# 4.5 Geology and Soils

This section evaluates potential geology and soils impacts that could affect or result from the future development consistent with the Encinitas Housing Element Update (HEU). Information in this section comes from secondary sources and the Final Existing Conditions Report (City of Encinitas 2010).

## 4.5.1 Existing Conditions

### 4.5.1.1 Environmental Setting

#### a. Geologic Overview

The geologic history of the entire San Diego area is strongly influenced by tectonic movement along series of faults. Earthquakes along these faults represent hazards that must be addressed. Uplift associated with these faults have created a diverse topographic environment that has also brought with it hazards, such as landslides, mudslides, and hillside creep (gradual downhill soil movement).

Erosion of mountains and the creation of sedimentary rocks have also produced soil conditions that are geotechnical challenges in the form of both compressible and expansive soils.

#### b. Geologic Formations

San Diego County can be divided between three distinct geomorphic regions: the Coastal Plain region as exposed west of the Peninsular Ranges, the Peninsular Range region, and the Salton Trough region as exposed east of the Peninsular Ranges. The City is within the Coastal Plain region. The Coastal Plain region is underlain by a sequence of marine and non-marine sedimentary rock units from the last 140 million years. Over this period of time the relationship of land and sea has fluctuated drastically, so that today we have ancient marine rocks preserved up to elevations around 900 feet above sea level and ancient river deposits as high as 1,200 feet. Faulting related to the local La Nacion and Rose Canyon fault zones has broken up this sedimentary sequence into a number of distinct fault blocks.

There are different formation types by three sedimentary and tectonic periods: Holocene, Pleistocene, and Eocene. A review of the geologic map of the Oceanside 30 feet x 60 feet Quadrangle, California, shows the following seven geologic formations mapped within the City (California Department of Conservation 2015).

### *Paralic Estuarine Deposits (Qpe)*

The paralic estuarine deposits consist mostly of fine-grained sand and clay. This formation dates from the late Holocene.

### *Young Alluvial Floodplain Deposits (Qya)*

The young alluvial floodplain deposits consist mostly of poorly consolidated, poorly sorted, permeable floodplain deposits. This formation dates from the Holocene and late Pleistocene.

### *Old Paralic Deposits Undivided (Qop)*

The old paralic deposits consist mostly of poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone, and conglomerate. This formation dates from the late to middle Pleistocene.

### *Very Old Paralic Deposits Undivided (Qvop)*

The very old paralic deposits consist mostly of poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate. This formation dates from the middle to early Pleistocene.

### *Torrey Sandstone (Tt)*

The Torrey Sandstone consists mostly of white to light brown, medium- to coarse-grained, moderately well-indurated, massive and broadly cross-bedded, arkosic sandstone. This formation dates from the middle Eocene.

### *Del Mar Formation (Td)*

The Del Mar Formation consists of dusky yellowish green, sandy claystone interbedded with medium-gray, coarse-grained sandstone. The Del Mar Formation dates from the middle Eocene.

### *Santiago Formation (Tsa)*

The Santiago Formation is a middle Eocene stratum composed of three distinctive parts. Throughout the formation, both vertically and laterally, there exist greenish-brown, massive claystone interbeds, tongues and lenses of often fossiliferous, lagoonal claystone and siltstone.

## c. Soil Characteristics

### *Compressible Soils*

Compressible soils underlie a significant part of the City, typically in the lowland areas, lagoons and in canyon bottoms. These are generally younger sediments like stream or tidal deposits of low density with variable amounts of organic materials. Under the added weight of fill embankments or buildings and vibration from vehicle traffic on roads, these sediments will settle, causing distress to improvements. Some older portions of the City may require remedial effort to correct this condition during redevelopment. Low-density soils, if sandy in composition and saturated with water, will also be susceptible of the effects of liquefaction during a moderate to strong earthquake.

### *Expansive Soils*

Some of the geologic units east of Interstate 5, including both surficial soils and bedrock, have fine-grained (clay) soils that are moderately to highly expansive. These materials may be present at the surface or exposed by grading activities. Artificial fills can also be expansive, depending on the soils used to construct them. In new development, grading can remove or lessen the effect of this condition, but in older buildings, the effects must be mitigated by strategies to control moisture or by structurally altering the building in accordance with the Building Code.

## d. Area Soils

The majority of the City is located in the coastal plains physiographic province, though the northeastern portion of the City is included in the foothills province (City of Encinitas 2010).

The coastal plains province is composed of dissected, mesa-like terraces that graduate inland into rolling hills. The terrain of the coastal plain province is underlain by sedimentary rocks composed mainly of sandstone, shale, and conglomerate beds, reflecting the erosion of the provinces to the east. The foothills province is a belt of narrow winding valleys and rolling to hilly uplands that have very few steep slopes.

## e. Geological Hazards

### *Faulting and Seismicity*

The City is in an area that is exposed to risk from multiple earthquake fault zones. The highest risks originate from the Elsinore fault zone, the Rose Canyon fault zone, and the offshore faults, each with the potential to cause moderate to large earthquakes that would cause ground shaking in Encinitas and nearby communities. Earthquake-triggered geologic effects also include surface fault rupture, landslides, liquefaction, subsidence, tsunamis, and seiches. Earthquakes can also lead to urban fires, dam failures, traffic accidents, and toxic chemical releases.

Strong ground motions can worsen existing unstable slope conditions, particularly if coupled with saturated ground conditions.

Much of the area in eastern Encinitas, mapped by the California Geologic Survey as subject to ordinary landslide, is potentially vulnerable to seismically induced slope failure. In steep areas, strong ground shaking can cause slides or rockfalls in this material. Rupture along the Rose Canyon fault zone and other faults in southern California could reactivate existing landslides and cause new slope failures throughout local hillsides.

The effects of earthquake shaking for new structures can be addressed by requiring conformance with the most current edition of the California Building Code.

The project area is within a low to moderate earthquake shaking probability zone (California Emergency Management Agency 2015). Based on published geologic maps, no active or potentially active faults cross beneath the project area. The nearest active fault, the Rose Canyon Fault, lies offshore to the west of the project area. Historically, the Rose Canyon Fault has exhibited low seismicity with respect to earthquakes in excess of magnitude 5.0 or greater.

### *Seismic Settlement and Liquefaction*

Strong ground shaking can result in liquefaction. Liquefaction, a geologic process that causes ground failure, typically occurs in loose, saturated sediments primarily of sandy composition. Areas of Encinitas susceptible to liquefaction and related ground failure (i.e., seismically induced settlement) include areas along the coastline that include Batiquitos and San Elijo lagoons. None of the housing sites are located within a mapped liquefaction seismic hazard zone.

### *Landslides and Mudslides*

Slope failures, commonly referred to as landslides, include many phenomena that involve the downslope displacement and movement of material, triggered either by static (i.e., gravity) or dynamic (i.e., earthquake) forces. Slope failures often occur as elements of interrelated natural conditions that create hazards where an adverse site condition exists, and another event or series of events, like rain or irrigation, grading, changes to drainage patterns, trigger a subsequent event such as earth movement like mudflows, slumps or landslides. Mudflows are fluid-like wet masses of suspended soil that flow downhill. Slumps are more coherent soil masses that fail along surfaces that develop due to the weakness of the materials, wetting, or a change in the shape by grading. Landslides are more typically larger scale features caused by movement along a discrete surface like a weak clay bed. Slope failure can occur on natural and man-made slopes.

The City's remaining natural hillsides and coastal bluff areas are generally vulnerable to various types of slope failures depending on location. Coastal areas in Leucadia, Old Encinitas, and Cardiff by the Sea are subject to coastal processes, but the eastern sections of these communities and including New Encinitas and Olivenhain are underlain by weaker

and adversely oriented geologic units that are more prone to slope movement like slumping and landsliding. Landslide susceptibility within the City is shown on Figure 4.5-1.

## 4.5.2 Regulatory Framework

A number of regulatory requirements and/or guidelines related to potential geologic and soils issues are applicable to future development within the HEU area. Generally, these regulatory requirements and guidelines contain standards and measures to evaluate risk and address potential hazards through design and construction techniques. Specific requirements and/or guidelines that may be applicable to future development associated with implementation of the HEU are outlined below.

### 4.5.2.1 State

#### a. Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act requires that proposed developments incorporating tracts of four or more dwelling units investigate the potential for ground rupture within Alquist-Priolo Zones. Where such zones are designated, no building may be constructed without a geologic study to determine the locations of all active fault lines in the zone. There are no Alquist-Priolo Zones in the project area.

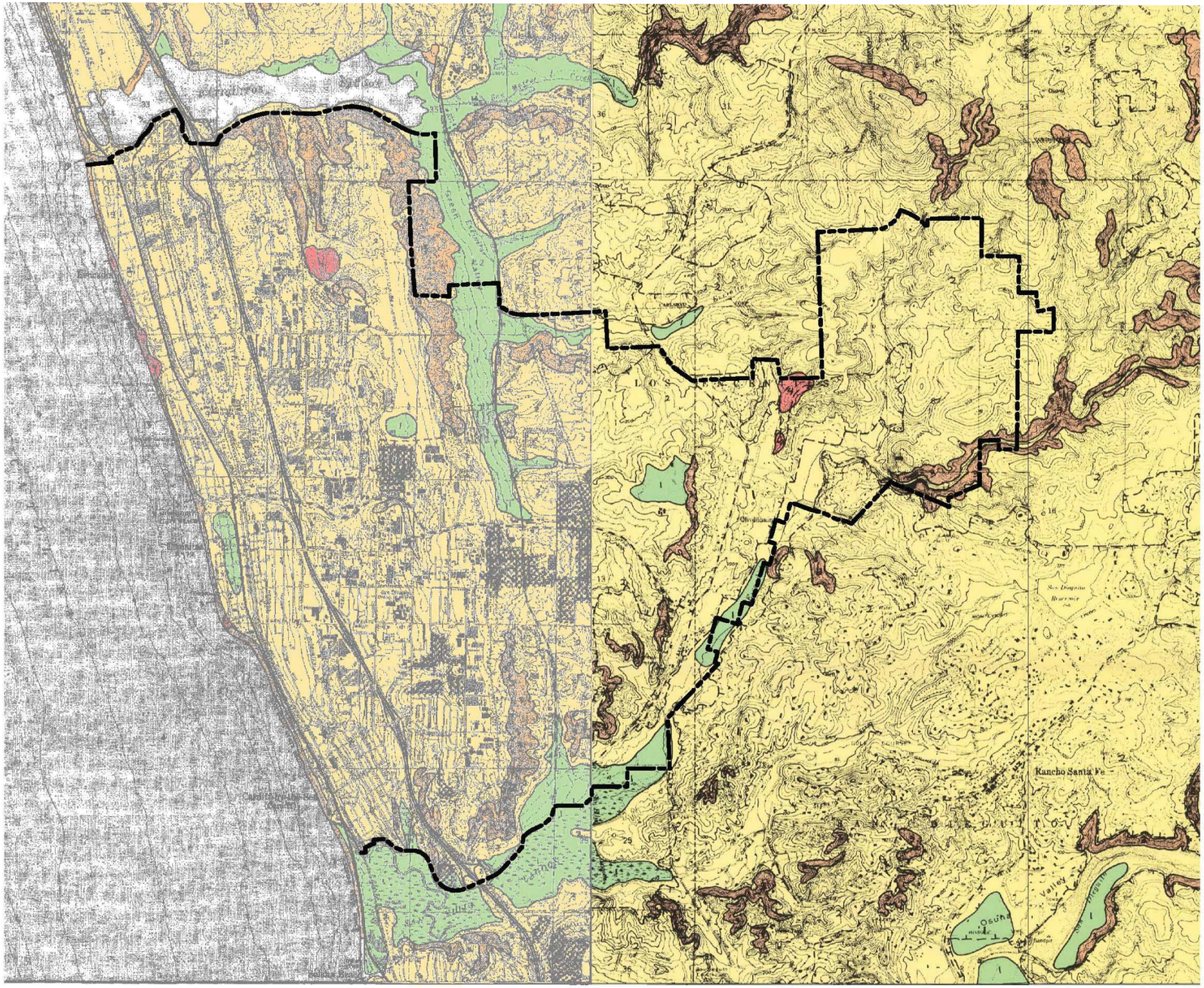
#### b. Building Code/Residential Code

Slope instability or erosion problems in the City are primarily regulated through the California Building Code (CBC) and the City of Encinitas Grading, Erosion and Sediment Control Ordinance (see below). The CBC 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. The CBC also contains design and construction regulations pertaining to seismic safety for buildings. These regulations cover issues such as ground motions, soil classifications, redundancy, drift, and deformation compatibility.

The CBC is part of the California Code of Regulations (CCR), Title 24 Part 2. The California Residential Code (CRC) will become part of the CCR, Title 24 Part 2.5. The CBC and CRC are based on the 2012 International Building Code and International Residential Code. The State updates the codes on a regular basis. It is anticipated that the next update will continue to require foundation analysis and reporting.

The CBC and CRC contain seismic safety standards outlining design and construction requirements. Development projects must show compliance with the CBC and/or CRC through the development review process. Building permits are submitted and reviewed for compliance prior to obtaining necessary construction and building permits.

Map Source: TerraCosta Consulting Group




**LANDSIDE HAZARDS IN THE ENCINITAS QUADRANGLE (Colorized)**
**SAN DIEGO COUNTY, CALIFORNIA**
**Landslide Hazard Identification Map No. 4**
**by Siang S. Tan, 1986**

**LANDSIDE HAZARDS IN THE RANCHO SANTA FE QUADRANGLE (Partial)**
**SAN DIEGO COUNTY, CALIFORNIA**
**Landslide Hazard Identification Map No. 6**
**by Siang S. Tan, 1986**

## RELATIVE LANDSLIDE SUSCEPTIBILITY

### EXPLANATION

**RELATIVE LANDSLIDE SUSCEPTIBILITY AREAS**

| 1 Least | 2 Marginally | 3 Generally | 4 Most Susceptible |
|---|---|---|---|

*Increasing Landslide Susceptibility* →

**AREA 1 -** *Least Susceptible Area. Landslides and features related to slope stability are very rare to nonexistent within this area. Included within this area are topographically low–lying valley bottoms and alluviated floodplains. Part of the area may be underlain by material that lacks the strength to support steep slopes (such as unconsolidated alluvium) but occupies a relatively stable position due to the flatness of the slope (lacks potential engergy). Also included are broad, relatively level areas along the tops of ridges underlain by resistant rock that is either exposed at the surface or covered only by shallow soil or colluvium. Land within area 1 will probably remain relatively stable unless the topography is altered radically.*

**AREA 2 -** *Marginally Susceptible Area. This area includes gentle to moderate slopes underlain by relatively competent material or colluvium that is considered unlikely to remobilize under natural conditions. Also includes ridgetops and spur crests that are underlain by relatively competent material but flanked by steep, potentially unstable slopes. The stability of slopes within area 2 may change radically in response to future natural or artificial alteration of the adjacent terrain.*

**AREA 3 -** *Generally Susceptible Area. Slopes within this area are at or near their stability limits due to a combination of weaker materials and steeper slopes. Although most slopes within area 3 do not currently contain landslide deposits, the materials that underlie them can be expected to fail, locally, when modified by natural processes or the activities of man because they are close to their stability limits. Most landslides now present in area 3 are interpreted to be in relatively more stable positions than those classified within area 4. Debris flows (also called debris avalanches or soil slips) may originate within area 3 and flow downslope, sometimes at high speeds, to impact land included within areas 1, 2, 3, or 4.*

**AREA 4 -** *Most Susceptible Area. This area is characterized by steep slopes and includes most landslides in upslope areas, whether apparently active at present or not, and slopes upon which there is substantial evidence of downslope creep of surface materials. Land within area 4 should be naturally unstable, subject to failure even in the absence of the activities of man.*

*LIMITS OF CITY OF ENCINITAS*

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FIGURE 4.5-1
Relative Landslide Susceptibility – City of Encinitas

### 4.5.2.2 Local

## a. General Plan/Local Coastal Program

Table 4.5-1 shows the goals and policies related to geology and soils from the City's General Plan.

**Table 4.5-1**
**Goals and Policies Related to Geology and Soils**

| Goal/Policy | Description |
|---|---|
| **City of Encinitas General Plan Land Use Element** | |
| Goal 8 | Environmentally and topographically sensitive and constrained areas within the City shall be preserved to the greatest extent possible to minimize the risks associated with development in these areas. (Coastal Act/30240/30253) Goal 8 amended 5111195 (Reso. 95-32) |
| 8.1 | Require that any improvement constructed in an area with a slope of more than 25% and other areas where soil stability is at issue to submit soils and geotechnical studies to the City for review and approval.<br>These studies shall document that the proposed development will not adversely affect hillside or soil stability and that no future protective measures will be required. (Coastal Act/30253) Policy 8.1 amended 5111195 (Reso. 95-32) |
| 8.5 | The City will encourage the retention of the coastal bluffs in their natural state to minimize the geologic hazard and as a scenic resource. Construction of structures for bluff protection shall only be permitted when an existing principal structure is endangered and no other means of protection of that structure is possible. Only shoreline/ bluff structures that will not further endanger adjacent properties shall be permitted as further defined by City coastal bluff regulations. Shoreline protective works, when approved, shall be aligned to minimize encroachment onto sandy beaches. Beach materials shall not be used as backfill material where retaining structures are approved. Approved devices protecting against marine waves shall be designed relative to a design wave, at least equal to 1982- 83 winter storm waves. (Coastal Act/ 30235/ 30240/ 30251/ 30253) |
| **City of Encinitas General Plan Resource Management Element** | |
| Goal 13 | Create a desirable, healthful, and comfortable environment for living while preserving Encinitas, unique natural resources by encouraging land use policies that will preserve the environment. (Coastal Act/30250/30251) |
| 13. 1 | The City shall plan for types and patterns of development which minimize water pollution, air pollution, fire hazard, soil erosion, silting, slide damage, flooding and severe hillside cutting and scarring. (Coastal Act/30250) |
| Goal 14 | The City shall stringently control erosion and sedimentation from land use and development to avoid environmental degradation of lagoons and other sensitive biological habitat, preserve public resources and avoid the costs of dealing with repair and sedimentation removal. (Coastal Act/30231/30240/30250/30253) |
| 14. 1 | The best strategy to reduce erosion and sedimentation is to reduce to the maximum extent feasible, grading and removal of vegetation. It is the policy of the City that, in any land use and development, grading and vegetation removal shall be limited to the minimum necessary. (Coastal Act/30240/30250) |

**Table 4.5-1**
**Goals and Policies Related to Geology and Soils**

| Goal/Policy | Description |
|---|---|
| 14. 3 | The City will reduce the rate of sedimentation of the lagoons by requiring procedures for controlling runoff and erosion associated with upland grading and development based on a minimum 10-year, six-hour storm event. The City shall provide regulations for the use of sedimentation basins and the potential transfer of sediment as beach replenishment (if of an acceptable material). (Coastal Act/30250/30251) |
| 14. 4 | Revegetation and appropriate landscaping of all areas graded and scraped of vegetative cover shall be required with land use and development. Plantings, hydroseeding, and irrigation systems used shall be selected on the bases of minimizing erosion and conserving water. (Coastal Act/30251) |
| 14. 5 | To minimize erosion and allow sedimentation control systems to work, no grading or vegetation removal shall be allowed to occur during the wet season, October 1 April 15, without all systems and devices per an approved erosion control plan and program being in place. During other times of the year such systems shall be provided and operative as required by a comprehensive City erosion control ordinance. No grading shall occur during the rainy season within the Special Study Overlay area, or in areas upland of sensitive areas including lagoons, floodplains, riparian or wetland habitat areas, unless by site- specific determination, the grading would not be occurring on sensitive slopes, in floodplain areas or upland of floodplains, where sedimentation might occur in other sensitive habitat areas. Then, if grading is determined to be allowable, all necessary erosion control devices, including sedimentation basins, must be in place, and shall be monitored and maintained throughout the grading period. (Coastal Act/30251) |
| 14. 6 | To achieve the ends of erosion control, a comprehensive erosion control plan shall be required with final building permit and improvement plans, subject to review and approval prior to commencement of grading and construction. (Coastal Act/30251) |
| 14. 7 | Minimize extensive or premature grading or filling, and penalize illegal grading or filling. |

SOURCE: City of Encinitas 1989, as amended.

## b. Multi-Jurisdictional Hazard Mitigation Plan

In 2010, San Diego County and 18 local jurisdictions, including the City, adopted the Multi-Jurisdictional Hazard Mitigation Plan (MHMP). The MHMP is a countywide plan that identifies risks and ways to minimize damage by natural and manmade disasters. The MHMP is a comprehensive document that serves many purposes, including creating a decision tool for management, promoting compliance with state and federal program requirements, enhancing local policies for hazard mitigation capability, and providing inter-jurisdictional coordination. Member agencies work together to update the MHMP every five years. As of this writing, the plan is currently being reviewed and revised to reflect changes to both the hazards threatening San Diego as well as the programs in place to minimize or eliminate those hazards.

The City's specific hazard mitigation goals, objectives, and related potential actions for earthquake hazards are included in the MHMP (County of San Diego Office of Emergency Services and Unified Disaster Council 2010).

## c. City of Encinitas Jurisdictional Runoff Management Program

The Jurisdictional Runoff Management Plan (JRMP) is the City of Encinitas's approach to improving water quality in its creeks, lagoons, and the ocean through reducing discharges of pollutants to the municipal separate storm sewer system (or storm drain system). The JRMP is discussed in Section 4.8, Hydrology and Water Quality.

## d. Municipal Code

### *Grading, Erosion, and Sediment Control Ordinance*

The City of Encinitas Grading, Erosion, and Sediment Control Ordinance (Ord. 94-06; Municipal Code Chapter 23.24.010) establishes minimum requirements for grading, excavating, and filling of land, to provide for the issuance of grading permits and to provide for the enforcement of the requirements. This ordinance was adopted pursuant to, and to implement provisions of, the General Plan and certified Local Coastal Program Land Use Plan (LUP). It is the intent of the City to protect life and property and promote the general welfare; enhance and preserve the physical environment of the community; and maintain the natural scenic character of the City. The provisions of this Ordinance shall be administered to achieve, to the extent possible, appropriate goals and policies of the General Plan/LUP. Key provisions include, but are not limited to, the following:

- Section 23.24.140, which requires that a grading plan be prepared and signed by a California registered civil engineer and if a soils and geology report is required, the grading plan shall also be signed by a registered soils engineer and a certified engineering geologist.

- Sections 23.24.150 and 23.24.160, which require an interim and final erosion and sediment control plan to be included as part of the grading plan by a California registered civil engineer with respect to conditions existing on the site during land disturbing or filling activities or soil storage and the conditions existing on the site after final structures and improvements (except those required under this section) have been completed and where these final structures have not been covered by an interim plan

- Section 23.24.170, which states that a soil engineering report, when required by the City Engineer, shall be prepared and certified by a California registered soils engineer and shall be based on adequate and necessary test borings.

- Section 23.24.180, which requires the preparation of an engineering geology report in accordance with Ordinance 2008–03. In addition to a soils report, an engineering geology report will be required when the City Engineer determines that the proposed development is located within an existing or a potential geologic hazardous

area. Geological hazardous area is referred to as areas subject to landslide, faulting, or other hazards identified by the City Engineer. The report shall be prepared by a California certified engineering geologist and California certified civil engineer or geotechnical engineer and shall be based on adequate and necessary test borings.

### e. Hillside/Inland Bluff Overlay Ordinance

The Hillside/Inland Bluff Overlay Ordinance regulations apply to all areas within the Special Study Overlay Zone where site-specific analysis indicates that 10 percent or more of the area of a parcel of land exceeds 25 percent slope. The Planning Commission is the authorized agency for reviewing and granting discretionary approvals for proposed development within the Hillside/Inland Bluff Overlay Zone. Where development is proposed on slopes of greater than 25 percent grade, the following additional standards apply:

- Slopes of greater than 25 percent grade should be preserved in their natural state.
- A geological reconnaissance report must be submitted.
- Where unstable conditions are indicated, a preliminary engineering geology report is also required.
- No principal structure or improvement or portion thereof shall be placed or erected, and no grading shall be undertaken, within 25 feet of any point along an inland bluff edge.
- All slopes over 25 percent grade which remain undisturbed or which are restored or enhanced as a result of a development approval, shall be conserved as a condition of that approval through a deed restriction, open space easement, or other suitable device that will preclude any future development or grading of such slopes.

## 4.5.3 Significance Determination Thresholds

Consistent with Appendix G of the CEQA Guidelines, impacts related to geology and soils would be significant if the HEU project would:

1. Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

    a. Rupture of a known earthquake fault, as delineated on the most recent Alquist Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42);

    b. Strong seismic ground shaking;

    c. Seismic-related ground failure, including liquefaction; or

    d. Landslides; or

2. Result in substantial soil erosion or the loss of topsoil;

3. Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse;

4. Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

## 4.5.4 Methodology

### 4.5.4.1 Sources

A review of secondary source information was completed to determine potential geologic hazards present within or adjacent to the housing sites, including the 2010 Final Existing Conditions Report.

### 4.5.4.2 Future Project Implementation

As noted previously in this chapter, for housing sites containing steep slopes within the Hillside/Inland Bluff Overlay Zone, the City of Encinitas Municipal Code requires a slope and impact analysis. In these instances, the City would review project applications for compatibility, applicable requirements for hillside/inland bluff overlay protection, and require specific conditions as part of the approval process. Additionally, the Municipal Code requires preparation of a soils study and/or engineering geology report when hazardous geologic conditions are present. Adoption of the HEU floating zone would not alter the City's adopted discretionary review process.

Redevelopment of any of the housing sites may occur with or without implementation of the HEU floating zone. The floating zone gives a property owner a choice whether to opt into the housing plan, or forgo doing so and retain their existing zoning rights. Depending on the category of the existing zoning, different levels of development or reconstruction activities are already permitted on the housing sites.

The impact analysis below describes the type and magnitude of the environmental impacts of future development on the housing sites and how such impacts would affect the existing environment. Future development has the potential to impact geologic and soil resources. The analysis in the following section identifies significant impacts and a mitigation framework for future projects. Subsequent "by right" development within the new floating zone district created through the HEU would not be subject to further CEQA review to analyze project-level impacts on geologic and soil resources, unless otherwise noted. Compliance with development standards required for "by right" development as well as the mitigation framework identified in this PEIR would serve to minimize the potential for significant impacts associated with implementation of the HEU.

## 4.5.5 Issue 1: Seismic Hazards

*Impacts related to geology and soils would be significant if the project would expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:*

*a. Rupture of a known earthquake fault, as delineated on the most recent Alquist Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault (refer to Division of Mines and Geology Special Publication 42);*

*b. Strong seismic ground shaking;*

*c. Seismic-related ground failure, including liquefaction; or*

*d. Landslides.*

### 4.5.5.1 Impacts

#### a. Housing Sites

There are no active faults near any of the housing sites; however, the project area is subject to seismic activity from the San Andreas fault to the east and the parallel fault systems of the Elsinore to the east, as well as the offshore Rose Canyon and Coronado Bank faults. Seismic hazards affecting the project area may include ground acceleration (shaking), liquefaction, and earthquake-induced landslides.

The HEU does not propose the construction of new housing or other development; rather, it provides capacity for future development consistent with State Housing Element Law. However, it is acknowledged that future development within the proposed housing sites would involve the construction of two to three-story structures in a seismically active area. While surface rupture from a known fault is unlikely to occur, all lands in the City including the proposed housing sites would likely experience moderate ground shaking as a result of earthquakes occurring on off-site faults. Earthquake-related ground shaking may cause concrete slabs, building walls, and pavement at the sites to crack, potentially threatening the integrity of the structures and the safety of the people present at the time of the earthquakes. Moreover, ground motions have the potential to initiate secondary events such as differential compaction, liquefaction, and seismically induced flooding and landslides, all of which could also threaten the integrity of the structures and safety of the people present on the sites. However, seismic-related risks may be reduced through the redevelopment of housing sites, on which existing improvements, especially older structures, do not meet current foundation or improvements standards.

The potential hazards of differential compaction, liquefaction, and seismically induced flooding at the housing sites are all low during a large earthquake. However, areas of loose soil or fill within the housing sites may be subject to seismically induced settlement or liquefaction and seismically induced landslides are possible in areas of steep topography

(discussed below under Issue 3). Housing sites that have been identified as containing steep slopes include: NE-3, NE-7, OE-4 and OE-7.

General Plan Policy 8.1 requires that soils and geotechnical studies be prepared for development on any site containing slopes in excess of 25 percent gradient. The Hillside/Inland Bluff Overlay Ordinance regulations would apply to housing sites containing slopes of greater than 25 percent grade, requiring a geological reconnaissance report and, where unstable conditions are indicated, a preliminary engineering geology report. The City's Grading, Erosion and Sediment Control Ordinance requires that an engineering geology report be prepared for proposed developments located within an existing or a potential geologic hazardous area, including those areas subject to landslide, faulting, or other hazards, as determined by the City engineer. In addition, HEU Policies 3.2, 3.7, and 3.10 would be implemented in conjunction with future projects, including the enforcement of building codes and standards (Policy 3.2), and those for developing on steep slopes (Policies 3.7 and 3.10; see Section 3.4.1.1)

Implementation of General Plan Land Use Policy 8.1; and compliance with City ordinances, the CBC, engineering standards and codes; and future site-specific geotechnical reports, would reduce risks of seismic hazards in conjunction with future development. Additionally, the typical site constraints for steep slopes would limit development potential and the potential for slope failure and landslides. Therefore, the existing regulatory process and policy framework (i.e. the General Plan policies and HEU Policies 3.2, 3.7, and 3.10), results in a future outcome where potential impacts associated with seismic hazards would be less than significant.

### b. Housing Strategy Summaries

Development of the housing sites in housing strategy 1 – Ready Made (RM)), housing strategy 2 - Build Your Own (BYO) and housing strategy 3 - Modified Mixed Use Places (MMUP) has the potential to result in impacts associated with loss, injury, or death involving seismic hazards. Relative to the project overall, there would be no inherent differences in impacts among the housing strategies. Impacts resulting from the three housing strategies would be less than significant.

## 4.5.5.2 Significance of Impacts

Adherence to the CBC; City of Encinitas Grading, Erosion, and Sediment Control Ordinance; General Plan policies related to geology and soils; HEU policies (specifically 3.2, 3.7, and 3.10); and implementation of any recommendations described in a subsequent project's geotechnical investigation would avoid or reduce potentially significant seismic and geological impacts to below a level of significance.

## 4.5.6 Issue 2: Soil Erosion

*Impacts related to geology and soils would be significant if the project would result in substantial soil erosion or the loss of topsoil.*

### 4.5.6.1 Impacts

#### a. Housing Sites

The HEU does not propose the construction of new housing or other development; it provides capacity for future development consistent with State Housing Element Law. The housing sites are susceptible to erosion from runoff (slopewash), including runoff along steep slopes. Future development would involve vegetation removal, grading, and potentially earth excavation, which would expose soils and increase the potential for soil erosion from wind or storm water runoff. Buildout of the housing sites would have the potential to result in short-term soil erosion during construction activities; especially on sites with steeper slopes. Grading activities associated with future development would disrupt soil profiles, thereby resulting in an increased exposure of soils to wind and rain, which are erosive forces. Erosion on drainage slopes could cause downstream sedimentation impacts. Other related impacts resulting from substantial short-term erosion or loss of topsoil include topography changes and the creation of impervious surfaces in the project area.

As part of the future development permitting process, adherence to the City's Grading, Erosion, and Sediment Control Ordinance; CBC; and the National Pollutant Discharge Elimination System (NPDES) General Construction Permit (as discussed in Section 4.8) would be required. Conformance with these requirements would ensure that future grading and construction operations would avoid significant soil erosion impacts. In accordance with the NPDES General Construction Permit, a storm water pollution prevention plan (SWPPP) is required to consider the full range of erosion control best management practices, including any additional site-specific and seasonal conditions. Project compliance with NPDES requirements would reduce the potential for substantial erosion or topsoil loss to occur in association with future housing site development.

General Plan policies listed in Table 4.5-1 contain provisions related to soil erosion. Implementation of these policies; compliance with the CBC; City ordinances; engineering standards and codes; and site-specific SWPPP would reduce impacts related to soil erosion. Therefore, through compliance with the existing regulatory process and General Plan policies, potential soil erosion impacts associated with future housing site development would be less than significant.

#### b. Housing Strategy Summaries

The Ready Made, (Housing Strategy No. 1), Build Your Own (Housing Strategy No. 2) and Modified Mixed Use Places (Housing Strategy No. 3) would result in soil erosion from future construction activities associated with development of the housing sites. Overall,

there would be no inherent differences in impacts among the housing strategies. Impacts resulting from the three housing strategies would be less than significant.

#### 4.5.6.2 Significance of Impacts

Adherence to the CBC; City Grading, Erosion, and Sediment Control Ordinance; General Plan policies concerning soil erosion; and implementation of any recommendations described in subsequent project's SWPPP would avoid or reduce potentially significant soil erosion impacts to below a level of significance.

### 4.5.7 Issues 3 and 4: Unstable and Expansive Soils

*Impacts related to geology and soils would be significant if the project would:*

- *Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse; or*

- *Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.*

#### 4.5.7.1 Impacts

##### a. Housing Sites

As discussed above, the project area contains fine-grained (clay) soils that are moderately to highly expansive. These materials may be present at the surface or exposed by grading activities. No areas of high liquefaction potential occur on the housing sites.

The project area contains steep slopes and formations that may be landslide-prone. Several housing sites have been identified as containing steep slopes. Future development within landslide-prone formations represents a potentially significant impact to buildout of the housing sites. Compressible and expansive soils in the City form a mild to moderate potential impact on development, which can result in the movement and/or cracking of structures.

Future development of housing sites would be required to comply with local, state, and federally mandated grading and construction requirements, including, but not limited to the CBC and City Grading, Erosion, and Sediment Control Ordinance. The City's Grading, Erosion, and Sediment Control Ordinance requires that an engineering geology report for proposed development located within an existing or a potential geologic hazardous area as determined by the City Engineer.

General Plan Land Use Policy 8.1 contains provisions related to soil stability. The Hillside/Inland Bluff Overlay Ordinance regulations would apply to housing sites containing slopes of greater than 25 percent grade, requiring a preliminary engineering

geology report where unstable conditions are indicated. Implementation of General Plan Land Use Policy 8.1; compliance with City ordinances and the CBC; City ordinances and engineering standards; and a site-specific geotechnical report would help minimize risks in conjunction with future development related to soil stability. Therefore, through existing regulatory processes and General Plan policies, potential impacts related to unstable or expansive soils in the project area would be less than significant.

### b. Housing Strategy Summaries

The Ready Made, (Housing Strategy No. 1), Build Your Own (Housing Strategy No. 2) and Modified Mixed Use Places (Housing Strategy No. 3) may expose people or structures to potential substantial adverse effects involving unstable or expansive soils. Overall, there would be no inherent differences in impacts among the housing strategies. Impacts resulting from the three housing strategies would be less than significant.

## 4.5.7.2 Significance of Impacts

Adherence to the CBC; City of Encinitas Grading, Erosion, and Sediment Control Ordinance; the City's General Plan policies; and implementation of any recommendations described in a site-specific geotechnical investigation would avoid or reduce potentially significant impacts related to unstable or expansive soils to below a level of significance.