A. GEOLOGY AND SOILS

This section was prepared by Cleath and Associates, and includes an analysis of geologic and soils hazards including landslides and slope stability; seismic induced landslides and rock falls, fault displacement, ground shaking and liquefaction; mineral hazards; and expansive soils. Published geologic reports, aerial photographs, the *Soil Survey of San Luis Obispo County (Coastal Part)*, and bluff retreat studies were reviewed prior to assessing these hazards. A geologic site reconnaissance was conducted, the distance to known faults was determined, and the information regarding the geologic subgrade were all used to evaluate seismic hazards.

1. REGULATORY SETTING

a. FEDERAL POLICIES AND REGULATIONS

Protection of aquatic resources, including wetlands, is under the purview of the ACOE, while the Federal Emergency Management Agency (FEMA) is responsible for identifying flood hazards, coordinating floodplain management, and regulating the placement of structures in floodplains. The minimum floodplain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations 44 CFR 60.3.

Water quality protection is regulated by the Federal National Pollutant Discharge Elimination System (NPDES) Program established by the Clean Water Act. The U.S. Environmental Protection Agency (EPA) establishes stormwater permit requirements based on compliance with a NPDES permit. Discharges of stormwater associated with construction activity that results in a disturbance of one acre or more of total land area requires a NPDES General Permit for Discharges of Stormwater Associated with Construction Activity. Permits are required for all stormwater discharges associated with a construction activity where clearing, grading, and excavation occurs. This permit requires developers to implement Best Management Practices (BMPs) to prevent the discharge of sediment-laden water off site. The site-specific plan to implement BMPs is called the Stormwater Pollution Prevention Plan (SWPPP). The plan must include a description of soil stabilization and sediment load control methods that would be implemented to minimize erosion and sediment loading during construction of the project. The SWPPP also includes descriptions of post-construction BMPs. The State of California administers stormwater permits through the SWRCB and its local Regional Water Quality Control Board (RWQCB) (Central Coast Region).

The U.S. Department of Agriculture Natural Resource Conservation Service (NRCS) recommended erosion control and gully stabilization methods for the West FRP Seaclift Gully. The *Management Plan* and *Community Park Master Plan* recommends consultation with NRCS to develop an appropriate plan for erosion control and gully stabilization for the West FRP Warren/Trenton Gully. The CCSD is currently working with the Central San Luis Resource Conservation District (RCD) regarding erosion control throughout the FRP.

b. STATE POLICIES AND REGULATIONS

The State of California administers Stormwater Regulations according to the California Water Code § 13399. The SWRCB issues the NPDES General Construction Activity Stormwater Permit. The RWQCB monitors the provisions of this general permit.

The State of California Coastal Commission provides guidelines for determining bluff retreat rates, and establishes development setbacks from coastal bluffs. Consistency with § 30253 of the Coastal Act requires that: New development shall: (1) Minimize risks to life and property in areas of high geologic, flood, and fire hazard; and, (2) Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

Bank stabilization projects are proposed along Santa Rosa Creek, and would comply with the California Department of Fish and Game (CDFG) California Salmonid Stream Habitat Restoration Manual (1998). The CDFG requires a permit and approval based on issuance of a Streambed Alteration Agreement. Additional permits would be required from the State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB) for disturbance of over one acre and potential discharges into surface water.

c. LOCAL POLICIES AND REGULATIONS

Based on the *County Coastal Zone Land Use Ordinance*, an approved land use permit, Coastal Development Permit, and construction permits would be requested prior to implementation of major project amenities (i.e., construction of facilities, grading, etc.). The County would also require an approved erosion control plan to be submitted and implemented if construction occurs between October 15 and April 15. *Guidelines for Engineering Geology Reports* (2005) establishes requirements for coastal bluff setbacks for developments and include methodologies for investigating geologic hazards.

2. EXISTING CONDITIONS

a. LOCAL GEOLOGIC FORMATIONS

Located in the Coast Range Geomorphic Province of California, the East and West FRP lie to the west of the northwest-southeast trending Santa Lucia mountain range. Four geologic units are mapped on the site (Hall, 1974). These are the Jurassic and Cretaceous age melange subunit of the Franciscan Complex, an Upper Cretaceous age marine sandstone referred to as the Cambria Slab (Howell, 1977), Quaternary age terrace deposits, and Quaternary age alluvial deposits (refer to Figure V-1).

b. REGIONAL FAULTING AND SEISMICITY

The nearest known fault with potential seismic hazard is the Hosgri fault, approximately five kilometers southwest of the site. This predominantly strike-slip fault (Hanson, 1995) has been observed to displace deposits of late Quaternary age over portions of its extent, and is capable of producing a magnitude 7.5 earthquake (Safety Element – San Luis Obispo County General Plan, 1998). Most seismic activity affecting the property is expected to occur along several fault

zones, including the Cambria, Hosgri, Oceanic, Los Osos, Rinconada, and San Andreas fault zones. Distances to these faults and their maximum magnitude using the moment magnitude scale are shown in Table V-1.

TABLE V-1
Sources of Ground Shaking

Fault Name[1]	Distance From Project Site[2] (in kilometers)	Maximum Magnitude[1]	Characteristic Return Interval[3]	Slip Rate[3]	
				(mm/yr)	(+/-)
Cambria	1	6.25	--	n/a	--
Hosgri	5	7.5	646	2.5	1.0
Oceanic	7	7	--	n/a	--
Los Osos	27	7	1925	0.5	0.4
Rinconada	30	7.5	1764	1.0	1.0
San Andreas	66	8.25	206	34.0	5.0

[1]Safety Element, San Luis Obispo County Department of Planning and Building (1999)

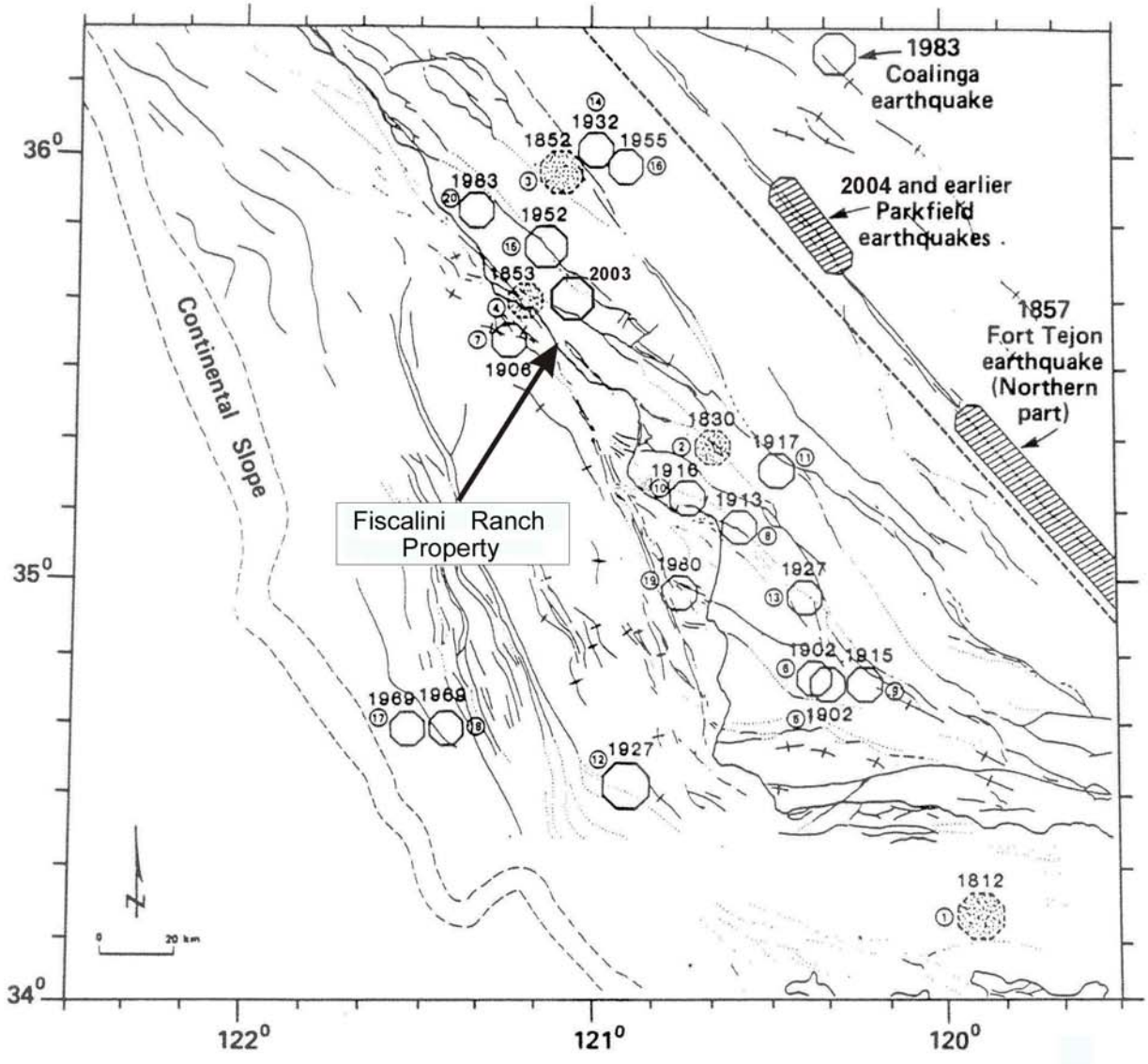
[2]Map of Faults and Folds Identified During Previous Investigations and During the Long Term Seismic Program, South-Central California, (PG&E 1988)

[3]Probabilistic Seismic Hazard Assessment for the State of California (DMG, 1996)

Significant earthquakes can, and probably will, occur on other faults in the region; however, available geologic data suggests that the effects of earthquakes from faults not listed on Table V-1 are likely to be less than the effects of earthquake activity generated by the faults listed on the table. Historic seismicity is shown on the Earthquake Epicenter Map, Figure V-3.

The San Andreas fault zone is widely known because it is historically active (during the last 200 years) and has produced numerous damaging earthquakes. It passes through San Luis Obispo County approximately 66 kilometers east of the site. A major earthquake on the San Andreas fault can be expected to occur during the design life of the project. Structures designed under the current version of the Uniform Building Code (UBC) may experience some damage in such an earthquake; however, the potential for collapse or life-threatening damage is very low.

Earthquakes of lesser magnitude may occur on the closer faults shown in Table V-1. Because of the closer proximity of these source faults than the San Andreas Fault, these earthquakes could result in stronger shaking that may exceed the design limitations of structures constructed under the UBC. However, because the postulated recurrence of potentially damaging earthquakes on these faults is longer, the risk of this hazard actually occurring is considered low.



EXPLANATION

Earthquake epicenter:

1812 – Year of event

① Event number

Event location that is poorly constrained

Event location that is within 20 kilometers and generally within 10 kilometers

Historic earthquakes with fault rupture along San Andreas fault zone

Magnitude

5.0 – 5.9

6.0 – 6.9

7.0 – 7.9

Base Map: Diablo Canyon Power Plant
Long Term Seismic Program - Final Report
Pacific Gas & Electric, July 1988

Scale: 1 inch = 20 kilometers

Cleath & Associates

Source: Cleath & Associates

Earthquake Epicenter Map
FIGURE V-1

c. WEST FRP – GENERAL SITE CONDITIONS

The West FRP consists of two parcels totaling 364 acres located on the west side of Highway 1. The West FRP consists of a gently sloping terrace rising from the coastal bluff top to an elevation of approximately eighty feet, and a higher upland area that reaches elevations of approximately 250 feet. The upland area consists of a nearly flat lying terrace flanked by gentle to moderate slopes descending to the lower terrace to the southwest, west, and northwest.

Within the lower terrace area there are five seasonal wetlands. A severely eroded gully known as the Seaclift Gully has formed east of the Seaclift neighborhood extending up-slope into the woodland area. A 36-inch diameter culvert under Windsor Boulevard receives runoff from the gully. A smaller, less severely eroded gully known as the Warren/Trenton Gully is present at the eastern facing slope adjacent to Highway 1.

1) West FRP – Bedrock Units

Exposed bedrock in the West FRP area consists of the Franciscan melange and the Cretaceous sandstone. The Franciscan melange is a pervasively sheared mixture of sandstone, chert, serpentine, basalt, and greenstone, with blocks of high grade metamorphic rocks, all set in a sheared claystone-siltstone matrix. The melange is exposed only in a few places at the base of the coastal bluff, whereas the Cretaceous sandstone is the predominant bedrock unit exposed along the bluff. The Cretaceous sandstone is also found either exposed or beneath thin pedogenic soils along the steeper, upland portions of the West FRP. The Cretaceous sandstone unit is of marine origin and consists mostly of moderate to well cemented arkosic sandstone, and lesser weakly resistant interbedded shale. The sandstone and shale beds are folded and generally dip to the northeast into the bluff at 27 to 45 degrees.

2) West FRP – Surficial and Soil Units

Quaternary age terrace deposits or thin pedogenic soil unconformably overlie the sandstone or melange at the site. Along the bluff, the terrace deposits rest on an abrasion platform cut across the bedrock. A basal lag deposit (gravel and cobbles) is exposed in several places in the bluff face at the base of the terrace. These deposits are overlain by poorly consolidated clayey coarse-grained sand, grading upward into finer grained sand. In the higher elevation portions of the site, the terrace deposits consist generally of colluvium and wind-blown sand.

Organic topsoil is relatively thin and poorly developed on the steeper portions of the site, and is thicker on the flatter higher site elevations. The onsite soils were mapped by the United States Department of Agriculture Soil Conservation Service (currently the Natural Resource Conservation Service) and were published in 1984 in the Soil Survey of San Luis Obispo County, California (Coastal Part). The following soil map units are described in the Soil Survey and are shown on Figure V-2:

- *Briones-Pismo loamy sands (109)* are found on the moderate slopes along most of the coastal bluffs and inland of the coast about 1,000 to 2,000 feet. These are shallow to moderately deep, somewhat excessively drained, and rapidly permeable soils that formed in residual material weathered from soft sandstone. The hazard of water erosion is moderate or high, and the hazard of soil blowing is high.

- *Concepcion loam (120)* is found in the gentle slopes above the bluff and several hundred feet inland of the bluff. It is generally very deep, moderately well drained, very slow permeable soil formed in old alluvium weathered from sedimentary rocks. The hazard from water erosion is slight. Because of the high clay content, the soil has a high shrink-swell potential in the subsoil.

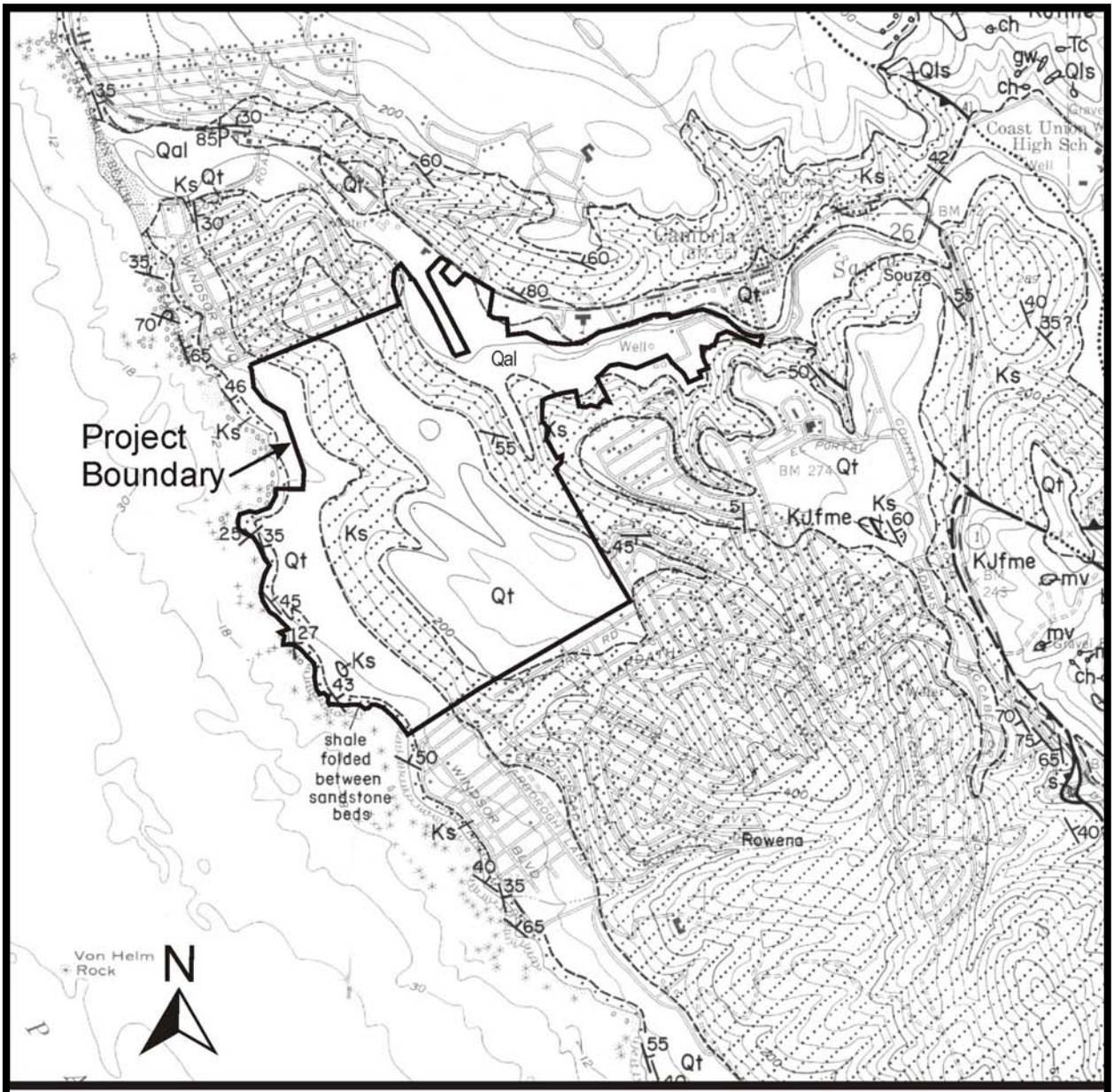
- *San Simeon sandy loam (201)* is found in the steeper sloping areas between the coastal terrace and the upland areas of the site, and in the moderately to steeply sloping upland areas in the southeast corner of the site. The soil is moderately deep, moderately well drained, and the permeability is very slow. It formed in residual material weathered from sandstone. Surface runoff is rapid, and the hazard of water erosion is high. The shrink-swell potential of the subsoil is high.

- *San Simeon sandy loam (200)* is located in the slightly upland areas of the site in areas of gentle to moderate slopes. The soil is moderately deep, moderately well drained, and the permeability is very slow. It formed in residual material weathered from sandstone. Surface runoff is medium, and the hazard of water erosion is moderate. The shrink-swell potential of the subsoil is high.

- *San Simeon sandy loam (199)* is located in the upland, gently sloping areas of the site. The soil is moderately deep, moderately well drained, and the permeability is very slow. It formed in residual material weathered from sandstone. Surface runoff is slow or medium, and the hazard of water erosion is slight or moderate. The shrink-swell potential of the subsoil is high. There is a stand of Monterey pines on this soil in the southeast portion of the site, and because of the limited rooting depth between twenty and forty inches, wind damage to trees can be a problem on exposed locations.

- *San Simeon sandy loam (202)* is found in the steeply northeast sloping portions of the site. The area extends from the north to the southeast corner, in the vicinity of Highway 1. The soil is moderately deep, moderately well drained, and the permeability is very slow. It formed in residual material weathered from sandstone. Surface runoff is rapid, and the hazard of water erosion is high. The shrink-swell potential of the subsoil is high. Because of the loamy surface layer and clayey subsoil, this soil is subject to gully erosion. The soil is mostly covered with Monterey pine and understory vegetation. Because of the limited rooting depth between twenty and forty inches, wind damage to trees can be a problem on exposed locations.

- *Salinas silty clay loam (198)* is found in the gently to moderately sloping northeast corner of the site. Highway 1 crosses over this soil. The soil is very deep, well drained, and the permeability is moderately slow. It formed in alluvium weathered from sandstone and Franciscan Complex rocks. Surface runoff is slow or medium, and the hazard of water erosion is slight or moderate. The shrink-swell potential is moderate. The effective rooting depth is sixty inches or more.



Source: Cleath & Associates

Regional Geology Map
FIGURE V-2

Source: Soil Survey of San Luis Obispo County, Coastal Part – Sheet 4

SOIL KEY

109	Briones-Pismo loamy sands, 9 to 30% slopes
120	Concepcion loam, 2 to 5% slopes
170	Marimel silty clay loam, drained
198	Salinas silty clay loam, 2 to 9% slopes
199	San Simeon sandy loam, 2 to 9% slopes
200	San Simeon sandy loam, 9 to 15% slopes
201	San Simeon sandy loam, 15 to 30% slopes
202	San Simeon sandy loam, 30 to 50% slopes

NORTH
1:24,000

Soil Survey Map
FIGURE V-3

3) West FRP – Surface and Groundwater Conditions

Surface water is generally present in the wetlands and in the minor gullies only during winter storm runoff. At the end of the summer during September 2006, surface water was observed flowing from springs in the upper portions of the Seaclift Gully and the adjacent gully to the south, and from a spring near the northeast part of the Creek to Ridge Trail. Water was also observed flowing seaward in a drainage swale from a Bluff Trail bridge located approximately 1,000 feet from the north end of the trail. A perennially wet swale is located in the upland wooded area, near the southeast corner of the site. The Ridge Trail was designed to avoid impacts associated with this surface water. During winter storm events, surface runoff sheet flows across the wetlands located along the southern property line and flows over the coastal bluff in two shallow gullies. The Warren/Trenton gully, along with minor gullies, also flow episodically during storm events.

Shallow groundwater is present in all the low-lying portions of the site and is at or near the surface in the wetlands and spring areas. Shallow bedrock or low permeable clay layers in these low-lying areas cause groundwater to be perched and to flow through permeable sandy layers until it intersects the surface or flows downward into more permeable zones. The shallow groundwater is visible in seeps in the bluff face or where it appears at the surface at springs or wetland areas. Seeps are readily visible in the bluff faces at the two coves located in the north and south ends of the site. The fact that all three of the springs are located at or near the upper contact between the sandstone bedrock and the terrace deposits suggests that groundwater is perched above the bedrock within the relatively permeable terrace deposits in the upland portions of the West FRP.

d. WEST FRP – GEOLOGIC AND SOILS HAZARDS

1) West FRP – Bluff Erosion

Project improvements near the coastal bluff include a trail system and some soil stabilization work associated with the trail. Erosion and subsequent landward retreat of the coastal bluff will affect the long-range design and location of the bluff trail system. Previous studies addressing bluff retreat on or near the West FRP have been performed. These include onsite study reports by R.T. Wooley (1982) and Donald Asquith (February, 2005); and two bluff retreat studies performed on a private property at the northern cove by Cleath & Associates (1987 and 1998). These reports found that the coastal bluff along the West FRP is eroding.

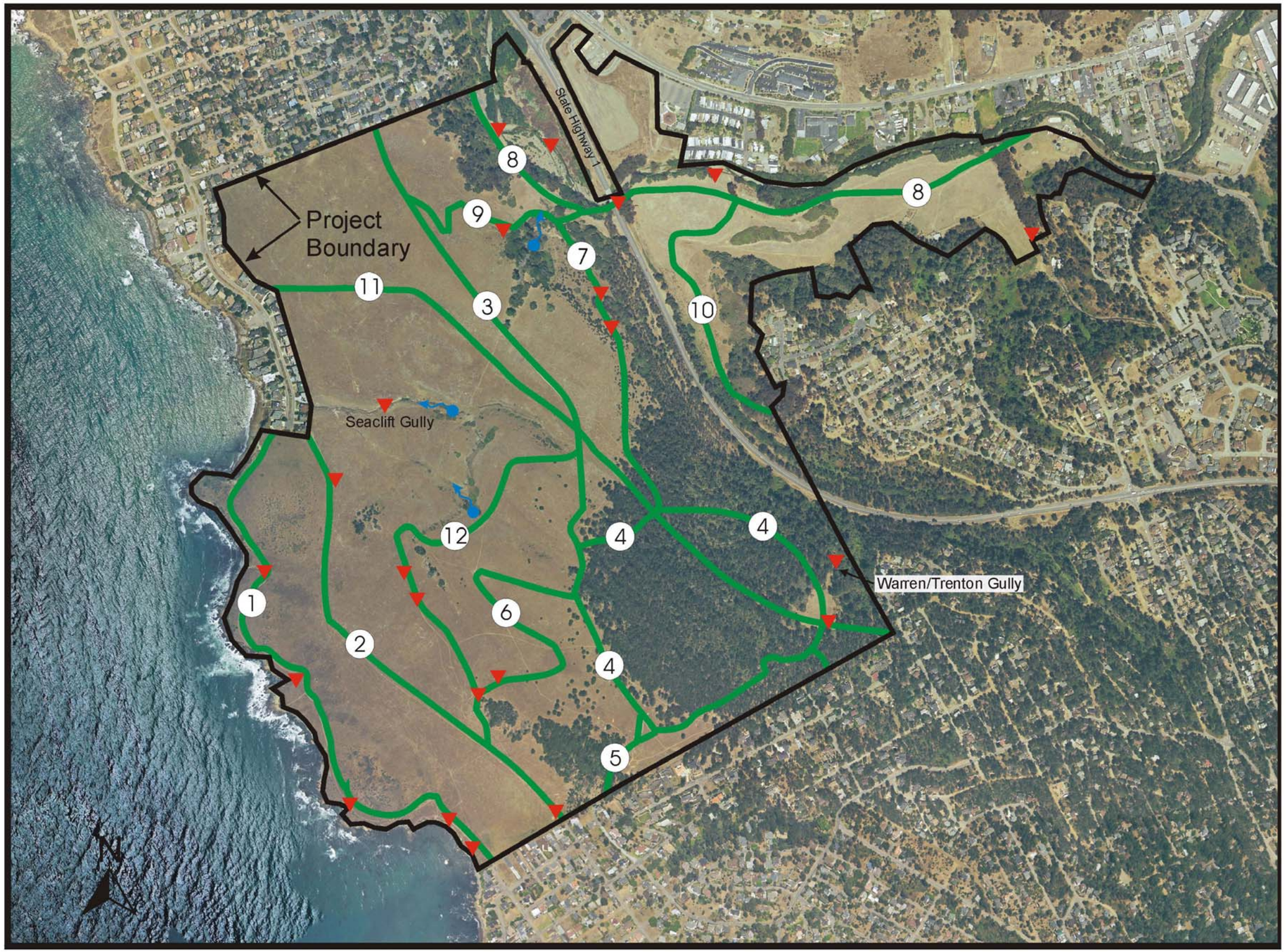
Current requirements for bluff retreat studies are outlined in the January 2005 County of San Luis Obispo Guidelines for Engineering Geologic Reports and in Coastal Commission guideline documents. These requirements and guidelines were referred to during review of the work performed by the previous investigators. The CCSD Ranch Manager continuously monitors the bluff for erosion near the Bluff Trail. Because the previous bluff retreat studies and continual monitoring on the site are general in nature, additional detailed work assessing bluff retreat and establishing the current bluff top definition may be required. This bluff retreat evaluation included the review of the four bluff retreat studies, an onsite evaluation, and a review of several aerial photographs spanning a 56-year period. There are three distinctly different bluff morphologies at the site, each having distinctly different bluff retreat rates, as discussed below, and shown in Figure V-4, V-13.

The cove at the north end of the property is characterized by a very high, nearly vertical bluff face with bedrock exposed very low on the bluff. Most of the exposed bluff face consists of highly erodible, poorly consolidated sandy materials. Groundwater seeps are visible approximately ten feet above the top of the bedrock. The bluff is facing westerly and northwesterly and is roughly perpendicular to the prevailing wave direction. South of the cove, the site protrudes seaward by 500 to 700 feet over a distance of approximately 2,700 feet. The bluff height in this section is generally lower than in the cove, and the bedrock sandstone is very high in the bluff face, placing the softer terrace deposits mostly above the area directly affected by waves. Seeps occur at the contact between terrace deposits and bedrock. The bluffs in this area face west or southwest. At the cove in the south end of the property, the bluff height becomes as low as six to eight feet in the center of the cove, and the bedrock/terrace deposit contact is near the base of the bluff and within the littoral zone. Most of the exposed bluff face consists of highly erodible, poorly consolidated sandy or gravelly materials. Groundwater seeps are visible approximately eight feet below the top of bluff in the center of the cove. On either side of the cove, bedrock extends higher up on the bluff face than in the center of the cove offering comparatively better protection from erosion. The bluff generally faces southwest. Because the bluff is at an oblique angle to the prevailing wave direction, and bedrock headlands are present at both ends of the cove, waves entering the cove diffract and lose energy before impacting the most erodible portion of the bluff.

The Wooley (1982) report is a preliminary geologic report based on a residential development previously proposed at the site, and it suggested that a more detailed investigation on a site-specific basis would be necessary in the future. The report appears to address bluff erosion in the area of the seaward protrusion and at the southern corner of the property. It concluded that negligible retreat can be demonstrated at the southern corner between 1930 and 1982, and that the bluff line will not retreat at an average rate greater than 2-inches per year.

The Asquith (2005) report estimated bluff retreat rates in the cove at the south end of the site and along the 2,700-foot long bluff section that protrudes seaward of the two coves. The evaluation of the cove bluff compared aerial photograph-based topographic maps, using an overlay of current topography on top of topography during 1980 to determine how much the bluff has retreated during the intervening 25 years. This suggested an average rate of twenty feet per 100 years, or 2.4 inches per year in the cove.

The retreat rate of the bluff in the area of the seaward protrusion was estimated in the Asquith report based on a comparison of the resistance to erosion of bluff faces in the protruded area and in the south cove. The resulting estimate was an average of ten feet per 100 years, or 1.2 inches per year. A cross check on the rates in this protruded zone was made in the report based on the amount of bluff retreat occurring in the cove since sea levels stabilized. The estimates in the two above referenced reports were not based on the type of rigorous assessment of bluff retreat rates that is typical for a site where building construction would occur. The California Coastal Commission recommends determining the bluff edge positions at as many times as possible, but covering a minimum of about fifty years and extending to the present. It also recommends using land surveys that identify the bluff edge, and using shoreline reference features that are static through time and are identifiable in each measurement interval.



Explanation

- Spring
- Area of erosion
- 1 Bluff Trail
- 2 Marine Terrace Trail
- 3 Ridge Trail
- 4 Forest Loop Trail
- 5 Victoria Lane Trail
- 6 Meander Trail
- 7 Creek to Forest Trail
- 8 Santa Rosa Creek Trail
- 9 Creek to Ridge Trail
- 10 Ramsey Trail
- 11 Wallbridge Trail
- 12 Terrace to Ridge Trail

Source: Cleath & Associates

NORTH
Scale as Shown

Base Map: by AirPhoto USA
Scale: 1 inch = 780 feet

Erosion and Spring Areas
FIGURE V-4

Back of Figure V-4

The two Cleath reports (1987, 1998) were performed on a property that shares the cove at the northern part of the site. These evaluations were site-specific to that cove, and described the geologic units comprising the bluff and their erodibility. The bluff top was defined and marked by a land survey. To determine the bluff position over time, measurements were taken from the street curb to the bluff top in 1964, 1971, 1987, and in 1998. A comparison of these measurements shows that up to four feet of property has been lost during the 34-year interval ending in 1998. This suggests a bluff retreat rate of 1.4-inches per year. The Cleath (1998) report states, however, that the bluff face is quite unstable and could experience high erosion over very short durations.

For this discussion of bluff retreat rates for the three separate bluff line areas identified in this report, a review of aerial photographs was conducted that compared vertical photos taken in 1949 and 1994, and oblique photos taken in 1972, 1979, 2004, and 2005. Because of the scarcity of near-bluff reference points and the fairly small map scales, the photo comparison suggested a range of bluff retreats up to a maximum distance.

In both the northern and southern coves, less than ten feet of bluff retreat was evident between 1949 and 1994, or less than 2.7-inches per year. A bluff retreat rate up to 2.7-inches per year would result in 22 feet of landward bluff retreat in 100 years. Bluff retreat in the protruded area of the site was negligible over the 45-year interval. The Bluff Trail is located nineteen feet from the current bluff top at the northern cove, and as near as eight feet to the bluff top in the protruded area of the trail.

This retreat rate is based on limited observations over 57 years, and rates may change over short periods of time within small portions of the bluff top. Onsite observations and oblique aerial photos revealed that portions of the bluff face in the northern cove can fail episodically and lose up to a few feet in one event. A network of tensional cracks on the bluff top above the northern cove was also noted, suggesting that the bluff top is unstable.

In addition to bluff retreat caused by direct wave attack, erosion and bluff retreat in the southern cove also occur from stormwater runoff over the bluff top. The runoff flows partly from the upland area of the site, and partly from subdrains and street surfaces at the adjoining residential area. There are two swales that drain this runoff over indentions in the bluff. These bluff indentions extend landward enough to intersect highly folded and weakly resistant shales interbedded in the Cretaceous sandstone bedrock, potentially accelerating bluff retreat in those areas.

2) West FRP – Erosion and Sedimentation

Erosion of low to moderately permeable topsoil and terrace deposits occurs in several locations in the West FRP. Erosion can occur in the steeper portions of the property, in places of shallow groundwater and seeps, or where animal or human activity causes soil to move down slope and prevents soil stabilization by denuding vegetation.

Areas of most active and severe erosion are the Seaclift Gully and the Warren/Trenton Gully. Surface flow originating from springs in the Seaclift Gully occurs year-round, with a possible exception during drought years; however, erosion in this and the Warren/Trenton Gully occurs

primarily during storm runoff. Erosion also occurs over relatively short distances in several places near the Bluff Trail. In the northeast corner of the property, erosion is occurring along a volunteer trail within the alignment of the proposed Creek to Ridge Trail. This currently informal trail is routed roughly parallel to slope direction, and is steep and subject to erosion during storm runoff and from hiking and bicycle activity.

A portion of the Santa Rosa Creek trail is located in the northeast corner of the West FRP, near historically eroding stream banks. Severe streambank erosion had occurred along the west bank, threatening a sanitary sewer line. Because of the continued bank erosion, the sewer line was relocated away from the creek, and streambank restoration efforts were conducted, which included manual revegetation and installing a geotextile fabric. An additional eroding stream bank was identified on the east bank just upstream of the restored area. Areas of erosion are shown on Figure V-4.

3) West FRP – Springs and Seeps

There are three springs on the West FRP that flow perennially (refer to Figure V-4). The spring water at all three sites flows from the upper terrace deposits at the contact with the Cretaceous sandstone. Seeps occur continuously at the base of the terrace deposits between the spring in the Seaclift Gully and the spring in the gully to the south. Water flowing from the springs and seeps at these two gullies flows to the 36-inch culvert beneath Windsor Boulevard. The spring in the northeast portion of the West FRP, south of the proposed Creek to Ridge Trail (Figure V-4) is located in heavy vegetation, and flows northeast to Santa Rosa Creek. These springs and seeps are set in steep-walled gullies or in soft, wet soils; however, they present negligible hazards to the trail systems. The proposed Creek to Ridge Trail may cross soft, wet soils down slope of the spring in the northeast corner.

4) West FRP – Landslides

There is no evidence of deep-seated slope failures at or in the immediate vicinity of the site. Given the slope and subsurface conditions, deep-seated slope failure is not likely to occur, and should be considered a low-level geologic hazard.

5) West FRP – Asbestos and Radon Gas

Naturally-occurring asbestos is most commonly found in serpentinites and partially serpentinized ultramafic rock. Since there are no serpentinite bodies or ultramafic rocks at or near the project site, naturally-occurring asbestos related hazards are negligible.

Radon gas is considered a potential geologic hazard when certain geologic formations are present, and can then be hazardous in enclosed, poorly ventilated indoor areas such as basements. Because the property is underlain by materials that are not known or suspected to emit radon gas, and since improvements at the site will not include poorly ventilated enclosed building structures, radon gas hazards are negligible.

6) West FRP – Expansive Soils

The shrink-swell potential at the site is documented in the Soil Survey of San Luis Obispo County (1984). Because of the high clay content in most of the soils in the West FRP, the

potential for shrinking and the alternating swelling in the expansive soils is high in most areas. The result of soil shrink in the dry season is severe cracking. In the wet season, swelling soil typically has a high moisture content, and can move structures founded on such soils. Hazards to the trail systems include tripping over cracked soil, minor movement of boardwalk structures during swelling conditions, and surface cracking in parking lots if asphalt concrete pavement is installed.

7) West FRP – Ground Shaking

A probabilistic Seismic Hazard Analysis was conducted using the U.S. Geological Survey (USGS) software "Seismic Design Parameters" to determine potential earthquake parameters. Although improvements to the West FRP are generally limited to trails and parking areas, a telecommunications facility has been proposed, and the application is under consideration by the County of San Luis Obispo. Ground motions estimated herein do not reflect site-specific motions expected at the proposed telecommunications site, but present a range of possible motions for the West FRP. Considering the general subsurface geology and the distance to known faults, the earthquake peak ground acceleration (PGA) that has a ten percent chance of being exceeded in fifty years is expected to range between 35 percent and 38 percent of the force of gravity (potential shaking hazard from future earthquakes).

8) West FRP – Surface Rupture

There are no topographic features on or near the site that are indicative of geologically recent fault rupture. If there is a fault at depth, it is covered by unaffected deposits that are a hundred thousand or more years old, and it would not be considered active. Because there is no evidence of an active fault on site, and the nearest identified active fault is five kilometers from the site, the risk of surface rupture is considered negligible.

9) West FRP – Liquefaction

Liquefaction is restricted to areas underlain by loose, granular materials, consisting of uniformly fine sands or sandy fill, where groundwater is within about thirty feet of the surface. Clay and silt content in the subsurface reduces the risk of liquefaction. In general, sites with the youngest and loosest deposits with very shallow groundwater are the most susceptible to liquefaction. Liquefaction may result in lateral spreading, ground settlement, and occasionally may generate sand boils. Structures supported on subsurface materials under these conditions would be subject to violent and rapid tilting or settlement as the supporting capability of the liquefying material is diminished. Because of the relatively high clay and silt content, and slight consolidation of the terrace deposits, liquefaction is considered to be a low risk at the site.

10) West FRP – Tsunami and Seiche

A tsunami is an ocean wave generated by vertical displacement of the sea floor during an earthquake, a large-scale submarine slope failure, or volcanic eruption. The maximum predicted tsunami run-up in Cambria was reported by Houston and Garcia (1978) to be nine feet for a 100-year event. The tsunami hazard for San Luis Obispo County is reported in the *County Safety Element* (1999), and the *Tsunami Emergency Response Plan* (San Luis Obispo County Office of Emergency Services, October 2005). Although a run-up estimate was not given for Cambria in the Safety Element, the hazard of tsunamis within the Morro Bay and Cayucos coastline

approximately fifteen miles south of Cambria, was reported as being greatest for elevations within 9.5 and 24.2 feet above sea level for the 100 to 500-year events. The *Tsunami Emergency Response Plan* notes that "recent run-up and inundation modeling and mapping, done by the University of Southern California (USC) under contract to State OES, indicates a general potential maximum inundation elevation of 40 feet above mean sea level. However, undersea geology or bathymetry and local natural or manmade structures may alter this estimate and the county has decided to utilize an inundation of 50 feet above mean sea level for emergency planning purposes." The 2005 report identifies evacuation areas on the West FRP, extending from the Marine Terrace Trail to the ocean.

A seiche is a periodic oscillation of an enclosed body of water, such as a harbor, lake, or reservoir. Because there are no harbors, lakes, or reservoirs on or near the site, the hazard related to seiche activity is negligible.

11) West FRP – Slope Failure

Earthquake-induced failure of steep slopes can occur in either bedrock or poorly consolidated deposits. The fact that the Cretaceous sandstone is only moderately weathered and is well cemented with favorable dipping beds, causes it to be generally resistant to seismically induced slope failure. However, where it is highly fractured or where the unit contains loose, friable shale beds, and it is exposed in steep slopes, the risk of rock fall during ground shaking is increased. The rock fall hazard within the bedrock is greatest within the bluff face along the protruded coastline and in the cove in the southern corner of the site.

Slope failure within the terrace deposits is a significant hazard in the high bluffs in the cove at the northern corner of the property, and also in the lower bluffs in the southern cove. Shallow or deep-seated seismically induced slope failure within the bedrock or terrace deposits in the remaining areas of the West FRP is considered to be a low-level hazard.

e. EAST FRP – GENERAL SITE CONDITIONS

The 75-acre East FRP comprises part of the floodplain of Santa Rosa Creek and the lower portions of steeply sloping hills along the southern margins. The floodplain gently slopes to the west from Cambria at a gradient of approximately one percent and is incised along the northern edge of the East FRP by Santa Rosa Creek. The uniformly sloping floodplain is interrupted by a broad gully approximately four to six feet deep, located between the proposed community park and Highway 1.

Stormwater runoff from the hills to the south sheet flows across the floodplain north and northwest to the creek or flows into the gully, ultimately flowing into Santa Rosa Creek upstream and adjacent to the Highway 1 bridge. The hillside slopes are vegetated with Monterey pines and an understory of thick, low brush. Grasses mantle the floodplain and the creek banks are heavily vegetated with riparian woodlands and scrub. Riprap and bridge abutments channel the creek under Highway 1 on the west end of the East FRP.

1) East FRP – Bedrock Units

Upper Cretaceous age sandstone is the only bedrock unit exposed in the East FRP area. It crops out in the heavily vegetated, steep slopes on the south side of the East FRP, and in several places in the stream bank of Santa Rosa Creek. This consists mostly of moderate to well-cemented arkosic sandstone, and lesser weakly resistant, interbedded shale.

2) East FRP – Surficial and Soil Units

Quaternary age alluvial deposits unconformably overlie the sandstone at the site. These deposits consist of unconsolidated cobbles, gravel, sand, silt, and clay. The maximum thickness of these deposits is approximately 110 feet along Santa Rosa Creek on the East FRP. Well driller's logs from wells drilled in the alluvium indicate alternating layers of coarse grained beds and silt and clay beds. The basal portion of the "alluvial deposits" is composed of unconsolidated marine sand, clay, and seashell fragments. Individual beds vary in thickness and are not laterally extensive.

Organic topsoil is generally thick and well developed on the valley floor. The onsite soils were mapped by the Soil Conservation Service (1984). The following soil map units are described in the Soil Survey and are shown on Figure V-2:

- *Salinas silty clay loam (198)* is found along Santa Rosa Creek and along Highway 1. The soil is very deep, well drained, and the permeability is moderately slow. It formed in alluvium weathered from sandstone and Franciscan Complex rocks. Surface runoff is slow or medium, and the hazard of water erosion is slight or moderate. The shrink-swell potential is moderate. The effective rooting depth is sixty inches or more.

- *Marimel silty clay loam (170)* extends across most of the East FRP and underlies all of the area proposed for the Community Park. The soil is very deep, well drained, nearly level, and the permeability is moderately slow. It formed in alluvium weathered from sandstone and Franciscan Complex rocks. Surface runoff is slow and the hazard for water erosion is slight. The effective rooting depth is sixty inches or more.

3) East FRP – Surface and Groundwater Conditions

Santa Rosa Creek usually flows throughout the year. Surface water outside of Santa Rosa Creek is generally present on the site during the rainy season only. During winter storm events, surface runoff from the hills to the south flows across the floodplain north and northwest to the creek or flows into the wide swale located in the west half of the site, ultimately flowing into Santa Rosa Creek. Significant runoff flows onto the southeast corner of the site from watersheds in the vicinity of Piney Way. The easterly drainage flows through an actively eroding swale forming along the road in the steep area of Piney Way, and the westerly drainage flows down the heavily vegetated hillside. The low vegetation serves to prevent hillside erosion and to slow runoff velocities.

Shallow groundwater is present throughout the valley areas of the East FRP, and is at or near the surface in the wet areas observed below Piney Way and in the southwest corner along Highway

1. The depth to groundwater measured in an unused well located near the center of the proposed Community Park was eighteen feet below ground surface in late summer 2006.

f. EAST FRP – GEOLOGIC AND SOILS HAZARDS

1) East FRP – Erosion and Sedimentation

Erosion on the East FRP is primarily in the form of stream bank erosion occurring along Santa Rosa Creek. The bank is most susceptible to erosion where the sandstone bedrock is not exposed in the bank, and the bank is made up of soft, highly erodible alluvial material. Erosion will occur in these bank conditions at the cut bank of a stream meander. The most severe bank erosion is occurring near the mobile home park northwest of the site, on the south bank along a high, near vertical cut. A comparison of aerial photographs taken in 1949, 1994, and within the last three years shows that the stream channel has not significantly changed. There was no other evidence in the photos of significant stream bank erosion at the site during the 45-year period.

Erosion is actively occurring on the proposed alignment for the Santa Rosa Creek Trail where it passes under the Highway 1 bridge. Stormwater runoff flows from Highway 1 beneath the bridge and across the trail which is underlain by soft fill material placed adjacent to riprap at the bridge supports.

In the vicinity of Piney Way, stormwater runoff flows through an actively eroding swale east of the property and flows onto the property near the sanitary sewer system. Erosion is occurring around the raised manhole in the southern-most corner of the property near Piney Way.

Erosion was not observed in all other areas along the southern edge of the East FRP where stormwater runoff occurs. Minor to insignificant sedimentation at the base of the steep, vegetated hillsides was observed along the southern edge of the site. Hazards from erosion and sedimentation along the hillsides are considered to be low based on the existing conditions of the hillsides. A reduction in vegetative cover or hillside grading could result in areas of severe erosion and sedimentation on the floodplain below.

2) East FRP – Landslides

There is no evidence of deep-seated slope failures at or in the immediate vicinity of the East FRP. The steep hillsides along the southern boundary are underlain by resistant Cretaceous sandstone with bedding dipping either into the slope or at a high angle to the slope. Based on these conditions, deep-seated slope failure is not likely to occur, and should be considered a low-level geologic hazard.

3) East FRP – Asbestos and Radon Gas

Naturally-occurring asbestos is most commonly found in serpentinites and partially serpentinized ultramafic rock. Since there are no serpentinite bodies or ultramafic rocks at or near the project site, asbestos related hazards are negligible.

Radon gas is considered a potential geologic hazard when certain geologic formations are present, and can then be hazardous in enclosed, poorly ventilated indoor areas such as basements. Because the property is underlain by materials that are not known or suspected to

emit radon gas, and since improvements at the site will not include poorly ventilated enclosed building structures, radon gas hazards are negligible.

4) East FRP – Expansive Soils

The shrink-swell potential at the site is documented in the *Soil Survey of San Luis Obispo County* (1984). The Marimel silty clay loam typically has a low potential for shrinking and the alternating swelling is low.

5) East FRP – Ground Deformation

Subsidence of ground surfaces occurred in Cambria during 1976 and 1977, and resulted in fractures of structures and road surfaces, and breaks in water, sewer, and gas utilities. CCSD production of groundwater was at its highest historic level, and coincided with the two-year drought of 1976 and 1977. The State Water Resources Control Board's (SWRCB) Decision/Order (1989) established conditions on which the appropriative right must conform to in relation to this potential impact. Future subsidence at the site is not likely to result from the limited production needed to meet the project demands (refer to Chapter V.B., Hydrology).

6) East FRP – Seismically Induced Hazards

Geologic hazards relating to seismicity include ground shaking, slope failure, liquefaction, surface rupture along the trace of an active fault, tsunami and seiche, and rock fall. The East FRP will experience strong ground shaking during the life of the project; however, because of difference geologic conditions, this site is not likely to experience all of these seismic effects.

7) East FRP – Ground Shaking

A probabilistic Seismic Hazard Analysis was conducted using the USGS software "Seismic Design Parameters" to determine potential earthquake parameters. Proposed building structures within the community park include public restrooms, a community center, gazebo, storage and maintenance building, and a relocated pump house. Ground motions estimated herein represent a range of motions that could be experienced at the proposed building sites, but do not reflect site-specific motions for each location individually. A more detailed analysis will be required prior to construction. Considering the general subsurface geology and the distance to known faults, the earthquake peak ground acceleration (PGA) that has a ten percent chance of being exceeded in fifty years is expected to range between 35 percent and 38 percent of the force of gravity (potential shaking hazard from future earthquakes).

8) East FRP – Surface Rupture

There are no topographic features on or near the site that are indicative of geologically recent fault rupture. If there is a fault at depth, it is covered by unaffected deposits that are a hundred thousand or more years old, and it would not be considered active. Because there is no evidence of an active fault on site, and the nearest identified active fault is five kilometers from the site, the risk of surface rupture is considered negligible.

9) East FRP – Liquefaction

Liquefaction is restricted to areas underlain by loose, granular materials, consisting of uniformly fine sands or sandy fill, where groundwater is located approximately thirty feet of the surface. Clay and silt content in the subsurface reduces the risk of liquefaction. In general, sites with the youngest and loosest deposits with very shallow groundwater are the most susceptible to liquefaction. Liquefaction may result in lateral spreading, ground settlement, and occasionally may generate sand boils. Structures supported on subsurface materials under these conditions would be subject to violent and rapid tilting or settlement as the supporting capability of the liquefying material is diminished.

The East FRP is underlain by young alluvial deposits with shallow groundwater. Depth to groundwater was measured at eighteen feet in the ten-inch diameter well located near the center of the proposed community park in late summer 2006, but depths are expected to be shallower during the winter months due to rainfall.

The general conditions required for liquefaction to occur appear to be present at the site, but because of the relatively high clay and silt content of the alluvial deposits, the risk may be significantly lessened. Prior to development of construction plans, a subsurface investigation of the site should be performed to assess the actual potential for liquefaction.

10) East FRP – Tsunami and Seiche

Because of its inland location, and the fact that surface elevations are above the maximum predicted run-up elevations of nine feet for a 100-year event, the tsunami hazard for the site is considered very low, based on technical data referenced in the County Safety Element. Based on updated mapping documented in the *Tsunami Emergency Response Plan* (2005), the county has decided to utilize an inundation of 50 feet above mean sea level for emergency planning purposes, and potential evacuation areas in Cambria include the East FRP. The proposed Community Park would be located at approximately 50 feet above mean sea level.

Because there are no harbors, lakes, or reservoirs on site, the hazard related to seiche activity is negligible.

11) East FRP – Slope Failure

Earthquake-induced failure of steep slopes can occur in either bedrock or poorly consolidated deposits. The Cretaceous sandstone onsite is only moderately weathered and is cemented with generally favorable dipping beds, and is generally resistant to seismically induced slope failure; however, where it is highly fractured or where the unit contains loose, friable shale beds and it is exposed in steep slopes, the risk of rock fall during ground shaking is increased. Rock fall hazard within the bedrock is greatest along the hillside to the south; however, these hillside slopes are heavily vegetated, reducing the rock fall hazard to a low-level hazard.

Slope failure consisting of shallow slumping and rock fall within the alluvial deposits is a significant hazard in the steep-walled stream bank located near the mobile home park. Deep-seated seismically induced slope failure within the bedrock or alluvial deposits at the East FRP is considered to be a low-level hazard.

3. THRESHOLDS OF SIGNIFICANCE

The thresholds of a significant soils hazard, geologic, or seismic impact is that which could result in the following:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving rupture of a known earthquake fault, as either delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist or by other substantial evidence of a known fault, as well as strong seismic ground shaking, liquefaction, or seismic-induced slope failure or rock fall.
- Result in substantial soil erosion or the loss of topsoil.
- Result in the loss of a unique geologic feature.
- Structure 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, subsidence, or collapse.
- Structure located on expansive soil, creating substantial risks to life or property.
- Expose people to potential adverse medical effects from natural gases or minerals such as radon gas or asbestos.
- Expose people or structures to injury or loss of life from tsunamis.

4. IMPACT ASSESSMENT AND METHODOLOGY

For this report, existing conditions were characterized based on available studies, interviews, and field reconnaissance. Potential project impacts and cumulative impacts were determined based on the proximity of project improvements to sources of geologic hazards, and an evaluation of construction and restoration techniques. Mitigation measures are identified along with a plan for implementation of the mitigation measures.

5. WEST FRP – IMPACTS AND MITIGATION MEASURES

a. WEST FRP – BLUFF, GULLY, AND STREAMBANK EROSION HAZARDS

The closest trail to the bluffs is the existing Bluff Trail that was improved in 2006. The trail was located along the previously existing trail route and was covered by a separate environmental determination. The route was determined with geologic review and the trail is generally located eight to 120 feet from the edge of the bluff top. Mitigation measures adopted upon approval of the Bluff Trail included implementation of erosion and sedimentation control measures, installation of water diversion features, and long-term monitoring of bluff erosion. The trail would be relocated if the bluff erodes up to ten feet from the trail. Erosion and subsequent landward retreat of the coastal bluff will affect the long-term design and location of the bluff trail system.

GEO Impact 1 Bluff retreat has the potential to undermine the Bluff Trail located on the West FRP.

GEO/mm-1 Any additional improvements or additions to the Bluff Trail shall be set back from the bluff top a minimum of 25 feet based on site investigations, Coastal

Commission and San Luis Obispo County Department of Planning and Building requirements and guidelines, and to the extent feasible considering protection of wetland resources.

Residual Impact With implementation of mitigation, this impact would be considered *less than significant with mitigation, Class II*.

Erosion occurs in several locations in the West FRP. Areas of most active and severe erosion are the Seaclift Gully and the Warren/Trenton Gully. Erosion also occurs over relatively short distances in several places near the Bluff Trail where minor gullies channel runoff to the bluff. In the northeast corner of the property, erosion is occurring along the Creek to Ridge Trail. Erosion will result in loss of topsoil, may accelerate bluff retreat rates, and damage affected portions of the trail system.

Streambank restoration efforts have been completed along the west bank of Santa Rosa Creek to protect the sanitary sewer system, access road, and trail. Continued streambank and gully restoration efforts and implementation of temporary and permanent erosion control measures are necessary during continued management of the FRP and are necessary to minimize erosion and subsequent sedimentation.

GEO Impact 2 Stormwater runoff within un-stabilized gullies and drainage courses causes erosion and down-gradient sedimentation, resulting in a potentially significant impact.

GEO/mm-2 Upon application for land use and construction permits from the County of San Luis Obispo, prior to site disturbance, and during management of the Fiscalini Ranch Preserve (FRP), the CCSD or its designee shall implement the following measures:

a. Implement soil stabilization and erosion prevention measures identified in the *Public Access and Management Plan* (RRM, 2003) for the Seaclift Gully and portions of the Bluff Trail.
b. Plans in conjunction with the Natural Resources Conservation Service (NRCS) shall be developed for the Warren/Trenton Gully.
c. The streambank restoration project along Santa Rosa Creek west of Highway 1 shall be monitored and evaluated to determine its effectiveness.
d. Additional restoration and bank stabilization efforts within Santa Rosa Creek shall be implemented based on consultation with the Natural Resource Conservation Service (NRCS) or Resource Conservation District (RCD); additional regulatory agency consultation shall be implemented within federal and state jurisdictional areas including the California Department of Fish and Game (CDFG), Regional Water Quality Control Board (RWQCB), and Army Corps of Engineers (ACOE).

e. Streambank restoration plans shall be developed to control bank erosion on the Santa Rosa Creek east bank upstream of the previously restored bank.

Residual Impact With implementation of mitigations, this impact would be considered *less than significant with mitigation, Class II*.

b. WEST FRP – TRAIL EROSION HAZARDS

During improvement activities to existing and proposed trail alignments, disturbance of soil and removal of vegetation may result in erosion and down-gradient sedimentation. Implementation of temporary and permanent soil stabilization measures identified in the *Public Access and Management Plan* and Best Management Practices recommended by the NRCS are necessary to minimize erosion and subsequent sedimentation.

GEO Impact 3 Implementation of improvements to existing and proposed trail corridors, soil disturbance, and removal of vegetation would cause erosion and down-gradient sedimentation, resulting in a potentially significant impact.

GEO/mm-3 Upon application for land use and construction permits to the County of San Luis Obispo, prior to site disturbance, and during management of the Fiscalini Ranch Preserve (FRP), the CCSD or its designee shall implement the following measures:

a. Implement soil stabilization and erosion prevention measures identified in the *Public Access and Management Plan* (RRM, 2003).
b. Final design plans for the Creek to Ridge Trail shall demonstrate that the trail alignment is located over less steep areas, and shall include the use of water bars where needed.

Residual Impact With implementation of mitigations, this impact would be considered *less than significant with mitigation, Class II*.

c. WEST FRP – SATURATED SOIL EROSION HAZARDS

There are three springs on the West FRP. Two springs and a seep area are located in the vicinity of the Seaclift Gully, and one spring is located in the northeast corner of the property near the Creek to Ridge trail, as shown in Figure V-4. Where existing and proposed trail systems cross wet, boggy areas downstream of the springs, trail damage, and associated erosion and soil loss will occur.

GEO Impact 4 Construction and use of the Terrace to Ridge Trail and Creek to Ridge Trail within areas of saturated soil would result in erosion and down-gradient sedimentation, resulting in a potentially significant impact.

GEO/mm-4 Upon application for land use and construction permits from the County of San Luis Obispo, and prior to site disturbance, the CCSD or its designee shall implement appropriate bridge design and construction methods (i.e., avoid saturated areas, install bridges or raised boardwalks, maintain drainage patterns, etc.) where trails cross wet, boggy areas below springs and seeps.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II*.

d. WEST FRP – SOIL SHRINK-SWELL HAZARDS

The potential for shrinking and the alternating swelling in expansive soils is high in most areas of the West FRP. Hazards to the trail systems include inconsistent ground surface due to cracked soil, minor movement of boardwalk structures during swelling conditions, and surface cracking and buckling within paved areas (if proposed).

GEO Impact 5 The high shrink-swell characteristic may result in damage to proposed improvements and inconsistent trail surfaces, resulting in a potentially significant impact.

GEO/mm-5 Upon application for land use and construction permits from the County of San Luis Obispo, and prior to site disturbance, the CCSD or its designee shall prepare trail plans showing the use of boardwalks or engineered base along the trails where severely cracked soils are present. Any asphalt concrete pavement (if proposed) shall be designed with sufficient base material and depth to prevent effects of expansive soils. If construction of boardwalks or engineered base is not feasible, the CCSD or its designee shall prepare and implement a site specific maintenance plan to ensure safe trail surfaces. The plan shall identify the person(s) responsible and schedule for maintenance, and proposed activities for trail improvements.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II*.

e. WEST FRP – SITE ALTERATION AND SLOPE STABILITY

There is no evidence of deep-seated slope failures at or in the immediate vicinity of the site. Given the slope and subsurface conditions, deep-seated slope failure is not likely to occur. The proposed site alterations including trail construction and gully stabilization will not increase this risk. This impact is considered *less than significant, Class III*, and no additional mitigation measures are considered necessary.

f. WEST FRP – SEISMIC HAZARDS

Strong ground shaking is expected to occur at the site during the life of the project. Because no structures are proposed that would expose the public to this hazard, this impact is not considered significant. There are no topographic features on or near the site that are indicative of geologically recent fault rupture. Because there is no evidence of an active fault on site, and the

nearest identified active fault is five kilometers from the site, the risk of surface rupture is considered negligible. This impact is considered *less than significant, Class III,* and no additional mitigation measures are considered necessary..

Liquefaction is restricted to areas underlain by loose, granular materials, consisting of uniformly fine sands or sandy fill, where groundwater is within about thirty feet of the surface. Because of the relatively high clay and silt content, and slight consolidation of the terrace deposits, liquefaction is considered to be a low risk at the site. Structural development would be limited to future telecommunications facilities at the site, which is currently under consideration by the County of San Luis Obispo.

GEO Impact 6 **Future wireless telecommunication facilities located on the West FRP would potentially be subject to ground-shaking and liquefaction hazards, resulting in a potentially significant impact.**

GEO/mm-6 Upon application for applications for land use and construction permits from the County of San Luis Obispo for a wireless telecommunications facility, the CCSD or its designee shall retain a County-approved, qualified geologist to prepare a site-specific, subsurface investigation regarding liquefaction potential. Based on the results of the investigation, the facility shall be constructed appropriately to minimize this hazard.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II.*

g. WEST FRP – TSUNAMI HAZARD

The National Oceanic and Atmospheric Administration's National Weather Service (NWS) operates the West Coast/Alaska Tsunami Warning Center to provide tsunami warning guidance for all U.S. coastal states (except Hawaii). The maximum predicted tsunami run-up in Cambria was reported by Houston and Garcia (1978) to be nine feet for a 100-year event. Such a tsunami striking the coast during an extreme high tide or during high surf conditions could overtop the coastal bluff in the cove at the southern portion of the site, possibly reaching the Bluff Trail.

In October 2005, a *Tsunami Emergency Response Plan* was completed by the San Luis Obispo County Office of Emergency Services. This plan notes that areas potentially susceptible to tsunami hazards include coastal areas less than fifty feet in elevation above mean sea level. The affected area includes the West FRP up to the Marine Terrace Trail.

GEO Impact 7 **The Bluff Trail and Marine Terrace Trail are located within an area potentially affected by a 100-year tsunami event, which would result in a hazard to trail users during the event.**

GEO/mm-7 In the event of a tsunami, the CCSD or ranch manager shall post National Weather Service (NWS) warnings at each trailhead, and create a plan for evacuation based on the NWS warning guidance and the San Luis Obispo County *Tsunami Emergency Response Plan*.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II*.

h. WEST FRP – SEISMIC EVENT SLOPE FAILURE

Earthquake-induced failure of steep slopes and rock fall can occur in either bedrock or poorly consolidated deposits. Slope failure and rock fall are most likely to occur along the coastal bluff. Shallow or deep-seated seismically induced slope failure and rock fall within the bedrock or terrace deposits in the remaining areas of the West FRP are considered to be low-level hazards. Because project improvements are to be located above the bluff top with an appropriate setback from the bluff, and with the low risk of slope failure in other inland locations, this impact is considered *less than significant, Class III,* and no additional mitigation measures are considered necessary.

6. EAST FRP – IMPACTS AND MITIGATION MEASURES

a. EAST FRP – STREAMBANK AND DRAINAGE EROSION

Erosion on the East FRP is primarily in the form of stream bank erosion along Santa Rosa Creek. Near the mobile home park northwest of the site, stream bank erosion is active along the southern bank along a high, near vertical cut. Erosion and sedimentation is actively occurring on the Santa Rosa Creek Trail where it passes under the Highway 1 bridge (linking East FRP and West FRP). Rock riprap adjacent to the trail is not sufficiently stable to provide lateral support to the trail.

Approximately 100 feet southwest of Piney Way, stormwater runoff flows through an actively eroding swale east of the property. Erosion is occurring around the raised manhole in the southern-most corner of the property near Piney Way. A reduction in vegetative cover in the area, or hillside grading could result in areas of severe erosion and sedimentation on the floodplain below.

GEO Impact 8 **Stormwater runoff within un-stabilized gullies and drainage courses causes erosion and down-gradient sedimentation, resulting in a potentially significant impact.**

GEO/mm-8 Prior to site disturbance and during trail and resource management within the Fiscalini Ranch Preserve (FRP), the CCSD or its designee shall implement the following measures:

a. Implement Santa Rosa Creek bank stabilization measures identified in the *Public Access and Management Plan* (RRM, 2003).
b. Streambank restoration plans shall be developed to control bank erosion on the Santa Rosa Creek east bank upstream of the previously restored bank.

GEO/mm-9 Upon application for land use and construction permits for the Santa Rosa Creek Trail, and prior to site disturbance, the CCSD or its designee shall implement the following measures:

a. Runoff from Highway 1 shall be conveyed away from the Santa Rosa Creek Trail by tightlining a drain pipe to the base of the stream bank.
b. For the portion of the trail crossing located under Highway 1, the trail design shall provide adequate head clearance for hikers, and a stable crossing over the rip-rap, pursuant to regulatory and responsible agency requirements, including but not limited to the California Department of Transportation and California Department of Fish and Game.

GEO/mm-10 Upon application for land use and construction permits to implement the *Community Park Master Plan* and prior to site disturbance, the CCSD or its designee shall consult with the County of San Luis Obispo to stabilize the offsite drainage swale in the vicinity of Piney Way. The applicant shall also implement the storm-drain system described in the *Community Park Master Plan Grading and Drainage Concept* (Firma, 2006) to capture runoff from both watersheds in this area and convey runoff across the site to Santa Rosa Creek. The condition of the hillside vegetation shall be monitored prior to finalizing plans for the storm-drain system.

Residual Impact With successful implementation of these mitigations, the impacts would be considered *less than significant with mitigation, Class II*.

b. EAST FRP – SOIL SHRINK-SWELL HAZARD

The potential for shrinking and the alternating swelling in expansive soils is low to moderate at the site. The Santa Rosa Creek Trail in the western portion of the East FRP is most susceptible to risks of shrinking and swelling soils. Hazards at the trail systems include tripping over cracked soil and minor movement of boardwalk structures during swelling conditions. Soils in the area of the proposed community park have a low potential for shrinking and swelling according to the *Soil Survey* (Ernstrom, 1984); however, the proposed two acres of pavement may be at some risk to cracking or buckling from these soils.

GEO Impact 9 The low to moderate shrink-swell characteristic may result in damage to proposed improvements and inconsistent trail surfaces, resulting in a potentially significant impact.

Implement GEO/mm-5.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II.*

c. EAST FRP – SITE ALTERATION AND SLOPE STABILITY

There is no evidence of deep-seated slope failures at or in the immediate vicinity of the site. Based on geologic conditions, deep-seated slope failure is not likely to occur. This impact is not considered significant.

d. EAST FRP – SEISMIC-INDUCED STRONG GROUND SHAKING

Strong ground shaking is expected to occur at the site during the life of the project. Proposed building structures at the site include public restrooms, a future community center, gazebo, storage and maintenance building, and a pump house. These structures will be designed for human occupation; therefore ground shaking is considered a significant impact. The U*niform Building Code* (1997) requires that the design-basis ground motion be provided in a geologic report to be used by the building design engineer.

GEO Impact 10 Seismic-induced strong ground shaking may affect the stability of proposed structures on the East FRP within the Community Park, resulting in a potentially significant impact.

GEO/mm-11 Upon application for land use and construction permits from the County of San Luis Obispo, and prior to site disturbance, the CCSD or its designee shall retain a County-approved, qualified geologist to prepare and submit a Probabilistic Seismic Hazard Analysis. The analysis shall determine the design-basis earthquake parameters for the building sites proposed in the *Community Park Master Plan.* Recommendations and requirements presented in the analysis shall be incorporated into construction plans.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II*.

e. EAST FRP – FAULT RUPTURE

There are no topographic features on or near the site that are indicative of geologically recent fault rupture. Because there is no evidence of an active fault on site, and the nearest identified active fault is five kilometers from the site, the risk of surface rupture is considered negligible. This impact is considered *less than significant, Class III,* and no mitigation measures are considered necessary.

f. EAST FRP – LIQUEFACTION HAZARDS

Liquefaction may result in lateral spreading, ground settlement, and occasionally may generate sand boils. Structures supported on subsurface materials under these conditions would be subject to violent and rapid tilting or settlement as the supporting capability of the liquefying material is diminished. The general conditions required for liquefaction to occur appear to be present at the site, but because of the relatively high clay and silt content of the alluvial deposits, the risk may be significantly lessened.

GEO Impact 11 The potential for liquefaction may affect the stability of proposed improvements and structures on the East FRP within the Community Park, resulting in a potentially significant impact.

GEO/mm-12 Upon application for land use and construction permits from the County of San Luis Obispo, and prior to site disturbance, the CCSD or its designee shall retain a County-approved, qualified geologist to prepare and submit a subsurface investigation of the site. The investigation report shall assess the potential for liquefaction. Building design parameters shall be based on the results of the subsurface investigation. Building foundations shall be founded on competent, native material, not subject to liquefaction.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II*.

g. EAST FRP – TSUNAMI HAZARD

Based on the *Tsunami Emergency Response Plan* (October 2005), completed by the San Luis Obispo County Office of Emergency Services, areas potentially susceptible to tsunami hazards include coastal areas less than fifty feet in elevation above mean sea level. The affected area includes the East FRP.

GEO Impact 12 The East FRP is located within an area potentially affected by a 100-year tsunami event, which would result in a hazard to trail and park users during the event.

Implement GEO/mm-7.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II*.

h. EAST FRP – SEISMIC-INDUCED SLOPE FAILURE

Deep-seated seismically induced slope failure within the bedrock or alluvial deposits is considered to be a low-level hazard. Slope failure consisting of shallow slumping and rock fall within the alluvial deposits is a significant hazard in steep-walled stream banks of Santa Rosa Creek. Restoration efforts would stabilize banks, reducing the potential for failure. Outside the 100-foot development setback from Santa Rosa Creek, the rock fall hazards are greatest along the hillside to the south; however, these hillside slopes are heavily vegetated, reducing the rock fall hazard to a low-level hazard.

GEO Impact 13 Seismically induced slope failure within the Santa Rosa Creek corridor would cause erosion and subsequent sedimentation, in addition to safety hazards due to un-stabilized soils within the riparian corridor, resulting in a potentially significant impact.

GEO/mm-13 Prior to site disturbance and during management of the FRP, the CCSD, or its designee, shall implement stream bank restoration projects within Santa Rosa

Creek. Restoration efforts shall be based on consultation with the Natural Resources Conservation Service and all other applicable resource agencies including the California Department of Fish and Game, Regional Water Quality Control Board, and Army Corps of Engineers.

Residual Impact With the implementation of this mitigation, this impact would be considered *less than significant with mitigation, Class II*.

7. CUMULATIVE IMPACTS

Cumulative effects of the proposed FRP project with other currently proposed projects in the area relating to geology and soils were evaluated. There are few proposed projects pending approval or recently issued land use permits in the vicinity of the project. The County of San Luis Obispo Public Works Department is developing a plan to construct a by-pass structure beneath Highway 1 north of the Highway 1 bridge, approximately 200 feet south of Cambria Drive. The purpose of the by pass is to drain flood waters northeast of the highway and south of Mid-State Bank to lessen flooding potential to the West Village. The floodwaters drained by the structure would be conveyed to the Santa Rosa Creek channel west of the highway. The outfall to the creek channel is not expected to result in streambank erosion.

Based on compliance with the mitigation measures listed above, and each projects' required compliance with the UBC and County Code, cumulative geology and soils impacts would be *less than significant, Class III*, and no additional mitigation measures are considered necessary.

LIST OF ABBREVIATED TERMS

Abbreviation	Term
ACOE	Army Corps of Engineers
BMP	Best Management Practices
CDFG	California Department of Fish and Game
CCSD	Cambria Community Services District
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
NPDES	Federal National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWS	National Weather Service
RWQCB	Regional Water Quality Control Board
SWPPP	Stormwater Pollution Prevention Plan
SWRCB	State Water Resources Control Board
UBC	Uniform Building Code
USGS	U.S. Geological Survey

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