3.8 Geology and Soils

This section provides background information regarding the hazards relating to the geology and soils present within the County, the regulations and programs relating thereto, and an assessment of the potential impacts of implementing the proposed General Plan Update. No specific key policy issues relating to geology and soils conditions have been identified through the General Plan Update process. Existing geology and soils conditions are described in Chapter 10: Geologic, Seismic, and Soil Hazards, of the *Natural Resources and Hazards Report*, September 2002 (Appendix D), which includes a discussion of bedrock geology and geologic hazards in the County. This report, which is available for review at the Planning Division public counter at 3015 H Street in Eureka during normal business hours, or for download at http://humboldtgov.org/571/Background-Reports, is incorporated herein by reference, and summarized below. Where any discrepancies may exist between the referenced material and the material presented here, the material presented here should be considered as the most up to date and is to be relied upon for the environmental setting and analyses.

3.8.1 Geology and Soils - Environmental and Regulatory Setting

Geologic, Seismic, and Soil Hazards

Humboldt County is located within a seismically active area of California. The County is located within the two highest seismic risk zones of the California Uniform Building Code. Cape Mendocino (offshore of the County) experiences the highest concentration of earthquake events in the continental United States. In addition to causing ground shaking, an earthquake can trigger other natural disasters such as fire, landslides, and flooding, resulting in loss of life and property damage. Seismic hazards in the County include earthquake ground shaking, surface fault rupture, liquefaction, and tsunami potential in the coastal zone areas. Geologic hazards that are not specifically related to earthquakes include landslides and unstable soils.

Bedrock Geology

Two geologic provinces cover Humboldt County: the dominant Coast Ranges province in the central and southwest sections of the County, and the Klamath Mountains province in the northeast. The Coast Ranges province is comprised mainly of the Franciscan complex inland, sand, and other alluvial deposits located closer to the coast. The Klamath Mountains is comprised generally of older rocks, many of which are sedimentary (e.g., sandstone, chert, slate, and schist). The South Fork Mountain Ridge generally divides the two provinces. The predominant rock types are the Franciscan Complex and schists, covering over a million acres in the County, and the Tertiary-Cretaceous Coastal Belt rocks, covering 340,000 acres. The Franciscan Complex is a suite of rocks that originated on the deep sea floor and were later pushed up against the continental margin along the coast of California through plate tectonic forces. The following paragraphs summarize the geology of each planning watershed. Additional geologic data is provided for the planning watersheds in Volume II of the Natural Resources and Hazards report.

Eel River Basin. The Eel River basin is a mountainous area uplifted in the post-Miocene era and underlain by a deformed, faulted, locally sheared and, in part, metamorphosed accumulation of subducted continental margin deposits. About 99 percent of the bedrock underlying the basin is sedimentary and metasedimentary.

The four planning watersheds in the Eel River Basin (South Fork Eel, Lower Eel, Middle Main Eel, and Van Duzen) are generally comprised of highly erodible rocks, including substantial amounts of Franciscan Complex rocks. Over 85 percent of the Middle Main Eel and 65 percent of the Van Duzen are Franciscan Complex. The Lower Eel and South Fork Eel planning watersheds contain some Coastal Belt rocks. Both the Lower Eel and South Fork Eel are comprised of over 50 percent Cenozoic Sedimentary rocks.

Klamath-Trinity Basin. The Klamath-Trinity Basin, composed of the Lower Klamath, Lower Trinity, and South Fork Trinity planning watersheds, is the only basin with notable amounts of plutonic and metavolcanic rocks. The Humboldt County portion of the basin encompasses the North Coast Ranges province. In the North Coast Ranges, landslides and soil slips are common due to the combination of sheared rocks, shallow soil profile development, steep slopes, and heavy seasonal precipitation. In addition, both the Lower Klamath and South Fork Trinity have substantial amounts of Franciscan Complex rocks. Jurassic marine sediments are the predominant bedrock type in the Lower Trinity planning watershed.

Mad-Redwood Basin. The geology of the Mad-Redwood Basin is complex and variable. The basin includes the Mad River, Redwood Creek, Eureka Plain, and Trinidad planning watersheds which all differ in their bedrock composition. Mad River, Redwood Creek, and Trinidad are composed primarily of Franciscan rock types, while Eureka Plain is mostly younger sedimentary rock.

Cape Mendocino. About 90 percent of the Cape Mendocino planning watershed is underlain by Tertiary-Cretaceous Coastal Belt rock. A highly active tectonic setting, combined with sensitive terrain and high rainfall amounts, make Cape Mendocino one of the most erodible watersheds in the state.

Seismic Hazards

Primary seismic hazard concerns include potential ground shaking and ground rupture along the surface trace of faults. Secondary seismic hazards are caused by the interaction of ground shaking with soft or unstable soils, resulting in liquefaction, settlement, and landslides. Tsunamis are also addressed in this section, as a secondary effect of seismic activity.

Faulting and Surface Rupture. A fault is a fracture in the crust of the earth along which rocks on one side have moved relative to those on the other side. Most faults are the result of repeated displacements over a long period of time. A fault trace is the line on the earth's surface defining the fault. Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. Not all earthquakes result in surface rupture. For example, the Loma Prieta Earthquake of 1989 caused major damage in the San Francisco Bay Area but the movement deep in the earth did not break through to the surface.

Fault rupture usually follows preexisting faults, which are zones of weakness. Rupture may occur suddenly during an earthquake or slowly in the form of fault creep. Sudden ruptures are more damaging to structures because they are accompanied by shaking.

The offshore and coastal regions of Humboldt County contain one of the most geologically complex areas in California. Three major faults, including the San Andreas, the Mendocino fracture zone, and the southern end of the Cascade subduction zone, all meet in what is known as a "triple junction." Three major plates of the Earth's surface are defined and separated by these three faults: Pacific plate, Gorda plate, and North American plate. As a result of this unique geologic setting, the North Coast is vulnerable to several types of earthquakes from a variety of sources. Because a triple junction has to accommodate plate motion in several directions, its faulting is varied and its seismicity is high. The geometry of the triple junction renders it unstable, resulting in a likelihood that it will change with time. Because much of this area lies under the Pacific Ocean, geological information is limited.

Surface fault rupture is a particular type of seismic hazard that is specifically addressed by the California Alquist-Priolo Earthquake Fault Zoning Act. This act generally requires disclosure and avoidance. Humboldt County has a number of fault zones mapped under this law. The County utilizes a combining zone designation (G) to identify areas where special geologic study is required to identify the precise location of active fault traces to ensure structures for human occupancy are not placed astride them.

The Alquist-Priolo Special Studies Zones Act of 1972 is the primary state legislation related to earthquake fault zones. The Act seeks to reduce fault rupture hazards by regulating development near active faults and preventing construction of buildings used for human occupancy on the surface trace of active faults. According to the Act, no buildings intended for human occupancy may be constructed on or within 50 feet of an active fault trace. For the purposes of the Act, an active fault is one that has ruptured in the last 11,000 years. Surface rupture is the most easily avoided seismic hazard. The Act only addresses the hazard of surface fault rupture and is not directed toward other earthquake hazards. The designated zone extends 200 to 500 feet on both sides of known active fault traces. Development proposed within an Alquist-Priolo zone is subject to a detailed geologic investigation.

Seismicity. The County is located within the two highest of five seismic risk zones specified by the California Uniform Building Code, and offshore Cape Mendocino has the highest concentration of earthquake events anywhere in the continental United States. The area near Cape Mendocino is a complex, seismically active region, where three crustal plates—the Pacific Plate, the Gorda Plate, and North American Plate—intersect to form the Mendocino Triple Junction.

The Juan de Fuca Plate, Gorda Plate, and Explorer Plate subducting beneath the North American Plate, form the Cascadia Subduction Zone, which runs offshore of Humboldt and Del Norte Counties north through Oregon and Washington states. Recent investigations have shown that this system has moved in unison in a series of great earthquakes (magnitude 8 to 9) over the last 20,000 years, most recently about 300 years ago, with events occurring at 300–500 year intervals.

The following is a brief description of each of the major fault zones that are present in Humboldt County from the Natural Resources and Hazards Report:

> San Andreas Fault. The San Andreas Fault system is located south of the triple junction (just offshore of the southern section of the County), where the Pacific plate is moving at a rate of about two inches per year to the northwest (relative to North America). The irregular sliding motion, which is almost entirely horizontal, deforms the rocks along the plate boundary until the rocks can no longer withstand the strain. Then, when the rocks shift, energy is released along the fault, causing earthquake shaking.
>
> Falor-Korbel (Mad River) Fault. This fault zone trends northwest to southeast through the central region of the County. Its northern end is on the coast near McKinleyville and the fault trace roughly parallels the Mad River.

Trinidad and Big Lagoon Faults. The Trinidad Fault is located near Trinidad, extending northwest to the coast near Trinidad State Beach. The Trinidad fault is potentially capable of generating an earthquake with a moment magnitude of 7.3. The Big Lagoon fault bisects Big Lagoon, north of Patrick's Point State Park.

Cascadia Subduction Zone. The forces are very different north of the triple junction, where the Gorda plate and its northern extension, the Juan de Fuca plate, collide with the North American plate. The Gorda plate slowly descends beneath the North American plate along the Cascadia Subduction Zone that extends approximately 750 miles north to the Canadian border. It is the first of a string of subduction zones to ring the Northern Pacific. Downward and eastward motion of the Gorda plate along this subduction zone dates back to at least 6 million years ago and continues today; this movement produced the volcanic Cascade Range in Washington, Oregon, and northern California.

Near its southern end, the subduction zone curves onshore, exposing nine major thrust faults along the Humboldt County coastline in the vicinity of Cape Mendocino. Thrust faults differ from the horizontally moving San Andreas Fault. Geologists have shown that during the last million years, the rocks on top of this group of North Coast thrust faults have been pushed a mile or more to the northeast relative to the rocks beneath.

The major active fault zones in the Humboldt area include the Cookskie and Petrolia shear zones. The Cookskie shear zone is a poorly defined section of sheared and broken rock that extends easterly from Punta Gorda. The Petrolia shear zone is a similar structure extending southeast through Petrolia along the Mattole River.

Until recently, scientists did not consider the Cascadia Subduction Zone a major earthquake threat. Prior to the April, 1992 Cape Mendocino earthquake, the Cascadia plate boundary was not known to have produced a major earthquake during the past 150 years. New evidence, however, indicates that the subduction zone is active and capable of producing great earthquakes (magnitude 8 to 9). Great earthquakes may occur as often as every 300 or 400 years, on average. There is good evidence that the last great earthquake on the Cascade subduction zone occurred about 300 years ago. However, the probability of such an earthquake occurring in the next few decades has not been estimated.

The above described seismic setting has the potential to cause significant ground shaking, leading to: (1) a serious liquefaction and subsidence hazard, particularly around the muds and sands of Humboldt Bay; (2) a nearshore tsunami striking the coast within 15 minutes of ground-shaking; (3) a significant landslide hazard countywide; and (4) surface fault rupture along the San Andreas, and possibly along the Little Salmon and Mad River Fault zones, and other active or potentially active faults in the County.

Since 1997, the California Uniform Building Code has required that in Seismic Zone 4 (most of Humboldt is in this zone), each listed ground motion fault shall be assigned a near-source seismic factor, to be used in building design. Applying these factors to building construction substantially increases building strength, and for large multi-story buildings, cost. In Humboldt County, there are "A" and "B" designated fault zone areas, with "A" zones (including the San Andreas and Little Salmon Faults) having more stringent design requirements.

Ground Shaking and Structural Damage. The fault systems in Humboldt County are historically very active with movement on the fault occurring in the last 200 years according the Natural Resources and Hazards Report, "Ground Shaking and Structural Damage", Page 10-12), and thus are considered to have the potential to cause future earthquakes, surface rupture, and ground failure. Surface rupture is the direct effect of activity along an active fault. However, most damage to structures is caused by ground shaking, which may occur throughout a wide area (not just along the fault line). A logarithmic scale is used to measure earthquake magnitude, where each unit of measurement represents an increase of about 30 times in the energy released. Figure 3.8-1, Probabilistic Ground Shaking, shows the areas within Humboldt County that are more likely to experience high levels of ground acceleration, or shaking, during a seismic event over the next 50 years.

About 25 percent of all earthquake energy released in California during historic times has occurred along the Humboldt County coast. The size, location, and frequency of past earthquakes indicate what to expect in the future. Strong earthquakes with epicenters onshore have recurred about every 20 years.

Recent earthquake activity includes several large-scale events in the Cape Mendocino area. In 1992, three powerful earthquakes rocked the Cape Mendocino area (magnitudes 7.1, 6.6, and 6.7). Injuries and damage occurred in the nearby towns of Ferndale, Petrolia, Fortuna, Rio Dell, and Scotia, and the earthquakes were felt as far north as southern Oregon and over much of northern California. The earthquakes ranged in magnitude from 6.2 to 6.9. A magnitude 6.5 earthquake occurred in January 2010 causing tens of millions of dollars in structural damage in Humboldt County, largely in the City of Eureka.

Ground shaking is responsible for most loss of life and property damage during an earthquake and therefore it is important to accurately evaluate shaking hazards as a basis for improving building designs and standards. Shaking intensity depends on distance from the earthquake source and on local ground conditions (soil type plus slope). In addition to faults, the presence of soft sediments in the area around Humboldt Bay contributes to higher intensity ground shaking.

Recent work by the United States Geological Service (USGS) on ground shaking severity has led to the preparation of new building codes for some areas. State regulations regarding seismic hazards are contained in Title 24, Part 2, of the California Uniform Building Code. Recordings conducted during the 1989 Loma Prieta earthquake confirmed previous USGS projections that ground shaking is much more violent on soft sediments than on bedrock. According to the USGS, these records provided a firm basis for revising building codes to reflect the need for extra strength in structures built on soft ground. Because earthquake-resistant design and construction are essential to reducing earthquake losses, these Code revisions are a major step toward greater earthquake safety.

The extent of structural damage from ground shaking depends on several factors, including geology of the area (e.g., soil types), duration and intensity of the fault movement, and structure design and construction characteristics. Buildings most vulnerable to ground shaking damage are older, unreinforced masonry buildings. Reinforced concrete structures constructed under less stringent building codes (prior to 1965) have a much higher chance of fracturing. Single-family homes constructed of wood frames are one of the safest building types. Their ability to withstand large earthquakes can be further improved with foundation bolts, shear walls, and other strengthening devices.

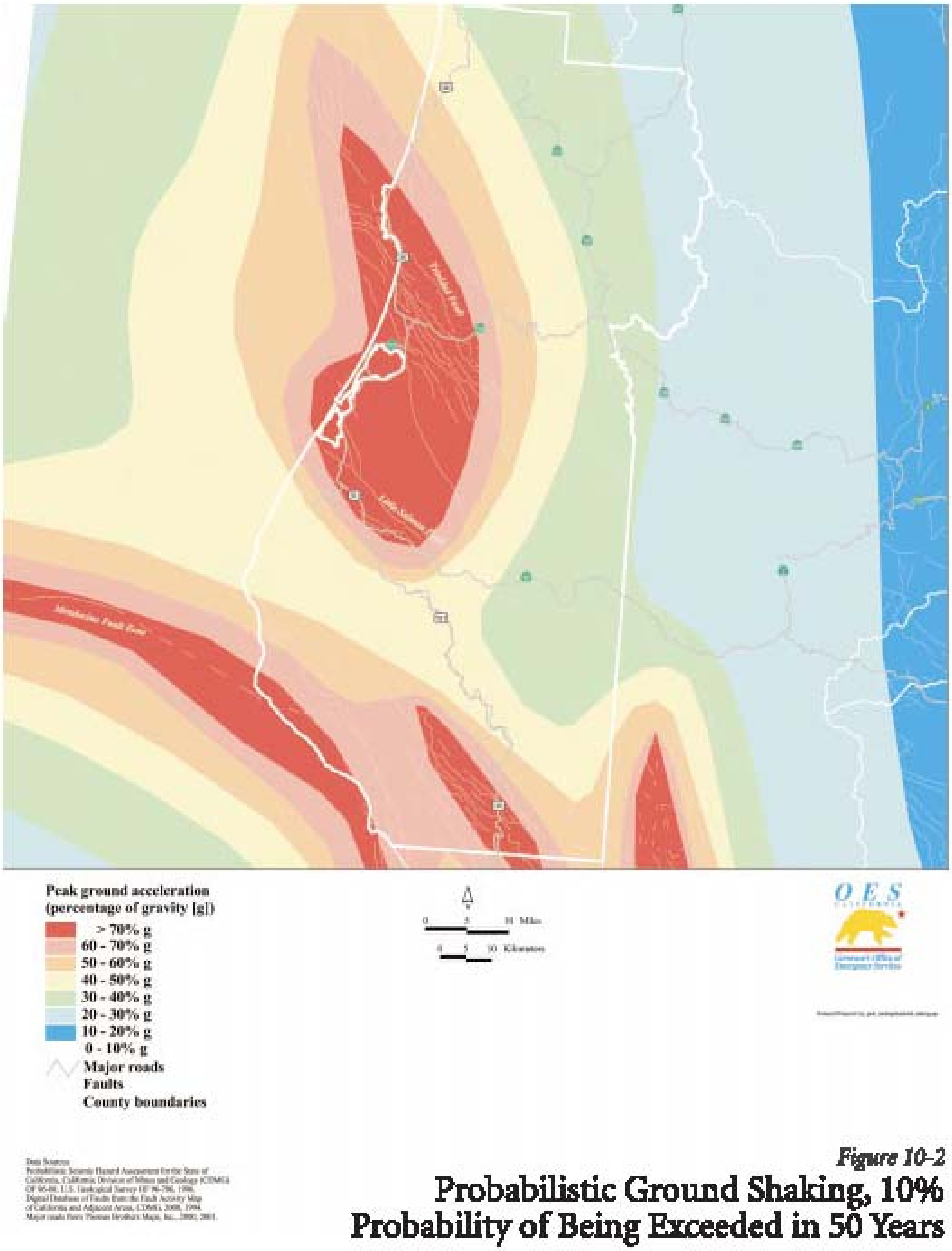
Liquefaction. Ground shaking gives rise to two secondary natural hazards, liquefaction and landsliding (landslides are discussed under Soil and Slope Hazards below). When shaken strongly, unconsolidated sandy deposits that are saturated with water can liquefy and form a slurry. This process is called "liquefaction." Liquefaction involves a sudden loss in strength of a water-saturated soil, and results in temporary transformation of the soil into a fluid mass. The soil loses its capacity to bear the weight of buildings or to resist flowing downslope, even on nearly flat ground. Liquefaction may result in sinking, tilt, distortion, or destruction of buildings and bridges, rupture of underground gas lines and water mains, and cracking and spreading of the ground surface. To mitigate such hazards, soils engineering investigations can be required to determine appropriate foundation and building design.

Liquefaction potential depends on groundwater depth and alluvial thickness. Correspondingly, recent alluvial floodplain soils exhibit the highest liquefaction hazard. Research into the process and consequences of liquefaction in past earthquakes has linked liquefaction to hydrologic and geologic settings that are characterized by water-saturated, cohesionless, granular materials situated at depths of less than 50 feet. The following types of areas are identified as being favorable for liquefaction:

- Areas known to have experienced liquefaction during historic earthquakes.
- Areas of uncompacted fills containing liquefaction-susceptible-material that are saturated, nearly saturated, or may be expected to become saturated. Areas where sufficient existing geotechnical data and analyses indicate that the soils are potentially liquefiable.
- Areas containing young (less than 15,000 years) soils where there is limited or no geotechnical data.

Specific areas of high liquefaction potential are located near Humboldt Bay, coinciding with the presence of the bay's muds and sands.

Figure 3.8-1. Probabilistic Ground Shaking, 10 Percent Probability of Being Exceeded in 50 Years, 2002 Natural Resources and Hazards Report.



Tsunamis. A tsunami, or large sea wave, may be produced by movement of the ocean floor resulting from either a nearby or distant earthquake. Tsunamis (and storm surges) are coastal flooding concerns; although rare, they are potentially catastrophic events. Tsunamis have historically been rare in California. Since 1812, California has experienced fifteen tsunamis with wave heights greater than three feet. Seven of these were destructive and eleven initiated from distant earthquakes near Alaska, Chile and Japan. The worst damage in California resulted from the 1964 Alaskan earthquake, some 1,500 miles away. The earthquake generated a tsunami that caused 12 deaths and severely damaged the harbor area at Crescent City in Del Norte County.

A tsunami resulting from the April 1992 Cape Mendocino earthquake reached Eureka in about 20 minutes, with wave heights of about one foot. The tsunami reached Crescent City in 50 minutes and was detected in Oregon, the San Francisco Bay Area, Santa Barbara, and Hawaii. Although not destructive, this event illustrates both how quickly a wave can arrive at nearby coastal communities and how long the danger period can last. The first wave arrived at Crescent City in less than an hour, but the highest waves, about one-and-a-half-feet tall, arrived nearly four hours later. Abnormally large waves continued for more than eight hours.

On March 11, 2011, a tsunami was triggered by the 9.0 Tōhoku earthquake in Japan that exceeded 8.0 feet in Crescent City. This tsunami destroyed the Crescent City harbor, sinking 35 boats and resulting in between $12 and $16 million in damage. Earthquakes in Russia’s Kuril Islands in 2006 and 2007 resulted in tsunami runups of approximately seven feet in Crescent City. The 2006 tsunami in Crescent City was reported to behave like a river surging back and forth and resulted in approximately $9.2 million in damage to the harbor.

Table 3.8-1, Tsunamis That Have Affected Humboldt County, displays information relating to tsunamis that have occurred in Humboldt County, and is derived from Table 18-1, Tsunamis That Have Affected North Coast California, from the Hazard Mitigation Plan. Although not in this table, Humboldt County experienced a small tsunami following the February 27, 2010 earthquake in Chile that resulted in unusual wave action in Humboldt Bay and was observed at the North Spit tidal gauge.

Table 3.8-1. Tsunamis That Have Affected Humboldt County.

Date	Origin of Tsunami	Impacted Areas	Runup (meters)	Observations/comments
3/19/1855	N. California	Humboldt Bay	Observed	Water in the bay agitated for 1 hour
4/25/1992	Northern CA Cape Mendocino	Humboldt Bay	0.3 Observed	Waves arrived at Humboldt Bay about 20 minutes after ground shaking.
		Clam Beach	0.6	Water level changed several feet
		Trinidad		Cars were struck on the beach
3/11/11	Japan	Humboldt Bay and coastline	Observed	

Source: Humboldt Operational Area Hazard Mitigation Plan (HMP), 2007; Humboldt County Community Development Services, 2011.

Very large earthquakes in other areas of the Pacific Ocean may generate tsunamis that could affect Humboldt County. Tsunami waves in the Pacific Ocean travel at hundreds of miles per hour and can reach California several hours after the earthquake. The International Tsunami Warning System monitors ocean waves after any Pacific earthquake with a magnitude larger than 6.5. If waves are detected, warnings are issued to local authorities who can order evacuation of low-lying areas, if necessary.

Smaller tsunamis have occurred along the North Coast and local earthquakes can produce damaging tsunamis that give very little warning time. The geologic record indicates that the Cascadia Subduction Zone has been a near-shore source for a number of significant tsunami events affecting Humboldt County, the most recent occurring about 300 years ago. The coastal area that could be affected by a tsunami is shown in the Natural Resources and Hazards Report Volume 1, Figure 10-4. This area is called the tsunami "run-up zone."

Soil and Slope Hazards

Soil Types

Agricultural Soils. There are a variety of soil types in Humboldt County. Some of the more abundant agricultural and lowland soils found in the County are the Ferndale series, a deep, well-drained soil formed on recent flood plains; the Bayside and the Loleta series, both deep, poorly drained soils found in depressed areas or on nearly level alluvial fans; and the Rohnerville, Carlotta and Hookton soils series, all moderately well-drained soils.

Rohnerville soils are found on relatively flat, high marine terraces. The Hookton soils are on sloping, dissected marine terraces and the Carlotta soils are found on flat, low-lying terraces. Most of these agricultural soils are rated 80-100 (good to excellent productivity) in the Storie Index of agricultural productivity. The exception is the Bayside soils where drainage problems may reduce agricultural potential.

Forest Soils. The forest soils of the County are, in general, medium textured, acid in reaction, and generally increasing in acidity with depth. They are permeable and well drained. In the lowlands, forest soils are formed on alluvial flood plains or low-lying terraces. Here, they are either unclassified or of the Carlotta and Ferndale groups. The most superlative old growth redwood groves are found on forest soils.

Grassland Soils. The general characteristics of grassland soils vary widely. They range from shallow loamy soils to deep clay soils. Their permeability ranges from moderate to slow. The general nutrient level of these grassland soils is higher than that of the adjacent forest soils. The major portion of these soils is intermingled with other soils in the Douglas fir zone beyond the fog belt. Some of these soils are formed on Franciscan parent material. Many of these are found in the shear zone or fault gouge material or on the melange material of the Franciscan Formation. This parent material weathers rapidly, forming a grey-blue clay subsoil (commonly called "blue goo") that tends to slip when wet. Thus, because of the parent material, these soils are found in landslide topography.

Woodland Soils. Most of the woodland soils are inland beyond the cool, foggy belt. They are intermingled with the conifer forest soils of the Douglas fir belt and the adjacent grassland soils. These are shallow soils, usually well drained, but permeability may be slow in some locations. The natural nutrient level of these soils tends to be somewhat higher than for the neighboring forest soils. Because the parent material is predominantly Franciscan melange, one should expect these soils to be relatively unstable.

In contrast to the information known or available on the County's bedrock geology, the available soils information is quite detailed. Soil-vegetation maps prepared by the California State Cooperative Soil-Vegetation Survey are available for Humboldt County at the 7.5-minute scale. These maps describe vegetation and soils, including parent rock materials, soil depth, erosion, and slope.

Slope Stability and Landslides

Slope stability refers to the landslide susceptibility of slopes composed of natural rock, soils, artificial fill, or combinations thereof. Landslides move along surfaces of separation by falling, sliding, and flowing, giving rise to many characteristic features. The features range in appearance from being clearly discernible, largely unweathered and uneroded, to highly weathered and eroded, recognized only by topographic configurations.

Landslides are characteristically abundant in areas of high seismicity, steep slopes, and high rainfall, but may be triggered by any or a mixture of the following: (1) type and structure of earth materials; (2) steepness of slope; (3) water; (4) vegetation; (5) erosion; and (6) earthquake-generated ground shaking.

The characteristics listed above are representative of the many complex variables contributing to the formation of landslides. The prediction of slope failure at a specific site, therefore, requires an analysis of all possible factors. Relative slope stability maps originally prepared as part of the Framework General Plan provide general identification of the relative slope stability hazard associated with various bedrock types. These maps do not identify the hazards at particular sites but indicate the relative likelihood of site instability.

Steep slopes, which are shown in Natural Resources and Hazards Report Volume 1, Figure 10-3, occur in a large portion of the County, including 775,203 acres in the 30–50 percent range and 531,179 acres with over 50 percent slopes. Slope information for each planning watershed is shown in Natural Resources and Hazards Report Volume 1, Table 10-2, (Appendix D). available at http://humboldtgov.org/571/Background-Reports.

Soil instability is often reflective of the parent bedrock material. Soils found in Humboldt's landslide topography often include mélange materials of the Franciscan Formation, which breaks down into clay subsoil that tends to slip when wet.

Landslides include earthflows, debris slides and flows, and translational/rotational slides. Many landslides are complex and are subject to more than one type of landslide process. Landslides are not depicted on a countywide basis in the Natural Resources and Hazards Report, but both active and dormant slides are shown on the constraints maps in Chapter 14 of the Natural Resources and Hazards Report Volume 1. Active slides are those areas that are presently moving or have recently moved, as indicated by the presence of distinct topographic features (e.g., sharp barren scarps, cracks, and tipped trees) where major revegetation has not occurred. Dormant slides demonstrate little evidence of recent movement; slide features have been modified by weathering and erosion and vegetation has been reestablished.

A common occurrence in Humboldt County, particularly in the Cape Mendocino watershed area, is high sedimentation rates due to the high tectonic uplift and high stream incision rates into relatively weak bedrock units (Natural Resources and Hazards Report, Page 10-19). This combination of forces has produced a high incidence of landsliding adjacent to stream channels, including large slump-earthflows and extensive zones of debris sliding. Additional details on stability issues in specific planning watersheds are provided in Volume II of the Natural Resources and Hazards Report.

Septic Suitability

A septic system is a biological method of wastewater treatment that can be very effective when it has been carefully designed and installed, as well as properly used and maintained. Septic systems can be sized to treat wastewater generated by single or multiple family dwellings as well as commercial and industrial facilities. Septic systems are designed to provide partial treatment of wastewater, with disposal of liquid wastewater to the soil in such a manner that it is further treated by soil organisms so that contaminants do not reach groundwater or streams.

Septic systems are used throughout Humboldt County in areas without municipal wastewater systems. Section 3.3 Utilities and Service Systems, estimates the number of houses within the service area of municipal wastewater system and the number of houses that likely utilize septic systems, or on-site wastewater systems, by planning watershed. It is estimated that there were approximately 17,653 homes utilizing on-site systems in 2010, with the largest number of systems in the Eureka Plain (4,068). See Table 3.3-7. Wastewater Service by System Type in Humboldt County in Section 3.3 (Utilities and Services) for a listing of the approximate number of septic systems by watershed.

A septic system typically consists of a septic tank and a leaching area. The tank is usually 1,000-2,000 gallons in size and is designed to trap solids and grease and provide initial, primary treatment of wastewater. Treatment in the septic tank is anaerobic (without oxygen) and produces a raw effluent that is still very high in bacteria and pathogens, dissolved solids and organics, ammonia, and organic nitrogen. The liquid then typically flows by gravity to a leaching area where it soaks into the soil, and where most of the treatment takes place. The total size of tank and leaching area needed is determined by the expected amount of wastewater flow into the system and capabilities of the soil to absorb water.

An important septic system design factor is the characteristics of the soil that will be used to filter and clarify the effluent before it reaches surface or groundwater. To determine septic suitability, soils must have a certain percolation rate, which is determined by conducting an on-site test. The percolation rate is a measure of a soils ability to absorb water. The type, size, and specific design characteristics of a septic system are dependent on the percolation rate(s) of on-site soils and expected wastewater load. In addition to percolation rate, several other important factors must be considered when locating a septic system, including: depth of groundwater, perched groundwater, and historic groundwater level; depth of bedrock; steepness of topography; presence of soils that could become seasonally saturated during times of intense rainfall; presence of soil types that may act as a barrier to effluent flow; and presence of landslides or other potentially unstable soil conditions.

The Land Use Program of the Humboldt County Department of Health and Human Services Public Health Branch is responsible for the review and approval of applications to construct septic systems. Determination of the septic suitability of soils is dependent on site-specific conditions and requires a thorough site investigation and analysis of the surface and subsurface characteristics. A septic system may have a limited or extended lifespan or can immediately fail if such analysis is not conducted.

3.8.2 Geology and Soils - Standards of Significance

This analysis uses the significance criteria from the California Environmental Quality Act (CEQA) Guidelines Appendix G. The proposed General Plan Update would result in a significant impact related to geology and soils if it would:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
   i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.
   ii. Strong seismic ground shaking.
   iii. Seismic-related ground failure, including liquefaction.
   iv. Landslides.
b) Result in substantial soil erosion or the loss of topsoil.
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
d) Be located on expansive soil, as defined in Table 18-1-B of the California Uniform Building Code (1994), creating substantial risks to life or property.
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Items “a” is discussed in Impact 3.8.3.1, Exposure to Seismic-Related Hazards. Item “b” is discussed in Impact 3.8.3.2, Soil Erosion or the Loss of Topsoil. Items “c” and “d” are discussed in Impact 3.8.3.3, Soil Stability. Item “e” is discussed in Impact 3.8.3.4, Septic Suitability.

3.8.3 Geology and Soils - Impacts and Mitigation Measures

Impact 3.8.3.1: Exposure to Seismic-Related Hazards

Implementation of the General Plan Update would result in new land uses and development being located in portions of the unincorporated County that are subject to seismic ground shaking, and could therefore expose people or structures to hazards including fault rupture, seismic-related ground failure, landslides and tsunamis.

This impact analysis addresses item “a” of the significance standards listed in Appendix G of the CEQA Guidelines as provided in Section 3.8.2 above. Pursuant to these standards, the proposed County General Plan Update would have a significant impact if it would:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
   i. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or

based on other substantial evidence of a known fault. Refer to Division of Mines and Geology Special Publication 42.

ii. Strong seismic ground shaking.
iii. Seismic-related ground failure, including liquefaction.
iv. Landslides.

Implementation of the General Plan Update would result in land uses and development in portions of the unincorporated area subject to ground shaking resulting from earthquakes. The County's seismic setting has the potential to cause significant ground shaking resulting in the following: (1) surface fault rupture hazards along the San Andreas fault, Cascadia Subduction Zone, and/or other active or potentially active faults in the County; (2) serious liquefaction hazards, particularly around the muds and sands of Humboldt Bay; ; and (3) significant landslide hazard countywide

Surface Fault Rupture

Surface rupture occurs when movement on a fault deep within the earth breaks through to the surface. The San Andreas Fault zone, Mendocino fracture zone, and the southern end of the Cascade subduction zone all meet within the offshore and coastal regions of Humboldt County, at what is known as a "triple junction." As a result, portions of Humboldt County are particularly vulnerable to surface fault rupture.

As indicated in the setting section above, pursuant to the Alquist-Priolo Special Studies Zones Act of 1972, active faults, which are those that have ruptured in the last 11,000 years, , are to be regulated. Based on Figures 10a through 10c, Humboldt County Bedrock and Faults, as noted in the 2002 *Natural Resources and Hazards Report* (Appendix D), known faults occur within most Humboldt County Planning Watersheds. However, Alquist-Priolo Zones are only mapped in the Trinidad, Mad River, Eureka Plain, Lower Eel and Van Duzen Planning Watersheds. .

The presence of active branches of a fault cannot be determined without site-specific geological investigation. However, areas that are planned for urban levels of development and contain Alquist-Priolo zones include portions of the McKinleyville Urban Development Area, Humboldt Hill Urban Development Area, the Hydesville Water Service Area, and areas around Arcata and Fortuna. As indicated above, Alquist-Priolo zones extend 200 to 500 feet on both sides of active fault traces. Proposed development within such areas requires the preparation of a detailed geologic fault evaluation report to limit potential hazards related to seismic activity. Therefore, Zoning Regulations along with the findings from the site-specific fault investigations prohibits a structure for human occupancy to be placed within fifty (50) feet of a trace of an active fault and requires the development and redevelopment of structures for human occupancy within the Alquist-Priolo Zone to conform to the recommendations and conclusions of the geologic report that has been concurred with by the County reviewing geologist.

The impacts of ground shaking on existing and future buildings are moderately low for most building types and settings. Most residential buildings in the County are one- or two-story wood frame structures, which are expected to perform adequately during earthquake events. The County expects that developers will continue to build this style of residential building because of construction costs. With the exception of McKinleyville and unincorporated areas directly surrounding the City of Eureka larger structures, which might be more susceptible to failure, are more likely to be found in the cities located around Humboldt Bay. Large structures within the cities are outside of the project area (unincorporated County) of these policy proposals. Ground shaking may have a substantial impact on the circulation system of the County. Freeway overpasses and bridges may be particularly susceptible to failure due to ground shaking. For the past several years, Caltrans has been implementing, and will continue to implement, earthquake retrofit projects for state highway overpasses and bridges.

The severity of the ground shaking impact is dependent on the distance of a structure to the earthquake source, the magnitude of an earthquake, and the underlying deposits. It would be expected that for any given earthquake event, the ground shaking will be greatest where the soils are prone to significant or strong seismic wave amplification. Based on Figure 3.8-1, Probabilistic Ground Shaking, 10 Percent Probability of Being Exceeded in 50 Years, the Trinidad, lower portion of the Mad River, Eureka Plain, Lower Eel, lower Van Duzen, and upper portion of the South Fork Eel Planning Watershed, could be subject to high levels of ground shaking within the next 50 years. As a result, the areas surrounding Humboldt Bay (Manila, Samoa, South Eureka, and Humboldt Hill), and McKinleyville and Glendale areas, may experience loss of life and property due to strong seismic shaking. Within these areas, as well as other areas the County subject to the same seismic hazards, the California Uniform Building Code applies factors to building design in order to increase building strength..

Liquefaction

Implementation of the General Plan Update would result in planned growth areas that would place some new development in areas susceptible to seismic-related ground failure and settling. In general, flat land areas underlain by deposits susceptible to liquefaction would experience this type of ground failure. The setting section above indicates that areas of high liquefaction potential are located near Humboldt Bay, where soils include bay muds and sands.

Should the soils underneath a site experience liquefaction, various types of ground failure could occur, including lateral spreading, lurching, differential settlement, and flow failures, as well as non-liquefaction failure in weak natural deposits and man-made structural fills. These types of ground failures would cause damage to infrastructure, cause building damage or collapse, and result in damage to nonstructural building features. In addition, seismically triggered ground failures would create substantial obstacles for emergency responders in the event of an earthquake. Ground failures would cause roads to fail or cover roads with debris, blocking access and evacuation routes. This is most likely to occur around Humboldt Bay or in the Mad and Eel River bottoms, although ground failures could occur anywhere in Humboldt County.

Landslides

Implementation of the General Plan Update could expose people and structures to landslide related hazards. Landslides are common occurrence in Humboldt County and have caused substantial damage. Landslides commonly occur during periods of intense rainfall and are triggered when the soil's capacity to hold water is exceeded. Landslides can be slow or rapid, moving debris and mudflows that can cause substantial loss, injury or death. A significant number of landslides could occur at the same time during a strong earthquake. Typically, these landslides are located on unstable slopes, or are preexisting landslides that are seismically triggered and move as earthquake energy moves through the ground. In addition to these more common triggers, landslides can be caused by erosion, or human-induced causes such as improper grading, broken water lines, overwatering, or improper drainage control.

Landsliding is a major hazard concern in Humboldt County that cannot be eliminated. Many existing roads in hillside areas would continue to be affected by this hazard and in many cases, they require constant maintenance. Many existing communities are currently affected by this hazard or could be in the future. The most notorious was an area of instability along U.S. 101, commonly referred to as the Confusion Hill slide, which would close US-101 in both directions for extended periods of time. Caltrans constructed two bridges over the Eel River, completed in October 2009, at a total cost of over $50 million, bypassing the slide area. A massive slide blocked both lanes of U.S. 101 north of Garberville on March 30, 2011. It took several days to open the highway to one-way traffic.

Section 14.5 of the *Natural Resources and Hazards Report* shows the acreage of each Community Planning Area that is constrained by slopes greater than 30 percent and the acres of active or dormant landslides. Unstable or steep slopes are common throughout the County. Landslide are present in portions of the McKinleyville, Fieldbrook-Glendale, Blue Lake, Jacoby Creek, Eureka, Fortuna, Hydesville-Carlotta, Avenues (Stafford, Redcrest, Miranda), and Garberville-Redway-Benbow Community Planning Areas.

Landslides and locations of potential debris-flows are present throughout the County. It is possible in most cases to reduce this impact to future development by employing design and construction methods based on finding developed through site-specific geologic investigations.

Tsunamis

Tsunamis are a threat to all communities situated along the west coast of the United States. Tsunamis are of special concern in Humboldt County due to its proximity to the Cascadia Subduction Zone. Implementation of the General Plan Update could result in new land uses and development in close proximity to the Pacific Ocean, Humboldt Bay, and the low-lying areas, and will therefore potentially expose people and structures to the risk of tsunamis generated primarily by high-magnitude earthquakes.

In Humboldt County, the most destructive tsunamis would damage or destroy any communities, structures, access routes, and utilities in low-lying areas such as the communities around Humboldt Bay and the Eel and Mad River deltas as well as Redwood Creek delta. Many structures in coastal communities are located above low-lying areas and many homes are located above likely tsunami inundation runup elevations. However, the low-lying areas of the communities described above could be adversely affected by a tsunami. A substantial number of homes in Manila, Samoa, and Fairhaven face a high level of risk, as they are located on the low-lying sand spit between Humboldt Bay and the Ocean. Existing and new development could be devastated without adequate emergency preparedness. However, even if such communities are prepared for evacuation, buildings in low-lying areas could be destroyed. In addition to the areas described above, the Humboldt County coast has many recreational use areas that could expose visitors to this hazard.

While a fair amount of investigation regarding tsunami risk has been undertaken, a probabilistic mapping of tsunami risk suitable for land use planning remains undone. Studies have been undertaken associated with PG&E's dry cask storage unit at King Salmon on Humboldt Bay, and for the Town of Samoa Master Plan project. Additionally, an interagency group called the Redwood Coast Tsunami Work Group has publicized a tsunami evacuation map for the Humboldt Bay region. These studies indicate the potential for a tsunami from 10 to 30 feet above mean sea level, possibly higher, to impact the Humboldt County coast, affecting an area similar to, but slightly larger than, the FEMA 100-year flood plain. Of note is that the potential for the highest tsunami waves comes from a near-source Cascadia Subduction Zone event, with a very short response time on the order of 15 minutes, possibly less.

Analysis of Relevant General Plan Update Policies

The primary goal of the General Plan Update Safety Element is to prevent unnecessary exposure to hazards and minimize loss to communities. The Safety Element contains Standard S-S1, Geologic Report Requirements, which requires that reports address geologic hazards and geologic conditions, and requires that the report be prepared in compliance with County Land Use and Development regulations for Geologic Hazards. These regulations (Humboldt County Code, Title III, Division 3, Chapter 6, Section 336-5) require proposed development (that is the subject of the geologic report) to be sited, designed and constructed in accordance with the recommendations of the report in order to minimize risk to life and property on the project site and for any other affected properties. Standard S-S2, Landslide Maps, requires the use of California Division of Mines and Geology, North Coast Watersheds landslide mapping as information in the review of developments. Standard S-S3 requires use of California Mines and Geology Board Policies and Criteria as standards of implementation within Alquist-Priolo Fault Hazard Zones. Standards S-S1 through S-S3, including Building Regulations, and Alquist-Priolo Zoning Regulations which are fundamental to these standards reduce the potential impacts in this category by preventing development in hazards areas or by requiring that development adhere to appropriate standards to address hazards.

The Safety Element also contains policies that would lessen the potential effects of the General Plan Update due to rupture of a known earthquake fault, strong seismic ground shaking, seismic-related ground failure, and tsunami through planning and coordination***.*** Policy S-P6, Structural Hazards, would apply and enforce state adopted building codes and Alquist-Priolo zone requirements to new construction in an effort to protect life and property. Through Policy S-P7, Improved Information, Humboldt County would encourage the development of detailed scientific analysis of Cascadia Subduction Zone earthquake risks, probabilities, and anticipated effects to inform future land use planning. Policy S-P8, Earthquake Mitigation Planning, sets the standard for the potential for a local earthquake in excess of magnitude 9.0 (Richter scale) to be considered in disaster planning, risk assessment, and pre-disaster mitigation efforts. Through Policy S-P9, Cascadia Event Disaster Response, the County shall maintain readiness for a comprehensive response to a major earthquake consistent with the nationwide emergency management hierarchy and the adopted Emergency Response Plan for the Humboldt Operational Area. Finally, through Policy S-PX1, Site Suitability, new development may be approved only if it can be demonstrated that the proposed development will neither create nor significantly contribute to geologic instability or geologic hazards.

As noted above, Standard S-S1, Geologic Report Requirements, specifies that reports prepared consistent with County Building Regulations addressing geologic hazards and geologic conditions be prepared as part of the review of discretionary development and ministerial permits. This standard lessens potential environmental effects relating to surface fault rupture, strong seismic ground shaking, and landslides. Standards S-S2, Landslide Maps, and S-S3, Alquist-Priolo Fault Hazard Zones, would utilize California Division of Mines and Geology Landslide Mapping and Policies and Criteria for Alquist-Priolo Fault Hazard Zones as North Coast Watersheds landslide mapping. The use of mapping from these sources would identify areas subject to hazards and the application of regulations specified by the standards would ensure that potential impacts associated with known hazards are reduced.

Conclusion

The General Plan Update could expose a significant number of persons to the geologic hazards which exist throughout the County. Pursuant to Policy S-S1, Geologic Report Requirements, and S-S3, Alquist-Priolo Fault Hazard Zones, development planned for hazardous areas would require detailed assessments and mitigation under the Plan. The Policies and Standards referenced above combined with the hazard awareness and emergency preparedness policies and programs of the General Plan Update would minimize the exposure of people and development to the adverse effects of surface fault rupture within an Alquist-Priolo Earthquake Fault Zone. These policies and programs would reduce the number of new structures built on active fault traces and improve building construction within such areas. However, while these measures would reduce the exposure of people and structures to the adverse effects of surface fault rupture for minor to moderate events to a less-than significant-level, they would not do so for severe events. Therefore, this impact is **potentially significant**.

Mitigation

No feasible mitigation measures are available to reduce the exposure of people and structures to the effects of severe surface fault rupture events.

Level of Significance after Mitigation

Humboldt County is subject to: serous liquefaction and subsidence hazards; the highest concentration of earthquake events anywhere in the continental U.S. and is located the closest county to the Cascadia Subduction Zone which can produce earthquakes of magnitude 9 and devastating tsunamis; significant landslide hazards countywide; and fault rupture zones associated the San Andreas, Little Salmon, and Mad River faults are present in the County which can generate highly destructive earthquakes. Although it is possible to limit impacts associated with minor to moderate events from these hazards through the policies, standards, and regulation described above, it is not feasible to limit impacts from the most significant hazards. Therefore, this would remain **a significant unavoidable impact.**

Impact 3.8.3.2 Soil Erosion or the Loss of Topsoil

Development of roads, storm drainage infrastructure, homes, and commercial structures consistent with the General Plan Update could result in increased erosion and the loss of topsoil.

This impact analysis addresses item “b” of the significance standards listed in Appendix G of the CEQA Guidelines as provided in Section 3.8.2 above. Pursuant to these standards, the proposed County General Plan Update would have a significant impact if it would:

b) Result in substantial soil erosion or the loss of topsoil.

Development of roads, storm drainage infrastructure, homes, and commercial structures consistent with the General Plan Update could result in increased erosion and the loss of topsoil. Erosion is frequently accelerated by site preparation activities such as excavation and grading, and cuts and fills. Exposed rock or soil surfaces associated with development-related site preparation can lead to increased erosion. Erosion potential can also be enhanced by changing the permeability or runoff characteristics of the soil, or by modifying or creating new drainages. Once development has been completed, slopes that are not effectively contoured, compacted, or revegetated may also be susceptible to erosion.

Erosion can have adverse effects on water quality from increased sediment loads carried in runoff, and can result in slope instability both during and after construction activities have been completed. Unless specific erosion controls are in place, people and structures could be exposed to increased risk of injury or damage resulting from mudslides, landslides, or other downslope movement of soil or rock. Development in hilly areas and along river and stream banks is most susceptible to erosion-related effects.

As indicated in Section 10, Geologic, Soil and Seismic Hazards, of the *Natural Resources and Hazards Report*, slope stability and erosion are a major concern in Humboldt County. For example, over 90 percent of the land within Cape Mendocino, South Fork Eel and Lower Trinity Planning Watersheds are at a slope of 15 percent or greater. The degree of slope and instability of the soils in these areas contributes to hazards associated with erosion.
Approximately 13 percent of peak housing development that is projected to occur during the General Plan Update planning period, or 137 units, is expected occur on resource lands or lands planned for rural residential development. In many instances, rural residential development or residential development within resource lands involves the construction of, or improvements to, unpaved access roads and driveways and the disturbance of previously undeveloped land for parking, structures, and on-site utilities. In addition, in most cases land planned rural residential or for timber production is in hilly topography. Development in such areas would be expected to contribute to increases in erosion such that water quality could be substantially impacted, and could result in soil erosion in greater quantities than land planned for urban development. Proposed development in urban areas, especially non-discretionary development would not be expected to involve offsite improvements on previously undeveloped and would therefore require less ground disturbance.

Analysis of Relevant General Plan Update Policies

The General Plan Update contains policies to protect soils in agricultural areas, as well as on slopes, to avoid erosion. The Water Resources Element Policies WR-P8, Erosion and Sediment Discharge, and WR-P36, Erosion and Sediment Control Measures specifies that erosion and sediment control measures, as appropriate, be incorporated into development design. Policy WR-Px2, Mitigate Controllable Sediment Discharge Sites, requires that discretionary development involving a site identified as part of the TMDL Controllable Sediment Discharge Inventory must be conditioned to mitigate sediment. This policy, in combination with Standard WR-S7, Total Maximum Daily Loads (TMDLs) Implementation, would require that discretionary development be conditioned to reduce or prevent further impairment consistent with applicable TMDLs. Standard S-S1, Geologic Report Requirements, requires that site-specific reports addressing geologic hazards be prepared for both discretionary and ministerial projects. Additionally, the implementation measures of the General Plan Update include provisions for applying grading and zoning ordinance requirements to address soil erosion and to require erosion control measures for all grading activities.

Conclusion

The General Plan Update requires that site-specific reports addressing geologic hazards be prepared and that grading standards and best management practices be employed to reduce sedimentation and avoid erosion. However, adding additional development areas of soil instability would increase erosion such that water quality could be substantially negatively impacted, or substantial soil erosion could result. Therefore, impacts in this regard would be potentially significant.

Mitigation

Mitigation Measure 3.8.3.2.a. To lessen impacts relating to water quality resulting from increased erosion, the following mitigation is required:

Implement Mitigation Measures 3.10.3.1.a and 3.10.3.1.b from Impact 3.10.3.1: Degrade Water Quality or Exceed Waste Discharge Requirements in Chapter 3.10, Hydrology and Water Quality.

Level of Significance after Mitigation

Adoption of the additional or revised policies described above would minimize soil erosion impacts of future land uses and reduce this impact to a **less than significant level**.

Impact 3.8.3.3. Soil Stability

Implementation of the General Plan Update could result in new development being located within a geologic unit or on soil that is unstable or could become unstable as a result of the development, thereby causing landslides, lateral spreading, subsidence, liquefaction, or collapse, or on expansive soil which could create substantial risks to life and property.

This impact analysis addresses items “c” and “d” of the significance standards listed in Appendix G of the CEQA Guidelines as provided in Section 3.8.2 above. Pursuant to these standards, the proposed County General Plan Update would have a significant impact if it would:

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.
d) Be located on expansive soil, as defined in Table 18-1-B of the California Uniform Building Code (1994), creating substantial risks to life or property.

Buildout of the General Plan Update would result in the development of new structures within a geologic unit or on soil that is unstable or that would become unstable as a result of the new development, potentially resulting in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse. This potential impact is similar to the Impact 3.8.3.1 Exposure to Seismic-Related Hazards, and Impact 3.8.3.2 Soil Erosion or the Loss of Topsoil, which analyze potential impacts to development in the unincorporated area located in areas subject to ground shaking, ground failure, or resulting from landslides, erosion, or other unstable slope conditions resulting from earthquakes. However, under Policy S-PX1, Site Suitability, new development may be approved only if it can be demonstrated that the proposed development will neither create nor significantly contribute to or be impacted by geologic instability or geologic hazards.

Humboldt County has adopted the California Building Code (CBC). The CBC provides soil classification guidelines for expansive soils. If a structure would be located on expansive soils, as defined by the CBC criteria, then special design considerations would be required. Title III, Land Use and Development Division 3, Building Regulations Chapter 6 - Geologic Hazards may require a preliminary soils report and geologic investigation, respectively. Preliminary soils and geologic investigation reports, typically, would report the presence of expansive soils. Where geologic hazards and other conditions are present (such as average slopes on the site are less than 15 percent and the building site is not on fill or marshlands), the Building Regulations provide discretion to the Building Official to waive geologic report requirements.

Analysis of Relevant General Plan Update Policies

Potential impacts resulting from development within unstable areas are addressed through geological report requirements for development projects as specified under standard S-S1, Geologic Report Requirements. Geological reports specify standards and construction requirements necessary to ensure that development does not occur in unstable areas or that specific construction techniques are required to address site stability.

Conclusion

Implementation of the General Plan Update policy and programs would require geologic reports, where necessary, and the avoidance of areas with expansive soils or geotechnical engineering to reduce impacts of expansive soils. This impact would be **less than significant**.

Mitigation

None required.

Impact 3.8.3.4. Septic Suitability

Implementation of the General Plan Update could result in new development utilizing septic systems that may be proposed in areas with soils that are not suitable for wastewater treatment.

This impact analysis addresses item "e" of the significance standards listed in Appendix G of the CEQA Guidelines as provided in Section 3.8.2 above. Pursuant to these standards, the proposed County General Plan Update would have a significant impact if it would:

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Development within urban development areas would likely be served by municipal wastewater treatment systems. Approximately 30 percent of projected development during the General Plan Update planning period is projected to occur outside areas served by wastewater systems, and would need to be served by on-site septic systems. Potential development utilizing septic systems may be proposed in areas with soils not suitable for wastewater treatment.

The suitability of a property for on-site disposal would depend on many variables including topography, type and thickness of appropriate soils, percolation rate, and depth to groundwater and bedrock. Existing County regulations require new development to demonstrate to the County Public Health Branch Land Use Program that soils on the site are suitable for the use of a standard septic system. Sites with inadequate soils and other unfavorable site characteristics, would be required to utilize alternative septic systems, such as mound and pressurized systems, or may not be allowed to have on-site disposal systems.

Analysis of Relevant General Plan Update Policies

The General Plan Update contains policies and standards that address both proposed new systems and existing failing septic systems. Impacts of such activities could be significant if not properly addressed. Under Policy GP-P6, Use of On-Site Sewage Systems within Urban Development Areas, the utilization of on-site sewage disposal systems shall not be acceptable for new subdivisions in the Urban Development Area, unless the Planning Commission makes specific factual findings that: 1) the extension of services is physically infeasible; or 2) the area is not planned for service in the service provider's Municipal Service Review and other written long-term plans; or 3) the services are not reasonably available in a timely manner. This policy limits the possible use of septic systems and therefore, limits the potential for septic failure. Policy

RL-P2, Water Withdrawal, requires that the cumulative impacts of water withdrawal from surface and groundwater sources and cumulative impacts from on-site sewage disposal systems shall be assessed during the zoning and subdivision, and during discretionary review of land designated for rural residential development in critical watersheds. The application of this policy ensures that the installation of new septic systems would not significantly contribute to the further degradation of soils or water supplies.

The General Plan Update contains policies to maintain septic regulations consistent with the Basin Plan and to establish programs to abate failing septic systems that represent a health hazard. Under Policy WR-Px6, Alternative Disposal Systems, the County supports programs and ordinance revisions that modify the permit process for alternative disposal systems to make such systems more accessible to individual households under conditions that do not threaten public health. Policy IS-P20, On-Site Sewage Disposal Requirements, requires that regulations governing construction and maintenance of on-site sewage disposal systems are maintained to protect health and safety, and to reflect changes in state law which would include the Basin Plan. This policy also recognizes and allows alternative onsite treatment systems that meet state standards. Policy WR-P14, Pathogen and Nutrient Discharge from Septic Systems, supports programs to reduce coliform bacteria and nitrate discharges from septic systems.

There are two Implementation Measures that address septic systems. Implementation Measure WR-IM5, Septic Systems, would require that the County pursue the abatement of failing septic systems that represent a health and safety hazard. Implementation Measure WR-IM7, Basin Plan Septic Requirements, directs the County to update and amend existing County septic regulations to reflect the latest Basin Plan standards for design and maintenance of on-site wastewater systems.

Conclusion

The General Plan Update would require that new on-site wastewater disposal systems meet the current requirements of the Basin Plan and state law. Therefore, potential for impacts resulting from development in areas incapable of adequately supporting the use of septic systems would be a **less than significant impact**.

Mitigation

None required.