

**GEOLOGIC/GEOTECHNICAL HAZARDS STUDY  
HARBOR TERRACE CAMPGROUND  
PORT SAN LUIS  
COUNTY OF SAN LUIS OBISPO, CALIFORNIA**

August 22, 2014

Prepared for

Lisa Wise Consulting

Prepared by

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August 22, 2014

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FILE NO.: SL-15831-SC

PROJECT: HARBOR TERRACE CAMPGROUND  
PORT SAN LUIS  
COUNTY OF SAN LUIS OBISPO, CALIFORNIA

SUBJECT: GEOLOGIC/GEOTECHNICAL HAZARDS STUDY

REF: Proposal for Fault Investigation and Geologic/Geotechnical Hazards Study, Harbor Terrace Project, Port San Luis, California, by Earth Systems Pacific, Doc. No. 1308-129.PRP.REV2, dated August 23, 2013 (*Revised September 6, 2013*)

Dear Ms. Wise:

As per your authorization of the referenced proposal, this geologic/geotechnical hazards study for the referenced project has been completed. An evaluation of potential geologic/geotechnical hazards, potential impacts upon the project, and possible mitigation measures are presented herein. One electronic copy and two bound copies of the report are furnished for your use.

We appreciate the opportunity to have provided professional services for this project. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

  
Dennis Shallenberger, GE  
Principal Engineer  
8/22/14  


  
Richard T. Gorman  
Associate Geologist  


Doc. No.: 1408-158.RPT/tf



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### APPENDICES

- Appendix A Site Layout Plan (Lisa Wise Consulting)
- Appendix B Geologic Map





## 1.0 INTRODUCTION

Harbor Terrace is an approximately 32-acre site situated on a hillside overlooking San Luis Obispo Bay in the Port San Luis Harbor District, County of San Luis Obispo, California. The site has supported a variety of land uses in the past, but currently is largely vacant of permanent structures. We understand that the Port San Luis Harbor District (the District) intends for the site to be developed with a mix of visitor-serving uses, reserving some areas for current and future District needs such as marine gear and boat storage.

Lisa Wise Consulting (LWC) was retained to assist the District with pre-development activities for the future construction of a low and moderate cost campground that will include a mix of hotel/motel units (cabins), tent sites, tent cabins, RV sites, other related amenities, commercial uses, and boat/equipment storage facilities. To this end, LWC has developed conceptual plans for site development; the conceptual site layout plan is presented in Appendix A. The plan includes the following components:

- 48,000 square feet of parking
- 80 RV sites
- 15 RV/RV cabins
- 31 hotel/motel units (cabins)
- 35 car/tent campsites
- 21 walk-in/bike-in sites
- 16,000 square feet of visitor-serving commercial uses, consisting of a building and a pool
- Area reserved for District's use:
  - 70 trailer boat storage spaces
  - 20 marine gear storage spaces
  - 1.05 acres of storage area
  - 10,000 square feet of expansion area

The grading concept, as presented on the conceptual site layout plan, indicates up to 37 feet of fill soil and cuts of up to 34 feet.



## 2.0 SCOPE OF SERVICES

The purpose of this geologic/geotechnical hazards study was to assess the major geologic/geotechnical issues that could potentially affect the project, thus providing a framework for continued project planning. The intent of this report is to provide information regarding the site features and geologic/geotechnical hazards that could constitute a constraint to the proposed campground as currently envisioned in the conceptual site layout plan, and to discuss potential mitigation measures for identified hazards. The scope of work for the study included research of geologic maps, review of existing geologic/geotechnical data contained in previous studies performed at the site, a site reconnaissance by a Certified Engineering Geologist and a Registered Geotechnical Engineer, and geologic/geotechnical evaluation of data with respect to the project as currently proposed. No subsurface exploration or laboratory testing was performed. The analysis and subsequent conclusions were based, in part, upon verbal information and the conceptual site layout plan provided by Ms. Lisa Wise and Ms. Menka Sethi of LWC. It is recognized that this plan may be subject to change; however, it is referred to in this report in discussions of various site features and potential geologic/geotechnical hazards.

In the event that there are any changes in the proposed development concept or layout, or if any of the assumptions used in the preparation of this report prove to be incorrect, the conclusions contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report verified or modified by this firm in writing. Please note that this report is not intended as a design-level geotechnical engineering report, or as an in-depth geologic investigation to address specific geologic conditions at the site. Further studies will be necessary as indicated later in this report. The conclusions presented in this report are considered preliminary until such time as they are modified or verified by additional geologic and geotechnical investigation.

This report does not address issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of fill soils during compaction, excavation techniques/equipment, dewatering, shoring, temporary slope angles, construction means and methods, etc. Evaluation or analyses of the soil for corrosivity, radioisotopes, hydrocarbons, or other chemical properties are beyond the scope of this report, as well as assessment of the site for mold or lead potential. Ancillary features such as temporary access roads, fences, flagpoles, signage, and nonstructural fills are not within our scope and are also not addressed.



### **3.0 BACKGROUND**

According to past reports prepared for the property, the site was originally graded by Union Oil Company in the early 1900s, and used by Union Oil Company and Standard Oil Company as an oil storage facility. It was later purchased by the Marre family, and additional grading was conducted prior to the construction of a trailer park. In the early 1970s, the site was graded for the proposed Port San Luis Marina Village, a project that was never completed. Additional projects were proposed in the 1980s and the 1990s, but also not constructed. Consequently, the property has remained largely undeveloped, with the exception of the trailer park, an annex building used by the District, RV camping, and areas that have been used for storage of boats and equipment.

Several geologic and soil investigations have been conducted at the parcel; the dates of these reports range from 1970 to 2008. Most of the reports were prepared in association with proposed projects that were planned for the site. A listing of the reports and summaries of their contents were presented in a report prepared by Earth Systems Pacific in 2008 (Earth Systems 2008).

### **4.0 SITE DESCRIPTION**

The Harbor Terrace site is located on the north side of Avila Beach Drive at the intersection with Diablo Canyon Road at Port San Luis, County of San Luis Obispo, California. The 32-acre site lies on the end of a moderately steep northwest-trending ridge. The ridge has been extensively altered by grading into a series of terraces that are separated by cut and fill slopes. The terraces and the slopes between the terraces range in elevation from 50 feet to approximately 200 feet above mean sea level (MSL). The terraces consist of a combination of cut and fill materials at gradients that vary from 1.5:1 to 2:1 (horizontal:vertical). The graded terraces are currently being used for RV camping, and storage of harbor material, trailer boats, and fisherman's gear. RV campsites and a closed annex office are present in the southeastern region of the site on what used to be the trailer park. With the exception of the annex office, there are no permanent buildings on the property. A water storage tank serving the harbor area is situated on a small pad in the north corner of the property, at an elevation of approximately 280 feet MSL. Several water lines traverse the site and serve the RV camping area.



## 5.0 GEOLOGIC SETTING

Port San Luis is located within the Coast Ranges province of California, a north-northwest trending mountain range that extends from the Santa Maria area north to Humboldt County. The Coast Ranges comprise Mesozoic-age to recent sedimentary, volcanic, metavolcanic, metamorphic, and granitic rocks. The Harbor Terrace site lies at the end of a ridge within the Irish Hills, which constitute part of the southern Coast Ranges and are characterized by Jurassic, Cretaceous, and Tertiary-age rock units. Surface elevations within the site range from 30 to 330 feet MSL.

The geologic units underlying the Harbor Terrace site include the Miocene-age Monterey Formation and rocks associated with the Jurassic/Cretaceous-age Franciscan Mélange. The Monterey Formation encompasses siltstone, claystone, dolomitic siltstone, cherty and opaline shale, and tuffaceous sandstone. The Franciscan Mélange generally underlies the Monterey Formation. It is a mixed-rock unit that, in this locale, consists predominantly of highly fractured green serpentinite, dark-green to black shale, and metavolcanic rocks. The entire unit has been extensively altered by tectonic activity, which is expressed as shearing and folding. The bedrock structure is highly complex, particularly within the serpentinite and metavolcanic rocks, and at contact areas with the younger Monterey sedimentary rocks. The Franciscan Mélange is particularly prone to instability and landsliding. The site is overlain by surficial units consisting of colluvium, landslide debris, and fill soil.

Please see the Geologic Map, Appendix B, for a depiction of the geologic units.

## 6.0 SEISMIC SETTING

### 6.1 Local and Regional Faults

The California Geological Survey evaluates faults based upon demonstrated activity and potential for future activity. "Historically active" faults have exhibited earthquake activity during historic time (within the last 200 years +/-). "Active" faults exhibit geologic evidence of movement in Holocene time (last 11,000 years +/-). "Potentially active" faults have geologic evidence of Pleistocene Era movement (last 2,000,000 years +/-).

Active faults that may impact the project include the Los Osos Fault, the San Andreas Fault, and the Hosgri Fault. The newly discovered Shoreline Fault also lies in close proximity to the site; however, its activity level has not yet been determined. The San Luis Bay Fault, a potentially active fault that is part of the San Luis Range Fault System, is believed to cross the site and may also result in impacts.

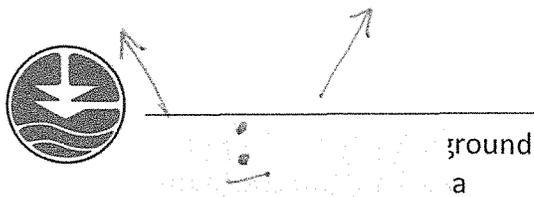


**Los Osos Fault.** The Los Osos Fault is a west-northwest-trending reverse fault that extends predominantly along the northeastern margin of the San Luis Range in San Luis Obispo County. The fault, which has an overall length of about 35 miles, is divided into four segments. The most westerly segment of the fault is the Estero Bay segment, which lies mostly offshore. The Irish Hills segment, the only active fault segment, starts in the vicinity of Los Osos and extends southeasterly to just past San Luis Obispo Creek. A two-mile length of the Irish Hills segment, west of Laguna Lake and near the westerly limit of the City of San Luis Obispo, is considered to be active (Treiman 1989) and is designated as an Alquist-Priolo Earthquake Fault Zone (Hart 1997, revised). The other two segments of the Los Osos Fault are the Lopez Reservoir segment and the Newsome Ridge segment, both located southeast of the Irish Hills segment, east of San Luis Obispo Creek. At its closest point, the Los Osos Fault lies approximately 7 miles north of the site.

**San Andreas Fault.** The most seismically active fault in California is the San Andreas Fault, which lies about 45 miles to the east of the site. The San Andreas Fault is the primary surface boundary between the Pacific and North American plates, and it is generally considered to be the most likely source for strong ground motion in San Luis Obispo County.

Approximately 600 miles long, the San Andreas Fault extends from the Gulf of California to the north coast of California just south of the town of Humboldt. The fault is a right-lateral strike-slip fault and, for classification purposes, is divided into several segments. Locally, the Cholame segment extends southeast from Cholame for about 40 miles, and joins the Carrizo segment, which extends another 90 miles to the southeast. The San Andreas Fault undergoes a major change in character between Parkfield and Cholame. This change is in the Parkfield segment, which has an approximate length of 17 miles and extends from Cholame to 4 miles north of Parkfield. This fault segment is locked, generating an earthquake every 5 to 20 years on average. Dated earthquakes on this segment are 1857, 1881, 1901, 1922, 1934, 1936, 1939, 1966, and 2004. They have historically been in the magnitude 5.5 to 6.0 range (Bakun 1988). A 6.0-magnitude earthquake last occurred on this fault segment on September 28, 2004 (USGS 2009).

**Hosgri Fault.** The Hosgri Fault consists of a series of faults off of the San Luis Obispo County coast. From an area offshore of San Simeon Point, the Hosgri Fault extends to an ocean shelf 2 miles west of Point Buchon, and then trends toward the Point Sal area. The fault is considered active by the United States Geologic Survey (USGS 2009), based on Hall's claims of recent offset terrace deposits along San Simeon Cove, and also by a relocation of the 1927 "Lompoc Earthquake" onto the southern end of the fault (Hall 1975, 1976, 1977). At its closest point, the Hosgri Fault lies approximately 6 miles to the west of the site.



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**Shoreline Fault.** The Shoreline Fault is a vertical strike-slip fault running along the coastline near San Luis Obispo, California, approximately 5.5 miles northwest of the site. Due to its relatively recent discovery, little is known about the Shoreline Fault, including its activity level, slip rate and details regarding its geometry. Research conducted to date has indicated that it is a single continuous fault that connects to the Hosgri Fault. As the Shoreline Fault is essentially vertical, and the Hosgri Fault dips steeply to the east, the Hosgri Fault is believed to dip toward and beneath the Shoreline Fault. The Shoreline Fault most likely transfers strike-slip motion between the Hosgri Fault and other faults of the Pacific–North America Plate Boundary system to the east.

**San Luis Range Fault System.** The San Luis Range Fault System comprises a series of west-northwest striking faults including, from south to north, the Santa Maria River Fault, the Wilmar Avenue Fault, the Oceano Fault, the San Luis Bay Fault and the Pecho Fault. The Santa Maria River Fault is approximately 17 miles southeast of the site. The trend of this fault is inferred from oil well logs and geophysical records. It extends from south of Sisquoc in Santa Barbara County to the Wilmar Avenue Fault in Nipomo. The Wilmar Avenue Fault extends from northern Nipomo to Pismo Beach, where it is exposed in the ocean bluff at the end of Wilmar Avenue. At this location, Pleistocene terrace deposits are displaced in the face of the bluff. The Wilmar Avenue Fault is approximately 4 miles southeast of the site. The Oceano Fault is a 12-mile long northwest-trending fault extending from the town of Nipomo to the offshore area of San Luis Obispo Bay. At its closest point, the Oceano Fault is about 7 miles to the southeast of the site. Because of thick dune sand and alluvial deposits, the onshore trace of the fault is buried or obscured, and the fault's geometry is inferred from subsurface geophysical and well data. The Pecho Fault is located along the coastline about 4 miles west of the site. It is the northernmost fault along the southwestern margin of the San Luis Range. The fault is not exposed in any outcrop and has no geomorphic expression. Its presence along the coast is inferred on the basis of an offset of late Pleistocene marine terrace sequence (Lettis et al 1994).

**San Luis Bay Fault.** The San Luis Bay Fault, part of the San Luis Range Fault System described above, is generally a west-trending reverse fault that displaces and locally warps late Pleistocene marine terraces near the community of Avila Beach. From the Avila Beach area, the fault extends west into the offshore area between the coastline and the Hosgri Fault, and to the southeast offshore of Avila Beach. The San Luis Bay does not directly connect with the Wilmar Avenue Fault, but has similar geometry and structural features along the southwestern margin of the San Luis Range. Geologic data developed by onshore geologic studies, offshore drill



holes, and geophysical data indicate that the fault has a maximum length of about 11.8 miles, including both onshore and offshore segments. The onshore portion is believed to have a length of approximately 2.8 miles. In the near-surface, it dips about 15 to 40 degrees to the north; the dip steepens to about 70 degrees at depth.

The fault is poorly exposed and not well-expressed geomorphically, suggesting a low level of activity. Due to the absence of onshore geomorphic expression, the age of the most recent movement is unknown. Mapping by Lettis and others (1994) indicate that the fault displaces strata of Pleistocene-age terrace deposits, leading to its designation by the California Division of Mines and Geology (CDMG) as "potentially active." Radiocarbon dating of charcoal deposits derived from a strand of the fault exposed in a sea cliff near Avila Beach yielded a date of 21,040 (+/- 850) years. According to discussions with William Lettis (personal communication, December 1996), there was evidence that the fault had displaced younger sediments above where the charcoal sample was dated. There were no charcoal deposits within the displaced younger strata, however, that would allow radiocarbon dating to establish a more recent date of the fault activity (Lettis et al, 1994). Although this date does not establish the fault as active, the fact that it broke younger sediments above the charcoal deposits indicates that it has moved more recently than 21,000 years ago.

## **7.0 GEOLOGIC HAZARDS**

### **7.1 Landslides**

Eight significant landslides have been identified on and in the general vicinity of the site. The approximate locations of these landslides are shown on the Geologic Map, in Appendix B. Please note that the map is a compilation of data from previous reports and our site reconnaissance. It was not subject to GPS or other survey control; consequently, the locations of all the features shown should be considered approximate. It should also be noted that none of the geologic studies conducted to date included in-depth geologic analysis or detailed subsurface exploration of any of the landslides, and past grading of the site has obscured some of the topography related to the landslides. Consequently, the precise areal extent, depth, and configurations of the landslides are unknown and can only be approximated at this time.

The largest landslide, referred to herein as Landslide 1, is located in the eastern region of the site. This landslide was studied to a degree by F. Beach Leighton and Associates (Leighton 1971) and its limits approximated and mapped; however, due to the lack of subsurface exploration, the depth, geometry, and stability characteristics of the landslide are unknown. While the slide's activity level is also unknown, Leighton noted that there had been recent



movement at the time of his evaluation and, in the mid 1980's, it was reported that evidence of minor movement within the slide mass had been observed at the existing trailer park. Based upon visual observations, it appears past movement of the slide has been slow; there is no visual evidence of rapid or catastrophic movement. At the time of the preparation of this report, four borings had been drilled in the past in this landslide; however, these borings were drilled as part of the subsurface assessment for environmental purposes and not as part of a geologic evaluation. The conceptual site layout plan indicates several hotel/motel units (cabins), a restroom, car/tent campsites, and walk-in/bike-in campsites will be located within the boundaries of Landslide 1.

A second landslide, designated Landslide 2, is present in the northwestern part of the site. Downslope of Landslide 2, an area of colluvium is shown on the Geologic Map. The conceptual site layout plan indicates that the areas intended for harbor use, i.e. trailer boat, marine gear, and harbor storage, are located below Landslide 2.

Landslide 3, also a significant landslide mass, lies downslope of the existing water tank site. The conceptual site layout plan indicates that some hotel/motel units (cabins) will be situated within and below Landslide 3.

A fourth landslide, Landslide 4, is located off-site to the southwest of the Harbor Terrace site and thus is not shown on the Geologic Map. Discussion of this landslide was included in previous studies as its location was within an area previously contemplated for development; however, it is not part of the currently proposed project.

A fifth landslide was identified by Leighton in the western region of the site (Leighton 1971). Leighton indicates that this landslide was activated by grading activities that took place in the early 1970's. There is a reference to a buttress fill that was placed to stabilize the landslide; however, the topography has been so obscured by grading that the landslide may have been removed, and its location and that of the buttress fill can only be approximated. The Harbor storage and marine storage areas in the northwest region of the site, as shown on the conceptual site layout plan, may lie within the boundaries of Landslide 5, if it or any remnants still exist.

A sixth landslide was also described by Leighton in the central region of the site; this landslide was also evidently triggered by grading during the early 1970's and was attributed by Leighton to a combination of shallow groundwater, oversteepening of slopes, and the claystone bedrock.



This landslide could not be identified during a site reconnaissance, and it is believed to have been largely (or entirely) removed by grading activities. RV sites may lie within the boundaries of Landslide 6, if it or any remnants are still present in this area.

Due to uncertainty regarding their current status, Landslides 5 and 6 are shown as queried on the Geologic Map.

In addition to the landslides described above, there are two landslides located to the northwest that are designated on the Geologic Map as Landslides 7 and 8. While Landslide 7 encroaches partially onto the site, it does not appear to pose a threat to any components of the project as currently planned. Due to their off-site locations, Landslides 4 and 8 are not discussed further in this report. There are also numerous smaller landslides and slumps located throughout the property that are not specifically identified.

#### Potential Impacts

Movement of landslides, including seismically-induced movement, could result in damage to proposed improvements that lie within their boundaries or in their path. Movement of Landslide 1 or Landslide 3 could damage cabins, campsites or vehicles and, depending upon the type and severity of the movement, could endanger those occupying these areas. If natural gas lines were to cross the sites, there would be a possibility of fire danger if rupture of the lines occurred. Rupturing or severing of “wet” utilities, i.e. water and sewer, could result in discharge of water or effluent into the subsurface, which could in turn trigger further instability and exacerbate slope movement. Movement of Landslide 2 could result in damage to boats, gear, vehicles, and other stored items. It is questionable as to whether Landslides 5 or 6, or remnants thereof, still exist; if movement in these areas occurred, damage to stored items in the Harbor area or to the RV sites could result. In general, movement of any of the landslides could result in damage to utilities, roads, pavement, retaining walls, and other infrastructure that lie within or below the landslides.

#### Mitigation Measures

- a. Geologic Investigation.* Where development within or below a landslide is planned, a geologic investigation should be conducted. The investigation should conform to Section 1803 of the 2013 edition of California Building Code and the Guidelines for Engineering Geology Reports, San Luis Obispo County, Department of Planning and Building (2005, revised 2013), or editions that are applicable at the time of investigation. The investigation should be conducted by a Certified Engineering Geologist. At a



minimum, it should address the type, extent, depth, configuration, and activity level of the landslide, and should include an analysis of slope stability. Once the characteristics of the landslide are known, the most appropriate mitigation measure(s) can be developed.

- b. Regrading.* The entire landslide mass can be regraded from the toe to the upper limit, or the grading program could involve only those areas including and above proposed improvements. If an entire landslide mass were to be regraded, removal of the slide materials and replacement as a structural fill, including excavation of proper keyways, benches, and installation of subdrains would likely be necessary. Use of geogrid reinforcing may be appropriate for some areas. Geogrid reinforcing involves the placement of alternating layers of geogrid and soil, and can be effective in increasing soil strength and stability. Another option that may be appropriate for specific project areas would be partial stabilization. This solution may include the construction of buttress fills below improvement areas that would be sufficient to resist movement of the upper portion of the slide mass. With partial stabilization, it should be noted that any improvements situated within the landslide but below the buttress would still be at risk from landslide movement.
- c. Structural mitigation.* Structural mitigation may be a potential option, depending upon the characteristics of the landslide in the area where the improvements are located. For habitable buildings, such solutions might include deep foundations e.g. driven piles or caissons designed with sufficient lateral resistance to overcome the sliding force exerted by the landslide. Foundation augmentation such as tie-back anchors attached to the concrete caissons or piles, or batter piles, may be appropriate. Another potential solution would be to construct walls that would be anchored through the slide and founded in underlying stable material.
- d. Mitigation for Roads and Utilities.* Potential mitigations to protect roads and utilities could include such measures as retaining walls, possibly anchored with tie-backs or reinforced with soil nails or geogrid, depending upon the depth and characteristics of the landslide in those areas. Flexible and/or articulating connections may provide some mitigation for utilities, again depending upon the nature and severity of the landslide movement. For water lines, sacrificial lines with automatic shut-off valves may be appropriate. If the geologic investigation confirms that the landslide is slow-moving, on-going repair and replacement of damaged roads and utilities may be feasible. Another option may be constructing utilities above grade in utility raceways.



- e. *Monitoring.* As landslide movement tends to be associated with inclement weather, seasonal monitoring of the landslides for indications of incipient movement would be prudent in addition to other selected mitigation measures. If monitoring indicates potential movement, or during periods of particularly intense or prolonged inclement weather, temporary restrictions on use and occupancy of the campground could be implemented.

## 7.2 Erosion

The extent and severity of erosion is related to the type of soil, the velocity of concentrated runoff that may come into contact with unprotected soil, and the length of time during which unprotected soils are in contact with concentrated runoff. Generally, the steeper the slopes, the less cohesive the soils, and the longer that the soils are unprotected and exposed to environmental elements, the greater the impact. At this site, there are many areas of steep slopes, some of which consist of fill soils that may not be properly or adequately compacted. Therefore, the potential for erosion is considered moderate to high in some areas of the site.

### Potential Impacts

Erosion can result in soil loss, degradation of slopes, downslope accumulation of sediment, and sedimentation of drainages and culverts.

### Mitigation Measures

Erosion can be controlled by the implementation of erosion control measures during construction, and as part of the permanent operational plan for the campground. Erosion control measures may include control of surface runoff; V-ditches, berms, brow ditches, or other drainage diversion features; mid-slope benches; vegetation; straw bales; erosion matting; vegetative cover, control of rodent activity, or other methods. Drainage should discharge in a nonerosive manner away from improvements and, where slopes are present, away from the tops and toes of the slopes.

## 7.3 Radon

Radon is a naturally occurring, gaseous element formed by radioactive decay of radium atoms, and is associated with certain rock or soil units. When buildings are constructed above radon-bearing soil or rock, the gas can seep upward and gain entrance to the structure via cracks in concrete floors or walls, through floor drains, joints, bricks, or other conduits. Accumulation of



radon gas within a structure can create significant health risks. Geologic units that are associated with radon gas include Mesozoic granitic rocks, Tertiary sedimentary rocks derived from Mesozoic granitic rocks, and Tertiary marine sedimentary rocks. Although the Monterey Formation that underlies portions of the site is a Tertiary marine sedimentary rock, according to Special Report 208 by the California Geological Survey (Churchill 2008), the project site is in an area of low potential for radon. Consequently, no significant impacts to the project associated with radon are anticipated.

#### **7.4 Naturally-Occurring Asbestos**

Asbestos can occur naturally in certain rock formations, such as those that include serpentinite or ultramafic rock. At this site, the Franciscan Mélange is present, generally underlying the Monterey Formation. It is a mixed-rock unit that, in this locale, consists predominantly of highly fractured green serpentinite, dark-green to black shale, and metavolcanic rocks.

##### Potential Impacts

When rock containing naturally-occurring asbestos is broken or crushed, such as during grading operations, asbestos fibers may be released and become airborne. Exposure to asbestos fibers may result in health issues such as lung cancer, mesothelioma, and asbestosis.

##### Mitigation Measures

If excavation into Franciscan Mélange rock units is planned, samples of the serpentinite or ultramafic rock should be tested to determine if asbestos is present, as only some types of these rocks contain asbestos. If the samples do prove to contain asbestos, an appropriate mitigation plan should be developed prior to the start of excavation operations. Potential mitigations include leaving the material known to contain asbestos in place, covering or capping it, limiting or controlling dust-generating activities, or excavating and disposing of materials containing naturally-occurring asbestos.

## **8.0 SEISMIC HAZARDS**

### **8.1 Faults**

According to previous studies conducted in the area, the Harbor Terrace site is crossed by the San Luis Bay Fault (PG&E 1988). While the precise location of the fault is not known, past studies constrained the fault to an approximately 1,200-foot wide zone that encompasses almost the entire campground site. (Leighton 1971) identified an area of highly sheared rock in the west central region of the site. Such a highly sheared rock zone is suggestive of faulting,



and may represent a secondary fault extending from the main fault. Although the fault is not considered active and is not recognized as being within a designated Alquist-Priolo Earthquake Fault Zone, there is a potential for it to move sympathetically in response to strong ground shaking from a seismic event along another fault. According to guidelines issued by the County of San Luis Obispo, Planning and Building Department (2005, revised 2013), structures intended for human occupancy must be setback an appropriate distance from active or “potentially active” faults.

In a previous phase of work for this project, a fault investigation was conducted in the southern region of the site (Earth Systems 2014). The building area indicated by the client was a 100-foot by about 175-foot rectangle that was within what is currently a boat storage area in the southern region of the site. This area was designated by the client as a probable building site for one or more structures intended for visitor-serving uses. Per the procedures specified by the County of San Luis Obispo, exploratory trenches were excavated perpendicular to the fault trace and extended beyond the building footprint at least the minimum setback distance for the building type. Per Table 1 of the San Luis Obispo County guidelines, the minimum setback under the 2013 California Building Code for a Class “B” (Business Occupancy) structure would be 20 feet from the fault. Due to the early stage of the project, an additional 10 feet (5 feet on each side) was added to the width of the building area indicated by the client. This was to allow the design consultant some flexibility in the eventual positioning of the building. The resulting potential building area was 110 feet wide, measured perpendicular to the fault trend.

Two exploratory trenches were excavated in a general northeast trend, i.e. perpendicular to the trace of the northwest-trending fault. The materials exposed in the trenches were logged by a Certified Engineering Geologist.

No fault-related features were observed in either of the two trenches. While shearing was observed in the metavolcanic and serpentinite bedrock units, the shearing was discontinuous and exhibited a random pattern that extended throughout large bedrock blocks. In our professional opinion, the shear pattern found is an example of the shearing and alteration caused by tectonic activity that is characteristic of, and prevalent within, bedrock of the Franciscan Mélange. No fault gouge was found, and there was no evidence of a fault plane.

As stated previously, San Luis Obispo County guidelines require that exploratory fault trenches be excavated a minimum of 20 feet beyond the limits of the proposed (Class “B”) structure(s). The 100-foot wide building area indicated by the client was extended to 110 feet and the



trenches extended 20 feet beyond this expanded building area. No evidence of faulting was observed in the two trenches, effectively “clearing” the designated building area of the San Luis Bay Fault. Furthermore, as the trend of the fault is relatively well documented, the cleared area can be extrapolated parallel to the known fault trend (perpendicular to the trenches) and the extrapolated area can also be considered to be clear of faulting. This zone, shown on the Geologic Map, extends from the property boundary setback at Diablo Canyon Road to the property boundary setback at Avila Beach Drive.

For structures built within the 110-foot “cleared” zone, no setbacks from the San Luis Bay Fault are considered necessary. Based upon the conceptual site layout plan provided by the client; however, some potentially habitable structures are located outside of the cleared area.

#### Potential Impacts

In the event of fault movement, buildings and associated improvements could be damaged, and building occupants could be endangered.

#### Mitigation Measures

Per the County of San Luis Obispo guidelines, a fault investigation is required for any structure considered to be habitable; consequently, it should be determined which of the structures situated outside of the cleared zone would be considered “habitable.” The building areas of habitable structures should be investigated by excavating an exploratory trench(es) perpendicular to the fault trace, and extending beyond the building footprint at least the minimum setback distance for the anticipated building type. The fault investigation should be overseen by a Certified Engineering Geologist and should conform to the Guidelines for Engineering Geology Reports, San Luis Obispo County, Department of Planning and Building, (2005, revised 2013) or the applicable edition at the time of investigation, or other pertinent codes or regulations that may be in effect at that time.

If any habitable structures are found to overlie the fault or are within the minimum setback distance to the fault, they should be relocated or designed to accommodate potential fault movement (pending approval by the County of San Luis Obispo). Potential design solutions could include mat foundations or overexcavated and geogrid-reinforced building pads designed with sufficient strength to overcome the maximum shearing forces exerted by seismic movement. Utility lines could be fitted with articulating connections and/or automatic shut-off valves.



## 8.2 Ground Shaking

The site is located in a seismically active area, as is most of California. The site has the potential to experience strong ground shaking from earthquakes on regional and/or local causative faults. There are several faults in the vicinity of the project site that are capable of producing strong ground motion, including the active Los Osos, San Andreas and Hosgri Faults. Ground shaking could also occur in the event of movement along the newly discovered Shoreline Fault or the San Luis Bay Fault. During an earthquake (or sympathetic fault movement) along any of these faults, seismically-induced ground shaking would be expected to occur at the Harbor Terrace site. The severity of the shaking will be influenced by the distance of the site to the seismic source, the soil conditions, and the depth to groundwater.

### Potential Impacts

In the event of severe ground shaking, buildings and associated improvements could be damaged, and building occupants could be endangered.

### Mitigation Measures

New construction is subject to compliance with the California Building Code (CBC), which includes measures to reduce risk from seismic events. Structures should be designed in accordance with the seismic parameters presented in a project-specific geotechnical engineering report, applicable sections of the appropriate edition of CBC, and other applicable local regulations relating to potential seismic hazards. The geotechnical engineering report should be prepared by a qualified geotechnical engineer.

## 8.3 Ground Surface Rupture

Surface rupture is the displacement and cracking of the ground surface that occurs along a fault trace during an earthquake. Unlike seismically-induced ground shaking, which can affect a wide geographic area, surface rupture is confined to the area very near the fault. The project site is not located in an Alquist-Priolo State Earthquake Fault Zone, and there are no mapped active faults immediately adjacent to or crossing the site. Evidence indicates, however, that the site is crossed by the San Luis Bay Fault. In the event that the San Luis Bay Fault moved sympathetically in response to strong ground shaking from a seismic event along another fault, there is a potential for ground rupture to occur.

### Potential Impacts

In the event of surface rupture, buildings and associated improvements could be damaged, and building occupants could be endangered.



### Mitigation Measures

Per the County of San Luis Obispo guidelines, a fault investigation is required for any structure considered to be habitable; consequently, it should be determined which of the structures situated outside of the cleared zone described previously would be considered “habitable.” The building areas of habitable structures should be investigated by excavating an exploratory trench(es) perpendicular to the fault trace, and extending beyond the building footprint at least the minimum setback distance for the anticipated building type. The fault investigation should be overseen by a Certified Engineering Geologist and should conform to the Guidelines for Engineering Geology Reports, San Luis Obispo County, Department of Planning and Building (2005, revised 2013) or the edition that is applicable at the time of investigation, or other pertinent codes or regulations that may be in effect at that time.

If any habitable structures are found to overlie the fault or are within the minimum setback distance to the fault, and consequently could be at risk in the event of ground surface rupture, they should be relocated or designed to accommodate this possibility (pending approval by the County of San Luis Obispo). Potential design solutions could include mat foundations or overexcavated and geogrid-reinforced building pads designed with sufficient strength to overcome the maximum shearing forced exerted by seismic movement. Utility lines could be fitted with articulating connections and/or automatic shut-off valves.

### **8.4 Liquefaction and Lateral Spreading**

The term liquefaction refers to the liquefied condition and subsequent softening that can occur in soils when they are subjected to cyclic strains, such as those generated during a seismic event. Studies of areas where liquefaction has occurred have led to the conclusion that saturated soil conditions, low soil density, grain sizes within a certain range, and a sufficiently strong earthquake, in combination, create a potential for liquefaction. When liquefaction occurs, the visible expression of the phenomenon can be localized loss of soil bearing capacity, sand boils at the ground surface, and dynamic settlement.

Lateral spreading is a phenomenon that is associated with liquefaction. Slopes may become unstable during liquefaction, and level areas near descending slopes may move laterally toward the slope as the slope becomes unstable.

While shallow groundwater was not encountered in most of the past borings drilled at the site, water seepage or perched water was noted in some borings, and Leighton attributed movement of Landside 6, in part, to shallow groundwater. Consequently, shallow groundwater may be present in some areas of the site. In view of this and the fact that the composition, density, and other properties of the native and fill soils at the site are not known, a potential for liquefaction and associated lateral spreading may exist in some areas of the site.



### Potential Impacts

In the event of liquefaction or lateral spreading, buildings can be damaged, slopes can become unstable, underground utility lines can be ruptured, and surface improvements such as pavement, flatwork and slabs can experience cracks, deformation, and settlement.

### Mitigation Measures

The potentials for liquefaction, lateral spreading, and associated slope failure should be addressed in a geotechnical engineering report prepared by a qualified geotechnical engineer. The report shall conform to Sections 1803.1 through 1803.6, J104.3, and J104.4 of the 2013 California Building Code, or the applicable edition at the time of project design/construction.

If significant potentials for liquefaction or lateral spreading are found to exist, recommendations for mitigation should be developed and presented in the geotechnical engineering report. If it is determined that liquefaction or lateral spreading may affect certain parts of the site, there are numerous mitigation measures that can be implemented. Depending upon the location, depth, and extent of liquefaction or lateral spreading-prone areas and the types of improvements planned for these areas, potential mitigations could include earthwork programs, specialized foundations (such as mat or deep foundations), ground modification, and designing pipes and pipe connections for high strength and ductility. Potential measures to mitigate slope instability induced by lateral spreading include deep ground improvement methods, reinforcing of slopes, reducing slope inclinations, or establishing adequate setbacks between structures and slopes.

### **8.5 Seismically-Induced Settlement**

Seismically-induced settlement of sufficient magnitude to cause structural damage is normally associated with sufficiently strong earthquake shaking combined with poorly consolidated, predominantly sandy soils, or variable consolidation characteristics within the structure area. Undocumented fill underlies much of the site, and may be deeper than the 36 feet encountered in past borings. Due to the unknown nature of the fill material, the potential for seismically-induced settlement should be considered moderate to high unless future analysis of the fill soils indicates otherwise.

### Potential Impacts

Seismically-induced settlement could result in damage to buildings, retaining walls, roads, utilities, and other infrastructure.



### Mitigation Measures

The potential for seismically-induced settlement should be addressed in a geotechnical engineering report prepared by a qualified geotechnical engineer. The report should conform to Sections 1803.1 through 1803.6, J104.3, and J104.4 of the 2013 California Building Code, or the applicable edition at the time of project design/construction. The report should include an evaluation of the properties of the fill and native soils, address the potential for seismic settlement, and provide specific recommendations for mitigation if appropriate. Available alternatives to reduce the effects of soil settlement may include deep ground improvement methods, surcharging the site to further consolidate the underlying soils, use of deep foundations such as driven piles combined with structural support of floor slabs, use of lightweight fills, and limiting the thickness of fills. Structures should be designed in accordance with the recommendations and seismic parameters presented in the geotechnical engineering report, applicable sections of the appropriate edition of California Building Code, and other applicable local regulations relating to potential seismic hazards, including seismic settlement.

### **8.6 Seismically-Induced Landsliding and Slope Instability**

Eight significant landslides have been identified at, or in the general vicinity of, the site on geologic maps and in previous geologic studies. There are also significant slopes at the site that comprise undocumented fill soils. In view of these conditions, which are described in greater detail later in this report, the potentials for seismically-induced landsliding and slope instability are considered high.

### Potential Impacts and Mitigations

Please see Sections 7.1 and 9.1 for discussion.

### **8.7 Tsunamis and Seiches**

A seismic sea wave or tsunami, which means “harbor wave,” is produced by a large displacement of the ocean bottom and can move at velocities of up to 500 miles per hour in deep ocean water. In the deep ocean, tsunamis can be only a few feet high. As the tsunami reaches shallower coastal waters, it travels much slower and wave energy is compressed, which can lead to a rapid and dramatic increase in wave height. Generally, a tsunami is not a single wave but a series of waves, and the first wave may not be the largest. Tsunami waves are often destructive, leading to property damage and sometimes loss of life. In some cases, the coastal waters are drawn out into the ocean just before the tsunami strikes. When this occurs, more shoreline may be exposed than even at the lowest tide.



Typically, hazardous tsunamis along the California coastline are associated with seismic events and are caused by vertical displacement of submarine faults. They can also occur as a result of submarine landslides that may or may not occur in conjunction with seismic activity. The Hosgri Fault, which lies offshore of the site, is a right lateral fault with strike-slip (horizontal) movement. Consequently, it is unlikely to generate tsunami surges within San Luis Obispo Bay. Due to the gradual shallowing of the ocean toward the coast in south-central and southern California, tsunami waves originating from distant earthquakes on the coast of Japan, Alaska, and Hawaii have historically only produced a few feet of rise above mean high tide (Lander et. al 1993).

The coastline configuration of the central coast area also influences tsunami formation; south of San Francisco, the California coast trends to the southwest. As a result, waves associated with tsunamis originating from Alaska and Japan will be refracted, reducing the energy of the tsunami waves as they travel south. The diminished energy of the waves reduces the height and inland extent of the tsunami surge. Tsunamis along the central California coast are relatively rare, and only a few such events are well documented. The seismic event that occurred in Japan on March 11, 2011 produced an 8.9-magnitude earthquake. According to PG&E meteorologist John Lindsey, a tsunami that occurred as a result of that earthquake produced a 6.3-foot surge at 9:20 AM and a 6.6-foot surge around 11:25 AM at Port San Luis, which was the largest seismic tsunami sea surge ever recorded at this location.

According to the County of San Luis Obispo Tsunami Inundation Zone map (California Geological Survey 2009), only the first level of the car/tent camp site area lies within a Tsunami Inundation Zone. In the remainder of the site, the elevations are sufficiently high that inundation in the event of a tsunami striking this part of the central coast is not expected to occur.

#### Potential Impacts

Flooding of the car/tent camp sites within the identified Tsunami Inundation Zone could occur as a result of a tsunami generated by a seismic event or submarine landslide.

#### Mitigation Measures

In the event of a tsunami warning, evacuation of the car/tent camp sites would provide mitigation.



## 9.0 GEOTECHNICAL HAZARDS

### 9.1 Fill Soils and Slope Instability

The site has been extensively graded in the past, which has resulted in a series of terraces that extend across most of the site. The terraces were created by cut-and-fill grading, with fill placed or side-cast to form the outer margins of the terraces. Borings encountered fill soils that ranged in depth from 8 feet to 36 feet; however, the depth of fill is likely to vary throughout the site. As much of the grading took place in the early 1900's to create pads for oil tanks, significant amounts of the fill were placed in a manner that would not be considered adequate by today's standards.

A major fill area begins at the west end of the site, extends southeast along Diablo Canyon Road, continues along the south margin of the site, and may extend into the former trailer park. This fill was placed during grading operations that took place in the early 1970's. Logs of borings drilled within the fill area indicated fill depths of 23 to 36 feet; however, based upon the existing topography, it is questionable as to whether the borings were drilled from the current ground surface elevation in this area. In our opinion, it is likely that these areas were further filled after the borings were drilled; consequently, we believe that there are areas of this fill that are significantly deeper than indicated in the borings. It is generally believed that this fill was placed partially to provide a buttress for Landslide 5. It appears that Landslide 5 may have been removed by the grading that later took place in this area.

There is, to our knowledge, no documentation attesting to the proper placement or compaction of the fill soils and, based upon the time periods when the grading took place, it is unlikely that the fill slopes were keyed, benched, compacted, or fitted with drains in a manner that would be considered acceptable by today's standards. As a consequence, some of these slopes may be unstable and prone to failure, particularly during periods of inclement weather. The fill areas, based upon mapping by Leighton and logs of borings, are shown on the Geologic Map.

The area slated for commercial uses is above deep fill soil, and at the top of an existing fill slope. The fill soils are undocumented. The harbor and marine storage areas in the northwest region of the site, as shown on the conceptual site layout plan, will also lie atop deep, undocumented fill soils. As discussed previously, the harbor and marine storage areas are also within the boundaries of Landslide 5, if Landslide 5 still exists. Colluvium is present in this region of the site, below Landslide 2. The stability of the fill slopes and the colluvium has not been studied.



### Potential Impacts

Where there is no documentation attesting to the proper placement or compaction of fill soils, they should not be relied upon for support of buildings. Constructing a building on fill soil that has not been properly placed or compacted can lead to excessive settlement or differential settlement of the building, which can in turn cause extensive damage. If fill slopes are not keyed, benched, compacted, or fitted with drains, they may be unstable and prone to failure, particularly during periods of inclement weather. In the event of failure of the slope supporting the commercial building, the building occupants could be endangered and damage to the commercial building, pool, and associated improvements could result. If the pool is damaged and water leaks into the subsurface, further instability and slope failure could result.

The proposed grading concept, as indicated on the site layout plan, indicate proposed fill depths of up to 37 feet, in many cases, new fill will be placed upon existing fill or existing fill slopes. If new placement of fill over existing uncompacted fill is planned, instability could result. Similarly, slope failures could occur where fills are placed over existing cut slopes, or where grading exposes cut over fill.

While the sites intended for harbor and marine storage would not be held to the same standard with respect to grading, and removal/replacement of the fill would most likely not be necessary, failure of fill slopes could impact these areas, potentially resulting in damage to stored items.

Where roads, retaining walls, and other infrastructure are constructed through areas of existing cut and fill, similar geotechnical issues could arise. Fill soils could prove to be unstable, resulting in slope failures that could range in severity from "nuisance factors" requiring periodic maintenance, to severe failures that could cause extensive damage and render portions of the site inaccessible until repairs can be effected. Fill soils that are not adequately compacted could also result in settlement, development of tension cracks, and failure of paved roads.

### Mitigation Measures

The properties of the existing fill and the stability of the existing fill slopes should be addressed in a geotechnical engineering report prepared by a qualified geotechnical engineer. The report should conform to Sections 1803.1 through 1803.6, J104.3, and J104.4 of the 2013 California Building Code, or the applicable edition at the time of project design/construction. The report should include assessment of the existing fills, including suitability of the materials



used, original site preparation, and degree of compaction; the suitability of the fill for supporting the proposed improvements; settlement of potential of the fill; slope stability; the impact of placing fill upon existing fill; placement of fill over existing cut slopes; and appropriate mitigations for all of these issues.

If the fill is found to be inadequate for the support of proposed improvements or unstable, mitigation measures may include regrading, including removal of existing materials and replacement with structural fill. For fill placed on slopes, this would likely entail excavation of keyways, benches, and installation of drains. Use of geogrid reinforcing may be appropriate.

Structural mitigation is another potential solution. Depending upon the characteristics of the fill, retaining structures founded in underlying competent material may be applicable to specific situations. Types of appropriate retaining structures could include post and lagging walls, possibly anchored; gravity walls, mechanically stabilized earth walls, or cantilevered walls possibly augmented with tie-back anchors. In the commercial area, drainage measures beneath and surrounding the pool should be incorporated into its design.

## **9.2 Slope Hazards**

Based upon a review of the conceptual grading as shown on the site layout plan, it appears that the project may entail grading and/or construction of buildings on slopes with natural grades between 25 and 30 percent.

### **Potential Impacts**

Grading activities on steep slopes can create a potential for slope failure if material is improperly removed from the base of a slope, if the slope gradient is too steep for the type of material, or if drainage is not properly controlled. The risk of slope failure can increase if cuts encounter contacts between colluvium or fill and bedrock, if unfavorable bedding planes are intersected by cuts, or if fractured rock materials are encountered.

### **Mitigation Measures**

The impact of grading of steep slopes should be should be addressed in a geotechnical engineering report prepared by a qualified geotechnical engineer. The report should conform to Sections 1803.1 through 1803.6, J104.3, and J104.4 of the 2013 California Building Code, or the applicable edition at the time of project design/construction. The report should address the potential for instability of natural and proposed slopes and provide recommendations for appropriate grading programs, including criteria for maximum slope heights and angles. Where buildings are to be constructed on steep slopes, development of suitable foundation systems and criteria for their design should be included in the report.



Potential mitigation measures could include regrading the slope to a flatter angle, use of geogrid reinforcement, or temporary shoring. Types of foundations appropriate for building construction on steep slopes may include driven piles, drilled caissons, or conventional foundations extended to bear in competent material.

### **9.3 Expansive Soils**

Expansive soils tend to swell with increases in soil moisture and shrink as soil moisture decreases; typically, they are soils that contain a significant percentage of clay or silt. Borings drilled at the site during previous investigations indicated that overburden soils, where present, include moderate to high clay and silt fractions, suggesting that these soils likely have expansive qualities.

#### **Potential Impacts**

The expansion-contraction cycle can create a substantial risk to property, and can contribute to downslope creep of soils on slopes. The volume changes that the soils undergo in this cyclical pattern can also stress and damage foundations, slabs-on-grade, and other improvements if precautionary measures are not incorporated in design and in the construction procedure. Expansive soils can be particularly damaging to pavement and the curbs that separate it from bioswales and other infiltration low-impact development (LID) features. This is due to the typical large variations in soils moisture content that occur in infiltration areas from season to season.

#### **Potential Mitigations**

Soil expansiveness should be addressed in a geotechnical engineering report prepared by a qualified geotechnical engineer. The report should conform to Sections 1803.1 through 1803.6, J104.3, and J104.4 of the 2013 California Building Code, or the applicable edition at the time of project design/construction. The report should include assessment of the expansive properties of the soil, and provide recommendations for mitigation. Appropriate mitigation may include such measures as deeper footings in combination with preserving or augmenting the soil moisture, and use of a layer of nonexpansive material beneath slabs. There are a number of other options available, including caissons and grade beams, post-tensioned slab foundations, conventionally reinforced mat foundations, and deep nonexpansive pads. Deepening of curbs between pavement and bioswales, increasing the separation distance between pavement and bioswales, or other LID infiltration features may be recommended to reduce the potential for expansive soil damage.



#### 9.4 LID/BMP Considerations

Many projects currently include provisions for LID post-construction storm water control using “best management practices” or BMPs. Examples of BMPs include passive methods such as disconnecting downspouts from storm drain systems and allowing them to drain on to the site; providing vegetated filter strip areas between parking lots, driveways or other hard surfaces and storm drain features, thereby allowing the vegetation to filter the and partially infiltrate water before it is discharged; and collecting storm water in rain barrels or other containment features to allow its re-use at a later date for irrigation or other non-potable uses. More active storm water control measures (SCMs) may include detention or retention (infiltration) basins, bioswales or vegetated swales, pervious pavement or pavers, subsurface infiltrators, and infiltration pits.

#### Potential Impacts

The use of BMPs can result in unanticipated geotechnical consequences that can adversely impact improvements such as foundations of structures, pavements, and retaining walls. All BMPs require maintenance, without which runoff may back up, overtop, or flow in unintended directions. This can cause erosion, localized flooding, excess shrink/swell of expansive soils, and possibly slope instability. Infiltration from BMPs may exacerbate fluctuations in soil moisture content and the corresponding shrink/swell cycle, causing damage to foundations and surface improvements. Infiltration BMPs and SCMs, whether maintained or not, may cause subsurface erosion, excess settlement of fill soils, or slope instability. For example, fills are generally constructed with subsurface drains; the intent of the drains is to capture and divert minor amounts of water and keep the fill in a reasonably dry condition. If infiltration SCMs are situated in or above a fill, drainage associated with the SCM may flow into the fill drains, which are typically not intended or designed to handle the resulting larger volume of water. In such a situation, the drainage may discharge from the fill drains, resulting in such adverse consequences as erosion, saturation of the fill soil, and possibly slope instability or triggering of landslide movement. Furthermore, the original objective of the SCM, i.e. to filter and control storm water, may not be achieved.

#### Mitigation Measures

A project specific geotechnical engineering report, prepared by a qualified geotechnical engineer and conforming to Sections 1803.1 through 1803.6, J104.3, and J104.4 of the 2013 California Building Code, or the applicable edition at the time of project design/construction,



should include assessment of the potential impacts of BMPs, including infiltration SCMs, and provide recommendations for mitigation. The impacts of infiltration SCMs upon slope stability, settlement of fill soils, drainage, and the shrink/swell cycle of expansive soils, should be analyzed and included in the report. In general, infiltration SCMs should not be placed in or above fill, near descending cut slopes, or at the toe of any slope. Infiltration SCMs should be set back from foundations and surface improvements, or barriers such as deepened curbs, cutoff walls or impermeable membranes should be placed between infiltration SCMs and foundations and/or improvements. Infiltration tests should be conducted to assess the infiltration potential for use in the design of infiltration SCMs.

To provide mitigation for potentially adverse impacts associated with BMPs, a maintenance program for all BMPs should be prepared and implemented. The program should include periodic inspection of BMPs, cleaning and removal of accumulated silt, sand, and debris from BMPs, maintenance of vegetation in BMPs, and periodic rehabilitation of infiltration SCMs.

## **10.0 CLOSURE**

This report is valid for conditions as they exist at this time for planning the project as presented in the conceptual site layout plan by LWC and described herein. Our intent was to perform this study in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the "Scope of Services" section. Application beyond the stated intent is strictly at the user's risk.

If changes with respect to the project become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions or descriptions used in the preparation of this report are not correct, this firm should be notified for modifications to this report.

The preliminary conclusions presented in this report are based upon the geotechnical and geologic conditions of the site as indicated by available geologic literature and maps, past geologic/geotechnical investigations, and a site reconnaissance. Conditions should be confirmed (or modified) by appropriate geologic and geotechnical engineering investigations once the project reaches the appropriate stage.



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Harbor Terrace Campground  
Port San Luis, California

August 22, 2014

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Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text



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## **APPENDIX A**

Site Layout Plan (Lisa Wise Consulting)



# SITE LAYOUT PLAN

## VICINITY MAP



## LEGEND

1. CHECK-IN STATION
2. PICNIC AREA / BBQ / OVERLOOK
3. CROSSWALK
4. ENTRY SIGNAGE
5. HARBOR USE SECURITY GATE
6. ACCESSIBLE RAMP / TRAIL / PATH
7. STAIRS
8. TRAILER BOAT STORAGE
9. MARINE GEAR STORAGE
10. HARBOR STORAGE AREA
11. FUTURE HARBOR USE BLDG (3,000 SF)
- Ⓢ COMFORT STATION W/ TRASH / RECYCLE ENCLOSURE
- Ⓟ PARKING
- ACCESSIBLE RAMP
- ⋯ TRAIL / PATH

### Notes:

1. Internal roads 20' wide min. asphalt unless otherwise noted.
2. Expanded water storage tank to accommodate possible increase in water storage capacity that may be determined during the building permit approval process. Any improvements or additions shall be consistent with the San Luis Bay Area Plan

## PROGRAM LEGEND

OVERNIGHT CAMPGROUND ACCOMMODATIONS		
	RV Sites	80
	RV / RV Cabins	15
	Hotel/Motel Units (yurts, cabins, inns, casitas, bungalows)	31
	Car/Tent Campsite	35
	Walk-In/Bike-in Sites	21
VISITOR SERVING COMMERCIAL USES		
	- Retail / Restaurant - Meeting / Conference - Office / Lobby / Reception - Managers Residence - Storage / Restroom / Laundry - Picnic / Gathering Area with BBQ	16,000 SF
HARBOR USES		
	Trailer Boat Storage (10'X25')	70 spaces
	Marine Gear Storage (20'X40')	20 spaces
	Harbor Storage Area	1.05 acre
	Expansion Area	10,000 SF
	PARKING	48,000 SF



Dimension  
East-West: 1,950 Feet  
North-South: 1,500 Feet  
**Property Line**

Scale 1"=60'  
0 60' 120' 240'  
North  
August 2014

Port San Luis Harbor Terrace Campground

## LAND USE PERMIT SET



**Note:**  
Site Layout Plan prepared by Lisa Wise Consulting, Inc and Sherwood Design Engineers



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**SITE LAYOUT PLAN**  
HARBOR TERRACE CAMPGROUND  
Port San Luis, California

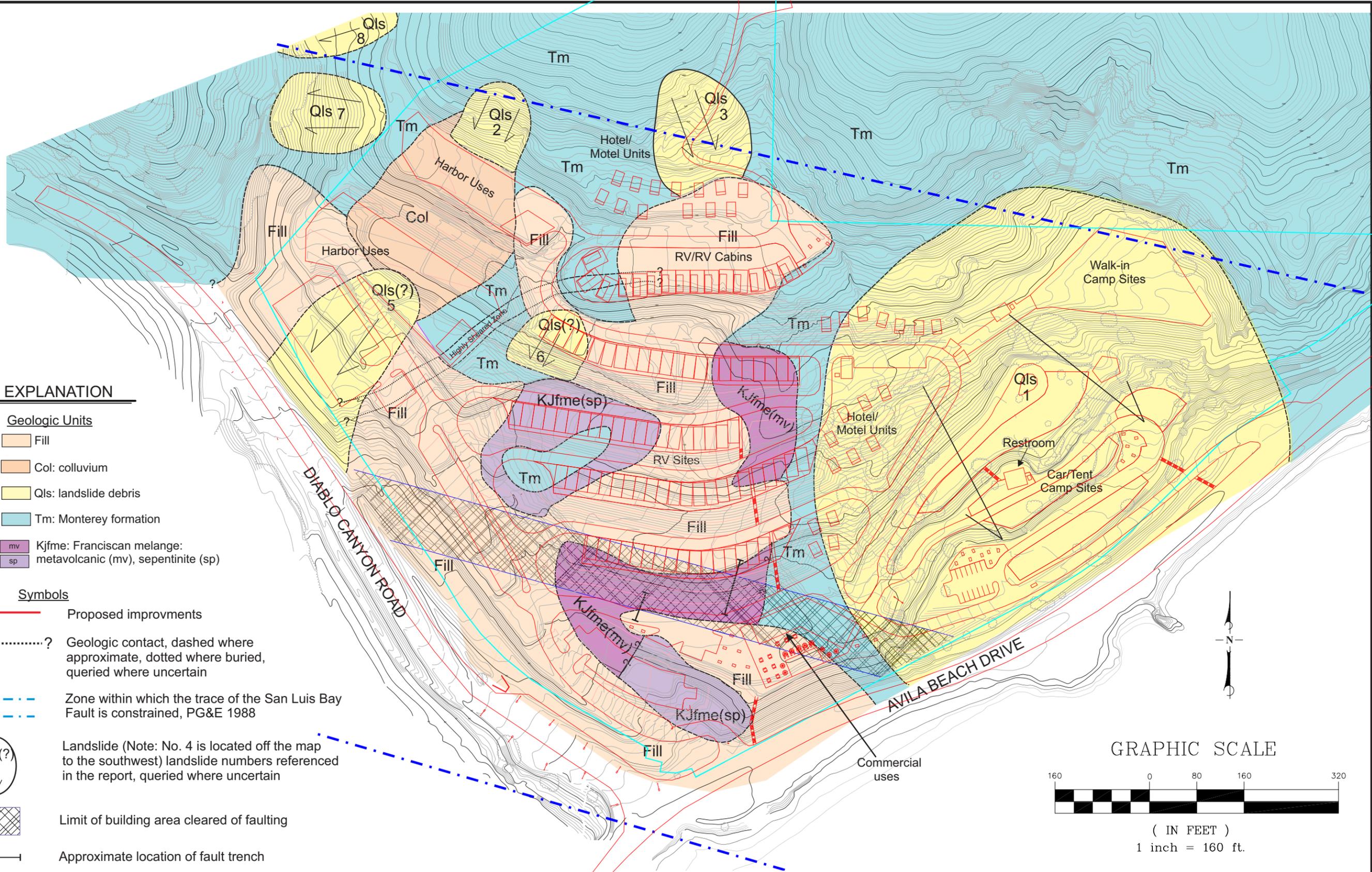
**Date**  
August 2014  
**Project No.**  
SL-15831-SC  
**Drafted by:**  
R. G.



## **APPENDIX B**

### Geologic Map





**EXPLANATION**

**Geologic Units**

- Fill
- Col: colluvium
- Qls: landslide debris
- Tm: Monterey formation
- mv
- sp

**Symbols**

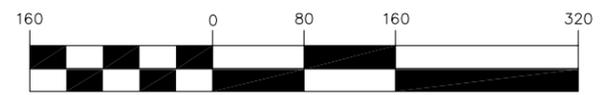
- Proposed improvements
- Geologic contact, dashed where approximate, dotted where buried, queried where uncertain
- Zone within which the trace of the San Luis Bay Fault is constrained, PG&E 1988
- Qls(?)  
8 Landslide (Note: No. 4 is located off the map to the southwest) landslide numbers referenced in the report, queried where uncertain
- Limit of building area cleared of faulting
- Approximate location of fault trench

**Notes:**

- 1) Base topographic map prepared by RRM Design Group, Inc.
- 2) Geology mapped by F. Beach Leighton 1971, Pacific Geoscience 1985, and Earth Systems Consultants Northern California 1995.



**GRAPHIC SCALE**



( IN FEET )  
1 inch = 160 ft.



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**GEOLOGIC MAP**

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Port San Luis, California

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**Drafted by:**  
R. G.

