5.6 GEOLOGY AND SOILS

This section of the Draft Environmental Impact Report (Draft EIR) addresses the potential for the proposed Section 31 Specific Plan Project ("Specific Plan Project" or "Project") to be affected by adverse geologic or soil conditions on the Project Site. More specifically, this section evaluates impacts associated with the Project that may potentially affect public health and safety or degrade the environment. Various federal, State of California (State), regional, and local programs and regulations related to anticipated geologic hazards are also discussed in this section. Information from the following studies of the Project Site are incorporated into this section:

- *Geologic and Seismic Hazards Report,* Earth Systems Pacific, March 2018; and
- *Seismicity and Faulting Memo*, Sladden Engineering, May 1, 2019.

Complete copies of these studies are included in the Appendices to this Draft EIR as **Appendix F.1: Geologic and Seismic Hazards Report** and **Appendix F.2: Seismicity and Faulting Memo**. Prior to the preparation of this Draft EIR, an Initial Study (see **Appendix A**) was prepared using the California Environmental Quality Act (CEQA) Guidelines Appendix G Environmental Checklist Form to assess potential environmental impacts associated with geology and soils. The following Initial Study screening criteria related to geology and soils do not require additional analysis in this Draft EIR:

- Potential impacts related to the creation of substantial direct or indirect risks to life or property through project location on expansive soils, as defined in Table 18-1-B of the Uniform Building Code (1994), were evaluated and determined to be "Less than Significant" in the Initial Study. Expansive soils are characterized as fine-grained, such as silts and clays; the Project Site consists of wind-blown dune sand and alluvium soil deposits that do not contain silts and clays. Therefore, this issue is not addressed any further within this section.

- Potential impacts related to the inadequacy of on-site soils to support the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater were evaluated and determined to have "No Impact" in the Initial Study. The Project Site will be connected to the existing sewer system serving the area. Therefore, this issue is not addressed any further within this section.

Impacts found to be less than significant are further discussed in **Section 8.1: Effects Not Found to be Significant** of this Draft EIR. Please see **Section 9.0** for a glossary of terms, definitions, and acronyms used in this Draft EIR.

A. ENVIRONMENTAL SETTING

1. Existing Conditions

Regional

The Project Site is located within the Coachella Valley in Riverside County. Regionally, the Coachella Valley is a part of the Colorado Desert Geomorphic Province of California. This Province consists of numerous north-south trending mountain ranges, including the San Bernardino Mountains to the north of the Coachella Valley, the San Jacinto Mountains to the west, and the Santa Rosa Mountains to the south. The major structural feature of the Coachella Valley is the San Andreas transform system that consists of several major northwest-trending lateral strike slip faults that extend through the San Gorgonio Pass along the southern foothills of the San Bernardino Mountains. The Colorado Desert Geomorphic Province is bound on the east by the Colorado River, on the south by the Baja California border, on the north by the Transverse Ranges Province, on the northeast by the Mojave Desert Province, and on the west by the Peninsular Ranges Province.

The elevations of the Coachella Valley floor are relatively flat and defined by the nature of the tectonic depression that is traversed by multiple fault strands and is punctuated by localized compressional squeeze-ups that form dome-shaped hills of uplifted sand and gravel. The Whitewater River is located south of the Project Site, flowing along the base of the Santa Rosa Mountains. The Whitewater River Basin provides drainage for the surrounding highlands and the northern portion of the Coachella Valley. The streams that are within the region tend to be dry during most of the year except for the winter/spring months when there are large amounts of snow runoff from the surrounding mountains.

The Coachella Valley is prone to wind-blown sand erosion hazards as a result of the strong winds that funnel through the steep mountain ranges. Areas at the base of the mountains are more sheltered from erosion from wind than areas in the floor of the valley. Areas adjacent to the mountains are susceptible to rock falls and unstable slopes. The regional tectonic subsidence along the Coachella Valley floor along with the uplift of adjacent mountains is responsible for the rapid deposition of poorly consolidated soils in the valley.

The California Geologic Survey (CGS) classifies faults as either (1) active, (2) potentially active, or (3) not active. Active faults as those that have, or are suspected to have, ruptured within the Holocene epoch - that is within the last 11,000 years. The Project Site is located in a moderately active seismic region. Ground shaking due to earthquakes should be anticipated during the life of the proposed improvements. The US Geological Survey (USGS) and CGS have identified 28 active, or potentially active, faults located within approximately 60 miles of the Project Site. Each of these faults is believed to be capable of producing sizeable earthquake events with significant ground motions.

The San Andreas Fault Zone is the major structural feature for the region, consisting of several northwest-trending right lateral strike slip faults that extend through the San Gorgonio pass along the southern foothills of the San Bernardino Mountains and along the northeast margin of the Coachella Valley. This Fault Zone is considered to be the longest in California, extending for over 800 miles from northern California to the Cajon Pass near San Bernardino and with depths of at least 10 miles within the Earth's surface.[1]

Project Site

The property consists of approximately 618 acres situated in Rancho Mirage, Riverside County, California. The site is described as essentially all of Section 31, Township 4 South, Range 6 East, and a portion of the southeast quarter of the southeast quarter of Section 36, Township 4 South, Range 5 East, San Bernardino Baseline and Meridian (SBBM). The site is bounded on the north by Gerald Ford Drive, on the east by Monterey Avenue, on the south by Frank Sinatra Drive, and on the west by Bob Hope Drive, all paved arterial streets.

The Project Site is situated on generally flat ground that is characterized by wind-blown sand dune topography extending in a northwest to southeast direction across the site. Site elevations range from approximately 319 feet above mean sea level (amsl) at the highest elevation in the northeast corner to 254 amsl at the lowest elevation at the southern property line. Overall, the site contains a slope of approximately 0.8 percent.

The Project Site is vacant and undeveloped, with vegetation including typical desert vegetation such as sparse grasses, weeds, scrub, creosote, and mesquite common to local dune fields. Improvements include the previously mentioned bounding streets and two shallow retention basins within the northern portion of the property adjacent to Gerald Ford Drive. Buried utilities are common adjacent to the major streets.

The Project Site is seismically characterized with a Site Class D soil profile. The existing soil and geologic units present within the Project Site are described below:

Soils

Artificial Fill

Minor deposits of artificial fill soils are present on the margins of the site. These soils are derived from on-site native sands and imported aggregate base and have been used to grade the roadways bounding the

1 Sandra S. Schultz and Robert E. Wallace, "The San Andres Fault" (Denver, CO: US Geological Survey, 2013). http://pubs.usgs.gov/gip/earthq3/safaultgip.html, accessed May 24, 2018.

site during construction and maintenance. Thicknesses of existing fill are estimated to be less than 2 feet. Shallow native soils appear to range from loose to medium dense and appear to have "very low" expansion potentials.

Quaternary Alluvium and Holocene Dune Sand

The Project Site is underlain by wind-blown sand and alluvial soil deposits, which eroded from the nearby mountain ranges. Barchan dunes are oriented in a northwest to southeast direction indicating the prevailing wind patterns. The composition of these surface soils consists predominantly of eolian sand composed of clean to slightly silty fine to medium sand (SP and SP-SM soil types per the Unified Soil Classification System). Shallow soils encountered in a prior soil boring drilled in the general vicinity of the site are composed of interbedded loose to medium-dense slightly silty sand (SP-SM soil type per the Unified Soil Classification Systems) to the maximum depth of exploration of approximately 26 feet below existing grades.

Paleontological Resources

Paleontological resources are valued for the information they yield about the history of the earth and its past ecological settings. The Project Site contains recent alluvium which has a low potential to contain significant paleontological resources.[2]

Seismic Hazards

Earthquake Faults

Due to the nature of Southern California straddling the North American and Pacific plates, the region is located in an area where numerous strike-slip faults are present. While no Holocene-active faults are known to exist within the limits of the Project Site, there are active faults located within proximity of the Project Site that have the potential to create seismic hazards. The closest known significant active faults to the Project Site include the Banning fault, located approximately 4.1 miles northeast, and the Mission Creek fault, located approximately 5.7 miles northeast, both branches of the San Andreas fault system. These faults roughly parallel the I-10 Freeway and the railroad corridor.

Other nearby active regional faults within approximately 30 miles of the site include the Burnt Mountain, Blue Cut, Eureka Peak, Garnet Hill, San Gorgonio, San Jacinto, Morongo and Pinto Mountain faults. In addition, there are abundant active or potentially active faults located in southern California that are capable of generating earthquakes that could affect the Rancho Mirage area. These include the Mojave

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2 *Riverside County General Plan*, "Multipurpose Open Space Element," (2003), fig. OS-8, "Paleontological Sensitivity Resources Map."

segment of the San Andreas fault, the many faults within the Mojave Desert located northeast of the San Bernardino Mountains, and numerous faults located in the vicinity of the Los Angeles basin and coastal southern California.

Surface Fault Rupture

Primary fault rupture results in fissuring and offset of the ground surface along a rupturing fault during an earthquake. Primary ground rupture typically makes up a relatively small percentage of the total damage in an earthquake, but being too close to a rupturing fault can cause severe damage to structures, and it is difficult to safely reduce the effects of this hazard through building and foundation design. The State definition of an active fault is designed to gauge the surface rupture potential of a fault and is used to prevent development from being sited directly on an active fault. The Alquist-Priolo Earthquake Fault Zoning Act imposes development constraints within active fault zones.

Although primary seismic hazards for sites in the region include strong ground shaking and fault rupture, no known active faults have been mapped across the Project Site and the Site is not within a currently designated Alquist-Priolo Earthquake Fault Zone or County of Riverside Earthquake Fault Zone. No known active faults have been identified on the site, thus the potential for future surface fault rupture at the site is considered to be nonexistent.

Strong Seismic Ground Shaking

Ground shaking poses the greatest potential hazard to the Project Site given its location to several active faults, which have the capability of producing earthquakes. Impacts that would result from ground shaking include extensive structural damage and risk of injury or death. This hazard is common all throughout Southern California and is associated with inducing other geologic hazards such as slope failure, liquefaction, and soil settlement. The Project Site is subject to strong ground shaking due to potential fault movements along the San Andreas and San Jacinto or other regional faults. These seismic hazards are discussed further below.

Seismically Induced Slope Failure

Slope failures generally occur within mountainous or hilly terrain where steep slopes are present. The Project Site is located within the relatively flat Coachella Valley floor and does not contain mountainous or hilly terrain that would be subject to slope failure.

Liquefaction and Ground Failure

Liquefaction generally occurs within the upper 50 feet of the ground surface when loose, cohesionless, and water-saturated soils (fine- to medium-grained) are subjected to strong seismic ground motions of earthquakes. The seismic shaking increases the pressure of the water that fills the pores of the soil grains. The site lies within a "low" liquefaction hazard area established in the City of Rancho Mirage ("City") General Plan Safety Element. The liquefaction potential at the site is currently considered very low as current groundwater depths are near 200 feet. Due to coarseness of the native soils and general lack of shallow silts and clays, the potential for soil saturation is low. Thus, earthquake-induced liquefaction is not likely to occur.

Fissuring and Ground Subsidence

The Project Site is not located within an area where previous ground fissuring from areal subsidence or groundwater withdrawal has been documented. However, the site is within a designated "susceptible" area for subsidence. In areas of fairly uniform thickness of alluvium, fissures are thought to be the result of tensional stress near the ground surface and generally occur near the margins of the areas of maximum subsidence. Surface runoff and erosion of the incipient fissures augment the appearance and size of the fissures.

Changes in pumping regimes can affect localized groundwater depths, related cones of depression, and associated subsidence such that the prediction of where fissures might occur in the future is difficult. In the event of future nearby aggressive groundwater pumping and utilization, the occurrence of deep subsidence cannot be ruled out, although, subsidence would most likely occur on an areal basis with the effects to individual structures anticipated to be minimal.

Dry sands tend to settle and densify when subjected to strong earthquake shaking. The amount of subsidence is dependent on relative density of the soil, ground motion, and earthquake duration. Due to relatively deep groundwater conditions of about 200 feet deep, it is anticipated that the deeper sediments underlying the site have been present for multiple San Andreas earthquakes and thus have experienced most dry settlement. Reduction of the groundwater table will expose soils that will be susceptible to further seismic induced settlement. Shallower soils in the upper 50 feet are much younger and may exhibit significant settlement in the event of future local earthquakes. Thus, the potential for seismically induced ground subsidence is considered to be moderate at the site and could be on the order of 2 to 3 inches.

Seismically Induced Settlement

Under certain conditions, strong ground shaking can cause the densification of soils, resulting in local or regional settlement of the ground surface. During strong shaking, soil grains become more tightly packed due to the collapse of voids and pore spaces, resulting in a reduction of the thickness of the soil column. This type of ground failure typically occurs in loose, granular, cohesionless soils and can occur in either wet or dry conditions. Under the added weight of fill embankments or buildings, these soils tend to settle, causing distress to improvements. Damage to structures typically occurs as a result of local differential settlements, although regional settlement can damage pipelines by changing the flow gradient on water and sewer lines, for example. Based upon previous studies and geotechnical experience in the area, the shallow native soils may have minor settlement potentials due to low relative compaction or non-uniformity. The potential for seismic-induced settlement to occur is considered "moderate."

Other Geologic Hazards

Other geologic hazards that have potential to pose safety impacts in reference to the construction and operational activities of the Project are described below.

Expansive/Collapsible Soils

Expansive soils are characterized as fine-grained, such as silts and clays, soils with variable amounts of expansive clay minerals that can change in volume due to changes in water content. Collapsible soils typically occur in recently deposited soils that tend to be more dry and granular. The Project Site consists in majority of dune sand and quaternary alluvium materials that are loose to medium dense silty sand to poorly graded fine sand. Direct observation of comparable on-site surficial soils confirms the presence of non-expansive slightly silty sands; therefore, the overall sand composition of the Project Site possesses very low expansion and collapsible potential.

Erosion

Since the Project Site contains cohesionless dune sand materials, the potential for surficial erosion exists. The low levels of rain in the Coachella Valley result in low vegetative growth to anchor soils. When the Coachella Valley experiences storms they tend to occur in high frequency, thus highly accelerating soil erosion and potentially causing floods. Moreover, the strong winds that are experienced in the Coachella Valley also accelerate erosional processes. Thus, the Project Site is considered to be located in hazard zones of severe and very severe wind erosion.

Windblown Sand

As previously discussed, the Coachella Valley is characterized by its strong winds, which can result in windblown sand damage to buildings and landscape, reduction of visibility, and serve as a source of health problems. The Project Site is located in the center of the Coachella Valley, where windblown sand impacts are the greatest.

Groundwater and Surface Water

Groundwater and surface water are not found to be present on the Project Site recently or historically. There are three wells in the vicinity of the Project; one well 1.5 miles west of the site, a well one mile south of the site, and one well about 2 miles east of the site. In 2017, all three wells had ground surface to water surface depths of 193 to 210 feet. Data is typically from water supply wells which tend to tap deeper aquifers and therefore may not reflect the depth to the shallowest water table. The site has relatively deep groundwater conditions of about 200 feet bgs.

Fluctuations of the groundwater level, localized zones of perched water, and soil moisture content should be anticipated during and following the rainy season. Irrigation of landscaped areas can also cause a fluctuation of local groundwater levels.

2. Regulatory Setting

Federal

National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) is a program created to implement the Clean Water Act. In November 1990, the USEPA published final regulations that establish requirements for specific categories of industries, including construction projects that encompass greater than or equal to 5 acres of land. The Phase II Rule became final in December 1999, expanding regulated construction sites to those greater than or equal to 1 acre. The regulations require that storm water and non-storm water runoff associated with construction activity, which discharges either directly to surface waters or indirectly through municipal separate storm sewer systems (MS4), must be regulated by an NPDES permit.

The EPA has delegated management of California's NPDES program to the State Water Resources Control Board (SWRCB) and the nine regional board offices which grant permits to regulate point source discharges of industrial and municipal wastewater into the waters of the United States. The NPDES program was established in 1972 to regulate the quality of effluent discharged from easily detected point sources of pollution such as wastewater treatment plants and industrial discharges. The 1987 amendments to the CWA[3] recognized the need to address non-point-source stormwater runoff pollution and expanded the NPDES program to operators of municipal separate storm sewer systems (MS4s), construction projects, and industrial facilities.

The Project Site is located within the 13-million-acre Colorado River Basin, which is governed by the Colorado River Basin Regional Water Quality Control Board (CRWQCB), also known as Region 7. The SWRCB administers the NPDES permit program regulating storm water from construction activities for projects greater than 1 acre in size. This is known as the General Permit for Storm Water Discharges Associated with Construction Activities, Order No. 2009-0009-DWQ, as amended by Order No. 2012-0006-

3 Clean Water Act, 33 Code of Federal Regulations, sec. 402(p) (2008).

DWQ, NPDES No. CAS000002. The main compliance requirement of NPDES permits is the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The purpose of a SWPPP is to identify potential on-site pollutants and identify and implement appropriate storm water pollution prevention measures to reduce or eliminate discharge of pollutants to surface water from storm water and non-storm water discharges. Storm water best management practices (BMPs) to be implemented during construction and grading, as well as post-construction BMPs, will be outlined in the SWPPP prepared for the proposed Project.

State

Alquist-Priolo Earthquake Fault Zoning Act

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act is to identify hazards associated with surface fault ruptures and to prevent the construction of buildings on active faults.[4] The State Geologist is required to establish and map zones around the surface traces of active faults, which are then distributed to county and city agencies to be incorporated into their land use planning and construction policies. Proposed development needs to be proven through geologic investigation to not be located across active faults before a city or county can permit the implementation of projects. If an active fault is found, development for human occupancy is prohibited within a 50-foot setback from the identified fault.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act is a State legislation that requires delineated maps to be created by the California State Geologist to reflect where potential ground shaking, liquefaction, or earthquake-induced landslides may occur.[5] Cities and counties are required to obtain approval for development on non-surface fault rupture hazard zones and mitigate seismic hazards. The purpose of the Seismic Hazards Mapping Act is to protect the public from the effects of nonsurface fault rupture earthquake hazards, inducing strong ground shaking, liquefaction, seismically induced landslides, or other ground failure caused by earthquakes.

2016 California Building Standards Code, California Code of Regulations

The 2016 California Building Code (CBC) is administered by the California Building Standards Commission (CBSC). The CBC governs all development within the State of California, as amended and adopted by each local jurisdiction. These regulations include provisions for site work, demolition, and construction, which include excavation and grading, as well as provisions for foundations, retaining walls, and expansive and

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4 California Public Resources Code, sec. 2621.5.

5 California Public Resources Code, sec. 2690–2699.6

compressible soils. The CBC provides guidelines for building design to protect occupants from seismic hazards.

Regional and Local

South Coast Air Quality Management District

The South Coast Air Quality Management District (SCAQMD) serves as the air pollution control agency for the counties of Orange, Los Angeles, Riverside, and San Bernardino. The SCAQMD is responsible for controlling emissions from primarily stationary sources. Rules 403 and 403.1 are designed to require that fugitive dust be controlled with best available control measures so that the presence of such dust does not remain visible in the atmosphere beyond the property line of the emissions source.

SCAQMD Rule 403. This rule governs emissions of fugitive dust during construction and operation activities. Compliance with this rule is achieved through BMPs. This may include application of water or chemical stabilizers to disturbed soils, covering haul vehicles, restricting vehicle speeds on unpaved roads to 15 miles per hour, sweeping loose dirt from paved site access roadways, cessation of construction activity when winds exceed 25 mph, and establishing a permanent ground cover on finished sites.

SCAQMD Rule 403.1. Rule 403.1 is a companion regulation to Rule 403 that is only applicable to fugitive dust sources in the Coachella Valley. Rule 403.1 establishes special requirements for Coachella Valley fugitive dust sources under high-wind conditions and requires AQMD approval of dust control plans for sources not subject to local government ordinances (e.g., school districts). As with Rule 403, compliance with this rule is achieved through BMPs. This supplemental rule requires the submittal and approval of a Fugitive Dust Control Plan before the start of any construction or earth-moving activities.

Rancho Mirage Municipal Code

Title 15, Building and Construction. Building and construction activities for the Project would be subject to Title 15 of the Rancho Mirage Municipal Code (RMMC), which governs the conditions and maintenance of all property, buildings, and structures within the City. Title 15 is based on the 2016 California Building Code (CBC), which sets minimum design and standards for construction of buildings and structures that must also meet minimum seismic strengthening standards.

Title 15, Chapter 64, Grading. This Chapter of the RMMC establishes standards for design and construction of buildings and development of property by grading. These regulations are intended to minimize impacts as a result of grading in order to protect and preserve the public health, safety, general welfare, aesthetic value, and natural resources of the City.

B. ENVIRONMENTAL IMPACTS

1. Thresholds of Significance

In order to assist in determining whether a project would have a significant effect on the environment, the City finds a project may be deemed to have a significant impact to geology and soils, if it would:

Threshold 5.6-1: **Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:**

- **a.) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.**
- **b.) Strong seismic ground shaking.**
- **c.) Seismic-related ground failure, including liquefaction.**
- **d.) Landslides.**

Threshold 5.6-2: **Result in substantial soil erosion or the loss of topsoil.**

Threshold 5.6-3: **Be located on a geologic unit or soil that is unstable, or that would become unstable as result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.**

Threshold 5.6-4: **Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature.**

2. Methodology

The 2019 *Geotechnical Investigation* (see **Appendix F.1**) and *Seismicity and Faulting Memo* (see **Appendix F.2**) provide an update to the previous prepared by Earth Systems in 2006. No significant changes with respect to findings in the 2006 report are noted, except the revised seismic design parameters, which are governed by changes in the standard of care and Building Code revisions. The analysis of potential impacts to geologic and soil hazards that would be associated with the Project included the following elements:

- A brief geologic reconnaissance of the Project Site
- Review of selected geological literature and aerial photographs
- A seismic hazards analysis

- A summary of the findings and conclusions in this written report

3. Project Design Features

The following **Project Design Features (PDF**) are incorporated into the proposed Project and would reduce the potential geology and soils impacts of the Project. These features were taken into account in the analysis of potential impacts.

PDF 5.6-1: The Project includes landscaped and paved open space areas as well as new buildings and non-erosive drainage structures that will be designed to prevent accelerating instability that would constitute a hazard to other properties.

PDF 5.6-2: When grading is completed, the vegetation planting of the Project Site will occur as soon as possible in order to maintain property erosion control measures and minimize blowsand.

PDF 5.6-3: The Project shall incorporate design features such as drought-tolerant landscaping, parks, stormwater retention/infiltration basins, and bioswales to minimize soil erosion from runoff.

4. Project Impacts

Threshold 5.6-1: Would the project directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

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

The State of California, under the guidelines of the Alquist-Priolo Earthquake Fault Zoning Act, classifies faults as active, potentially active, and not active. The Project Site is located in a region that consists of numerous active fault zones, such as the Garnet Hill Fault, Banning Fault, and Mission Creek strand of the San Andreas Fault.[6] The Banning Fault is the only fault to be located within an Alquist-Priolo Earthquake

6 California Institute of Technology, Southern California Earthquake Data Center, "Significant Earthquakes and Faults," accessed June 2018, http://scedc.caltech.edu/significant/.

Fault Zone. The Garnet Hill Fault is regulated as an active Fault Hazard Management Zone,[7] which requires subsurface investigations of the fault as the area develops. Since the Project Site does not directly transect the Banning Fault, it would not expose people or structures to any substantial effects involving the rupture of a known Alquist-Priolo Earthquake Fault. Therefore, impacts would be less than significant.

b.) Strong seismic ground shaking?

The intensity of ground shaking at a given location depends on several factors, but primarily on the earthquake magnitude, the distance from the hypocenter to the site of interest, and response characteristics of earth units underlying the site of interest. Similar to most of Southern California, the Project Site is in a seismically active area and is subject to some level of ground shaking as a result of movement along the major active (and potentially active) fault zones that characterize this region. The Project Site would most likely experience background shaking or potentially moderate to occasionally high ground shaking from faults in the region. Strong ground shaking can cause settlement by allowing sediment particles to become more tightly packed, thereby reducing pore space. Unconsolidated, loosely packed granular alluvial deposits are especially susceptible to this phenomenon. Poorly compacted artificial fills may also experience seismically induced settlement. Settlement caused by ground shaking is often non-uniformly distributed, which can result in differential settlement.

While no active faults are known to transect, or project onto, the Project Site, the nearest faults in proximity to the Project Site that could generate seismic activity that would affect the site are the Garnet Hill and San Andreas (San Andreas Coachella Segment; Banning and Mission Creek branches) Faults. The Garnet Hill Fault is the closest fault at approximately two miles north of the Project Site. The Banning branch of the San Andreas fault system is approximately four miles northeast and the Mission Creek branch of the San Andreas fault system is approximately 5.7 miles northeast from the Project Site. Intensity of ground shaking at a given location depends primarily upon earthquake magnitude, site distance from the source, and site response (soil type) characteristics. The Project's proximity to these three faults entails the likely prospect that potentially significant seismic activity is bound to be experienced at the Project Site.

Through inspiration of Mitigation Measures **MM 5.6-1** through **MM 5.6-3**, the buildings and structures that would be developed upon implementation of the Project would be required to adhere to the minimum standards and seismic safety requirements outlined in the 2016 California Building Code, as adopted and amended by the City and codified in Title 15: Buildings and Construction, in the Rancho

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7 City of Rancho Mirage *General Plan*, "Safety Element" (2004), VIII-21, https://www.ranchomirageca.gov/content_files/pdf/departments/community_development/chapter_8_safety.pdf, accessed May 25, 2018, updated with the 2017 *General Plan* update.

Mirage Municipal Code. These requirements protect people and structures from ground shaking. As outline in **MM 5.6-2**, seismicity studies would be required as a condition for issuance of a grading permit and/or building permit for all subdivisions (tracts), all critical structures, major structures, and other sites containing earthquake-sensitive earth materials and/or sites that are located on or near potentially active or active faults, as determined by the City engineer. **MM 5.6-3** would ensure that all grading and earthwork recommendations from the Project geotechnical and soils reports would be incorporated into the final Project design to the satisfaction of the City's Mirage Building and Safety Division prior to issuance of a grading permit. Implementation of seismic safety requirements and site-specific seismicity reports would be enforced during the City's development review and permitting process and supervised by a certified engineering geologist. Therefore, implementation **MM 5.6-1** through **MM 5.6-3** would ensure that the Project would be designed in accordance with City and professional standards to avoid hazards related to seismic ground shaking. Impacts would be less than significant.

c.) Seismic-related ground failure, including liquefaction?

The Project Site is not included on any California Geological Society-prepared maps for designated liquefaction zone, nor is it identified in the City's General Plan Safety Element to be within an area of high susceptibility to liquefaction. This is due to the nature of the soil composition of the Project Site. Liquefaction occurs usually when loose, cohesionless, and water-saturated soils (generally fine-grained sand and silt) are subjected to strong seismic ground motion of a single sudden motion or through repeated cyclic durations; this tends to occur within the upper 50 feet of the ground surface. Groundwater depths of the Project Site and surrounding off-site areas are expected to be about 200 feet deep; it is anticipated that the deeper sediments underlying the site have been present for multiple San Andreas earthquakes and thus have experienced most dry settlement. Based on the depth of groundwater in the soils, liquefaction is not likely to occur. Therefore, impacts are considered to be less than significant.

d.) Landslides?

There are no natural or man-made hillsides within the Project Site. The Project Site is relatively flat with gentle northeast to southwest sloping, thus slope instability is not considered to be an issue. Oversteepened dune slopes or cut slopes excavated into dunes sands will pose slope stability issues. In general, graded slopes at 3:1 (horizontal to vertical) finished grades are anticipated to be stable from gross or surficial landslide failures. In addition, the Project would not result in any post-grading conditions that would have a potential for seismic slope instability and land sliding; therefore, impacts would be less than significant.

Threshold 5.6-2: Would the project result in substantial soil erosion or the loss of topsoil?

Construction

The Project Site is currently undeveloped and vacant with a majority of the soils uncovered. The Project Site would be graded during construction; therefore, the soils would be exposed and could be subject to erosion. In compliance with SCAQMD Rule 403 and Rule 403.1, exposed soils would need to be covered with vegetation as soon as possible and/or watered in order to reduce fugitive dust, and construction vehicles on Project Site would need to maintain low speeds as another measure to reduce airborne fugitive dust particles.

Dune sands and quaternary-aged alluvial deposits were encountered to the maximum depth explored in conjunction with the Project Site's geotechnical investigation. The dune sand materials are composed predominately by loose to medium dense silty sand to poorly graded fine sand. The alluvium materials are composed of medium dense to very dense, poor-graded fine sand to sand with silt. The combination of both these soil materials causes a very low expansion potential.

As required by the General Permit for Storm Water Discharges Associated with Construction Activities and identified in **MM 5.6-4**, the applicant would be required to develop and implement a SWPPP which includes BMPs that would be employed to prevent erosion of on-site soils, as well as discharge of other construction related pollutants. A monitoring program is required as part of the SWPPP to ensure that BMPs are implemented appropriately and are effective at controlling discharges of pollutants that are related to stormwater, including erosion of on-site soils. Rancho Mirage Municipal Code Title 15, Chapter 64, Sections 10-750 describe regulation standards for sediment and erosion control during grading activities. Therefore, with the implementation of **MM 5.6-4** and adherence to the Rancho Mirage Municipal Code for sediment and erosion control, soil erosion impacts would be less than significant.

Operation

The increased intensity of use on the Project Site would potentially impact the surrounding undeveloped adjacent landscape and influence acceleration of erosion from stormwater runoff. In addition, wind erosion from the surrounding undeveloped properties could have potential impacts on the buildings, structures, and individuals within the Project Site. This is due to the nature of the regional landscape, wind patterns, and soil composition. These factors influence the area to be more susceptible to wind erosion impacts.

The Project would incorporate **PDF 5.6-1** through **PDF 5.6-3** that would include landscaping, parks, stormwater retention/infiltration basins, and bioswales at various locations that would minimize accelerated soil erosion from water runoff and strong winds. With these features or because of these features, soil erosion impacts will be less than significant.

Threshold 5.6-3: Would the project be located on a geologic unit or soil that is unstable, or that would become unstable as result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

The relatively flat topography of the Project Site and surrounding off-site areas precludes both stability problems and the potential for lurching, which is earth movement at right angles to a cliff or steep slope during ground shaking. The existing on-site dune sand and alluvium composed soils are generally classified as having a small-to-moderate potential for volumetric change. As previously discussed, the potential for hazards such as landslides and liquefaction is considered low. Liquefaction may also cause lateral spreading. For lateral spreading to occur, the liquefiable zone must be continuous, unconstrained laterally, and free to move along gently sloping ground toward an unconfined area. However, if lateral containment is present for those zones, then no significant risk of lateral spreading would be present. Since the liquefaction potential at the Project Site is low, earthquake-induced lateral spreading is not considered to be a significant seismic hazard, nor would it result in off-site impacts.

Ground surface subsidence generally results from the extraction of fluids or gas from the subsurface that can result in a gradual lowering of the ground level. According to the geotechnical study, groundwater was not found to be present on the Project Site and groundwater depths are estimated to be approximately 200 feet bgs. With the lack of presence of shallow groundwater, the potential for ground collapse and other adverse effects due to subsidence to occur on the Project Site and off-site areas is considered low.

Seismically induced settlement is considered to be less than significant when considered along with the proposed grading recommendations. With the removal of heavy vegetation, boulders, roots, and debris from the Project Site and with the excavation/recompaction of uncertified fill, ground settlement would be reduced to levels that can be accommodated by conventional foundation designs. Therefore, the risk of ground settlement would be less than significant.

MM 5.6-1 through **MM 5.6-3** would be implemented in order to minimize damage due to geologic hazards. These mitigation measures would ensure that all development would comply with the CBC, prepare a detailed geotechnical and soils investigation approved by the City, and incorporate the recommendations presented in the draft and final soils engineering reports prepared for the Project Site. Therefore, impacts related to exposure to hazards including landslides, lateral spreading, subsidence, liquefaction and collapse would be less than significant.

Threshold 5.6-4: Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Paleontological resources are valued for the information they yield about the history of the earth and its past ecological settings. The Project Site contains recent alluvium soils which have a low potential to contain significant paleontological resources.[8] Geologic features within the Project Site, such as sand and soil types, are common in the area and extensive in the Coachella Valley. Therefore, impacts would be less than significant.

5. Cumulative Impacts

Geology and soil hazards are related to conditions and circumstances that are considered site-specific. Therefore, the geographic context for the analysis of potential cumulative geology and soils impacts consists of individual development sites. Although cumulative development in the City and broader Coachella Valley may include numerous projects with geologic and soil impacts, these impacts would affect each individual project, rather than resulting in an additive cumulative effect. Mitigation measures would be taken on a project-by-project basis and be specific to each site. None of the related projects are located on an adjacent property or nearby, and all projects have to be designed in accordance with the appropriate jurisdiction's building and grading standards to reduce seismic-related risks to less than significant levels. Thus, cumulative development would result in a less than significant cumulative impact related to geology and soil hazards.

C. MITIGATION MEASURES

In addition to the Project Design Features identified in *Chapter B.3* above, the following mitigation measures would reduce geology and soil impacts:

MM 5.6-1: The Project would be designed in accordance with the 2016 California Building Code and City of Rancho Mirage Municipal Code, as applicable, to minimize the potential for damage due to geologic hazards.

MM 5.6-2: As part of final design development, a detailed geotechnical and soils investigation shall be conducted by a registered engineering geologist for review and approval by the City of Rancho Mirage Building and Safety Division prior to the issuance of grading and building permits.

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8 Riverside County General Plan, "Multipurpose Open Space Element" (2003), fig. OS-8.

MM 5.6-3: All grading and earthwork recommendations from the Project geotechnical and soils reports, including any updates, must be incorporated into the final Project design, including the final grading, drainage and erosion control plans, or other plans deemed necessary by the City of Rancho Mirage Engineering Division, and must ensure they meet the City's Building Code requirements set forth in the City Municipal Code. All grading activities must be supervised by a certified engineering geologist: Final grading, drainage, and erosion control plans must be reviewed and approved by the City of Rancho Mirage Engineering Division before the City issues a grading permit.

MM 5.6-4: In accordance with the NPDES, the Project would develop and implement a Storm Water Pollution Prevention Plan (SWPPP), including Best Management Practices (BMPs), in order to minimize soil erosion impacts.

D. LEVEL OF SIGNIFICANCE AFTER MITIGATION

With implementation of existing regulations and standards identified above, along with the Project's Design Features and **MM 5.6-1** through **MM 5.6-4**, potential impacts associated with geology and soils would be reduced to a level that is less than significant. Therefore, all potential impacts related to geology and soils would be less than significant.