IV. ENVIRONMENTAL IMPACT ANALYSIS
A. GEOLOGY AND SOILS

A Geotechnical Evaluation for the proposed project was prepared by Zeiser King Consultants, Inc. in March 2003 to analyze the potential geology and soils impacts associated with the proposed project. A summary of the Geotechnical Evaluation with respect to the potential geology and soils impacts is set forth below. The Geotechnical Evaluation, which is incorporated herein by this reference, is included as Appendix D (as a CD-ROM) to this Draft EIR and is available for public review (in hard copy form) at the Los Angeles Department of City Planning, 200 N. Spring Street, Room 763, Los Angeles, California 90012. The Geotechnical Evaluation and the following summary include an evaluation of both the project site and the Duke Property.

ENVIRONMENTAL SETTING

Topography

The project site is steep, hilly terrain with distinctive ridgelines dropping sharply into deep "V" shaped canyons. The northern portion of the project site includes a prominent east-west trending ridgeline, and several steep tributary ridgelines trending in a north-south direction. The southern portion of the project site is dominated by north-south trending ridgelines and intervening canyons. The La Tuna Canyon drainage is the predominant topographic feature of the southern portion of the project site and drains to the west to the San Fernando Valley. The local relief changes up to approximately 900 vertical feet. Land elevations range approximately from 1,160 feet to 2,064 feet above sea level. Natural slope gradients roughly range from 3:1 to as steep as 0.75:1 (horizontal:vertical). Steep "V" shaped canyons are abundant throughout the project site.

Previous Grading

The project site lies both to the north and south of Interstate 210. The portion of Interstate 210 adjacent to the project site was constructed in the early 1970s. Several cut and fill areas with large embankments were constructed in conjunction with the Interstate 210 construction. The artificial fill associated with Interstate 210 construction is addressed below. Various minor access roads and "leveled" areas exist mainly concentrated in Development Area A, the northern portion of the project site. The SCE transmission lines transect Development Area A from east to west. Observations indicate that cut and fill grading was used to create the pads for these transmission line towers.

Geologic Setting

Regional Geology

The Canyon Hills project site lies near the northern edge of the Los Angeles Basin within the northwestern flank of the Verdugo Mountains. These mountains are a portion of the Transverse Ranges geomorphic province of Southern California. The Transverse Ranges are characterized by east-west trending geologic structures, as opposed to prevailing northwest-southeast structural trends that dominate elsewhere in the State. The Verdugo Mountains are characterized primarily of Mesozoic or older age crystalline metamorphic and igneous basement rocks.

Quaternary age alluvial deposits, including stream terrace deposits and older alluvium, as well as recent alluvium occur in present-day stream courses. Man-made artificial fill is also common within developed portions of the Verdugo Mountains.

The Verdugo Mountains were most likely elevated above sea level in middle Pliocene time (approximately 5 million to 1.6 million years ago). Uplift of the Verdugo Mountains has continued to the present day. The mountains have been thrust up to the south and eroded to form the present mountain range. Terrace deposits, representing the uplifted remnants of older alluvium, exist at various elevations up to 2,800 feet, indicating that the range has undergone intermittent uplift during Pleistocene time (1.6 million to 11,000 years ago).

The Verdugo Mountains are surrounded by several known active fault zones that collectively comprise an active thrust belt. To the north and east, the Verdugo Mountains are in close proximity to the Sierra Madre Fault Zone. To the south and east, the Raymond Hill Fault Zone and the Verdugo-Eagle Rock Fault Zone exist within close proximity to the project site. In recent geologic time, considerable uplift and compression of Mesozoic bedrock blocks occurred along the fault zones that produced the linear features expressed as alternating regional valleys and ranges. The recent and high rate of bedrock uplift is apparent by the steep and narrow "V" shaped gorges typical of these mountainous areas.

Local Geology

Onsite geology consists of numerous surficial and bedrock units. The surficial units consist of artificial fill, topsoil/colluvial soils, recent alluvium and landslide debris. Bedrock units consist of sedimentary and volcanic Topanga formation and basement igneous rock, including granite, quartz diorite and metamorphic gneisses. As described above, the structure of the project site and the Verdugo Mountains is a direct result of uplift and exposure of the Mesozoic bedrock units. Sympathetic faulting and fracturing of the bedrock throughout the Verdugo Mountains has developed as a result of the uplift. These sympathetic faults are considered inactive (>1.6 million years old). The approximate limits of the respective surficial and bedrock units are illustrated in Figures IV.A-1 through IV.A-5.

Surficial Units

Artificial Fill. Most fill encountered on the project site is associated with materials generated from Interstate 210 construction of fill embankments (see Figures IV.A-1 through IV.A-5). The Caltrans artificial fill embankments/slopes found onsite are brown silty sands with some gravel and cobbles. These slopes range in height roughly from tens of feet to approximately 250 feet with fill depths up to approximately 270 feet thick. Artificial fill widths vary from approximately 50 feet to about 460 feet. Artificial fill lengths (dimension parallel to Interstate 210) range approximately from 100 to 4,000 feet. In general, the majority of "large" fill slopes are on the southern boundary of Interstate 210 (the northern portion of Development Area B) and are south facing with respect to orientation.

Other minor artificial fills are associated with dirt road construction and SCE transmission tower pad construction.

Topsoil/Colluvium (Qcol). Topsoil and colluvium within the project site consists of a relatively thin mantle of soil above the onsite bedrock materials. Generally, the topsoil and colluvial deposits were less than two feet in thickness. These materials consisted of fine to medium grained silty sands that were generally loose to medium dense and dry to damp.

Alluvium (Qa). Alluvial materials within the project site are confined to stream deposited materials consisting of brown clays, silts, and sands with gravel and cobbles. Generally, the alluvial materials are very minor with occurrences in canyon drainage bottoms. The only area of significant alluvial materials is in the southern portion of the project site, within the proposed equestrian park (see Figure IV.A-1).

Landslide Debris (Qls). Landslide debris is a general term used to describe the results of a variety of processes and landforms involving the downslope movement of earth material due to gravity. This term can describe existing surficial slumps, mud and debris flows, rock fall, soil creep or other movement of bedrock. Within the project site, the existing landslide materials are the result of prior accumulations of loose rock and debris flowing down canyon from steeper slopes above, and steeper slope areas undercut by stream erosion. The debris flows typically occur during periods of heavy rainfall and/or in association with ground shaking caused by earthquakes. These materials are composed mainly of brown silty sands with some gravel, cobbles, and boulders. The areas mapped on the project site that contain landslide debris (commonly referred to as "landslides" or "landslide areas") are typically less than 20 feet in thickness and exist at the base of steeper slopes. The landslides' consistency is generally loose and unsuitable for the support of fill embankments or engineered improvements. The approximate boundaries of the landslide areas are illustrated on Figure IV.A-1.

Figure IV.A-1, Geotechnical Map

Figure IV.A-1A, Geotechnical Map– Northern Portion Detail

Figure IV.A-1B, Geotechnical Map– Southern Portion Detail

Figure IV.A-2, Geotechnical Cross Section A

Figure IV.A-3, Geotechnical Cross Section B

Figure IV.A-4, Geotechnical Cross Section C

Figure IV.A-5, Geotechnical Cross Section D

Bedrock Units

Topanga Formation – Sandstone/Conglomerate (Ttusg). The upper Topanga Formation (Ttusg) consists of massive sandstone with pebble-cobble-boulder conglomerate beds of mostly granitic detritus. Bedding of this formation generally dips steeply to the northwest. This geologic unit can also include thin lenses of semi-siliceous shale. Exposures of this formation are limited to the extreme northwest corner of the project site, outside of the proposed Development Areas.

Topanga Formation - Volcanic Flows/Breccia (Tvb). Topanga volcanic rocks (Tvb) consist of basaltic to mafic andesitic flows and flow-breccias. They are dark brown to black in color and, in some areas, vesicular structures can occur and, when weathered they tend to be incoherent. This formation can be correlated with the Conejo Volcanics of the Santa Monica Mountains. This formation outcrops in a small band in the northwest corner of the project site, outside of the proposed Development Areas.

Leucocratic Granitic Rocks (gr). Granitic rock (gr), formed during the late Mesozoic (Cretaceous), is nearly white in color, massive, and consists of medium to fine-grained granitic rocks mostly comprised of quartz monzonite-granodiorite. This unit complexly intrudes into the quartz diorite (qd) and gneiss (gn). In general, this crystalline basement formation is made up of quartz, potassic feldspar, and sodic plagioclase feldspar, with sparse biotite. Where abundant mixing of the units occurred within the project site, the granitic materials were mapped as part of the quartz diorite (qd). This formation is sparsely located throughout the northern portion of the project site, and within the western and southern portions of Development Area A. General foundation characteristics of this formation indicate good to very good bearing characteristics, low to very low potential for settlement, and high compressive strength. This formation, as observed, is highly weathered near the surface, with the degree of weathering decreasing with depth.

Quartz Diorite (qd). Quartz Diorite (qd) is the predominant geologic bedrock terrain contained within the project site. It is gray in color, medium-grained quartz diorite with variations to diorite where the rock unit contains less quartz minerals. The quartz diorite is composed of quartz minerals, sodic plagioclase, feldspar, biotite, and hornblende. Roughly, 70 percent of the project site, and over 90 percent of the proposed Development Areas, is comprised of this geologic unit, which in some areas is complexly intruded by the aforementioned Leucocratic Granitic unit (gr). Foundation characteristics of quartz diorite indicate good to very good bearing characteristics, low to very low potential for settlement, and high compressive strength. This formation, as observed, is highly weathered near the surface, with the degree of weathering decreasing with depth.

Gneissic Rocks (gn). Gneiss consists of granitic rocks and quartz diorite metamorphosed under conditions of high temperature and pressure. Gneissic Rocks (gn) are generally found in the western portion of the project site. Small, localized pockets are located within the proposed Development Areas and are predominantly dark gray biotite-quartz-feldspar gneiss. This geologic unit ranges from thin layered gneiss to somewhat incoherent gneissoid quartz diorite or biotite diorite. Foundation characteristics of the gneissic rocks indicate good to very good bearing characteristics, low to very low potential for settlement, and high compressive strength. This formation, as observed, is highly weathered near the surface, with the degree of weathering decreasing with depth.

Geologic Structure

Bedding and Foliation

Bedding is defined as a continuous planar fabric as a result of layering during deposition of sedimentary rock. Bedding planes are preserved in the fabric of the rock structure as it undergoes further deposition, folding and faulting. Similarly, as igneous and metamorphic rocks are subjected to intense heat and pressure, minerals will align themselves in a fashion similar to bedding. This planar fabric of mineral alignment is defined as foliation. Foliation was mapped where observed within the gneissic bedrock materials. The existence of bedding and/or foliation are critical existing features of bedrock units which influence the stability of both natural and manufactured slopes. The orientation of these planar surfaces is a key factor to be considered during the analysis of slope stability.

Folding

The Transverse Range Province, of which the Los Angeles Basin is a part, is the result of uplift caused by the relative movement of the Pacific Plate and the North American Plate along the San Andreas Fault. Tectonic forces between the two crustal plates caused compression of the bedrock wherein large bedrock blocks were “bowed” in an anticlinal (convex upward) fashion to accommodate compressive forces. Compressive forces have also been accommodated within thrust faults throughout the Los Angeles Basin and surrounding areas.

Folding is indicated within the project site as the reflection of uplift of the Verdugo Mountains. Sympathetic (inactive) faulting, jointing, and fracturing of the hard granitic bedrock materials is also a result of the general uplift and compressive folding observed throughout the northern Los Angeles Basin and surrounding area.

Faulting and Seismicity

Southern California is a tectonically active region. Tectonic activity will typically create stress and strain within rock units that is relieved by fracturing and faulting within the bedrock materials. A fault is defined as a fracture within rock upon which there has been an observable amount of displacement. Fracturing or jointing is defined as a break within the rock structure that has not experienced displacement. Faulting can include major sutures within the earth’s crust that can produce earthquakes to smaller features that have experienced sympathetic movement due to movement on major faults, to joints and fractures that have not experienced displacement.

As a result of damage due to the 1971 San Fernando earthquake, the State of California enacted the Alquist-Priolo Act. The Act required the State Geologist to map known faults and determine relative activity of the fault. As such, the California Geologic Survey has created definitions for active, potentially active and inactive fault zones. An active fault is defined as a well-defined fault that has exhibited surface displacement during the Holocene (recent) time (approximately the last 11,000 years). A potentially active fault is defined as having a history of movement within the Pleistocene time (between 11,000 to 1.6 million years ago). An inactive fault is defined as any fault that has not experienced movement in the last 1.6 million years.

The fault systems discussed below in proximity to the project site are all active faults also classified as strike-slip, reverse, thrust and blind thrust faults. These classifications are irrespective of the fault activity and are based on the general sense of displacement and type of movement on the fault. A strike-slip fault has motion that is parallel to the direction or trend of the fault's surface trace. A reverse fault has displacement that is sub-vertical with one side of the fault moving over and above the other side. If a reverse fault has a dip angle of less than 45 degrees, it is called a thrust fault. A thrust fault which terminates before it reaches the surface is referred to as a blind thrust fault. When a blind thrust fault produces movement it may produce uplift of the ground above, but does not produce a clear surface rupture.

The faults mapped as part of the Alquist-Priolo Act only depict visible faults that have ruptured the ground surface. However, it is the quakes along faults that do not break the surface, or blind thrust faults, such as the fault that is associated with the Northridge and Whittier Narrows earthquakes, that increasingly are becoming the focus of study within the Los Angeles Basin. The effect of such faults may dominate the geology of the region in a way not previously known. The Alquist-Priolo fault rupture hazard zones, together with known blind thrust faults, are depicted within the Safety Element of the City of Los Angeles General Plan.

In particular, potential fault rupture zones are depicted on both the Fault Rupture Study Areas Map (Exhibit A) in the Safety Element of the City of Los Angeles General Plan and the State of California Alquist-Priolo Fault Rupture Hazard Maps of the Burbank and Sunland Quadrangle. The project site is not located within either the City or State delineated zones for fault rupture. None of the faults or fault zones with surface rupture potential identified on these maps cross or intersect the project site or the adjacent Duke Property. Based on review of referenced data, field mapping, exploration and aerial photo review of the project site, the project site does not exhibit surface expression that indicates the presence of active or potentially active faulting onsite or in the immediate vicinity of the project site.

The project site does contain some minor inactive sympathetic faults, as well as jointing and fracturing of the bedrock materials, as discussed above. These geologic features are illustrated on Figure IV.A-1.

Generally, the major faults beyond the immediate vicinity of the project site within the regional area trend northwest and are parallel to the San Andreas Fault, which is the largest regional fault. Numerous active and potentially active fault systems exist in regional proximity to the project site (see Figure IV.A-6). Below is a brief summary of the active fault systems that may produce seismic events that could affect the project site.

The Verdugo fault is located approximately two miles south of the project site at the southern base of the Verdugo Mountains. It generally parallels the Sierra Madre fault zone, dips to the northeast and has a general trend of direction from northwest to southeast. It is believed that this fault zone was responsible for the uplift of the Verdugo Mountains relative to the San Fernando Valley. The Verdugo fault is considered a thrust or reverse fault with most portions of the surface expression of the fault buried by alluvium at the southern base of the Verdugo Mountains. Portions of this fault as close as two miles from the project site have been classified as active by the California Geologic Survey.

The Sierra Madre fault zone is located approximately 1.5 miles to the east and northeast of the project site at the base of the San Gabriel Mountains. The fault dips to the north below the San Gabriel Mountains. It is largely buried beneath alluvial material derived from the San Gabriel Mountains. The Sierra Madre fault is classified as a thrust fault, and is considered active by the California Geologic Survey.

The San Fernando fault zone is located approximately two miles to the northwest of the project site. It is generally considered to be an extension of the Sierra Madre fault zone. This fault zone is believed to be a thrust fault that primarily dips steeply to the north with respect to rupture surfaces. This fault was responsible for the February 9, 1971 "San Fernando" earthquake (Mw 6.6). Surface rupture mapped in 1971 at the base of the San Gabriel Mountains was observed as close as two miles from the project site.

The San Gabriel fault zone, located approximately five miles north of the project site, is a steep north dipping active fault zone. It is approximately 84 miles long and is mapped as part of the San Andreas system. Similarly, the San Gabriel fault zone shows predominately right lateral strike-slip displacement. This system has also experienced varying vertical displacement, with the north side up in some places and down in others. The San Gabriel Fault has experienced some minor activity in recent geologic times and does display a few youthful breaks. Some Pleistocene deposits and stream courses have been affected by movement on this fault. The San Gabriel Fault is considered active by the California Geologic Survey.

Figure IV.A-6, Regional Fault and Seismicity Map

The Hollywood fault is generally considered a westward extension of the Raymond Hill fault. The Raymond Hill fault zone traverses roughly from South Pasadena to just east of Monrovia with the Hollywood fault traversing the area of Glendale to Beverly Hills. These faults are approximately 8 miles south and southeast of the project site. The Hollywood and Raymond Hill Faults are considered active by the California Geologic Survey.

The Northridge Fault, the causative fault for the 1994 Northridge Earthquake, is believed to be a buried or "blind" thrust associated with the Oak Ridge Fault system that extends westward to Santa Paula. The blind thrust portion of the fault is of unknown length due to the lack of surface expression. As such, the fault does not present a surface rupture hazard to the project site, but is capable of generating future seismic activity. This fault is approximately seven miles west of the project site.

The Elysian Park Thrust System underlies the central Los Angeles Basin and describes a series of northwest-southeast trending folds that overlie blind thrust faults. Regional seismicity indicates that these blind thrust faults are active, and include the fault ramp that produced the 1987 Whittier Narrows magnitude 6.0 earthquake. These subsurface faults are not exposed at the surface, and do not pose a fault rupture hazard to the project site. However, as demonstrated by the 1987 earthquake, the fault system is capable of generating future seismic activity. This fault is approximately 11 miles south of the project site.

The San Andreas fault zone, located approximately 25 miles north of the project site, is a major geologic structural element in California, and represents the boundary between the Pacific and North American tectonic plates. It strikes roughly west-northwest in the region closest to the project site and has a dip that is close to vertical. The entire fault system is over 750 miles long with a right lateral strike-slip sense of movement. The most recent large-scale seismic event of the southern portion of the San Andreas fault occurred in 1857.

Seismic Hazards

Seismic Shaking

The project site would be subject to ground motions induced by the movement along active faults, as discussed above. Earthquake magnitudes are typically characterized by the "Moment Magnitude" (Mw). The moment magnitude is a relative measure of the energy released by a given earthquake. Ground motions are typically summarized and represented by the Peak Ground Acceleration (PGA). The PGA is defined as the peak acceleration of a specific site due to a given earthquake.

The California Geologic Survey (formerly the California Division of Mines and Geology, CDMG) performed a probabilistic seismic hazard assessment for the State of California in 1996 (CGS OFR 96-08). The methodology for performing the assessment is also detailed in the 1996 document. As part of their methodology, the Geologic Survey delineated earthquake sources, defined the potential distribution of seismicity for each of the sources, and calculated the potential ground motions.

The City of Los Angeles Building Code (LABC) is based on the 2001 California Building Code (CBC) and 1997 Uniform Building Code (UBC). The LABC indicates that the design PGA at a site is to be calculated for a probability of exceedance of 10 percent in a 50-year exposure period, equivalent to a 475-year recurrence interval. Based on the above parameters, the magnitude resulting from this probabilistic analysis is referred to as the Maximum Probable Event (MPE). MPEs for the faults discussed in the previous section are presented in Table IV.A-1 below as Maximum Earthquake Magnitude (Mw). The PGA (i.e., ground motion) that would be experienced at the project site is calculated by inputting the MPE magnitude into a statistical attenuation relation equation that calculates energy loss as a result of distance from the seismic event. Generally, the closest fault system will produce the highest ground motion. Results of this analysis are listed below.

Table IV.A-1
Summary of Seismic Sources
Canyon Hills Project

Fault Name	Type of Faulting	Distance from Project Site (miles)	Maximum Earthquake Magnitude(M_w[a])	Peak Ground Acceleration g[b]
Verdugo	Reverse	2.0	6.7	0.82
Sierra Madre	Reverse	1.5	7.0	0.61
San Fernando	Thrust	2.0	6.7	0.44
San Gabriel	Right-Lateral Strike Slip	5.0	7.0	0.33
Hollywood/ Raymond Hill	Left-Lateral Reverse	7.8/8.4	6.4/6.5	0.26
Northridge Blind Thrust	Blind Thrust	6.8	6.5	0.35
Elysian Park	Blind Thust	11.4	6.7	0.17
San Andreas	Left-lateral Strike Slip	25.0	6.8-8.0	0.15

[a] *Moment Magnitude.*
[b] *Percentage of Gravity calculated by Borzongia, Campbell, Niazi, attenuation relation (1999).*

Source: Zeiser Kling Consultants, Inc., March 2003.

In order for engineered structures to withstand the PGAs summarized above, design procedures contained within the LABC provide the parameters set forth in Table IV.A-2 below to be input into the design of structures within the proposed Development Areas. The procedures contained within the

LABC incorporate the known seismic framework of the region, the relative activity of nearby faults, and the proximity of the project site to active faults to determine the parameters to be used in structural engineering calculations. The design fault is chosen based on the largest PGA for the project site (Table IV.A-1). The Seismic Source Type for a chosen design fault has been defined by the California Geologic Survey (CGS OFR 96-08) and in Table 16-U, LABC. The proximity of the project site to the design fault (near source distance) and soil and bedrock conditions beneath the project site (soil profile) are used to determine the Near-Source Factors (Na and Nv), which in turn are used to calculate the Seismic Coefficients (Ca and Cv) for the project site. These parameters are used by structural engineers in the design of structures to withstand earthquake forces. A listing of the design parameters are listed in Table IV.A-2.

Table IV.A-2
2002 City of Los Angeles Building Code Parameters[a]
Canyon Hills Project

Design Fault	Verdugo
Seismic Source Type	Type B
Near-Source Distance	2-km
Seismic Zone	4 (z = 0.4)
Soil Profile (Table 16-J, LABC)	S_B
Near-Source Factor N_a (Table 16-S, LABC)	1.5
Near-Source Factor N_v (Table 16-T, LABC)	2.0
Seismic Coefficient C_a (Table 16-Q, LABC)	0.40
Seismic Coefficient C_v (Table 16-R, LABC)	0.40

[a] 2002 City of Los Angeles Building Code, Chapter 16.

Source: Zeiser Kling Consultants, Inc., March 2003.

Liquefaction

The term liquefaction refers to a phenomenon that occurs when saturated, loose granular soils experience a temporary loss of strength when subjected to seismic ground vibrations. This loss of strength occurs when an increase of water pressure within the soil matrix exceeds the soil overburden pressure and therefore liquefies the soil matrix. For liquefaction to occur, three conditions are required:

- Ground shaking of significant magnitude and duration;
- Groundwater conditions sufficient to create saturated soil conditions; and

- Loose cohesionless soils.

Liquefaction does not directly pose a hazard to life, but the settlements and lateral ground displacements it may cause can severely damage or destroy structures or cause landslides that in turn could pose a hazard to life or property.

As part of the State of California Seismic Hazard Mapping program, the California Geologic Hazard Mapping program created seismic hazard maps to identify liquefaction hazards on an aerial basis. The project site and the Duke Property[1] fall within the Burbank and Sunland Quadrangles. Based on the most recent version of these maps, neither the project site nor the Duke Property is shown as a liquefaction hazard area. The Areas Susceptible to Liquefaction plate (Exhibit B) of the City of Los Angeles General Plan Safety Element also depicts areas of potential liquefaction hazard. There are no potential liquefaction hazard areas included within the project site or the Duke Property.

Seismically-Induced Settlement

Seismic shaking of loose sands and gravels, including those subject to liquefaction as well as unsaturated granular materials, may result in settlement. Seismically-induced settlement is especially pronounced when liquefaction occurs simultaneously with seismic settlement. Materials prone to seismically induced settlement were not observed within the project site boundaries or the Duke Property.

Seismically-Induced Landsliding

Just as man-made structures can be damaged by severe shaking from an earthquake, natural slopes can weaken and fail and cause damage to buildings and site improvements. Although most types of earthquake-induced landslides pose some hazard to human life and property, historical evidence shows that the predominant hazards to life safety come from rock avalanches, rock falls, and rapid soil flows.

Approximately 50 percent of the natural slopes within the project site and the Duke Property are located within an Earthquake Induced Landslide Hazard Zone as delineated on the State of California Seismic Hazard Maps, Burbank and Sunland Quadrangle. According to California Geologic Survey, Special Publication 118, the zones are defined as "areas meeting one or more of the following criteria":

- Areas known to have experienced earthquake-induced slope failure during historic earthquakes;

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[1] *The Duke Property is addressed throughout this analysis to provide supporting information for Alternative C (see Section VI (Alternatives to the Proposed Project)).*

- Areas identified as having past landslide movement, including both landslide deposits and source areas; and
- Areas where the California Geologic Survey's analysis of geologic and geotechnical data indicate that the geologic materials are susceptible to earthquake-induced slope failures.

Based on geologic mapping of the project site, it does not appear that the project site suffered considerable earthquake-induced landslides as a result of the 1971 San Fernando or 1994 Northridge earthquakes or other historic earthquakes of lesser magnitudes. Within the project site boundaries, rock fall would be the most likely form of earthquake-induced slope failure. A rock fall is defined as a free fall of rock fragments of various sizes detached from a slope. The fall may be combined with rolling and leaping of fragments, which may be broken into pieces in the process. Specifically, rock fragments might detach and roll downslope onto homes and other improvements below. Eight areas of potential seismically-induced rock fall have been identified within the project Development Areas (see Figure IV.A-1). These eight areas of potential seismically-induced rock fall are all located within an Earthquake Induced Landslide Hazard Zone, as discussed above.

Landslides

The Dibblee Foundation Map for the Sunland and Burbank (north ½) Quadrangles does not identify any landslides within the project site or the Duke Property. The State of California Seismic Hazards Zone map designates some of the natural slopes as areas with potential for "Earthquake-Induced Landslides." The Landslide Inventory & Hillside Areas plan (Exhibit C) in the City of Los Angeles General Plan Safety Element indicates that the project site is within a hillside area. However, there are no bedrock or probable bedrock landslide sites within the project site identified on Exhibit C.

Within the project site, landslide materials are due to accumulations of loose rock and debris flowing down canyon from steeper slopes above, and steeper slope areas undercut by stream erosion. These debris flows typically occur during periods of heavy rainfall and/or in association with ground shaking caused by earthquakes. Landslides mapped within the project site are typically less than 20 feet in thickness and exist at the base of steeper slopes generating loose rock debris. The landslides consistency is generally loose and unsuitable for the support of fill embankments or engineered improvements. The approximate landslide boundaries are illustrated on the Geotechnical Map (Figure IV.A-1). A summary of each landslide is presented in the Table IV.A-3 below. Landslides 4 and 7 through 9 are not within proposed Development Areas.

Table IV.A-3
Summary of Landslides
Canyon Hills Project

Landslide Designation	Approximate Depth	Approximate Width	Approximate Height	General Trend
1	10-20’	250’	100’	NW
2	10-20’	370’	130’	S
3	10’	30’	50’	W
4	10’	40’	70’	W
5	10’	70’	60’	NW
6	10’	40’	70’	S
7	10’	75’	120’	SW
8	10’	90’	100’	S
9	10’	150’	60’	SW
10	10’	50’	150’	SW
11	10-20’	310’	80’	S
Source: Zeiser Kling Consultants, Inc., March 2003.				

Slope Stability

Cut and Natural Slope Stability

Bedrock Fabric Stability

As noted in the physical descriptions and structure descriptions of the bedrock materials on the project site, the materials have undergone stress and strain resulting in fracturing and jointing of the bedrock. In the absence of bedding features, rock structure is controlled by faulting, jointing, and foliation. The orientation of these planar surfaces is a key factor to be considered during the analysis of the slope stability of the project site and proposed Development Areas.

During field mapping and subsurface exploration, these planar surface orientations were measured, located, and recorded on geologic maps and trench logs. The method of analysis of these features included tabulating the orientation of planar surfaces to evaluate where these surfaces might intersect with adverse orientation for slope stability. The method of analysis also included the use of a stereonet procedure. A stereonet is a two-dimensional process to interpret three-dimensional representations of planar surfaces. This can in turn be used to determine the stability of intersecting planar features. The first step in this process was a review of aerial photographs and site topography to determine areas of similar structural characteristics. These were identified by the “sectors” contained within the table below. The locations of the sectors are illustrated on the Stereonet Sector Map (Figure IV.A-7).

The major orientation patterns of bedrock jointing and foliation within bedrock sectors were collected from this investigation, previous investigations, and published geologic maps and were entered into the computer program SpheriSat 2. This computer program determines the major orientations as a density distribution of the plotted structural element pole projections utilizing the Gaussian counting model on an equal area Schmidt stereograph. From the density distribution it was determined that the most prominent planar orientations of the planar surfaces. Planar surfaces trends are identified by a compass bearing direction (strike) and an inclination in degrees (dip) from an imaginary horizontal planar surface (e.g., strike N (North) 13 (degrees) E (east) and dip 59 (degrees) NE (northeast)). Therefore, the first Prominent Planar Trend in Sector I is oriented in a compass direction 13 degrees east from north with an inclination of 59 degrees down from the horizontal toward the southeast. The results of the point density distribution analysis are presented in Table IV.A-4 below. The analyzed plots are presented in Appendix F to the Geotechnical Evaluation.

Table IV.A-4
Point Density Distribution Analyses Results
Canyon Hills Project

Sector Number	Structural Element	Number of Attitudes Analyzed	Prominent Planar Trend(s) Strike, Dip
I	Jointing	38	N13E, 59SE
			N68W, 47SW
			N12W, 74SW
			N22W, 80NE
II	Jointing	31	N54E, 66SE
			N62W, 46SW
			E-W, 71N
	Foliation	14	N-S, 57W
			N49E, 63NW
			N44E, 88NW
III	Jointing	94	N72W, 88SW
			N31W, 56SW
			N10W, 72SW
			N14E, 79NW
IV	Jointing	130	E-W, 52S
			N26E, 65SE
			N10E, 43SE
			N62W, 58SW
			N14W, 59SW
	Foliation	14	N2W, 64NE
V	Jointing	94	E-W, 90
			E-W, 58S
			N72E, 45SE
Source: Zeiser Kling Consultants, Inc., March 2003.			

Figure IV.A-7, Stereonet Sector Map

After determining the prominent compass orientation of planar surfaces, it was next determined the resultant compass orientation of these intersecting planar surfaces within individual sectors. The direction and inclination (plunge) of intersecting planar surfaces are characterized by their own strike and dip compass orientations. The compass orientation of the intersecting planar surfaces is a key factor to be considered during the analysis of the stability of natural and manufactured slopes. Within individual sectors, it is anticipated that slopes oriented subparallel to the inclination (dip) direction of the intersecting planes would potentially be adversely affected by potential slope failures. Table IV.A-5 below identifies compass orientations of slopes that may be affected by these inclined intersecting planes.

Table IV.A-5
Potential Adverse Slope Orientations
Canyon Hills Project

Sector Number	Direction of Intersecting Joint Sets	Plunge of Intersecting Joint Sets	Slopes Affected
I	S3E	45°	South facing
II	N62W S34W	38° 48°	Southwest facing Northwest facing
III	S7W	52°	South facing
IV	S to SE	45°	South to southeast facing
V	S42E	43°	Southeast facing
Source: Zeiser Kling Consultants, Inc., March 2003.			

Table IV.A-5 indicates that south-facing cut and natural slopes in all five Sectors of the Development Areas (as shown on Figure IV.A-7) are subject to potential slope instabilities. In addition, west and northwest facing slopes in Sector II, southeast-facing slopes in Sectors IV and V have adverse orientations in relation to jointing and would be subject to potential slope instabilities.

Fill Slope Stability

Fill slopes constructed of excavated and recompacted earth materials are proposed to a maximum height of approximately 200 feet. Slope stability analyses of these configurations utilizing shear strength testing of soil materials from within the proposed Development Areas indicates that current slopes, as shown in the current development plan meet LABC criteria of a 1.5 factor of safety under static loading conditions. Analyses of fill slope stability are included in Appendix G to the Geotechnical Evaluation.

Excavatability

Excavatability or "rippability" refers to the hardness of, and ability of conventional earthmoving equipment to excavate, earth materials within the project site. Excavatability surveys evaluate bedrock hardness generally by measuring a shear wave velocity through the bedrock formation with a higher velocity representing more resistant bedrock material. This is compared through empirical relations to determine relative ease of excavation for differing types of earthmoving equipment.

Onsite bedrock materials appear to be highly weathered and fractured where observed during field observations at the ground surface. The results of the seismic refraction survey generally indicate that the bedrock materials encountered to the depths explored exhibit relatively low seismic velocities corresponding to easily excavatable rock. Comparing the seismic velocities above, with the Rock Rippability Classification table contained in the seismic survey report (Appendix E to the Geotechnical Evaluation) suggests that the bedrock materials can be excavated with conventional earthworking equipment to surveyed depths. Table IV.A-6 below is a summary of the results of the seismic refraction survey perform within the Development Areas.

Table IV.A-6
Summary of Seismic Refraction Survey
Canyon Hills Project

Line	Depth of Survey (bgs)[a]	General Depth of Proposed Cut	Maximum Average Velocity to Survey Depth
1	60 feet	60 feet	2,501 feet/sec
2	80 feet	80 feet	2,567 feet/sec
3	80 feet	80 feet	2,808 feet/sec
4	80 feet	70 to 80 feet	3,515 feet/sec
5	60 feet	60 feet	2,373 feet/sec
6	80 feet	80 to 95 feet	3,642 feet/sec

[a] *bgs = below ground surface*

Source: Zeiser Kling Consultants, Inc., March 2003.

Seismic data obtained from the Pacific Soils Engineering report for the Duke Property (see Appendix C to the Geotechnical Evaluation) indicates average velocities of between approximately 2,800 feet/second to 4,000 feet/second to 60 feet in depth.[2] These velocities are similar to the velocities shown in Table IV.A-6, above. Although Caltrans documentation indicated similar velocities to those indicated by the

[2] *Pacific Soils Engineering, Inc. "Preliminary Geologic/Soil Engineering Investigation for Tentative Tract 48754, 7201 La Tuna Road, City of Los Angeles, California," June 21, 1990.*

Geotechnical Evaluation and the Pacific Soils Engineering report, some localized blasting was required during the construction of Interstate 210 to achieve proposed cuts.

The measured velocities are averages of the subsurface materials encountered and that significant local variations, such as fracture spacing, frequency and orientation in bedrock materials, may be encountered. Therefore, based on the data, the majority of the bedrock can be excavated without blasting. However, due to these expected variations, small, localized areas may still require blasting due to the variability of the onsite bedrock conditions.

Groundwater

Based on a recent report by the California Department of Water Resources (Bulletin 118, "California's Groundwater"), the project site is located within an elevated area between the San Gabriel groundwater basin and the San Fernando Valley groundwater basin. The project site and the Verdugo Mountains are not within either basin due to their relative elevation above the basins.

Locally, groundwater was encountered during the construction of Interstate 210 as discussed in the As-Built Materials report prepared after freeway construction was completed (see Appendix D to the Geotechnical Evaluation). Generally, the groundwater was located in the drainage area of La Tuna Canyon and subsidiary canyons draining into it. The depth of ground water ranged from 18 to 60 feet below the surface where encountered. This water was considered isolated to the tributary drainages through the site and not representative of a true groundwater "table" as found within the larger groundwater basins. No groundwater was encountered in exploratory excavations conducted by the consulting geotechnical engineers. The exploratory excavations were conducted periodically from June 2001 through March 2003. The locations of the exploratory excavations are shown on Figures IV.A-1A and IV.A-1B.

ENVIRONMENTAL IMPACTS

Thresholds of Significance

In accordance with Appendix G to the CEQA Guidelines, the proposed project could have a significant environmental impact if it would:

(a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

   (i) 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.

(ii) Strong seismic ground shaking.

(iii) Seismic-related ground failure, including liquefaction.

(iv) Landslides.

(b) Result in substantial soil erosion or the loss of topsoil.

(c) 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.

(d) Be located on expansive soil, as defined in Table 18-1-B of the California Building Code (2001), creating substantial risks to life or property.

(e) 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.

In addition to the above, the California Geologic Survey has also incorporated the following potential impacts within their "Guidelines for Preparation of Geologic Sections of Environmental Impact Reports" (CDMG Note 46, 1982):

(a) Flooding due to Dam or Levee Failure.

(b) Loss of Mineral Resources.

(c) Excavation and Blasting.

(d) Impacts due to seiches.

(e) Impacts due to tsunami.

(f) Volcanic Hazards.

Project Impacts

The project impacts focus on the project site, but the analysis is generally applicable with equal force to the Duke Property. The Duke Property is included in this analysis in order to provide additional information with respect to Alternative C (Duke Property Alternative Access, 280 Lots) (see Section VI (Alternatives to the Proposed Project)).

Seismic Impacts

In general, seismic exposure at the project site is typical of the Southern California region. Possible sources or causes of earthquake-related damages are addressed below.

Rupture of a Known Earthquake Fault

The project site does not lie within an Alquist-Priolo Special Studies Zone, nor is the project site within an active fault zone as defined by the City of Los Angeles General Plan Safety Element Fault Rupture Study Areas. No known active or potentially active faults cross the project site. Faults encountered within the project site are considered sympathetic to tectonic movement on major earthquake-producing faults. Evidence of movement on these sympathetic faults within the last 1.6 million years that would indicate an active or potentially active fault was not encountered during exploration of the site. Therefore, the proposed project would not expose people or structures to potential substantial adverse effects involving rupture of a known earthquake fault.

Seismic Ground Shaking

As with all properties in the seismically active Southern California region, the project site is susceptible to ground shaking during a seismic event. Potential impacts from seismic ground shaking are present throughout Southern California and would be of comparable intensity at the project site as it would be for large parts of the City and the region. The proposed homes and infrastructure that comprise the project will be designed in accordance with the seismic parameters set forth in Table IV.A-2, which incorporate the known seismic framework of the region, the relative activity of nearby faults, the proximity of the project site to active faults (or "near-source" effects), and soil and bedrock conditions beneath the project site. Compliance with the LABC utilizing the parameters set forth in Table IV.A-2 would reduce seismic risks to an acceptable level. Therefore, the proposed project would not expose people or structures to potential substantial adverse effects relating to strong seismic ground shaking.

Seismic-Related Ground Failure and Liquefaction

The project site is not within an area considered subject to liquefaction or seismic settlement as delineated by the State of California Seismic Hazard Maps, or the City of Los Angeles General Plan Safety Element. In any event, surficial earth materials within the proposed Development Areas that may be susceptible to liquefaction will be removed in accordance with normal grading procedures. The proposed project would not expose people or structures to potential substantial adverse effects involving liquefaction or other seismic-related ground failure. Materials prone to seismically induced settlement were not observed within the project site or the Duke Property.

Seismically-Induced Landslides and Rock Fall

The project site is dominated by steep canyons composed primarily of weathered and jointed bedrock. Based on geologic mapping of the project site, it does not appear that the project site has suffered considerable earthquake-induced landslides as a result of historic earthquakes. Within the project site boundaries, rock fall would be the most likely form of earthquake-induced landslide. Seismically-induced rock fall describes rock fragments loosened due to shaking related to an earthquake.

As discussed above, there are eight areas of potential seismically-induced rock fall in the Development Areas (see Figure IV.A-1). These eight areas are all located in an Earthquake Induced Landslide Hazard Zone, as discussed above. There are approximately 21 proposed homes in exposed locations beneath those eight areas. Although geologic mapping of the project site indicates that no significant earthquake-induced landslides occurred in these areas as the result of historic earthquakes, the potential for significant property damage or potential loss of life exists if such a landslide did occur. Therefore, the proposed project could expose people or structures to potential substantial adverse effects as the result of seismically-induced rock fall and therefore is a significant impact. However, incorporation of the mitigation measures presented below would reduce this potentially significant impact to a less-than-significant level.

The potential for seismically-induced landslides, other than those that cause rockfall, are addressed by the LABC and City Grading Code and therefore would be a less-than-significant impact.

Tsunami

A tsunami is a sea wave caused by a submarine earthquake, landslide, or volcanic eruption. Tsunami can cause catastrophic damage to shallow and or exposed coastline. The project site is located approximately 40 miles inland from the Pacific Ocean, and is at an elevation sufficiently above sea level to preclude affects of tsunami. Therefore, the potential for tsunami to affect the project site is considered non-existent.

Seiches

Seiches are changes or oscillations of water levels within a confined body of water due to fluctuations in the atmosphere, tidal currents, or earthquakes. The effect of this phenomenon is a “standing wave” that would occur in a body of water that would occur when influenced by the external stimulus. No lakes, reservoirs, or other large confined bodies of water are in close proximity of the project site. Therefore, the potential for seiches to affect the project is considered non-existent.

Soil Erosion or Loss of Topsoil

The graded and natural areas of the proposed project will be subject to erosion, sedimentation during, and following grading of the Development Areas. The Grading Code, as well as the provisions of the Federal Clean Water Act regulations, requires that erosion be controlled and minimized through the use of Best Management Practices, and appropriate flood and storm drainage control systems. Compliance with those codes and regulations will reduce soil erosion and loss of topsoil to acceptable levels. Therefore, the proposed project would not result in substantial soil erosion or loss of topsoil.

Project Site Stability

Landslides

The proposed development may be subject to slope and/or foundation instability due to landslides. Landslides 1 through 3, 5, 6, 10 and 11 are located within the proposed Development Areas (see Figure IV.A-1). Approximately 10 of the proposed homes are located within or adjacent to these landslide areas. Without mitigation, the potential exposure would constitute a significant environmental impact. However, incorporation of the mitigation measures presented below would reduce this potentially significant impact to a less-than-significant level. Landslides 4 and 7 through 9 would not expose people or structures to landslides because they are not located in proximity to any of the proposed homes or infrastructure.

Mudflows

The primarily granular character of the surficial materials within the Development Areas is not conducive to the development of mud and debris flow. Therefore, no impact from mud and debris flow would occur.

Proposed Cut Slopes

Natural and proposed cut slopes within the Development Areas perpendicular to and sloping in the direction of the trend presented in Table IV.A-4 would potentially be subject to slope instabilities. As such, the grading of south and northwest facing cut slopes for the proposed project may result in slope and/or foundation instability. The majority of the proposed cut slopes on the project site will expose highly weathered and/or highly jointed bedrock, which will be susceptible to possible surficial failure or deep-seated slope failures and will require stabilization measures. Proposed cut slopes range in height from tens of feet to roughly 100 feet (vertical relief). As indicated above, all five Sectors of the Development Areas (as shown on Figure IV.A-7) are subject to potential slope instabilities. In addition, west and northwest facing slopes in Sector II, and southeast facing slopes in Sectors IV and V, have adverse orientations in relation to jointing and would be subject to potential slope instabilities. Slope instability could lead to slope failures that would pose a hazard to property and life safety.

Therefore, this is considered a potentially significant impact. However, incorporation of the mitigation measures below would reduce this potentially significant impact to a less-than-significant level.

Cut Pads

The majority of the cut pads proposed in the development plan are situated along ridgelines with a portion of the proposed cut pad extending to the natural slope face. These pads are anticipated to expose one or a combination of the following conditions:

- Highly sheared, jointed or fractured bedrock;
- Unsuitable topsoil and/or highly weathered bedrock;
- Materials with different settlement characteristics; and/or
- Hard rock with difficult excavation characteristics.

The LABC requires that potentially adverse bedrock conditions be mitigated by appropriate foundations or remedial grading to address potential differential settlement. Grading of cut pads in accordance with the LABC would have a less-than-significant impact.

Proposed Fill Slopes

In accordance with the LABC, proposed fill slopes within the proposed Development Areas will be required to meet a minimum factor of safety of 1.5, and be stable under seismic loading conditions. Any portion of a proposed fill slope with a gradient steeper than 2:1 should be reinforced with geogrid or lessened to a 2:1 gradient with retaining walls. Grading of fill slopes in accordance with the LABC would be a less-than-significant impact.

Comprehensive Earth Materials

In accordance with LABC requirements, compressible earth materials are to be removed and replaced as compacted fill. The proposed project will avoid the compressible fills placed on the project site in connection with the construction of Interstate 210. Therefore, the existence of compressible earth materials would be a less-than-significant impact.

Land Subsidence

Land subsidence is the gradual sinking or downward warping of the earth's surface due to a variety of possible circumstances and or activities that include mining, and the removal of oil or groundwater. No potential land subsidence-related circumstances and or activities are suspected to occur on the project site, nor have they in the past. No potential for land subsidence exists and, as such, no impact is expected to occur.

Expansive Earth Materials

Expansive soils generally contain clay minerals that absorb moisture and cause the material to "swell" or increase in volume. Likewise, when expansive soils dry out, they tend to shrink or decrease in volume. Volume changes associated with changes in the moisture content of near surface soils can cause uplift or heave of the ground surface. Less commonly, settlement can occur when they lose moisture or dry out. Expansive earth materials are not known to be present within the project site. Therefore, no impact from the existence of expansive earth materials would occur.

Onsite Waste Disposal

It is assumed that a sanitary sewer system will be constructed to serve the proposed development with connection to the local sanitation district system. Onsite sewage disposal will therefore not be necessary. However, private sewage disposal systems reportedly serve the existing residential neighborhood to the northeast of Development Area A. Excavation of cut slopes adjacent to existing neighborhoods are proposed in a limited area of proposed Development Area A. These cut slopes could expose seepage associated with the drain fields of existing private sewage disposal systems. Due to the limited area affected by potential groundwater and the distance from Development Area A, this would be a less-than-significant impact.

Flooding Due to Dam or Levee Failure

No dams or levees are located on or upstream of drainage courses to the project site. As such, no impact due to flooding caused by a dam or levee failure would occur.

Loss of Mineral Resources

No published geologic maps indicate any significant mineral or petroleum resources within the project site. The project site also lies outside of "Areas Containing Significant Mineral Deposits" and "Oil Field and Oil Drilling Areas" as defined in the City of Los Angeles General Plan. Therefore, no impact on mineral resources would occur.

Excavation and Blasting

Seismic refraction data gathered as a part of this study indicates that at the depths of proposed grading within the proposed Development Areas, bedrock materials should be excavatable using conventional heavy earthmoving equipment. It is noted, however, that during construction of Interstate 210, some localized blasting was necessary to achieve grades within the freeway alignment, despite favorable seismic refraction data. Based on the discussions above, it should be assumed that some blasting may be necessary in small, localized areas to achieve proposed grades within the Development Areas. Blasting would be conducted in accordance with the applicable requirements of the City of Los Angeles

Building, Grading, and Fire Codes. Impacts due to blasting would be noise, vibration, and dust. Locations of areas that may be subject to blasting are significantly distant from existing development to reduce impacts from noise and vibration. Adherence to the City of Los Angeles Grading and Fire Codes will reduce impacts to a less-than-significant level. Therefore, grading, excavation and blasting of the proposed Development Areas would be a less-than-significant impact.

Volcanic Hazards

No potential source of volcanic activity that would produce such hazards as lava flow or ash fall are known to exist in Southern California. Therefore, no volcanic hazard impact would occur.

MITIGATION MEASURES

As indicated in the above discussion, significant impacts to geology and soils would occur with implementation of the proposed project due to the potential for rock fall, landslides, and cut slopes. To address these impacts, the following mitigation measures should be implemented during grading and construction activities associated with the proposed project:

A-1 The project developer shall incorporate setback zones from potential rock fall areas (as shown in Figure IV.A-1). In areas where proposed structures may encroach within the setback area, rock fall containment devices shall be incorporated into the design. Examples of such devices include debris fences or walls, rock bolting and netting, or rock fall containment basins.

A-2 The project developer shall grade buttresses of existing landslides and install subdrainage systems to reduce the build-up of subsurface water, thereby increasing the stability of the slopes. At a minimum, slopes prone to landsliding shall be provided with a minimum keyway width of one-half of the slope height (with a minimum width of 12 feet), and a buttress fill to provide a final slope gradient of 2:1 (horizontal:vertical) in accordance with the LABC.

A-3 The following mitigation shall be completed during grading using standard grading techniques in accordance with the LABC, which would reduce risks from landslides to an acceptable level. The project developer shall:

- Stabilize or remove Landslide 1 during grading.
- A cut slope proposed into Landslide 2 will require stabilization of the slope and a partial removal of the landslide mass.

- Landslide 3 shall include a shear key for the outside edge of the roadway above.
- Landslides 5 and 6 shall be removed during grading.
- The outside edge of the lot above Landslide 10 will require a shear key to proposed building pads above.
- Landslide 11 will require a partial excavation of the landslide mass to provide support for the adjacent fill slope.

A-4 The project developer shall replace most cut slopes, as required, with a stabilization fill slope or buttress fill slope with a maximum slope gradient of 2:1 (horizontal:vertical). Any slope that cannot be rebuilt as a 2:1 or flatter shall be rebuilt as a reinforced slope or lessened to a 2:1 gradient with retaining walls.

A-5 The project developer shall ensure that temporary back cut slopes associated with remedial grading of stabilization fills and buttress slopes shall not exceed a slope gradient of 1.5:1 (horizontal:vertical), and shall more typically maintain a slope gradient of 2:1. Fill widths at the top of the proposed slopes shall maintain a minimum width of 15 feet. Buttress and stabilization fills shall be built with keyways with a minimum width of one-half the slope height (with a minimum width of 12 feet) and supplied with subdrainage to preclude buildup of water. Design and grading construction of the proposed cut slopes shall conform with the LABC.

Although additional mitigation measures are not required under CEQA, the following additional mitigation measures are recommended to reduce further the proposed project's construction-related impacts on geology and soils:

A-6 Excavation and grading activities shall be scheduled during dry weather periods. If grading occurs during the rainy season (October 15 through April 1), diversion dikes to channel runoff around the site shall be constructed. Channels shall be lined with grass or pavement shall be roughened to reduce runoff velocity.

A-7 Appropriate erosion control and drainage devices to the satisfaction of the Building and Safety Department, Grading Division, shall be incorporated, such as interceptor terraces, berms, vee-channels, and inlet and outlet structures, as specified by Section 91.7013 of the LABC, including planting fast-growing annual and perennial grasses in areas where construction is not immediately planned to shield and bind the soil.

A-8 All construction waste shall be disposed of properly. Appropriately labeled recycling bins shall be provided to recycle construction materials, including solvents, water-based paints, vehicle fluids, broken asphalt and concrete, wood and vegetation. Non-recyclable materials/wastes shall be taken to an appropriate landfill. Toxic wastes shall be discarded at a licensed regulated disposal site.

A-9 During construction, leaks, drips and spills shall be immediately cleaned up to prevent contaminated soil on paved surfaces that can be washed away into the storm drains.

A-10 During construction, pavement shall not be hosed down at material spills and dry cleanup methods shall be used whenever possible.

A-11 During construction, dumpsters shall be covered and maintained. Uncovered dumpsters shall be placed under a roof or cover with tarps or plastic sheeting.

A-12 During construction, gravel approaches shall be used where truck traffic is frequent to reduce soil compaction and limit the tracking of sediment into streets.

A-13 During construction, all vehicle/equipment maintenance, repair and washing shall be conducted away from storm drains. All major repairs shall be conducted offsite. Drip pans or drop clothes shall be used to catch drips and spills.

CUMULATIVE IMPACTS

Development of the proposed project in conjunction with the 13 related projects indicated in Figure II-1 in Section II.C (Related Projects) of this Draft EIR would result in further development of the Verdugo Mountains area in the City. Only the Duke Project (Related Project No. 7) is sufficiently close to the project site to expose people or structures to the combined effects of hazardous geotechnical conditions. As reflected above, the Geotechnical Evaluation that was prepared for the proposed project included an evaluation of both the project site and the Duke Property. The Geotechnical Evaluation considered the potential cumulative impacts of the soil and bedrock characteristics, seismic considerations, mineral resources, slope and foundation stability, excavatability, groundwater, erosion, land subsidence and volcanic hazards of the project site and the Duke Property. It was concluded, however, that no cumulative geology and soils impacts would occur. Other issues analyzed in this Section relative to geology and soils are site-specific and there is little, if any, cumulative relationship between development of the proposed project and the 12 other related projects. Therefore, cumulative geology and soils impacts would be less than significant.

LEVEL OF SIGNIFICANCE AFTER MITIGATION

With the implementation of the mitigation measures listed above, potentially significant impacts on geology and soils would be reduced to a less-than-significant level.