Geological Resources

SECTION 4.5

4.5 GEOLOGIC RESOURCES

4.5.1 Introduction

This section is based upon the *Earth Systems Pacific Soils Engineering Reports* (2011, 2008) and a series of related letters (Appendix D~~E~~). The report includes a review of previous geologic and geotechnical reports prepared for the site, site reconnaissance, and review of aerial photographs. Envicom Corporation's certified engineering geologist, Kenneth Wilson, provided a third party peer review for technical accuracy. It should be noted that the soils engineering review is based on a limited number of borings for soil samples.

4.5.2 Existing Conditions

Geologic Setting

Based upon the National Geodetic Vertical Datum (NGVD) of 1929, the elevation of the site ranges from approximately 20 to 30 feet above mean sea level (msl), with a slope toward the southeast. A stockpile on the site rises to just over 36 feet above msl.

The site is located in the Goleta Valley, a broad and flat alluvial plain bordered on the south by the Pacific Ocean coastline and on the north by foothills and terraces, which lie in the foreland of the Santa Ynez Mountains. The Valley and adjacent foothills are located within the Transverse Ranges Geomorphic Province of Southern California. The Transverse Ranges are a complex series of mountain ranges and valleys distinguished by an anomalous dominant east-west trend, which contrasts the northwest-southeast trend of the neighboring Coast and Peninsular Ranges. The area consists of a southerly-dipping east-west trending homocline, similar in character to the geologic structure of the Santa Ynez Mountains to the north.

The regional stratigraphy includes Tertiary rocks and Quaternary sediments. The Tertiary rocks underlying the Goleta Valley include: undifferentiated Eocene strata (Matilija sandstone, Cozy Dell shale, and the Coldwater Formation), the Sespe Formation, the Vaqueros Formation, the Rincon Formation, the Monterey Formation, and the Sisquoc Formation. The Quarternary sediments overlying the Tertiary rocks include: the Santa Barbara Formation, terrace deposits, older alluvium, and younger alluvium.

~~Fugro West, Inc. (1995)~~ Earth Systems Pacific performed geotechnical engineering evaluations ~~within the project site during the period from 1994 to 1995~~ incorporating reviews of past studies on the site. ~~These evaluations included several borings from which samples were taken for laboratory testing. They also reported on data developed by other consultants in 1982.~~ Descriptions presented for the geologic units are representative of site conditions for soils. Artificial fill and intermediate-age alluvium are the materials that occur in the proposed building areas. Overall, both units are clay-rich and have layers of sand, silty sand, and cobble-rich horizons. Clay-rich areas within the natural deposits have moderate to very high expansion potential. Specifically, the specific geologic formations exposed on the site are Santa Barbara Formation (Qsb), Older Alluvium (Qoa), Alluvium (Qal), and Artificial fill (Qaf).

The topography of the project site is relatively flat and slopes generally to the south. Although currently vacant and undeveloped, the project site was previously used for agricultural purposes, including grazing, row crops and orchards, with several areas having been graded on several occasions. A groundwater aquifer underlies the site, with groundwater encountered at depths of 2 to 20 feet below the ground surface.

Figure 4.5-1 provides the regional geologic formation of the Santa Barbara Coastal Plain Area and relative location of the project site.

Fault Rupture

Fault rupture is defined as the displacement that occurs along the surface of a fault during an earthquake. Based on criteria established by the State Mining and Geology Board (SMGB) in the California Code of Regulations, Title 14, Sections 3600 et seq., and as summarized in the Special Publication 42 Fault Rupture Hazard Zones in California by the State of California Geological Survey (CGS), faults can be classified as active, potentially active, or inactive.[1] Active faults are those that have shown evidence of movement within the past 11,000 years (i.e., Holocene). Potentially active faults are those that have shown evidence of movement between 11,000 and 1.6 million years ago (i.e., Pleistocene). Inactive faults are those that have not exhibited displacement younger than 1.6 million years before the present. Additionally, there are blind thrust faults, which are low angle reverse faults with no surface exposure. Due to their buried nature, the existence of blind thrust faults is usually not known until they produce an earthquake.

The seismically active region of Southern California is crossed by numerous active and potentially active faults and is underlain by several blind thrust faults. As further discussed below, the Alquist-Priolo Earthquake Fault Zoning Act, California Public Resources Code Sections 2621 et seq., requires the State Geologist to establish earthquake fault zones around the surface traces of active faults and to issue appropriate maps to assist cities and counties in planning, zoning, and building regulation functions. These zones, which generally extend from 200 to 500 feet on each side of the known active fault, identify areas where potential surface rupture along an active fault could prove hazardous and identify where special studies are required to characterize hazards to habitable structures. Based on the most recent geologic information available, no known active or potentially active faults underlie the project site. Thus, the project site is not located within a State-designated Alquist-Priolo earthquake fault zone for active surface faulting.

Ground Shaking

Earthquake records in the Santa Barbara area extend from the late 1700's during the time of Spanish mission formation. Three large earthquakes occurred, one each in 1812, 1925, and 1927 (Gurrola, 2003). The 1812 event, based on strong shaking and damage records was likely a magnitude 7 event. The City of Santa Barbara event on June 26, 1925 produced extensive damage to the downtown and surrounding areas with an estimated Modified Mercalli Intensity (MMI) of VII-IX indicating a magnitude of M6.3 to 6.8; the source fault has not been identified. In 1927 the Point Arguello earthquake produced low MMI values in the City of Goleta (City) from a M7.3 earthquake some 100 miles to the west.

Regardless of these historical events, the project site is not located within a State-designated earthquake fault zone or City-designated fault rupture study area, and no known active or potentially active faults underlie the project site. However, the project site is located within the seismically active region of southern California, with the nearest significant fault being the More Ranch Fault, located south of the project site as shown in Figure 4.5-1.[2] The soils engineering

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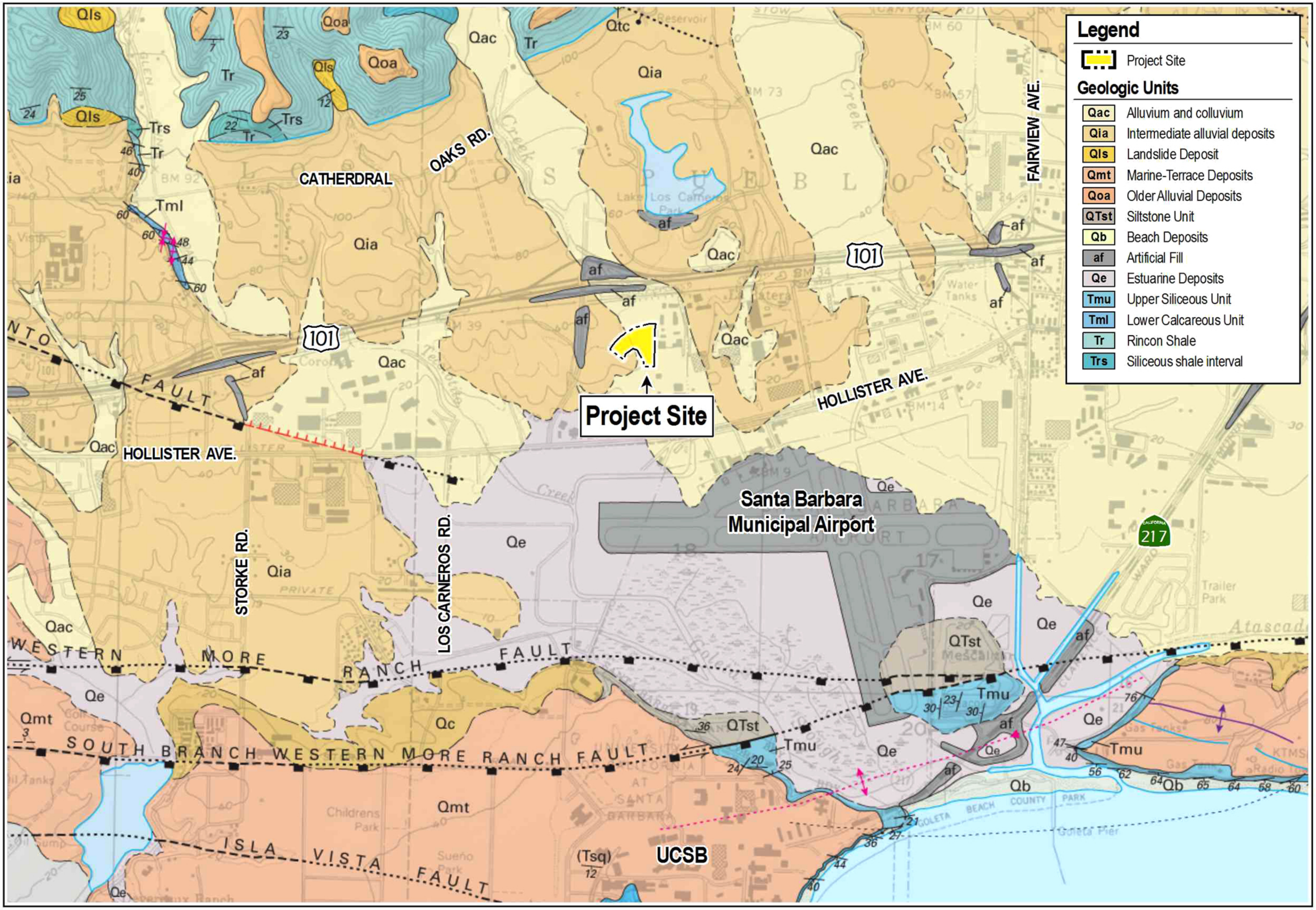
1 The California Geological Survey was formerly called the California Division of Mines and Geology (CDMG).
2 *Earth Systems Pacific, 2008, Soils Engineering Report.*



Source: USGS, Geologic Map of the Santa Barbara Coastal Plain Area, Santa Barbara County, California (2009).

WILLOW SPRINGS II

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Regional Geologic Formation and Fault Map

0 1,000 2,000 Feet

FIGURE 4.5-1

report included in Appendix D provides additional details on the ground-shaking aspects of the project area.

Liquefaction

Liquefaction is a form of earthquake-induced ground failure that occurs primarily in relatively shallow, loose, granular, water-saturated soils. Liquefaction can occur when these types of soils lose their inherent shear strength due to excess water pressure that builds up during repeated movement from seismic activity. A shallow groundwater table, the presence of loose to medium dense sand and silty sand, and a long duration and high acceleration of seismic shaking are factors that contribute to the potential for liquefaction. Liquefaction usually results in horizontal and vertical movements from lateral spreading of liquefied materials and post-earthquake settlement of liquefied materials.

As further discussed below, the Seismic Hazards Mapping Act, California Public Resources Code Sections 2690 et seq., requires the State Geologist to delineate seismic hazard zones in areas where the potential for strong ground shaking, liquefaction, landslides, and other ground failures due to seismic events are likely to occur. Cities and counties must regulate certain development projects within these zones until the geologic and soil conditions of the project site are investigated and appropriate mitigation measures, if any, are incorporated into development plans. The project site is not located within a State-designated seismic hazard zone for liquefaction potential. Nevertheless, two of three elements for potential liquefaction are present at the project site, strong earthquake groundshaking (as described above) and shallow groundwater (approximately 2 to 20 feet below ground surface).

According to the Earth Systems Pacific Ssoils Engineering Rreports (2011 and 2008), there appears to be a potential for liquefaction to occur between the depths of approximately 10 to 35 feet below the existing ground surface based on two of the borings drilled at different locations as part of their investigation. Should liquefaction occur at the site, the repercussions would be in the form of dynamic settlement (impacts due to loss of bearing and lateral spreading are not anticipated). Based on the liquefaction analysis in Appendix C of the 2011 Earth Systems Pacific Soils Engineering Report (Appendix D, herein), the dynamic settlement is less than three inches, with a magnitude of differential dynamic settlement of less than 1.5 inches.

Expansive Soils

Expansive soils are typically associated with fine-grained clayey soils that have the potential to shrink and swell with repeated cycles of wetting and drying. Expansive soils tend to swell with seasonal increases in soil moisture and shrink during the dry season as moisture decreases. Changes in soil moisture content can result from rainfall, landscape irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may cause unacceptable settlement or heave of structures, concrete slabs-on-grade, or pavements supported over these materials. Depending on the extent and location below finished subgrade, expansive soils could have a detrimental effect on proposed construction. Due to the presence of clayey soils beneath the project site, an expansion index test was performed on the bulk sample of the upper soil and produced a value of 89, which indicates a "medium" expansion category per the American Society for Testing and Materials (ASTM) index as set forth in the Earth Systems Pacific Soils Engineering Reports (2011 and 2008) (Appendix D herein). The site soils may be susceptible to temporary high soil moisture conditions, especially during or soon after the rainy season.

Regulatory Setting

Federal Regulations

The Uniform Building Code (UBC) is a model building code that was published by the International Conference of Building Officials (ICBO). The UBC defines different regions of the United States and ranks them according to their seismic hazard potential. There are four types of these regions, designated as Seismic Zones 1 through 4, with Zone 1 having the least seismic potential and Zone 4 having the highest seismic potential. Structural design standards would depend on the Seismic Zone in which the structure would be located. The project site would be within Seismic Zone 4.

The International Building Code (IBC) is a model building code published by the International Code Council (ICC) that combines three model building codes: the UBC published by the ICBO used on the West Coast and in some of the Midwest, the Building Officials Code Administartors National Building Code (BOCA/NBC) published by the Building Officials Code Administrators International (BOCA) used on the East Coast and in some of the Midwest, and the Standard Building Code (SBC) published by the Southern Building Code Congress International (SBCCI) used in the Southeast. The IBC has no regional limitations and, like the UBC, is published on a triennial basis.

The IBC classifies strutures into Seismic Design Categories, which involves more than the location of the structure as is the case with the UBC. Seismic Design Categories includes classifications of A-F and are based on three criteria: (1) probable site ground motions, which is based on Federal Emergency Management Agency maps, the maximum spectral acceleration and the design acceleration response; (2) soil site class, which are based on soil classifications A-F (hard rock, rock, very dense soil/soft rock, stiff soil, soft soil and special soil); and (3) building occupancy use, which is broken down by four types – Type IV (agricultural buildings), Type III (essential buildings), Type II (structures that represent a substantial hazard in the event of a collapse), Type I (all other buildings). The process to determine the applicable Seismic Design Category must be done by an engineer.

State Regulations

In 2010, the California Building Standards Commission (CBSC) adopted the 2009 IBC as amended by the CBSC, which became the 2010 California Building Standards Code, California Code of Regulations, Title 24. The 2010 California Building Standards Code is commonly referred to as the 2010 California Building Code and became effective January 1, 2011. Development in the State of California is governed by the 2010 California Building Code (CBC) as amended and adopted by each local jurisdiction. These regulations include provisions for site work, demolition, and construction, which include excavation and grading, as well as provisions for foundations, retaining walls and expansive and compressible soils.

The California Seismic Safety Commission was established by the Seismic Safety Commission Act in 1975, California Government Code Sections 8870 et seq., with the intent of providing oversight, review, and recommendations to the Governor and State Legislature regarding seismic issues. The commission's name was changed to Alfred E. Alquist Seismic Safety Commission in 2006. Since then, the Commission has adopted several documents based on recorded earthquakes, such as the 1994 Northridge earthquake, 1933 Long Beach earthquake, the 1971 Sylmar earthquake, etc. Some of these documents are listed below:

- Research and Implementation Plan for Earthquake Risk Reduction in California 1995 to 2000, report dated December 1994;
- Seismic Safety in California's Schools, 2004, "Findings and Recommendations on Seismic Safety Policies and Requirements for Public, Private, and Charter Schools", report dated December 1994;
- Findings and Recommendations on Hospital Seismic Safety, report dated November 2001; and
- Commercial Property Owner's Guide to Earthquakes Safety, report dated October 2006.

The Alquist-Priolo Geologic Hazards Zone Act was enacted by the State of California in 1972 to address the hazard and damage caused by surface fault rupture during an earthquake. The Act has been amended ten times and renamed the Alquist-Priolo Special Studies Zones Act, effective May 4, 1975, and then renamed again the Alquist-Priolo Earthquake Fault Zoning Act, effective January 1, 1994, which is the name of the Act today. The Alquist-Priolo Earthquake Fault Zoning Act, California Public Resources Code Sections 2621 et seq., requires the State Geologist to establish "earthquake fault zones" along known active faults in the State. Cities and counties that include earthquake fault zones are required to regulate development projects within these zones.

The Seismic Hazards Mapping Act of 1990, California Public Resources Code Sections 2690 et seq., was enacted, in part, to address seismic hazards not included in the Alquist-Priolo Earthquake Fault Zoning Act, including strong ground shaking, landslides, and liquefaction. Under ~~this~~ the Seismic Hazards Mapping Act, the State Geologist is assigned the responsibility of identifying and mapping seismic hazards zones.

The State of California Geologic Survey (CGS), previously known as the California Division of Mines and Geology (CDMG), has also adopted seismic design provisions in Special Publication 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California on March 13, 1997 and revised and readopted on September 11, 2008. The CGS also provides guidance with regard to seismic hazards. Under the ~~CGS's~~ Seismic Hazards Mapping Act, seismic hazard zones are to be identified and mapped to assist local governments in planning and development purposes. The intent of this publication is to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and other hazards caused by earthquakes. In addition, CGS's Special Publication~~s~~ 117A, Guidelines for Evaluating and Mitigating Seismic Hazards in California, provides guidance for evaluation and mitigation of earthquake-related hazards for projects within designated zones of required investigations.

City of Goleta Regulations

The City's Planning and Environmental Services Department and Community Services Department Engineering Division have the responsibility for land development review and engineering approvals of all private development within the City to ensure compliance with City codes, ordinances and policies, and the preparation/enforcement of conditions of approval for development projects. The City has adopted the CBC to use as its own building code in Title 15 of the Goleta Municipal Code (GMC).

Further, the City also has grading regulations (GMC, Title 15, Chapter 15.09) that pertain to new grading, excavations, fills, cuts, borrow pits, stockpiling, and compaction of fill, "… where the transported amount of materials… exceeds 50 cubic yards or the cut or fill exceeds 3 feet in vertical distance to the natural contour of the land."

4.5.3 Thresholds of Significance

The City of Goleta's *Environmental Thresholds and Guidelines Manual* includes Geologic Constraints Guidelines approved in August 1993 by the Santa Barbara County Board of Supervisors. These guidelines are reproduced below:

> The purpose of these guidelines is to provide preliminary criteria for determining whether a particular activity could have a potentially significant impact on the environment as described in Section 15064 of the State CEQA Guidelines. Because geologic conditions are highly variable within the City, these guidelines are not fixed thresholds upon which a determination of significance would be made. Rather they serve to point out when further study of site-specific conditions is required to assess potential geologic impacts. The level of geologic impacts (i.e., potentially significant, potentially significant but subject to effective mitigation or not significant) is made by the City of Goleta staff (in consultation with licensed geologists and engineers as necessary) upon review of project plans, proposed mitigation measures and site-specific geologic information.

Impacts are considered potentially significant if the proposed development activity, including all proposed mitigation measures, could result in substantially increased erosion, landslides, soil creep, mudslides and unstable slopes (Appendix G, CEQA Guidelines). In addition, impacts are considered potentially significant when people or structures would be exposed to major geologic hazards upon implementation of the project (Appendix G, CEQA Guidelines).

> <u>The City of Goleta's *Environmental Thresholds and Guidelines Manual* provides that i</u>~~I~~mpacts related to geology have the potential to be significant if the proposed project involves any of the following characteristics:

- ~~c.~~<u>a.</u> The project site or any part of the project is located on land having substantial geologic constraints, as determined by the City of Goleta. Areas constrained by geology include parcels located near active or potentially active faults and property underlain by rock types associated with compressible/collapsible soils or susceptible to landslides or severe erosion.
- ~~c.~~<u>b.</u> The project results in potentially hazardous geologic conditions such as the construction of cut slopes exceeding a grade of 1.5 horizontal to 1 vertical.
- ~~d.~~<u>c.</u> The project proposes construction of a cut slope over 15-feet in height as measured from the lowest finished grade.
- ~~e.~~<u>d.</u> The project is located on slopes exceeding 20% grade.

> Mitigation measures may reduce impacts to a less than significant level. These measures would include minor project redesign and engineering steps recommended by licensed geologists and engineers subsequent to detailed investigation of the site.

Based on Appendix G of the CEQA Guidelines, the project would <u>further</u> result in a potentially significant impact relating to geologic resources if the project, and/or implementation of recommended mitigation measures, would result in exposure of people or structures to potentially substantial adverse effects, including risk of loss, injury, or death involving the following:

- f.e. Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area based on other substantial evidence of a known fault, as described by CGS CDMG Special Publication 42;
- g.f. Strong seismic ground shaking;
- h.g. Seismic-related ground failure, including liquefaction;
- i.h. Substantial soil erosion or the loss of topsoil; or
- j.i. Location of a project site on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

4.5.4 Project Impacts

The project would include the development of a 100-unit residential project on approximately 6 acres of undeveloped land. The 100 new units would be incorporated into ten residential, two-story stacked flats of four to sixteen units per building. Building coverage would be 49,869 square feet (sf) and the total gross building area of the project would be 99,142 sf. Associated infrastructure improvements include construction of the Camino Vista Road extension between the roadway's existing western terminus in front of Willow Springs I and its eastern terminus along the eastern property line of the project site; construction of internal private roads and parking areas; installation of drainage features including a bio-swale along the eastern property line (with all project runoff ultimately directed to the existing approximately 7.25-acre wetland/storm water retention area southwest of the Willow Springs I residential development), and installation of landscaping and utilities.

As discussed in Section 4.4 *Cultural Resources*, the project site includes sensitive archaeological resources over a 2.56-acre area affecting the proposed grading methods. To preserve the resource area, the project would include placing fill of up to 6 feet of soil to provide a cap for preservation-in-place of on-site archaeological resources. Mass grading of the archaeological soils would not occur. Site preparation for this area would be limited to vegetation removal at the surface only. Prior to fill placement, a geogrid fabric would be placed over the existing native ground surface to avoid major scarification as is typically required for filling, as well as to distribute the load of the soil compaction and structures to be placed later. The vegetation removal and geogrid application requirements are outlined in detail in Mitigation Measure CR 1-2 of Section 4.4 *Cultural Resources*. The fill would be placed in layers and compacted according to building code requirements. The source of fill soil would be from the existing on-site stockpile as well as an additional 15,475 cubic yards to be imported from a stockpile located on the Willow Springs North site. The source of the fill soil from the on-site stockpile is reported to be from an excavation for construction of a UCSB parking structure, and[3] the stockpiled soil at Willow Springs North is reportedly from construction near Cottage Hospital in Santa Barbara and/or retention basin clean-outs in the area.[4]

[3] Geosyntec letter to Steven Nailer, County Fire Department, January 8, 2007.

[4] Telephone Communication with Dale Weber, Mac Design Associates, by Brian McCarthy, Envicom Corporation, July 2011.

The project site is subject to the following geologic/soils issues, which are described below in detail: high groundwater, artificial fill, expansive soils, and the potential for liquefaction, seismic shaking (Zone 4 as described above), settlement, and erosion associated with site development and project implementation. Geologic issues are addressed in the project soils engineering reports. These reports provide grading and construction specifications consistent with the City's building code (Earth Systems Pacific Soils Engineering Reports, 2011 and 2008).

Geologic Hazards

Seismic Ground Shaking[5]

Severe ground shaking during earthquakes is a hazard endemic to most of California, and all project construction would be subject to compliance with the seismic safety standards of the CBC Zone 4, as adopted by the City. Based on the soils and engineering reports prepared for the project, the project is feasible for development from a geotechnical perspective. Preliminary design recommendations are set forth in these reports with regard to seismic design and other geotechnical issues. A more detailed geotechnical report would be required prior to issuance of a grading permit to address the specific foundation design and footprint of the proposed buildings. Until specific design features as specified in a final geotechnical report have been incorporated into the project plans, impacts as a result of ground shaking would be considered **potentially significant (GEO 1)**.

Liquefaction[6]

As indicated in the geotechnical and soils investigation, soils identified as having liquefaction potential were encountered at depths of approximately 10 to 35 feet below the existing ground surface. According to the Earth Systems Pacific Ssoils Engineering Rreports (2011 and 2008), if liquefaction were to occur at the site, the repercussions would likely be in the form of dynamic settlement, as loss of bearing is not anticipated. An analysis of the potential for liquefaction concluded that the estimated magnitude of dynamic settlement would be less than 3 inches. As described above, up to six feet of compacted fill material would be placed on top of the proposed geogrid and existing soils within the archaeologically sensitive areas, and other areas would undergo over-excavation, re-compaction and fill. Given that the thickness of the potentially liquefiable soil layer (or layers) appears to be less than the thickness of the overlying non-liquefiable soil, Earth Systems Pacific believes that surface manifestation of the dynamic settlement would be significantly reduced from the estimated value, or possibly eliminated altogether. To reduce the effects of dynamic settlement to an acceptable level of risk per California Code of Regulations Title 14, Section 3721(a), the structures can be supported by Portland Cement Concrete (PCC) slabs-on-grade foundations with conventional continuous and spread footings provided that all isolated spread footings are interconnected with grade beams so the foundation system acts as an integral unit. The foundations would be constructed within the fill and not intrude into native soils within the archeological area. Additionally, service utility connections must be sufficiently flexible to withstand the potential dynamic settlement. The construction specifications would be designed to ensure structures remain sufficiently intact, such that occupants could evacuate safely if there is a substantial seismic event.

[5] Addresses Thresholds "a", "e", "f", "g", "i"
[6] Addresses Thresholds "a", "f", "g", "i"

Until specific design features as specified in a final geotechnical report are incorporated into the project plans, impacts associated with liquefaction would be considered **potentially significant (GEO 2)**.

Landslides/Slope Stability[7]

The topography of the project area is generally subdued and the underlying geologic formations are not layered in a manner prone to landslide activity. The project site and surrounding area are relatively flat with a range in elevation of approximately 20 to 36 feet above msl. The project site is not located within a State-designated seismic hazard zone for landslide potential[8] or City-designated landslide area. In addition, there are no distinct or prominent geologic or topographic features located at the project site such as hilltops, ridges, hillslopes, canyons, ravines, rock outcrops, water bodies, or streambeds. The stockpile, which is currently subject to erosion, would be removed as part of the project. During grading activity, the transition between the archaeological area to be capped in place and the adjacent over-excavation areas, may involve the creation of temporary slopes of up to 1.5:1 (horizontal:vertical) gradient. The temporary slope would be required to be stabilized based on the CalOSHA requirements for the on-site soil type and would be temporary in nature until fill, compaction and geogrid installation is complete. Concerns related to potential impacts to the archaeological area as a result of potentially unstable slopes temporarily created due to adjacent over-excavation are addressed in Mitigation Measure CR 1-6. Therefore, no impact from landslides or other forms of natural slope instability, or landform alteration would occur as a result of the project.

Expansive Soils[9]

Expansive soils are developed over the intermediate-age alluvium found within the project area, and are considered in the “medium” expansion category based on testing reported in the May 2011 Earth Systems Pacific Soils Engineering Report. Expansion and contraction of clays in these soils can cause substantial damage to building foundations and other structures. Potential impacts associated with expansive soils on the building areas are addressed through the standard building code process by which building permits are issued. Natural alluvium, soil, and improperly engineered artificial fill materials are subject to consolidation from an increase in overburden pressure (new compacted fill or heavy structures) or earthquake shaking, which can lead to ground cracking, settlement and structural damage. Areas outside the archaeological site boundaries may contain artificial fill from stockpiling, but these areas would be excavated and re-compacted prior to placement of compacted fill and subsequent structural construction. Fill placed above the proposed geogrid within the archaeological site would also be compacted to meet the requirements of the City’s building code and soils engineering report. In addition, the soils engineering report requires that a minimum of 18 inches of non-expansive soils be placed below all foundations, along with other specific construction techniques, such as moisture compaction, use of re-bar, and options for reducing subsurface moisture vapor. The required soils engineering and geotechnical/foundation reports would provide lot-specific data on expansion and consolidation potential for the site alluvium and fill materials. Impacts as a result of expansive soils would be **potentially significant (Impact GEO 3**).

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7 Addresses Thresholds “”a-d”, “I”

8 *State of California Geologic Survey (CGS), Seismic Hazards Zonation Program ~~Department of Conservation website~~:http://www.conservation.ca.gov/cgs/shzp/Pages/Index.aspx, accessed October 2010.*

9 Addresses Thresholds “a”, “f”, “g”, “i”

Settlement[10]

Over the archeological area of 2.56 acres, existing ground surfaces would remain virtually undisturbed. Remedial grading (involving over-excavation and re-compaction) of existing soils would be limited to areas outside the archaeological boundary. Within the archaeological area, up to six feet of compacted fill soil would be placed on-site in 8-inch lifts with compaction and moisturizing to create suitable fill for placement of foundations and road surfaces. No foundation elements would extend into the existing soils. In addition, a geogrid fabric would underlie the fill soil in this area to distribute the loading of structures. The placement of fill soil above existing un-compacted soils would increase the potential for settlement, although the use of a geogrid fabric would reduce differential settlement. The over-excavation area would be compacted and filled to meet finished grade elevations with appropriate compaction to reduce effects of settlement. As described above, the dynamic settlement could be up to 3 inches. As such, Earth Systems Pacific recommends that non-expansive soils be placed under slab-on-grade foundations and that load bearing capacities are designed to meet seismic parameters for the specific soil type per the California Building Code Table 1613.5.2, as adopted by the City, and as summarized in the Earth Systems Pacific Soils Engineering Report (2011).

Until specific design features specified in the project's soils engineering reports are incorporated into the project plans, impacts associated with settlement would be **potentially significant (Impact GEO 4**).

Erosion and Sedimentation[11]

Erosion and sedimentation from exposed soils could potentially occur during construction. However, construction activities would comply with erosion control requirements, including grading and dust control measures, imposed by the City pursuant to grading permit regulations. Specifically, project construction would comply with City's Community Service's guidelines, which requires necessary permits, plans, plan checks, and inspections to reduce the effects of sedimentation and erosion. In addition, as discussed in Section 4.8, *Hydrology and Water Quality*, the project would be required to have a Storm Water Pollution Prevention Plan (SWPPP) pursuant to the National Pollutant Discharge Elimination System (NPDES) permit requirements. As part of the SWPPP, BMPs would be implemented during construction to reduce soil erosion and pollutant levels to the maximum extent possible.

After construction, the project may result in a limited degree of soil erosion effects from vegetated areas. However, in accordance with NPDES requirements, the project would be required to have a Standard Urban Stormwater Mitigation Plan (SUSMP) in place during the operational life of the project, which would include BMPs that would reduce on-site erosion from vegetated areas on the project site.

However, prior to implementation of the above requirements, impacts associated with erosion and sedimentation would be **potentially significant (Impact GEO 5).**

Please refer to Section 4.8 *Hydrology and Water Quality*, for a more detailed analysis regarding erosion and sedimentation effects during construction and operation of the project.

[10] Addresses Thresholds "a", "f", "g", "i"

[11] Addresses Thresholds "h"

4.5.5 Cumulative Impacts[12]

Cumulative development in the area would increase the overall potential for exposure to seismic hazards by potentially increasing the number of people exposed to seismic hazards. Cumulative development would also contribute to erosion and sedimentation. Cumulative projects would be subject to established guidelines and regulations pertaining to building design, seismic safety, and erosion control, including those set forth in the City's building regulations. Cumulative impacts related to geologic resources are considered **potentially significant** until such time as it is determined that compliance with regulations has been demonstrated.

4.5.6 Mitigation Measures

Mitigation for Impacts GEO 1, GEO 2, GEO 3, and GEO 4

GEO 1-1 The permittee shall ensure that all soils and engineering report recommendations are incorporated into the project engineering and construction plans, including soils tests of the imported soil to ensure that it meets the soil classifications assumed in the soils reports, and that an adequate amount of non-expansive soils occurs with the import soils to meet the ~~CBC~~ City's building code requirements set forth in Title 15 of the Goleta Municipal Code for construction, as outlined in the reports. The permittee shall retain a licensed soils engineer acceptable to the City to review all construction plans for consistency with the soils reports and to monitor on-site grading and construction to ensure the conditions at the project site do not substantially change the requirements of the report.

Plan Requirements and Timing: All project plans as determined necessary by City staff, including g~~G~~rading and c~~C~~onstruction p~~P~~lans, shall be reviewed and stamped by the project soils engineer and shall be submitted to the City for review and verification that all requirements have been incorporated prior to issuance of any ~~the~~ LUP for grading and any LUP for construction.

Monitoring: The project soils engineer shall monitor grading and construction activity and report observations to the City. The City shall conduct field inspections as needed.

Mitigation for Erosion and Sedimentation (Impact GEO 5)

Water Quality Mitigation Measure WQ 1-2, identified in Section 4.8 *Hydrology and Water Quality*, would also mitigate Impact GEO 5.

GEO 5-1 The final grading and erosion control plan shall be designed to minimize erosion.

Plan Requirements: The plan shall include~~, but not be limited to,~~ the following:

a. Best management practices (BMPs), such as temporary berms and sedimentation traps (such as silt fencing, straw bales, and sand bags), shall be installed in association with project grading. The BMPs shall be placed at the base of all cut/fill slopes and soil stockpile areas where

[12] Addresses Thresholds "a-i" in cumulative setting

potential erosion may occur and shall be maintained to ensure effectiveness. The sedimentation basins and traps shall be cleaned periodically and the silt shall be removed and disposed of in a location approved by the City.

b. Non-paved areas shall be revegetated or restored (i.e. geotextile binding fabrics) immediately after grading and installation of utilities, to minimize erosion and to re-establish soil structure and fertility. Revegetation shall include drought-resistant, fast-growing vegetation that would quickly stabilize exposed ground surfaces. Alternative materials rather than reseeding (e.g., gravel) may be used, subject to review and approval by the Planning and Environmental Services and Community Services departments.

c. Runoff shall not be directed across exposed slopes. All surface runoff shall be conveyed in accordance with the approved drainage plans.

d. Energy dissipaters or similar devices shall be installed at the end of drainpipe outlets to minimize erosion during storm events.

e. Grading shall occur during the dry season (April 15th to November 1st) unless a City approved erosion control plan is in place and all erosion control measures are in effect. Erosion control measures shall be identified on an erosion control plan and shall prevent runoff, erosion, siltation, and tracking of mud and soil onto City streets. All exposed graded surfaces shall be reseeded with ground cover vegetation to minimize erosion. Graded surfaces shall be reseeded within four (4) weeks of grading completion, with the exception of surfaces graded for the placement of structures. These surfaces shall be reseeded if construction of structures does not commence within four (4) weeks of grading completion.

f. Site grading shall be completed such that permanent drainage away from foundations and slabs is provided and so that water shall not pond near proposed structures or pavements.

Timing: Final project plans as determined necessary by City staff, including grading, drainage, and erosion control plans, shall be reviewed and approved by the City prior to any LUP issuance for grading and any LUP issuance for construction. BMPs and erosion control measures shall remain in place/shall be implemented for the duration of grading and construction.

Monitoring: City staff shall verify compliance during grading and construction activities.

4.5.7 Residual Impacts

Compliance with the above mitigation measures would reduce potential geologic impacts to less than significant (**Class II**).