4.5 GEOLOGY AND SOILS

This section of the EIR analyzes the potential environmental effects on geology and soils from implementation of the proposed project. Data for this section was taken from the California Department of Conservation and the Glendale General Plan Safety Element. Full reference-list entries for all cited materials are provided in Section 4.5.5 (References).

4.5.1 Environmental Setting

Natural geologic processes that represent an existing or future hazard to life, health or property are called geologic hazards. Natural geologic hazards which have the potential to affect people and property in the proposed SGCP area include earthquakes (which can cause surface fault rupture, ground shaking, and liquefaction), expansive soils, weathering, and mass wasting phenomena, such as landslides or liquefaction. The southern California region contains active faults, steep topography, and other geological characteristics that pose public safety concerns and constrain physical development.

Regional Topography

Los Angeles County is located along the Pacific Rim, an area characterized by island arcs with subduction zones forming mountain ranges and deep oceanic trenches, active volcanoes, and earthquakes. The U.S. Geological Survey (USGS) defines a subduction zone as any area where one lithospheric plate sinks under another. This occurs when plates move toward each other, or converge.

The City is located in the Transverse Ranges Geomorphic Province of California. The San Gabriel Mountains, which are part of the Transverse Ranges, are northeast of the City. The Verdugo Mountains, located in the northern portion of the City, are separated from the San Gabriel Mountains by the La Crescenta Valley, but are composed of many of the same rock types and are largely an extension of the San Gabriel Mountains terrain. The proposed SGCP area is located at the eastern end of the San Fernando Valley at the southern base of the Verdugo Mountains.

Local Topography and Geology

The topography of the City is characterized by mountainous borders that gently slope down to flat areas. The Verdugo Mountains are located north of the proposed SGCP area, the San Rafael Hills to the northeast, and the Hollywood Hills west. The youngest and most widely exposed alluvial units near the City consist of the Holocene channel and floodplain deposits derived from the Verdugo Mountains, San Rafael Hills, and the Hollywood Hills. Sediments that have been transported from the base of the Verdugo Mountain slopes to the piedmont surfaces by the streams that drain these highlands form the tributaries to Verdugo Wash located in the northeast and west corners of the proposed SGCP area.

The Holocene Alluvium unit underlies most of the proposed SGCP area. This unit consists of fluvial and alluvial fan deposits of unconsolidated, gray to olive brown silt, fine to course sand, and gravel. Mid to late Holocene in age (approximately 5,000 years old and younger), these deposits have been elevated above the modern drainage courses. The gravels are typically sub angular and rounded. In the southern portion of the San Rafael Hills, this deposit consists primarily of silty and clayey sand with interbedded clay. The density of these deposits is loose to medium dense (Glendale 2003a).

Geologic Hazards

Faults

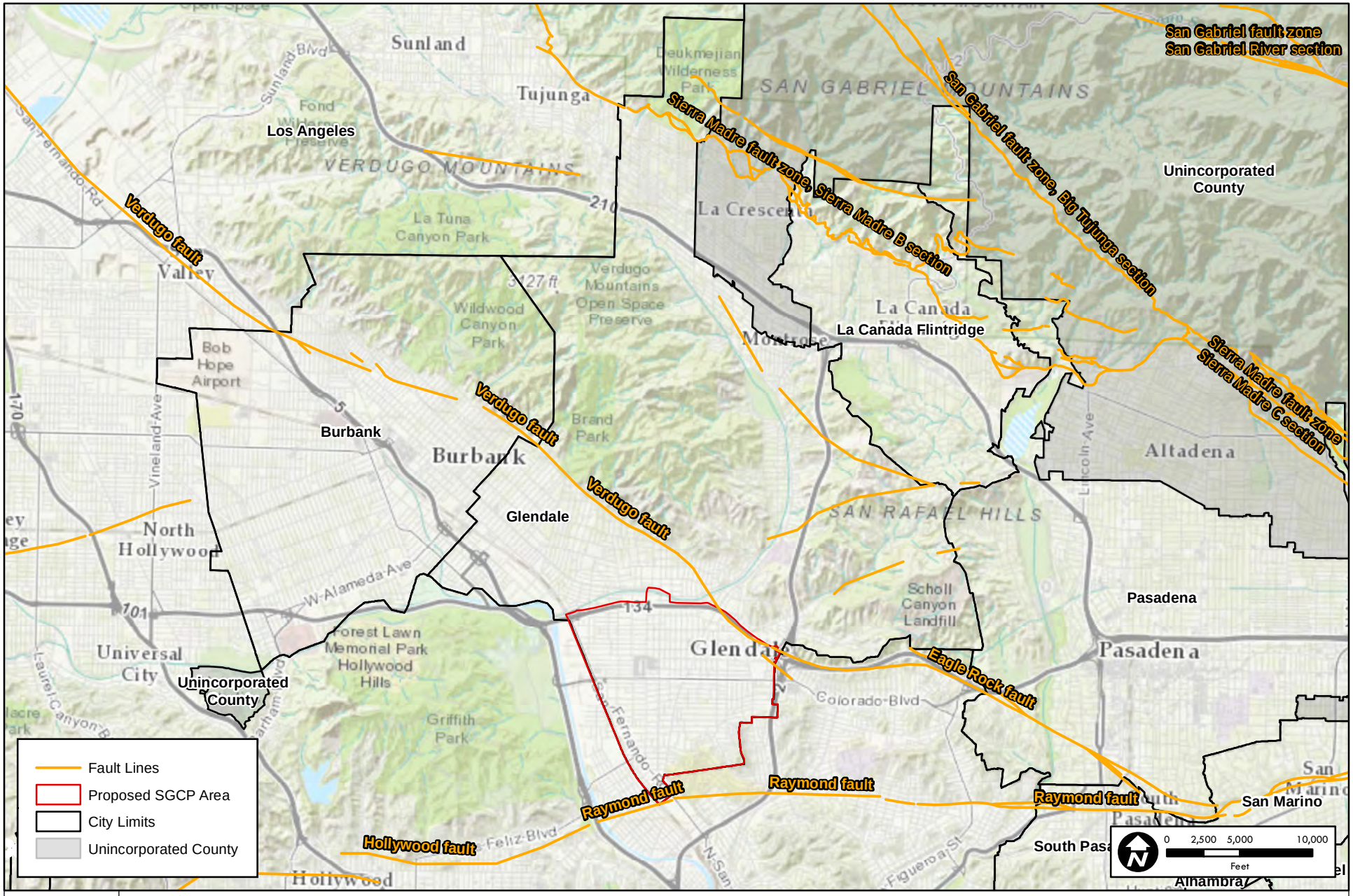
The southern California region is crossed by a network of major regional faults and minor local faults. This faulting and seismicity is dominated by the San Andreas Fault System, which separates two of the major tectonic plates; the Pacific plate is to the west of the San Andreas Fault System and the North American plate is to the east.

There are numerous faults in southern California that are categorized as active, potentially active, and inactive by the California Geological Survey. A fault is classified as active if it has either moved during the Holocene epoch (during the last 11,000 years) or is included in an Alquist-Priolo Earthquake Fault Zone. A fault is classified as potentially active if it has experienced movement within the Quaternary period (during the last 1.6 million years). Faults that have not moved in the last 1.6 million years generally are considered inactive. Surface displacement can be recognized by the existence of cliffs in alluvium, terraces, offset stream courses, fault troughs and saddles, the alignment of depressions, sag ponds, and the existence of steep mountain fronts.

The San Andreas Fault is the main boundary between the Pacific and North American plates and controls the seismic hazard in southern California. At its closest approach, the San Andreas Fault is approximately 24 miles north of the City. Compression of the fault has produced uplift of many of the mountain ranges in southern California. This crustal shortening is accommodated by reverse faulting, the motion of the block above the fault moving up over the block below the fault, caused by compressional forces, which causes a high potential for seismicity throughout most of southern California. Faults of the northern Peninsular Ranges Province generally reflect reverse as well as strike-slip faulting patterns, since the province is in a transitionary position between areas dominated by strike-slip movement and by compression. Seismic studies following the 1994 Northridge Earthquake have indicated that blind-thrust fault systems underlying the Los Angeles Basin could produce moderate to large earthquakes resulting in severe ground shaking.

The City is situated in the Transverse Ranges Province, which is at risk from several surrounding earthquake faults, shown in Figure 4.5-1, including the South Branch of San Gabriel fault (east of the northern part of the City), the Scholl Canyon Fault (within the eastern part of the City), Eagle Rock Fault (east of the proposed SGCP area), Sycamore Canyon Fault (within the eastern part of the City), and the Verdugo Canyon-La Tuna Canyon Fault (within the northeastern portion of the City). Faults within the northern part of the City include; the Rowley Fault, the Tujunga Fault, and the Mount. Lukens Fault. The highest risks originate from the southern-striking Verdugo fault zone (within 1 mile of the SGCP), the Raymond Hill fault zone (2 miles southeast of the proposed SGCP), the north-dipping reverse Sierra Madre fault zone (5 miles north east of the SGCP), and the blind thrust Elysian Park fault zone (located 6 miles south of the SGCP) (ECI 2003a).

Three faults are located within the proposed SGCP area: the Verdugo Fault (a south-striking fault), the Hollywood Fault (a left-lateral strike-slip fault), and the York Boulevard Fault. The York Boulevard Fault, a short northeast trending fault, located within the southernmost portion of the proposed SGCP area. Due to the relatively short length of the York Boulevard Fault, an earthquake is unlikely to be generated, but it may move should an earthquake occur on the nearby active Hollywood Fault (ECI 2003a).



ATKINS

FIGURE 4.5-1

Regional Faults

Sources: Esri 2017, Atkins 2017, Los Angeles County 2017, USGS 2017

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Liquefaction

Liquefaction is the process in which uniformly sized, loosely deposited, saturated, granular soils with low clay contents undergo rapid loss of shear strength through the development of excess pore pressure during strong earthquake induced ground shaking of sufficient duration, which cause the soil to behave as a fluid for a short period of time. Liquefaction generally occurs in saturated or near saturated cohesionless soils at depths shallower than 50 feet below the ground surface. If the liquefying layer is near the surface, structures supported by the soil may tilt or sink. If the layer is deeper in the subsurface, materials above the surface would have the potential to slide. Liquefaction prone areas associated with the Verdugo Wash are located above the northwest and northeast corners of the proposed SGCP area, as shown in Figure 4.5-2. In addition, liquefaction prone areas occur in the southeastern portion of the proposed SGCP area.

Landslides

A landslide is the down slope movement of soil and/or rock. Landslides can range in speed from very rapid to an imperceptible slow creep. Landslides can be caused by ground shaking from an earthquake or water from rainfall, septic systems, landscaping or other origins that infiltrate slopes with unstable material. Boulder-strewn hillsides can pose a boulder-rolling hazard from ground shaking, blasting or a gradual loosening of their contact with the surface. The likelihood of a landslide depends on an area's geologic formations, topography, ground shaking potential, and impacts caused by humans. Improper or excessive grading can increase the probability of a landslide. Land alterations, such as excavation, placement of fill, removal of vegetative cover, and introduction of water from drainage, irrigation or septic systems, may contribute to the instability of a slope and increase the likelihood of a landslide. Undercutting support at the base of a slope or adding too much weight to the slope can also produce a landslide.

The northern part of the City consists of steep hillslopes and rugged mountains. Much of the existing development has occurred in the flat to gently sloping alluvial surfaces at the base of the mountains; however, some development is present in and adjacent to steep hillsides. These areas include the canyons within the Verdugo Mountains and the San Rafael Hills, and the alluvial fans situated at the front of the San Gabriel and Verdugo Mountains (ECI 2003a). Such areas are locally vulnerable to slope instability, particularly in winters of heavy rainfall and following wildfires. The proposed SGCP area lies within an area with a low slope instability rating ranging from 0 to 10 degrees, as shown in Figure 4.5-3.

Soil Erosion

Erosion of soils can occur from both wind and water sources. Wind erosion physically removes the lighter, less dense soil constituents, such as organic matter, clays and silts, which are often the most fertile part of the soil. Surface water runoff erodes agricultural land and undercuts roadbanks, landfills, and riverbanks. Wind moves exposed loose soils off site and can contribute to reduced air quality. Eroded materials fill reservoirs, ponds, and drainage ditches and silt up harbors, streams, and rivers. The proposed SGCP area is underlain by alluvial units that are composed primarily of granular soils (silty sand, sand, and gravel), which can be susceptible to erosion. Although, the proposed SGCP area is primarily developed, the potential for soil erosion is low as soil is unlikely to be exposed.

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FIGURE 4.5-2

Areas at Risk of Liquefaction within Proposed SGCP Area

Source: City of Glendale 2017

100042606 South Glendale Community Plan PEIR

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FIGURE 4.5-3

Areas at Risk of Landslide

Source: City of Glendale 2017

100042606 South Glendale Community Plan PEIR

Seismic Hazards

The strength of an earthquake is generally expressed in two ways: magnitude and intensity. The magnitude is a measure that depends on the seismic energy radiated by the earthquake as recorded on seismographs. The intensity at a specific location is a measure that depends on the effects of the earthquake on people or buildings. Although there is only one magnitude for a specific earthquake, there may be many values of intensity (damage) for that earthquake at different sites.

Another measure of earthquake size is seismic moment, measured as moment magnitude (Mw). The seismic moment determines the energy that can be radiated by an earthquake. The moment magnitude of an earthquake is defined relative to the seismic moment for that event. Magnitudes are not used to directly estimate damage. An earthquake in a densely populated area, which results in many deaths and considerable damage, may have the same magnitude as an earthquake that occurs in a barren, remote area that does nothing more than frighten wildlife.

The proposed SGCP, located in the Transverse Ranges Province, is in an area of high seismicity with a documented history of earthquake activity. As stated above, active local and regional faults include the Verdugo Fault, the Raymond Hill Fault, the Sierra Madre Fault, the Hollywood Fault, the York Boulevard Fault, and the Elysian Park Fault. Historically, strong shaking has occurred within the vicinity of the proposed SGCP area. Notable earthquakes include the San Fernando Earthquake of 1971 (magnitude Mw 6.6) on the western-most segment of the Sierra Madre Fault, the Pasadena Earthquake of 1988 (local magnitude 5.0) on the Raymond Hill Fault, the Northridge Earthquake of 1994 (magnitude Mw 6.7) on the Northridge Thrust, and the West Hollywood Earthquake of 2001 (magnitude Mw 4.2) near the intersection of the Newport-Inglewood and Hollywood faults (ECI 2003b).

Surface Fault Rupture

Structures built within or adjacent to an active fault zone can sustain extensive damage during a fault rupture The Alquist-Priolo Earthquake Fault Zoning Act prohibits the construction of buildings for human occupancy across the trace of a known active fault. Avoidance of the active trace is the only available treatment and is the one required by the Alquist-Priolo Earthquake Fault Zoning Act for sites within State of California Earthquake Fault Zones (ECI 2003b). The proposed SGCP area is not located in or adjacent to an Alquist-Priolo Fault Zone (ECI 2003b).

Ground Shaking

Ground shaking is the earthquake effect which results in the majority of damage. Several factors control how ground motion interacts with structures, causing ground shaking hazards to be difficult to predict. Earthquakes, or earthquake-induced landslides, can cause damage near and far from fault lines. The potential damage to public and private buildings and infrastructure can threaten public safety and result in economic loss. Ground shaking is the most common effect of earthquakes that adversely affects people, animals, and infrastructure. Seismic waves can vibrate in any direction, and at different frequencies, depending on the frequency content of the earthquake rupture mechanism and the path and material through which the waves are moving through. The earthquake rupture mechanism is the distance from the earthquake source, or epicenter, to an affected site.

In the past, nearby faults have generated moderately sized earthquakes. Due to their length, the nearby faults may have the potential to cause much larger earthquakes, which would cause strong ground shaking.

Expansive Soils

Expansive soils contain types of clays (principally montmorillonite, illite, and kaolinite) that can release water (shrink) or take in water (swell) during changes in soil moisture content. The change in volume exerts stress on building foundations and other loads placed on these soils. The occurrence of these clays often is associated with geologic units of marginal stability. Expansive soils can be widely dispersed and are found in hillside areas, as well as low lying areas in alluvial basins. Soils testing to identify expansive characteristics and appropriate remediation measures are required routinely by grading and building codes. Collapsible soils undergo a re-arrangement of their grains, and a loss of cementation, resulting in substantial and rapid settlement under relatively low loads. Soils prone to collapse are commonly associated with man-made fill, wind-lain sands and silts, and alluvial fan and mudflow sediments deposited during flash floods.

Most of the City is underlain by alluvial units that are composed primarily of granular soils (silty sand, sand, and gravel). Such units are in the low to moderately low range for expansion potential. However, every sedimentary unit in the area contains lenses or layers of fine-grained soils (clays and silty clays) that are typically in the moderate to highly expansive range. These sediments are predominantly found in the distal parts of the alluvial fans, found in the proposed SGCP area. The proposed SGCP area is primarily composed of Hanford Sandy Loam with pockets of Hanford Sand and Holland Sandy Loam (Glendale 2003).

Subsidence and Settlement

Subsidence is the gradual settling or sinking of the ground surface with little or no horizontal movement. Subsidence is usually associated with the extraction of oil, gas or groundwater from below the ground surface. Ground surface effects related to regional subsidence can include earth fissures, sinkholes or depressions, and disruption of surface drainage. Damage is generally restricted to structures sensitive to slight changes in elevations, such as canals, levees, underground pipelines, and drainage courses; however, significant subsidence can result in damage to wells, buildings, roads, railroads, and other improvements. Regional subsidence as a result of groundwater pumping has not been reported in the proposed SGCP area. However, the thick alluvial deposits underlying the City may be susceptible to subsidence should rapid groundwater withdrawal occur beneath this portion of the groundwater basin.

Lateral Spreading

Lateral spreading is the displacement of relatively flat-lying alluvial material toward an open body of water or the wall of a channel. Lateral spreading typically occurs on gentle slopes ranging from 0.3 to 3 degrees, and displaces the ground surface by several yards. This horizontal movement of loose, unconfined sediments usually occurs in areas subject to liquefaction, during seismic vibration movements. of loose sediments. The potential for lateral spreading to occur within the proposed SGCP area is considered low.

4.5.2 Regulatory Framework

Federal

U.S. Geological Survey Landslide Hazard Program

In fulfillment of the requirements of Public Law 106-113, the USGS created the Landslide Hazard Program in the mid-1970s. According to USGS, the primary objective of the Landslide Hazards Program is to reduce long-term losses from landslide hazards by improving our understanding of the causes of ground failure and suggesting mitigation strategies (USGS 2016). The federal government takes the lead role in funding

and conducting this research, whereas the reduction of losses due to geologic hazards is primarily a state and local responsibility.

State

California Building Code

Adopted in 2016, and effective January 1, 2017, the California Building Code (CBC) update is based largely on the 2015 International Building Code and Uniform Building Code. The CBC includes the addition of more stringent seismic provisions for hospitals, schools, and essential facilities. The CBC contains specific provisions for structures located in seismic zones.

The CBC, which is updated every three years, is adopted by reference by City Ordinance 5892. Through the CBC, the State provides a minimum standard for building design and construction. The CBC contains specific requirements for seismic safety, excavation, foundations, retaining walls, and site demolition. Grading activities, including drainage and erosion control, are also regulated by the CBC.

Alquist-Priolo Earthquake Fault Zoning Act

The State legislation protecting the population of California from the effects of fault line ground surface rupture is the Alquist-Priolo Earthquake Fault Zoning Act (PRC 1972, 1994). The Act provides for special seismic design considerations if development is planned in areas adjacent to active or potentially active faults. The Act was passed in response to the 1971 Sylmar Earthquake (also known as the San Fernando Earthquake), which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. At the direction of the Act, in 1972 the State Geologist became responsible for delineating Earthquake Fault Zones around active and potentially active fault traces to reduce fault rupture risks to structures for human occupancy. The zones are revised periodically, and extend 200 to 500 feet on either side of identified active fault traces.

No structures for human occupancy may be built across an identified active fault trace. An area of 50 feet on either side of an active fault trace is assumed to be underlain by the fault, unless proven otherwise. Proposed structures for human occupancy within an Alquist-Priolo Earthquake Fault Zone are permitted only following the completion of a fault location report prepared by a California-registered professional geologist, usually in cooperation with a geotechnical engineer, and reviewed by the City-approved California-registered professional geologist. These reports conform to the guidelines set forth by California Geological Survey Note 49 Guidelines for Evaluating the Hazard of Surface Fault Rupture (1997a), and Special Publication 117 Guidelines for Evaluating and Mitigating Seismic Hazards in California (1997b). The investigations encompass the most recent information obtainable from the USGS, California Geological Survey, and other published sources, as well as data recovered on site from trenches, borings, test pits, and by geophysical methods. The location and structural design recommendations resulting from the investigation must be incorporated in the planning for, and structural design of, the proposed development.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act (1990) directs the State Geologist to delineate regulatory "Zones of Required Investigation" to reduce the threat to public health and safety and to minimize hazards associated with earthquake triggered ground failures. The Act regulations apply to public buildings intended for human occupancy and a large percentage of private buildings intended for human occupancy. The Act became effective in 1991 with the purpose of identifying and mapping seismically hazardous areas to assist

cities and counties in preparing the safety elements of their general plans and to encourage land use management policies and regulations that reduce seismic hazards. Under the terms of the Act, cities and counties must require a geotechnical report defining and delineating any seismic hazard prior to the approval of a project in a state identified seismic hazard zone. The local jurisdiction is required to submit one copy of the approved geotechnical report to the State Geologist within 30 days of approval of the report.

Hazards recognized in the Seismic Hazards Mapping Act include strong ground shaking, liquefaction, landslides, and other ground failure. At the direction of the Act, the State Geologist became responsible for preparing maps delineating 'Liquefaction Zones of Required Investigation' and earthquake-induced 'Landslide Zones of Required Investigation' in the Los Angeles Basin and San Francisco Bay areas. Evaluation and mapping have been completed by USGS, which encompass the proposed SGCP area.

Regional

There are no existing regional regulations pertaining to geology and soils that are applicable to the proposed project.

Local

Glendale General Plan

The following Glendale General Plan policies, goals, and objectives located in the Safety Element are applicable to geology and soils.

Safety Element

- **Goal 1:** Reduce the loss of life, injury, private property damage, infrastructure damage, economic losses and social dislocation and other impacts resulting from seismic hazards.
  - **Policy 1-1:** The City shall ensure that new buildings are designed to address earthquake hazards and shall promote the improvement of existing structures to enhance their safety in the event of an earthquake.
  - **Policy 1-2:** The City shall enforce the provisions of the Alquist-Priolo Earthquake Fault Zoning Act and the Seismic Hazards Mapping Act, with additional local provisions.
  - **Policy 1-3:** The City shall ensure to the fullest extent possible that, in the event of a major earthquake, essential structures and facilities will remain safe and operational. Essential facilities include hospitals, police stations, fire stations, emergency operation centers (as shown on Plate 1-4 of the Technical Background Report), communication centers, generators and substations, reservoirs and "lifeline" infrastructure (as defined in Section 1.8.3 of the Technical Background Report).
  - **Policy 1-4:** The City shall ensure that current seismic and geologic knowledge and State-certified professional review are incorporated into the design, planning and construction stages of a project, and that site-specific data are applied to each project.
- **Goal 2:** Reduce the loss of life, injury, private property damage, infrastructure damage, economic losses and social dislocation and other impacts resulting from geologic hazards.

- **Policy 2-1:** The City shall avoid development in areas of known slope instability or high landslide risk when possible, and will encourage that developments on sloping ground use design and construction techniques appropriate for those areas.

Glendale Building & Safety Code

The Glendale Building & Safety Code (GB&SC) contains rules and regulations which govern activities that could result in soil erosion or slope instability. Volume IA, Appendix J, Grading, provides provisions for excavation, grading, and earthwork construction, permitting procedures, as well as grading inspection protocols and procedures. Provisions for construction related erosion control include the preparation of cut and fill slopes and the implementation of erosion control measures, such as check dams, cribbing, riprap, or other methods are included in Section J110.

Glendale Municipal Code

Glendale Municipal Code Chapter 15.12 (Grading, Fills, and Excavation) provides rules and regulations to control grading, excavation, and earthwork construction (including fills, embankments, and erosion control) in hillside areas within the City. Glendale Municipal Code Chapter 30.11.040 provides hillside development standards specific to the Residential Open Space (ROS) and Restricted Residential (R1R) zones that limit development potential based on slope and provide for a greater degree of development review than in non-hillside zones. Glendale Municipal Code Chapter 16.08.160 (Design Standards-Mountainous Terrain) provides specific design standards for subdivisions located in the ROS and R1R zones.

4.5.3 Project Impacts and Mitigation

Analytic Method

Potential impacts associated with geology and soils resulting from implementation of the proposed project were evaluated and based on technical background reports prepared for the Glendale General Plan Safety Element, which describe existing geological conditions.

Thresholds of Significance

The following thresholds of significance are based on the 2017 State CEQA Guidelines Appendix G. For purposes of this EIR, implementation of the proposed project may have a significant adverse impact on geology and soils if it would do any of the following:

- 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 (refer to Division of Mines and Geology Special Publication 42)
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
  - Landslides

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

Effects Found Not Significant

Threshold	Would the project 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?

Development under the proposed SGCP would be served by sanitary sewer service and would not include the use of septic tanks. As such, the proposed project would not result in impacts due to the existence of inappropriate soils to support septic systems or alternative wastewater disposal systems where sewers are not available.

Less Than Significant Impacts

Threshold	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; strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides?

Impact 4.5-1 **Implementation of the proposed project 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; strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides. This would be a *less than significant* impact.**

Rupture of a Known Earthquake Fault

The proposed SGCP area is not located within an established Alquist-Priolo Earthquake Fault Zone. Designated Fault-Rupture Hazard Zones, as identified in the Glendale General Plan Safety Element, are depicted in Figure 4.5-1. Surface fault rupture hazards within the proposed SGCP area include the Verdugo Fault (a south-striking fault), York Boulevard Fault (a short northeast trending fault), and Hollywood Fault (a left-lateral strike-slip fault). The York Boulevard Fault is within a fault hazard management zone, and the Hollywood Fault Zone is located in the southern portion of the proposed SGCP area. Due to the relatively short length of the York Boulevard Fault, an earthquake is unlikely to be generated, but it may move should an earthquake occur on the nearby active Hollywood Fault (ECI 2003b). The Verdugo Fault

is also an active fault and is located along the north-east border of the proposed SGCP area. The potential for surface rupture as a result of fault plane displacement within the proposed SGCP area is low, and compliance with the CBC and applicable City codes would reduce any potential impacts associated with fault rupture to a level below significant; therefore, impacts would be less than significant and no mitigation is required.

Seismic Ground Shaking

Strong ground shaking would potentially occur in the event of an earthquake originating along one of the faults listed as active or potentially active within the proposed SGCP area. This hazard exists throughout southern California and could pose a risk to public safety and property by exposing people, property or infrastructure to potentially adverse effects.

To ensure safety, future development projects within the proposed SGCP area would be designed in accordance with the CBC, applicable City codes, and design recommendations found in the project specific soils engineering report. Compliance with applicable building codes would minimize structural damage and ensure safety in the event of strong seismic ground shaking; therefore, impacts are less than significant and no mitigation is required.

Seismic-related Ground Failure, Including Liquefaction

According to the ECI technical background report prepared for the Glendale General Plan Safety Element, the potential for liquefaction to occur within the proposed SGCP area is low. Liquefaction prone areas associated with the Verdugo Wash are located north of SR-134 outside the proposed SGCP area. Furthermore, the liquefaction prone areas near the Adams Hill and Forest Lawn areas are identified by the proposed SGCP as areas to be maintained; no changes to the existing land uses are proposed within these areas. Therefore, impacts related to liquefaction would be less than significant and no mitigation is required.

Landslides

Overall, the current built environment of the proposed SGCP area is relatively flat, with slopes primarily between 0 and 10 degrees. In the southeastern corner of the proposed SGCP area, there are small areas which contain slopes between 10 to 40 degrees, where land is primarily used for cemetery purposes. Landslide potential occurs within the Somerset, Adams Hill, and Forest Lawn areas. While there is potential for landslides in these areas, the proposed SGCP does not propose any changes to those areas, and future development of land uses in these areas is unlikely due to implementation of the proposed SGCP. Therefore, impacts related to landslides would be less than significant and no mitigation is required.

Threshold	Would the project result in substantial soil erosion or the loss of topsoil?

Impact 4.5-2 Implementation of the proposed project would not result in substantial soil erosion or the loss of topsoil. This would be a *less than significant* impact.

The proposed SGCP area primarily consists of a built urban environment. New development within the boundaries of the proposed SGCP area would have the potential to expose topsoil to erosion from water or wind during construction or operational activities, specifically earth moving and grading activities. This development could result in an increase of impermeable areas, which would potentially increase surface water runoff and associated erosion. A discussion of erosion from water runoff can be found in Section 4.8 of this EIR.

Future projects that would result in channel modification and hydro-modification, which is the alteration of the natural flow of water through a landscape, as well as grading and excavation during construction, would have the potential to result in an increase in erosion or topsoil loss from runoff. Additionally, removal of vegetation during or after construction would expose topsoil to wind that may result in loss of topsoil.

All future development projects implemented under the proposed project would be required to comply with the CBC, Glendale Municipal Code, and the GB&SC, which would ensure implementation of appropriate measures during grading and construction activities to reduce soil erosion. Furthermore, compliance with the adopted Glendale General Plan policies, as well as all applicable regulations, including the Glendale Municipal Code, GB&SC, National Pollution Discharge Elimination System permit program, and City-issued Grading Permits, would reduce impacts to a less than significant level. This impact is considered less than significant and no mitigation is required.

Threshold	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?

Impact 4.5-3 Implementation of the proposed project would not be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the proposed project, and potentially result in on or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. This would be a *less than significant* impact.

Topography within the proposed SGCP area is relatively flat, with the exception of the Adams Hill Neighborhood having a slope between 0 and 10 degrees; thus, stability problems are not likely to occur during ground shaking. Adams Hill, a neighborhood within the proposed SGCP area, is zoned entirely as a R1R Zone. Section 30.11.040 of the Glendale Municipal Code provides hillside development standards unique to R1R Zone and the ROS Zone that limit development potential based on slope and provide for a greater degree of development review than in non-hillside zones. Elsewhere in the generally flat SGCP area, the potential for hazards, such as landslides and liquefaction, as a result of seismic activity are considered low. A discussion of these impacts can be found above in the Impact 4.5-1 analysis.

Lateral spreading occurs as a result of liquefaction. As such, liquefaction prone areas could also be susceptible to lateral spreading. Since the potential for liquefaction is low, the risk for impacts associated with lateral spreading are considered low. Subsidence is generally related to the over pumping of groundwater or petroleum reserves from deep underground reservoirs. The thick, alluvial deposits underlying the City may be susceptible to subsidence associated with groundwater pumping; however, groundwater conservation practices would allow the groundwater basins to recharge, preventing subsidence.

Development within the proposed SGCP area would be required to comply with the GB&SC and the CBC regarding the minimum standards for structural design and site development, including GB&SC §1617 Seismic Design Provisions for Hillside Buildings. As part of the construction permitting process, the City would require complete geotechnical investigation at specific construction sites to identify potentially unsuitable soil conditions, including lateral spreading, subsidence, and collapse. The CBC requires that "classification of the soil at each building site shall be determined when required by the building official," and that "the classification shall be based on observation and any necessary test of the materials disclosed by borings or excavations." Similarly, GB&SC §J104.3 requires submittal of a geotechnical report "for all

projects requiring a grading permit, unless such report is determined unnecessary by the building official," and GB&SC §J104.2.3 requires a geotechnical report with an application for an engineered grading permit that includes "data regarding the nature, distribution and strength of existing soils, conclusions and recommendations for grading procedures and design criteria for corrective measures, including buttress fills, when necessary, and opinion on adequacy for the intended use of sites to be developed by the proposed grading as affected by geotechnical engineering factors, including the stability of slopes." The CBC and GB&SC Appendix J, Grading, also provides standards including, but not limited to, excavation, grading, and earthwork construction, foundation investigations, and liquefaction potential and soils strength loss. A site-specific evaluation of soil conditions, as required under Glendale General Plan Safety Element Policy 2-1, would be required for all construction projects within the proposed SGCP area and must contain recommendations for ground preparation and earthwork specific to the site, which plays an integral part of the construction design. Additionally, the design of the foundation support must conform to the analysis and implementation criteria described in CBC Chapter 15 & GB&SC §R401.1.

Adherence to Glendale General Plan policies, City requirements, as well as other State and federal building codes would ensure that development is not located on unstable soils or geologic units. With these requirements, the proposed project would have a less than significant impact in regard to the exposure of people or structures to hazards associated with unstable geologic units or soils, and no mitigation is required.

Threshold	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?

Impact 4.5-4 Implementation of the proposed project could be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994). However, adherence to General Plan standards and city, state, and federal regulations would result in a *less than significant* impact.

Fine-grained soils, such as silts and clays, may contain variable amounts of expansive clay minerals. As a result of moisture content changes, expansive clay minerals can change volumetrically. When expansive soils swell, the upward pressure created can have significant harmful effects upon structures and infrastructure.

The City is underlain by alluvial units that are composed primarily of granular soils (silty sand, sand, and gravel), which have a low to moderately low range for expansion potential. Every sedimentary unit within the proposed SGCP area contains lenses or layers of fine-grained soils (clays and silty clays) which are in the moderate to highly expansive range. Fine grained soils are likely to be found situated away from the central part of the alluvial fans, within the southern portions of the proposed SGCP area. Additionally, expansive clay can be found lining faults and fractures where clay can be deposited by groundwater (ECI 2003a).

Expansive soils may be exposed at the surface by erosion, or may be uncovered by grading. Most of the proposed SGCP area has already been developed, so the exposure of expansive soils through grading or erosion would be low. However, there remains undeveloped hillside areas in the Adams Hill Neighborhood located in the southeastern portion of the proposed SGCP. The neighborhood's R1R Zone has specific hillside development standards that limit development potential based on slope and provide for a greater degree of development review than in non-hillside zones.

Structures placed directly on fine-grained soils (clays and silty sands) within the proposed SGCP area may experience structural distress as a result of expansion in the clay minerals in an upward direction. The impacts associated with implementation of the proposed SGCP would potentially create substantial risks to life or property.

Construction standards have been developed to ensure structures can withstand changes in the integrity of the soil. Structural engineering standards have been incorporated into the CBC and GB&SC. If the area is located within a zone that has high shrink-swell soils, compliance with the structural and engineering standards set forth within the CBC and GB&SC §J107 and §J112 are required as project design considerations through the City building permit process. Such standards require that all development adhere to strict guidelines for construction on soils that are within a high shrink/swell category as defined by the U.S. Department of Agriculture Soil Survey. The CBC also contains construction and engineering standards for projects located in areas that have high shrink-swell soils. The provisions of the CBC and GB&SC §J104.3 and §R401.4 require that a geotechnical investigation be performed to provide data for the architect and/or engineer to responsibly design the project. Additionally, adherence to the soil and foundation support parameters and the grading requirements in the City's Building and Safety Code is required, and would ensure the maximum practicable protection available to soil features under static conditions.

New development within the proposed SGCP area would have the potential to be adversely impacted by expansive soils; however, compliance with the requirements for geotechnical investigation, following any resulting construction recommendations, and compliance with building code requirements would result in less than significant impacts related to expansive soils, and no mitigation is required.

4.5.4 Cumulative Impacts

Threshold	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; strong seismic ground shaking; seismic-related ground failure, including liquefaction; or landslides?

Most of southern California is located in an area of relatively high seismic activity. Cumulative projects, as with future projects within the proposed SGCP area, would be subject to the CBC and GB&SC §1617 standards, which contain requirements for developments in areas subject to Seismic Design. Additionally, cumulative projects would be subject to the Alquist-Priolo Earthquake Fault Zone Act, which restricts development on active fault traces. Other jurisdictions in the region have policies and guidelines in place to reduce seismic-related risks, and cumulative projects in these jurisdictions would be subject to these and other applicable State and/or federal regulations. Risk related to seismic hazards is site specific and is not compounded by adjacent development or increased development within the region; therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project would have a less than significant cumulative impact.

Threshold	Would the project result in substantial soil erosion or the loss of topsoil?

Cumulative projects would have the potential to result in substantial soil erosion or the loss of topsoil through construction activities, such as grading and excavation that may result in hydromodification or exposure of topsoil to wind that would result in the loss of topsoil. Development of cumulative projects

would result in a potentially significant cumulative impact associated with sedimentation of stream courses. Most cumulative projects are subject to State and local runoff and erosion prevention requirements, including the applicable provisions of the CBC, GB&SC §J101, SWRCB general construction permit, best management practices, and Phases I and II of the NPDES permit program. These measures are required to be implemented as conditions of approval for future development projects and are subject to continuing enforcement. Risk related to soil erosion or topsoil loss is site specific and is not compounded by adjacent development or increased development within the region; therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project would have a less than significant cumulative impact.

Threshold	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?

Cumulative projects would have the potential to be located on geologic units or soils that are 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. It is anticipated that some cumulative projects, such as those allowable under the general plans of adjacent jurisdictions, would be required to undergo analysis of geological and soil conditions applicable to the development site in question during CEQA environmental review. Further, they will have to comply with all applicable regulations to reduce risks, including those in the CBC and GB&SC §J101. Cumulative project compliance with applicable regulations would ensure that a significant cumulative impact would not occur. Risk related to soil stability is site-specific and is not compounded by adjacent development or increased development within the region; therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project would have a less than significant cumulative impact.

Threshold	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?

Cumulative projects would have the potential to be located on expansive soil, as defined in CBC Section 1802A.3.2, creating substantial risks to life or property. Some cumulative projects, such as those located within the City and adjacent jurisdictions, would be subject to CBC standards and GB&SC §J104.3 and §R401.4, ensuring that development can withstand changes in soil integrity. Risk related to expansive soil is limited to the development site and is not compounded by adjacent development or increased development within the region; therefore, cumulative projects in the region would not result in a significant cumulative impact. The proposed project would have a less than significant cumulative impact.

Threshold	Would the project 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?

All cumulative projects would be located in areas served by municipal sewer systems, as the Glendale Building Code does not allow septic tanks if a property is 200 feet or less from a City sewer main; therefore, new developments in the SGCP area will have to connect to the City's sewer main. While it is anticipated that most adjacent jurisdictions have permit requirements for on-site wastewater treatment system in place for the purpose of public health and safety, it is possible that some do not. Risk related to soils incapable of supporting waste water disposal systems is limited to the development site and is not compounded by adjacent development or increased development within the region; therefore, cumulative projects in the

region would not result in a significant cumulative impact. The proposed project would have a less than significant cumulative impact.

4.5.5 References

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