4.5 Geology and Soils

This section of the EIR describes the geologic and soil characteristics of the project site and the potential geology and soils impacts associated with construction and operation of the Project. The analysis in this section is largely based on the *Supplemental Geotechnical Evaluation and Update*, prepared by EEI Geotechnical & Environmental Solutions (EEI, 2016), which is included as Appendix E of this EIR. Additional descriptions of erosion and sediment impacts on surface water (e.g., turbidity) and mitigation, as appropriate, are presented in Section 4.8, *Hydrology and Water Quality*.

4.5.1 REGULATORY SETTING

Federal

International Building Code

The International Building Code (IBC) is the national model building code providing standardized requirements for construction. The IBC replaced earlier regional building codes (including the Uniform Building Code) in 2000 and established consistent construction guidelines for the nation. In 2006, the IBC was incorporated into the 2007 California Building Code, and currently applies to all structures being constructed in California. The 2015 IBC is the most recent addition. The national model codes are therefore incorporated into the building codes of local municipalities, such as the California Building Code discussed below. The California Building Code includes building design and construction criteria that take into consideration the State's seismic conditions.

Earthquake Hazards Reduction Act

The Earthquake Hazards Reduction Act of 1977 established the National Earthquake Hazards Reduction Program (NEHRP). Under the NEHRP, four federal agencies have responsibility for long-term earthquake risk reduction: the U.S. Geological Survey (USGS), the National Science Foundation, the Federal Emergency Management Agency (FEMA), and the National Institute of Standards and Technology. NEHRP's mission includes improved understanding, characterization, and prediction of hazards and vulnerability; improvements of building codes and land use practices; risk reduction through post-earthquake investigation and education; development and improvement of design and construction techniques; improvement of mitigation capacity; and accelerated application of research results.

State

California Building Code

The California Building Code (also known as the "California Building Standards Code" or CBC) is promulgated under the *California Code of Regulations* (CCR), Title 24 (Parts 1 through 12) and is administered by the California Building Standards Commission. Local agencies must ensure the development complies with the guidelines contained beyond the CBC. Cities and counties have the ability to adopt additional building standards beyond the CBC. CBC Part 2, named in the California Building Code is based upon the 2012 International Building Code with necessary California amendments, and Part 11, named the California Green Building Standards Code, and is also called the CalGreen Code.

The Alquist-Priolo Earthquake Fault Zoning Act of 1972

The Alquist-Priolo Earthquake Fault Zoning Act (Alquist-Priolo Act) was passed in 1972 to regulate development and construction of buildings intended for human occupancy to avoid the hazard of surface fault rupture along known active faults. Under the Alquist-Priolo Act, the California State Geologist identifies areas that are at risk of surface fault rupture. The primary purpose of the Alquist-Priolo Act is to reduce the threat to life and property, specifically from surface fault rupture, by preventing the construction of buildings used for human occupancy on the surface trace of active faults. An active fault is defined by the State Mining and Geology Board as one which has "had surface displacement within Holocene time (about the last 11,000 years)." This definition does not mean that faults that lack evidence of surface displacement within Holocene times are necessarily inactive. A fault may be presumed to be inactive based on satisfactory geologic evidence; however, the evidence necessary to prove inactivity is sometimes difficult to obtain and locally may not exist.

The State of California Geological Survey (CGS), previously known as the California Division of Mines and Geology, has compiled Special Publication 42 – Fault Rupture Hazard Zones that delineates and defines active fault traces and zones that require specific studies to address rupture hazards with respect to "structure[s] for human occupancy" (CGS, 2007) Any project that involves the construction of buildings or structures for human occupancy is subject to the Alquist-Priolo Act, and any structures for human occupancy must be located at least 50 feet from any active fault.

Seismic Hazards Mapping Act

In accordance with Public Resources Code, Chapter 7.8, Division 2, the CGS is directed to delineate Seismic Hazard Zones through the Seismic Hazards Zonation Program. The purpose of the Seismic Hazards Mapping Act is to reduce the threat to public health and safety and to minimize the loss of life and property by identifying and mitigating seismic hazards, such as those associated with strong ground shaking, liquefaction, landslides, other ground failures, or other hazards caused by earthquakes. Cities, counties, and State agencies are directed to use seismic hazard zone maps developed by CGS in their land-use planning and permitting processes. In accordance with the Seismic Hazards Mapping Act, site-specific geotechnical investigations must be performed prior to permitting most urban development projects within seismic hazard zones.

Regional and Local

City of Newport Beach General Plan Safety Element

The primary goal of the *City of Newport Beach General Plan's* Safety Element is to reduce the potential risk of death, injuries, property damage, and economic and social dislocation resulting from natural and human-induced hazards. The Safety Element specifically addresses coastal hazards, geologic hazards, seismic hazards, flood hazards, wildland and urban fire hazards, hazardous materials, aviation hazards, and disaster planning. The Project's consistency with applicable General Plan safety goals and policies is provided in Section 4.9, *Land Use and Planning*.

City of Newport Beach Municipal Code

Title 15 (Buildings and Construction), Chapter 15.10 Excavation and Grading Code

Chapter 15.10 of the City's Municipal Code regulates grading, drainage, and hillside construction. Grading permits are required for all project sites requiring excavation, fills, and paving. This code provides for the approval of grading and building plans and inspection of grading and construction, and drainage control for projects in compliance with the current Municipal Separate Storm Sewer System (MS4) Permit issued by the California Regional Water Quality Control Board, Santa Ana Region (Santa Ana RWQCB), under the National Pollutant Discharge Elimination System (NPDES) permitting process.

4.5.2 ENVIRONMENTAL SETTING

Site Topography

The elevation of the project site range from approximately 46 feet above mean sea level (msl) to approximately 52 feet above msl. In general, the overall project site ground surface is relatively level with a gentle slope to the west.

Geologic Setting

Regionally, the site lies within the Peninsular Ranges Geomorphic Province of Southern California. This province consists of a series of ranges separated by northwest tending valley, sub-parallel to branches of the San Andreas Fault. The Peninsular Ranges Geomorphic Province, one of the largest geomorphic units in western North American, extends from the Transverse Ranges Geomorphic Province and the Los Angeles Basin, south to Baja California. It is bound on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by Colorado Desert Province. The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Major fault zones and subordinate fault zone found in the Peninsular Ranges Province typically tend in a northwest-southeast direction.

As a part of the Proposed Project, seven borings were drilled to depths ranging from 12 feet to approximately 49 feet below the ground surface (bgs). Subsurface exploration also included four cone penetration test soundings to a depth of approximately 75 feet bgs to determine the geotechnical properties of the soils and delineate subsurface soil stratigraphy.

The project site and surrounding area is predominately underlain by Quaternary terrace deposits overlying Miocene Monterey Formation. Soil has been identified by the United States Department of Agriculture – National Resources Conservation Service as belonging to a mixture of sandy loams of the Myford Series and Xeralfic arents, loamy, at 2 to 9 percent slopes. The soils of the Myford Series are deep, moderately well drained soils formed on terraces. These have medium to rapid runoff; and very slow permeability. The Xeralfic arents consists of well drained soils formed in sandy marine deposits (EEI, 2016a). Subsurface conditions encountered at the project site consisted of asphalt pavement and base, artificial fill and Pleistocene-aged old paralic deposits. Fill materials were encountered in each of the exploratory borings and extended to a depth of approximately 2 to 5 feet bgs across the project site. In general, the fill was composed of reddish brown to dark reddish brown mixed sands, silts, and clays. The Pleistocene-age old paralic deposits were encountered underlying the fill. In general, the old paralic deposits consists of loose to very dense sands with interbedded layers of loose to medium dense silty sand and clayey sand, and

soft to hard sandy-clay and silty-clay. A layer of stiff to hard clay underlies the sands at depths ranging from approximately 35 to 60 feet bgs.

Groundwater

There are no designated groundwater recharge areas in the City (Newport Beach, 2006). The Orange County Water District notes that the principal groundwater aquifer at the project site has ranged from approximately 50 to 110 feet bgs over the past 10 years. At the time of subsurface exploration of the site, a zone of heavy seepage was encountered at depths ranging from 20 to 25 feet bgs. The groundwater encountered represented intermittent seepage and perched zones throughout the site. The cone penetration test soundings indicated that groundwater was present at 23 feet bgs at the time of testing. Variations in groundwater may result from fluctuation in ground surface topography, subsurface stratifications, rainfall, and other factors. In general, groundwater is expected to follow the direction of surface topography; therefore, local groundwater flow is expected to be in a general westerly direction. Due to the varying groundwater depths at the site, there is the potential need for a Dewatering Permit to remove groundwater from under the site.

Per Newport Beach Municipal Code Policy 15.10.140, if dewatering is necessary, a dewatering plan showing the location of the following is required:

- Location of the dewatering wells and its depth;
- Location of the water pump(s) and the power source for the equipment and means of sound attenuation for pump(s) and any power generation on the job site; and
- Approval from RWQCB for dewatering.

Faulting and Seismicity

Most of Southern California is subject to ground shaking (ground motion) as a result of movement along active and potentially active fault zones in the region. A probabilistic seismic hazard analysis (PSHA) of horizontal ground shaking was performed to evaluate the likelihood of future earthquake ground motion occurring at the site. The PSHA uses seismic sources and attenuation equations consistent with the USGS National Seismic Hazard Maps. *Table 4.5-1* provides a summary of active fault zones within an approximately 40-mile radius of the project site that would potentially have a considerable effect on the site in the event significant activity is experienced.

Fault Rupture

Ground surface rupture along an earthquake fault may cause damage to aboveground infrastructure and other features. The State of California has mapped known active faults that may cause surface fault rupture in inhabited areas as part of the Alquist-Priolo Earthquake Fault Zoning Act. There are no known active faults crossing the project site and the site is not located within an Alquist-Priolo Earthquake Fault Zone as defined by the State. The likelihood of surface fault rupture at the site is relatively low and the risk is considered similar to other sites in the vicinity.

Table 4.5-1. Summary of Major Active Faults		
Fault Name	**Approximate Distance from Site (miles)**	**Maximum Moment Magnitude**
San Joaquin Hills	2.6	6.6
Newport-Inglewood (Los Angeles Basin)	5.5	7.1
Newport-Inglewood (Offshore)	6.0	7.1
Chino-Central Avenue (Elsinore)	15.8	6.7
Whittier	17.0	6.8
Palos Verdes	17.1	7.3
Puente Hills Blind Thrust	18.0	7.1
Elsinore (Glen Ivy)	18.3	6.8
San Jose	25.8	6.4
Coronado Bank	27.7	7.6
Elsinore (Temecula)	29.5	6.8
Upper Elysian Park Blind Thrust	31.0	6.4
Sierra Madre	32.2	7.2
Cucamonga	32.6	6.9
Raymond	34.4	6.5
Clamshell-Sawpit	36.2	6.5
Verdugo	36.3	6.9
Hollywood	37.8	6.4
Source: EEI, 2016b.		

Seismically-Induced Ground Shaking

Strong ground shaking from an earthquake can result in damage associated with landslides, ground lurching, structural damage, and liquefaction. The project site is subject to fairly high levels of seismically-induced ground shaking due to its proximity to the San Joaquin Hills Fault Zone. Other nearby seismic sources include the Los Angeles Basin and Offshore segments of the Newport-Inglewood fault, the Elsinore segment of the Chino-Central Avenue fault, and the Whittier fault; each of these active faults is capable of generating severe ground shaking at the project site. An analysis of seismic parameters and peak-ground acceleration was performed to quantify the peak ground acceleration that could be expected at the project site. The analysis concluded that the Peak Horizontal Ground Acceleration (PHGA), adjusted for site class effects, would be approximately 0.615g.[1]

Liquefaction and Lateral Spreading

Liquefaction is the loss of soil strength or stiffness due to a build-up of water pressure between soil particles during severe ground shaking or other rapid loading. This condition is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils that often make up alluvial materials. Lateral spreading is the finite, horizontal movement of material associated with pore pressure build-up or liquefaction. This process can occur in a shallow underlying deposit during an earthquake in

[1] Site acceleration during a seismic event is measured as a percent of gravity, or "g". For instance, 0.615g is 62 percent of the force of gravity.

areas susceptible to liquefaction. In order to occur, lateral spreading requires the existence of a continuous and laterally unconstrained liquefiable zone.

Lateral spreading is the finite, horizontal movement of material associated with pore pressure build-up or liquefaction. This process can occur in a shallow underlying deposit during an earthquake in areas susceptible to liquefaction. In order to occur, lateral spreading requires the existence of a continuous and laterally unconstrained liquefiable zone. Lateral spreading can occur on gently sloping and on flat ground close to rivers and lakes. These conditions do not exist within the project site, given the relatively level topography of the site and the lack of adjacent water bodies.

The City of Newport Beach Seismic Hazard Zones Map for the project vicinity indicates that the project site is not in an area considered susceptible to liquefaction. Exploratory borings conducted for the Project concludes that the site is susceptible to limited amounts of liquefaction. The potentially liquefiable soils consist of isolated and discontinuous thin lenses of saturated sands, silts, and clays.

The subsidence of soils is characterized by sinking or descending soils that occurs as the result of a heavy load being placed on underlying sediments, and may be triggered by seismic events. Seismically-induced settlement is dependent on the relative density of the subsurface soils. Settlements from collapsible soils can be relatively large and damaging to improvements. It is estimated that the total maximum seismic-induced settlement at the project site would be 1.5 inches at isolated locations. Differential earthquake-induced settlements estimated to be less than 1 inch across a 50-foot span.

4.5.3 THRESHOLDS OF SIGNIFICANCE

The following significance criteria are from the City of Newport Beach Environmental Checklist. The Project would result in a significant impact related to geology and soils if it would:

Threshold 4.5-1 Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death from 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.

Threshold 4.5-2 Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking.

Threshold 4.5-3 Expose people or structures to potential substantial adverse effects including the risk of loss, injury, or death from seismic-related ground failure, including liquefaction.

Threshold 4.5-4 Expose people or structures to potential substantial adverse effects including the risk of loss, injury, or death from landslides.

Threshold 4.5-5 Result in substantial soil erosion or the loss of top soil.

Threshold 4.5-6 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.

Threshold 4.5-7 Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

As previously discussed in Section 1.4, *Summary of Effects with No Impact*, in addition to the thresholds listed above, the City has determined that the Proposed Project would not have a significant impact on the following threshold for the reasons stated below, and that no further analysis was required:

- 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.

The project site has sewer connections maintained by the City of Newport Beach Municipal Operations Department. Wastewater treatment for the site is provided by the Orange County Sanitation District. The Project does not require septic tanks or assume alternative wastewater disposal systems.

4.5.4 ENVIRONMENTAL IMPACTS

Threshold 4.5-1:	**Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death from 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?**
Threshold 4.5-2:	**Would the Project expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?**

The project site is not located within an Alquist-Priolo Earthquake Fault Zone and no known active faults cross the site. The *Geotechnical Evaluation* determined that the likelihood of surface fault rupture at the site is relatively low and the risk is considered similar to other sites in the vicinity.

The CGS and the USGS have placed the City in an area designated to have a moderate to high potential for ground shaking associated with regional earthquake activity (CGS and USGS 2008). A site-specific analysis of the project site's potential to experience significant seismic ground motion was conducted and concludes that, although the site is not located within a designated Alquist-Priolo Earthquake Fault Zone, strong ground shaking due to regional seismic activity is anticipated.

Several active faults are near the project site, including the San Joaquin Hills fault (6.6 miles), Los Angeles Basin and Offshore segments of the Newport-Inglewood fault (7.1 miles), the Elsinore segment of the Chino-Central Avenue fault (6.7 miles), and the Whittier fault (6.8 miles). An analysis of seismic parameters and peak-ground acceleration was performed to quantify the peak ground acceleration that could be expected at the project site. The analysis concluded that the peak ground acceleration adjected for site class effect is approximately 0.615g.

Construction of the Proposed Project would be required to conform to the seismic design requirements of the 2016 CBC (or applicable adopted code at the time of plan submittal or grading and building permit issuance for construction) which would reduce anticipated impacts related to the proximity of earthquake faults by requiring structures to be built to withstand seismic ground shaking. Additionally, the Project

would need to comply with the City of Newport Beach Municipal Code, Chapter 15.10, Excavation and Grading Code, which requires approval of soil engineering and engineering geology report (SC 4.5-1). The Excavation and Grading Code also requires that recommendations included in the reports and approved by the building officials be incorporated in grading plans or specifications. The Project would also be required to adhere to the most recent seismic and geologic hazards standards (SC 4.5-2). Mitigation Measure (MM) 4.5-1 requires geotechnical evaluation to identify appropriate engineering design measures to reduce potential impacts relative to strong seismic ground shaking to less than significant.

State laws and local ordinances require that, prior to construction, potential seismic hazards be identified and mitigated, as needed, to protect public health and safety from substantial risks through appropriate engineering practices. Compliance with SC 4.5-1, SC 4.5-2, and MM 4.5-1 would ensure that impacts related to strong seismic ground shaking remain at a less than significant level. SC 4.5-1 identifies that the issuance of grading permits is subject to approval of geological and soils engineering reports. SC 4.5-2 requires that the Proposed Project to adhere to the most recent seismic and geologic hazards standards (SC 4.5-2). MM 4.5-1 requires geotechnical evaluation to identify appropriate engineering design measures to reduce potential impacts relative to strong seismic ground shaking to less than significant.

Impact Summary: ***Less Than Significant With Mitigation***. The Proposed Project would not result in any significant impacts in relation to a rupture of a known earthquake fault as delineated on the most recent Alquist-Priolo Earthquake Fault Map. The project site is in a seismically active area and strong ground shaking due to regional seismic activity is anticipated. Habitable structures on the site are subject to seismic design parameters that would appropriately address seismic building standards. Impacts associated with seismic shaking would be mitigated to a level considered less than significant with implementation of SC 4.5-1, SC 4.5-2, and MM 4.5-1.

Threshold 4.5-3:	**Would the Project expose people or structures to potential substantial adverse effects including the risk of loss, injury, or death from seismic-related ground failure, including liquefaction?**
Threshold 4.5-6:	**Would the Project 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?**

Based on the evaluation conducted in the *Geotechnical Evaluation* and *Supplemental Geotechnical Evaluation*, earth materials underlying the project site are considered susceptible to limited amounts of seismically-induced liquefaction. As previously addressed, it is estimated that the total maximum seismic-induced settlement at the site would be 1.5 inches at isolated locations. Differential earthquake-induced settlements estimated to be less than 1 inch across a 50-foot span. Liquefaction-induced lateral spreading would not be an impact because of the level topography of the site and distance from water sources.

Remedial grading would include the replacement of unsuitable materials with suitable engineered fill materials prior to recompaction with paralic deposits and/or other non-expansive materials. The resulting configuration would not be subject to liquefaction.

The assessment of hazards related to seismic activity has been completed consistent with the standards set forth in the California Building Code. There are no known geologic conditions on the project site that would render development infeasible. SC 4.5-1, SC 4.5-2, and MM 4.5-1 are applicable to the Project. Therefore, the risk associated with seismic-related ground failure and associated liquefaction, lateral spreading, or subsidence is less than significant level with mitigation.

Impact Summary: ***Less Than Significant With Mitigation***. The project site is in a seismically active area and considered susceptible to limited amounts of seismic induced liquefaction. Habitable structures on the project site are subject to seismic deign parameters that would appropriately address seismic building standards. Impacts associated with seismic shaking would be mitigated to a level considered less than significant with implementation of SC 4.5-1, SC 4.5-2, and MM 4.5-1. The potential for seismic shaking, landslides, lateral spreading, and subsidence are low and considered less than significant.

Threshold 4.5-4:	**Would the Project expose people or structures to potential substantial adverse effects including the risk of loss, injury, or death from landslides?**

The project site is located at an elevation of approximately 46 to 52 feet above msl. In general, the overall project site ground surface is relatively level with a gentle slope to the west. Due to the level topography on the project site and in area surrounding the site, landslides are not anticipated. According to the Seismic Hazard Zones Map for the Tustin Quadrangle, the site is not located within a Zone of Required Investigation for earthquake-induced landslides (CGS, 2001). Additionally, no historic landslides have been mapped within or adjacent to the site, nor were there any indications of landslides encountered during site reconnaissance performed for the *Geotechnical Evaluation*. Therefore, Project implementation would not expose people or structures to potential substantial adverse effects involving landslides.

Impact Summary: ***No Impact***. The project site is relatively level and landslides would not occur on the project site. No impacts would occur in this regard.

Threshold 4.5-5:	**Would the Project result in substantial soil erosion or the loss of topsoil?**

Soil erosion occurs when surface materials are worn away from the earth's surface due to land disturbance and/or natural factors such as wind and precipitation. The potential for soil erosion is determined by characteristics including texture and content, surface roughness, vegetation cover, and slope grade and length. Wind erosion typically occurs when fine-grained non-cohesive soils are exposed to high velocity winds, while water erosion tends to occur when loose soils on moderate to steep slopes are exposed to high-intensity storm events.

Short-Term Construction

The project site is currently developed with surface parking areas and landscaping. There is very limited areas of exposed topsoil on the site. Grading and earthwork activities during construction would expose soils to potential short-term erosion by wind and water. The project site would be graded, and foundation excavation would require the removal of approximately 127,730 cubic yards (cy) of material with an export of approximately 118,500 cy.

During construction, the Proposed Project would be required to comply with the NPDES permitting process. Standard Condition (SC) 4.8-1 in Section 4.8, *Hydrology and Water Quality*, identifies NPDES compliance requirements for the Project. The NPDES permitting process requires development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) and the Construction General Permit (General Permit; Orders No. 2009-009-DWQ as amended by Order 2010-0014-DWQ and 2012-006-DWQ) issued by the State Water Resources Control Board (SWRCB). The General Permit would include erosion-control and sediment-control Best Management Practices (BMPs) to be implemented throughout the construction process which would prevent or reduce erosion. Erosion-control BMPs are designed to prevent erosion, whereas sediment controls are designed to trap sediment once it has been mobilized. Upon completion, the Proposed Project would be fully developed and landscaped and no top soil would be exposed. The potential for top soil erosion or loss would be extremely minimal. These requirements would ensure that potential project impacts are less than significant.

Long-Term Operations

The project site is currently developed with surface parking and common landscape areas. The site is approximately 73 percent impervious with the landscaped areas being approximately 27 percent pervious. Upon completion, the Project would include three buildings, a free-standing parking structure, surface parking, and a 1.17-acre public park. The Proposed Project would include 7.31 acres of impervious surfaces and 3.79 acres of pervious surfaces (trees and landscaping). Pervious areas would be landscaped to prevent soil erosion; the remainder of the project site would be impervious and therefore not subject to soil erosion. Therefore, the Project would not result in substantial soil erosion or loss of top soil.

Impact Summary: ***Less Than Significant*****.** Grading activities would increase the potential for soil erosion and loss of topsoil. With the incorporation of construction BMPs as described in Section 4.8, *Hydrology and Water Quality*, Project impacts on soil erosion and loss of top soil would be less than significant. Upon completion of the Project, soil erosion and the loss of top soil would be minimized through the use of engineered grading, surface drainage improvements, and landscaping.

Threshold 4.5-7	**Would the Project be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?**

Soils that expand and contract in volume ("shrink-swell" pattern) are considered to be expansive and may cause damage to aboveground infrastructure as a result of density changes that shift overlying materials. Fine-grain clay sediments are most likely to exhibit shrink-swell patterns in response to changing moisture levels. Expansion index testing was performed to evaluate the expansion potential of on-site soils. The results of the laboratory testing of a localized pocket of fine grained materials sampled at a depth of 1 to 8 feet bgs indicate an Expansion Index of 107, which represents a high expansion potential for those soils. However, the on-site soils are variable and are anticipated to range from very low to medium to highly expansive. Without correction, expansive soils can be unsuitable for building. Mitigation Measure 4.5-1 is applicable and requires the Project plans for foundation design, earthwork, and site preparation to incorporate all the mitigation in the site-specific geotechnical investigations.

Impact Summary: ***Less Than Significant With Mitigation***. On-site soils have a very low to medium to high expansion potential. With the incorporation MM 4.5-1, impacts from the Project associated with expansive soils would be less than significant.

4.5.5 CUMULATIVE IMPACTS

Southern California is a seismically active region with a range of geologic and soil conditions. These conditions can vary widely within a limited geographical area due to factors, including differences in landforms and proximity to fault zones, among others. Therefore, while geotechnical impacts may be associated with the cumulative development, by the very nature of the impacts (i.e., landslides and expansive and compressible soils), the constraints are typically site specific and there is typically little, if any, cumulative relationship between the development of a proposed project and development within a larger cumulative area, such as citywide development. Additionally, while seismic conditions are regional in nature, seismic impacts on a given project site are site specific. For example, development within the site or surrounding area would not alter geologic events or soil features/characteristics (such as ground-shaking, seismic intensity, or soil expansion); therefore, the Project would not affect the level of intensity at which a seismic event on an adjacent site is experienced. However, Project development and future development in the area may expose more persons to seismic hazards.

In accordance with the thresholds of significance, impacts associated with seismic events and hazards would be considered significant if the effects of an earthquake on a property could not be mitigated by an engineered solution. The significance criteria do not require elimination of the potential for structural damage from seismic hazards. Instead, the criteria require an evaluation of whether the seismic conditions on a site can be overcome through engineering design solutions that would reduce to less than significant the substantial risk of exposing people or structures to loss, injury, or death.

State and local regulatory code requirements and their specific mandatory performance standards are designed to ensure the integrity of structures during maximum ground shaking and seismic events. The Proposed Project would be constructed in compliance with all applicable codes and in accordance with the Mitigation Program set forth in this EIR, which are designed to reduce the exposure of people or structures to substantial risk of loss, injury, or death related to geological conditions or seismic events. Therefore, Project impacts would be mitigated to a less than significant level. Current building codes and regulations would apply to all present and reasonably foreseeable future projects, which could also be subject to even more rigorous requirements. Therefore, the Project—in combination with past, present, and reasonably foreseeable future projects—would not result in a cumulatively significant impact by exposing people or structures to risks related to geologic hazards, soils, or seismic conditions.

The Proposed Project's compliance with the California Building Code, City building code requirements, and General Plan policies would ensure that geology and soil impacts would be less than significant. As such, potential impacts would be reduced to a less than significant level with implementation of applicable standard engineering practices and construction requirements. The Project's incremental contribution to cumulative geotechnical and seismic impacts would be less than significant. None of the Project characteristics would affect or influence the geotechnical hazards for off-site development. Similarly, the cumulative projects, which would be required to comply with the California Building Code, City building

code requirements, and General Plan policies, are not expected to have an adverse impact on the Project. For these reasons, no significant cumulative geotechnical impacts would occur for the Project.

4.5.6 MITIGATION PROGRAM

Project Design Features

No project design features have been identified by the Applicant.

Standard Conditions

Please refer to SC 4.8-1, in Section 4.8, *Hydrology and Water Quality*, which identifies NPDES permitting requirements.

SC 4.5-1 The Project is required to comply with City of Newport Beach Municipal Code, Chapter 15.10, Excavation and Grading Code. Prior to the issuance of any grading permits, the City of Newport Beach Community Development Department, Building Division Manager or his/her designee shall review the grading plan for conformance with the grading shown on the approved tentative map. The grading plans shall be accompanied by geological and soils engineering reports and shall incorporate all information as required by the City. Grading plans shall indicate all areas of grading. Grading plans shall provide for temporary erosion control on all graded sites scheduled to remain unimproved for more than 30 days. If the Applicant submits a grading plan that deviates from the grading shown on the approved tentative map, as determined by the Building Manager, s/he shall review the plan for a finding of substantial conformance. If the Building Manager finds the plan not to be in substantial conformance, the Applicant shall process a revised tentative map or, if a final map has been recorded, the Applicant shall process a new tentative map. A determination of CEQA compliance shall also be required.

SC 4.5-2 The Project is required to comply with General Plan Safety Element Policies S 4.1 through S 4.6, which require new development to be in compliance with the most recent seismic and other geologic hazard safety standards, and help protect community health and safety through the implementation of effective, state-of-the-art standards for seismic design of structures.

Mitigation Measures

MM 4.5-1 The Applicant shall submit to the City of Newport Beach Community Development Department, Building Division for review and approval, a site-specific, design-level geotechnical investigation prepared for the project site by a registered geotechnical engineer. The investigation shall comply with all applicable State and local code requirements and:

a) Include an analysis of the expected ground motions at the site from known active faults using accepted methodologies;

b) Determine structural design requirements as prescribed by the most current version of the California Building Code, including applicable City amendments, to ensure that structures can withstand ground accelerations expected from known active faults;

c) Determine the final design parameters for walls, foundations, foundation slabs, utilities, roadways, parking lots, sidewalks, and other surrounding related improvements;

Project plans for foundation design, earthwork, and site preparation shall incorporate all of the mitigation in the site-specific investigations. The structural engineer shall review the site-specific investigations, provide any additional necessary measures to meet Building Code requirements, and incorporate all applicable recommendations from the investigation in the structural design plans and shall ensure that all structural plans for the Project meet current Building Code requirements.

The City's registered geotechnical engineer or third-party registered engineer retained to review the geotechnical reports shall review each site-specific geotechnical investigation, approve the final report, and require compliance with all geotechnical requirements contained in the investigation in the plans submitted for the grading, foundation, structural, infrastructure and all other relevant construction permits.

The City shall review all Project plans for grading, foundations, structural, infrastructure and all other relevant construction permits to ensure compliance with the applicable geotechnical investigation and other applicable Code requirements.

4.5.7 LEVEL OF SIGNIFICANCE AFTER MITIGATION

With implementation of the Mitigation Program set forth in this section, potential geology and soils impacts would be reduced to a level considered less than significant.

This page intentionally left blank