E. GEOLOGY AND SOILS

The project site is located south and west of the Inglewood (Baldwin Hills) Oil Field, west of the intersection of Jefferson Boulevard and Overland Avenue between Freshman and Sophomore Drives and Stocker Street. Off-site second access (three alternate routes) is proposed from the north and east. Active oil wells and drilling operations in the Baldwin Hills border the property on the east and north, and the Ballona Creek floodplain of the Los Angeles Coastal Plain borders the property on the west and south. Geology and soils issues focus on the following: earthquake fault rupture, strong seismic shaking, seismic ground failure, landslides, unstable geology/soil units, subsidence and expansive soils.

Reports were available from the project geotechnical consultants for two previously constructed buildings on campus. Converse Consultants West (Converse Consultants West; 1992) prepared a geotechnical report for the Fine Arts Building and Leighton and Associates (Leighton and Associates; 1999) prepared a report for the Child Development Center. These building sites are in adjacent areas of the southeast quadrant of the campus in reasonable proximity to the proposed campus facilities east of “B” Street. Although somewhat less representative of the facilities proposed west of “B” Street, the data are adequate to characterize geologic conditions for purposes of this EIR. Other more regional studies also provided data on the geologic units and fault conditions within and around the campus. These include reports by the California Geological Survey (formerly the California Division of Mines and Geology; 1982 and 1998), County of Los Angeles General Plan Safety Element (1990), and Dibblee (1991). These reports formed the primary basis for the geotechnical analysis contained in this section, including the analysis of the proposed second access road alternatives.

Existing Conditions

Regulatory Framework

This regulatory framework identifies the State and local statues and policies that relate to geology and soils, and which must be considered in County of Los Angeles during the decision-making process for projects that involve grading (excavation or fill), modification of existing structures, or construction of new structures. Because this is a community college school facility, additional requirements are to be met, as discussed below.

State

State of California Geological Survey (CGS; formerly the CDMG, the California Division of Mines and Geology) identifies several earth resource issues that should be taken into consideration in evaluating whether a proposed project would likely be subject to geologic hazards, particularly related to earthquake damage. These considerations include the potential for existing conditions to pose a risk to the project and the potential for the project to result in an impact on the existing conditions for geology and soils.

The CGS establishes regulations related to geologic hazards (e.g., faulting, liquefaction, earthquake-induced landslides, ground shaking) as they affect people and structures. Projects located within special study zones (active or potentially active faults) or designated hazards zones (liquefaction or seismically induced landslide) as delineated by the Alquist-Priolo Earthquake Fault Zone (APEFZ) and Seismic Hazards Mapping Program (SHMP) may be subject to regulatory control. The State delegates this control to local governments to regulate development within special studies and hazards zones. The CGS also issues guidelines for the evaluation of geologic and seismic factors that may impact a project, or that a project may affect. The guidelines that are most applicable are as follows:

- CDMG Note 42, Guidelines to Geologic/Seismic Reports; [1]
- CDMG Note 46, Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports; [2] and
- CDMG Note 49, Guidelines for Evaluating the Hazard of Surface Fault Rupture.[3]

Each guideline provides checklists and outlines to help insure a comprehensive report of geologic/seismic conditions. Although not mandatory in all their detail, these guidelines provide assistance in assuring completeness of geologic/seismic studies conducted for a project.

The California Department of General Services Division of the State Architect (DSA) reviews and approves public school plans prior to issuance of building permits. The DSA publishes an Interpretation of Regulations (IR) document that explains acceptable methods for achieving compliance with building codes and regulations. IR A-4 explains Geologic Hazard Studies for Schools, IR 16-3 Earth Retaining Systems, and IR M-6 School Site Improvements for School Building Projects, all of which apply to the project site. The CGS reviews school site engineering geology and geotechnical reports using CGS Note 48 as a checklist/guideline for acceptable reports.

Alquist-Priolo Earthquake Fault Zoning Act (Special Studies Zone Act of 1972)

The CGS has delineated special study zones along known active or potentially active faults in California pursuant to the Alquist Earthquake Fault Zoning Act (APEFZ) of 1972.[4] The State designates the authority to local government to regulate development within an APEFZ. Construction of habitable structures is not permitted over potential rupture zones. The proposed project is located on the Beverly Hills APEFZ Map. The Newport-Inglewood APEFZ zone is near the site.

Seismic Hazards Mapping Act of 1990

The CGS has also identified Seismic Hazard Zones that are delineated in accordance with the Seismic Hazards Mapping Program (SHMP) of the Seismic Hazards Act of 1990. [5] The Act is "to provide for a statewide seismic hazard mapping and technical advisory program to assist cities and counties in fulfilling their responsibilities for protecting the public health and safety from the effects of string ground shaking, liquefaction, landslides, or other ground failure and other seismic hazards caused by earthquakes." The project site is located in the Beverly Quadrangle Official Seismic Hazard Zones Map[6].

State of California (Uniform) Building Code

The State of California (Uniform) Building Code (California Building Code) sets standards for investigation and mitigation of the site conditions related to fault movement, liquefaction, landslides, differential compactions/seismic settlement, ground rupture, and ground shaking, tsunami, seiche, and seismically induced flooding. Mitigation of geological (including earthquake) and soils (geotechnical) issues must be undertaken in compliance with the California Building Code as adopted by the DSA. The proposed project lies within "Seismic Zone 4", the highest-level hazard zone.

[1] California Department of Conservation, Division of Mines and Geology, 1997 (Revised). Fault-Rupture Hazard Zones in California. Special Publication 42. Supplements 1 and 2 added 1999. Contact: 655 S. Hope Street, #700, Los Angeles, CA 90017.
[2] California Department of Conservation, Division of Mines and Geology, 1986. Guidelines for Geologic/Seismic Considerations in Environmental Impact Reports. Special Publication No. 46. Contact: 801 K Street, MS 14-33, Sacramento, CA 95814-3531.
[3] California Department of Conservation, Division of Mines and Geology, 1998. Guidelines for Evaluating the Hazard of Surface Fault Rupture. Special Publication No. 49. Contact: 801 K Street, MS 14-33, Sacramento, CA 95814-3531. Available at http://www.consrv.ca.gov/dmg/pubs/notes/49/index.htm (Last viewed April 8, 2002.)
[4] California Public Resources Code, § 2621 et. seq.: Alquist-Priolo Earthquake Fault Zoning Act.
[5] California Public Resources Code, § 2690 et. seq.: Seismic Hazards Mapping Act.
[6] California Department of Conservation, Division of Mines and Geology, 17 January 2001. State of California Seismic Hazard Zones: Calabasas Quadrangle Official Map.

California Division of Oil, Gas, and Geothermal Resources (DOGGR)

DOGGR regulates the Inglewood Oil Field activity with regard to re-injection of fluid to minimize the affects of subsidence and uplift in the vicinity of the field. DOGGR is also responsible for well abandonment and performance of previously abandoned wells.

County of Los Angeles Building Code

The County of Los Angeles Building Code (2002) typically follows the California Building Code for geology and geotechnical standards. In addition, the County Grading Ordinance mandates specific compliance requirements for all projects within the County. If project site activities were to affect off-site areas, the Los Angeles County Department of Publics Works may be involved in addition to the DSA.

Regional and Local Setting

Earthquakes and Faults

The Transverse Ranges (represented by the Santa Monica Mountains in the general project area) are an anomalous west-trending geological province of deformation associated with relative movement of the North American and Pacific Plates. The majority of the Los Angeles Basin (south of the Santa Monica mountains) lies within the northwest-trending Peninsular Ranges Province, which represents the prevailing structural orientation of California. Associated northwest trending surface faults are the San Andreas and San Jacinto faults, the Whittier-Elsinore, Palos Verdes, and Newport-Inglewood faults (**Figure V.E-1**). The active Newport-Inglewood fault is about one mile east of the site.

Major surface faults and fault zones associated with the Transverse Ranges generally parallel the province, and include the Malibu Coast, Anacapa-Dume, Santa Monica, Hollywood, Raymond, and San Fernando-Sierra Madre-Cucamonga faults. Some earthquake faults are not exposed at the surface; these faults are buried (blind) thrusts. Faults such as these were responsible for the 1987 Whittier and 1994 Northridge earthquakes. The classification process is incomplete, and there is controversy about the extent of various proposed blind thrust faults. Four such buried thrust faults that could affect the site are the Santa Monica Mountains, Compton-Los Alamitos, Puente Hills, and Elysian Park faults. The Compton-Los Alamitos fault is beneath the project area at a depth of more than a mile.

The active Newport-Inglewood fault (zoned Alquist-Priolo) is about one mile east of the site. Other potentially active faults (Jennings, 1994) exist near the site, the Overland Avenue and Charnock faults about 1,000 feet and 7,600 feet to the west, respectively. Smaller faults of unknown activity are mapped in the bedrock just north and east of the project site (CDMG, 1982; Dibblee, 1991). One of these that projected toward the site was investigated for this EIR, using aerial photographic analysis; this fault appears to extend from the northwest to southeast outside the site boundary to the north and east. Having been shown to be potentially active by offsetting Pleistocene deposits (CDMG, 1982), it should be considered potentially active adjacent to the project site.

Topography

With the Transverse Ranges (Santa Monica Mountains) on the north and the Peninsular Ranges (Puente Hills) on the east, the project area is located in the Los Angeles Basin at the boundary between the western slopes of the Baldwin Hills and the Los Angeles Coastal Plain. The Baldwin Hills are part of a belt of northwest to southeast-trending geologic folds (anticlines and synclines) and associated strike slip faults in the Newport-Inglewood zone formed in response to generally complex local effects of crustal tension and compression. The flanks of the Baldwin Hills are cut by numerous small drainages incised into the relatively soft bedrock.

The project site is just south of the Ballona Gap, the ancestral trace of the Los Angeles River now occupied by Ballona Creek, which lies about 1,200 feet west of the site. An apparent alluvial fan/floodplain formed under the influence of the ancestral Los Angeles River from the north and the drainages of the hills to the east. Pre-1950s

Figure V.E-1 Regional Fault Map

aerial photographs viewed for this study indicate that this alluvial area was highly dissected by drainages from the east, creating a series of alternating drainages and ridgelines from north to south. Three primary drainages still visible east of Sophomore Drive are at least partially filled within the campus due to previous development.

Elevations on the site range from a high of about 195 feet along Sophomore Drive near Stocker Street to a low of about 65 feet near the intersection of Freshman Drive and Overland Avenue. The 90 to 100-foot elevation lines are roughly along "B" Street. Campus grading activity has created a series of cut/fill pads that step down in elevation from east to west (Sophomore Drive to Freshman Drive). The areas of the access road alternatives traverse existing roads and undeveloped natural topography, consisting of ridges and valleys ranging in elevation from 60 to 350 feet.

Surficial Geologic Units

The subject site, and most of the second access road locations, are underlain by the alluvium consisting of clay, silt and sand with some gravel, and soft bedrock consisting of sand with gravel and some shell material (CGS, 1998). Alluvium is classified as young alluvium (map symbols Qya and Qya1) and bedrock as San Pedro (sometime Inglewood) Formation (Qsp) (**Figure V.E-2**). The bedrock is covered by a residual (native) soils consisting of silty sand and silty clay to clayey silt, ranging in depth from 1 to 4 feet in thickness.

Qya1 alluvium is adjacent to and overlies the San Pedro Formation covering the largest percentage of the site. Borings (Converse Consultants West, 1992; Leighton and Associates, 1999) indicate that the alluvium is at least 15 to 20 feet thick and is classified as dark orange to medium brown, slightly moist to moist, medium dense silty sand with a trace of clay and minor gravel. Younger alluvial floodplain deposits (Qya) are found in the relatively narrow (200 to 500 feet wide) band along Freshman Drive and at the east end of the second access road alternative from La Cienega. No information about the formation is known from geotechnical borings, however the CGS (1998) characterizes this formation as loose to moderately dense, clay, silt, and fine- to medium-grained sand with a thickness of about 25 feet.

Each of the natural alluvial units was deposited by either water (streams, tidal areas, and debris flows), gravity (slow creep or rapid slippage), or by in-place weathering (soil). These generally sandy, silty, and clayey alluvium materials form a wedge-shaped deposit thickening to the west toward Ballona Creek.

Fill soils underlying the site are not mapped by previous studies, but were determined by geotechnical drilling to exist at the Fine Arts and Child Development Center. A review of vintage (pre-1950's) aerial photographs indicates that a dissected alluvial topography existed in the project area prior to any development. The alternating stream channel-ridgeline topography would have been filled to create a working surface for construction of existing campus buildings. No documentation of the amount and location of fill is known to exist. The existing older fill materials may not be considered suitable for support of the proposed foundations, floor slabs, or additional fill.

Artificial fill was detected in borings for the Fine Arts and Child Development buildings. It consisted of mixed sandy silt and silty sand with clay (Leighton and Associates, 1999) as well as clay and clayey sand with silty sand and silt (Converse Consultants West, 1992). Fill thickness in these two building areas ranged from 9 to 24 feet. Colluvium and residual soils are not specifically mapped, but seem to have been encountered in borings (Converse Consultants West, 1992) buried under fill materials. If this interpretation of the boring logs is correct, the soil is an organic-rich silty sand dark brown to black in color, porous, with silt layers, and clay. It is expected to be 2 to 8 feet thick.

Bedrock Geologic Units and Structure

The soft bedrock formations exposed in the northern Baldwin Hills are the San Pedro (also termed the Culver Sand by CDMG, 1982) and Inglewood Formations (Dibblee, 1991). These are lower Pleistocene-age sand, silt,

Figure V.E-2 Site Geology and Seismic Hazards Map

and clay formations prevalent within about one mile to the north, east, and south from the project site. Due to the folding and faulting that has affected the Baldwin Hills, bedrock formations have some fractures, faults, and tilted bedding planes. Bedding structure is very difficult to discern in the San Pedro Formation, which is the bedrock underlying the southeast corner of the site and most of the second access road areas. If bedding angles are shallow and tilted to the west, they would potentially affect slope stability.

San Pedro Formation bedrock should be at or near the ground surface in the southeast corner of the project site (Figure V.E-2) and may have been encountered in borings for the Fine Arts Building at depths of 20 to 30 feet (elevation 100 feet ±). It is expected that the San Pedro will consist of a gray to brown fine-to medium-grained sand with some gravel that is suitable for foundations.

Because of the lack of readily definable bedding and the lack of clay in the San Pedro Formation, few geologic attitudes are mapped. General bedrock structure (bedding) is indicated on the CDMG (1982) regional map to have a generally northwest to north-northwest strike and a southwest dip direction. No bedding attitudes were available from the site-specific geotechnical reports reviewed. This general attitude should be considered in planning cut slopes along Sophomore Drive. The San Pedro and Inglewood Formations along the second access road alternatives will encounter variable bedding plane orientations as they cross the core of the Baldwin Hills.

Soils Engineering Characteristics of Bedrock and Alluvium

Expansiveness. For the most part, the bedrock formations will have a nil to low expansion potential due to the silty sand-rich nature of the formation as encountered in the Converse Consultants West (1992) borings and based upon the general nature of San Pedro Formation in other areas of the basin. Soil and/or colluvium overlying the alluvium and bedrock units in the area (at the surface or beneath artificial fill) will tend to be more clay-rich than the underlying material due to the chemical and physical breakdown of the parent material. Converse Consultants West (1992) indicates that some of the fill material is clay-rich, which tends to create expansion issues. However, no tests were run for expansion potential.

Compressibility and Collapse (Consolidation and Settlement). Consolidation is generally not an issue with the bedrock materials due to their relatively high density. Boring log descriptions of the surficial materials indicate that they would be likely to undergo some consolidation. Younger (Qya) near-surface alluvium and non-engineered artificial fills have not been consolidated by overburden pressure and should have the highest consolidation potential depending upon the material type. Qya1 should have a lower potential. Converse Consultants West (1992) recommend that soil, colluvium, and alluvium are not suitable for foundations, presumably due to the porosity/lower densities. They also found the artificial fill generally unsuitable, and recommended pile foundations for the Fine Arts Building. Leighton and Associates (1999) recommended spread footings in artificial fill for the Child Development Center. Consolidation and collapse related ground failures manifest as ground cracks with relative vertical displacements as indicated above. Expected settlement is 0.5 inch or less for foundations in firm bedrock or compacted fill.

Erosion. Severe erosion by flowing water along natural ground flow paths will be a concern for the bedrock materials and for surficial deposits due to the relatively low compactness, low clay content, and low cementation of the bedrock. There is greater concern for bedrock areas in the southeast portion of the project area with moderate local relief where flow over extended periods will seek lower adjacent base (elevation) levels. Bedrock would be less likely to undergo significant erosion (relief will also be a factor), than the younger near surface alluvium (Qya1 and Qya). Younger alluvium will have a moderate to high erosion potential depending upon the material type, local relief, and runoff velocity. Soil/colluvium will somewhat lower erosion potential due to the organic and clay content, but will be moderately erodible if subject to concentrated surface flow. Wind erosion is not a significant factor.

Dynamic (Earthquake) Considerations

Liquefaction and Lateral Spreading. Based on the Los Angeles County Seismic Element Maps, conditions for liquefaction exist within most of the project area. However, the more recent and more detailed State Seismic Hazard Maps indicate only a small area in the extreme southwest corner of the project site has historically shallow groundwater and poorly consolidated fine sandy soils suggesting liquefaction prone materials exist (CGS, 1998). For this study we suggest that the southwest corner has a moderate to high potential, the San Pedro Formation area a low potential, and the remainder of the site a low to moderate potential. Borings by Converse Consultants West (1992) and Leighton and Associates (1999) did not encounter groundwater to depths of about 50 to 55 feet in the Fine Arts and Child Development Building areas, suggesting that liquefaction potential is low in that area.

Due to the significant depth to the groundwater surface (generally greater than 50 feet deep) and the substantial distance to a “free-face” where movement would commence (Ballona Creek over 1000 feet to the west), lateral spreading landslide occurrence is unlikely.

Slope Instability. Earthquake-induced landslide potential is shown on the State Seismic Hazards Mapping Program for the bedrock areas immediately east of the project site within the San Pedro Formation, along the west side of Sophomore Drive. These relatively steep bedrock slopes thus require site-specific slope stability analysis that considers earthquake input parameters. Neither Converse Consultants West (1992) nor Leighton and Associates (1999) analyzed critical slopes within the project area due to the relatively low topographic gradients at these locations.

Settlement. Leighton and Associates (1999) indicate that low to moderate compressibility would be expected from the existing fill and the alluvium, suggesting standard over-excavation and recompaction methods under spread footing foundations to minimize settlement of structures. Converse Consultants West (1992) found negligible to small compressibility of fill materials with moisture added, however we were unable to find documentation that the fill had been placed under engineering controls and recommended pile foundations. No specific predictions of locations or settlement amounts were made. Due to the fairly large fill, alluvial/colluvial thicknesses, settlement amounts may vary from location to location. Both the Converse Consultants West and Leighton and Associates foundation options exist to remove and recompact or bypass unsuitable material where necessary.

Faulting and Seismicity.

Fault Rupture. There are no faults mapped in the project site based on Converse Consultants West (1992), Leighton and Associates (1999), Dibblee (1992), the County of Los Angeles (1991), CDMG (1982), and the State Fault Map (Jennings, 1994). Fault rupture potential is considered nil to very low within the project area based on this data.

CDMG (1982) shows a potentially active (lower Pleistocene-age) fault projecting from the northwest (with a trend of south eight degrees east [S8E] toward the site) toward the eastern portion of the campus where new construction is planned. In order to assess the possible extension of this fault toward the site, vintage (pre-1950) aerial photographs from the Fairchild Collection at Whittier College were analyzed. This analysis indicated that a lineament oriented south 10 degrees east passes a few hundred feet east of the project site. This may be the CDMG 1982 fault, or on parallel to it on the east. Based on the lack of activity reported by the State maps (produced after 1982), it is likely that this fault is not active and it is unlikely [although not confirmed by this study] to have affected the Qya and Qya1 units.

The second access road alternatives will cross the active Newport-Inglewood fault zone and parallel faults that are considered potentially active. No specific studies were available in these areas.

Groundshaking. Table V.E-1 presents the Peak Horizontal Ground Acceleration (PHGA) and estimated Modified Mercalli Intensity (MMI) for the project site area based on the mean earthquake occurrence values presented in a commonly used seismic analysis computer program (Blake, 2000). Rounded PHGA acceleration and MMI values for the four most critical faults are as follows:

Table V.E-1

Earthquake Groundshaking Parameters for the Four Most Critical Project Area Faults

FAULT NAME	Distance Miles (Kilometers)	Maximum Magnitude	Peak Horizontal Ground Acceleration	Modified Mercalli Intensity
Newport-Inglewood (L. A. Basin)	1.8 (2.9)	6.9	0.311	IX
Compton Thrust	3.7 (6.0)	6.8	0.292	IX
Puente Hills Blind Thrust (L. A. Segment)	4.8 (7.8)	6.6	0.232	IX
Santa Monica	5.2 (8.4)	6.6	0.223	IX
These are only estimates and design values must be determined for each aspect of the site development.				

Subsidence, Uplift, and Related Affects

The project site lies immediately west of the Inglewood (Baldwin Hills) Oil Field, which has been removing underground oil from deep geologic formations since 1924. Production as of late 2000 was 6,700 barrels of oil, and 2,650,000 cubic feet of gas, per day (Baldwin Hills Park Master Plan, May 2002). The western edge of the oil field crosses the project site near the intersection of "B" Street and Sophomore Drive, and exits the project site where Sophomore Drive curves from east to south (Figure V.E-2). The oil field has been subject to artificial re-pressurization (i.e., underground injection of oil field wastes and saltwater/brine liquid to replace the volume of the withdrawn fluids) in order to prevent excessive ground subsidence. In some cases this injection can cause ground uplift. The movement up or down can cause differential movements of the ground and associated cracking/displacement (Hamilton and Meehan, 1971). Interferometric synthetic aperture radar (InSAR) and Global Positioning System station elevation measurements of the Los Angeles Basin/Baldwin Hills area (Bawdin, et al, 2001) suggests that the Baldwin Hills west of the Newport-Inglewood fault (the same site as the project site) is subsiding at a different rate relative to the area east of the fault. It is not possible to deduce from this study (it is very regional in scope) whether subsidence or uplift is affecting the project site. DOGGR (Jepson, personal communication, 2003) indicates that "minor" subsidence (possibly one to two feet) may have occurred over the long history of the field, but that there is no on-going attempt to monitor subsidence associated with the activities at the field. There is no one published source of subsidence information for this field and the DOGGR annual reports would have to be reviewed to document this conclusion.

Another possible outcome of oil field re-pressurization is the migration of methane gas from deep geologic units toward the ground surface. If there are conduits to the ground surface that can act as "short-cuts" (e.g., faults, fracture zones, previously abandoned wells, undocumented wells or dry holes) methane can reach the near-ground surface in sufficient concentrations to cause asphyxiation, or to cause explosion and/or fire. DOGGR (Sanchez, personal communication, 2003) indicates that he knows of no instances of methane leakage from wells in the area associated with the activities at the field. There is no one published source of methane gas information unless associated with specific reported leaks. While we have no indication that shallow subsurface gas is present at the project site, or along the second access roads, we have no evidence that this has been evaluated.

Groundwater

Groundwater in the alluvial formations is within intragranular pore space. The younger alluvium is near-horizontally bedded and very thin (likely less than 25 feet), and therefore does not constitute a "groundwater aquifer" per se. The alluvium may be near saturation during and after wet seasons; CGS (1999) indicates there is liquefaction potential for a small portion of the site. Historic high groundwater levels (CGS, 1998) appear to be greater than 40 feet deep across most of the site. Converse Consultants West (1992) indicates that water was at 72 feet below the ground at Freshman Drive and Stocker Street in 1972. Groundwater movement within the alluvium and in porous bedrock would be to the west toward Ballona Creek. Shallow perched water zones may be associated with faults in bedrock along the second access road alternative routes.

Thresholds of Significance

The following significance thresholds are based on the CEQA Guidelines Environmental Checklist Form (Appendix G). The proposed project's impacts are considered significant if the project would:

a. Expose people or structures to potential 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. (Refer to Division of Mines and Geology Special Publication 42.)
    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 Uniform Building Code (1994), creating substantial risks to life and property.

Project Impacts

Compliance With Existing Regulations and Permit Requirements

There is a range of geologic conditions within the overall setting described above that could potentially lead to significant impacts should the proposed project be approved and implemented. Most considerations are rendered less than significant by compliance of the project plans and specifications with existing regulations as implemented by the DSA. Slope stability, expansive soils, compressible soils and other similar engineering geology and geotechnical hazard considerations are addressed by the grading standards in the California (Uniform) Building Code, the County Grading Ordinance and by the general requirement for engineering investigation reports, and by many of the implementation programs within other categories. Necessary reports required by DSA will be prepared by the geotechnical and engineering geology consultants of record, and thoroughly reviewed by the DSA and the CGS. For off-site second access roads, the LACDPW will be responsible to establish the criteria for roadway construction once a final route has been selected.

To date no project geotechnical or engineering geology consultants of record have been named to prepare geologic and soils investigation reports, updates, and supplements for the project site developments. The Applicant, in preparation of final design plans and construction specifications will have such reports prepared for each of the buildings/facilities proposed for Phases I and II, and for the chosen second access road route. The Applicant shall adhere to the recommendations in the reports (and as amended from time to time as required by the DSA and the CGS, as well as the LACDPW for the roadway) as they may apply to the grading, construction, and operational phases of the proposed development. In conjunction with field inspections under the supervision of the project geotechnical or engineering geology consultants of record, additional changes would be implemented as necessary to ensure that proper design and construction guidelines are followed as part of the project development. However, this EIR analysis is designed to identify any potentially significant impacts, if any, that would be expected. Should later analysis identify new significant impacts or more severe significant impacts, additional CEQA review would be required. At this point in time, no such additional impacts are expected.

The following analysis briefly describes the nature of the potential impacts on the environment or the project (see **Table V.E-2**). If the potential impact is less than significant, or will be reduced to less than significant based on project plans and/or existing regulations, that is so indicated without extensive discussion. If an impact is considered potentially significant and requires additional "non-routine" investigation, an additional investigation measure is recommended to emphasize this need. The potentially significant impacts requiring additional investigation relate to subsidence and related fault effects. With regard to the issues of APEFZ active fault rupture, soil erosion, landslides and expansive soil, there may be significant impacts for the off-site second access roadway.

Less Than Significant Impacts Before Implementation of DSA and LACDPW Regulatory Oversight

For some issues in Table V.E-2 there may be limited potential for adverse effects. With regard to the issues of APEFZ active fault rupture, soil erosion, lateral spreading and expansive soil, there would be less than significant impacts for the project site based on existing data. With regard to the issues of strong groundshaking, liquefaction, lateral spreading, compressible/collapsible soil and dynamic consolidation, there would be less than significant impacts for the off-site second access roadway based on existing data.

Potentially Significant Impacts Before Implementation of DSA and LACDPW Regulatory Oversight

The presence of soft sedimentary bedrock and nearby active faults subject the site to the potential for significant impacts due to slope instability, high levels of earthquake groundshaking, liquefaction, earthquake induced landslides, subsidence/uplift and compressible materials (static and dynamic). Where these conditions exist (Table V.E-2), there could be damage to structures within or adjacent to these areas without proper adherence to existing regulations and/or mitigation arising from additional investigation.

While there is no evidence to suggest that the project site has been subject to adverse effects from subsidence and/or uplift due to oil reservoir pressurization issues, this subject warrants further investigation. As indicated above, the CGS reviews school site engineering geology and geotechnical reports using CGS Note 48 as a checklist/guideline for acceptable reports. The CGS Note 48 specifically requires that subsidence potential be addressed. While already subject to the CGS review process, the project shall implement mitigation measure GEO-1 to make clear the CGS requirements and to insure that subsidence impacts are less than significant.

Similarly, there is no evidence that nearby oil field re-pressurization is causing the migration of methane gas from deep geologic units toward the project site. Previous investigators raised this hazard potential hazard for the Inglewood Oil Field (Hamilton and Meehan, 2000). If there are conduits to the ground surface that can act as "short-cuts" (e.g., faults, fracture zones, previously abandoned wells, undocumented wells or dry holes) methane can reach the near-ground surface in sufficient concentrations to cause asphyxiation, or to cause explosion and/or fire. While we have no indication that this may be the case at the project site, we have no evidence that this has been evaluated. However, CGS Note 48 specifically requires that methane gas hazards be addressed. While already

Table V.E-2
Summary Table of Estimated Potential Risk and Degree of Hazard for the Proposed Development Components

		Estimated Potential Risk and/or Degree of Hazard										
	Geology Unit	Alquist-Priolo Zone	Strong Ground Shaking	Liquefaction	Earthquake Induced Landslide	Soil Erosion	Landslide	Lateral Spreading	Subsidence, Uplift, and Related affects	Compressible or ollapsible Soil	Dynamic Compaction/Consolidation	Expansive Soil
PHASE I												
Science and Math	Qya1	NP	H	M	L-M	L	M	NP	L-M	L-M	L-M	L
Student Services/ Administration	Qya1	NP	H	M	L-M	L	L	NP	M	L-M	L-M	L
General Classroom	Qya1	NP	H	M	L-M	L	L	NP	L-M	L-M	L-M	L
Convenience Store	Qya1	NP	H	M	L-M	L	L	NP	L-M	L-M	L-M	L
Lot 8 Parking Structure	Qsp	NP	H	L	L-M	L	M	NP	L-M	NP	L	L
PHASE II												
Media Arts Complex	Qsp	NP	H	L	L-M	L	M	NP	L-M	NP	L	L
Student Services/IT/ High Tech Classroom	Qya1	NP	H	M	L	L	L	NP	M	L-M	L-M	L
Physical Education Annex	Qya/Qya1	NP	H	M	VL	L	L	NP-VL	L	M	M	L
Lot 1 and 2 Parking Structures	Qya1	NP	H	M	L	L	L	NP	M	L-M	L-M	L
Community Center	Qya1	NP	H	M-H	VL	L	L	NP-VL	L	M	M	L
Ice Hockey Rink	Qya1	NP	H	M-H	VL	L	L	NP-VL	L	M	M	L
Athletic Field Restroom	Qya	NP	L	M	VL	L	L	NP-VL	L	L	L	L
Bleachers	Qya	NP	L	M	VL	L	L	NP-VL	L	L	L	L
Second Access Road	Qsp and Qya	H	M	L	H	H	H	NP-L	M	M	M	M
Potential Impact After Mitigation or Compliance with Existing Regulations Implemented by the Division of the State Architect		NSI	NSI	NSI	NSI	NSI	NSI	NSI	AIR/ NSI	NSI	NSI	NSI

NP = No Potential Risk; VL - Very Low Risk; L - Low Risk; M - Moderate Risk; H - High Risk; AIR - Additional Investigation Recommended; NSI No Significant Impact after mitigation o compliance with existing regulations implemented by the Division of the State Architect.

subject to the CGS review process, the project shall implement mitigation measure GEO-2 to make clear the CGS requirements and to insure that methane hazard impacts are less than significant.

Cumulative Impacts

Twenty-eight (28) related projects are proposed for development within the general study area encompassing the Project site. The Project is not located adjacent or close enough to any of the related projects (the nearest is about 0.25-mile to the north) to directly compound any of the potential geology or soils impacts from development. Further, all related projects would require municipal government approvals of grading plans, design, and mitigation, significant cumulative grading and geotechnical impacts resulting from the potentially concurrent construction of the related projects are not anticipated.

Some of the proposed and related projects would be subject to potential geologic, earthquake, and soils hazards outlined for the Project site. With respect to subsidence and methane gas, only related projects #4 (9599 Jefferson) and #28 (10100 Jefferson) also overlie, or is immediately adjacent to the Inglewood oil field. Other sites at much greater distances (miles away), specifically 20-26, are over or adjacent to the Playa del Rey (Oil Field) Gas Storage Field which has some potential for methane hazard. Assuming adherence to the building codes and other locally imposed plans, these hazards (if they exist) would be identified and cumulative impacts would be reduced, but not eliminated. The remaining related projects would not be exposed to a greater (or even similar) risk related to methane and subsidence, which is the same as most other areas in Southern California. In addition, related projects would not compound (due to the significant distances involved) the specific effects that could occur on the Project site. Therefore, cumulative impacts would not be considered significant.

Mitigation Measures

Considering the project site development, compliance with existing local, County, State, and Federal laws, regulations, codes, and statutes applicable to the geology, soils and seismicity conditions outlined in this document or found subsequent to this document's approval will render the geology and soils issues less than significant. Mitigation measures GEO-1 and GEO-2 clarify investigation requirements for subsidence, uplift, and methane gas and will address these issues under the auspices of the DSA and CGS.

GEO-1 Proposed new structures shall comply with all design and monitoring techniques (e.g., pile foundations, reinforced mat foundations, settlement/uplift monuments) developed during the CGS review process. At a minimum the applicant shall consult with the CGS in advance to solicit input regarding the investigation tasks. Unless otherwise approved by the CGS investigation tasks shall include:

1. Review and analyze DOGGR records (including annual reports) related to the Inglewood (Baldwin Hills) Oil Field with respect to measure subsidence or uplift to determine the magnitude and location of affects.
2. As dictated by the results of this review, existing aerial photographs, geologic maps, and other available imagery of the area (e.g., In SAR and GPS elevations) shall be reveiwed to assess the potential for active subsidence or uplift, and the potential for faults to pass through the project site that could serve as locations for future differential movement.
3. Considering steps 1 and 2, determine the likelihood, location, and magnitude (if any) of future subsidence or uplift affects within the project site.

GEO-2 Proposed new structures shall comply with all methane hazard design and monitoring techniques developed during the CGS review process. At a minimum the applicant shall consult with the CGS in advance to solicit input regarding the investigation tasks. Unless otherwise approved by the CGS investigation tasks shall include:

1. Review and analyze DOGGR records related to the Inglewood Oil Field with respect to measured methane gas releases in the vicinity of the field, and determine the magnitude and location of these releases (if any).
2. Review other existing reports on this subject that may have been conducted for other projects (e.g., Culver City, City of Los Angeles, County of Los Angeles) in the vicinity to assess the potential for active methane gas release from conduits such as faults, fracture zones, previously abandoned wells, undocumented wells or dry holes.
3. Considering steps 1 and 2, determine the likelihood, location, and magnitude (if any) of future methane gas releases within the project site.
4. If sufficient evidence is developed to suggest methane gas potential within the project site, a site specific methane gas study shall be performed by a DSA/CGS-approved consultant at the project site to characterize the levels of methane and other volatile gases that may be present

at the site and to evaluate the level of impact that hazardous gases might have on the proposed project.

The selected second access road route will require a thorough engineering geology and geotechnical evaluation, which is required based on compliance with existing County laws, regulations, codes, and statutes applicable to the geology, soils and seismicity. The following mitigation applies:

GEO-3 Prior to the completion of final plans and specifications, the Applicant shall provide a geotechnical investigation program report describing the engineering geology and geotechnical stability conditions for critical natural and artificial slopes, and road foundations to be created by the development process for the selected second access road route. The report shall provide recommendations for the proper support of all slopes and roadbed conditions. The report shall contain a description of engineering geology and soils engineering conditions present, and shall provide specific tests, analyses and recommendations for necessary soils engineering parameters. In all cases, methods, techniques, and analyses shall be consistent with the planning, building, and safety guidelines established by the Los Angeles County Department of Public Works. This report shall be submitted to the Los Angeles County Department of Public Works for review, comment, and approval that shall be completed in a reasonable period of time.

Significant Project Impacts After Mitigation

Potentially significant subsidence, uplift, and/or methane gas impacts to the project could occur. These impacts will be reduced to a less than significant level with implementation of the design and monitoring plans arising from the mitigation measures outlined above. Impacts for all of the geology and soils issues will be rendered less than significant with strict adherence to construction and building regulations, and other laws and codes pertaining to the project site development.