantial soil erosion or loss of topsoil would be less than significant. Therefore, impacts related to Project buildout of the site would be consistent with the impact conclusions set forth in the GPU FEIR, which determined that impacts related to erosion or the loss of topsoil would be less than significant.

IMPACT GEO-3: THE PROJECT WOULD NOT 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.

Less than Significant Impact with Mitigation Incorporated. As described previously, the elevation of the site is approximately 34 feet above msl and the site is not located on or adjacent to a hillside or slope. Based on the relatively flat topography of the site, lack of a free face nearby and low liquefaction potential, the Geotechnical Report determined that the potential for lateral spreading on the site is low (Appendix G). Thus, impacts related to lateral spreading would be less than significant. Also, as described previously, impacts related to landslides would not occur.

However, as detailed in the Geotechnical Report (Appendix G), groundwater has been encountered at the site at between 5 and 16 feet bgs and excavations during Project construction are likely to encounter groundwater. The Geotechnical Report identified that excavations within potentially collapsible wet soils may need to be stabilized; and stabilization may consist of placement of a granular working mat consisting

of geogrid and coarse gravel or subexcavation and replacement with dried soil. All Project excavations would comply with the current California and Federal Occupational Safety and Health Administration (CALOSHA) requirements (29 CFR-Part 1926, Subpart P), as applicable and included in Project permitting. In addition, Mitigation Measure GEO-1 has been included to require that the proposed Project comply with a final design-level geotechnical report that must be completed in compliance with the current CBC requirements, and prepared to the satisfaction of the City's Building and Safety Division. Also, Mitigation Measure GEO-2 is included to ensure that geotechnical recommendations regarding groundwater induced unstable soils are implemented pursuant to existing CBC construction measures.

The Geotechnical Report identified that seismically-induced settlement onsite could be 2 inches or less; and differential seismic settlement is estimated to be at least 2 inches (Appendix G). The Geotechnical Report recommends that the Project implement CBC seismic structural design criteria that are specific to the onsite soils, including excavation and recompaction of soils, and development of foundation systems to reduce potential settlement. The City requires the Project-specific engineering design recommendations be incorporated into grading plans and building specifications as a condition of construction permit approval. These recommendations have been incorporated into Mitigation Measures GEO-1 and GEO-2.

Furthermore, the CBC, as currently adopted in the City's Municipal Code Chapter 8, Article 2, Division 1, requires that a California Certified Engineering Geologist or California-licensed civil engineer provide site-specific engineering data for the proposed structures, which are reviewed by the City for appropriate inclusion as part of the building plan check and development review process. Compliance with the requirements of the CBC and City's Municipal Code for structural safety is included as PPP GEO-1 and would also reduce potential impacts to a less than significant level. Therefore, due to the need for mitigation to ensure implementation of existing CBC measures, impacts related to Project buildout of the site would be slightly greater than the impact conclusions set forth in the GPU FEIR, which determined that impacts related to unstable soils would be less than significant with implementation of existing regulations.

IMPACT GEO-4: THE PROJECT WOULD BE LOCATED ON EXPANSIVE SOIL, AS DEFINED IN TABLE 18-1-B OF THE UNIFORM BUILDING CODE (1994) BUT WOULD NOT CREATE SUBSTANTIAL RISKS TO LIFE OR PROPERTY.

Less than Significant Impact with Mitigation Incorporated. The Project site contains lean and fat clays, and silty sand and poorly-graded sands with interbeds of clays, which have been tested and determined to have a medium to high potential for expansion due to the clay content (Appendix G). The clayey soils are present onsite from the ground surface to approximately 25 to 30 feet bgs. Therefore, the foundations of the buildings would be required to be designed to resist the expansion pressures. The Geotechnical Report describes that excavation and recompaction of soils, and design of foundation systems would reduce potential effects of expansive soils to a less than significant level.

Prior to approval of construction, an engineering level design geotechnical report is required to be prepared and submitted to the City that details the project designs that have been included to address potential geotechnical and soil conditions pursuant to the CBC requirements that are included in the City's Municipal Code Chapter 8, Article 2, Division 1, and implemented by Mitigation Measures GEO-1 and GEO-2. Compliance with the CBC, through design level geotechnical specifications that would be reviewed and approved by the City Building and Safety Division would ensure that potential impacts related to expansive soils would be less than significant. Therefore, due to the need for mitigation to ensure implementation of existing CBC measures, impacts related to Project buildout of the site would be slightly greater than the impact conclusions set forth in the GPU FEIR, which determined that impacts related to expansive soil would be less than significant with implementation of existing regulations.

IMPACT GEO-5: THE PROJECT WOULD NOT RESULT IN SOILS INCAPABLE OF ADEQUATELY SUPPORTING THE USE OF SEPTIC TANKS OR ALTERNATIVE WASTEWATER DISPOSAL SYSTEMS WHERE SEWERS ARE NOT AVAILABLE FOR DISPOSAL OF WASTEWATER.

No Impact. The Project site is currently connected to the City's sewer system. As detailed in Chapter 3.0, *Project Description*, the Project would install a new onsite sewer system that would connect to the existing 78-inch sewer in Sunflower Avenue. The proposed Project would not use septic tanks or alternative wastewater disposal systems. As a result, no impacts related to septic tanks or alternative wastewater disposal systems would occur from implementation of the proposed Project. Therefore, impacts related to Project buildout of the site would be less than the impact conclusions set forth in the GPU FEIR, which determined that impacts related to septic tanks would be less than significant.

IMPACT GEO-6: THE PROJECT WOULD NOT DIRECTLY OR INDIRECTLY DESTROY A UNIQUE PALEONTOLOGICAL RESOURCE OR SITE OR UNIQUE GEOLOGIC FEATURE.

Less than Significant Impact with Mitigation Incorporated. As described in Appendix H, the Project site is underlain by Holocene-aged axial channel deposits, and due to the young age of the onsite soils, it is unlikely that excavation at the surface would impact fossil resources. However, Pleistocene age alluvium may exist below the younger axial channel deposits which could yield fossils. Throughout Orange County, extinct Pleistocene animals are well known from alluvial sediments. Thus, excavation and grading during construction of the proposed Project has the potential to impact paleontological resources. As such, impacts to paleontological resources within the Project site are potentially significant. Therefore, GPU FEIR Mitigation Measures GEO-2 and GEO-3 would be required to confirm onsite sediments and provide measures in the case that a fossil is discovered onsite. In addition, Mitigation Measures PALEO-1 through PALEO-3 have been included to retain a qualified paleontologist prior to the start of excavation, provide paleontological resources sensitivity training, and monitor the site for excavations below 20 feet bgs. Mitigation Measure PALEO-4 has been included to identify and catalog any significant fossils and Mitigation Measure PALEO-5 has been included to prepare a Paleontological Resources Monitoring Report that summarizes the findings. Thus, with implementation of GPU FEIR and Project-specific mitigation measures, impacts related to paleontological resources would be less than significant. Therefore, impacts related to Project buildout of the site would be consistent with the impact conclusions set forth in the GPU FEIR, which determined that impacts related to paleontological resources would be less than significant with the implementation of mitigation.

5.4.7 CUMULATIVE IMPACTS

The potential cumulative exposure of people or structures to unstable geologic units and/or expansive soils that have the potential to result in onsite or offsite landslides, lateral spreading, subsidence, liquefaction, movement, or collapse tend to be localized in nature, as each site-specific development has unique geologic considerations. For geology and soils, the cumulative study area consists of the area that could be affected by proposed Project activities and the areas affected by other projects whose activities could directly or indirectly affect the geology and soils of the project site. The cumulative impacts are evaluated in light of development projections in the recent City General Plan update and GPU FEIR.

Site-specific development projects within Santa Ana and adjacent areas within the City of Costa Mesa are subject to uniform site-development policies and construction standards imposed by the Cities that are based on the state requirements in the CBC and site-specific geotechnical studies prepared to define site-specific conditions that might pose a risk to safety, such as those described previously for the proposed Project. While increases in the number of people and structures subject to unstable geologic units and soils would increase

in the proposed Project and with cumulative development, given the application of CBC requirements by the City through the construction permitting process, the cumulative effects would be less than significant.

Paleontological Resources: Paleontological Resources: The geographic area of potential cumulative impacts related to paleontological resources includes areas that are underlain by similar geologic units from the same time period, which includes the Orange County region. A cumulative impact could occur if development projects incrementally result in the loss of the same types of unique paleontological resources. As detailed in the City's GPU FEIR, the City, including the Project site, vary in paleontological sensitivity from low to high sensitivity increasing with depth. However, with incorporation of the GPU FEIR Mitigation Measures GEO-1 through GEO-3 and Project specific Mitigation Measures PALEO-1 through PALEO-5, which require paleontological monitoring and provides procedures for fossil recovery which would preserve the quality and integrity of these resources, avoid them when possible, and salvage and preserve them if avoidance is not possible. These measures would reduce the potential for the proposed Project to result in cumulatively considerable impacts to a less than significant level. Therefore, impacts would be less than cumulatively significant.

5.4.8 EXISTING STANDARD CONDITIONS AND PLANS, PROGRAMS, OR POLICIES

PPP GEO-1: CBC Compliance. The proposed Project is required to comply with the California Building Standards Code (CBC) as included in the City's Municipal Code as Chapter 8, Article 2, Division 1, to preclude significant adverse effects associated with seismic and soils hazards. As part of CBC compliance, CBC related and geologist and/or civil engineer specifications for the proposed Project shall be incorporated into grading plans and building specifications as a condition of construction permit approval.

5.4.9 LEVEL OF SIGNIFICANCE BEFORE MITIGATION

Upon implementation of regulatory requirements, Impacts GEO-1 through GEO 2 would be less than significant.

Without mitigation, the following impacts would be potentially significant:

- Impact GEO-3: Geologic unstable units or soils that could result in lateral spreading, subsidence, liquefaction, or collapse.
- Impact GEO-4: Expansive soils could result in impacts related to risks to life or property.
- Impact GEO-6: Direct or indirect impacts and cumulative impacts to paleontological resources.

5.4.10 MITIGATION MEASURES

GPU FEIR Mitigation Measures

GEO-1 High Sensitivity. Projects involving ground disturbances in previously undisturbed areas mapped as having "high" paleontological sensitivity shall be monitored by a qualified paleontological monitor on a full-time basis, under the supervision of the Qualified Paleontologist. Monitoring shall include inspection of exposed sedimentary units during active excavations within sensitive geologic sediments. The monitor shall have authority to temporarily divert activity away from exposed fossils to evaluate the significance of the find and, if the fossils are determined to be significant, professionally, and efficiently recover the fossil specimens and collect associated data. The paleontological monitor shall use field data forms to record pertinent location and geologic data, measure stratigraphic sections (if applicable), and collect appropriate sediment samples from any fossil localities.

Proposed Project Applicability: Mitigation Measure GEO-1 is not applicable to the proposed Project, as the site is not located within an area of high sensitivity.

GEO-2 Low-to-High Sensitivity. Prior to issuance of a grading permit for projects involving ground disturbance in previously undisturbed areas mapped with “low- to-high” paleontological sensitivity (see Figure 5.6-3), the project applicant shall consult with a geologist or paleontologist to confirm whether the grading would occur at depths that could encounter highly sensitive sediments for paleontological resources. If confirmed that underlying sediments may have high sensitivity, construction activity shall be monitored by a qualified paleontologist. The paleontologist shall have the authority to halt construction during construction activity as outlined in Mitigation Measure GEO-3.

Proposed Project Applicability: Mitigation Measure GEO-2 is applicable to the proposed and will be included in the Mitigation Monitoring and Reporting Program (MMRP) for the proposed Project.

GEO-3 All Projects. In the event of any fossil discovery, regardless of depth or geologic formation, construction work shall halt within a 50-foot radius of the find until its significance can be determined by a Qualified Paleontologist. Significant fossils shall be recovered, prepared to the point of curation, identified by qualified experts, listed in a database to facilitate analysis, and deposited in a designated paleontological curation facility in accordance with the standards of the Society of Vertebrate Paleontology (2010). The most likely repository is the Natural History Museum of Los Angeles County (NHMLA). The repository shall be identified, and a curatorial arrangement shall be signed, prior to collection of the fossils.

Proposed Project Applicability: Mitigation Measure GEO-3 is applicable to the proposed Project and will be included in the MMRP for the proposed Project.

Proposed Specific Plan Project Mitigation Measures

MM GEO-1: Incorporation of and Compliance with a Design Level Geotechnical Report. A final design level geotechnical report that complies with all applicable state and local code requirements shall be prepared for each Project structure by a California licensed qualified geotechnical engineer consistent with the California Building Code and City of Santa Ana requirements applicable at the time of grading/construction and shall include recommendations related to site grading and earthwork, fill materials, compaction, foundations, and other structural elements. The report recommendations shall be included in construction specifications and permits; and confirmed through onsite inspections.

MM GEO-2: Implementation of Geotechnical Recommendations for Groundwater and Expansive Soils. Project plans, grading specifications, and construction permitting shall incorporate site specific earthwork and ground improvement requirements related to groundwater saturated soils and expansive soils consistent with the California Building Code and City of Santa Ana requirements applicable at the time of grading/construction as stated in a design level geotechnical report and approved by the City’s Building and Safety Division. This shall include recommendations related to discovery of groundwater, wet soils, or unstable soils during grading, stabilization, dewatering, fill materials, and foundations.

MM PALEO-1: Retention of a Qualified Paleontologist. Project plans, grading specifications, and construction permitting shall ensure that prior to the start of excavation, the client shall retain a Qualified Paleontologist who meets the professional criteria established by the Society of Vertebrate Paleontology (SVP 2010) to oversee the implementation of all paleontological resources mitigation requirements for the proposed Project.

MM PALEO-2: Paleontological Resources Sensitivity Training. Project plans, grading specifications, and construction permitting shall ensure that prior to the start of excavations, the Qualified Paleontologist, or their designee, shall conduct paleontological resources awareness training for onsite personnel. The training session shall focus on how to identify paleontological resources that may be encountered during excavations and the procedures to be followed in the event of their discovery. The City shall ensure onsite personnel are made available for and attend the training and retain documentation demonstrating attendance.

MM PALEO-3: Paleontological Monitoring. Project plans, grading specifications, and construction permitting shall detail that paleontological resources monitoring shall be required for excavations below 20 feet below ground surface (bgs). Paleontological monitoring shall be conducted by a monitor who meets the professional criteria established by the Society of Vertebrate Paleontology working under the direct supervision of the Qualified Paleontologist. Monitoring can be reduced, or ceased entirely, if determined adequate by the Qualified Paleontologist.

Recommendations for reduction or cessation of monitoring will be based on a more accurate understanding of the lithologic character and age of the sediments exposed during excavation. If deeper excavations continue to encounter younger, Holocene alluvium, monitoring shall be reduced from full-time to part-time monitoring or weekly inspections. If the Qualified Paleontologist determines, based on the lithologic character of the sediments, that there is very little likelihood of impacting Pleistocene marine sediments, paleontological monitoring shall cease entirely.

The paleontological monitor shall collect any identifiable fossils encountered during the excavations. If onsite personnel discover potential fossils during excavations when a paleontological monitor is not present, they shall cease excavation within 50 feet of the discovery and contact the Qualified Paleontologist. Construction activities may resume after the discovery is assessed by the Qualified Paleontologist and appropriate treatment measures have been implemented.

MM PALEO-4: Paleontological Resources Treatment and Disposition. Project plans, grading specifications, and construction permitting shall require that significant fossils be prepared to the point of identification and cataloged. Significant fossils shall be curated at a public, non-profit institution with a research interest in the material and with retrievable storage, such as the Natural History Museum of Los Angeles County, if such an institution agrees to accept the fossils. If no institution accepts the fossil collection, then the fossils may be donated to a local museum, historical society, school, or other institution for educational purposes. Accompanying notes, reports, maps, and photographs shall also be filed with the final repository.

MM PALEO-5: Paleontological Resources Monitoring Report. Project plans, grading specifications, and construction permitting shall ensure that upon completion of the excavation phase of the Project, the Qualified Paleontologist shall prepare a report summarizing the results of the monitoring efforts. The report shall be submitted to the City to signify the satisfactory completion of required paleontological mitigation measures. If significant fossils are discovered, the report shall also be submitted to the appropriate repositories.

5.4.11 LEVEL OF SIGNIFICANCE AFTER MITIGATION

Compliance with existing regulatory programs and implementation of GPU FEIR Mitigation Measures GEO-1, GEO-2, GEO-3, and PALEO-1 through PALEO-5 would reduce potential impacts associated with potential geotechnical hazards and unique paleontological resource impacts to a level that is less than

significant. Therefore, no significant unavoidable adverse impacts related to geology and soils and paleontological resources would occur.

REFERENCES

- City of Santa Ana General Plan Update. April 2022. Accessed: <https://www.santa-ana.org/general-plan-documents/>
- City of Santa Ana General Plan Update Final Recirculated Draft Program Environmental Impact Report - October 2021. Accessed: <https://www.santa-ana.org/general-plan-environmental-documents/>
- Preliminary Investigation Report Related Bristol Project. August 2022. Prepared by Group Delta Consultants, Inc. (Appendix G)
- Related Bristol, Santa Ana, California Paleontological Resources Assessment Report. January 2023. Prepared by ESA. (Appendix H)
- State Water Resources Control Board Construction Storm Water Program. Accessed: http://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.shtml