4.5 GEOLOGY AND SOILS

This section of the EIR describes the existing geology, soils, and seismic conditions on the project site and analyzes the potential physical environmental effects related to seismic hazards, underlying soil characteristics, slope stability, erosion, and excavation and export of soils. Potential effects of soil conditions on air and water quality as a result of construction-related activities are discussed in Section 4.2, Air Quality, and Section 4.8, Hydrology and Water Quality, respectively. This section is based on a geotechnical investigation conducted by Christian Wheeler Engineering in January, 2005, and a subsequent update in May, 2008. These reports are provided in Appendix E.

4.5.1 EXISTING CONDITIONS

4.5.1.1 REGIONAL GEOLOGY

The project site is situated at the western margin of the Peninsular Ranges Geomorphic Province of southern California. This geomorphic province encompasses an area that extends approximately 800 miles, from the Transverse Ranges and the Los Angeles Basin to the tip of Baja California. In general, the province consists of rugged mountains underlain by Mesozoic era (67 to 245 million years old) metamorphic and crystalline rocks to the east and a dissected coastal plain underlain by Cenozoic era (up to 67 million years old) sediments. The mountain ranges are largely composed of granitic and related rocks and smaller amounts of metamorphic rocks. The geomorphic province is bounded on the east by the Salton Trough (the Salton Sea), on the north by the Los Angeles Basin, and extends westward into the Pacific Ocean, where its highest peaks are exposed at Catalina, Santa Barbara, San Clemente, and San Nicholas Islands.

The Peninsular Ranges are traversed by several major active faults. The Whittier-Elsinore, San Jacinto, and San Andreas faults are major active fault systems located northeast of San Diego. The Agua Blanco-Coronado Bank and San Clemente faults are active faults located to the west-southwest. The Rose Canyon fault zone is also a major active fault system located in the San Diego area with portions that have been included in the State of California Earthquake Fault Zones. Right-lateral strike-slip movement is the major tectonic activity associated with these and other faults within this regional tectonic framework, which also have the potential for generating strong ground motions (earthquakes) at the project site.

4.5.1.2 SOILS AND GEOLOGIC FORMATIONS

The project site is located in the Foothills Physiographic Province of San Diego County. Based on the results of the geotechnical investigation, the site appears to generally be underlain by Cretaceous-age granitic materials overlain by a relatively thick layer of Quaternary-age younger and older alluvium that is capped by a thin veneer of residual soil and in some areas by minor amounts of artificial fill. These materials are described below.

Artificial Fill

Artificial fill was documented in the northwestern portion of the site and within a fill area in the eastern third of the existing driving range pad. The fill material consists of natural materials from the surrounding area, generally consisting of medium brown, silty sand and sandy clay. The fill material is considered to be unsuitable in its present condition to support fill and/or settlement-sensitive improvements, but may be used for structural fill material.

Residual Soil

Natural residual soils were observed on the majority of the southern and western portions of the site. The residual soil has a thickness ranging from two to five feet and generally consists of medium brown, silty sand and clayey sand that is typically loose and damp. The residual soil is considered to be unsuitable in its present condition to support fill and/or settlement-sensitive improvements, but may be used for structural fill material.

Younger Alluvium (Qyal)

Quaternary-age younger alluvial deposits were encountered throughout the project site and extended to a depth of 18 feet below existing grade in some areas. The younger alluvium consists of medium brown, silty sand overlying a dark brown to medium reddish brown sandy clay and light grayish-brown to reddish-brown clayey sand. The younger alluvium materials were generally damp to moist above the perched water table and saturated below. These materials are considered to be unsuitable in their present condition to support fill and/or settlement-sensitive improvements.

Older Alluvium (Qoal)

Quaternary-age older alluvial deposits were encountered in the southeast and northwest corners of the project site. Within these areas, the older alluvial material was found below the younger alluvial material at depths ranging from six to nine feet below existing grade. The older alluvium consists of light grayish-brown to light reddish-brown, clayey sand. The older alluvium materials were generally moist above the water table and saturated below. The older alluvial materials are considered to be suitable in their present condition to support fill and/or settlement-sensitive improvements.

Granitics (Kgr)

The site is ultimately underlain by Cretaceous-age granitic materials associated with the Southern California Batholith. The uppermost layers of the encountered granitics were highly weathered or decomposed. The granitics consisted of reddish-brown and medium grayish-brown, silty sands that were moist and dense to very dense. The upper 15 to 20 feet of the underlying granitic materials would be rippable and non-rippable below this depth. Blasting would be required to make cuts in the non-rippable range.

4.5.1.3 FAULTING AND SEISMICITY

Ground shaking as a result of earthquakes is a potential hazard throughout southern California. The intensity of ground shaking at any particular site and relative potential for damage from this hazard depends on the earthquake magnitude, distance from the source (epicenter), and the site response characteristics (ground acceleration, predominant period, and duration of shaking).

Based on site reconnaissance, evidence obtained in exploratory excavations and a review of published geologic maps and reports, no major faults are known to traverse the project site and the project site is not located on any known active or potentially active fault traces.

A review of available geologic maps indicates that the active Rose Canyon Fault Zone is located approximately 12 miles west of the project site. Other active fault zones in the region that could possibly affect the project site include the Coronado Bank Fault Zone to the southwest and the San Jacinto, Elsinore and San Andreas Fault Zones to the northeast. Portions of the Rose Canyon Fault have been included in a California Geologic Survey Earthquake Fault Zone. A maximum credible seismic event of magnitude 6.9 is postulated for the Newport-Inglewood (offshore) and the Rose Canyon Faults.

Table 4.5-1 presents the earthquake events and site accelerations for the five most significant faults considered most likely to subject the site to ground shaking. However, the seismic risk at the site is not considered significantly greater than that of the surrounding developments.

In the event of a major earthquake on any of the faults listed in Table 4.5-1 or other significant faults in the southern California area, the site could be subjected to slight to moderate ground shaking. With respect to this hazard, the site is considered comparable to others in the general vicinity. While listing peak accelerations is useful for comparison of potential effects of fault activity in a region, other considerations are important in seismic design, including the frequency and duration of motion and the soil conditions underlying the site.

Table 4.5-1. Potential Impact of Regional Active Faults at Project Site

Fault Name	Distance from Site (miles)	Maximum Magnitude Earthquake	Maximum Ground Acceleration (acceleration due to gravity)
Rose Canyon	12	6.9 magnitude	0.17 g
Coronado Bank	25	7.4 magnitude	0.12 g
Elsinore-Julian	29	7.1 magnitude	0.09 g
Earthquake Valley	34	6.5 magnitude	0.06 g
Newport-Inglewood (Offshore)	34	6.9 magnitude	0.08 g

Source: Christian Wheeler Engineering, 2005

4.5.1.4 LANDSLIDES AND SLOPE STABILITY

Areas having the potential for earthquake-induced landslides generally occur within areas of previous landslide movement, or where local topographic, geological, geotechnical, and subsurface water conditions indicate a potential for permanent ground displacements. According to the geotechnical report prepared for the proposed project site, the northeastern portion of the project site, adjacent to Cuyamaca Street, is considered to be "marginally susceptible" to slope instability hazards due to gentle to moderate slopes where the slope angles are less than 15 degrees. The southwestern portion of the project site is considered to be "generally susceptible" to slope instability hazards. Slopes within this area of the project site are considered at or near their stability limits due to steep slopes and can be expected to fail locally when adversely modified. This area is located outside of known landslides, but contains unstable slopes that may be underlain by weak materials and/or adverse geologic structure. According to the geotechnical report, the potential for deep-seated landsliding within the project site is considered to be very low based on the stable nature of the underlying granitic rock and the relatively moderate inclines of the on-site slopes.

4.5.1.5 LIQUEFACTION

Liquefaction typically occurs when a site is located in a zone with seismic activity, on-site soils are cohesionless, groundwater is encountered within 50 feet of the surface, and soil relative densities are less than about 70 percent. If all four previous criteria are met, a seismic event could result in a rapid pore water pressure increase from earthquake-generated ground accelerations. The potential for liquefaction occurring at the site is considered to be very low due to the soil density, grain size distribution and the absence of shallow groundwater conditions of the near-surface soils.

4.5.1.6 GROUNDWATER

Perched groundwater was encountered within the younger alluvium above some of the underlying granitic materials. The groundwater was observed at depths ranging from approximately 12 to 12.5 feet below the existing site grades within the northeast portion of the site, adjacent to Forrester Creek.

4.5.1.7 TOPOGRAPHY

Topographically, the project site is characterized by gently sloping areas throughout the majority of the site, and relatively high, steeply sloping areas in the northwestern and southeastern portions of the site. According to the grading plan, the site varies in elevation by approximately 20 feet, and slopes from elevations of 370 feet above mean sea level (AMSL) along the southern and western site boundaries to a low point of approximately 350 feet AMSL at the northeastern corner of the site.

4.5.2 REGULATORY FRAMEWORK

Regulations pertaining to water quality impacts that may result from erosion are included in Section 4.8, Hydrology and Water Quality, of this EIR, while the regulatory framework pertaining to geology, soils and related hazards is described below.

4.5.2.1 FEDERAL

Uniform Building Code

The Uniform Building Code (UBC) is a model building code that provides the basis for the California Building Code (CBC). The UBC defines different regions of the United States and ranks them according to their seismic hazard potential. There are four types of these regions, which include Seismic Zones 1 through 4, with Zone 1 having the least seismic potential and Zone 4 having the highest seismic potential. The proposed project site is located in Seismic Zone 4.

4.5.2.2 STATE

California Building Code

California law provides a minimum standard for building design through the CBC. The CBC is based on the UBC, with amendments for California conditions. Chapters 17 and 17A of the CBC contain specific requirements for seismic safety. Chapters 18 and 18A of the CBC regulate excavation, foundations, and retaining walls. Chapter 33 of the CBC contains specific requirements pertaining to site demolition, excavation, and construction to protect people and property from hazards associated with excavation cave-ins and falling debris or construction materials. Appendix J of the CBC regulates grading activities, including drainage and erosion control. Construction activities are subject to occupational safety standards for excavation, shoring, and trenching as specified in Cal-OSHA regulations (Title 8 of the California Code of Regulations [CCR]) and in Section A33 of the CBC.

Seismic Hazards Mapping Act

The California Geologic Survey, formerly the California Department of Conservation, Division of Mines and Geology (CDMG), provides guidance with regard to seismic hazards. Under CDMG's Seismic Hazards Mapping Act (1990), seismic hazard zones are to be identified and mapped to assist local governments in land use planning. The intent of this publication is to protect the public from the effects of strong ground shaking, liquefaction, landslides, ground failure, or other hazards caused by earthquakes.

In addition, CDMG's Special Publications 117, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," provides guidance for the evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations.

4.5.2.3 LOCAL

City of El Cajon Municipal Code

Title 15, Buildings and Construction, of the El Cajon Municipal Code sets forth rules, regulations, and minimum standards for buildings, lot grading, and construction activities. The California Building Code, 2007 Edition, is adopted by reference as the building code of the City for regulating the construction, erection, enlargement, repair, removal, demolition, occupancy, equipment, use, height, area and maintenance of all buildings and structures in the City.

4.5.3 IMPACT SIGNIFICANCE CRITERIA

The proposed project would have a significant effect related to geology and soils if it would result in:

- Exposure of people or structures to geological hazards, including rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, including liquefaction, and/or landslides;
- On- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse from construction of project on a geologic unit or soil that is unstable or that would become unstable as a result of the project; and/or
- Substantial soil erosion or the loss of topsoil.

4.5.4 ISSUE 1 – GEOLOGIC HAZARDS

Would the project expose people or structures to geologic hazards, including rupture of a known earthquake fault, strong seismic ground shaking, or seismic-related ground failure, including liquefaction and/or landslides?

4.5.4.1 IMPACT ANALYSIS

Fault Rupture

The project site is not located on any known active or potentially active fault traces. The closest fault to the project site is the Rose Canyon Fault Zone located approximately 12 miles to the west. Other active fault zones in the region that could possibly affect the project site include the Coronado Bank, San Jacinto, Elsinore and San Andreas Fault Zones. Due to the distance of these faults from the project site, project construction would not result in ground surface rupture at any of these faults. As required by Chapter 15.04 of the City's Municipal Code, the proposed project would be constructed in compliance with the CBC, which contains specific requirements for seismic safety. Therefore, because no active faults are located on site and project construction would comply with the CBC, implementation of the proposed project would result in a less than significant impact associated with the rupture of a known earthquake fault.

Ground Shaking

As previously discussed, the project site is located in a seismically active area that could experience slight to moderate ground shaking. Ground shaking has the potential to dislodge objects from walls, ceilings, and shelves, and to damage and destroy buildings and other structures. People in the area would be exposed to these hazards. The proposed project site would have the same potential for ground shaking as other land uses in the vicinity of the project site. The proposed project would minimize hazards associated with damage or destruction to buildings and other structures through compliance with the CBC, which includes specific structural seismic safety provisions. Therefore, impacts associated with ground shaking would be less than significant.

Liquefaction

Soil liquefaction occurs within relatively loose, cohesionless sands located below the water table that are subjected to ground accelerations from earthquakes. The potential for liquefaction occurring at the site is very low due to the soil density, grain-size distribution and the absence of shallow groundwater conditions. In addition, the proposed project would include the removal, moisture conditioning and, as necessary, compaction of on-site soils in conformance with the CBC. Therefore, impacts associated with liquefaction would be less than significant.

Landslides

No landslides were encountered during the geotechnical field investigation. Landslides are not known to exist on the property or at a location that would impact the proposed industrial development. Therefore, impacts associated with landslides would be less than significant.

4.5.4.2 SIGNIFICANCE OF IMPACT

Implementation of the proposed project would not result in exposing people or property to geologic hazards including fault rupture, ground shaking, liquefaction, or landslides.

4.5.4.3 MITIGATION, MONITORING, AND REPORTING

No significant impact is identified; therefore, no mitigation measures are necessary or recommended.

4.5.5 ISSUE 2 – UNSTABLE SOILS

Would the project be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslides, lateral spreading, subsidence, liquefaction or collapse?

4.5.5.1 IMPACT ANALYSIS

The geotechnical investigation prepared for the proposed project site identified that the on-site surficial soil units, including fill material, topsoil, subsoil, and younger alluvial deposits, are not considered suitable for support fill or and/or settlement-sensitive improvements in their present condition. Construction of the proposed project would result in a potentially significant impact associated with unstable soils.

As discussed in Section 4.5.4 above, the proposed project would not result in hazards from landslides or liquefaction.

4.5.5.2 SIGNIFICANCE OF IMPACT

Implementation of the proposed project would have a potentially significant impact associated with unstable soils because the proposed project site contains existing soil units that are not suitable for use as support fill or structures.

4.5.5.3 MITIGATION, MONITORING AND REPORTING

Implementation of the following mitigation measures would reduce impacts associated with unstable soil conditions to below a level of significance.

Geo-1 After site clearing and grubbing has been completed, all fill material, topsoil, subsoil, and younger alluvial deposits shall be removed in the areas to be graded or that will support settlement-sensitive improvements, in compliance with the CBC. In the areas where structures and streets are proposed, the younger alluvium shall be removed to the granitic bedrock, older alluvium, or at least two feet above the groundwater table, whichever is less. In areas that will be paved for parking or driveway access, material removal shall extend to a depth of four feet below subgrade.

Geo-2 Prior to placing any new fill soils or constructing any new improvements in areas that have been cleaned out to receive fill, the exposed soils should be scarified to a depth of 12 inches, moisture conditioned, and compacted to at least 90 percent relative compaction, in compliance with the CBC. In areas supporting fill slopes, keys should be cut into the competent supporting materials. The keys should be at least twelve feet wide and be sloped back into the hillside at least two percent.

Please refer to the Christian Wheeler Geotechnical Report (2005) pages 13 through 18, "Grading and Earthwork" recommendations for more detailed information regarding soil remediation (see Appendix E).

4.5.6 ISSUE 3 – SOIL EROSION OR LOSS OF TOPSOIL

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

4.5.6.1 IMPACT ANALYSIS

Erosion could occur as a result of, and could be accelerated by, activities associated with the proposed project. Soil removal associated with grading and excavation activities would reduce soil cohesion. Furthermore, excavated soils would be temporarily stockpiled before redistribution on site, which would be potentially exposed to erosive forces such as wind and water.

Wind Erosion

Construction

As identified in Chapter 3.0, Project Description, grading and excavation of the proposed project site would occur over a three year period in three distinct phases. The grading, excavation and temporary stockpiling operation would have the potential to expose soils to wind erosion. However, as stated in Section 4.2, Air Quality, dust control measures would be implemented which would reduce the potential for fugitive dust emissions. These measures would be implemented in compliance with the City of El Cajon's Municipal Code and San Diego Air Pollution Control District (APCD) regulations. As identified in Section 4.2.3, dust control measures during project construction may include, but would not be limited to, the following:

- Multiple applications of water during grading between dozer/scraper passes
- Paving, chip sealing or chemical stabilization of internal roadways after completion of grading
- Use of sweepers or water trucks to remove material at any point of public street access
- Termination of grading if winds exceed 25 mph
- Stabilization of dirt storage piles by chemical binders, tarps, fencing or other erosion control
- Hydroseeding of graded lots
- Reduction of idling times for construction equipment

With the implementation of these measures the project's wind erosion impacts occurring during construction would be less than significant.

Operation

Upon completion of construction, the project site would be developed with industrial buildings, parking lots, a northern extension of Gillespie Way, and landscaping. Slopes would be vegetated with native plants. No exposed soils would remain on site that would be susceptible to the effects of wind erosion. Therefore, wind erosion associated with the operation of the proposed project would not occur.

Water Erosion

Construction

All construction activities would comply with the City's Municipal Code and the CBC, which regulate excavation activities, construction of foundations and retaining walls, and grading activities including drainage and erosion control. As stated in Section 4.8, Hydrology and Water Quality, the proposed project would implement construction site erosion and sedimentation control BMPs. With the continued implementation of these measures, substantial erosion or topsoil loss would be minimized during construction, and the associated impact would be less than significant.

Operation

Erosion can also occur in connection with the hydrology of a project. Increases in surface water flow, typically associated with impermeable surfaces, can result in increased erosion in on-site and off-site drainage courses. Implementation of the proposed project would result in an increase in impervious surfaces on the project site from site development with new industrial uses. However, as discussed in Section 4.8, Hydrology and Water Quality, the proposed project would comply with all applicable regulations, including the City's Standard Urban Stormwater Management Plan (SUSMP) and Storm Water Management and Erosion Control Ordinance, which require permanent BMPs to be incorporated into the project design in order to reduce the quantity of pollutants in storm water runoff, including sediment from erosion. Therefore, compliance with applicable regulations would ensure that impacts would be less than significant.

4.5.6.2 SIGNIFICANCE OF IMPACT

The proposed project would not result in significant impacts associated with wind or water erosion.

4.5.6.3 MITIGATION, MONITORING AND REPORTING

No significant impact would occur; therefore, no mitigation measures are required.