4.7 GEOLGY, SOILS, AND MINERAL RESOURCES

This section evaluates the potential impacts to geology, soils, and mineral resources associated with implementation of the 2050 RTP/SCS. The information presented was compiled from multiple sources, including the County of San Diego, SANDAG, USGS, and local jurisdictions.

4.7.1 EXISTING CONDITIONS

4.7.1.1 Geology and Soils

Geologic Conditions

The San Diego region is underlain by three principal geologic provinces. The majority of the region is in the Peninsular Ranges province bounded by the coastal province to the west and the Salton Trough province to the east. The western edge of the Peninsular Ranges province corresponds with the eastern hills and mountains along the edge of Poway, Lakeside, and El Cajon. Extending east of Julian and Jacumba, the province abruptly ends along a series of faults. To the north, the Peninsular Ranges province continues into the Los Angeles basin area; to the south it makes up the peninsula of Baja California.

As the Peninsular Ranges province experienced uplifting and tilting, a series of large faults, such as the Elsinore and San Jacinto, developed along the edge of the province. The eastern area “dropped” down, creating what is now known as the Salton Trough–Gulf of California depression. The Salton Trough province, being lower than the surrounding landscape, became an area of deposition with sediments being carried to the depressed area by drainages of the peninsular ranges. Occasionally, the Salton Trough was inundated with marine waters from the Gulf of California, adding marine deposits to the sediment (Peterson 1977).

The coastal plain province extends from the western edge of the Peninsular Ranges and runs roughly parallel to the coastline. The coastal plain ranges in elevation from sea level to approximately 600 feet above mean sea level and lies mostly within incorporated cities in San Diego County. The province is composed of dissected, mesa-like terraces that graduate inland into rolling hills. The terrain is underlain by sedimentary rocks composed mainly of sandstone, shale, and conglomerate beds, reflecting the erosion of the Peninsular Ranges to the east. Portions of the project area lie within the coastal plain province.

Seismic Setting

Earthquakes are caused by the release of accumulated strain along fractures in the earth’s crust (County of San Diego 1975). Several earthquake fault zones exist in and around the San Diego region, as shown in Figure 4.7-1. Since high-magnitude shocks transmit energy over large areas, fault zones outside of the San Diego region boundaries are included in this discussion. The San Diego region is in a medium-high to high level shaking-hazard area, which is based on the rate at which earthquakes occur in different areas and on how far strong shaking extends from quake sources (USGS 1996).

The dominant trend of faulting in Southern California is northwest-southeast. In the Transverse Ranges, however, faults trending east-west to northeast predominate, including a nearly east-west striking segment of the San Andreas fault. Historically, most of the recorded earthquakes and recorded fault breaks occurred as a result of rupture along the faults in the San Andreas system, which suggests that most of the accumulating strain energy is being released along these breaks.
Figure 4.7-1
Earthquake Fault Zones and Seismic Conditions
October 2011

- Earthquake Fault Lines
- Alquist-Priolo Earthquake Fault Zone Buffer Zone (Miles from active fault)
  - 9 miles
  - 6 miles
  - 3 miles
  - 1 mile

<table>
<thead>
<tr>
<th>ID</th>
<th>FAULT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rose Canyon Fault</td>
</tr>
<tr>
<td>2</td>
<td>Coronado</td>
</tr>
<tr>
<td>3</td>
<td>Silver Strand</td>
</tr>
<tr>
<td>4</td>
<td>Silverwater</td>
</tr>
<tr>
<td>5</td>
<td>La Nacion Fault</td>
</tr>
<tr>
<td>6</td>
<td>Elsinore Fault (Segment A)</td>
</tr>
<tr>
<td>7</td>
<td>Elsinore Fault (Segment B)</td>
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<td>8</td>
<td>Elsinore Fault (Segment C)</td>
</tr>
<tr>
<td>9</td>
<td>Earthquake Valley</td>
</tr>
<tr>
<td>10</td>
<td>Aguanga Fault</td>
</tr>
<tr>
<td>11</td>
<td>San Felipe</td>
</tr>
<tr>
<td>12</td>
<td>Hot Springs</td>
</tr>
<tr>
<td>13</td>
<td>Aguila Tibia Fault</td>
</tr>
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<td>14</td>
<td>Coyote Creek Fault</td>
</tr>
<tr>
<td>15</td>
<td>Borrego Mountain Fault</td>
</tr>
<tr>
<td>16</td>
<td>Valk Fault</td>
</tr>
<tr>
<td>17</td>
<td>San Felipe Hills Fault</td>
</tr>
<tr>
<td>18</td>
<td>Santa Rosa Fault</td>
</tr>
</tbody>
</table>

0 5 10 15 Miles
0 4 8 12 Kilometers

SOURCE: SanGIS 2011; SANDAG 2011
Sources of most earthquakes felt in the county are from the Imperial Valley and offshore fault systems (Lee 1977). The Imperial Valley area is the most active source of local earthquakes and is the location of portions of the San Andreas, San Jacinto, and Elsinore faults. The recently discovered Yuha Wells fault cuts the Elsinore fault zone from the Laguna Salada fault about 17 miles west of El Centro in Imperial County. The San Andreas fault is outside the San Diego region but poses a potential hazard to the San Diego region. It extends a total of 650 miles from Baja California to the California coast north of San Francisco. In the vicinity of the San Diego region, the San Andreas fault follows the east side of Coachella and Imperial valleys. The nearest inhabited sections of the San Diego region are 30 miles away.

The San Jacinto fault is the largest of the active faults in San Diego region. The fault extends 125 miles from Imperial Valley to San Bernardino. The Coyote Creek fault and Borrego Mountain fault in the eastern part of the San Diego region are considered segments of the San Jacinto fault. The maximum probable earthquake expected to occur along the San Jacinto fault would be a magnitude of 7.5 to 7.8 on the Richter scale. An earthquake of this magnitude would be likely to cause severe damage in Borrego Springs and Ocotillo Wells with moderate damage to coastal areas. Historical activity associated with the San Jacinto fault occurred in 1890, 1899, 1968, and 1979. The quake in 1968 had a recorded magnitude of 6.8 and was centered near Ocotillo Wells. The earthquake of 1979 was associated with a branch of the Imperial fault near the Mexican border and registered magnitude 6.4 on the Richter scale, causing extensive structural damage to Imperial Valley residences and businesses.

The Elsinore fault represents a serious earthquake hazard for most of the populated areas of the San Diego region. This fault is approximately 135 miles long and is located approximately 40 miles from downtown San Diego. This fault can register large earthquakes in the range of magnitude 6.9 to 7.0 on the Richter scale with a recurrence interval of approximately 100 years.

The Rose Canyon fault zone is an active offshore/onshore fault capable of generating an earthquake of magnitude 6.2 to 7.0 on the Richter scale. The fault zone lies partially offshore as part of the Newport/Inglewood fault zone and parallels the northern coastline of the San Diego region within approximately 2 to 6 miles until coming ashore near La Jolla Shores. The onshore segment trends through Rose Canyon, through Old Town San Diego, and appears to die out in San Diego Bay (Abbott 1989). Evidence of faulting in San Diego Bay is thought to be associated with this fault (County of San Diego 1975). The fault zone is composed of a number of fault segments, including the Rose Canyon, Mount Soledad, and Country Club faults.

The La Nación fault zone and the Sweetwater fault run parallel to the Rose Canyon fault zone approximately 5 miles inland from the bay. These faults are considered potentially active (County of San Diego 1975).

The major offshore fault zones are the San Clemente, San Diego Trough, and Coronado Bank. The San Clemente fault zone, located 40 miles off La Jolla, is the largest offshore fault. It is estimated that the maximum plausible quake along this fault would be between magnitude 6.7 and 7.7 (Kern 1988). An earthquake in 1951 registered 5.9 and was centered near the San Clemente fault (County of San Diego 1975). The San Diego Trough and Coronado Bank fault zones are capable of seismic events of magnitude 6.0 to 7.7 (Deméré 1997).

**Fault Rupture**

Fault rupture is defined as the breakage of ground along the surface trace of a fault caused by the intersection of the fault surface area ruptured in an earthquake with the earth’s surface. During earthquakes, the ground can rupture at or below the surface. Ground rupture occurs when two lithospheric plates heave past each other, sending waves of motion across the earth. The lithosphere is approximately
75 miles thick and consists of the upper continental and oceanic crusts and the rigid mantle layer that is directly beneath the crust. Earthquakes can cause large vertical and/or horizontal displacement of the ground along the fault. Ground rupture can completely demolish structures by rupturing foundations or by tilting foundation slabs and walls, as well as damage buried and above ground utilities. Drinking water can be lost, and the loss of water lines or water pressure can affect emergency services, including fire fighting ability. Research of historical earthquakes has shown that, although only a few structures have been ripped apart by fault rupture, this hazard can produce severe damage to structures built across active fault lines (County of San Diego 2010).

Ground Shaking

Ground shaking from earthquakes produces the vast majority of damage. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. Earthquakes, or earthquake-induced landslides, can cause damage near and far from fault lines. The potential damage to public and private buildings and infrastructure can threaten public safety and result in significant economic loss. Ground shaking is the most common effect of earthquakes that adversely affects people, animals, and structures. Several factors control how ground motion interacts with structures, making the hazard of ground shaking difficult to predict. Seismic waves propagating through the earth’s crust are responsible for the ground vibrations normally felt during an earthquake. Seismic waves can vibrate in any direction, and at different frequencies, depending on the frequency content of the earthquake rupture mechanism and the path and material through which the waves are propagating. The earthquake rupture mechanism is the distance from the earthquake source, or epicenter, to an affected site (County of San Diego 2010).

Slope Failure/Landslides

Slope failure is the movement of soil and rock material downhill to a lower position. Landslides are the most common naturally occurring type of slope failure in the San Diego region. Block falls, slumps, and block glides are specific types of landslides. The region’s landslides are commonly composite slides, a combination of block glides and slumps. Block falls are of concern primarily in coastal bluff areas (Ganus 1977). Earthquakes and their aftershocks can intensify or activate an unstable slope. Loosely and weakly consolidated soils, steepened slopes caused by either human activities or natural causes, and saturated earth materials create a fragile situation easily affected by an earthquake. In the San Diego region, a major earthquake could cause the occurrence of landslides along sea cliffs, on mountain road cuts, along the slopes of Palomar and Laguna mountains, and in subdivisions where unprotected cut slopes occur in landslide-prone areas (County of San Diego 1975). Landslides in the San Diego region generally occur in sedimentary rocks such as sandstone, siltstone, mudstone, and claystone. When these fine-grained rocks are exposed to the erosional actions of air and water, they often turn into clay. Seams of saturated clays can be responsible for landslides even on gentle slopes.

Bentonite clay is a component of many San Diego soils. It is an expandable clay randomly interbedded with sandstone strata. The resistant beds of the sandstone can assume a slick surface along which the heavy, waterlogged clays can “slide” down the unstable slope. A slope can be made potentially unstable by grading operations involving (a) removing material from the bottom of the slope, thus increasing the angle of the slope; (b) raising the height of the slope above the previous level; (c) saturating the slope with water from septic tank, gutter runoff, or diverted drainage from another part of the slope; or (d) adding fill to the top of the slope, creating additional weight (County of San Diego 1973). In addition, earth-moving activities can reactivate an old slide.

Areas of the San Diego region that have experienced sliding are commonly underlain by the Ardath Shale, Friars, Mission Valley, San Diego, and Otay rock formations. The Ardath Shale Formation extends
4.7 Geology, Soils, and Mineral Resources

from Torrey Pines State Park to Mission Bay and is composed of a bentonite-rich clay. The Friars Formation occurs from Mission Valley to beyond Rancho Bernardo. The formation is composed of expandable clays with properties similar to those of bentonite. The Mission Valley Formation is found from Mission Valley to Rancho Bernardo. The San Diego Formation occurs throughout the coastal mesas from Mission Valley southward to the Mexican border. The Otay Formation is found in the southwestern portion of the San Diego region and is composed of slide-resistant sandstone with occasional thin interbedding of bentonite clay (County of San Diego 1975). Significant landslides have occurred along coastal bluffs and hilly areas (County of San Diego 2010).

Liquefaction

Liquefaction is a process by which water-saturated granular soils transform from a solid to a liquid state during strong ground shaking. Primary factors controlling development of liquefaction include intensity and duration of ground accelerations, characteristic of the subsurface soils, in situ stress conditions, and depth of groundwater. Sites underlain by relatively loose sandy soils and saturated deposits of fill combined with a shallow groundwater table, which typically are located in alluvial river valleys/basins and floodplains, are susceptible to liquefaction.

Erosion and Loss of Topsoil

Erosion is defined as a combination of processes in which the materials of the earth’s surface are loosened, dissolved, or worn away, and transported from one place to another by natural agents. The two types of soil erosion include wind erosion and water erosion. Erosion potential in soils is influenced primarily by loose soil texture and steep slopes. Loose soils can be eroded by water or wind forces, whereas soils with high clay content are generally susceptible only to water erosion. The potential for erosion generally increases as a result of human activity, primarily through the development of structures and impervious surfaces and the removal of vegetative cover.

High erosion potential in soils is primarily caused by loose soils and steep slopes. The potential for erosion generally increases as a result of human activity, primarily through development of structures and impervious surfaces and the removal of vegetative cover. Steep slopes and bluffs resulting from beachside erosion and wave action are found along the coastal cities in the northern part of the region, particularly in and near Del Mar, Solana Beach, and Encinitas. Areas of potential slope failure or high erodibility could be potentially hazardous.

Expansive Soils

Expansive soils contain minerals such as smectite clays that are capable of absorbing water. When they absorb water they increase in volume. The more water they absorb the more their volume increases. Expansions of 10 percent or more are not uncommon. This change in volume can exert enough force on a building or other structure to cause damage. Cracked foundations, floors, and basement walls are typical types of damage done by swelling soils. Damage to the upper floors of the building can occur when motion in the structure is significant.

Expansive soils will also shrink when they dry out. This shrinkage can remove support from buildings or other structures and result in damaging subsidence. Fissures in the soil can also develop. These fissures can facilitate the deep penetration of water when moist conditions or runoff occurs. This produces a cycle of shrinkage and swelling that places repetitive stress on structures (Geology.com 2011). Expansive soils occur throughout many areas of the San Diego region. Expansive soils primarily consist of clayey soils that have a potential for significant volume changes (shrinking and swelling) with moisture fluctuations. Deterioration of infrastructure, structures, and pavements can result when not designed to withstand the
soil pressures exerted by expansive soils. Less than 50 percent of areas within the coastal plain of the San Diego region are underlain by soils with abundant clays of slight to moderate swelling potential. The remaining areas of the region are typically underlain by soils with little or no clays with swelling potential (Olive et al. 1989).

### 4.7.1.2 Mineral Resources

In evaluating impacts under CEQA, the term “mineral resources” is used. In mining and conservation, economists, engineers, and scientists use the term “mineral resources” to mean a concentration or occurrence of natural, solid, inorganic, or fossilized organic material in or on the earth’s crust in such form and quantity and of such a grade or quality that it has reasonable prospects for economic extraction (County of San Diego 2008). Locally important mineral resources in the region include construction aggregate materials (sand, gravel, and crushed rock), industrial and chemical mineral materials (limestone, dolomite, and marble), and metallic and rare minerals (precious metals, gemstones, iron and other ferro-alloy metals, copper, lead, zinc, and optical-grade calcite) (County of San Diego 2010).

### Mineral Resources Zones

Existing urban development in the western portion of the San Diego region has made mining infeasible in many areas where prime deposits of sand, gravel, and stone are located. State law requires cities and counties to plan for the beneficial management of valuable mineral resources. The State Surface Mining and Reclamation Act of 1975 (SMARA) establishes policies for the conservation, development, and reclamation of mineral lands, and requires all cities and counties to incorporate in their general plans the mapped locations of lands categorized as Mineral Resource Zones (MRZs) as designated by the Division of Mines and Geology (DMG).

Figure 4.7-2 shows existing MRZ designations, which are described in Table 4.7-1.

<table>
<thead>
<tr>
<th>Zone</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRZ-1</td>
<td>Areas where adequate information indicates that no significant mineral deposits are present, or where there is little likelihood for their presence.</td>
</tr>
<tr>
<td>MRZ-2</td>
<td>Areas where adequate information indicates that significant mineral deposits are present or where there is a high likelihood for their presence.</td>
</tr>
<tr>
<td>MRZ-3</td>
<td>Areas containing mineral deposits, the significance of which cannot be evaluated from available data.</td>
</tr>
<tr>
<td>MRZ-4</td>
<td>Areas where available information is inadequate for assignment to any other MRZ.</td>
</tr>
</tbody>
</table>

Source: City of San Diego 2008a

The locations designated MRZ-2 are high-quality mineral resource areas in the San Diego region. These are areas where adequate information indicates that significant mineral deposits are present or where there is a high likelihood for their presence, and they are most likely to be designated for the managed production of mineral resources. In general, the existing MRZ-2 areas in the San Diego region are concentrated along major drainages such as the San Luis Rey River Area, Otay River, the Tijuana River, the San Diego River, Carroll Canyon, Sweetwater River, and the San Dieguito River. Many of the region’s existing mining operations are located along rivers and water courses. More specifically, MRZ-2 locations exist along SR 76, between I-15 and SR 78, north of SR 52 east of I-805, along I-8, in southern Chula Vista and Otay Mesa, and from Imperial Beach south to the U.S./Mexican border.
Figure 4.7-2
San Diego Region
Mineral Resource Zone Map
October 2011

MRZ-1: Resource Not Present
MRZ-2: Resource Present
MRZ-3: Resource Potentially Present
MRZ-4: Inconclusive
Unclassified

SOURCE: SANDAG 2011
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Mineral resources and exaction operations also exist in lands governed by tribal councils. In land governed by the Pala Band of Mission Indians, the Oceanview Mine is an operational gem mine active in the Pala Gem Mining District and mines tourmaline, lepidolite, kunzite, and quartz. A number of mines were active in the Pala Gem Mining District, typically during the early to mid-1900s, with a resurgence of mining activity during the 1970s. Several active or inactive mines or quarry sites are located within proximity to tribal land boundaries (BIA 1982). The Bureau of Indian Affairs (BIA) Minerals and Mining program has been active in promoting the production of oil, coal, precious metals, granite, gypsum, sand and gravel, and natural gas resources on Indian lands nationwide (BIA 1997).

Resource recovery sites are areas where mineral resources could be extracted for use, as designated by local land use plans. Locally important resource recovery sites or areas where important resource recovery sites could potentially be located are designated by the California Geologic Survey (CGS) as MRZ-2.

**Aggregate Supply**

Sand, gravel, and crushed rock provide essential construction aggregate material for modern society and compose the most important mineral resource category in the region. Aggregate is used in one form or another for the construction of roads, parking lots, buildings, homes, schools, hospitals, shopping centers, and other essential infrastructure. The highest grade aggregate is used to provide the bulk and strength to Portland Concrete Cement (PCC) and Asphalt Cement (AC). Aggregate supply sources within the San Diego region have dropped from 48 mines in 1980 to 27 mines in 1995. Since then, the number of significant and active mines declined to 16; this decline will likely continue over the next two decades as mining permits expire and/or resources are depleted. There is a projected 40 percent shortfall in the statewide supply of aggregate material needed to meet demand through 2055. An 83 percent shortfall is projected in the region’s supply of aggregate material in the next 50 years (SANDAG 2011). Figure 4.7-3 shows the locations of potential aggregate supply sites.

**4.7.2 REGULATORY SETTING**

**4.7.2.1 Federal Laws and Regulations**

**Earthquake Hazards Reduction Act**

In 1977, Congress passed the Earthquake Hazards Reduction Act (EHRA) (P.L. 95-124) establishing the National Earthquake Hazards Reduction Program as a long-term earthquake risk reduction program for the United States. The program initially focused on research, led by USGS and National Science Foundation (NSF), toward understanding and ultimately predicting earthquakes. The current program activities are focused on four broad areas:

- Developing effective measures to reduce earthquake hazards;
- Promoting the adoption of earthquake hazard reduction activities by federal, state, and local governments, national building standards and model building code organizations, engineers, architects, building owners, and others who play a role in planning and constructing buildings, bridges, structures, and critical infrastructure or “lifelines”; and
- Improving the basic understanding of earthquakes and their effects on people and infrastructure, through interdisciplinary research involving engineering, natural sciences, and social, economic, and decision sciences; and
• Developing and maintaining the Advanced National Seismic System, the George E. Brown Jr. Network for Earthquake Engineering Simulation, and the Global Seismic Network (Folger 2011).

U.S. Geological Survey Landslide Hazard Program

The USGS created the Landslide Hazard Program (LHP) in fulfillment of the requirements of Public Law 106-113. The primary objective of the LHP is to reduce long-term losses from landslide hazards by improving the understanding of the causes of ground failure and suggesting mitigation strategies. The federal government takes the lead role in funding and conducting this research, whereas the reduction of losses due to geologic hazards is primarily a state and local responsibility. In the San Diego region, the Unified Disaster Council (UDC) is the governing body of the Unified San Diego County Emergency Services Organization. The primary purpose of the UDC and the Emergency Services Organization is to provide for the coordination of plans and programs designed for the protection of life and property in the County of San Diego (County of San Diego 2010).

Indian Mineral Development Act of 1982

The Indian Mineral Development Act (IMDA) outlines provisions for Minerals Agreement contracts. Subject to the approval of the Secretary of the BIA and any limitation or provision contained in its constitution or charter, tribes may enter into any joint venture, operating, production sharing, service, managerial, lease or other agreement providing for the exploration for, or extraction, processing, or other development of, energy and nonenergy mineral resources in which such Indian tribe owns a beneficial or restricted interest, or providing for the sale or other disposition of the production or products of such mineral resources (BIA 2011).

4.7.2.2 State Laws and Regulations

Alquist-Priolo Earthquake Fault Zoning Act

The purpose of the Alquist-Priolo Earthquake Fault Zoning Act of 1972 (renamed in 1994) is “to regulate development near active faults so as to mitigate the hazard of surface fault rupture.” The State Geologist (Chief of the Division of Mines and Geology) is required to delineate Earthquake Fault Zones (formerly known as “Special Studies Zones”) along known active faults. As defined by the California Division of Mines and Geology (DMG), an active fault is one that has had surface displacement within Holocene time (roughly the last 11,000 years) and/or has an instrumental record of seismic activity. Potentially active faults are those that show evidence of surface displacement during Quaternary time (roughly the last 2 million years), but for which evidence of Holocene movement has not been established. The DMG evaluates faults on an individual basis to determine if a fault will be classified as an Alquist-Priolo Earthquake Fault Zone. In general, faults must meet certain DMG criteria, including seismic activity, historic rupture, and geologic evidence to be zoned as an Earthquake Fault Zone. Cities and counties affected by the zones must regulate certain development within the zones. They must withhold development permits for sites within the zones until geologic investigations demonstrate that the sites are not threatened by surface displacement from future faulting. Typically, structures for human occupancy are not allowed within 50 feet of the trace of an active fault (County of San Diego 2010).

1990 Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act (SHMA) of 1990 (PRC §2690–2699.6) directs the California Geological Survey (CGS) to identify and map areas prone to earthquake hazards of liquefaction,
Figure 4.7-3
Potential Aggregate Supply Sites
October 2011

Available Land (20 acres or greater)
- MRZ-2: Resource Present
- MRZ-3: Resource Potentially Present
- MRZ-4: Inconclusive
- Unclassified

SOURCE: SANDAG 2011
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earthquake-induced landslides, and amplified ground shaking. The purpose of the SHMA is to reduce the threat to public safety and to minimize the loss of life and property by identifying and mitigating these seismic hazards. The SHMA was passed by the legislature following the 1989 Loma Prieta earthquake. Staff geologists in the Seismic Hazard Mapping Program gather existing geological, geophysical, and geotechnical data from numerous sources to compile the Seismic Hazard Zone Maps. They integrate and interpret these data regionally to evaluate the severity of the seismic hazards and designate Zones of Required Investigation for areas prone to liquefaction and earthquake–induced landslides. Cities and counties are then required to use the Seismic Hazard Zone Maps in their land use planning and building permit processes (CGS 2007).

**Natural Hazards Disclosure Act**

The Natural Hazards Disclosure Act requires that property sellers and their agents provide buyers with a “Natural Hazard Disclosure Statement” if the property being sold lies within one or more state-mapped hazard areas, including a Seismic Hazard Zone as defined by the SHMA. These disclosures can be made with a Natural Hazard Disclosure Statement or a Local Opinion Real Estate Transfer Disclosure Statement, provided it contains substantially the same information and warning as the Natural Hazard Disclosure Statement (CGS 2007).

**Building Codes**

Chapter 16A, Division IV of the California Building Code (CBC), titled “Earthquake Design,” states that “The purpose of the earthquake provisions herein is primarily to safeguard against major structural failures or loss of life.” The CBC and the Uniform Building Code (UBC) regulate the design and construction of excavations, foundations, building frames, retaining walls, and other building elements to mitigate the effects of seismic shaking and adverse soil conditions. The procedures and limitations for the design of structures are based on site characteristics, occupancy type, configuration, structural system height, and seismic zoning. Seismic zones are mapped areas that are based on proximity to known active faults and the potential for future earthquakes and intensity of seismic shaking. Seismic zones range from 0 to 4, with areas mapped as Zone 4 being potentially subject to the highest accelerations due to seismic shaking and the shortest recurrence intervals. According to the UBC and CBC, the entire San Diego region is within seismic Zone 4.

The CBC also contains (1) specific provisions to classify soils as expansive, (2) exploratory boring procedures, (3) soil boring reporting procedures, and (4) special building foundation and investigation requirements (County of San Diego 2010).

**Construction General Permit**

The State of California adopted a new Construction General Permit effective on July 1, 2010. SWRCB Water Quality Order 2009-0009-DWQ (Construction General Permit) regulates construction site storm water management. Dischargers whose projects disturb 1 or more acres of soil, or whose projects disturb less than 1 acre but are part of a larger common plan of development that in total disturbs 1 or more acres, are required to obtain coverage under the general permit for discharges of storm water associated with construction activity. This requirement includes linear projects that disturb 1 or more acres. Construction activity subject to this permit includes clearing, grading, and disturbances to the ground, such as stockpiling or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of the facility.

Permit applicants are required to submit a Notice of Intent (NOI) to the SWRCB and to prepare a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP identifies BMPs that must be implemented to
reduce construction effects on receiving water quality based on pollutants. The BMPs identified are directed at implementing both sediment and erosion control measures and other measures to control chemical contaminants. The SWPPP shall also include descriptions of the BMPs to reduce pollutants in storm water discharges after all construction phases have been completed at the site (postconstruction BMPs). The SWPPP should contain a site map(s) that shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. Additionally, the SWPPP must contain a visual monitoring program, a chemical monitoring program for "nonvisible" pollutants to be implemented if there is a failure of BMPs, and a sediment monitoring plan if the site discharges directly to a waterbody listed on the 303(d) list for sediment.

The permit includes several new requirements (as compared to the previous Construction General Permit, 99-08-DWQ), including risk level assessment for construction sites, an active storm water effluent monitoring and reporting program during construction (for risk level II and III sites), rain event action plans for certain higher risk sites, and numeric effluent limitations as well as numeric action levels for pH and turbidity.

If a single construction project traverses more than one RWQCB jurisdiction, a complete NOI package (NOI, site map, and fee) and Notice of Termination (upon completion of each section), must be filed for each RWQCB.

**State Surface Mining and Reclamation Act of 1975**

As described previously, SMARA requires all cities and counties to incorporate in their general plans the mapped designations approved by DMG. These designations include lands categorized as MRZs. MRZ classifications are set forth in guidelines developed by the State Mining and Geology Board (SMGB 2007) and are used to communicate information concerning the existence of mineral resources (City of San Diego 2008a). Mineral lands are mapped using the California Mineral Land commodities at one time in the area, including aggregate, common clay, and dimensions stone. Priority is given to areas where future mineral resources are likely to be mined during the 50-year period following their classification (SMGB 2007).

Section 2762(d) of SMARA establishes specific lead agency noticing requirements prior to permitting a use that would preclude future extraction of identified mineral resources, defined as either (1) the potential to extract minerals in MRZ-2 lands, or (2) land designated in a lead agency’s general plan as having important minerals to be protected. Prior to permitting a use that would threaten the potential to extract minerals in either of these two areas, the lead agency shall prepare a statement specifying its reasons for permitting the proposed use. The statement is required to be forwarded to the State Geologist and SMGB for review and is required to comply with the public review requirements of CEQA (County of San Diego 2010).

**4.7.2.3 Local Plans and Policies**

**Earthquake Fault Zones**

Under the Alquist-Priolo Earthquake Fault Zoning Act, jurisdictions are required to delineate Earthquake Fault Zones. Before any construction is allowed, a geologic study must be conducted to determine if any active fault lines are located on or within the vicinity of the project site.
Mineral Resources

Under SMARA, jurisdictions must incorporate in their general plans the mapped designations approved by the DMG, including MRZs. Jurisdictions may also have policies regarding surface mining or extractive use regulations. These regulations may provide the means for public review and/or regulation of mineral resources and associated on-site processing operations. Table 4.7-2 lists policies or regulations by jurisdiction.

Table 4.7-2
Policies or Regulations by Jurisdiction

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Policy or Regulation on Mineral Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carlsbad</td>
<td>The City of Carlsbad does not have any economically significant mineral resources (City of Carlsbad 1994).</td>
</tr>
<tr>
<td>Chula Vista</td>
<td>City of Chula Vista Municipal Code Section 19.69 covers surface mining regulations (City of Chula Vista 2010).</td>
</tr>
<tr>
<td></td>
<td>The Chula Vista General Plan policies concerning mineral resources include:</td>
</tr>
<tr>
<td></td>
<td>E 5.1 Ensure that permit applications for proposed mineral resource extraction are consistent with the Chula Vista Multiple Species Conservation Program (MSCP) Subarea Plan.</td>
</tr>
<tr>
<td></td>
<td>E 5.2 Consider and minimize impacts from mining operations to existing and future surrounding land uses.</td>
</tr>
<tr>
<td></td>
<td>E 5.3 Ensure that approved mining reclamation plans fully comply with requirements of the Chula Vista MSCP Subarea Plan; Chula Vista Greenbelt Master Plan; Otay Valley Regional Park Concept Plan; and all other applicable plans regarding the restoration of biological habitats and the creation of trails and parkland (City of Chula Vista 2005).</td>
</tr>
<tr>
<td>Coronado</td>
<td>The City of Coronado recognizes the salt ponds as a valuable resource not only for salt evaporation purposes, but also for providing habitat for birds and marine wildlife; as such, the City supports the continuation of the salt extraction industry. Salt evaporation ponds are allowed in the Wildlife Preserve Modifying Overlay Zone, subject to a special use permit (City of Coronado 1994).</td>
</tr>
<tr>
<td>Del Mar</td>
<td>The City of Del Mar Municipal Code Chapter 23.32 contains provisions on excavating and grading permits (City of Del Mar 2008).</td>
</tr>
<tr>
<td>El Cajon</td>
<td>The City of El Cajon does not have any known mineral resources and does not have any lands designated for mineral resource extraction (Shute 2011).</td>
</tr>
<tr>
<td>Encinitas</td>
<td>The City of Encinitas contains a policy allowing mineral resource extraction within the Coastal Zone, except in environmentally sensitive areas (City of Encinitas 1995).</td>
</tr>
<tr>
<td>Escondido</td>
<td>The City of Escondido does not have any economically significant mineral resources (City of Escondido 1990).</td>
</tr>
<tr>
<td>Imperial Beach</td>
<td>The City of Imperial Beach does not have any economically significant mineral resources (Foltz 2011).</td>
</tr>
<tr>
<td>La Mesa</td>
<td>The City of La Mesa does not have any policies pertaining to mineral resources (City of La Mesa 1996).</td>
</tr>
<tr>
<td>Lemon Grove</td>
<td>The City of Lemon Grove does not have any policies pertaining to mineral resources (City of Lemon Grove 2006).</td>
</tr>
<tr>
<td>National City</td>
<td>The City of National City’s Draft General Plan Update contains language on the salt ponds of the San Diego National Wildlife Refuge. The U.S. Fish and Wildlife Service has prepared a Comprehensive Conservation Plan that includes a holistic habitat restoration plan for the existing salt works property (City of National City 2011).</td>
</tr>
<tr>
<td>Oceanside</td>
<td>The City of Oceanside General Plan’s long-range policies include regulating mineral extraction activities to minimize hazards and conflicts with other land uses as well as to preserve and enhance the appearance of the area. The General Plan also details erosion control practices for excavation activities (City of Oceanside 2002). Municipal Ordinance 81-16 sets minimum standards for excavation, grading, and embankment of land within the City (City of Oceanside 2010).</td>
</tr>
<tr>
<td>Jurisdiction</td>
<td>Policy or Regulation on Mineral Resources</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Poway          | The City of Poway’s General Plan states that the City’s only known valuable mineral resource, as recognized by the California Department Conservation Division of Land Resources Mines and Geology, is construction-quality sand and gravel that is located in the southern area of the city. Currently, one sand and gravel extraction operation is located in Beeler Canyon on the southernmost portion of this area.  
  
  The City’s General Plan also states that areas designated as Region-Serving Open-Space (areas that are lightly developed with activities or facilities that serve the region as unique or outstanding recreational, safety, or managed production such as agriculture, mineral extraction) should be retained as open space and in some cases increased to serve the region’s expanding needs (City of Poway 1991).  
  
  Chapter 16.54 of the City of Poway’s Municipal Code contains regulations on surface mining and reclamation (City of Poway 2010). |
| City of San Diego | The City of San Diego General Plan includes policies to balance mineral extraction with habitat conservation. These policies include:  
  
  CE-K.1. Promote the recycling and reclamation of construction materials to provide for the City’s current and future growth and development needs (see also Public Facilities, Policy PF-I.1 and Conservation Element, Policy CE-A.8).  
  
  CE-K.2. Permit new or expanding mining operations within the Multi-Habitat Planning Area (MHPA) in accordance with MSCP policies and guidelines.  
  
  CE-K.3. Produce sand and gravel with minimal harm and disturbance to adjacent property and communities.  
  
  CE-K.4. Plan rehabilitation of depleted mineral areas to facilitate reuse consistent with state requirements, the Surface Mining and Reclamation Act (SMARA), and local planning goals and policies, including the MSCP.  
  
  CE-K.5. Consider local evaporative salt production for future economic value, open space use, and for important ecological habitat (City of San Diego 2008b).  
  
  Section 141.1004 of the City’s Municipal Code covers regulations pertaining to mining and extractive industries (City of San Diego 2006). |
| San Marcos     | The City of San Marcos’ General Plan states that the City does not contain any lands designated MRZ-2, and that no active sand and gravel and quarry operations occur within San Marcos or its Sphere of Influence (City of San Marcos 1997).  
  
  City of San Marcos Municipal Code Section 20.124 covers regulations pertaining to surface mining and reclamation (City of San Marcos 2010). |
| Santee         | According to the City of Santee’s General Plan, the City has three aggregate mining operations that have been active since the 1970s and are approaching completion. As of 2002, approximately 50 percent of the mining operation has been reclaimed. As mining is completed in an area, the area is reclaimed in accordance with the approved reclamation plan, which will result in significant revegetation and habitat enhancement in this stretch of the San Diego River. The City’s General Plan contains specific policies concerning mineral resources:  
  
  Policy 5.1 The City shall require that all proposed mining operations are adequately reviewed during the project and environmental review processes to minimize to the greatest degree possible, all identified environmental impacts, especially water quality, habitat preservation and bridge undermining.  
  
  Policy 6.1: The City shall require the planned reclamation of mined lands following extraction of mineral resources with consideration of the land's potential for recreational, wildlife habitat, and scenic uses as well as for residential, industrial or commercial development (City of Santee 2002).  
  
  Section 15.58.710 of the City’s Municipal Code covers regulations pertaining to surface mining and regulation (City of Santee 2010). |
Jurisdiction | Policy or Regulation on Mineral Resources  
--- | ---  
Solana Beach | Chapter 15.40 of the Solana Beach Municipal Code regulates excavations and grading (City of Solana Beach 2006).  
  
The Solana Beach General Plan contains the following language:  
Open space used for the managed production of resources is important to maintain adequate supplies of food and fiber. Thus, agricultural lands and mineral resource zones are often designated as open space to ensure their continued productivity (City of Solana Beach 1999).  

Vista | The Vista General Plan contains policies regarding the extraction of mineral resources:  
  
a. The exploitation of mineral resources or rock, sand, and gravel shall be permitted by Special Use Permit only, with strict provisions that would prevent pollution or unsightly remaining land.  
  
b. An economic study shall identify a definite need for the minerals being extracted.  
  
c. An Environmental Impact Report shall identify the consequences of the operation to the native ecology of the area (City of Vista 1988).  
  
In addition, the City of Vista Municipal Code Chapter 15.16, Surface Mining and Reclamation, declares the extraction of mineral resources to be essential to the continued economic well-being of city and needs of society. This chapter outlines the requirements for permits and reclamation plans (City of Vista 2003).  

Unincorporated County of San Diego | San Diego County Zoning Ordinance, Section 2820 et seq., known as the S82 Extractive Use Regulations, are intended to identify and create areas within the County where mining, quarrying, or oil extractive uses are permitted. Typically, the S82 Extractive Use Regulations would be applied to areas of mineral deposits to signify the presence of such deposit and notify adjacent or affected properties of the intention to allow extraction of minerals within the zone. These regulations are used to preserve areas with valuable mineral deposits until extraction can take place.  
  
San Diego County Zoning Ordinance, Section 6550 et seq. (Extractive Use Regulations) provide the means for public review and regulation of mineral extraction and associated on-site processing operations.  
  
County of San Diego Code of Regulatory Ordinances Section 87.701-87.714 regulates all surface mining operations in the unincorporated area of the County of San Diego as authorized by the San Diego County Zoning Ordinance and SMARA. The objectives of these regulations are:  
  
a. The continued mining of minerals will be permitted in a manner which will protect the public health and safety and will provide for the protection and subsequent beneficial use of mined and reclaimed land; and  
  
b. The possible adverse effects of surface mining operations on the environment, including air pollution, impedance of groundwater movement, water quality degradation, damage to aquatic or wildlife habitat, flooding, erosion and sedimentation, will be prevented or minimized; and  
  
c. The production and conservation of minerals will be encouraged while giving consideration to values relating to recreation, watershed, wildlife, range and forage, and aesthetic enjoyment (County of San Diego 2010).  

Tribal Lands | Policies and regulations regarding mineral resource extraction or surface mining are determined by the individual tribe.  

Source: Data compiled by AECOM in 2011

**Grading and Erosion**

Jurisdictions contain grading and erosion control ordinances in their individual municipal codes. These ordinances establish minimum requirements for grading, including clearing and grubbing of vegetation. Through these ordinances, jurisdictions ensure compatibility of graded land development sites with surrounding land forms and land uses; prevent unnecessary and unauthorized grading; and facilitate the
planning, design, and construction of development sites to maximize safety and human enjoyment while protecting the surrounding natural environment.

4.7.3 SIGNIFICANCE CRITERIA

The 2050 RTP/SCS would have a significant impact related to geology and soils/mineral resources if implementation were to:

GEO-1 Expose people or structures to potential substantial significant impacts, including the risk of loss, injury, or death involving:

- 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;
- Strong seismic ground shaking;
- Seismic-related ground failure, including liquefaction; and
- Landslides.

GEO-2 Locate projects 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.

GEO-3 Result in substantial soil erosion or the loss of topsoil.

GEO-4 Locate projects on expansive soil, as defined in Table 18-1-B of the Uniform Building Code creating substantial risks to life or property.

MR-1 Result in the loss of availability of a known mineral resource or mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan that would be of value to the region and the residents of the state.

4.7.4 IMPACT ANALYSIS

This section analyzes the impacts associated with implementation of the 2050 RTP/SCS. It is organized in sections to address the two main components of the 2050 RTP/SCS: regional growth/land use change and transportation system improvements. A discussion of the forecasted population, housing, and employment increases is included below for each planning horizon of 2020, 2035, and 2050, to help facilitate understanding of forecasted growth. Analysis for each significance criterion includes a programmatic-level discussion of anticipated impacts in the planning horizon years of 2020, 2035, and 2050. Significant impacts are identified and mitigation measures are provided where appropriate.

GEO-1 SEISMIC ACTIVITY, GROUND SHAKING, GROUND FAILURE, AND LANDSLIDES

The entire San Diego region is subject to seismic ground shaking. Potential effects from surface rupture and severe ground shaking could cause catastrophic damage to transportation infrastructure, particularly to overpasses and underground structures. Earthquake faults occur in and through the urban areas of the region, increasing the potential of earthquake damage on structures and potentially endangering the safety of the area’s inhabitants. Most damage from earthquake activity results from ground movement, causing
ground shaking, surface fault rupture, landslides and mudslides, liquefaction, and tectonic subsidence or uplift. Ground shaking is the oscillation or vibration of earth materials that causes the greatest amount of damage during an earthquake. Ground-shaking hazards usually occur in areas underlain by loose, water-saturated, unstable materials. Surface fault rupture results from the intersection of the ground surface with fault displacement. Only one documented incident of surface rupture has occurred in the San Diego region. Due to recent historical activity of faults in the county, however, the potential for surface rupture remains.

Earthquake-related geologic hazards pose a significant threat to the San Diego region and can impact extensive expanses of land. Primary effects of earthquakes include violent ground motion, and sometimes permanent displacement of land associated with surface rupture. Potential effects from severe ground shaking and surface rupture could cause catastrophic damage to transportation infrastructure, as well as built structures for residential, commercial, and other types of development. Earthquakes can also trigger landslides, rockfalls, and soil liquefaction. In turn, these geologic hazards can lead to other hazards such as fires, dam failures, and toxic chemical releases. Long-term effects associated with earthquakes include phenomena such as regional subsidence or emergence of landmasses and regional changes in groundwater level.

Earthquakes within 60 miles of the San Diego region are capable of generating significant ground shaking, which could be generated along the San Clemente, San Diego Trough, Coronado Bank, Rose Canyon, Elsinore, and San Jacinto fault zones. Numerous active faults are known to exist in the region that could potentially generate seismic events capable of significantly affecting existing and proposed facilities and the existing built environment in the region. The existing transportation network and built development are subject to seismic influences, as is the entire San Diego region. Likewise, new transportation facilities and development associated with regional growth would be exposed to both direct and indirect effects of seismic activity.

Slope failure results in landslides and mudslides from unstable soils or geologic units. Construction of transportation projects or regional growth development associated with the 2050 RTP/SCS may require significant earthwork and road cuts, increasing the potential for slope failure. In addition, soils with high percentages of clay can expand when wet, causing structural damage to surface improvements. These clay soils can occur in localized areas throughout the San Diego region, making it necessary to survey project areas extensively prior to construction. Each new project location would have the potential to contain expansive soils, although they are more likely to be encountered in lower drainage basin areas. Expansive soils are generally removed during foundation work to avoid structural damage. Proposed projects in the 2050 RTP/SCS that would occur within existing transportation corridors and areas with existing development may be located in areas where expansive soils may have already been removed.

2020

Regional Growth/Land Use Change

By 2020, population within the region is expected to increase by 310,568 people; housing by 113,062 units; and employment by 118,535 jobs. The majority of existing development is concentrated in the western third of the region. By 2020, new development and redevelopment is primarily concentrated in or near these areas of existing development. Some locations that would experience the most extensive land use change and development by 2020 would include areas such as eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 corridor; City of San Diego coastal and bay communities south of I-8 including Ocean Beach and the Peninsula planning areas; portions of northern Santee; areas north and south of the SR 56 corridor in the San Diego planning areas of Carmel Valley, Del Mar Mesa, Pacific Highlands Ranch, and Torrey
4.7 Geology, Soils, and Mineral Resources

Highlands; the San Marcos area near both the SR 78 and I-15 corridors; and within unincorporated County communities such as Fallbrook, Pala-Pauma Valley, and Valley Center along the I-15 and SR 76 corridors.

As shown in Figure 4.7-1, several active fault lines and Alquist-Priolo Earthquake Fault Zones are located in areas that are currently developed and that are forecasted to develop by 2020. Implementation of the 2050 RTP/SCS would contribute to the exposure of people or structures to potential substantial significant impacts of seismic activity. Areas that contain or are in proximity to Alquist-Priolo Earthquake Fault Zones include downtown San Diego, Coronado, and communities along I-5 from I-8 to SR-52. Additionally, several earthquake fault lines are located in the western third of the region. New development in these areas may expose additional people and structures to seismic activity. Although new development and infrastructure associated with implementation of the 2050 RTP/SCS would expose people and infrastructure to the effects of earthquakes, earthquake-resistant designs employed on new structures minimize the impact to public safety from seismic events. As discussed in Section 4.7.2, Regulatory Setting, there are numerous federal, state, and local laws, regulations, and programs in place to avoid or reduce impacts from earthquakes and other geologic hazards. All projects would be required to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce impacts from earthquakes, ground shaking, ground failure, and landslides. Regulatory agencies with oversight on development associated with the 2050 RTP/SCS have developed regulations and engineering design specifications to consider and compensate for site-level geological and seismic conditions.

New development and infrastructure anticipated to occur by 2020 would increase the number of people and structures located in or near areas containing Alquist-Priolo Earthquake Fault Zones, earthquake fault lines, and other geologic hazards. Through adherence to existing laws and regulations, developments associated with the 2050 RTP/SCS would be required to undergo site-specific geotechnical analysis and employ design standards that consider seismically active areas and comply with the CBC and UBC, as described in Section 4.7.2. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Transportation Network Improvements

The majority of proposed improvements to the transportation network associated with the 2050 RTP/SCS would be developed in the western third of the region. The transportation network improvements that would be implemented between 2010 and 2020 generally include widening and/or installation of HOV lanes, Managed Lanes, and Transit Lanes along portions of I-5, I-15, I-805, SR 78, and SR 94; completion of SR 905 and SR 11; and HOV connector projects along I-805 and SR 78 at I-15. Some key network improvements in place by 2020 would include increases in existing COASTER service, including extension of COASTER service to the San Diego Convention Center and Petco Park. BRT downtown express services from inland and south bay locations would be expanded as well as new BRT routes from the south bay area and along I-15. Rapid bus service would add new routes and streetcar routes would be established. Airport express routes would also be developed. Local bus service would be improved to 15 minutes in key corridors. Double-tracking of the LOSSAN rail corridor would occur to accommodate increased frequency in COASTER and other rail services that utilize this rail line. In addition, the new Mid-Coast Trolley line from Old Town to University Town Center would be constructed and the Green Trolley line would be extended to downtown San Diego.

Therefore, the majority of improvements would also be located in proximity to several fault lines and Alquist-Priolo Earthquake Fault Zones, and expose people or structures to risk of loss, injury, or death from earthquakes and other geologic hazards. Specific transportation facilities that would be most at risk for damage from seismic effects include the downtown San Diego streetcar, improvements to SR 94, and
multiple BRT and rapid bus lines that are located near downtown San Diego. As discussed above, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require each improvement or project to be reviewed by appropriate regulatory agencies prior to construction, and would require each improvement or project to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce impacts from geologic hazards. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Conclusion

By 2020, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements that would expose a greater number of people and structures to impacts from seismic activity, including earthquakes, ground shaking, ground failure, and landslides. However, adherence to the laws, regulations, and programs included in Section 4.7.2 would ensure people or structures would not be exposed to substantial adverse effects, and these impacts would therefore be less than significant. No mitigation is required.

2035

Regional Growth/Land Use Change

By 2035, the population of the region is expected to increase by 801,699 people; 268,094 housing units; and 312,292 jobs over existing 2010 conditions. As shown in Figure 4.11-4, regional land use and development changes are evident by 2035. Some locations that would experience the most extensive land use change and development by 2035 would include continued growth in eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 and SR 125 corridors: northeast of the SR 94 corridor in the unincorporated County planning areas of Jamul/Dulzura, Tecate, and Potrero; eastern Poway along the SR 67 corridor; the County planning area of Ramona along the SR 67 and SR 78 corridors; the County planning areas of Lakeside and Alpine and the Crest, Granite Hills, Dehesa, Harbison Canyon subregion; and multiple north County planning areas along the 1-15 and SR 76 corridors such as Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, and Hidden Valley. Areas of increased residential density by 2035 would be apparent in some coastal cities such as Oceanside and Encinitas, and City of San Diego coastal communities. Also, increased density would occur in more inland areas along the I-8 corridor through Mission Valley, College Area, and into the City of La Mesa, as well as eastern Chula Vista along the SR 125 corridor. As discussed in the 2020 analysis above, the construction of additional buildings would result in significant impacts to the exposure of people or structures to seismic activity, including earthquakes, ground shaking, ground failure, and landslides. This risk would continue to occur into 2035 as development intensities and extension of infrastructure increase to accommodate the forecasted growth.

Growth by 2035 would be more susceptible to seismic activity than growth by 2020 as more development and redevelopment activities would be located in areas in proximity to Alquist-Priolo Earthquake Fault Zones, such as downtown San Diego and nearby coastal communities. As discussed in the 2020 analysis, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require new structures to adhere to design standards described in the CBC, and ensure impacts from seismic activity and other geologic hazards would be less than significant. No mitigation is required.

Transportation Network Improvements

By 2035, additional transportation network improvements would be implemented. Some key highway improvements in place by 2035 would include continued widening along portions of I-5; additional HOV
and Managed Lanes along portions of I-5, I-15, I-805, and SR 52; widening of portions of SR 125 and SR 67; and additional freeway and HOV connector improvements. Some important transit projects operational by 2035 would include continued increases in COASTER service, increases in SPRINT service, increases in downtown area streetcar service, and substantial increases in rapid bus service throughout the region. The Trolley Blue Line would be extended from UTC to Mira Mesa via Sorrento Mesa and Carroll Canyon; the Orange Line would be extended to Lindbergh Field; Phase 1 of the new Mid-City to Downtown San Diego line would provide service from the Mid-City transit station via El Cajon Boulevard to Downtown; and a new line from Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, and San Diego State University would be established. Double-tracking along the SPRINT rail line through the cities of Oceanside, Vista, San Marco, and Escondido would take place by 2035 as well as continued double-tracking along the LOSSAN corridor.

As true in the 2020 analysis, many of these improvements would be located in areas containing Alquist-Priolo Earthquake Fault Zones and other earthquake fault lines, such as improvements located near downtown San Diego. Given the location of these improvements, additional people or structures would be at risk of loss, injury, or death from earthquakes and other geologic hazards. As discussed above, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require each improvement or project to be reviewed by appropriate regulatory agencies prior to construction, and would require each improvement or project to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce impacts from geologic hazards. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Conclusion

By 2035, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements that would expose a greater number of people and structures to impacts from seismic activity, including earthquakes, ground shaking, ground failure, and landslides. However, adherence to the laws, regulations, and programs included in Section 4.7.2 would ensure people or structures would not be exposed to substantial adverse effects, and these impacts would therefore be less than significant. No mitigation is required.

2050

Regional Growth/Land Use

By 2050, the population of the region is forecast to increase by 1,160,435 people; 379,664 housing units; and 501,958 jobs over existing conditions. Areas of substantial land use change and development, beyond that described in 2035, would include significant industrial development in the County’s Otay planning area and San Diego Otay Mesa community surrounding the East Otay Mesa POE; throughout County planning areas located along the international border including Tecate, Potrero, Campo/Lake Morena, Boulevard, and Jacumba; throughout the Ramona and Julian planning areas in the unincorporated County; throughout other northeastern County planning areas including North Mountain, Desert, and Borrego Springs; and continued development throughout County planning areas located north and east of Escondido extending to the northern border with Riverside County including Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, Hidden Valley, Twin Oaks Valley, and North County Metro. Increased density is most apparent in City of San Diego communities near the downtown area near I-5 and I-805 and along the I-8 corridor to the east.

As discussed in the 2020 and 2035 analyses above, the construction of additional buildings would result in significant impacts to the exposure of people or structures to seismic activity, including earthquakes,
ground shaking, ground failure, and landslides. This risk would continue to occur into 2050 as development intensities increase and infrastructure is extended to accommodate the forecasted growth.

By 2050, the extent of impacts due to seismic activity would be greater than that experienced in 2035 and 2020 as additional development and redevelopment activities would be located in areas in proximity to Alquist-Priolo Earthquake Fault Zones, such as downtown San Diego and surrounding coastal communities. As discussed in the 2020 and 2035 analyses, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require new structures to adhere to design standards described in the CBC, and ensure impacts from seismic activity and other geologic hazards would be less than significant. No mitigation is required.

**Transportation Network Improvements**

By 2050, most of the highway, transit, and active transportation (bicycle and pedestrian) improvements, along with other infrastructure projects, would be in place and operational in accordance with the proposed 2050 RTP/SCS. Some key highway improvements that would be in place by 2050 would include widening portions of SR 52, SR 56, SR 76, SR 94, SR 125, and I-5; additional HOV lanes and Managed Lanes along segments of I-805, I-5, I-15, SR 94, SR 125, and SR 54; and freeway and HOV connector improvements. Important transit improvements in place by 2050 would include the extension of Trolley lines and increased Trolley service frequency. The Trolley Green Line would be extended to Downtown-Bayside; a new Phase 2 of the line connecting San Diego State University to Downtown San Diego via El Cajon Boulevard/Mid-City would be constructed; a line connecting San Ysidro Palomar Trolley Station in the South Bay via Kearny Mesa, Mission Valley, Mid-City, and National City, and Chula Vista would be established.

As true in the 2020 and 2035 analyses, some of these improvements would be located in areas containing Alquist-Priolo Earthquake Fault Zones and other earthquake fault lines. Given the location of these improvements, additional people or structures would be at risk of loss, injury, or death from earthquakes and other geologic hazards. Specific transportation facilities likely to have increased risk for damage from earthquakes include improvements to I-5 near La Jolla, and downtown San Diego and Trolley lines that transverse the downtown area. As discussed above, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require each improvement or project to be reviewed by appropriate regulatory agencies prior to construction, and would require each improvement or project to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce impacts from geologic hazards. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

**Conclusion**

By 2050, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements that would expose a greater number of people and structures to impacts from seismic activity, including earthquakes, ground shaking, ground failure, and landslides. However, adherence to the laws, regulations, and programs included in Section 4.7.2 would ensure people or structures would not be exposed to substantial adverse effects, and these impacts would therefore be less than significant. No mitigation is required.

**GEO-2 UNSTABLE SOILS AND SLOPE FAILURE**

Slope failure results in landslides and mudslides from unstable soils or geologic units. Slope failure can occur over time as a result of rainfall, seismic activity, or human activity such as earthwork or grading. Mountainous regions, hilly regions, and coastlines have the greatest risk of slope failures. Locations in active tectonic regions are prone to slope failures triggered by earthquakes or volcanic activity. Portions
of the transportation improvements or regional growth development included in the 2050 RTP/SCS would be constructed on or through unstable soils or geologic formations susceptible to slope failure, thereby increasing the risk to people and facilities.

2020

Regional Growth/Land Use Change

By 2020, population within the region is expected to increase by 310,568 people; housing by 113,062 units; and employment by 118,535 jobs. Some locations that would experience the most extensive land use change and development by 2020 would include areas such as eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 corridor; City of San Diego coastal and bay communities south of I-8 near Ocean Beach and the Peninsula planning areas; portions of northern Santee; areas north and south of the SR 56 corridor in the San Diego planning areas of Carmel Valley, Del Mar Mesa, Pacific Highlands Ranch, and Torrey Highlands; the San Marcos area near both the SR 78 and I-15 corridors; and within unincorporated County communities such as Fallbrook, Pala-Pauma Valley, and Valley Center along the I-15 and SR 76 corridors.

Much of the population growth projected by 2020 would occur in or adjacent to areas with existing development. These areas may already have been tested for slope failure. However, even developed areas, particularly those on or near mountains, hills, or the coast, can experience slope failure. New development in areas prone to slope failure would be at a higher risk, particularly development located in coastal communities. Redevelopment of existing areas or new development would likely require grading or earthwork, which may increase the propensity for soils to become unstable and cause slope failure. Although slope failure may not be completely avoidable, site-specific analyses would reduce risks associated with regional growth development.

Regional growth and associated infrastructure improvements developed by 2020 would increase the risk of impacts from slope failure. Through adherence to existing laws and regulations, development associated with the 2050 RTP/SCS would be required to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce geologic hazards, including those associated with unstable soils and slope failure, as described in Section 4.7.2. Corrective measures such as structural reinforcement and using engineered fill to replace unstable soils would be applied to the design of individual future projects. All site designs would be reviewed and approved by the appropriate agencies. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Transportation Network Improvements

By 2020, additional transportation network improvements would be developed. Improvements to the transportation network involve the expansion of highways, new or extended transit lines, and other transportation-related facilities. The transportation network improvements that would be implemented between 2010 and 2020 generally include widening and/or installation of HOV lanes, Managed Lanes, and Transit Lanes along portions of I-5, I-15, I-805, SR 78, and SR 94; completion of SR 905 and SR 11; and HOV connector projects along I-805 and SR 78 at I-15. Some key transit network improvements in place by 2020 would include increases in existing COASTER service, including extension of COASTER service to the San Diego Convention Center and Petco Park. BRT downtown express services from inland and south bay locations would be expanded as well as new BRT routes from the south bay area and along I-15. Rapid bus service would add new routes and streetcar routes would be established. Airport express routes would also be developed. Local bus service would be improved to 15 minutes in key corridors. Double-tracking of the LOSSAN rail corridor would occur to accommodate
increased frequency in COASTER and other rail services that utilize this rail line. In addition, the new Mid-Coast Trolley line from Old Town to University Town Center would be constructed and the Green Trolley line would be extended to downtown San Diego.

Some of these improvements may involve significant grading or earthwork, which may increase the propensity for slope failure. Additionally, some of the transportation improvements would be located in, on, or near hills, coastal areas, canyons, and other places with steep slopes or unstable soils. Specific transportation facilities that would be susceptible to hazards associated with slope failure, or their development is more likely to cause slope failure, include the Mid-Coast Trolley line and extension of the COASTER. Additionally, improvements proposed for I-15 are in proximity to soils with high erosion potential. These improvements may be at a greater risk for effects of slope failure, or cause soils to become unstable and cause greater risks to people or structures in proximity to these improvements. As discussed above, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require each improvement or project to be reviewed by appropriate regulatory agencies prior to construction, and would require each improvement or project to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce impacts from geologic hazards, including unstable soils. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Conclusion

By 2020, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements that would expose a greater number of structures to risks from unstable soils, including landslides, lateral spreading, subsidence, liquefaction, or collapse, or cause soils to become unstable. However, adherence to the laws, regulations, and programs included in Section 4.7.2 would minimize risks to people or property, and ensure impacts would be less than significant. No mitigation is required.

2035

Regional Growth/Land Use Change

By 2035, the population of the region is expected to increase by 801,699 people; 268,094 housing units; and 312,292 jobs over existing 2010 conditions. Some locations that would experience the most extensive land use change and development by 2035 would include continued growth in eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 and SR 125 corridors; northeast of the SR 94 corridor in the unincorporated County planning areas of Jamul/Dulzura, Tecate, and Potrero; eastern Poway along the SR 67 corridor; the County planning area of Ramona along the SR 67 and SR 78 corridors; the County planning areas of Lakeside and Alpine and the Crest, Granite Hills, Dehesa, Harbison Canyon subregion; and multiple north County planning areas along the 1-15 and SR 76 corridors such as Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, and Hidden Valley. Areas of increased residential density by 2035 would be apparent in some coastal cities such as Oceanside and Encinitas, and City of San Diego coastal communities. Also, increased density would occur in more inland areas along the I-8 corridor through Mission Valley, College Area, and into the City of La Mesa, as well as eastern Chula Vista along the SR 125 corridor.

As discussed in the 2020 analysis, additional growth and development would result in an increase of the number of structures and facilities that may be in areas with unstable soils or prone to slope failure. Impacts would be greater by 2035 than by 2020 as more development or redevelopment activities would occur in coastal communities or near areas with canyons and hills. As mentioned above, slope failure may not be completely avoidable, but site-specific analyses would minimize risks associated with regional
growth development. All projects associated with regional growth would be required to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce geologic hazards, including those associated with unstable soils and slope failure. Regulatory agencies with oversight on development associated with the 2050 RTP/SCS have developed regulations and engineering design specifications to consider and compensate for site-level geological and seismic conditions. Corrective measures such as structural reinforcement and using engineered fill to replace unstable soils would be applied to the design of individual future projects. All site designs would be reviewed and approved by the appropriate agencies. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

**Transportation Network Improvements**

Some key highway improvements in place by 2035 would include continued widening along portions of I-5; additional HOV and Managed Lanes along portions of I-5, I-15, I-805, and SR 52; widening of portions of SR 125 and SR 67; and additional freeway and HOV connector improvements. Some important transit projects operational by 2035 would include continued increases in COASTER service, increases in SPRINTER service, increases in downtown area streetcar service, and substantial increases in rapid bus service throughout the region. The Trolley Blue Line would be extended from UTC to Mira Mesa via Sorrento Mesa and Carroll Canyon; the Orange Line would be extended to Lindbergh Field; Phase 1 of the new Mid-City to Downtown San Diego line would provide service from the Mid-City transit station via El Cajon Boulevard to Downtown; and a new line from Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, and San Diego State University would be established. Double-tracking along the SPRINTER rail line through the cities of Oceanside, Vista, San Marco, and Escondido would take place by 2035 as well as continued double-tracking along the LOSSAN corridor.

As true in the 2020 analysis, transportation network improvements would occur in areas susceptible to slope failure and unstable soils, particularly improvements located in hilly or coastal areas. Specific transportation facilities located in areas prone to slope failure, or where the development of these facilities would be likely to cause slope failure, include widening of I-5 along the coast and expansion of rail and Trolley services through coastal areas or canyons. These improvements may be at a greater risk for effects of slope failure, or cause greater risks to people or structures in proximity to these improvements. As discussed above, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require each improvement or project to be reviewed by appropriate regulatory agencies prior to construction, and would require each project or improvement to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce impacts from geologic hazards. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

**Conclusion**

By 2035, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements that would expose a greater number of structures to risks from unstable soils, including landslides, lateral spreading, subsidence, liquefaction, or collapse, or cause soils to become unstable. However, adherence to the laws, regulations, and programs included in Section 4.7.2 would minimize risks to people or property, and ensure impacts would be less than significant. No mitigation is required.
Regional Growth/Land Use Change

By 2050, the population of the region is forecast to increase by 1,160,435 people; 379,664 housing units; and 501,958 jobs over existing conditions. Areas of substantial land use change and development, beyond that described in 2035, would include significant industrial development in the County’s Otay planning area and San Diego Otay Mesa community surrounding the East Otay Mesa POE; throughout County planning areas located along the international border including Tecate, Potrero, Campo/Lake Morena, Boulevard, and Jacumba; throughout the Ramona and Julian planning areas in the unincorporated County; throughout other northeastern County planning areas including North Mountain, Desert, and Borrego Springs; and continued development throughout County planning areas located north and east of Escondido extending to the northern border with Riverside County including Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, Hidden Valley, Twin Oaks Valley, and North County Metro. Increased density is most apparent in City of San Diego communities near the downtown area near I-5 and I-805 and along the I-8 corridor to the east.

As discussed in the 2020 and 2035 analyses above, additional growth and development would result in an increase of the number of structures and facilities that may be in areas with unstable soils or prone to slope failure. Impacts would be greater by 2050 than by 2020 or 2035 as more development or redevelopment activities would occur in coastal communities or near areas with canyons and hills. As mentioned above, slope failure may not be completely avoidable, but site-specific analyses would minimize risks associated with regional growth development. All projects associated with regional growth would be required to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce geologic hazards, including those associated with unstable soils and slope failure. Regulatory agencies with oversight on development associated with the 2050 RTP/SCS have developed regulations and engineering design specifications to consider and compensate for site-level geological and seismic conditions. Corrective measures such as structural reinforcement and using engineered fill to replace unstable soils would be applied to the design of individual future projects. All site designs would be reviewed and approved by the appropriate agencies. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Transportation Network Improvements

By 2050, most of the highway, transit, and active transportation (bicycle and pedestrian) improvements, along with other infrastructure projects, would be in place and operational in accordance with the proposed 2050 RTP/SCS. Some key highway improvements that would be in place by 2050 would include widening portions of SR 52, SR 56, SR 76, SR 94, SR 125, and I-5; additional HOV lanes and Managed Lanes along segments of I-805, I-5, I-15, SR 94, SR 125, and SR 54; and freeway and HOV connector improvements. Important transit improvements in place by 2050 would include the extension of Trolley lines and increased Trolley service frequency. The Trolley Green Line would be extended to Downtown-Bayside; a new Phase 2 of the line connecting San Diego State University to Downtown San Diego via El Cajon Boulevard/Mid-City would be constructed; Trolley service to San Diego State University; and a line from University Town Center to San Ysidro Palomar Trolley Station in the South Bay via Kearny Mesa, Mission Valley, Mid-City, and National City, and Chula Vista would be established.

As true in the 2020 and 2035 analyses, transportation network improvements would occur in areas susceptible to slope failure and unstable soils, particularly improvements located in hilly or coastal areas. These improvements may be at a greater risk for effects of slope failure, or cause greater risks to people or structures in proximity to these improvements. Specific transportation facilities prone to risks of slope failure, or the development of which would be likely to cause slope failure, include the downtown San Diego Trolley tunnel, improvements to I-5 near the coast, and improvements to highways that would
involve grading or tunneling through hills or mountains. Additionally, improvements proposed for I-15 and SR 76 just west of I-15 are in proximity to soils with high erosion potential.

As discussed above, existing federal, state, and local laws, regulations, and programs included in Section 4.7.2 would require each improvement or project to be reviewed by appropriate regulatory agencies prior to construction, and would require each improvement or project to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce impacts from geologic hazards. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Conclusion

By 2050, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements that would expose a greater number of structures to risks from unstable soils, including landslides, lateral spreading, subsidence, liquefaction, or collapse, or cause soils to become unstable. However, adherence to the laws, regulations, and programs included in Section 4.7.2 would minimize risks to people or property, and ensure impacts would be less than significant. No mitigation is required.

GEO-3 SOIL EROSION

High erosion potential in soils is primarily caused by loose soils and steep slopes. The potential for erosion generally increases as a result of human activity, primarily through development of structures and impervious surfaces and the removal of vegetative cover. Some projects associated with the 2050 RTP/SCS would require extensive cut-and-fill grading and could result in manufactured slopes that become unstable over time and increase long-term erosion potential. Additionally, any increase in volume and/or velocity of storm water flow increases the potential for erosion and other drainage pattern alterations. High volumes of storm water runoff can cause slope failures, particularly in areas where native soils have a moderate to high erosion potential.

2020

Regional Growth/Land Use Change

By 2020, population within the region is expected to increase by 310,568 people; housing by 113,062 units; and employment by 118,535 jobs. By 2020, regional growth is expected to increase the number of residential and commercial structures and other facilities. Some locations that would experience the most extensive land use change and development by 2020 would include areas such as eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 corridor; City of San Diego coastal and bay communities south of I-8 including Ocean Beach and the Peninsula planning areas; portions of northern Santee; areas north and south of the SR 56 corridor in the San Diego planning areas of Carmel Valley, Del Mar Mesa, Pacific Highlands Ranch, and Torrey Highlands; the San Marcos area near both the SR 78 and I-15 corridors; and within unincorporated County communities such as Fallbrook, Pala-Pauma Valley, and Valley Center along the I-15 and SR 76 corridors.

Development associated with the 2050 RTP/SCS would cause erosion due to a greater degree of exposed graded surfaces, excavation, stock piling, or boring that would occur with development. This growth would mainly take place in areas of existing urban development, which may increase the susceptibility of soil erosion or loss of topsoil in erosion-prone areas, such as along the coast. New development may disturb soils in previously undisturbed areas. Increased development may also cause higher amounts of water runoff, which can cause or exacerbate erosion problems and slope failure. Projects may cause
significant soil erosion depending on project size and location, particularly large-scale development or redevelopment located in coastal communities, where growth is forecasted to occur under the 2050 RTP/SCS.

Slope instability or erosion problems in the San Diego region are primarily regulated through the UBC and the grading ordinances of local jurisdictions. The UBC requires special foundation engineering and investigation of soils on proposed development sites located in geologic hazard areas. These reports must demonstrate either that the hazard presented by the project will be eliminated or that there is no danger for the intended use. To minimize slide danger and erosion, a grading permit must be obtained for all major earth-moving projects. All land use jurisdictions have grading ordinances designed in part to ensure that development in earthquake- or landslide-prone areas does not threaten human life or property. Many of the country’s most slide-prone or erosion-prone areas occur along the coastal bluffs, which are within the jurisdiction of the California Coastal Commission (CCC). In addition to protecting unique recreational and natural resources, the CCC requires the inclusion of grading, drainage, and erosion control plans with the submittal of a development application. The local geologic background and potential for geologic impacts are important components of the Local Coastal Programs that have been, or are in the process of being, prepared for each coastal jurisdiction (SANDAG 2004).

As discussed in Section 4.7.2, the Construction General Permit regulates construction site storm water management, including the effects of erosion. Under the Construction General Permit, permit applicants would be required to prepare a SWPPP, which identifies BMPs that must be implemented to reduce construction effects on receiving water quality based on pollutants. The BMPs identified are directed at implementing both sediment and erosion control measures and other measures to control chemical contaminants. However, application of existing stormwater regulations does not necessarily guarantee that erosion impacts will be less than significant for every project, particularly for large projects in areas prone to soil erosion.

Adherence to the UBC, coastal zone regulations, construction general permit requirements, and local grading and erosion control ordinances would reduce the potential for substantial soil erosion or loss of topsoil. However, existing regulations cannot guarantee that all erosion impacts would be less than significant for all projects associated with the 2050 RTP/SCS. This is a significant impact.

Transportation Network Improvements

The transportation network improvements that would be implemented between 2010 and 2020 generally include widening and/or installation of HOV lanes and Managed Lanes and Transit Lanes along portions of I-5, I-15, I-805, SR 78, and SR 94; completion of SR 905 and SR 11; and HOV connector projects along I-805 and SR 78 at I-15. Some key transit network improvements in place by 2020 would include increases in existing COASTER service, including extension of COASTER service to the San Diego Convention Center and Petco Park. BRT downtown express services from inland and south bay locations would be expanded as well as new BRT routes from the south bay area and along I-15. Rapid bus service would add new routes and streetcar routes would be established. Airport express routes would also be developed. Local bus service would be improved to 15 minutes in key corridors. Double-tracking of the LOSSAN rail corridor would occur to accommodate increased frequency in COASTER and other rail services that utilize this rail line. In addition, the new Mid-Coast Trolley line from Old Town to University Town Center would be constructed and the Green Trolley line would be extended to downtown San Diego.

Portions of the transportation improvements included in the 2050 RTP/SCS would be constructed on or in proximity to steep slopes and would increase the amount of impervious surfaces and the removal of additional vegetative cover. Some transportation or transit projects associated with the 2050 RTP/SCS
could require significant earthwork, including cuts into hillsides that can become unstable over time, increasing long-term erosion potential. Road cuts can expose soils to erosion over the life of the project, creating potential landslide and falling rock hazards. Engineered roadways can be undercut over time by stormwater drainage and wind erosion. Some areas would be more susceptible to erosion than others due to the naturally occurring soils with high erosion potential. Improvements to the transportation network implemented by 2020 may cause or worsen soil erosion or loss of topsoil, particularly if those improvements require significant earthwork, such as below-grade transit line extensions or routes. The transportation projects include major freeway completion and freeway widening, which also may occur in erosion-prone areas. Vibration from new or expanded highways or transit lines, such as the development of the Mid-Coast Trolley line and improvements to segments of I-5 along the coast, may also cause or exacerbate soil erosion along hillsides in canyons or coastal bluffs.

Each improvement or project would be reviewed by appropriate regulatory agencies prior to construction and would adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce soil erosion or loss of topsoil. Adherence to these regulations would reduce the potential for substantial soil erosion or loss of topsoil. However, existing regulations cannot guarantee that all erosion impacts would be less than significant for all projects, particularly projects that involve extensive highway widening or double-tracking of rail lines in erosion-prone areas. This is a significant impact.

**Conclusion**

By 2020, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements, both of which would cause soil erosion or the loss of topsoil. This is a significant impact for which mitigation measures are described in Section 4.7.5.

**2035**

**Regional Growth/Land Use Change**

By 2035, the population of the region is expected to increase by 801,699 people; 268,094 housing units; and 312,292 jobs over existing 2010 conditions. Some locations that would experience the most extensive land use change and development by 2035 would include continued growth in eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 and SR 125 corridors: northeast of the SR 94 corridor in the unincorporated County planning areas of Jamul/Dulzura, Tecate, and Potrero; eastern Poway along the SR 67 corridor; the County planning area of Ramona along the SR 67 and SR 78 corridors; the County planning areas of Lakeside and Alpine and the Crest, Granite Hills, Dehesa, Harbison Canyon subregion; and multiple north County planning areas along the 1-15 and SR 76 corridors such as Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, and Hidden Valley. Areas of increased residential density by 2035 would be apparent in some coastal cities such as Oceanside and Encinitas, and City of San Diego coastal communities. Also, increased density would occur in more inland areas along the I-8 corridor through Mission Valley, College Area, and into the City of La Mesa, as well as eastern Chula Vista along the SR 125 corridor.

Impacts may be greater by 2035 than by 2020 as additional growth is forecasted to occur in coastal areas or in areas near or in canyons. Adherence to the UBC, coastal zone regulations, construction general permit requirements, and local grading and erosion control ordinances would reduce the potential for substantial soil erosion or loss of topsoil. However, existing regulations cannot guarantee that all erosion impacts would be less than significant for all projects associated with the 2050 RTP/SCS. This is a significant impact.
Transportation Network Improvements

Some key highway improvements in place by 2035 would include continued widening along portions of I-5; additional HOV and Managed Lanes along portions of I-5, I-15, I-805, and SR 52; widening of portions of SR 125 and SR 67; and additional freeway and HOV connector improvements. Some important transit projects operational by 2035 would include continued increases in COASTER service, increases in SPRINT service, increases in downtown area streetcar service, and substantial increases in rapid bus service throughout the region. The Trolley Blue Line would be extended from UTC to Mira Mesa via Sorrento Mesa and Carroll Canyon; the Orange Line would be extended to Lindbergh Field; Phase 1 of the new Mid-City to Downtown San Diego line would provide service from the Mid-City transit station via El Cajon Boulevard to Downtown; and a new line from Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, and San Diego State University would be established. Double-tracking along the SPRINT rail line through the cities of Oceanside, Vista, San Marco, and Escondido would take place by 2035 as well as continued double-tracking along the LOSSAN corridor.

As true in the 2020 analysis, transportation network improvements would cause or worsen soil erosion or loss of topsoil, particularly if those improvements require significant earthwork, such as below-grade transit line extensions or routes. Vibration from new or expanded highways or transit lines may also cause or exacerbate soil erosion along hillsides in canyons or coastal bluffs. Particular projects located in coastal areas, such as expansion of I-5 along the coast, double-tracking of the COASTER, and expansion of SR 67 in hilly or mountainous areas, would be susceptible to causing soil erosion impacts.

Each improvement or project would be reviewed by appropriate regulatory agencies prior to construction and would adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce soil erosion or loss of topsoil. Adherence to these regulations would reduce the potential for substantial soil erosion or loss of topsoil. However, existing regulations cannot guarantee that all erosion impacts would be less than significant for all projects, particularly projects that involve extensive highway widening or double-tracking of rail lines in erosion-prone areas. This is a significant impact.

Conclusion

By 2035, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements, both of which would cause soil erosion or the loss of topsoil. This is a significant impact for which mitigation measures are described in Section 4.7.5.

2050

Regional Growth/Land Use Change

By 2050, the population of the region is forecast to increase by 1,160,435 people; 379,664 housing units; and 501,958 jobs over existing conditions. Areas of substantial land use change and development, beyond that described in 2035, would include significant industrial development in the County’s Otay planning area and San Diego Otay Mesa community surrounding the East Otay Mesa POE; throughout County planning areas located along the international border including Tecate, Potrero, Campo/Lake Morena, Boulevard, and Jacumba; throughout the Ramona and Julian planning areas in the unincorporated County; throughout other northeastern County planning areas including North Mountain, Desert, and Borrego Springs; and continued development throughout County planning areas located north and east of Escondido extending to the northern border with Riverside County including Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, Hidden Valley, Twin Oaks Valley, and North County Metro. Increased density is most apparent in City of San Diego communities near the downtown area near I-5 and I-805 and along the I-8 corridor to the east.
Impacts may be greater by 2050 than by 2020 or 2035 as additional growth is forecasted to occur in coastal areas or in areas near or in canyons. Adherence to the UBC, coastal zone regulations, construction general permit requirements, and local grading and erosion control ordinances would reduce the potential for substantial soil erosion or loss of topsoil. However, existing regulations cannot guarantee that all erosion impacts would be less than significant for all projects associated with the 2050 RTP/SCS. This is a significant impact.

Transportation Network Improvements

By 2050, most of the highway, transit, and active transportation (bicycle and pedestrian) improvements, along with other infrastructure projects, would be in place and operational in accordance with the proposed 2050 RTP/SCS. Some key highway improvements that would be in place by 2050 would include widening portions of SR 52, SR 56, SR 76, SR 94, SR 125, and I-5; additional HOV lanes and Managed Lanes along segments of I-805, I-5, I-15, SR 94, SR 125, and SR 54; and freeway and HOV connector improvements. Important transit improvements in place by 2050 would include the extension of Trolley lines and increased Trolley service frequency. The Trolley Green Line would be extended to Downtown-Bayside; a new Phase 2 of the line connecting San Diego State University to Downtown San Diego via El Cajon Boulevard/Mid-City would be constructed and extended to San Diego State University; and a line from University Town Center to San Ysidro Palomar Trolley Station in the South Bay via Kearny Mesa, Mission Valley, Mid-City, and National City and Chula Vista would be established.

As true in the 2020 and 2035 analyses, transportation network improvements would cause or worsen soil erosion or loss of topsoil, particularly if those improvements require significant earthwork, such as below-grade transit line extensions or routes. Vibration from new or expanded highways or transit lines may also cause or exacerbate soil erosion along hillsides in canyons or coastal bluffs. Specific transportation improvements that may cause or exacerbate soil erosion would be the expansion of I-5 along the southern coast and canyon areas, and expansion of Trolley lines near the coast. The greatest impacts from construction would likely occur by 2035, although impacts from operation of transportation improvements would be greatest by 2050 as all projects would be implemented by that time.

Each improvement or project would be reviewed by appropriate regulatory agencies prior to construction and would adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce soil erosion or loss of topsoil. Adherence to these regulations would reduce the potential for substantial soil erosion or loss of topsoil. However, existing regulations cannot guarantee that all erosion impacts would be less than significant for all projects, particularly projects that involve extensive highway widening or double-tracking of rail lines in erosion-prone areas. This is a significant impact.

Conclusion

By 2050, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements, both of which would cause soil erosion or the loss of topsoil. This is a significant impact for which mitigation measures are described in Section 4.7.5.

GEO-4 EXPANSIVE SOILS

Areas with potential to have expansive soils within the region occur predominately in the coastal plains, an area of dissected marine terraces and uplands. They can also be found in valleys and on slopes in the foothills and mountains of the Peninsular Ranges Region and, to a lesser extent, in the desert (County of San Diego 2007). Soils with high clay content can cause expansion that results in structural damage to surface improvements such as concrete foundations or paved roads and streets. Structural damage may result over a long period of time, usually the result of inadequate soil and foundation engineering or the
placement of structures directly on expansive soils. The issue of expansive soils is not as common in the San Diego region as in other parts of the country; however, development in coastal areas is more susceptible to damage from expansive soils than eastern areas of the region.

2020

Regional Growth/Land Use Change

By 2020, population within the region is expected to increase by 310,568 people; housing by 113,062 units; and employment by 118,535 jobs. By 2020, new development is projected to occur, mainly in or adjacent to areas with existing urban development concentrated in the western portion of the region. Some locations that would experience the most extensive land use change and development by 2020 would include areas such as eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 corridor; City of San Diego coastal and bay communities south of I-8 including Ocean Beach and the Peninsula planning areas; portions of northern Santee; areas north and south of the SR 56 corridor in the San Diego planning areas of Carmel Valley, Del Mar Mesa, Pacific Highlands Ranch, and Torrey Highlands; the San Marcos area near both the SR 78 and I-15 corridors; and within unincorporated County communities such as Fallbrook, Pala-Pauma Valley, and Valley Center along the I-15 and SR 76 corridors.

Development associated with implementation of the 2050 RTP/SCS may be constructed in areas containing expansive soils, thereby increasing the risk to people and structures from deterioration of infrastructure, structures, and pavements. If the moisture content and/or soil type differs at various locations under the foundation of a structure, localized or nonuniform movement may occur. This movement can cause damage to the foundation and building structural system, evidenced by cracking of the slab or foundation, cracking in the exterior or interior wall coverings (indicating movement of support framing), uneven floors, and/or misaligned doors and windows. Damage caused by expansive soils can be slow and long term, and not attributable to any particular event. Development that occurs near the coast would be more susceptible to damage caused by expansive soils. However, any structure developed in the western part of the San Diego region may be at risk for expansive soils. Through adherence to existing laws and regulations, development associated with the 2050 RTP/SCS would be required to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce hazards associated with expansive soils, as described in Section 4.7.2. Corrective measures would be applied to the design of individual future projects. All site designs would be reviewed and approved by the appropriate agencies. Adherence to these laws and regulations and those described in Section 4.7.2 would ensure impacts would be less than significant. No mitigation is required.

Transportation Network Improvements

The transportation network improvements that would be implemented between 2010 and 2020 generally include widening and/or installation of HOV lanes, Managed Lanes, and Transit Lanes along portions of I-5, I-15, I-805, SR 78, and SR 94; completion of SR 905 and SR 11; and HOV connector projects along I-805 and SR 78 at I-15. Some key transit network improvements in place by 2020 would include increases in existing COASTER service, including extension of COASTER service to the San Diego Convention Center and Petco Park. BRT downtown express services from inland and south bay locations would be expanded as well as new BRT routes from the south bay area and along I-15. Rapid bus service would add new routes and streetcar routes would be established. Airport express routes would also be developed. Local bus service would be improved to 15 minutes in key corridors. Double-tracking of the LOSSAN rail corridor would occur to accommodate increased frequency in COASTER and other rail services that utilize this rail line. In addition, the new Mid-Coast Trolley line from Old Town to University Town Center would be constructed and the Green Trolley line would be extended to downtown San Diego.
Improvements to the transportation network implemented by 2020 may be located in areas with expansive soils, particularly if they are located near the coast, such as double-tracking of the LOSSAN rail corridor and improvements to I-5. Transportation network improvements constructed on or adjacent to expansive soils may suffer infrastructure damage, such as weakening or cracking of bridges, concrete platforms, and other facilities. Each improvement or project would be reviewed by appropriate regulatory agencies prior to construction and would adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce risks associated with expansive soils. Adherence to the laws and regulations described above and in Section 4.7.2 would ensure impacts would be less than significant. No mitigation is required.

Conclusion

By 2020, implementation of the 2050 RTP/SCS would result in regional growth development and transportation network improvements that would be constructed on expansive soils. However, adherence to the laws and regulations included in Section 4.7.2 and described above would minimize the potential for projects located on expansive soils to create substantial risks to life or property, and this impact would therefore be less than significant. No mitigation is required.

2035

Regional Growth/Land Use Change

By 2035, the population of the region is expected to increase by 801,699 people; 268,094 housing units; and 312,292 jobs over existing 2010 conditions. Some locations that would experience the most extensive land use change and development by 2035 would include continued growth in eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 and SR 125 corridors; northeast of the SR 94 corridor in the unincorporated County planning areas of Jamul/Dulzura, Tecate, and Potrero; eastern Poway along the SR 67 corridor; the County planning area of Ramona along the SR 67 and SR 78 corridors; the County planning areas of Lakeside and Alpine and the Crest, Granite Hills, Dehesa, Harbison Canyon subregion; and multiple north County planning areas along the I-15 and SR 76 corridors such as Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, and Hidden Valley. Areas of increased residential density by 2035 would be apparent in some coastal cities such as Oceanside and Encinitas, and City of San Diego coastal communities. Also, increased density would occur in more inland areas along the I-8 corridor through Mission Valley, College Area, and into the City of La Mesa, as well as eastern Chula Vista along the SR 125 corridor.

As discussed in the 2020 analysis, additional growth and development would be susceptible to the effects of expansive soils, particularly development located in coastal communities.

As mentioned above, all projects associated with regional growth would be required to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce hazards from expansive soils. Regulatory agencies with oversight on development associated with the 2050 RTP/SCS have developed regulations and engineering design specifications to reduce risks from expansive soils. Corrective measures such as structural reinforcement and using engineered fill to replace unstable soils would be applied to the design of individual future projects. All site designs would be reviewed and approved by the appropriate agencies. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.
Transportation Network Improvements

Some key highway improvements in place by 2035 would include continued widening along portions of I-5; additional HOV and Managed Lanes along portions of I-5, I-15, I-805, and SR 52; widening of portions of SR 125 and SR 67; and additional freeway and HOV connector improvements. Some important transit projects operational by 2035 would include continued increases in COASTER service, increases in SPRINT service, increases in downtown area streetcar service, and substantial increases in rapid bus service throughout the region. The Trolley Blue Line would be extended from UTC to Mira Mesa via Sorrento Mesa and Carroll Canyon; the Orange Line would be extended to Lindbergh Field; Phase 1 of the new Mid-City to Downtown San Diego line would provide service from the Mid-City transit station via El Cajon Boulevard to Downtown; and a new line from Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, and San Diego State University would be established. Double-tracking along the SPRINT rail line through the cities of Oceanside, Vista, San Marco, and Escondido would take place by 2035 as well as continued double-tracking along the LOSSAN corridor.

As true in the 2020 analysis, transportation network improvements would be built in areas with expansive soils, particularly improvements located near the coast, such as improvements to I-5 and double-tracking of the LOSSAN rail corridor. Each improvement or project would be reviewed by appropriate regulatory agencies prior to construction and would adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce risks associated with expansive soils. Adherence to the laws and regulations described above and in Section 4.7.2 would ensure impacts would be less than significant. No mitigation is required.

Conclusion

By 2035, implementation of the 2050 RTP/SCS would result in regional growth development and transportation network improvements that would be constructed on expansive soils. However, adherence to the laws and regulations included in Section 4.7.2 and described above would minimize the potential for projects located on expansive soils to create substantial risks to life or property, and this impact would therefore be less than significant. No mitigation is required.

2050 Regional Growth/Land Use Change

By 2050, the population of the region is forecast to increase by 1,160,435 people; 379,664 housing units; and 501,958 jobs over existing conditions. Areas of substantial land use change and development, beyond that described in 2035, would include significant industrial development in the County’s Otay planning area and San Diego Otay Mesa community surrounding the East Otay Mesa POE; throughout County planning areas located along the international border including Tecate, Potrero, Campo/Lake Morena, Boulevard, and Jacumba; throughout the Ramona and Julian planning areas in the unincorporated County; throughout other northeastern County planning areas including North Mountain, Desert, and Borrego Springs; and continued development throughout County planning areas located north and east of Escondido extending to the northern border with Riverside County including Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, Hidden Valley, Twin Oaks Valley, and North County Metro. Increased density is most apparent in City of San Diego communities near the downtown area near I-5 and I-805 and along the I-8 corridor to the east.

As discussed in the 2020 and 2035 analyses above, additional growth and development would be susceptible to the effects of expansive soils, particularly development located in coastal communities.

As mentioned above, all projects associated with regional growth would be required to adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or
reduce hazards from expansive soils. Regulatory agencies with oversight on development associated with the 2050 RTP/SCS have developed regulations and engineering design specifications to reduce risks from expansive soils. Corrective measures such as structural reinforcement and using engineered fill to replace unstable soils would be applied to the design of individual future projects. All site designs would be reviewed and approved by the appropriate agencies. Adherence to these laws and regulations would ensure impacts would be less than significant. No mitigation is required.

Transportation Network Improvements

By 2050, most of the highway, transit, and active transportation (bicycle and pedestrian) improvements, along with other infrastructure projects, would be in place and operational in accordance with the proposed 2050 RTP/SCS. Some key highway improvements that would be in place by 2050 would include widening portions of SR 52, SR 56, SR 76, SR 94, SR 125, and I-5; additional HOV lanes and Managed Lanes along segments of I-805, I-5, I-15, SR 94, SR 94, SR 125, and SR 54; and freeway and HOV connector improvements. Important transit improvements in place by 2050 would include the extension of Trolley lines and increased Trolley service frequency. The Trolley Green Line would be extended to Downtown-Bayside; a new Phase 2 of the line connecting San Diego State University to Downtown San Diego via El Cajon Boulevard/Mid-City would be constructed extended to San Diego State University; and a line from University Town Center to San Ysidro Palomar Trolley Station in the South Bay via Kearny Mesa, Mission Valley, Mid-City, and National City, and Chula Vista would be established.

As true in the 2020 and 2035 analyses, transportation network improvements would be built in areas with expansive soils, particularly improvements located near the coast, such as improvements to I-5 and transportation facilities located in downtown San Diego and the coastal region of the South Bay. Each improvement or project would be reviewed by appropriate regulatory agencies prior to construction and would adhere to design standards described in the CBC and all standard design, grading, and construction practices to avoid or reduce risks associated with expansive soils. Adherence to these regulations would reduce impacts to a level less than significant. No mitigation is required.

Conclusion

By 2050, implementation of the 2050 RTP/SCS would result in regional growth development and transportation network improvements that would be constructed on expansive soils. However, adherence to the laws and regulations included in Section 4.7.2 and described above would minimize the potential for projects located on expansive soils to create substantial risks to life or property, and this impact would therefore be less than significant. No mitigation is required.

MR-1  KNOWN MINERAL RESOURCES

A significant impact would occur if known mineral resources or lands designated for extractive use became permanently inaccessible, where the resources were determined to be minable, processable, and marketable under the technological and economic conditions that exist at present or that can be estimated to exist in the next 50 years (County of San Diego 2008). Lands designated as MRZ-2 locations are areas of known mineral resources. As shown in Figure 4.7-2, MRZ-2 locations exist along SR-76, between I-15 and SR-78, north of SR-52 east of I-805, along I-8, in southeastern Chula Vista and Otay Mesa, and from Imperial Beach south to the U.S./Mexican border.

Aggregate, a regionally important mineral resource, is potentially found in portions of MRZ-2 locations, as seen in Figure 4.7-3. SANDAG, in cooperation with Caltrans District 11, completed the San Diego Region Aggregate Supply Study in January 2011 to examine the supply issues related to aggregate. According to the study, 1,159 potential aggregate supply sites are in the region. Information contained in
the San Diego Region Aggregate Study will be used by planners to help manage the region’s aggregate resources (SANDAG 2011).

Permanent loss of availability to land containing mineral resources in the San Diego region is caused by the development of incompatible land uses, which directly or indirectly makes the resources inaccessible for future extraction. Compatible land uses are defined in Article 6, Section 3675, of the SMGB Reclamation Regulations (SMGB 2007) as land uses that require a minimum public or private investment in structures and land improvements, and would allow mining because of the relative economic value of the land and its improvements. Examples of such uses include, but are not limited to, very low-density residential, geographically extensive but low impact industrial, recreational, agricultural, timber harvesting, grazing, and open space land uses.

Incompatible land uses are also defined in Article 6, Section 3675, of the SMGB Reclamation Regulations as land uses that require public or private investment in structures, land improvements, and landscaping and that would prevent mining because of the greater economic value of the land and its improvements. Examples of such uses would include, but are not limited to, high-density residential, low-density residential with high unit value, public facilities, and geographically limited but impact-intensive industrial and commercial land uses (County of San Diego 2010). Although there are several places in the San Diego region where active mining operations have functioned in proximity to urban development, such as Mission Valley or Carroll Canyon in the City of San Diego, residential development typically restricts the availability of lands for mining operations. Noise from quarry and mining activities is typically the largest environmental impact to nearby noise-sensitive land uses (such as residential developments, industrial developments, commercial developments, and major public facilities). Residents can be concerned about potential dust, noise, blasting vibrations, truck traffic, unsightly scars on the land, and loss of habitat caused by aggregate mining.

Additionally, jurisdictions may have placed restrictions on mining operations and locations, as described in Section 4.7.2. Mining in MRZ-2 locations within lands designated for habitat preservation may also be restricted in order to preserve the natural ecology of the area. Permanent open spaces placed on parcels for the protection of sensitive environmental resources permanently remove the ability for that land to be used for future extraction of mineral resources (County of San Diego 2008).

2020

Regional Growth/Land Use Change

By 2020, population within the region is expected to increase by 310,568 people; housing by 113,062 units; and employment by 118,535 jobs. Some locations that would experience the most extensive land use change and development by 2020 would include areas such as eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 corridor; City of San Diego coastal and bay communities south of I-8 including Ocean Beach and the Peninsula planning areas; portions of northern Santee; areas north and south of the SR 56 corridor in the San Diego planning areas of Carmel Valley, Del Mar Mesa, Pacific Highlands Ranch, and Torrey Highlands; the San Marcos area near both the SR 78 and I-15 corridors; and within unincorporated County communities such as Fallbrook, Pala-Pauma Valley, and Valley Center along the I-15 and SR 76 corridors. By 2020, a portion of vacant and undeveloped land in MRZ-2 locations would be developed for uses considered incompatible with mining operations. Development to accommodate regional growth would be constructed near Poway, Santee, I-15 between SR-56 and I-8, along SR-76, and other locations. Some of the land in MRZ-2 locations would also be protected for habitat preservation, although mining operations would be allowed in several areas under jurisdictional approval. Therefore, the regional growth
development associated with the 2050 RTP/SCS would result in the loss of availability of a known mineral resource, and impacts would be significant.

**Transportation Network Improvements**

The transportation network improvements that would be implemented between 2010 and 2020 generally include widening and/or installation of HOV lanes, Managed Lanes, and Transit Lanes along portions of I-5, I-15, I-805, SR 78, and SR 94; completion of SR 905 and SR 11; and HOV connector projects along I-805 and SR 78 at I-15. Some key transit network improvements in place by 2020 would include increases in existing COASTER service, including extension of COASTER service to the San Diego Convention Center and Petco Park. BRT downtown express services from inland and south bay locations would be expanded as well as new BRT routes from the south bay area and along I-15. Rapid bus service would add new routes and streetcar routes would be established. Airport express routes would also be developed. Local bus service would be improved to 15 minutes in key corridors. Double-tracking of the LOSSAN rail corridor would occur to accommodate increased frequency in COASTER and other rail services that utilize this rail line. In addition, the new Mid-Coast Trolley line from Old Town to University Town Center would be constructed and the Green Trolley line would be extended to downtown San Diego.

Transportation network improvements and projects associated with the 2050 RTP/SCS may require increased right-of-way within MRZ-2 locations, which would potentially limit areas within those zones that could be used for mining operations. Improvements located in undisturbed or vacant areas in MRZ-2 locations, such as widening of SR 76 and improvements to I-15, would potentially decrease available land with known mineral resources. Any work within the right-of-way of a federal or state corridor is subject to Caltrans regulations governing allowable actions within the right-of-way. Caltrans issues permits to allow encroachment on land within its jurisdiction to ensure the encroachment is compatible with the primary uses of the State Highway System. The encroachment permit application requirements include information on the location of mineral resources approved under the SMARA. Although this permitting process may allow mining operations to occur within transportation right-of-ways once the projects have been implemented, it is likely that some of this land would be permanently impacted by transportation improvements. Therefore, transportation improvements would result in significant impacts to lands with known mineral resources.

**Conclusion**

By 2020, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements, both of which would result in the loss of availability of a known mineral resource. This is a significant impact for which mitigation measures are described in Section 4.7.5.

**2035**

**Regional Growth/Land Use Change**

By 2035, the population of the region is expected to increase by 801,699 people; 268,094 housing units; and 312,292 jobs over existing 2010 conditions. Some locations that would experience the most extensive land use change and development by 2035 would include continued growth in eastern Chula Vista along the SR 125 and I-805 corridors; San Diego community planning areas of San Ysidro and Otay Mesa along the SR 905 and SR 125 corridors; northeast of the SR 94 corridor in the unincorporated County planning areas of Jamul/Dulzura, Tecate, and Potrero; eastern Poway along the SR 67 corridor; the County planning area of Ramona along the SR 67 and SR 78 corridors; the County planning areas of Lakeside and Alpine and the Crest, Granite Hills, Dehesa, Harbison Canyon subregion; and multiple...
north County planning areas along the I-15 and SR 76 corridors such as Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, and Hidden Valley. Areas of increased residential density by 2035 would be apparent in some coastal cities such as Oceanside and Encinitas, and City of San Diego coastal communities. Also, increased density would occur in more inland areas along the I-8 corridor through Mission Valley, College Area, and into the City of La Mesa, as well as eastern Chula Vista along the SR 125 corridor.

Additional vacant and undeveloped land in MRZ-2 locations would be developed for uses considered incompatible with mining operations. Development to accommodate regional growth would be constructed near Poway, Santee, El Cajon, eastern Chula Vista and Otay Mesa; the I-15 and SR 76 corridors; and other locations. Some of the land in MRZ-2 locations would also be protected for habitat preservation, although mining operations would be allowed in several areas under jurisdictional approval. Therefore, the regional growth development associated with the 2050 RTP/SCS would result in the loss of availability of a known mineral resource, and impacts would be significant.

Transportation Network Improvements

Some key highway improvements in place by 2035 would include continued widening along portions of I-5; additional HOV and Managed Lanes along portions of I-5, I-15, I-805, and SR 52; widening of portions of SR 125 and SR 67; and additional freeway and HOV connector improvements. Some important transit projects operational by 2035 would include continued increases in COASTER service, increases in SPRINTER service, increases in downtown area streetcar service, and substantial increases in rapid bus service throughout the region. The Trolley Blue Line would be extended from UTC to Mira Mesa via Sorrento Mesa and Carroll Canyon; the Orange Line would be extended to Lindbergh Field; Phase 1 of the new Mid-City to Downtown San Diego line would provide service from the Mid-City transit station via El Cajon Boulevard to Downtown; and a new line from Pacific Beach to El Cajon via Kearny Mesa, Mission Valley, and San Diego State University would be established. Double-tracking along the SPRINTER rail line through the cities of Oceanside, Vista, San Marco, and Escondido would take place by 2035 as well as continued double-tracking along the LOSSAN corridor.

Transportation network improvements and projects associated with the 2050 RTP/SCS implemented by 2035 may require increased right-of-way within MRZ-2 locations, which would potentially limit areas within those zones that could be used for mining operations. Transportation network improvements built in MRZ-2 locations, such as improvements to the SPRINTER rail line, SR 67, and I-805 near Chula Vista, would potentially decrease some land available for mining operations. Therefore, transportation improvements would result in significant impacts to lands with known mineral resources.

Conclusion

By 2035, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements, both of which would result in the loss of availability of a known mineral resource. This is a significant impact for which mitigation measures are described in Section 4.7.5.

2050

Regional Growth/Land Use Change

By 2050, the population of the region is forecast to increase by 1,160,435 people; 379,664 housing units; and 501,958 jobs over existing conditions. Areas of substantial land use change and development, beyond that described in 2035, would include significant industrial development in the County’s Otay planning area and San Diego Otay Mesa community surrounding the East Otay Mesa POE; throughout County
planning areas located along the international border including Tecate, Potrero, Campo/Lake Morena, Boulevard, and Jacumba; throughout the Ramona and Julian planning areas in the unincorporated County; throughout other northeastern County planning areas including North Mountain, Desert, and Borrego Springs; and continued development throughout County planning areas located north and east of Escondido extending to the northern border with Riverside County including Rainbow, Fallbrook, Bonsall, Pala-Pauma Valley, Valley Center, Hidden Valley, Twin Oaks Valley, and North County Metro. Increased density is most apparent in City of San Diego communities near the downtown area near I-5 and I-805 and along the I-8 corridor to the east.

Additional vacant and undeveloped land in MRZ-2 locations would be developed for uses considered incompatible with mining operations. Development to accommodate regional growth would be constructed near El Cajon, along the SR 76 corridor, and other locations. Some of the land in MRZ-2 locations would also be protected for habitat preservation, although mining operations would be allowed in several areas under jurisdictional approval. Therefore, the regional growth development associated with the 2050 RTP/SCS would result in the loss of availability of a known mineral resource, and impacts would be significant.

Transportation Network Improvements

By 2050, most of the highway, transit, and active transportation (bicycle and pedestrian) improvements, along with other infrastructure projects, would be in place and operational in accordance with the proposed 2050 RTP/SCS. Some key highway improvements that would be in place by 2050 would include widening portions of SR 52, SR 56, SR 76, SR 94, SR 125, and I-5; additional HOV lanes and Managed Lanes along segments of I-805, I-5, I-15, SR 94, SR 125, and SR 54; and freeway and HOV connector improvements. Important transit improvements in place by 2050 would include the extension of Trolley lines and increased Trolley service frequency. The Trolley Green Line would be extended to Downtown-Bayside; a new Phase 2 of the line connecting San Diego State University to Downtown San Diego via El Cajon Boulevard/Mid-City would be constructed extended to San Diego State University; and a line from University Town Center to San Ysidro Palomar Trolley Station in the South Bay via Kearny Mesa, Mission Valley, Mid-City, and National City, and Chula Vista would be established.

Additional transportation network improvements and projects associated with the 2050 RTP/SCS implemented by 2050 may require increased right-of-way within MRZ-2 locations, which would potentially limit areas within those zones that could be used for mining operations. Transportation improvements that occur in MRZ-2 locations, such as improvements to SR 125 in Otay Mesa and SR 76 east of I-15, may decrease land available for mining operations. Therefore, transportation improvements would result in significant impacts to lands with known mineral resources.

Conclusion

By 2050, implementation of the 2050 RTP/SCS would result in land use changes and the construction of transportation network improvements, both of which would result in the loss of availability of a known mineral resource. This is a significant impact for which mitigation measures are described in Section 4.7.5.

4.7.5 MITIGATION MEASURES

The following mitigation measures aim to reduce impacts related to geology and soils and mineral resources. These mitigation measures are general and programmatic in nature, and would be refined in project-specific CEQA documents.
SOIL EROSION AND LOSS OF TOPSOIL

2020, 2035, 2050

Implementation of the 2050 RTP/SCS would result in significant impacts to soil erosion and loss of topsoil in 2020, 2035, and 2050. Implementation of Mitigation Measure GEO-A would reduce impacts to a less than significant level.

GEO-A

During project-specific design and CEQA review, SANDAG shall and other implementing agencies can and should develop detailed erosion control mitigation measures tailored to the project and site to be developed and included in the SWPPP upon application for a Construction General Permit. During construction, implementing agencies can and should avoid construction on unstable slopes and erosion-prone areas where possible, use special construction techniques to minimize erosion, and manage on-site grading to maximize the capture and retention of on-site runoff by creating perimeter ditches, trenches, siltation ponds, or similar depressions. Low-impact development (LID) design features, including drought-tolerant landscaping, shall be incorporated into each drainage design to the maximum extent practicable. Where permanent, postconstruction BMPs are specified (e.g., detention/retention systems), features shall be utilized for temporary sediment trap devices during construction. In addition, agencies can and should develop an erosion control and revegetation plan for the project site to delineate measures to minimize soil loss and prevent short-term and long-term significant soil erosion problems. Routine site inspections should be made to assess long-term effectiveness of soil erosion control.

KNOWN MINERAL RESOURCES

2020, 2035, 2050

Implementation of the 2050 RTP/SCS would result in significant impacts to the availability of known mineral resources in 2020, 2035, and 2050. Implementation of Mitigation Measures MR-A and MR-B would reduce impacts, but not beyond a less than significant level.

MR-A

The 19 incorporated cities and the County of San Diego, when updating the Conservation Element of their General Plans, can and should identify locations with known mineral resources and adopt policies and objectives to conserve the land most suitable for mineral resource extraction from development of incompatible land uses. Local jurisdictions shall pay particular attention to lands with known aggregate supply sources, as identified in the 2011 San Diego Region Aggregate Supply Study, with the intention to manage the region’s aggregate resources during the lifespan of the 2050 RTP/SCS.

MR-B

During project-specific design and CEQA review of transportation facilities, SANDAG shall and other implementing agencies can and should minimize impacts on known mineral resources through the evaluation of alternate route alignments and transportation facilities that conserve the land most suitable for mineral resource extraction from development of transportation uses. SANDAG and other implementing agencies shall pay particular attention to lands with known aggregate supply sources, as identified in the 2011 San Diego Region Aggregate Supply Study, with the intention to manage the region’s aggregate resources during the lifespan of the 2050 RTP/SCS.
The following mitigation measure to avoid or reduce impacts to the availability of mineral resources is considered infeasible:

- Local jurisdictions shall conserve all vacant or undeveloped lands with known mineral resources from the development of incompatible uses. These lands include all vacant or undeveloped lands designated as MRZ-2 locations or lands with potential aggregate supply sites.

This mitigation measure is considered infeasible because it would restrict future development in areas identified for increased growth under jurisdictions’ land use plans. Doing so would cause conflicts with existing land use plans and conflict with the region’s ability to manage growth in a sustainable manner, which is a project objective of the 2050 RTP/SCS. Restricting development of residential units or increasing density of residential development may cause the 2050 RTP/SCS to be out of compliance with implementing the RHNA allocation, a requirement mandated by state law, or impede implementation of a jurisdiction’s Housing Element.

### 4.7.6 SIGNIFICANCE AFTER MITIGATION

#### GEO-3 SOIL EROSION

**2020, 2035, and 2050**

Implementation of the 2050 RTP/SCS would result in substantial erosion and loss of topsoil. Implementation of Mitigation Measure GEO-A would reduce impacts below a less than significant level by requiring a detailed erosion and water runoff mitigation plan specific to each project and site that would be included in the SWPPP, with an objective of minimizing erosion and loss of topsoil. Responsible agencies would be encouraged to conduct the following:

- Identify and avoid areas with unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, slope angles, and geologic structure).
- Develop a site grading and management plan to identify areas of disturbance; areas of cut and fill; slope during and after grading; existing vegetation; and measures to protect slope, drainages, and existing vegetation in the project area.
- Identify and avoid areas with unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, slope angles, and geologic structure).
- Develop an erosion control and revegetation plan to delineate measures to minimize soil loss and reduce sedimentation to protect water quality.
- Use special construction techniques in areas of steep slopes, erodible soils, and stream crossings.
- Conduct routine site inspections to assess the effectiveness of and the maintenance requirements for erosion and sediment control systems.

This mitigation measure would be included in project-level planning, design, and analysis, as appropriate CEQA reviews. Implementation of this mitigation measure would require project implementation agencies to follow comprehensive, proven procedures to assess the magnitude of impact anticipated on a project level, and avoid or substantially reduce soil erosion or loss of topsoil. Therefore, with implementation of this mitigation measure, impacts to soil erosion and loss of topsoil would be less than significant because substantial erosion or loss of topsoil would not occur.
MR-1    KNOWN MINERAL RESOURCES

2020, 2035, and 2050

Implementation of the 2050 RTP/SCS would result in the loss of areas with known mineral resources. While implementation of Mitigation Measure MR-A would reduce impacts associated with loss of availability of known mineral resources, it cannot be ensured that the proposed mitigation would reduce potential impacts to all mineral resource lands to a less than significant level. Therefore, impacts would remain significant and unavoidable.

By 2020, 2035, and 2050, implementation of the 2050 RTP/SCS, including regional growth and land use changes and transportation network improvements, would decrease the availability of MRZ-2 lands, which are lands with known mineral resources. Mitigation Measure MR-A would require local jurisdictions to identify policies and objectives in their General Plan updates to conserve the most suitable lands in MRZ-2 locations for mineral resource extraction. Mitigation Measure MR-B would require SANDAG and implementing agencies to conserve the most suitable lands in MRZ-2 locations by evaluating alternative route alignments and locations for transportation facilities. However, not all of MRZ-2 lands would be conserved under Mitigation Measures MR-A and MR-B. Jurisdictions update their General Plans during the most suitable time for them to do so, which may be after some regional growth and land use change has already been implemented in MRZ-2 locations. Additionally, alternative route alignments for transportation projects that best conserve lands in MRZ-2 locations may not be technically or financially feasible.