5.5 Geology and Soils

5.5 GEOLOGY AND SOILS

This section describes the geologic and seismic conditions within the City and Site and evaluates the potential for geologic hazard impacts associated with implementation of the Project. Mitigation measures are recommended, as needed, to avoid or lessen the Project's potentially significant impacts. This section is primarily based on the following technical studies:

- *Report of Engineering Geology Study*, dated January 19, 2017, prepared by Land Phases Inc.;
- *Geotechnical Engineering Investigation, Proposed Multi-Unit Senior Living Development, California Grand Village at Azusa Greens*, dated January 19, 2017, prepared by Calwest Geotechnical Inc. (Calwest);
- *Addendum Geotechnical Engineering Report*, dated February 27, 2017, prepared by Calwest;
- *Addendum Geotechnical Engineering Report #2*, dated April 17, 2017, prepared by Calwest; and
- *Addendum Geotechnical Engineering Report #3*, dated June 6, 2017 (Geotechnical Reports), prepared by Calwest; refer to Appendix 11.5, *Geotechnical Reports*.

The Geotechnical Reports were prepared to evaluate the Site's subsurface conditions, identify potential geologic and seismic hazards that may affect the development, and provide preliminary geotechnical recommendations for design and construction.

5.5.1 EXISTING SETTING

GEOLOGIC SETTING

The Site is situated within the City of Azusa, California, in the Los Angeles Basin, along the foothills of the San Gabriel Mountains. The area is dominated by broad alluviated basins, which are mostly aggrading surfaces, receiving non-marine continental deposits from the adjacent upland areas. The Site is underlain by alluvial deposits composed of gravel and sand of stream channels and alluvial fan outwash from major canyons. Geology conditions in and around the City are reflected in the nature of the steep mountains, low foothills, and relatively flat valleys that make up the area. In the north and northwest mountainous areas of the City, the land is generally too steep and bedrock is too unstable for most construction. Construction is possible in selected areas of the mountains. However, many precautions must be taken to avoid land sliding, severe erosion, and earthquake shaking hazards. Azusa's foothills just northeast and east of the central City are less steep and more stable than the mountains. While there is greater potential for safe development in these areas, some slope stability, erosion and mudflow potential remains in certain areas. Flatter valley areas make up most of the City (which includes the Site).

EXISTING ON-SITE CONDITIONS

Soils and Fill Materials

Topography at the Site is generally level, with minor undulations and grade changes typical of golf courses. According to the Geotechnical Reports, the Site is underlain by artificial fill and natural alluvium deposits. The artificial fill is composed of loose to medium dense silty sand with gravel, which is dry to slightly moist. The gravel component of the artificial fill consists of sub-rounded to

rounded, pebble- to large boulder-size clasts of granite and gneiss. The artificial fill is not considered suitable for foundation support or the support of any concrete slabs-on-grade.

The alluvium encountered on-site is an interlayered mix of medium dense to dense sand and gravel with occasional fines present at depth. The sand portion is fine to very coarse grained, while the rock component is comprised of sub- to well-rounded pebble to boulder-sized clasts of granite and gneiss.

Groundwater

According to the Geotechnical Reports, groundwater has been recorded at the Site at depths of 134.5 to 216.5 feet below ground surface (bgs). The Site is anticipated to have a historic high groundwater elevation of 30 feet bgs.

GEOLOGIC HAZARDS

Faulting and Seismicity

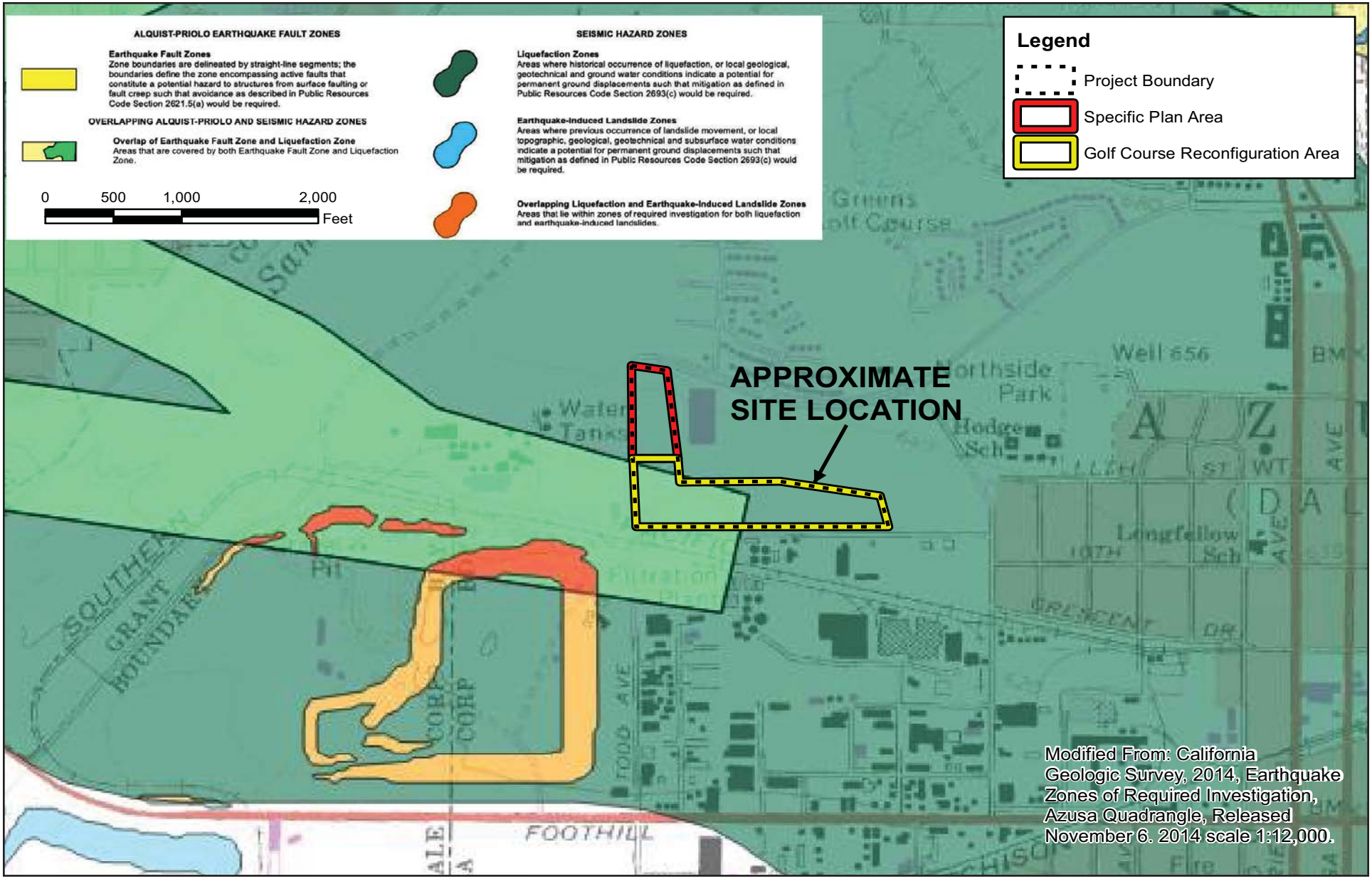
According to the California Geological Survey (CGS) a fault is defined as a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time. An inactive fault is a fault that has not experienced earthquake activity within the last three million years. In comparison, an active fault is one that has experienced earthquake activity in the past 11,000 years. A fault that has moved within the last two to three million years but has not been proven by direct evidence to have moved within the last 11,000 years, is considered potentially active.

The Alquist-Priolo Earthquake Fault Zoning Act, Public Resources Code Sections 2621-2624, Division 2, Chapter 7.5 regulates development near active faults in order to mitigate the hazard of surface fault-rupture. Under the Act, the State Geologist is required to delineate "special study zones" along known active faults in California. The Act also requires that, prior to approval of a project, a geologic study be conducted to define and delineate any hazards from surface rupture. A geologist registered by the State of California, within or retained by the lead agency for a project, must prepare this geologic report. A 50-foot setback from any known trace of an active fault is required for all habitable structures.

Regionally, the City is sited within a highly seismically active area of southern California referred to as the Los Angeles Basin. Hazards associated with earthquakes include primary seismic hazards, such as fault rupture and strong seismic ground shaking, and secondary seismic hazards, such as seismic-induced landslides, liquefaction, lateral spreading, and settlement.

The CGS released the earthquake Zones of Required Investigation (ZORI) for the Azusa Quadrangle on November 6, 2014.[1] As depicted on Exhibit 5.5-1, *Seismic Hazard and Alquist-Priolo Zone Map*, the Upper Duarte Fault and its established fault setback zone run in an east-west direction within the southern portion of the Site (at the Golf Course Reconfiguration Area), more than 50 feet south of the Specific Plan Area. According to the Geotechnical Reports, the northern limit of the Upper Duarte Fault is likely further south than currently depicted by CGS mapping.

[1] California Geologic Survey, *Earthquake Zones of Required Investigation Azusa Quadrangle*, November 6, 2014.



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11/18 | JN 162172

ENVIRONMENTAL IMPACT REPORT
CALIFORNIA GRAND VILLAGE PROJECT

Seismic Hazard and Alquist-Priolo Zone Map

Exhibit 5.5-1

The Site is located within approximately ten miles or less of the Sierra Madre Fault, Raymond Fault, Puente Hills Blind Thrust, Clamshell-Sawpit, San Jose Fault, Whittier Fault, Cucamonga Fault, and Verdugo Fault. The Sierra Madre Fault is the nearest known active fault, located approximately 4,000 feet to the north of the Site, with a probable moment magnitude (M_w) of M_w6.0 to 7.0.[2] The Sierra Madre, Raymond, Puente Hills Blind Thrust, Clamshell-Sawpit, and San Andreas Faults are capable of significant seismic hazards to the Site.

Seismic-Induced Landslides

The Site is generally level and is not located within an area mapped as having the potential for seismic-induced landslides.[3] As depicted on Exhibit 5.5-1, the closest source of seismic-induced hazards is the Vulcan Materials Gravel Quarry, which is located approximately 350 feet southwest of the Site and has previously been mapped as having the potential for seismic-induced landslide hazards.[4] Based on the distance between the Site and the gradient of slopes associated with the Vulcan Materials Gravel Quarry, the potential for seismic-induced landslide hazards at the Site is considered negligible.

Liquefaction and Lateral Spreading

Liquefaction, which is associated primarily with loose (low density), saturated, fine- to medium-grained, cohesionless soils, is the loss of soil strength or stiffness due to increasing porewater pressure during severe ground shaking. When the pore-water pressure approaches the total overburden pressure, the soil reduces greatly in strength and temporarily behaves similarly to a fluid. Liquefaction could 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.

As indicated on Exhibit 5.5-1, the Site is located within an area documented to have a potential for seismic-induced liquefaction based on the CGS Mapping.[5] However, according to the Geotechnical Reports, the potential for liquefaction at the Site is considered low based on recorded groundwater depths, underlying geologic conditions, distance to potentially active and/or active faults, and estimated duration of strong seismic ground shaking. Due to the Site's relatively flat topography, distance from any slopes, and low potential for liquefaction, the potential for lateral spreading at the Site is also considered low.

[2] California Institute of Technology, *Southern California Earthquake Data Center, Sierra Madre Fault Zone*, http://scedc.caltech.edu/significant/sierramadre.html, accessed August 9, 2018.

[3] California Department of Conservation, *California Geologic Survey, Landslide Inventory Map of the Azusa Quadrangle, Los Angeles County*, California, December 2007.

[4] It should be noted that the Vulcan Materials Quarry is required per their conditional use permit (CUP) to implement geostability safety regulations to prevent slope instability and landslides.

[5] California Department of Conservation, *California Geologic Survey, GGS Information Warehouse: Regulatory Maps*, http://maps.conservation.ca.gov/cgs/informationwarehouse/index.html?map=regulatorymaps, accessed August 9, 2018.

Seismic-Induced Settlement

Ground accelerations generated from a seismic event can produce settlements in sands or in granular earth materials both above and below the groundwater table. This phenomenon is often referred to as seismic settlement and is most common in relatively clean sands, although it can also occur in other soil materials. According to the Geotechnical Reports, the combined total settlement expected at the Site is expected to be less than 0.5 inch (within the acceptable ranges for the proposed type of structure.

Shrinkage and Subsidence

As discussed above, the Site is underlain by artificial fill and natural alluvium deposits. During construction, settlement due to hydro-consolidation is expected to be negligible based on consolidation test results conducted as part of the Geotechnical Reports.

Soil Expansion

Expansive soils are clay-rich soils that can undergo a significant increase in volume with increased water content and a significant decrease in volume with a decrease in water content. Significant changes in moisture content within moderately to highly expansive soil can produce adverse impacts to structures constructed on these soils. The Site's subsurface soils (artificial fill and natural alluvium deposits) are not characterized as expansive soils.

5.5.2 REGULATORY SETTING

FEDERAL LEVEL

Earthquake Hazards Reduction Act

The Earthquake Hazards Reduction Act of 1977 (Public Law 95-124) established the National Earthquake Hazards Reduction Program, which is coordinated through the Federal Emergency Management Agency (FEMA), the U.S. Geological Survey (USGS), the National Science Foundation, and the National Institute of Standards and Technology. The purpose of the Program is to establish measures for earthquake hazards reduction and promote the adoption of earthquake hazards reduction measures by Federal, State, and local governments; national standards and model code organizations; architects and engineers; building owners; and others with a role in planning and constructing buildings, structures, and lifelines through (1) grants, contracts, cooperative agreements, and technical assistance; (2) development of standards, guidelines, and voluntary consensus codes for earthquake hazards reduction for buildings, structures, and lifelines; and (3) development and maintenance of a repository of information, including technical data, on seismic risk and hazards reduction. The Program is intended to improve the understanding of earthquakes and their effects on communities, buildings, structures, and lifelines through interdisciplinary research that involves engineering, natural sciences, and social, economic, and decisions sciences.

Disaster Mitigation Act of 2000

The Federal Disaster Mitigation Act of 2000 (DMA 2000; Public Law 106-390) provides the legal basis for FEMA mitigation planning requirements for State, local, and tribal governments as a condition of mitigation grant assistance. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and tribal entities to closely coordinate mitigation planning and implementation efforts. The requirement for a state mitigation plan is continued as a condition of disaster assistance, adding incentives for increased coordination and integration of mitigation activities at the state level through the establishment of requirements for two levels of state plans. DMA 2000 also established a new requirement for local mitigation plans and authorized up to seven percent of Hazard Mitigation Grand Program funds available to a state for development of state, local, and tribal mitigation plans.

Uniform Building Code

The Uniform Building Code (UBC) is published by the International Conference of Building Officials and forms the basis for California's Building Code, as well as approximately half of the state building codes in the United States. It has been adopted by the California Legislature to address the specific building conditions and structural requirements for California, as well as provide guidance on foundation design and structural engineering for different soil types. The UBC defines and ranks the regions of the United States according to their seismic hazard potential. There are four types of regions defined by Seismic Zones 1 through 4, with Zone 1 having the least seismic potential and Zone 4 having the highest.

U.S. Geological Survey Landslide Hazard Program

The USGS Landslide Hazard Program provides information on landslide hazards including information on current landslides, landslide reporting, real time monitoring of landslide areas, mapping of landslides through the National Landslide Hazards Map, local landslide information, landslide education, and research.

STATE LEVEL

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Act) (Public Resources Code 2621-2624, Division 2 Chapter 7.5) was passed in 1972 to mitigate the hazard of surface faulting to structures for human occupancy. The Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The Act requires the State Geologist to establish regulatory zones, known as "Earthquake Fault Zones," around the surface traces of active faults and to issue appropriate maps. Local agencies must regulate most development projects within these zones. Before a project can be permitted, cities and counties must require a geologic investigation to demonstrate that proposed buildings would not be constructed across active faults. An evaluation and written report of a specific site 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 from the fault (typically 50-foot set backs are required).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 directs the Department of Conservation, CGS to identify and map areas prone to liquefaction, earthquake-induced landslides, and amplified ground shaking. The purpose of the Seismic Hazards Mapping Act is to minimize loss of life and property through the identification, evaluation, and mitigation of seismic hazards.

Staff geologists in the Seismic Hazard Zonation Program gather existing geological, geophysical, and geotechnical data from numerous sources to produce the Seismic Hazard Zone Maps. They integrate and interpret these data regionally to evaluate the severity of the seismic hazards and designate as Zones of Required Investigation (ZORI) those areas prone to liquefaction and earthquake-induced landslides. Cities and counties are then required to use the Seismic Hazard Zone Maps in their land use planning and building permit processes.

The Seismic Hazards Mapping Act requires that site-specific geotechnical investigations be conducted within the ZORI to identify and evaluate seismic hazards (i.e., liquefaction and earthquake-induced landslides) and formulate mitigation measures prior to permitting most developments designed for human occupancy.

Special Publication 117A

The CGS prepared its Guidelines for Evaluating and Mitigating Seismic Hazards in California (Special Publication 117A) in 2008. Special Publication 117A constitutes the guidelines for evaluating seismic hazards other than surface fault-rupture, and for recommending mitigation measures as required by Public Resources Code Section 2695(a) and contains several important revisions to the 1997 edition of Special Publication 117. The objectives of Special Publication 117A are to assist in the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigation and to promote uniform and effective statewide implementation of the evaluation and mitigation elements of the Seismic Hazards Mapping Act.

2016 California Building Standards Code

California building standards are published in the California Code of Regulations, Title 24, also known as the California Building Standards Code (CBSC). The CBSC, which applies to all applications for building permits, consists of 11 parts that contain administrative regulations for the California Building Standards Commission and for all State agencies that implement or enforce building standards. Local agencies must ensure development complies with the CBSC guidelines. Cities and counties can adopt additional building standards beyond the CBSC. CBSC Part 2, named the California Building Code, is based upon the 2015 International Building Code.

LOCAL LEVEL

City of Azusa General Plan

The Geologic Hazards Element of the General Plan addresses natural hazards in the City. Potential risks to residents and the local environment associated with hazards such as liquefaction, soil failure, earthquakes, and flooding, are considered. The Geologic Hazards Element provides background

information related to each issue, and identifies goals and policies regarding hazardous structures, flooding and drainage, emergency preparedness and education, and post-disaster reconstruction. The following goal and policies are those related to seismic issues. Refer to Section 5.6, *Hydrology and Water Quality*, for flooding issues.

GOALS AND POLICIES

Goal 1 – Ensure the continued functioning of essential (critical, sensitive and high-occupancy) facilities following a disaster; help prevent loss of life from the failure of critical and sensitive facilities in an earthquake; and help prevent major problems for post-disaster response, such as difficult or hazardous evacuations or rescues, numerous injuries, and major cleanup or decontamination of hazardous materials.

Policy 1.1: Require that earthquake survival and efficient post-disaster functioning are primary concerns in the siting, design and construction standards of essential facilities.

Policy 1.2: Require that proposed essential facilities apply the most current professional standards for seismic design and be subject to seismic review, including detailed site investigations for faulting, liquefaction, ground motion characteristics, and slope stability.

Policy 1.4: Prohibit the location of Sensitive and High-Occupancy facilities within 100 feet of the identified active fault zone or potentially active fault zone of concern, unless it is determined by a qualified geologic engineer that a closer location will not result in undue risks based on detailed site investigations.

Policy 1.7: Incorporate planning for potential seismic incidents affecting Critical, Sensitive and High-Occupancy Facilities into the City's contingency plans for disaster response and recovery.

City of Azusa Municipal and Development Code

Chapter 60, *Stormwater and Urban Runoff Pollution Prevention*, of the City's Municipal Code applies to the discharge, deposit, or disposal of any stormwater and/or runoff to the storm drain system and/or receiving waters within the City. Chapter 60 specifies that no person shall commence any construction activity for which a permit is required without implementing all required stormwater and runoff pollution mitigation measures required.

5.5.3 IMPACT THRESHOLDS AND SIGNIFICANCE CRITERIA

Appendix G of the *CEQA Guidelines* contains the Environmental Checklist form that was used during the preparation of this EIR. Accordingly, a project may create a significant adverse environmental impact if it would:

a) Exposure of people or structures to 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 fault? Refer to Division of Mines and Geology Special Publication 42 (refer to Impact Statement GEO-1);

b) Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking (refer to Impact Statement GEO-2);

c) Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving seismic-related ground failure, including liquefaction (refer to Impact Statement GEO-3);

d) Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving landslides (refer to Impact Statement GEO-5);

e) Result in substantial soil erosion or the loss of topsoil (refer to Impact Statement GEO-4);

f) 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 (refer to Impact Statement GEO-5);

g) 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 (refer to Impact Statement GEO-5); and

h) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water (refer to Section 8.0, *Effects Found Not To Be Significant*).

Based on these standards, the effects of the Project have been categorized as either a "less than significant impact" or a "potentially significant impact." Mitigation measures are recommended for potentially significant impacts. If a potentially significant impact cannot be reduced to a less than significant level through the application of mitigation, it is categorized as a significant unavoidable impact.

5.5.4 IMPACTS AND MITIGATION MEASURES

EARTHQUAKE FAULT RUPTURE

GEO-1 Would the Project expose people or structures to 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 fault?

Impact Analysis: As depicted on Exhibit 5.5-1, the southern portion of the Site (Golf Course Reconfiguration Area) is identified within a ZORI for the Upper Duarte Fault by the Alquist-Priolo Earthquake Fault Zoning Map for the Azusa Quadrangle. However, the Upper Duarte Fault and its established fault setback zone bisect the Golf Course Reconfiguration Area of the Site from east-west more than 50 feet south of the Specific Plan Area. Based on groundwater elevations recorded as part of the Geotechnical Reports, the actual location of the Upper Duarte Fault is likely further

south than currently depicted by CGS mapping.[6] For this reason, the Specific Plan Area would be well outside of the Alquist-Priolo Earthquake Fault Zoning Act's 50-foot setback requirement. Although an existing restroom building between golf holes 3 and 4 of the Golf Course Reconfiguration Area would be relocated approximately 150 feet to the south, the potential for adverse effects to people and structures associated with rupture of a known earthquake fault would be sufficiently mitigated through proper seismic design and conformance with the City's Building Code. As a result, the Project's proposed Golf Course Reconfiguration would not result in surface rupture of the Upper Duarte Fault and would not introduce habitable structures within 50 feet of the fault. Thus, Project implementation would not expose people or structures to 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 fault and a less than significant impact would occur.

Standard Conditions of Approval: No standard conditions of approval are applicable.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

STRONG SEISMIC GROUND SHAKING

GEO-2 Would the Project expose people and structures to potential substantial adverse effects, including the risk of loss, injury, or death involving strong seismic ground shaking?

Impact Analysis: The Site is generally located within proximity to several mapped surface faults, including the Sierra Madre Fault, Raymond Fault, Puente Hills Blind, Clamshell-Sawpit, San Jose Fault, Whittier Fault, Cucamonga Fault, and Verdugo Fault. Of these, the Sierra Madre, Raymond, Puente Hills Blind Thrust, Clamshell-Sawpit, and distant San Andreas Faults are capable of strong seismic ground shaking with the potential to result in substantial adverse effects to the Site. The nearest known active fault is the Upper Duarte Fault, which bisects the Golf Course Reconfiguration Area of the Site with a probable magnitude of M_w6.0 to 7.0.[7] According to the Geotechnical Reports, the Site could be subjected to moderate to strong ground shaking based on its proximity to known active and potentially active faults. The intensity of ground shaking experienced on the Site would depend upon the magnitude of the earthquake, distance to the epicenter, and the geology of the area between the epicenter and the Site.

To reduce the potential effects of seismic ground shaking, the City regulates development under the requirements of the CBSC, Municipal Code, the California Department of Conservation, CGS Special Publications 117, and project-specific mitigation measures. Pursuant to CBSC requirements,

[6] An 84.5-foot difference in groundwater elevations was observed between two borehole locations recorded as part of the Geotechnical Reports, even though the horizontal differences between the two is only 100 to 120 feet. Typically, a significant difference in groundwater elevations is indicative of fault presence. Due to movement and shearing, a zone of low permeability clayey material can form along the fault line which can disrupt movement of groundwater.

[7] California Institute of Technology, *Southern California Earthquake Data Center, Sierra Madre Fault Zone*, http://scedc.caltech.edu/significant/sierramadre.html, accessed August 9, 2018.

and as incorporated by reference in Municipal Code Section 14-1, the Project would be designed to withstand the "design-level" earthquake. The potential adverse effects to people and new structures from strong, seismically-induced, vibratory ground motion would be sufficiently mitigated through proper seismic design and conformance with the City's Building Code. Additionally, consistent with General Plan policies pertaining to site-specific geotechnical evaluation, the Geotechnical Reports outline earthwork and grading specifications for the Project. SCA GEO-1 requires the Project Applicant to demonstrate that the recommendations for design and construction identified in the Geotechnical Reports have been incorporated into Project's design, grading plans, and building plans. Following compliance with the CBSC, Municipal Code, and SCA GEO-1, impacts concerning the exposure of people and structures to a substantial risk involving seismic-related hazards, including strong seismic ground shaking, would be less than significant.

Standard Conditions of Approval:

SCA GEO-1 Prior to issuance of a grading permit, the Project Applicant shall demonstrate, to the satisfaction of the City of Azusa Building Official, that the recommendations for design and construction identified in the *Geotechnical Engineering Investigation, Proposed Multi-Unit Senior Living Development, California Grand Village at Azusa Greens*, and all subsequent Addendums, prepared by Calwest Geotechnical Inc., dated January 19, February 27, April 17, and June 6, 2017, and in the *Report of Engineering Geologic Study, Proposed Multi-Unit Senior Living Residential Development – California Grand Village at Azusa Greens*, prepared by Land Phases, Inc., dated November 11, 2016 (revised January 19, 2017) have been incorporated into the Project design, grading plans, and building plans. The Project's final grading plans, foundation plans, building loads, and specifications shall be reviewed by a State of California Registered Professional Geologist/Registered Professional Engineer to verify that the Geotechnical Reports' recommendations have been incorporated and updated, as needed.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

LIQUEFACTION AND SEISMICALLY-INDUCED SETTLEMENT

GEO-3 Would the Project expose people and structures to potential substantial adverse effects, including the risk of loss, injury, or death involving liquefaction or seismically-induced settlement?

Impact Analysis: The Site is located within a ZORI for earthquake-induced liquefaction. Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction. However, based on the Geotechnical Reports, the potential for liquefaction and seismically-induced settlement at the Site is considered low based on recorded groundwater depths, underlying geologic conditions, distance to potentially active and/or active faults, and estimated duration of strong seismic ground shaking. Nonetheless, pursuant to the Seismic Hazards Mapping Act, the City would be required to submit the Geotechnical Reports to the State Geologist

within 30 days after the EIR is certified and the reports are approved by the City (SCA GEO-2). A less than significant impact would occur in this regard.

Standard Conditions of Approval:

SCA GEO-2 Pursuant to the Seismic Hazards Mapping Act, the City of Azusa shall submit the *Geotechnical Engineering Investigation, Proposed Multi-Unit Senior Living Development, California Grand Village at Azusa Greens*, and all subsequent Addendums, prepared by Calwest Geotechnical Inc., dated January 19, February 27, April 17, and June 6, 2017, and the *Report of Engineering Geologic Study, Proposed Multi-Unit Senior Living Residential Development – California Grand Village at Azusa Greens*, prepared by Land Phases, Inc., dated November 11, 2016 (revised January 19, 2017) to the State Geologist within 30 days after the EIR is certified and the reports are approved by the City of Azusa Building Official.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

SOIL EROSION OR LOSS OF TOPSOIL

GEO-4 Would the Project result in substantial soil erosion or loss of topsoil?

Impact Analysis:

PROJECT CONSTRUCTION

According to the Geotechnical Reports, the Site is underlain by artificial fill and natural alluvium deposits. Project construction would have the potential to result in soil erosion or the loss of topsoil. As discussed in Section 5.6, *Hydrology and Water Quality*, the Project would be required to demonstrate compliance with the National Pollutant Discharge Elimination System (NPDES) permitting process to reduce short-term construction impacts, which would require preparation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP would control common pollutants such as suspended soil in stormwater runoff from leaving the Site. Additionally, all construction activities would be subject to compliance with Municipal Code Chapter 60, *Stormwater and Urban Water Runoff Pollution Prevention*, which specifies that no person shall commence any construction activity for which a permit is required without implementing all stormwater and runoff pollution mitigation measures required by such permit. As discussed in Section 5.9, *Air Quality*, the Project would also be required to comply with South Coast Air Quality Management District (SCAQMD) Rule 403, which would reduce the potential for wind erosion by requiring implementation of dust control measures during construction. Following compliance with the established regulatory requirements (i.e., NPDES, Municipal Code Chapter 60, and SCAQMD Rule 403), Project construction would result in a less than significant impact involving soil erosion or the loss of topsoil.

PROJECT OPERATIONS

As concluded in Section 5.6, following conformance with NPDES permit requirements and implementation of all BMPs identified in the Project's *California Grand Villages Azusa Greens Preliminary Water Quality Management Plan* (WQMP), prepared by Proactive Engineering Consultants, dated May 2017, and the City's Municipal Code, Project operations would involve less than significant long-term operational water quality impacts, including those related to soil erosion or loss of topsoil.

Standard Conditions of Approval: No standard conditions of approval are applicable.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

UNSTABLE GEOLOGIC UNITS

GEO-5 Would the Project result in significant impacts related to unstable geologic conditions, including landslide, lateral spreading, subsidence, liquefaction, collapse, and expansive soils?

Impact Analysis:

LATERAL SPREADING, LIQUEFACTION, AND LANDSLIDES

As discussed in Impact Statement GEO-3, the potential for liquefaction at the Site is considered low. Due to the Site's relatively flat topography, distance from any slopes, and low potential for liquefaction, the potential for lateral spreading at the Site is also considered low. Topography on the Site is generally level, with minor grade changes typical of golf courses; thus, the potential for landslide hazards at the Site is considered negligible. In addition, the potential for landslide hazards associated with Vulcan Materials Quarry operations to the southwest are considered negligible due to the distance between the Site and Quarry (approximately 0.5-mile to the southwest across North Todd Avenue) and the existing gradient of slopes present at the Quarry. For these reasons, the Project would result in less than significant impacts related to lateral spreading, liquefaction, and landslides.

SOIL SHRINKAGE AND SUBSIDENCE

According to the Geotechnical Reports, the Site is underlain by artificial fill and natural alluvium deposits. During construction, settlement due to hydro-consolidation (soil shrinkage) is expected to be negligible. The potential for damage to the proposed buildings as a result of subsidence is anticipated to be very low provided implementation of remedial grading activities and the specific recommendations for fill placement and compaction identified in the Geotechnical Reports. To reduce the potential for damage as a result of subsidence, SCA GEO-1 requires the Project Applicant to demonstrate that the Geotechnical Reports' recommendations for design and construction have been incorporated into the Project's design, grading plans, and building plans. Following conformance with SCA GEO-1, the Project would result in less than significant impacts related to soil shrinkage and subsidence.

EXPANSIVE SOILS

As indicated above, the Site's subsurface soils (artificial fill and natural alluvium deposits) are not characterized as expansive soils. No impact would occur in this regard.

Standard Conditions of Approval: Refer to SCA GEO-1.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

5.5.5 CUMULATIVE IMPACTS

Section 15355 of the *CEQA Guidelines* requires an analysis of cumulative impacts, which are defined as, "two or more individual effects which, when considered together, are considerable, or which compound or increase other environmental impacts." As outlined in Table 4-1, *Cumulative Projects List*, and illustrated on Exhibit 4-1, *Cumulative Projects Map*, cumulative projects are located on both developed and undeveloped sites.

- **Would the Project, combined with other related cumulative projects, cause a cumulatively considerable effect of exposing people or structures to potential substantial adverse effects involving geology and soils?**

Impact Analysis: The cumulative development identified in Table 4-1 and Exhibit 4-1 would involve a similar regional geologic setting and regional seismicity as the proposed Project; however, the local geologic setting, surficial geology, and subsurface soils conditions would vary by site. Like the rest of southern California, cumulative development would be sited within an area subject to seismic activity. Intensity of ground shaking on cumulative development would vary by site based on the earthquake's magnitude, distance to epicenter, and geology of the area between the epicenter and the cumulative site. Impacts to cumulative development could include exposure of people/ structures to potential substantial adverse effects involving seismic-related ground failure (i.e., liquefaction or landslides), unstable geologic units or soils (i.e., landslides, lateral spreading, subsidence, liquefaction or collapse), or expansive soils. Impacts would be evaluated at the project-level through site-specific geotechnical and soil investigations and would be mitigated through site-specific recommendations for design and construction. Compliance with the CBSC, applicable General Plan and Municipal Code requirements, and implementation of site-specific recommendations outlined in the site-specific geotechnical and soil investigations would reduce cumulative impacts concerning seismic-related ground failure, unstable geologic units or soils, or expansive soils to less than significant. The Project's potential impacts associated with seismic-related ground failure, unstable geologic units or soils, and expansive soils would be reduced to less than significant levels following implementation of engineering and construction best practices, compliance with the existing regulatory framework (i.e., CBSC and Municipal Code requirements), and SCA GEO-1 and SCA GEO-2. Therefore, the Project's incremental effects involving seismic-related ground failure, unstable geologic units or soils, and expansive soils would not be cumulatively considerable.

Cumulative development could involve construction activities, which result in soil erosion or loss of topsoil. Cumulative impacts would depend upon each respective cumulative site's topography and on-site soils' susceptibility to erosion. Impacts would be evaluated at the project-level through site-specific soil investigations and would be mitigated through site-specific recommendations for design and construction. Compliance with existing regulations (i.e., NPDES and SCAQMD Rule 403), and implementation of site-specific recommendations outlined in site-specific soil investigations, would reduce cumulative impacts concerning soil erosion or loss of topsoil to less than significant. As discussed above, Project impacts related to soil erosion or loss of topsoil would be reduced through compliance with NPDES, SCAQMD Rule 403, and Municipal Code requirements. Therefore, the Project's incremental effects involving exposure of persons or structures to potential substantial adverse effects related to soil erosion and loss of topsoil would not be cumulatively considerable.

Standard Conditions of Approval: Refer to SCA GEO-1 and SCA GEO-2.

Mitigation Measures: No mitigation measures are required.

Level of Significance: Less Than Significant Impact.

5.5.6 SIGNIFICANT UNAVOIDABLE IMPACTS

No significant unavoidable impacts related to geology and soils have been identified following conformance with existing regulatory requirements and standard conditions of approval.

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