G. GEOLOGY, SOILS AND SEISMICITY

This section describes the project area geologic environment based on a site reconnaissance, published and unpublished geologic reports and maps, and site-specific technical reports. This section also assesses potential impacts from seismically-induced fault rupture, strong ground shaking, liquefaction, slope failure, lateral slope deformation, differential settlement and unstable or expansive soils. Mitigation measures for the identified significant impacts are provided, as appropriate.

1. Setting

This subsection describes the existing geologic and seismic conditions of the project and the vicinity and associated hazards.

a. Geologic Conditions. The geology, topography and soils of the project site and vicinity are described below.

(1) Geology. The project site is located at the western coastal margin of the Coast Range Geomorphic Province of Northern California, a relatively geologically young and seismically-active region on the western margin of the North American plate.[1] More specifically, the site is located at the northern end of the Santa Clara Valley, an alluvial valley and plain developed along the Guadalupe River. The project site is underlain by Quaternary-aged sand, gravel, silt, and mud.[2] A 2005 geotechnical feasibility study, prepared for the project site indicates that, in general, the midtown/downtown portion of San Jose is underlain by 20 to 25 feet of unconsolidated, moderately compressible, alluvial soils consisting of soft to stiff silts and clays and loose to dense sands.[3]

(2) Topography. The approximately 23.1-acre project site is located within a relatively flat urbanized area. The existing ground surface elevation varies from about 100 feet above mean sea level (amsl) to about 90 feet amsl.[4] No open creek or stream channels cross the site; however, Los Gatos Creek flows along the eastern project site boundary. The bottom of the creek channel is approximately 20 to 25 feet below the existing grade of the project site. The western bank has a slope of about 2:1 (horizontal to vertical).[5]

(3) Soils. Surface soils at the project site are mapped by the Natural Resource Conservation Service (formerly the Soil Conservation Service)[6] as soils of the Yolo Association. The Yolo association soils are characterized as well drained, medium and moderately fine textured soils developed in medium textured sedimentary alluvium. Yolo association soils have moderate to high shrink/swell potential, low to moderate corrosivity and fair strength.

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[1] California Geographic Survey (CGS), 2002, California Geomorphic Provinces, Note 36.

[2] Wentworth, C.M., 1997. Geologic Materials of the San Francisco Bay Region, United States Geological Survey (USGS) Open File Report 97-744.

[3] Lowney Associates, 2005. Geotechnical Feasibility Consultation San Jose Ballpark, Park Avenue and Autumn Streets, San Jose California, Report No. 2184-1G, prepared for: the Redevelopment Agency of The City of San Jose, December 7

[4] California Division of Mines and Geology (CDMG), 2002. Seismic Hazard Zones, San Jose West Quadrangle Map.

[5] Lowney Associates, 2005, op. cit.

[6] U.S. Department of Agriculture (USDA), 1968, Soils of Santa Clara County, Soil Conservation Service.

The geotechnical feasibility study (based on data reviewed from six previous investigations located within ½ mile of the project) indicates that subsurface conditions in the area consist of about 20 feet of interbedded layers of medium stiff to stiff clays and silts and loose to medium dense sands and gravels. Based on plasticity index testing at these former sites, it is anticipated that the project site will contain low to moderate plastic soils with a low to moderate expansion potential.[7] At the nearby site of the San Jose Diridon Light Rail Station, subsurface conditions were reported to consist of firm to stiff sandy lean clay with sand layers and lenses in the upper 35 feet overlying stiff sandy clay and dense to very dense sand layers through the depth drilled of about 100 feet.[8]

b. Seismic Conditions. Regional seismicity and site specific seismicity are described below.

(1) Regional Seismicity. The entire San Francisco Bay Area is located within the San Andreas Fault Zone (SAFZ), a complex of active faults forming the boundary between the North American and Pacific lithospheric plates. Movement of the plates relative to one another results in the accumulation of strain along the faults, which is released during earthquakes. Numerous moderate to strong historic earthquakes have been generated in northern California by the SAFZ. The level of active seismicity results in classification of the area of seismic risk Zone 4 (the highest risk category) in the California Building Code.

The SAFZ includes numerous active faults found by the California Geological Survey under the Alquist-Priolo Earthquake Fault Zoning Act (A-PEFZA) to be "active" (i.e., to have evidence of fault rupture in the past 11,000 years). The primary faults within the zone are the San Andreas, Hayward-Rodgers Creek, Calaveras, and San Gregorio faults. Regional active faults are shown on Figure V.G-1. There are no known active faults crossing the project site.[9]

The U.S. Geological Survey's Working Group on California Earthquake Probabilities estimated that there is a 62 percent probability that one or more Moment Magnitude (M_w) 6.7[10] or greater earthquakes will occur in the San Francisco Bay Area between 2002 and 2031.[11] The probability of a M_W 6.7 magnitude or greater earthquake occurring along individual faults was estimated to be 21 percent along the San Andreas Fault, 27 percent along the Hayward Fault, eleven percent along the Calaveras Fault, four percent along the Concord Fault, and three percent on the Greenville (Clayton/Marsh Creek) Fault. When predictions are expanded to 100 years it is estimated that about three M_W6.7 or greater events could occur during that time. Thus the probability of at least one M_W6.7 or greater magnitude earthquake rises to the near certainty of about 96 percent when calculated for a 100-year span.[12]

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[7] Lowney Associates, 2005, op. cit.

[8] Parikh Consultants, Inc., 2000. *Geotechnical Engineering Investigation Report, Diridon LRT Subway Structure*, Job No. 98168.10, March.

[9] City of San Jose, 1983. *Fault Hazard Map, San Jose West Quadrangle.*

[10] Moment magnitude (M_W) is now commonly used to characterize seismic events as opposed to Richter Magnitude. Moment magnitude is determined from the physical size (area) of the rupture of the fault plane, the amount of horizontal and/or vertical displacement along the fault plane, and the resistance to rupture of the rock type along the fault. Therefore, the magnitudes of expected earthquakes in the San Francisco Bay Area are reported as moment magnitude.

[11] USGS, 2003. *Earthquake Probabilities in the San Francisco Bay Region: 2002 to 2031 – A Summary of Findings*, Open File Report 03-214.

[12] Ibid.

Figure V.G-1: Regional Faults

8x11 b/w

(2) Site-Specific Seismicity. The project site is about 11 miles northeast of the San Andreas A-PEFZA fault zone[13] and about 6 miles southwest of the southern Hayward A-PEFZA fault zone.[14] Both faults are right lateral strike-slip faults with a northwest-southeast axis.[15] The site is not within an Alquist-Priolo Earthquake Fault Zone or a City of San Jose Potential Fault Hazard Zone[16]; however, it is located within a California Department of Conservation Seismic Hazard Zone as defined by the Seismic Hazards Mapping Act. Specifically, the project site falls within a liquefaction hazard zone.[17]

c. Seismic and Geologic Hazards. Seismic and geologic hazards, including surface rupture, ground shaking, peak acceleration, liquefaction and lateral spreading, expansive soils, slope stability, and settlement and differential settlement are discussed below.

(1) Surface Rupture. Surface rupture occurs when the ground surface is broken due to fault movement during an earthquake. The location of surface rupture generally can be assumed to be along an active or potentially active major fault trace. No active faults have been mapped at the project site. Therefore, potential for fault rupture at the site is negligible, and no portion of the site is located within an Alquist-Priolo Earthquake Fault Zone.

The closest active fault to the project site is the Hayward fault zone, located approximately 6 miles to the northeast. Other potentially damaging faults are located within 10 miles of the project site, including the Calaveras and Monte Vista-Shannon faults. The Calaveras fault is listed by A-PEFZA and is about 10 miles east of the site. The Monte Vista-Shannon fault is about 8 miles southwest of the project site and is considered a 'potentially active' fault that has not been active in the last 11,000 years.

(2) Ground Shaking. Ground shaking is a general term referring to all aspects of motion of the earth's surface resulting from an earthquake, and is normally the major cause of damage in seismic events. The extent of ground shaking is controlled by the magnitude and intensity of the earthquake, distance from the epicenter, and local geologic conditions. The Modified Mercalli Intensity Scale (MMI) is the most commonly used scale for measurement of the subjective effects of earthquake intensity (see Table V.G-1 for detailed descriptions of MMI levels). A related concept, acceleration, is measured as a fraction or percentage of the acceleration under gravity (g).

The repeat of the 1906 San Andreas quake is considered capable of generating about an M_w7.9 maximum earthquake.[18] An earthquake of this magnitude on the Hayward fault would generate very strong seismic shaking (MMI VIII) at the project site.

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[13] California Division of Mines and Geology (CDMG), 1974. *Special Studies Zone Map of the Cupertino Quadrangle.*

[14] California Division of Mines and Geology (CDMG), 1982. *Special Studies Zone Map of the San Jose East Quadrangle.*

[15] Right-lateral: if the trace of the fault were viewed while standing on one side during an event, it would appear that the ground on the other side of the fault moved to the right. Strike-slip: the sides are moving laterally relative to each other with little or no vertical movement.

[16] City of San Jose, 1983, op. cit.

[17] California Department of Conservation (CDC), 2002. *Seismic Hazard Zones Map, San Jose West Quadrangle.*

[18] ABAG, 2005. *Earthquake Shaking Scenario Map*, http://www.abag.ca.gov/bayarea/eqmaps/mapsba.html.

Table V.G-1: Modified Mercalli Scale

I	Not felt except by a very few under especially favorable circumstances.
II	Felt only by a few persons at rest, especially on upper floors of buildings. Delicately suspended objects may swing.
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration like passing of truck. Duration estimated.
IV	During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V	Felt by nearly everyone, many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII	Everybody runs outdoors. Damage negligible in building of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from river banks and steep slopes. Shifted sand and mud. Water splashed (slopped) over banks.
XI	Few, if any, (masonry) structures remain standing. Bridges destroyed. Board fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.
XII	Damage total. Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted.

Source: California Geological Survey, 2002, How Earthquakes and Their Effects are Measured, Note 32. April.

(3) Peak Acceleration. Estimates of the peak ground acceleration have been made for the Bay Area based on probabilistic models that account for multiple seismic sources. Under these models, consideration of the probability of expected seismic events is incorporated into the determination of the level of ground shaking at a particular location. The expected peak horizontal acceleration (with a ten percent chance of being exceeded in the next 50 years) generated by any of the seismic sources potentially affecting the project area, including the project site, is estimated by the California Geological Survey as 0.482.[19] This level of ground acceleration at the project site is a potentially significant hazard.

(4) Liquefaction and Lateral Spreading. Liquefaction is the temporary transformation of loose, saturated granular sediments from a solid state to a liquefied state as a result of seismic ground shaking. In the process, the soil undergoes transient loss of strength, which commonly causes ground

[19] California Geological Survey (CGS), 2005. *Probabilistic Seismic Hazards Mapping Ground Motion Page*, accessed 12/6/2005, www.consrv.ca.gov/cgs/rghm/pshamap/pshamain.html.

displacement or ground failure to occur. Since saturated soils are a necessary condition for liquefaction, soil layers in areas where the groundwater table is near the surface have a higher liquefaction potential than those in which the water table is located at greater depths.

As mentioned above, the project is located within a State of California-defined Liquefaction Hazard Zone, and is rated as a moderate liquefaction hazard area by Association of Bay Area Governments (ABAG) studies.[20]

Lateral spreading is a form of horizontal displacement of soil toward an open channel or other "free" face, such as an excavation boundary. Lateral spreading can result from either the slump of low cohesion unconsolidated material or more commonly by liquefaction of either the soil layer or a subsurface layer underlying soil material on a slope.[21] Earthquake shaking leading to liquefaction of saturated soil can result in lateral spreading where the soil undergoes a temporary loss of strength.

The lateral spreading hazard will tend to mirror the liquefaction hazard for the project, and by definition needs an open channel or "free" face to expand into; one example of such a condition would be the temporary excavations resulting from the construction process. Regional mapping provided by ABAG indicates the risk of liquefaction for the general area of the project to be moderate. Therefore, the risk of lateral spreading is considered to be moderate unless site-specific investigations determine otherwise.[22]

(5) Expansive Soils. Expansion and contraction of volume can occur when expansive soils undergo alternating cycles of wetting (swelling) and drying (shrinking). During these cycles, the volume of the soil changes markedly. As a consequence of such volume changes, structural damage to building and infrastructure may occur if the potentially expansive soils were not considered in project design and during construction.

Alluvium, of the type that generally characterizes the site and vicinity, can develop into compressible or expansive soils. Regional mapping indicates the risk of expansive soils for the area of the project to be moderate to high. Therefore, the risk of expansive soils in the project site should be considered to be moderate to high unless site-specific investigations determine otherwise. [23]

(6) Slope Stability. Slope failure can occur as either rapid movement of large masses of soil ("landslide") or slow, continuous movement ("creep"). The primary factors influencing the stability of a slope are: 1) the nature of the underlying soil or bedrock; 2) the geometry of the slope (height and steepness); 3) rainfall; and 4) the presence of previous landslide deposits.

Regional mapping shows that the project and surrounding area is mapped as Category 1, stable areas of zero to 5 percent slope that are not underlain by landslide deposits.[24]

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[20] ABAG, 2003. *Liquefaction Hazard Map for San Jose, Scenario: Entire San Andreas, Magnitude 7.9 Earthquake,* accessed 12/13/05 www.abag.ca.gov/cgi-bin/pickmapliq.pl.

[21] Rauch, Alan F., 1997. EPOLLS: An Empirical Method for Predicting Surface Displacements due to Liquefaction-Induced Lateral Spreading in Earthquakes, Ph. D. Dissertation, Virginia Tech, Blacksburg, VA.

[22] ABAG, 2003, op. cit.

[23] USDA, 1968, op. cit.

[24] USGS, 1970. *Regional Slope Stability Map of the Southern San Francisco Bay Region.*

(7) Settlement and Differential Settlement. Differential settlement or subsidence could occur if buildings or other improvements were built on low-strength foundation materials (including imported fill) or if improvements straddle the boundary between different types of subsurface materials (e.g., a boundary between native material and fill). Although differential settlement generally occurs slowly enough that its effects are not dangerous to inhabitants, it can cause significant building damage over time. Portions of the project site that contain loose or uncontrolled (non-engineered) fill may be susceptible to differential settlement. The area of the project site has undergone several development cycles since the 1880's, and the possibility of casual or non-engineered fill being present on the site exists, as documented in the series of Phase I Site Assessments prepared for project area parcels.[25,26,27,28,29,30,31]

d. San Jose 2020 General Plan Goals and Policies.[32] Applicable Goals and Policies from the City's General Plan are presented below.

Hazards

- *Hazards Goal:* Strive to protect the community from injury and damage resulting from natural catastrophes and other hazard conditions.
  - *Hazards Policy 1:* Development should only be permitted in those areas where potential danger to the health, safety, and welfare of the residents of the community can be mitigated to an acceptable level.
  - *Hazards Policy 2:* Levels of "acceptable exposure to risk" established for land uses and structures based on descriptions of land use groups and risk exposure levels are outlined in Figure 15, "Acceptable Exposure to Risk Related to Various Land Uses," of the San Jose General Plan 2020 and should be considered in the development review process.
  - *Hazards Policy 3:* Provisions should be made to continue essential emergency public services during natural catastrophes.
- *Soils and Geologic Conditions Goal:* Protect the community from the hazards of soil erosion, soil contamination, weak and expansive soils and geologic instability.
  - *Soils and Geologic Conditions Policy 1:* The City should require soils and geologic review of development proposals to assess such hazards as potential seismic hazards, surface ruptures, liquefaction, land-sliding, mud-sliding, erosion, and sedimentation in order to determine if these hazards can be adequately mitigated.
  - *Soils and Geologic Conditions Policy 4:* In order to prevent undue erosion of creek banks, the City should seek to retain creek channels in their natural state, where appropriate.

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[25] Lowney Associates, 2005. *Phase I Site Assessment (Draft), 102 South Montgomery and 530 West San Fernando Streets, San Jose, California* for the Redevelopment Agency of the City of San Jose, Project No. 2184-1D, October.

[26] Lowney Associates, 2005. *Phase I Site Assessment (Draft), 150 South Autumn Street, San Jose, California* for the Redevelopment Agency of the City of San Jose, Project No. 2184-1F, October.

[27] Lowney Associates, 2005, *Phase I Site Assessment (Draft), 170 South Autumn Street, San Jose, California* for the Redevelopment Agency of the City of San Jose, Project No. 2184-1F, October.

[28] Lowney Associates, 2005. *Phase I Site Assessment (Draft), 645 Park Avenue, San Jose, California* for the Redevelopment Agency of the City of San Jose, Project No. 2184-1D, October.

[29] Lowney Associates, 2005. *Phase I Site Assessment (Draft), 150 South Montgomery Street, San Jose, California* for the Redevelopment Agency of the City of San Jose, Project No. 2184-1D, October.

[30] Lowney Associates, 2005. *Phase I Site Assessment (Draft), 105 South Montgomery Street, San Jose, California* for the Redevelopment Agency of the City of San Jose, Project No. 2184-1D, October.

[31] Lowney Associates, 2005. *Phase I Site Assessment (Draft), 510 West San Fernando Street and 115 South Autumn Street, San Jose, California* for the Redevelopment Agency of the City of San Jose, Project No. 2184-1D, October.

[32] City of San Jose, California, 2005. General Plan 2020, accessed 12/13/05 www.sanjoseca.gov/planning/.

- *Soils and Geologic Conditions Policy 6:* Development in areas subject to soils and geologic hazards should incorporate adequate mitigation measures.
- *Soils and Geologic Conditions Policy 8:* Development proposed within areas of potential geological hazards should not be endangered by, nor contribute to, the hazardous conditions on the site or on adjoining properties.

- *Earthquakes Goal:* Minimize the risk from exposure to seismic activity.
  - *Earthquakes Policy 1:* The City should require that all new buildings be designed and constructed to resist stresses produced by earthquakes.
  - *Earthquakes Policy 2:* The City should foster the rehabilitation or elimination of structures susceptible to collapse or failure in an earthquake.
  - *Earthquakes Policy 3:* The City should only approve new development in areas of identified seismic hazard if such hazard can be appropriately mitigated.
  - *Earthquakes Policy 4:* The location of public utilities and facilities, in areas where seismic activity could produce liquefaction should only be allowed if adequate mitigation measures can be incorporated into the project.
  - *Earthquakes Policy 5:* The City should continue to require geotechnical studies for development proposals; such studies should determine the actual extent of seismic hazards, optimum location for structures, the advisability of special structural requirements, and the feasibility and desirability of a proposed facility in a specified location.
  - *Earthquakes Policy 6:* Vital public utilities as well as communication and transportation facilities should be located and constructed in a way which maximizes their potential to remain functional during and after an earthquake.

2. Impacts and Mitigation Measures

a. Criteria of Significance. The project would have a significant geology, soils, or seismicity impact if it would:

- Expose people or structures to substantial risk of loss, injury, or death involving:
  - Rupture of a known active or potentially active 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.
- Result in substantial soil erosion or 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 an on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.
- Be located on expansive soils (as defined in Table 18-1-B of the 1994 Uniform Building Code) or corrosive soils, which could cause substantial damage to building foundations, pavements, utilities, and/or other improvements.

b. Less-than-Significant Geology, Soils and Seismicity Impacts. The proposed project is not located on an unstable geologic unit, the development of which would be subject to, or contribute to, on- or off-site fault rupture, landslide, lateral spreading, or subsidence. Potential impacts associated with erosion and loss of topsoil is discussed in Section V.H., Hydrology and Water Quality.

c. Significant Geology, Soils and Seismicity Impacts. The following four significant impacts associated with the project have been identified.

Impact GEO-1: Seismically-induced ground shaking at the project could result in damage to life and/or property. (S)

All structures in the Bay Area could potentially be affected by ground shaking in the event of an earthquake. The amount of ground shaking depends on the magnitude of the earthquake, the distance from the epicenter, and the type of earth materials in between. Very strong to violent ground shaking is expected at the project site during expected earthquakes on the San Andreas and other regional faults. This level of seismic shaking could cause extensive non-structural damage in buildings at the site. In addition, limited structural damage may occur.

> Mitigation Measure GEO-1: Prior to the issuance of any site-specific grading or building permits, a design-level geotechnical investigation shall be prepared by a licensed professional and submitted to the City of San Jose Public Works Department for review and confirmation that the proposed development fully complies with the California Building Code (Seismic Zone 4). The report shall determine the project site's geotechnical conditions and address potential seismic hazards such as liquefaction. The report shall identify building techniques appropriate to minimize seismic damage. In addition, the following requirement for the geotechnical and soils report shall be met:
>
> - Analysis presented in the geotechnical report shall conform with the California Division of Mines and Geology recommendations presented in the *Guidelines for Evaluating Seismic Hazards in California*.[33]
>
> All mitigation measures, design criteria, and specifications set forth in the geotechnical and soils report shall be followed. (LTS)

It is acknowledged that seismic hazards cannot be completely eliminated even with site-specific geotechnical investigation and advanced building practices (as provided in the mitigation measure above). However, exposure to seismic hazards is a generally accepted part of living in the San Francisco Bay Area and therefore the mitigation measure described above reduces the potential hazards associated with seismic activity to a less-than-significant level.

Impact GEO-2: Structures or property at the project could be adversely affected by expansive soils or by settlement of project site soils. (S)

Soils underlying portions of the project site have moderate to high shrink/swell potential.[34] This condition could significantly damage structures and utilities. In addition, non-uniformly compacted imported fill placed at the site could experience settlement under new structural loads. Structural damage, warping, and cracking of roads and other infrastructure, and rupture of utility lines may also occur if the potential expansive soils and the nature of the imported fill were not considered during design and construction of improvements.

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[33] California Division of Mines and Geology (CDMG), 1997. *Guidelines for Evaluating Seismic Hazards in California*, CDMG Special Publication 117, 74 p.

[34] U.S. Department of Agriculture, 1968. *Soils of Santa Clara County*.

Mitigation Measure GEO-2: In locations underlain by expansive soils and/or non-engineered fill, the designers of stadium foundation and other improvements (including the electrical substation, sidewalks, roads, and underground utilities) shall consider these conditions. The design-level geotechnical investigation to be prepared by a licensed professional and approved by the City of San Jose Public Works Department (required in Mitigation Measure GEO-1), shall include measures to minimize potential damage related to expansive soils and non-uniformly compacted fill. Mitigation options may range from removal of the problematic soils and replacement, as needed, with properly conditioned and compacted fill to design and construction of improvements to withstand the forces exerted during the expected shrink-swell cycles and settlement.

All mitigation measures, design criteria, and specifications set forth in the geotechnical and soils report shall be followed to reduce impacts associated with shrink-swell soils to a less-than-significant level. (LTS)

Impact GEO-3: Differential settlement at the project site could result in damage to project buildings and other improvements. (S)

Grading of the project site in preparation for construction of buildings and utilities would result in areas of cut and fill. Fills of different thickness and fills adjacent to cut areas where native soils are exposed at the surface could create the potential for differential settlement. If the settlement is not uniform, structural damage could occur. Buried utilities may also experience differential settlement along their alignments.

Uncompacted and loose fill and existing casual and historic fill will be subject to varying rates of compaction and settlement compared to the native undisturbed soil. Structures built over discontinuous materials of varying densities and compactness may be subject to stress or damage due to differential settlement.

Mitigation Measure GEO-3: Prior to issuance of a grading permit, a site-specific grading plan shall be prepared by a licensed professional and submitted to the City of San Jose Public Works Department (see Mitigation Measure GEO-1). The plan shall include specific recommendations for mitigating potential settlement associated with fill placement and areas of different fill thickness. (LTS)

Impact GEO-4: Liquefaction at the project site could result in damage to buildings and other improvements. (S)

Regional mapping by ABAG indicates moderate to high susceptibility to liquefaction across the project site. Adverse effects of liquefaction can take many forms including flow failures, lateral spreads, ground oscillation, loss of bearing strength, settlement, and increased lateral pressure on retaining walls.[35] When the soil supporting a building or other structure liquefies and loses strength, large deformations can occur within the soil that may allow the structure to settle and tip; smaller settle-

[35] Earthquake Engineering Research Institute (EERI), 1994. *Earthquake Basics: Liquefaction – What is it and what to do about it.* Accessed at http://www.eeri.org on October 20, 2005.

ments may also occur as soil pore-water pressures dissipate and the soil consolidates after the earthquake.[36]

> Mitigation Measure GEO-4: Project design shall be in accordance with the recommendations contained in a site-specific geotechnical report prepared by a licensed professional and reviewed and approved by City of San Jose Public Works Department. (see Mitigation Measure GEO-1). The San Jose Public Works Department shall approve all final design and engineering plans. Project design and construction shall be in conformance with current best standards for earthquake resistant construction in accordance with the California Building Code (Seismic Zone 4), applicable local codes, and the generally-accepted standard of geotechnical practice for seismic design in Northern California. The design-level geotechnical investigation shall include measures to minimize that potential damage related to liquefaction. (LTS)

[36] The California Public Resources Code states that cities and counties shall require a geotechnical report defining and delineating any seismic hazards prior to approval of a project located in a seismic hazard zone.