

## Section 3.6

# Geology, Seismicity, and Soils

## Summary

Table 3.6-1 below provides a summary of the potential environmental impacts of the Proposed Project related to geology, seismicity, and soils. As shown in Table 3.6-1, the Proposed Project would have less-than-significant impacts on geology, seismicity, and soils within the project area.

**Table 3.6-1.** Summary of Potential Impacts to Geology, Seismicity, and Soils

<b>Impact</b>	<b>Level of Significance before Mitigation</b>	<b>Mitigation Measures</b>	<b>Level of Significance after Mitigation</b>
Impact GEO-1: Potential Structural Damage and Injury from Fault Rupture	Less Than Significant	Mitigation not required.	Less Than Significant
Impact GEO-2: Potential Structural Damage and Injury from Groundshaking	Less Than Significant	Mitigation not required.	Less Than Significant
Impact GEO-3: Potential Structural Damage and Injury from Development on Materials Subject to Liquefaction	Less Than Significant	Mitigation not required.	Less Than Significant
Impact GEO-4: Potential Structural Damage and Injury from Slope Failure	Less Than Significant	Mitigation not required.	Less Than Significant
Impact GEO-5: Potential Accelerated Runoff, Erosion, and Sedimentation from Grading Activities	Less Than Significant	Mitigation not required.	Less Than Significant
Impact GEO-6: Potential Loss of Topsoil	Less Than Significant	Mitigation not required.	Less Than Significant
Impact GEO-7: Potential Structural Damage as a Result of Development on Expansive Soils	Less Than Significant	Mitigation not required.	Less Than Significant
Impact GEO-8: Construction on Soils Incapable of Adequately Supporting the Use of Septic Tanks or Alternative Wastewater Disposal Systems	No Impact	Mitigation not required.	No Impact

## Introduction

This section describes the geology and soils of the Union City Intermodal Station District area and the regulations that cover geologic hazards and practices. Potential impacts of the Proposed Project related to geology, geologic hazards, and soils and the mitigation measures that would reduce these impacts are identified.

## Sources of Information

The key sources of data and information used in the preparation of this section are listed and briefly described below.

- Maps and reports by United States Geological Survey (USGS),
- Maps and reports by the California Geological Survey (CGS),
- Maps and reports by the U.S. Department of Agriculture's Natural Resources Conservation Service (USDA NRCS),
- Geotechnical Investigation, Decoto Road Mixed-Use Residential Development (Cornerstone Earth Group, 2007), and
- Union City General Plan. Union City. 2002. *Health and Safety Element*. Union City, CA. 2002. *City of Union City 2002 General Plan: Policy Document*. Adopted: February 12, 2002. Union City, CA.

## Regulatory Setting

### Federal

#### Clean Water Act 402/National Pollutant Discharge Elimination System

The CWA is discussed in detail in Section 3.7, Hydrology and Water Quality. However, because CWA Section 402 is directly relevant to excavation, additional information is provided below.

Amendments in 1987 to the CWA added Section 402p, which establishes a framework for regulating municipal and industrial stormwater discharges under the National Pollutant Discharge Elimination System (NPDES) program. The EPA has delegated to the State Water Resources Control Board (SWRCB) the authority for the NPDES program in California, which is implemented by the state's nine regional water quality control boards. Under the NPDES Phase II Rule, construction activity disturbing 1 acre or more must obtain coverage under the state's General Construction Permit. General Construction Permit applicants are required to prepare a Notice of Intent (NOI) and a Storm Water Pollution Prevention Plan (SWPPP) and implement and maintain Best Management

Practices (BMPs) to avoid adverse effects on receiving water quality as a result of construction activities, including earthwork.

## State

### Alquist-Priolo Earthquake Fault Zoning Act

California's Alquist-Priolo Act (Public Resources Code [PRC] 2621 et seq.), originally enacted in 1972 as the Alquist-Priolo Special Studies Zones Act and renamed in 1994, is intended to reduce the risk to life and property from surface fault rupture during earthquakes. The Alquist-Priolo Act prohibits the location of most types of structures intended for human occupancy across the traces of active faults and strictly regulates construction in the corridors along active faults (Earthquake Fault Zones). It also defines criteria for identifying active faults, giving legal weight to terms such as "active" and establishes a process for reviewing building proposals in and adjacent to Earthquake Fault Zones.

Under the Alquist-Priolo Act, faults are zoned, and construction along or across them is strictly regulated if they are "sufficiently active" and "well-defined." A fault is considered sufficiently active if one or more of its segments or strands shows evidence of surface displacement during Holocene time (defined for the purposes of the Act as within the last 11,000 years). A fault is considered well-defined if its trace can be clearly identified by a trained geologist at the ground surface or in the shallow subsurface, using standard professional techniques, criteria, and judgment (Hart and Bryant, 1997).

### Seismic Hazards Mapping Act

Like the Alquist-Priolo Act, the Seismic Hazards Mapping Act of 1990 (PRC 2690–2699.6) is intended to reduce damage resulting from earthquakes. While the Alquist-Priolo Act focuses on surface fault rupture, the Seismic Hazards Mapping Act addresses other earthquake-related hazards, including strong ground shaking, liquefaction, and seismically induced landslides. Its provisions are similar in concept to those of the Alquist-Priolo Act: the state is charged with identifying and mapping areas at risk of strong ground shaking, liquefaction, landslides, and other corollary hazards, and cities and counties are required to regulate development within mapped Seismic Hazard Zones.

Under the Seismic Hazards Mapping Act, permit review is the primary mechanism for local regulation of development. Specifically, cities and counties are prohibited from issuing development permits for sites in Seismic Hazard Zones until appropriate site-specific geologic or geotechnical investigations have been carried out, and measures to reduce potential damage have been incorporated into the development plans.

## 2007 California Building Standards Code (SBSC)

The State of California's minimum standards for structural design and construction are given in the CBSC (CCR Title 24). The CBSC is based on the UBC (International Code Council, 2006), which is used widely throughout United States (generally adopted on a state-by-state or district-by-district basis) and has been modified for California conditions with numerous, more detailed or more stringent regulations<sup>1</sup>. In addition, the City has adopted some local amendments to CCR Title 24 that will apply to the Proposed Project. The CBSC requires that "classification of the soil at each building site will be determined when required by the building official" and that "the classification will be based on observation and any necessary test of the materials disclosed by borings or excavations." In addition, the CBSC states that "the soil classification and design-bearing capacity will be shown on the (building) plans, unless the foundation conforms to specified requirements." The CBSC provides standards for various aspects of construction, including (i.e., not limited to) excavation, grading, and earthwork construction; fills and embankments; expansive soils; foundation investigations; and liquefaction potential and soil strength loss.

### Local

#### Geotechnical Investigations

Local jurisdictions typically regulate construction activities through a multistage permitting process that may require the preparation of a site-specific geotechnical investigation. The purpose of a site-specific geotechnical investigation is to provide a geologic basis for the development of appropriate construction design. Geotechnical investigations typically assess bedrock and Quaternary geology, geologic structure, soils, and the previous history of excavation and fill placement.

The City requires investigations by both registered soils engineers and engineering geologists prior to issuing building permits or discretionary approvals (i.e., general plan amendment, rezoning, conditional use permit, tentative subdivision map, etc.) for any new construction unless waived due to current existing information and location. Soils engineering reports specifically address secondary seismic hazards, especially potential for soil liquefaction, ground shaking, lateral spreading, local subsidence and lurch cracking. All reports are independently evaluated, on behalf of the City, for completeness and accuracy.

A site-specific geotechnical investigation *2007 Geotechnical Investigation, Decoto Road Mixed-Use Residential Development*, has been completed for the project area (Cornerstone Earth Group, 2007). All recommended mitigation

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<sup>1</sup> Local jurisdictions have the right/responsibility to adopt building codes, and they can choose to use UBC, CBC, or something similar, although certain aspects of the project would be required to comply with all provisions of the CBSC.

measures identified in this report have been included in the *Project Impacts and Mitigation Measures* section below.

## Local Grading and Erosion Control Ordinances

The Union City Public Works Department is responsible for issuing grading permits (Union City 2008). Grading permits are required for any project that involves removal or disturbance of 50 cubic yards of material or more. Besides the required fee that accompanies the permit, the permit also requires a basic erosion control plan. Standard conditions in the grading permit include a description of BMPs similar to those contained in a SWPPP. The only erosion control ordinance (besides the submittal of an erosion control plan) adopted by the City is that all earth-moving activities have to occur during the dry period of the year (i.e., April 15 to October 15).

## Union City General Plan

The following goals and policies from the Union City General Plan Health and Safety Element are applicable to the Proposed Project:

### Health and Safety Element

#### **Goal HS-A.1. To protect the public health and safety and minimize the damage to structures, property, and infrastructure as a result of natural and manmade hazards.**

Policy HS-A.1.1. The City shall evaluate proposed projects and land use policy decisions based on the environmental hazards identified in this element, its hazard maps and reports, FEMA Flood Insurance Rate Maps, and hazard maps prepared by the California Division of Mines & Geology and the Association of Bay Area Governments.

Policy HS-A.1.3. The City shall maintain information on soil and geologic hazards in the Planning Area, including maps that identify the locations of known hazard zones, as reported to the City or available from information published by State and Federal agencies. This information shall be used by the City to inform and guide review of proposed development.

#### **Goal HS-B.1. To minimize the risks associated with geologic and soils hazards in order to protect public health, safety, and property.**

Policy HS-B.1.1. The City shall require investigations by both registered soils engineers and engineering geologists prior to issuing building permits or discretionary approvals (i.e., general plan amendment, rezoning, conditional use permit, tentative subdivision map, etc.) for any new construction unless waived due to current existing information and location. Soils engineering reports shall specifically address secondary seismic hazards, especially potential for soil liquefaction, ground shaking, lateral spreading, local subsidence and lurch

cracking. All such reports shall be independently evaluated, on behalf of the City, for completeness and accuracy.

- a. All development proposals for lands west of Union City Boulevard shall coordinate with Alameda County Flood Control and Water Conservation District to evaluate the stability of all levees in order to identify potential hazards and necessary mitigation measures. Such evaluation will be the responsibility of the applicant(s) to prepare.
- b. Soils and geologic engineering reports shall be required for sites within the "Special Seismic Studies Zone" and lands east of Mission Boulevard to deal specifically with risks related to primary effects of ground rupture along fault traces and secondary seismic effects of slope instability and erosion control.
- c. For buildings larger than single-family residences, there shall be a soils report and an engineer-of-record. Contract services for structural review of plans, when necessary, should be done at the applicant's expense. Soils engineer reports shall address secondary seismic hazards, especially potential for soil liquefaction, lateral spreading and lurch cracking.

Policy HS-B.1.4. The City shall continue to implement updated editions of the Uniform Building Code published by the International Conference of Building Officials.

Policy HS-B.1.5. All environmental analyses submitted to the City under the California Environmental Quality Act in support of development proposals shall include sections evaluating seismic and geologic hazards.

Policy HS-B.1.7. The City shall not develop any lands which are found to contain potential geologic or seismic hazards defined as an "unacceptable risk." An unacceptable risk is a level of risk above which specific action by government is deemed to be necessary to protect life and property.

Policy HS-B.1.8. The City shall not extend utility service lines and streets across known or suspected active fault traces or active or historic slide planes. The City may permit exceptions when special engineering practices or techniques are employed that ensure that the extension can remain operational after a disaster.

Policy HS-B.1.9. The City shall require all structures designed for human occupancy in high risk areas and all critical structures throughout the city to meet local and State-applied code regulations.

## Environmental Setting

This section discusses the existing conditions related to geology, seismicity, and soils in the project area.

## Geology and Topography

Union City is situated at the foot of the East Bay Hills uplift, with the eastern edge of the city located in the hills, east of the Hayward fault. Most of the city, including the project area, is located on the alluvial valley floor.

Geologically, the basement rocks underneath the project area consist of Upper Jurassic- Lower Cretaceous Franciscan Complex. The Franciscan Complex consists of an assemblage of serpentinitized ultramafic rock, chert, limestone, metagraywacke, sandstone, shale, conglomerate, and greenstone. On top of this assemblage are undivided Tertiary marine sedimentary rocks of the Great Valley sequence. On the surface is older (i.e., Pleistocene) alluvium. These dissected, unconsolidated stream and basin deposits range in size from clay to boulder (Wagner et al., 1991). Elevations range from approximately 47 to 60 feet. Topography of the project area is nearly level, and slopes gently to the south.

## Seismicity

There are a number of active faults in the vicinity of the project area. Alameda County, as well as the San Francisco Bay Area as a whole, is located in one of the most seismically active regions in the United States. Major earthquakes have occurred in the vicinity of the project area in the past and can be expected to occur again in the near future. The 2002 Working Group on California Earthquake Probabilities estimated that there is a 62 percent probability of at least one magnitude 6.7 or greater earthquake to occur on one of the major faults within the San Francisco Bay region before 2030 (US Geological Survey Working Group on California Earthquake Probabilities Report, 2003). Furthermore, in a previous study, it determined that there is a 30 percent chance of one or more magnitude 6.7 or greater earthquakes occurring somewhere along the Calaveras, Concord, Green Valley, Mount Diablo Thrust, or Greenville faults before 2030, faults very close to the project area (US Geological Survey 1999).

Seismic hazards are earthquake fault ground rupture and ground shaking (primary hazards) and liquefaction and earthquake-induced slope failure (secondary hazards), discussed below. Groundshaking is the most significant earthquake-related hazard within the project area.

## Fault Rupture Hazard

The project area is not located within a State-designated Alquist-Priolo Earthquake Fault Zone. No known surface expression of fault traces is known to cross the project area (Cornerstone Earth Group, 2007; Hart and Bryant, 1997; International Conference of Building Officials, 1997; Jennings, 1994).

## Ground-Shaking Hazard

The measurement of the energy released at the point of origin, or epicenter, of an earthquake is referred to as the magnitude, which is generally expressed in the

Richter Magnitude Scale or as moment magnitude. The scale used in the Richter Magnitude Scale is logarithmic so that each successively higher Richter magnitude reflects an increase in the energy of an earthquake of about 31.5 times. Moment magnitude is the estimation of an earthquake magnitude by using seismic moment, which is a measure of an earthquake size utilizing rock rigidity, amount of slip, and area of rupture.

The greater the energy released from the fault rupture, the higher the magnitude of the earthquake<sup>2</sup>. Earthquake energy is most intense at the fault epicenter; the farther an area from an earthquake epicenter, the less likely that ground shaking will occur there. Geologic and soil units comprising unconsolidated, clay-free sands and silts can reach unstable conditions during ground shaking, which can result in extensive damage to structures built on them (see *Liquefaction Hazard* below).

The project area is located in a region of California characterized by locally high historical seismic activity. The CBC and the State of California recognize a series of active seismic sources in the project area vicinity (International Code Council 2006, CBC 2007.; Hart and Bryant, 1997), described below.

Active faults that present a significant ground-shaking risk include the Hayward Fault (proper), located 0.6 miles east and northeast of the project area; the Calaveras Fault, located approximately 7 miles east and northeast of the project area; and the Hayward Fault (southeast extension), located 11 miles east and southeast of the project area (Cornerstone Earth Group, 2007). All of these faults are seismic source type A faults within Alquist-Priolo Earthquake Fault Zones (Hart and Bryant, 1997).

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<sup>2</sup> Ground shaking is described by two methods: ground acceleration as a fraction of the acceleration of gravity (g) or the Modified Mercalli scale, which is a more descriptive method involving 12 levels of intensity denoted by Roman numerals. Modified Mercalli intensities range from I (shaking that is not felt) to XII (total damage). The intensity of ground shaking that would occur in the project area as a result of an earthquake is partly related to the size of the earthquake, its distance from the project area, and the response of the geologic materials within the project area. As a rule, the earthquake magnitude and the closer the fault rupture to the site, the greater the intensity of ground shaking. When various earthquake scenarios are considered, ground-shaking intensities will reflect both the effects of strong ground accelerations and the consequences of ground failure. The potential for a large-magnitude seismic event to occur in the project vicinity is expressed in terms of the Maximum Credible Earthquake (MCE), the largest earthquake with the potential to occur on a given fault.

**Table 3.6-2.** California Building Code (CBC) Classification, Maximum Credible Earthquake (MCE), and Recurrence Interval for Principal Active Faults in Project Area

Fault	UBC Seismic Source Type*	MCE Magnitude	MCE Recurrence Interval
San Andreas	A	7.0–7.9a	210–400 years a
Hayward	A	Entire fault: 7.1a	Entire fault: 330 years a
		Southern segment: 6.5a–6.9c	Southern segment: 161c–167 b years
Ortogonalita	B	6.5–6.75b, 6.9a	2,000–5,000 years b
Calaveras (northern)	A	6.8a	187 years c
Greenville	B	6.9a	Southern segment: 623 years c
			Northern segment: 644 years c

\* The CBC defines *active seismic sources* as faults “that have evidence of Holocene displacement (last 11,000 years), are exposed at the ground surface, [and] have reported slip rates greater than about 0.1 mm per year” (International Conference of Building Officials, 1997). *Type A seismic sources* are faults that are “capable of producing large magnitude events and that have a high rate of seismic activity.” *Type B seismic sources* have a lesser but still substantial maximum moment magnitude and slip rate.

Sources:

<sup>a</sup> International Conference of Building Officials, 1997.

<sup>b</sup> Anderson et al., 1982.

<sup>c</sup> U.S. Geological Survey Working Group on California Earthquake Probabilities, 2003 and 2007.

There are additional active faults 20 to 50 miles away from the project area, including the San Andreas Fault, a seismic source type A fault. As seen with damage in San Francisco and Oakland due to the 1989 Loma Prieta earthquake that was centered about 50 miles south, significant damage can occur at considerable distances. Higher levels of shaking and damage would be expected for earthquakes occurring at closer distances.

Furthermore, buried thrust faults and inferred faults are located near the Project Area. These faults are not officially recognized yet by the State of California or the UBC, but they are potential seismic sources. For example, recent research suggests that the Mount Diablo fault system (referred to as the Mount Diablo Thrust) is a complex active thrust system with some blind strands and likely poses a substantial seismic hazard (Sawyer, 1999; Unruh, 2000; Sawyer and Unruh, 2004). Accordingly, the seismic hazards for the Project Area are affected by both the San Andreas fault system and these buried thrust faults and inferred faults. The buried thrust faults and inferred thrust faults are not listed in Alquist-Priolo Earthquake Fault Zones because they do not have surface ruptures and are not officially recognized.

Based on existing published data on officially recognized faults, the following faults are considered to have the greatest potential to impact the project area: the Hayward Fault (proper); the Calaveras Fault; and the Hayward Fault (southeast extension) (Cornerstone Earth Group, 2007).

## Estimates of Earthquake Shaking

The CGS maintains a web-based computer model that estimates probabilistic seismic ground motions for any location within California. The computer model estimates the “Design Basis Earthquake” ground motion, which is defined as the Peak Ground Acceleration (PGA) with a 10 percent chance of exceedance in 50 years (475-year return period). For an alluvial soil type, the estimated PGA for the project area is approximately 0.69g, thus indicating that the ground-shaking hazard in the project area is high (Cao et al., 2003; California Geological Survey, 2003a; Cornerstone Earth Group, 2007).

## Liquefaction and Related Hazards

Liquefaction is a phenomenon in which the strength and stiffness of unconsolidated sediments are reduced by earthquake shaking or other rapid loading. Poorly consolidated, water-saturated fine sands and silts having low plasticity and located within 50 feet of the ground surface are typically considered to be the most susceptible to liquefaction. Soils and sediments that are not water-saturated and that consist of coarser or finer materials are generally less susceptible to liquefaction. Geologic age also influences the potential for liquefaction. Sediments deposited within the past few thousand years are generally much more susceptible to liquefaction than older Holocene sediments; Pleistocene sediments are even more resistant; and pre-Pleistocene sediments are generally immune to liquefaction (California Division of Mines and Geology, 1997).

The State of California maps seismic hazards statewide. These maps assist cities and counties in fulfilling their responsibilities for protecting the public safety from the effects of earthquake-triggered ground failure as required by the Seismic Hazards Mapping Act. Based on the final map for the Newark Quadrangle, the site is not located within a State of California Seismic Hazard Zone for liquefaction (California Geological Survey, 2003b). Liquefaction susceptibility maps compiled by the USGS (Wentworth et al., 2000) and ABAG (ABAG, 2005) also verify that Union City is not highly susceptible to liquefaction.

As determined by Cornerstone Earth Group, some discontinuous sandy and silty lenses underlying the project area theoretically can liquefy. However, because these lenses are relatively thin, potential settlement due to liquefaction would be minimal (less than 0.25 inch). Based on Cornerstone Earth Group’s analysis and engineering judgment, the potential for impact to the development due to liquefaction is low.

Two potential ground failure types associated with liquefaction in the region are lateral spreading and differential settlement (Association of Bay Area Governments, 2001). Lateral spreading involves a layer of ground at the surface being carried on an underlying layer of liquefied material over a gently sloping surface toward a river channel or other free face. The project site is located on relatively flat topography, and there are no free faces within close proximity of

the project area where lateral spreading could occur; therefore, the potential for lateral spreading to affect the project area is considered low (Cornerstone Earth Group, 2007).

Another common hazard in the region is differential settlement (also called ground settlement and, in extreme cases, ground collapse) as soil compacts and consolidates after the ground shaking ceases. Differential settlement is usually, but not always, related to liquefaction. Differential settlement may occur when the layers that liquefy are not of uniform thickness, a common problem when the liquefaction occurs in artificial fills. Settlement can range from 1 to 5 percent, depending on the cohesiveness of the sediments (Tokimatsu and Seed, 1984). Limited field and laboratory data is available regarding ground deformation due to settlement in the project area; however, in clean sand layers settlement on the order of 2 to 3 percent of the liquefied layer thickness can occur. As described above, soils most susceptible to liquefaction are loose, non-cohesive soils that are saturated and are bedded with poor drainage, such as sand and silt layers bedded with a cohesive cap. Accordingly, differential settlement is not expected to be a significant hazard in the project area (Cornerstone Earth Group, 2007).

## Seismically-Induced Ground Failure and General Slope Stability

The existing potential for landslides (both seismically and non-seismically induced) in the project area is expected to be low because the topography is virtually flat and surface elevations are generally uniform, varying from approximately 47 to 60 feet across the area. Based on a review of aerial photographs and site reconnaissance, the project area is not located in a landslide runoff zone.

## Soils

According to the Natural Resources Conservation Service's Web Soil Survey (Natural Resources Conservation Service, 2008) and the Soil Survey of Alameda County, California, Western Part (Welch, 1981), the project area includes two soil map units:

- Rincon clay loam, 0 to 2 percent slopes—occupies approximately 94 percent (approximately 8.5 acres) of the project area. Typically, the surface layer is grayish brown and dark grayish brown neutral clay loam about 16 inches thick. The subsoil extends to a depth of 52 inches. It is dark grayish brown, neutral heavy clay loam in the upper part, and brown, neutral and mildly alkaline clay in the lower part. The substratum is yellowish brown, calcareous clay loam and extends to a depth of 60 inches or more. Its parent material consists of alluvium derived from sedimentary rock. It is well-drained, has a slight hazard of erosion. It is highly expansive.
- Clear Lake clay, 0 to 2 percent slopes, drained—occupies approximately 6 percent (approximately 0.5 acre) of the project area. Typically, the surface layer is very dark gray, neutral and moderately alkaline clay about 37 inches

thick. The underlying material is calcareous, dark gray and grayish brown clay and silty clay to a depth of 60 inches or more. Its parent material consists of alluvium derived from sedimentary rock. It is poorly-drained and has no hazard of erosion. It is highly expansive.

Based on field exploration and review of available data, the site is generally underlain by undocumented fill material (resulting from the remediation actions) and highly variable interbedded alluvial soils. Where undisturbed, subsurface materials are dominated by clayey soils. Surficial fills were encountered in several borings to depths of 1 to 4 feet; they appear to be derived from the native soils. Near-surface native soils generally consist of highly plastic clays from 4 to 16 feet in depth, which are underlain by lean silty clays interbedded with occasional lenses of silt and sand to depths of 30 to 70 feet, with very dense sand layers encountered generally below a depth of 50 feet (Cornerstone Earth Group, 2007).

According to Cornerstone Earth Group, remnants of past developments, including concrete pads, foundations, wood debris, and other materials are scattered across the project area. At the time of their site reconnaissance, several portable structures and storage containers were located toward the western end of the project area near Decoto Road. Soil stockpiles were being placed near the center of the project area. Soils from the stockpiles appeared to have been generated from nearby construction projects. A site access road running generally in a northwest-southeast direction was located along the northeast site boundary. Accordingly, much of the surface soil (and a majority of the subsurface soil to a depth of approximately 4 feet) has been removed and/or modified.

## Impact Analysis

### Methods

Evaluation of the geology and soils impacts in this section is based on the results of technical maps, reports, and other documents that describe the geologic, seismic, and soil conditions of the project area, and on professional judgment. The analysis assumes that the project applicants will conform to the latest CBSC standards, Union City General Plan policies, Union City grading ordinance, and NPDES requirements. This analysis also assumes the Proposed Project Applicant will conform to all recommended mitigation measures in Cornerstone Earth Group's 2007 *Geotechnical Investigation, Decoto Road Mixed-Use Residential Development*.

### Thresholds of Significance

For this analysis, an impact pertaining to geology, seismicity, and soils was considered significant under CEQA if it would result in any of the following environmental effects, which are based on current standards of professional practice and State CEQA Guidelines Appendix G (14 CCR 15000 et seq.).

- expose people or structures to increased risk from 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;
- expose people or structures to increased risk related to strong seismic ground shaking;
- expose people or structures to increased risk related to seismically induced ground failure, including liquefaction;
- expose people or structures to increased risk of landslides or other slope failure;
- result in substantial soil erosion or the loss of topsoil;
- be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project and potentially result in an onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse; or
- be located on expansive soil, as defined in Table 18-1-B of the UBC (International Conference of Building Officials, 1997), creating substantial risks to life or property; or
- have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

## Impacts and Mitigation Measures

### Impact GEO-1: Potential Structural Damage and Injury from Fault Rupture

Fault rupture has the potential to compromise the structural integrity of proposed new facilities and cause injury to construction workers and residents. However, based on available knowledge of fault locations, the risk of surface fault rupture in the project area is generally low because of its distance to active faults—no known faults or faults suspected to be active cross the site (Cornerstone Earth Group, 2007). Therefore, because of the low hazard of surface fault rupture, this impact is considered to be less than significant.

### Impact GEO-2: Potential Structural Damage and Injury from Groundshaking

A large earthquake on a nearby fault could cause strong ground shaking in the project area, which in turn could increase the risk of structural loss, injury, or death. However, as part of the design process described above, the Proposed Project Applicants are required to implement CBSC standards (or applicable building code standards in effect at the time of building permit issuance) into the project design for applicable features to minimize the potential ground shaking hazards on associated project features. Therefore, assuming implementation of

CBSG standards to reduce the potential for ground shaking hazards, this impact is considered less than significant.

### **Impact GEO-3: Potential Structural Damage and Injury from Development on Materials Subject to Liquefaction and Other Types of Seismically Induced Ground Failure**

Liquefaction and related hazards such as lateral spreading and differential settlement have the potential to compromise the structural integrity of proposed new facilities and cause injury to construction workers and residents. However, liquefaction susceptibility maps compiled by the CGS, USGS, and ABAG suggest that the project area is not highly susceptible to liquefaction. Site-specific evaluation by Cornerstone Earth Group confirms a low risk of liquefaction and other types of seismically induced ground failure. Therefore, impacts related to seismically induced ground failure are considered less than significant.

### **Impact GEO-4: Potential Structural Damage and Injury from Slope Failure**

The existing potential for landslides (both seismically and non-seismically induced) in the project area is expected to be low because the topography is virtually flat and surface elevations are generally uniform. The project area is not located in a landslide runout zone.

Per recommendation of Cornerstone Earth Group, the contractor will be responsible for maintaining all temporary slopes and providing temporary shoring where required. Temporary shoring, bracing, and cuts/fills should be performed in accordance with the strictest government safety standards. On a preliminary basis, the upper 30 feet at the site may be classified as OSHA Type C materials. A Cornerstone representative should be retained to confirm the preliminary site classification. Recommended soil parameters for temporary shoring are provided in the “Temporary Shoring” section of the Cornerstone Report. Therefore, with implementation of measures including maintenance of slopes and temporary shoring where required, impacts related to structural damage and injury from slope failure is considered to be less than significant.

### **Impact GEO-5: Potential Accelerated Runoff, Erosion, and Sedimentation from Grading Activities**

Grading, excavation, removal of vegetation cover, and loading activities associated with construction could temporarily increase erosion and sedimentation. Construction activities also could result in soil compaction and wind erosion effects that could adversely affect soils and reduce the revegetation potential at the construction sites and staging areas.

However, as previously discussed in this section and the Hydrology and Water Quality section, a SWPPP will be developed by a qualified engineer or erosion control specialist and implemented before construction. The SWPPP will be kept on-site during construction activity and will be made available upon request to

representatives of the RWQCB. The objectives of the SWPPP will be to: (1) identify pollutant sources that may affect the quality of stormwater associated with construction activity; and (2) identify, construct, and implement stormwater pollution prevention measures to reduce pollutants in stormwater discharges during and after construction. Therefore, the SWPPP will include a description of potential pollutants, the management of dredged sediments, and hazardous materials present on the site during construction (including vehicle and equipment fuels). The SWPPP also will include details of how the sediment and erosion control practices, referred to as Best Management Practices (BMPs), would be implemented. Therefore, with implementation of the measures and BMPs included in the SWPPP, impacts related to runoff, erosion, and sedimentation are considered less than significant.

### **Impact GEO-6: Potential Loss of Topsoil**

Ground-disturbing activities such as grading, excavation, removal of vegetation cover, and loading are expected to result in the removal or loss of topsoil in the project area. Per recommendation of Cornerstone Earth Group, surface vegetation and topsoil should be stripped to a sufficient depth to remove all material greater than 3 percent organic content by weight. Therefore, because surface soils in the project area are already mostly disturbed and no topsoil is present, this impact is considered to be less than significant.

### **Impact GEO-7: Potential Structural Damage as a Result of Development on Expansive Soils**

The soil units in the project area have been identified as having high shrink-swell potential. Expansive soils have the potential to compromise the structural integrity of proposed new facilities. However, as part of the design process described above, the Proposed Project Applicants are required to implement CBSC standards (or applicable building code standards in effect at the time of building permit issuance) into the project design for applicable features to minimize the potential shrink-swell hazards on associated project features. Therefore, because the project will be built in compliance with CBSC standards, impacts from expansive soils are considered to be less than significant.

### **Impact GEO-8: Construction on Soils Incapable of Adequately Supporting the Use of Septic Tanks or Alternative Wastewater Disposal Systems**

The Project does not propose the use of septic tanks or alternative wastewater disposal systems. The Project would be connected to the local wastewater sewer system. Therefore, there are no impacts related to septic tanks or alternative wastewater disposal systems.

## Cumulative Impacts

Cumulative impacts of the Proposed Project related to geology, seismicity, and soils are limited to the project area. Although the Proposed Project would result in the addition of residents and visitors to the project area, potentially exposing them to a geologic or seismic event, the risk would be no greater than in other areas of the Bay Area. The Proposed Project would include new construction compliant with current seismic safety standards per the CBC, which would be a beneficial impact compared to occupation in older structures. Therefore, the Proposed Project's contribution to cumulative geology, seismicity, and soils impacts are less than significant.