Appendix E

Geotechnical and Geologic Reconnaissance

REVISED GEOTECHNICAL AND GEOLOGIC RECONNAISSANCE
MORENA CORRIDOR SPECIFIC PLAN
SAN DIEGO, CALIFORNIA

Prepared for
RECON ENVIRONMENTAL, INC.
San Diego, California

TerraCosta Consulting Group

Prepared by
TERRACOSTA CONSULTING GROUP, INC.
3890 Murphy Canyon Road, Suite 200
San Diego, California 92123
(858) 573-6900

Project No. 2882
May 15, 2018

TerraCosta Consulting Group

Geotechnical Engineering
Coastal Engineering
Maritime Engineering

Project No. 2882
May 15, 2018

Ms. Jennifer Campos
RECON ENVIRONMENTAL, INC.
1927 Fifth Avenue
San Diego, California 92101

REVISED GEOTECHNICAL AND
GEOLOGIC RECONNAISSANCE
MORENA CORRIDOR SPECIFIC PLAN
SAN DIEGO, CALIFORNIA

Dear Ms. Campos:

TerraCosta Consulting Group, Inc. (TerraCosta) performed a geotechnical and geologic reconnaissance of the area comprising the Morena Corridor Specific Plan. Our reconnaissance consisted of a review of pertinent technical documents in our files and readily available sources, and preparing this "desktop" study report summarizing existing geologic and geotechnical conditions within the Morena Corridor Specific Plan area. Our January 8, 2018, "Geotechnical and Geologic Reconnaissance" report has been revised to address issues raised by the City of San Diego in their February 21, 2018, Cycle Type: 5 LDR-Geology review comments.

We appreciate the opportunity to be of service and trust this information meets your needs. If you have any questions or require additional information, please give us a call.

Very truly yours,
TERRACOSTA CONSULTING GROUP, INC.

Matthew W. Eckert, Ph.D., Director of Engineering, R.C.E. 45171, R.G.E. 2316

Braven R. Smillie, Principal Geologist
C.E.G. 207, P.G. 402

MWE/BRS/jg
Attachments

REGISTERED PROFESSIONAL ENGINEER
MATTHEW W. ECKERT
No. 2316
GEOTECHNICAL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
BRAVEN R. SMILLIE
No. 207
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

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REVISED GEOTECHNICAL AND GEOLOGIC RECONNAISSANCE **MORENA CORRIDOR SPECIFIC PLAN** SAN DIEGO, CALIFORNIA

1 INTRODUCTION

TerraCosta Consulting Group, Inc. (TerraCosta) performed a geotechnical and geologic reconnaissance of the area comprising the Morena Corridor Specific Plan (MCSP). Our reconnaissance consisted of a review of pertinent technical documents in our files and other readily available sources, and preparing this "desktop" study report summarizing existing geologic and geotechnical conditions within the MCSP area. Our January 8, 2018, "Geotechnical and Geologic Reconnaissance" report has been revised to address issues raised by the City of San Diego in their February 21, 2018, Cycle Type: 5 LDR-Geology review comments. The general location of the project study area is shown on the Vicinity Map (Figure 1).

2 OVERVIEW OF THE MORENA CORRIDOR SPECIFIC PLAN

The MCSP proposes the transformation of the area of the City of San Diego known as the Morena Corridor (Figure 2) from a primarily auto-oriented commercial corridor into a pedestrian-oriented village, a vibrant community core that provides a variety of mixed uses and employment and housing opportunities, while promoting variable travel choices that include walking, bicycles, and high frequency transit.

The Morena Corridor area consists of approximately 300 acres along Morena Boulevard and West Morena Boulevard between Clairemont Drive and Friars Road. To the north and east, the area is bounded by the single-family residential areas of Clairemont Mesa, the University of San Diego, and multifamily and student housing in Linda Vista. To the south, the area is bounded by the San Diego River and Interstate 8 (I-8). To the west, the area is bounded by the railroad right-of-way and Interstate 5 (I-5).

Within the Morena Corridor Special Plan area, there are five planning districts: The Clairemont District, Artesian District, Tecolote Village District, Employment District, and the Morena Station District. The boundaries of the planning districts are shown on Figure 3, and the planned land use areas are shown on Figure 4. Lastly, a summary of the specific plans for each of the districts is provided in Table 1.

3 SITE AND SUBSURFACE CONDITIONS

3.1 Geologic Setting

The MCSP Area is located within the Peninsular Ranges Geomorphic Province, which is generally characterized as a series of northwest-trending mountain ranges and valleys between Baja California and the Santa Monica Mountains. Geomorphic maps typically show that the Peninsular Ranges Province, which is bounded by the Transverse Ranges and the Colorado Desert Geomorphic provinces to the north and east, respectively, extends into the Baja California peninsula on the south, and is often mapped as extending as far west as the western edge of the offshore continental borderland. Within San Diego County, the Peninsular Range Province is oftentimes further subdivided into a coastal plain subzone (referred to as the San Diego Embayment), a central mountain subzone, and a desert subzone.

Within the Peninsular Ranges Province, the project site is further situated on the westerly margin of the coastal plain subzone, which is characterized by a series of uplifted coastal terraces (stepping down to the west) that have been modified and abraded by various sea-level high stands and incised by numerous drainages.

The coastal plain terraces are typically covered by a veneer of Quaternary-age nearshore marine, beach, and non-marine sediments, which are in turn underlain by Cretaceous- and Tertiary-age deposits that may or may not be exposed within the coastal bluff face. The incised drainages are generally filled by Quaternary-age alluvial sediments.

The regional geology in the vicinity of the project site is shown in Figure 1.

3.2 Faulting and Seismicity

Tectonic movement between the North American and Pacific Plates makes Southern California one of the more seismically active regions in the United States. Strain, caused by movement between the North American Plate and the Pacific Plate, is spread across a 150+ mile wide zone between the San Andreas fault zone, approximately 100 miles east of San Diego, out to and beyond the San Clemente fault zone located approximately 50 miles west of San Diego. The location of the site in the context of regional faulting is shown in Figure 5.

Nearing the end of the Miocene, approximately 5.5 million years ago, the boundary between the North American and Pacific Plates moved eastward to its present-day position in the Gulf of California (Abbott, 1999). The resultant extension and stretching of the North American continental crust formed a rift between the two plates, creating the Gulf of California, which continues opening through the present day. The San Andreas, San Jacinto, Elsinore, Rose Canyon/Newport-Inglewood, and San Clemente fault zones are just a few of the resultant strain features (faults) created by this tectonic movement. Today, there is an estimated 22 to 24 inches per year of relative plate motion between the North American and Pacific Plates, spread across the faults within this 150+ mile wide zone, of which the Rose Canyon fault zone is estimated to contribute 0.06 inch/year (±0.02 inch).

Of the major active fault systems in Southern California, the Rose Canyon/Newport-Inglewood fault zone has impacted the local San Diego region the most. In addition, the La Nacion fault zone to the east of the project and the Descanso Fault offshore to the west, have contributed to the local tectonic state of the project site. Together with other offshore fault zones, these faults have contributed to the formation of San Diego Bay. South of La Jolla, the Rose Canyon fault zone changes its orientation from a northwest/southeast trend to a more north/south trend, creating a left bend in the fault zone. This left bend locally creates a locking mechanism within the predominantly right-lateral Rose Canyon fault zone. The compressional forces within this zone have caused folding, uplift, and tilting of the overlying sedimentary rocks, thus creating Mount Soledad and the down-dropped Mission Bay area. To the south, in San Diego Bay, the Rose Canyon fault zone separates into a “horsetail splay,” spreading movement across the Silver Strand, Coronado, and Spanish Bight Faults (as well as several smaller faults) as it trends offshore toward the Descanso Fault. The Descanso Fault trends offshore from Point Loma, where it extends southerly toward the Agua Blanca fault zone in northern Baja (Legg and Kennedy, 1991). This right step, between the

Descanso and Rose Canyon fault zones, creates a releasing bend, causing the rocks to be stretched and down-dropped. In response, the rocks have not deformed elastically, but instead have responded with brittle fault failure (Abbott, 1999). The easterly boundary of this releasing bend is formed by the La Nacion fault zone, which generally consists of normal faults that down-drop to the west.

The Rose Canyon fault zone passes through the project limits (Figures 2, 3, and 4).

3.3 Site Conditions

The topography for most of the San Diego coastal metropolitan area is relatively simple, consisting of uplifted ancient sea floors and shore platforms that have become the present-day westerly sloping coastal terraces. These terraces are in turn dissected by westerly flowing streams and rivers, which have incised significant canyons as they flow to the coast (Abbott, 1999).

The project site is located at the base of an ascending ancient coastal slope, with current ground surface elevations ranging from approximately +7 feet MSL near the Interstate 5 overpass at Tecolote Creek to an approximate elevation of +100 feet MSL at the northeastern-most corner of the project limits near Clairemont Drive. However, the majority of the site is located below elevation +40 feet MSL.

3.4 Site Geology

From a local geological perspective, the project site is located on gently westerly sloping, late Quaternary-age terrace deposits, which generally follow along the easterly limits of Mission Bay and Interstate 5 at the base of the current coastal bluff. The site is bisected by Tecolote Creek and is bounded on the south by the San Diego River. Quaternary-age alluvial deposits fill Tecolote Creek, the eastern edge of Mission Bay, and the San Diego River. In addition, Tertiary-age formational soils of the Ardath, Scripps, and San Diego Formations are encountered in a few areas along the western edge of the project site. Portions of the project site have been raised by the placement of artificial or man-made fills soils. These fill soils have generally been placed within the lower lying areas along the southerly end of the project area adjacent to Mission Bay and the San Diego River. Lastly, the project site is located along and within the Rose Canyon fault zone.

Historically the geologic characterization of surface conditions changes over time. For example, the geologic conditions within the study area, as understood prior to our current understanding, are shown in Figure 6. The current map of geologic conditions within the project area is shown in Figure 7. Explanations of the geologic units shown on Figure 7 are presented on Figure 8.

Bedrock units exposed locally within the project limits include the Tertiary-age Ardath Shale (Ta), Scripps Formation (Tsc), and the San Diego Formation. General descriptions (Kennedy and Tan, 2008) of these three bedrock units are presented below in order of decreasing age:

- Ardath Shale (Ta) – The Ardath Shale is a middle Eocene deposit consisting of uniform, weakly fissile, olive-gray silty shale, with thin beds of medium-grained sandstone in the upper part, and thicker concretionary sandstone beds with molluscan fossils in the lower part. Exposures of the Ardath Shale at the site are mapped within the shear zone forming the westerly side of the Rose Canyon fault zone.

- Scripps Formation (Tsc) – The Scripps Formation is a middle Eocene deposit that is mostly pale yellowish-brown, medium-grained sandstone containing cobble-conglomerate interbeds. Middle Eocene molluscan fauna are found within the unit. The Scripps Formation is exposed locally along the southern boundary of Tecolote Creek and is very limited in exposure.

- San Diego Formation (Tsd) – The San Diego Formation is an early Pleistocene and late Pliocene deposit of undivided sandstone and conglomerate. The sandstone has been described as a predominantly yellowish-brown, gray, fine to medium-grained, poorly indurated fossiliferous marine sandstone, whereas the conglomerate has been described as reddish-brown, transitional marine and non-marine pebble and cobble conglomerate.

Surficial soil units exposed within the site include old paralic deposits (Qop6), young alluvial deposits (Qya), and artificial fill (af). A general description of these units in order of decreasing age follows:

- Old Paralic Deposits of Unit 6 (Qop6) – The old paralic deposits of Unit 6 are late to middle Pleistocene deposits consisting of poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine, and colluvial deposits composed of siltstone, sandstone, and conglomerate. In the project site area, these deposits rest on the 22 to 23 meter Nestor Terrace.

- Young Alluvial Floodplain Deposits (Qya) - Those materials mapped as young alluvial floodplain deposits are considered Holocene and late Pleistocene in age and typically consist of poorly consolidated, poorly sorted, permeable floodplain deposits of sandy, silty, or clay-bearing alluvium.

- Artificial Fill (af) – Artificial fill soils resulting from construction in and around the project site area are of unknown composition and may be compacted or uncompacted. Without documentation, these materials should be considered undocumented and non-engineered structural fills, pending additional studies.

A relatively recent geotechnical investigation performed as part of the Pure Water Program by AECOM for the Morena Pump Station and the cut and cover portions of the associated pipeline (AECOM, 2017) reports the subsurface conditions as follows:

- Morena Pump Station – The subsurface conditions consist of a relatively thin fill layer over alluvium to the depths explored. The maximum depth explored was estimated to be approximately 80 feet below the existing ground surface. The thickness of fill was on the order of 3 to 5 feet. The alluvial soils, to depths ranging from 19 to 29 feet, were generally comprised of loose sands to silty sands with some zones of very loose to medium dense materials. In addition, significant interbeds of low-plastic silts were encountered at some of the exploration locations. Underlying the upper sands to silty sands were fine-grained soils characterized as silt with interbeds of clay and silty sand. The consistencies of these fine-grained soils were characterized as soft to stiff. These fine-grained soils extended to an approximate depth of 50 feet below the ground surface. At a depth of approximately 50 feet, medium dense to dense sands to silty sands were encountered to the depths explored. Within this lower granular layer were zones of looser soils and an approximately 5-foot-thick, stiff, fine-grained layer.

- Pipeline from along Morena/West Morena Boulevard from Friars Road to Ingulf Street – The subsurface conditions within the planned trench depths generally consisted of fill soils over alluvium or estuarine deposits. AECOM noted that for short reaches, old paralic deposits (historically referred to as Bay Point Formation) were encountered. The estuarine deposits were encountered between Dorcas Street on the south and Savannah Street on the north, and were described as consisting of mostly sands, clays, and some very soft organic soils.

3.5 Geologic Hazards

In general, a project may be exposed to risks associated with various geologic hazards. Many of those hazards are related to the actions of earthquakes and faulting. Such geologic hazards generally include ground rupture, ground shaking, tsunamis, seiches, seismic-induced flooding, liquefaction, seismic-induced ground settlement, and seismic-induced slope instability.

In addition to geologic hazards associated with earthquakes and faulting, there are other potential geologic hazards that may impact the proposed project. These include: landslides, expansive soils, collapsible soils, corrosive soils, and high or perched groundwater.

A brief description of various geologic hazards is presented below.

3.5.1 *Seismic Hazards*

3.5.1.1 Earthquake Faults, Including Information on Historic Earthquakes

Southern California is located across the boundary of two major tectonic plates, the North America Plate and the Pacific Plate. The San Andreas Fault System (SAFS) is the main structural expression of the boundary between these two plates. The SAFS is a transform plate boundary. The relative displacement between the two plates is right-lateral. This SAFS distributes the right-lateral displacement across numerous secondary faults located to the west of the boundary. The Rose Canyon fault zone is one of these secondary faults.

The project site is located within the Rose Canyon fault zone, which is considered part of the Newport-Inglewood-Rose Canyon fault system. Other significant faults within approx-imately 60 miles of the site, and which contribute to the overall ground-shaking risk at the site, include the Coronado Bank Fault, the Palos Verdes Connected Fault, the San Diego Trough, the Elsinore Fault (including the Julian, Temecula, Coyote Mountain, Whittier, and Glen Ivy segments), the Earthquake Valley Fault, the San Clemente North and South Faults, the Palos Verdes Fault, the San Jacinto Fault (including the Coyote Creek, Anza, Clark, Borrego, Superstition Mountain, SBV, and SJV segments), and the San Joaquin Fault.

Historically, the project site has been subjected to ground shaking. According to our search of the California historical earthquake database used in the computer program EQSEARCH (Blake, 2001), the site has been subjected to 1,070 earthquakes of magnitude 4 or greater, 122 earthquakes of magnitude 5 or greater, 23 earthquakes of magnitude 6 or greater, and one earthquake of magnitude 7 or greater. In addition, four earthquakes of magnitude 5.5 or greater have occurred within 31 miles of the site. These four earthquakes occurred prior to 1900. The largest estimated peak ground acceleration that the project site has experienced was approximately 0.26g.

3.5.1.2 Surface Fault Rupture

The project site is located within the Rose Canyon fault zone. There are five Alquist-Priolo Earthquake Fault Zones (APEFZ) delineated along the Rose Canyon fault zone located within San Diego, California. Four of the APEFZ are located in the downtown and San Diego Bay area of the City of San Diego, and one begins just to the north of the project and extends up the Interstate 5 corridor to the ocean through La Jolla. The closest APEFZ is located approximately one-quarter of a mile north-northwest of the project limits, as measured from Clairemont Drive. The next closest APEFZ is located approximately 2.4 miles southeast from the southern limits of the project site.

While not located within a delineated APEFZ, numerous fault zones (City of San Diego, 2008) have been identified and are referenced as Geologic Hazard Category No. 12, and are shown on Figure 9. The fault zones shown on Figure 9 are labeled “Potentially Active,” “Inactive,” “Presumed Inactive” or “Activity Unknown.” A study prepared by SANDAG (SANDAG, 2013) presented the results of aerial photographic interpretation by Kleinfelder, Inc. of various geomorphic features, such as suspected faults, drainages, side slope bench lineaments, scarps, pressure ridges, and landslides. Also, AECOM (AECOM, 2017) reported finding an active fault strand located near the proposed pump station. The location of the offset identified by AECOM is shown on Figure 2. City-identified fault zones and suspected fault traces identified by Kleinfelder (SANDAG, 2013) are shown on Figures 2, 3, and 4.

It is important to note that the Morena Specific Plan study area is located in an area where faults crisscross the site. In addition, while the City of San Diego has identified several fault zones, twelve within the study area, on their Seismic Safety Maps (Figure 9), which according to Appendix E of the City of San Diego Guidelines for Geotechnical Reports (Guidelines) indicates that fault studies may be required, recent discussions with City Staff made it clear that faults studies will be required throughout the Morena Specific Plan area, as the City considers this area to contain active faults that could be located anywhere on the project site. Accordingly, fault studies will be needed for all new developments, as well as projects where repurposing of existing occupancy and use will occur. Lastly, fault studies will need to be performed in accordance with the Alquist-Priolo Earthquake Zoning Act, California Geological Survey Note 49, and the requirements of the City of San Diego Guidelines for Geotechnical Reports. According to City Guidelines, the preferred method for field investigation for surface faulting is trenching. Where trenching is not feasible, alternatives include continuously logged borings spaced adequately to allow valid correlations and interpretations with optimal coverage, or cone penetration testing (CPT) on a 10- to 15-foot spacing with continuously logged borings of adequate spacing for validation of CPT interpretations.

California Building Code requirements state that new buildings cannot be located over active faults. As such, the specific locations of buildings may be impacted due to locations of discovered and identified active faults. To mitigate surface fault rupture hazards, new and re-purposed existing buildings will need to be appropriately located a setback distance from any identified active fault, such as was recommended for the proposed Morena Pump Station (AECOM, 2017). Typical setback distances are on the order of 50 feet. Thus, some proposed developments may be prohibited where impacted buildings cannot be set back from identified active faults.

3.5.1.3 Strong Seismic Ground Shaking

The significance of ground shaking, as it relates to a geologic hazard, is associated with two issues. The most commonly understood issue pertains to the imparting of inertial forces into buildings and structures. The second issue, of equal significance, is related to the stability of the ground during ground shaking.

The characterization of ground shaking is often expressed in terms of either peak ground acceleration (PGA) or the response of a single degree of freedom oscillating mass for various periods or frequencies of motion to the ground shaking produced by an earthquake. This response is generally expressed in terms of a response spectrum that encapsulates the range of motions anticipated at the site for a given set of earthquake events.

A given site is potentially exposed to a wide range of earthquake events, each having a different likelihood of occurring. As such, the risk of ground shaking is generally expressed in terms of likelihood or probability of exceedance for a particular earthquake event. In addition, the likelihood of a particular event is only one part of the measurement of risk at a site. Another key part of risk is the consequence to a given building or structure associated with a given earthquake event. Thus, both the likelihood of occurrence of a given earthquake and its consequence are generally paired together to form design code requirements. Each class of structure or facility typically has its own design code requirements. For example, buildings in general are designed in accordance with Chapters 16 and 18 of the California Building Code (CBC).

3.5.1.4 Seismically Induced Slope Failure

For purposes of discussion, seismically induced slope failure excludes liquefaction-induced slope instability and lateral spreading, and pertains to slopes that fail due to imposed inertial loads associated with ground shaking. For liquefaction-induced ground and slope failure, refer to the below subsection on Liquefaction and Related Ground Failure.

According to the City of San Diego Seismic Safety Study, slopes within the project site are located in Geologic Hazard Category 52 or 53 (Figure 9). Geologic Hazard Category 52 is described as other level areas and gently sloping to steep terrain with favorable geologic structure, and is considered low risk. Geologic Hazard Category 53 is described as level or sloping terrain with unfavorable geologic structure, having low to moderate risk. In general, the portion of the site in Geologic Hazard Category 52 is located south of Tecolote Creek, and the portion in Geologic Hazard Category 53 is located to the north of Tecolote Creek.

In general, site grades are mild and on the order of 2 to 10 percent. However, there are steeper slopes located within the site generally along the edges of Tecolote Creek and at the northeastern-most corner. The slopes along Tecolote Creek are either laterally restrained by the concrete-lined portions of the creek, or are comprised of fairly competent terrace deposits and Tertiary formational materials with favorable structure and, as such, are considered low risk with respect to seismically induced slope instability. The slopes at the northeastern-most corner of the project are located within Ardath Shale formation within an identified fault shear zone. Such slopes likely have unfavorable geologic structure and, as such, are considered to have a low to moderate risk with respect to seismically induced slope instability.

City code requires geotechnical and geologic studies for projects, including the requirement that slopes be evaluated for stability under both static and seismic conditions. If slopes are found to be not in compliance with City requirements, they would need to be remediated so that they do comply with City requirements in order for project approval to be granted. As such, this potential hazard is considered to be non-significant, as we anticipate that potential hazards can be mitigated as part of project design.

3.5.1.5 Tsunamis and Seiches

Our review of the State of California Tsunami Inundation Map for Emergency Planning for the La Jolla Quadrangle indicates that the land portions of the project site are not located within the tsunami inundation zone (Figure 10A, 10B, and 10C). However, tsunami inundation is anticipated for some part of the reach of Tecolote Creek. In addition, the project site is located on higher ground to the east of Mission Bay, as evidenced by the limits of the tsunami inundation limit line and, as such, is not considered to be susceptible to flooding caused by seiches within Mission Bay due to earthquakes. Thus, tsunamis and seiches are not considered likely hazards at this project site.

3.5.1.6 Liquefaction and Related Ground Failure

Liquefaction is a process whereby strong earthquake shaking causes sediment layers that are saturated with groundwater to lose strength and behave as a fluid. This subsurface process can lead to near-surface or surface ground failure that can result in property damage and structural failure. If surface ground failure does occur, it is usually expressed as lateral spreading, flow failures, ground oscillation, and/or general loss of bearing strength. Sand boils (injections of fluidized sediment) can commonly accompany these different types of failure.

In order to determine a region's susceptibility to liquefaction, three major factors must be analyzed. These include:

- The intensity and duration of ground shaking.

- The age and textural characteristic of the alluvial sediments: Generally, the younger, less well compacted sediments tend to have a higher susceptibility to liquefaction. Textural characteristics also play a dominant role in determining liquefaction susceptibility. Sand and silty sands deposited in river channels and floodplains tend to be more susceptible to liquefaction, and floodplains tend to be more susceptible to liquefaction than coarser or finer grained alluvial materials.

- The depth to the groundwater: Groundwater saturation of sediments is required in order for earthquake-induced liquefaction to occur. In general, groundwater depths shallower than 10 feet of the surface can cause the highest liquefaction susceptibility.

Research and historical data indicate that loose, granular materials at depths of less than 50 feet with silt and clay contents of less than 30 percent saturated by a relatively shallow groundwater table are most susceptible to liquefaction. These geological conditions are typical in parts of southern California, including the City of San Diego, and in valley regions and alluviated floodplains.

The project site contains both non-liquefiable and potentially liquefiable soils. The areas susceptible to liquefaction include those areas designated as Category 31 (Figure 9), as defined by the City of San Diego Seismic Safety Guide. In general, the potentially liquefiable soils are confined to the main drainages that cut through and border the site. The liquefiable areas include the alluvial deposits associated with the drainages of Tecolote Creek and the San Diego River, as well as those low-lying areas where artificial fill has been used to raise grades within the floodplain of the San Diego River and adjacent to Mission Bay.

Consequences associated with liquefaction include ground settlements, loss of foundation support, ground oscillation, surface damage from sand boils, and lateral spreading. In cases where lateral stability of the ground is low, ground instability associated with the lateral movement or lateral spreading of soil is more likely. Within the project site, areas more susceptible to lateral spreading are located along the edges of drainages such as Tecolote

Creek and the San Diego River. Areas adjacent to Mission Bay are considered less susceptible to lateral spreading due to the distance from the bay.

New developments located within liquefiable areas will require site-specific investigations to ascertain the level of risk and hazard. Structures and buildings will need to be designed to address life and safety concerns. Such designs may include ground remediation as one method to mitigate the hazards associated with liquefaction. Other mitigation strategies that may be viable include structural reinforcement of the facilities, as well as specific foundation systems.

3.5.2 *Landslides*

No landslides have been mapped within the project limits. As such, landslides are not considered a geologic hazard for the project site.

According to the City of San Diego Geologic Hazard Category system, the project site contains areas that are classified as Categories 31, 52, and 53 (Figure 9). Hazards related to slope stability and mudslides, if they exist, are more likely to be found within Categories 52 and 53. Areas located within Category 52 are considered to have low risk, while areas located within Category 53 are considered to have low to moderate risk.

Areas of the project site having significantly steep slopes are generally located along Tecolote Creek and the northeastern corner of the project site near Clairemont Drive. Development in these areas will likely require evaluation of the stability of the existing slopes. As part of any geotechnical investigation, an assessment of slope stability is required, with a determination of the stability of the slope and any mitigation measures that may be warranted.

Review of USGS Open-File Report OF 03-17 titled, "Preliminary Soil-Slip Susceptibility Maps, Southwestern California," indicates that the susceptibility for soil-slip, including mudslides, is low for the project site.

Site-specific studies will be required to assess site-specific risks and hazards, and mitigation strategies that may be required to mitigate any discovered hazard. We anticipate that hazards associated with landslides, slope instability, and mudflows can be mitigated and, as such, we consider the risk associated with landslides, slope instability, and mudflows to be less than significant.

3.5.3 *Collapsible Soils*

Soils that undergo volumetric reduction due to wetting and inundation are considered collapsible soils. Such soils are typically found within alluvial deposits. Some fill soils also undergo collapse when wetted or inundated. As such, potentially collapsible soils are anticipated within those areas of the site that are mapped as younger alluvium (Qya) and artificial fill (af).

The primary hazard associated with collapsible soils is settlement-induced damage. This hazard can be mitigated by identifying and delineating the limits of these soils during the geotechnical investigation for specific structures, and by removing and recompacting the soils in question or founding the proposed structure on a foundation system designed to protect the proposed structure from settlement-induced damage.

3.5.4 *Expansive Soils*

In general, portions of the upper fill soils and alluvial deposits within the project limits may contain clayey soils that are potentially expansive. However, as most of these soils are generally covered by hardscape and pavements, these soils are likely kept at a fairly constant moisture content by the relatively shallow underlying groundwater table. As such, it is our opinion that impact to the proposed project due to expansive soils is low. However, the designers of future projects within the area will need to assess the potential impacts of expansive soils on a case-by-case basis. If expansive soils are found at a particular project site within the study area, that project site would need to comply with the both California Building Code and San Diego code requirements.

3.5.5 *Corrosive Soils*

The project study area is located within a marine environment. As such, on-site soils run the risk of being potentially corrosive. Therefore, new developments within the study area will need to assess potential impacts associated with corrosive soils. If corrosive soils are found, the potential impacts related to corrosive soils can be mitigated to non-impacting conditions through the use of material selection and design criteria. For example, concrete mix designs can be adjusted to accommodate corrosive soils.

3.5.6 *Erosion and Sedimentation*

Erosion and sedimentation are a function of rainfall, runoff, topographic conditions, ground cover, and various soil characteristics such as grain size and permeability. Bare and poorly vegetated areas are prone to soil erosion and sediment being transported by surface waters and drainages. The site is well-developed and generally well-landscaped. In addition, Tecolote Creek is a concrete-lined drainage. As such, erosion of soil from properties located within the project limits is considered to be not significant. Similarly, redepositing eroded soils as sediments is considered not significant.

3.5.7 *Groundwater*

Groundwater within the project site is influenced by water levels in Mission Bay, Tecolote Creek, and the San Diego River. As such, the depth to the groundwater table, likely to be encountered near mean sea level, will vary. However, nearby recharge sources, such as Mission Bay, Tecolote Creek, and the San Diego River, may cause seasonally higher groundwater levels at the site.

The recent study for the Morena Pump Station and cut and cover portions of the associated pipeline (AECOM, 2017) indicates that groundwater was measured at depths below ground surface (bgs) ranging from 6 to 20 feet. In addition, AECOM noted that, at the proposed pump station site, groundwater was measured at a depth of 8 feet bgs at an approximate elevation of 5 to 6 feet (MSL).

3.5.8 *Infiltration Characteristics for Storm Water Management*

Based on our review of the County of San Diego Hydrologic Soils Group Map, the majority of the soils within the project area classify as undetermined. Review of the Morena Pump Station geotechnical report (AECOM 2017) indicates that the site is covered with a relatively thin layer of fill soils overlying alluvial soils with a relatively shallow groundwater table. The fill soils are described as generally silty sand near the pump station, and silty to clayey sand along the pipeline. The infiltration characteristics of such soils vary depending upon fines content. Underlying these fill soils are alluvial soils, which are generally sandy just under the fill. Given such conditions, it is our opinion that the general infiltration rates of these soils are likely less than 0.5 inch per hour. However, locally higher infiltration rates could exist.

Given the relatively shallow groundwater conditions within the project site, groundwater mounding due to infiltration is likely. An increase in groundwater levels would increase the risk of liquefaction. In addition, the quality of water infiltrated could increase the risk of groundwater contamination. However, it may be possible to screen out contaminants from surface runoff to mitigate this concern.

Site-specific studies will be needed to assess the feasibility of infiltration of stormwater, either fully or partially. However, given the shallow water depth, the risk of groundwater mounding, the increased risk of liquefaction, and the potential transportation of contaminants via infiltration, it is our opinion that the feasibility of infiltrating stormwater is low.

4 DISCUSSION

4.1 Geotechnical Concerns

The guiding principles of the MCSP seek to:

- Protect and enhance the neighborhood character of the area;
- Establish a balanced mix of use, which includes preserving existing restaurants, encouraging development of new restaurants, and providing a range of housing options that complement the existing character of the area;
- Promote services, shopping, and small business;
- Create additional gathering and recreational open space opportunities; and
- Improve mobility of all modes of transportation.

To this end, a variety of projects and developments will be required. Such projects and/or developments will likely include modifications to existing buildings and structures, new buildings and structures, and improvements to the infrastructure. All these endeavors will likely require geotechnical and geological studies.

The project site is located in an area of known geologic hazards that will require future investigation and potential mitigation to lessen the impacts of a potential hazard to less than significant. While all geologic hazards can potentially impact and influence the nature of a particular project, there are two hazards of greater concern that could impact new and modified existing structures, these being surface fault rupture and liquefaction. The current state of practice provides methods that can mitigate the impacts of most hazards to less than significant. However, with respect to surface ground rupture, the only effective mitigation option is to offset and locate the building away from the identified fault zone. As such, some locations may require the demolition of existing structures and re-siting of the replacement building. For the hazard of surface fault rupture, the relationship between building location to fault location will dictate the viability of mitigating the impacts of this particular hazard.

4.2 Thresholds of Significance

According to Appendix G of the CEQA Guidelines, a project would normally have a significant effect on the environment if the project would:

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

- i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault. (refer to Division of Mines and Geology Special Publication 42).
- ii) Strong seismic ground shaking.
- iii) Seismic-related ground failure, including liquefaction.
- iv) Landslides.

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

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

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

G-5 Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water.

To address these CEQA Guidelines, we have provided the following comments.

4.2.1 *CEQA Threshold G-1 i, ii, and iii*

The project is located within Southern California, known for the occurrence of earthquakes. Also, the project site is located along and within the Rose Canyon fault zone. In addition, while no APEFZ are delineated within the project limits, numerous potentially active fault features have been identified and featured within the project limits. In addition, an active fault offset was identified at one location near the proposed Morena Pump Station. Lastly, portions of the project site contain soils that have been identified as being potentially liquefiable.

Given the above, the project site is exposed to the following potential seismic-induced impacts: ground shaking, rupture, liquefaction, seismic-induced ground settlement, and lateral spreading. Left unmitigated, the impacts associated with these hazards could subject the residences, occupants, visitors, structures, etc. to substantial adverse effects, including the risk of loss, injury, or death.

However, given that development within the project site area is subjected to City of San Diego code requirements, these potential impacts will be mitigated by complying with City Code requirements. For example, impacts associated with ground shaking are mitigated by the requirement that projects be designed to accommodate ground shaking effects such that the potential for loss, injury, or death are mitigated to less than significant. As such, this impact is considered less than significant with mitigation incorporated.

While the site does not have any APEFZ delineated within the project limits, the City of San Diego Seismic Safety Element has identified potentially active faults within the area. Also, the City of San Diego guidelines state that fault studies may be required for a project. In addition, we understand that the City views this area as having the potential for active faults anywhere within the study area, not unlike the downtown San Diego area that has been designated as a Special Studies Zone. As such, geotechnical investigations for projects would have to demonstrate that fault rupture is not an issue or would have to identify mitigation measures to address fault rupture impacts for the project in order to obtain approval from the City. Such mitigation measures would be offsetting buildings from the fault or the no project option. These measures would be implemented as part of site-specific geotechnical report requirements as future development is proposed. Therefore, with implementation of the site-specific geotechnical report required pursuant to City Municipal Code requirements, the impact would be considered less than significant.

Regarding liquefaction and liquefaction-related issues such as lateral spreading, City code requires that liquefaction and its consequences be evaluated for projects. In addition, if the finding of the required study establishes an impact to a project, City code requires that the impacts be mitigated to address potential loss, injury, or death.

Lastly, City code requirements mandate an assessment of seismic-induced settlements, as well as the mitigation of their impacts. These measures would be implemented as part of site-specific geotechnical report requirements as future development is proposed. Therefore, with implementation of the site-specific geotechnical report required pursuant to City Municipal Code, the impact would be considered less than significant

Individual projects within the City must comply with City codes. These codes contain the requirements to design projects to accommodate ground shaking and to assess various geologic hazards, including rupture, ground shaking, liquefaction, lateral spreading, seismic-induced ground instability, and seismic-induced settlement. In addition, City code requires that impacts associated with identified hazards be mitigated to address loss, injury, and death issues related to the identified hazards. These measures would be implemented as part of site-specific geotechnical report requirements as future development is proposed. Therefore, with implementation of the site-specific geotechnical report required pursuant to City Municipal Code, the impact would be considered less than significant

4.2.2 *CEQA Threshold G1-iv*

Review of available geologic maps and the City of San Diego Seismic Safety Element revealed no mapped landslides located within the project limits. As such, the impact to the project associated with landslides is considered not significant.

4.2.3 *CEQA Threshold G-2 and G-3*

The project site is a well-developed urban area located within the City of San Diego. As such, the majority of surface soils are landscaped and maintained, thus reducing erosion in general throughout the project site.

Geologic surface units within the site include Quaternary-age terrace deposits, alluvial deposits, and Tertiary-age formational (bedrock) units. The terrace deposits and bedrock units are considered stable and competent. The identified alluvial areas have been developed and generally covered with landscaping, pavements, paved parking, and buildings. As such, the risk concerning soil erosion is considered to be very low to not significant. Applicable measures to address soil erosion would be implemented as part of site-specific geotechnical report requirements as future development is proposed. Therefore, with implementation of the site-specific geotechnical report required pursuant to City Municipal Code, the impact would be considered less than significant.

However, the areas occupied by alluvial soils are potentially liquefiable and have been identified in the City of San Diego Seismic Safety Element as being potentially liquefiable. Any development within the project limits would need to be evaluated on a case-by-case basis. Geotechnical investigations performed for those projects are required by City code to assess their liquefaction potential, including related ground instabilities associated with liquefaction, such as surface damage, lateral spreading, induced ground settlement, etc. City code requires that impacts associated with liquefaction hazards be mitigated when there is a potential for loss, injury, or death. As such, any potential impacts related to unstable ground associated with liquefaction would be required to be addressed and mitigated. Site specific measures would be implemented as part of geotechnical report requirements as future development is proposed. Therefore, with implementation of the site-specific geotechnical report required pursuant to City Municipal Code, the impact would be considered less than significant. Lastly, the risk of soil erosion increases during the construction phases of projects, when surface conditions are disturbed and oftentimes stripped of vegetation and other features that have limited soil exposure. As such, soil erosion could become significant if not addressed during construction. Fortunately, City code requires that construction sites develop and maintain drainage and erosion control to address soil erosion within a project site, as well as transportation of sediment off-site due to runoff. These systems require extensive documentation, monitoring, and verification. Compliance with applicable City code requirements would ensure that construction-induced soil erosion would be reduced to less than significant.

4.2.4 *CEQA Threshold G-3*

Geologic surface units within the site include Quaternary-age terrace deposits, alluvial deposits, and Tertiary-age formational (bedrock) units. The terrace and bedrock units are considered stable and competent. The identified alluvial areas have been developed and generally covered with landscaping, pavements, paved parking, and buildings.

In those areas of the site where slopes do not exist, the terrace and bedrock soil units would not result in risk to life or property. In those areas where slopes do exist, there could be a potential risk to life or property if those slopes were unstable. According to the City of San Diego Seismic Safety Element, the project site contains two categories of geologic hazard in which slopes are of concern. These areas are classified as Categories 52 and 53. Slopes within Category 52 have favorable geologic structure and, as such, have a low risk with respect to slope instability. Slopes within Category 53 have unfavorable geologic structure, which results in slopes having low to moderate risk as it pertains to slope instability. That said, for this project site, City code requires that geotechnical investigations and studies be conducted prior to City approval of development. City guidelines for geotechnical investigations require the evaluation of slope stability associated with any project. Slopes found to be unstable shall be modified and/or strengthened to make the slopes stable. Such measures would be implemented as part of site-specific geotechnical report requirements as future development is proposed. Therefore, with implementation of the site-specific geotechnical report required pursuant to City Municipal Code, the impact would be considered less than significant.

However, areas occupied by alluvial soils may be potentially liquefiable, and have been identified in the City of San Diego Seismic Safety Element as being potentially liquefiable. Areas identified as potentially susceptible to liquefaction can become unstable during earthquake events. Any development within the project limits would need to be evaluated on a case-by-case basis. Geotechnical investigations performed for those projects are required by City code to assess liquefaction potential, including related ground instabilities associated with liquefaction, such as surface damage, lateral spreading, induced ground settlement, etc. City code requires that liquefaction hazards be mitigated when there is a potential for loss, injury, or death. As such, any potential impacts related to unstable ground associated with liquefaction would be required to be addressed and mitigated as part of site-specific geotechnical report requirements as future development is proposed. Therefore, with implementation of City requirements, the impact would be considered less than significant.

4.2.5 *CEQA Threshold G-4*

Geologic surface units within the site include Quaternary-age terrace deposits, alluvial deposits, and Tertiary-age formational (bedrock) units. The terrace deposits generally consist of interbedded sands, silts, and clays existing in varying compositions such as sands, silty sands, clayey sands, sandy silts, clayey silts, silty clays, and sandy clays. The alluvial soils consist of interlayered sands and finer grained soils, likely interlayered.

The infiltration characteristics of the terrace deposits are variable and not consistent, and range from very to moderately permeable. As such, soils are not conducive to rapid infiltration. In addition, the interbedded nature of the deposits would lead to the potential for perching infiltrated waters and the potential for lateral migration of infiltrated waters to areas off site. As such, the terrace deposits will not adequately support any proposed septic tanks. Fortunately, the project site is located within the City limits and in a well- developed area and wastewaters are collected from the individual properties and conveyed by sewer lines to the City's Point Loma Wastewater Treatment Plant.

In general, the project area alluvial soils are more permeable than the terrace deposit soils. However, these soils are either located near or below groundwater. As such, these soils cannot be used to infiltrate wastewater from septic tanks. Fortunately, the project site is located within the City limits and in a well- developed area, and wastewater is collected from the individual properties and conveyed by sewer lines to the Point Loma Wastewater Treatment Plant.

4.3 **Concluding Remarks**

As stated previously, the polices of the MCSP are intended to transform the area of known as the Morena Corridor (Figures 2, 3, and 4) from a primarily auto-oriented commercial corridor into a pedestrian-oriented village, a vibrant community core that provides a variety of mixed-use and employment and housing opportunities, while promoting variable travel choices that include walking, bicycling, and high frequency transit.

To accomplish this, the guiding principles of the MCSP seek to: protect and enhance the neighborhood character of the area; establish a balanced mix of use, which includes preserving existing restaurants, encouraging new restaurants, and providing a range of housing options that complement the existing character of the area; promoting services, shopping, and small business; creating additional gathering and recreational open space opportunities; and improving mobility of all modes of transportation.

Of the policies of the MCSP that directly or indirectly may have significant environmental impacts are those structures associated with human occupancy where life-safety issues are paramount, such as with new businesses, residences, and re-purposed existing structures that place such structures in areas of identified surface ground rupture hazards and in areas where ground instability could result in structural collapse if left unmitigated. As such, a particular use of a particular parcel of land will play a significant role in determining any potential impacts if mitigation is not possible.

The current state of engineering practice provides methods and strategies that can mitigate the impacts of most hazards to less than significant. However, the one potential geologic hazard that cannot be mitigated is when the location of a new structure, re-purposed existing structure subjected to current building code requirements, or a rebuilt structure cannot be located over an identified active fault and its associated offset zone. In this case, the only way to mitigate to a less than significant impact would be to not proceed with the project (non-project alternative) or to redesign the project to avoid the fault zone, if feasible. Thus, for the hazard of surface fault rupture, the relationship between building location to active fault location will dictate the viability of mitigating the impacts of this particular hazard.

Given that we consider the non-project alternative a viable mitigation measure for a given geologic hazard, it is our opinion that the potential impacts related to the geologic hazards from the implementation of the MCSP would be avoided, reduced to an acceptable level of risk, or reduced below a level of significance through mandatory conformance with the applicable regulatory requirements.

Lastly, it is important to note that if the MCSP is not implemented, the study area will still be subjected to the same geologic hazards identified in this report. As such, it should be noted that, assuming no new project that would be subjected to the given set of regulatory requirements applicable to development is ever proposed within the study area, the existing facilities would be prone to impacts associated with earthquakes, such as ground shaking, potential surface ground rupture from active faults known or unknown, liquefaction, and lateral spreading. Such impacts, as we understand, are permitted to occur by current City building code requirements as the structures are already existing and no improvements are required. Thus, these impacts as such, can only be mitigated via mandated action adopted and implemented by the City.

5 LIMITATIONS

Geotechnical engineering and the earth sciences are characterized by uncertainty. Professional judgments presented herein are based partly on our evaluation of the technical information gathered, partly on our understanding of the proposed project, and partly on our general experience. Our engineering work and judgments rendered meet the current professional standards. We do not guarantee the performance of the project in any respect.

This study is a geotechnical and geologic desktop reconnaissance study whose primary purpose was to provide input into the preparation of draft environmental impact reports. We have conducted no field investigation or laboratory testing. We have reviewed information available in our files, as well as other cited sources. There may be other studies that we are unaware of that may require reassessment of our opinions and comments. If such information becomes available that is relevant to the general conclusions of this study, then we recommend that that information be reviewed and a revised report issued.

This report is not intended for use other than for providing a general assessment of geotechnical and geologic conditions for the preparation of environmental planning documents and is not appropriate or suitable for detailed design or development. Detailed geotechnical reports and investigations for any specific projects will be required.

REFERENCES

Abbott, P.L., 1999, The Rise and Fall of San Diego: 150 Million Years of History Recorded in Sedimentary Rocks, Sunbelt Publications, San Diego.

AECOM, 2017, Geotechnical Report, Pump Station and Cut & Cover Sections, Morena Pump Station, WW Force Main, and Brine Conveyance Predesign (NC01), San Diego, California, Revised May, 17, 2017.

AECOM, 2017, Fault Investigation, Morena Pump Station, WW Force Main, and Brine Conveyance Predesign (NC01), San Diego, California, Second Revision August 31, 2017.

Apex Geotechnology/Group Delta Consultants, 1993, Design Memorandum No. 4, Foundation Investigation, San Diego River Bridge, West Mission Valley LRT, San Diego, California, Project No. 1423-SI15, August 13, 1993.

Blake T..F., EQSEARCH Version 3.xx – A computer program for the estimation of peak acceleration from California Historical Earthquake Catalogs.

Blake, T..F., EQFAULT Version 3.00 – A computer program for the identifying nearby faults relative to a given location.

California Building Standards, 2013, California Building Code, California Code of Regulations, Title 24, Part 2, Volumes 1 and 2, 2013.

California Department of Conservation, August 2011, http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/Inundation_Maps/SanDeigo/Pages/SanDiego.aspx.

California Department of Conservation, Division of Mines and Geology, 2008, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117A.

California Department of Conservation, Division of Mines and Geology, 1997, Guidelines for Evaluating and Mitigating Seismic Hazards in California, Special Publication 117.

California Department of Conservation, August 2011, http://redirect.conservation.ca.gov/cgs/rghm/quakes/historical/index.htm

California Division of Mines and Geology, 1979, Fault Evaluation Report FER-80, January 5, 1979.

REFERENCES
(continued)

Caltrans, City of San Diego, and KTUA, 2014, Morena Boulevard Station Area Planning Study, February 2014.

Kahle, J.E., 1988, A Geomorphic Analysis of the Rose Canyon, La Nacion and Related Faults in the San Diego Area, California, California Division of Mines and Geology, Fault Evaluation Report FER-196, June 30, 1988.

Kennedy, M.P., and G.L. Peterson, 1975, Geology of the San Diego Metropolitan Area, California: Section A – Western San Diego Metropolitan Area (Del Mar, La Jolla, Point Loma 72 minute quadrangles), California Department of Conservation, Divisions of Mines and Geology.

Morton, D.M., R.M. Alvarez, and R.H. Campbell, 2003, Preliminary Soil-Slope Susceptibility Maps, Southwestern California, Open-File report OF 03-17, U.S. Geological Survey.

Norris, R.M., and R.W. Webb, 1990, Geology of California, Second Edition, John Wiley & Sons, Inc.

Placeworks and Cehn-Ryan for the City of San Diego, 2017, Morena Corridor Specific Plan, Public Review Draft-June 2017.

SANDAG, 2013, Mid-Coast Corridor Transit Project, Geotechnical, Geologic, and Seismic Impacts Technical Report, April 2013.

San Diego, City of, 2008, Seismic Safety Study, Geologic Hazard Faults, Development Services Department.

San Diego, City of, 2011, Guidelines for Geotechnical Report, 2011.

San Diego, City of, 2015, Land Development Manual, www.sandiego.gov/development-services/industry/landdevcode/landdevmanual.shtml.

TerraCosta Consulting Group, 2009, Geotechnical Investigation Mission Valley YMCA Addition and Remodel, San Diego California, revised September 4, 2009.

TerraCosta Consulting Group, 2002, Liquefaction Study Mission Valley YMCA Pool Additions Mission Valley YMCA, San Diego, California, revised April 15, 2002.

REFERENCES
(continued)

TerraCosta Consulting Group, 2004, Updated Geotechnical Investigation Addendum, Additions/Modifications to Existing Building Complex and South Parking Lot, Mission Valley YMCA, San Diego California, revised June 8, 2004. This document includes copies of previous studies by personnel of TerraCosta for the project site.

Treiman, J.A., 1991, Rose Canyon Fault Zone, San Diego County, California, California Division of Mines and Geology Fault Evaluation Report FER-216, January 25, 1991.

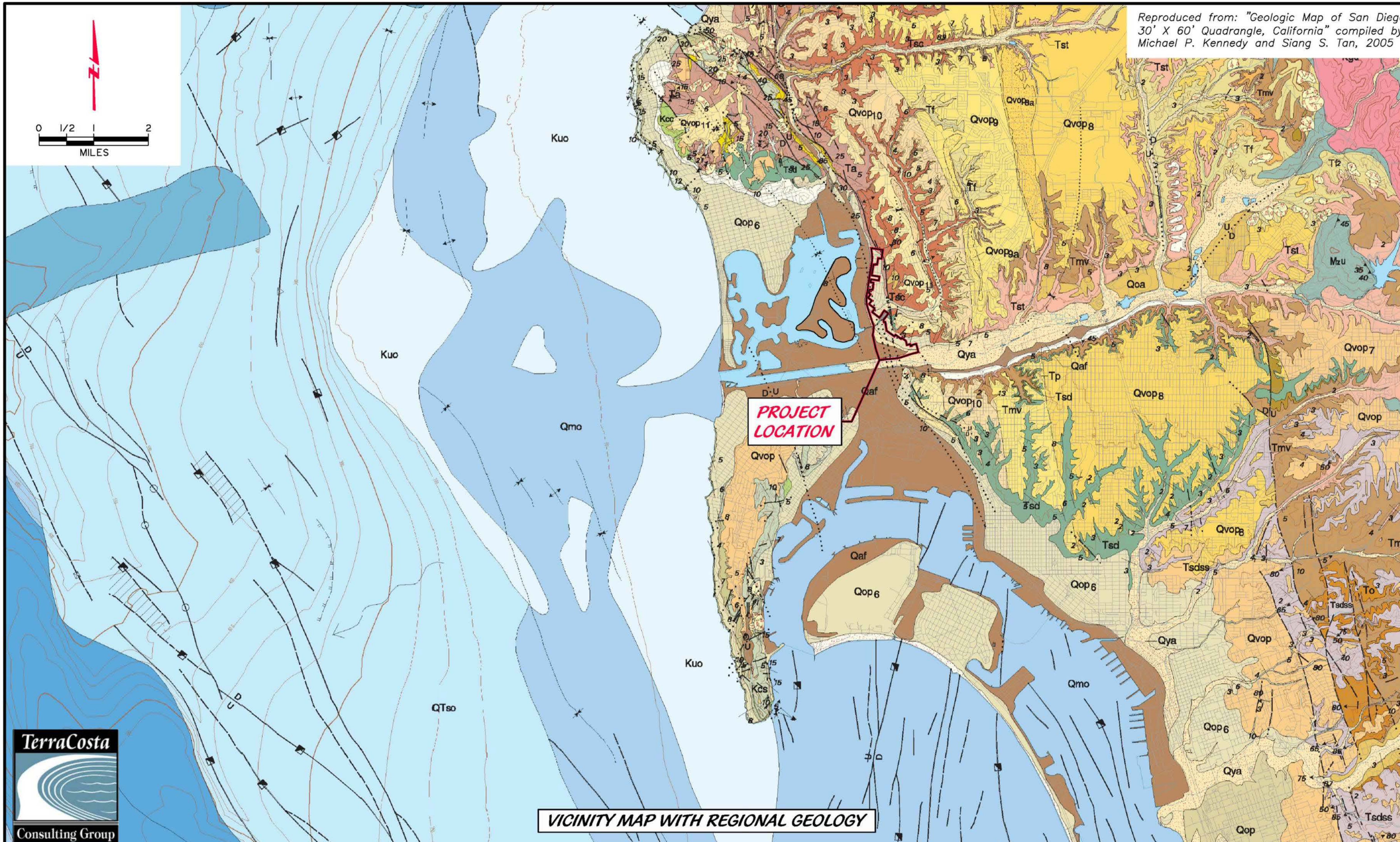
Treiman, J.A., 1991, Rose Canyon Fault Zone, San Diego County, California, California Division of Mines and Geology, Fault Evaluation Report FER-216, Supplement No. 1, August 30, 1991.

Treiman, J.A., 2002, Silver Strand Fault, Coronado Fault, Spanish Bight Fault, San Diego Fault, and Downtown Graben, Southern Rose Canyon Fault Zone. California Division of Mines and Geology, Fault Evaluation Report FER-245, June 17, 2002.

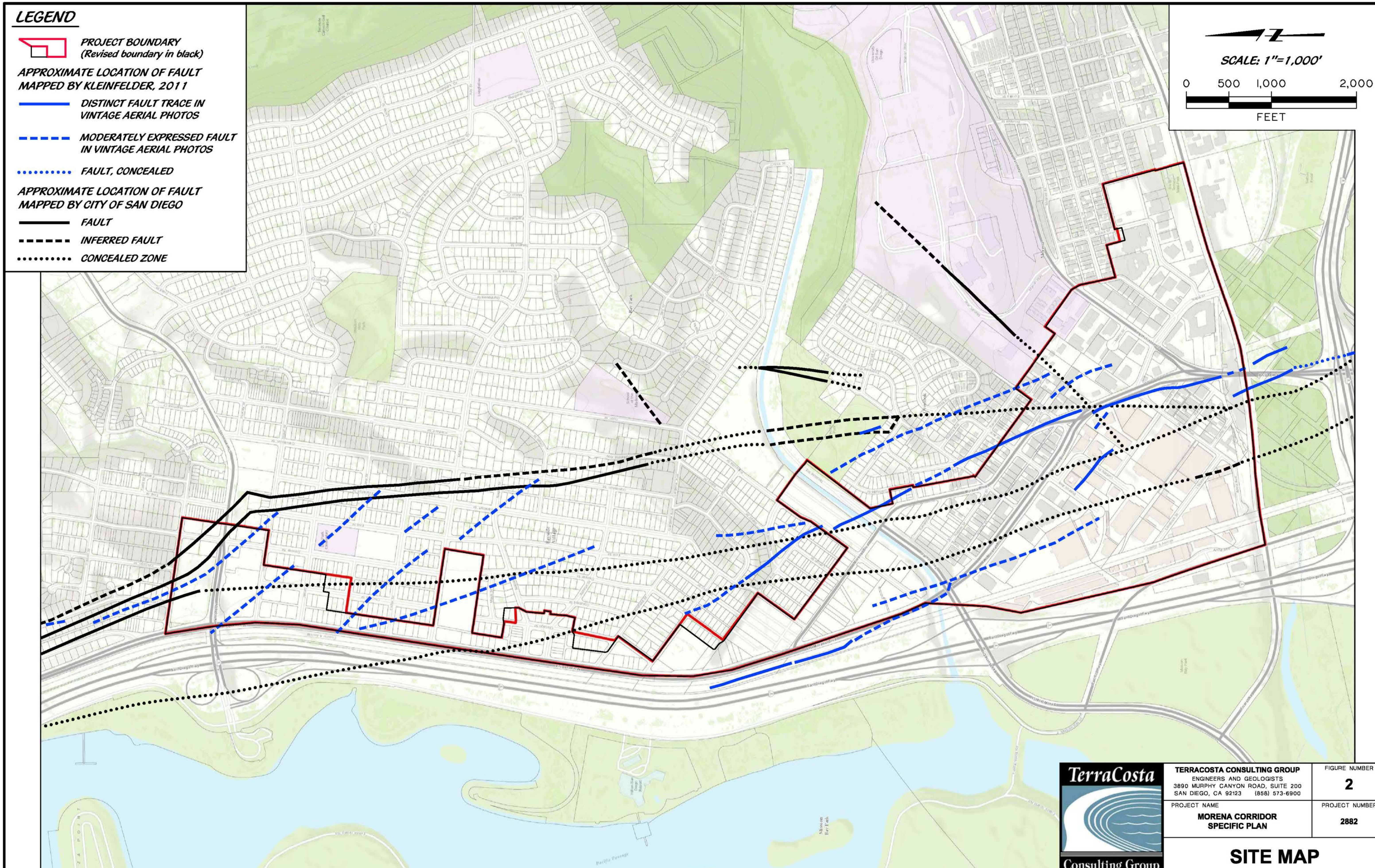
Treiman, J.A., 2003, Silver Strand Fault, Coronado Fault, Spanish Bight Fault, San Diego Fault, and Downtown Graben, Southern Rose Canyon Fault Zone. California Division of Mines and Geology, Fault Evaluation Report FER-245 Supplement No. 1, April 22, 2003.

TABLE 1
SUMMARY OF SPECIFIC PLANS FOR EACH PLANNING DISTRICT

Planning District	Policies
Clairemont	• Support restaurant and retail use in "village" core between Ashton and Napier, including wider pedestrian area and pocket parks and public spaces. • Implement street modal design for Morena Blvd with accessible travel for bicycles and pedestrians • Enhance frontage elements of buildings and public places
Artisan	• Support artisan, craft, produce goods, and food and beverage businesses • Support consolidation of lots to allow larger buildings • Support development of the Tecolote Linear Park
Tecolote Creek	• Establish pedestrian and transit-oriented development that integrates with the Tecolote Transit Station • Provide entertainment, office, retail, residential, service commercial, public and park uses • Provide system of incorporated public streets, private drives, pedestrian and bicycle facilities, paseos, and sidewalks
Employment	• Support a range of urban-oriented light industrial, creative office/flex space businesses and commercial uses to increase employment and stimulate business growth and development • Provide pedestrian and bicycle connection • Expand right-of-ways, where needed • Provide sidewalks
Morena	• Develop a mixed-use and pedestrian-oriented district that is supported by a network of public streets • Provide for entertainment, office, retail, residential, recreational, public, and park uses • Provide housing • Connect Morena Blvd and Sherman St • Provide pedestrian paths, sidewalks, and walkways



TERRACOSTA CONSULTING GROUP - 3890 MURPHY CANYON ROAD, SAN DIEGO, CA 92123 • Project: Morena Corridor Specific Plan - Project Number: 2882 • Figure 1


LEGEND
PROJECT BOUNDARY
(Revised boundary in black)
APPROXIMATE LOCATION OF FAULT MAPPED BY KLEINFELDER, 2011
DISTINCT FAULT TRACE IN VINTAGE AERIAL PHOTOS
MODERATELY EXPRESSED FAULT IN VINTAGE AERIAL PHOTOS
FAULT, CONCEALED
APPROXIMATE LOCATION OF FAULT MAPPED BY CITY OF SAN DIEGO
FAULT
INFERRED FAULT
CONCEALED ZONE
SCALE: 1"=1,000'
0 500 1,000 2,000
FEET
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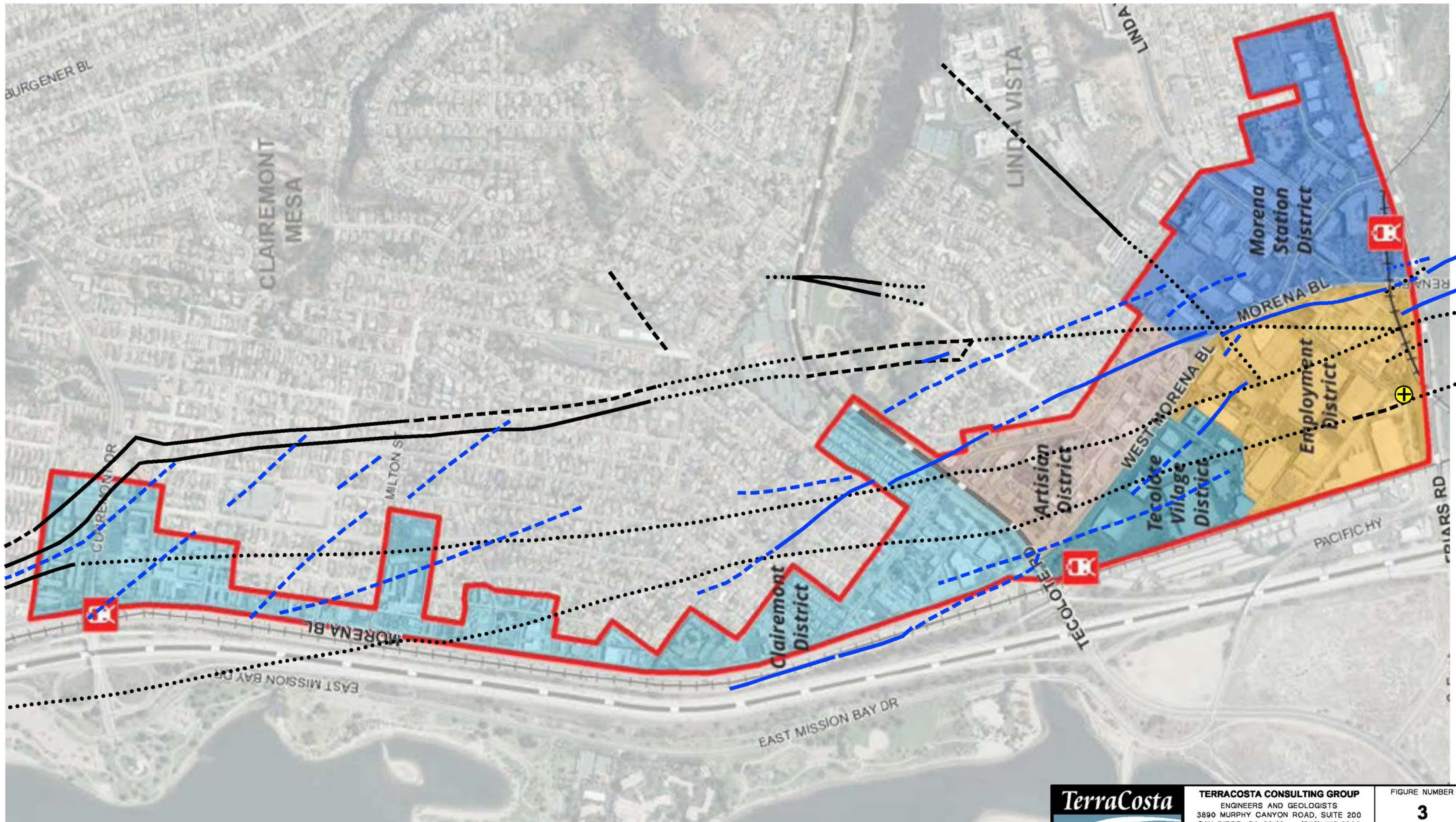
ENGINEERS AND GEOLOGISTS
3890 MURPHY CANYON ROAD, SUITE 200
SAN DIEGO, CA 92123 (858) 573-6900
FIGURE NUMBER
2
PROJECT NAME
MORENA CORRIDOR SPECIFIC PLAN
PROJECT NUMBER
2882
SITE MAP

SCALE: 1"=1,000'

0 500 1,000 2,000

FEET



LEGEND

APPROXIMATE LOCATION OF FAULT MAPPED BY KLEINFELDER, 2011

- DISTINCT FAULT TRACE IN VINTAGE AERIAL PHOTOS
- MODERATELY EXPRESSED FAULT IN VINTAGE AERIAL PHOTOS
- FAULT, CONCEALED

APPROXIMATE LOCATION OF FAULT MAPPED BY CITY OF SAN DIEGO

- FAULT
- INFERRED FAULT
- CONCEALED ZONE
- ACTIVE FAULT LOCATED BY AECOM, 2017

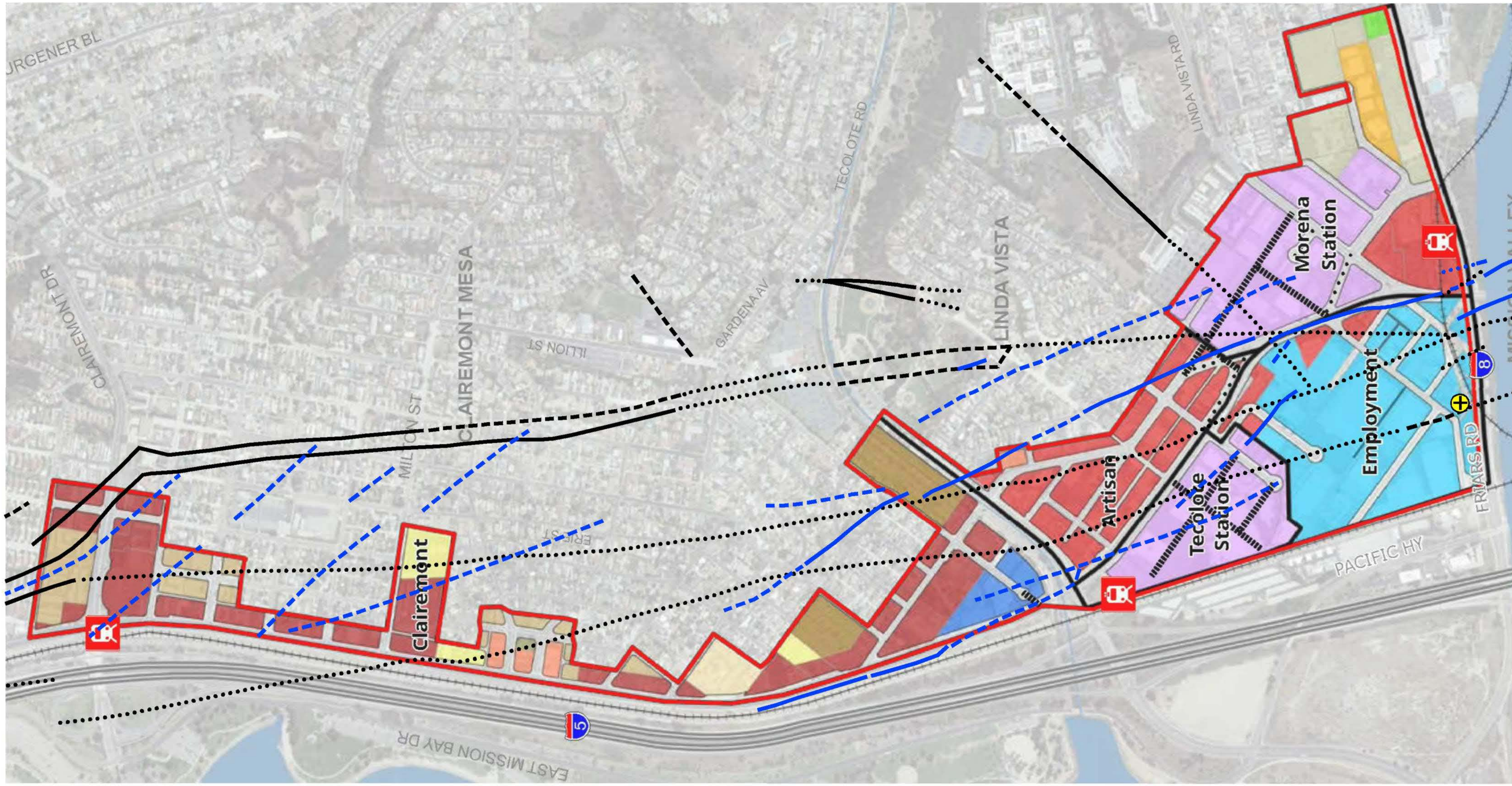
- Specific Plan Boundary
- Tecolote Village District
- Employment District
- Artisian District
- Morena Station District
- Clairemont District
- Trolley Station
- Community Planning Area

TerraCosta Consulting Group	TERRACOSTA CONSULTING GROUP ENGINEERS AND GEOLOGISTS 3890 MURPHY CANYON ROAD, SUITE 200 SAN DIEGO, CA 92123 (858) 573-6900	FIGURE NUMBER 3
	PROJECT NAME MORENA CORRIDOR SPECIFIC PLAN	PROJECT NUMBER 2882
	PLANNING DISTRICTS MAP	

SCALE: 1"=1,000'

0 500 1,000 2,000

FEET



LEGEND

APPROXIMATE LOCATION OF FAULT MAPPED BY KLEINFELDER, 2011

- DISTINCT FAULT TRACE IN VINTAGE AERIAL PHOTOS
- MODERATELY EXPRESSED FAULT IN VINTAGE AERIAL PHOTOS
- FAULT, CONCEALED

APPROXIMATE LOCATION OF FAULT MAPPED BY CITY OF SAN DIEGO

- FAULT
- INFERRED FAULT
- CONCEALED ZONE
- ACTIVE FAULT LOCATED BY AECOM, 2017

Plan Land Use - Clairemont

- Residential - Low (5- 9 Du/Ac)
- Residential - Medium (15-29 Du/Ac)
- Residential - Medium High (30-44 Du/Ac)
- Mobile Home Park
- Neighborhood Commercial (0-29 Du/Ac)
- General Commercial
- Light Industrial
- Fire Station

Plan Land Use - Linda Vista

- Residential - Medium (15-29 Du/Ac)
- Neighborhood Commercial (0-29 Du/Ac)
- Community Commercial (0-29 Du/Ac)
- Community Commercial (15-54 Du/Ac)
- Community Village (0-54 Du/Ac)*
  *Tecolote Station Residential Density up to 109 Du/Ac allowed with PDP
  *Morena Station Residential Density up to 73 Du/Ac allowed with PDP
- Industrial
- Institutional
- Park
- Districts
- Light Rail
- Trolley Stations
- Specific Plan Boundary
- Right of Way to be removed
- Extension / Addition

TerraCosta Consulting Group	TERRACOSTA CONSULTING GROUP ENGINEERS AND GEOLOGISTS 3890 MURPHY CANYON ROAD, SUITE 200 SAN DIEGO, CA 92123 (858) 573-6900	FIGURE NUMBER 4
	PROJECT NAME MORENA CORRIDOR SPECIFIC PLAN	PROJECT NUMBER 2882
	LAND USE MAP	

SCALE
0 30,000 60,000
(Approx. Scale: Feet)
REFERENCE:
"FAULT ACTIVITY MAP OF CALIFORNIA AND ADJACENT AREAS," DIVISION OF MINES & GEOLOGY, COMPILED BY CHARLES W. JENNINGS, 1994.
PROJECT LOCATION
Faults in northern Baja California are shown more extensively on Plate 1 in pocket of the
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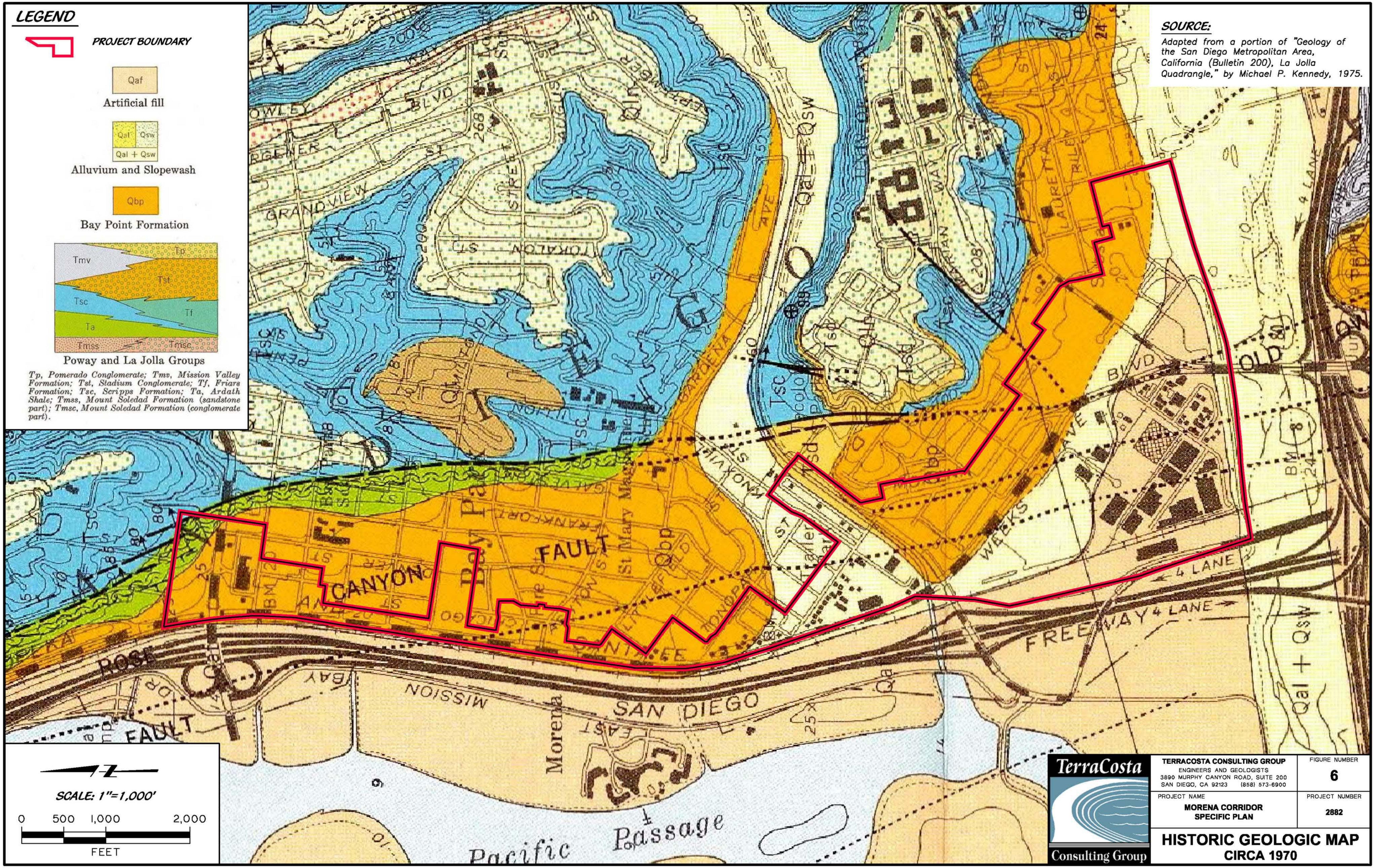
FIGURE NUMBER
5
PROJECT NAME
MORENA CORRIDOR SPECIFIC PLAN
PROJECT NUMBER
2882
REGIONAL FAULT MAP



TerraCosta Consulting Group

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ENGINEERS AND GEOLOGISTS
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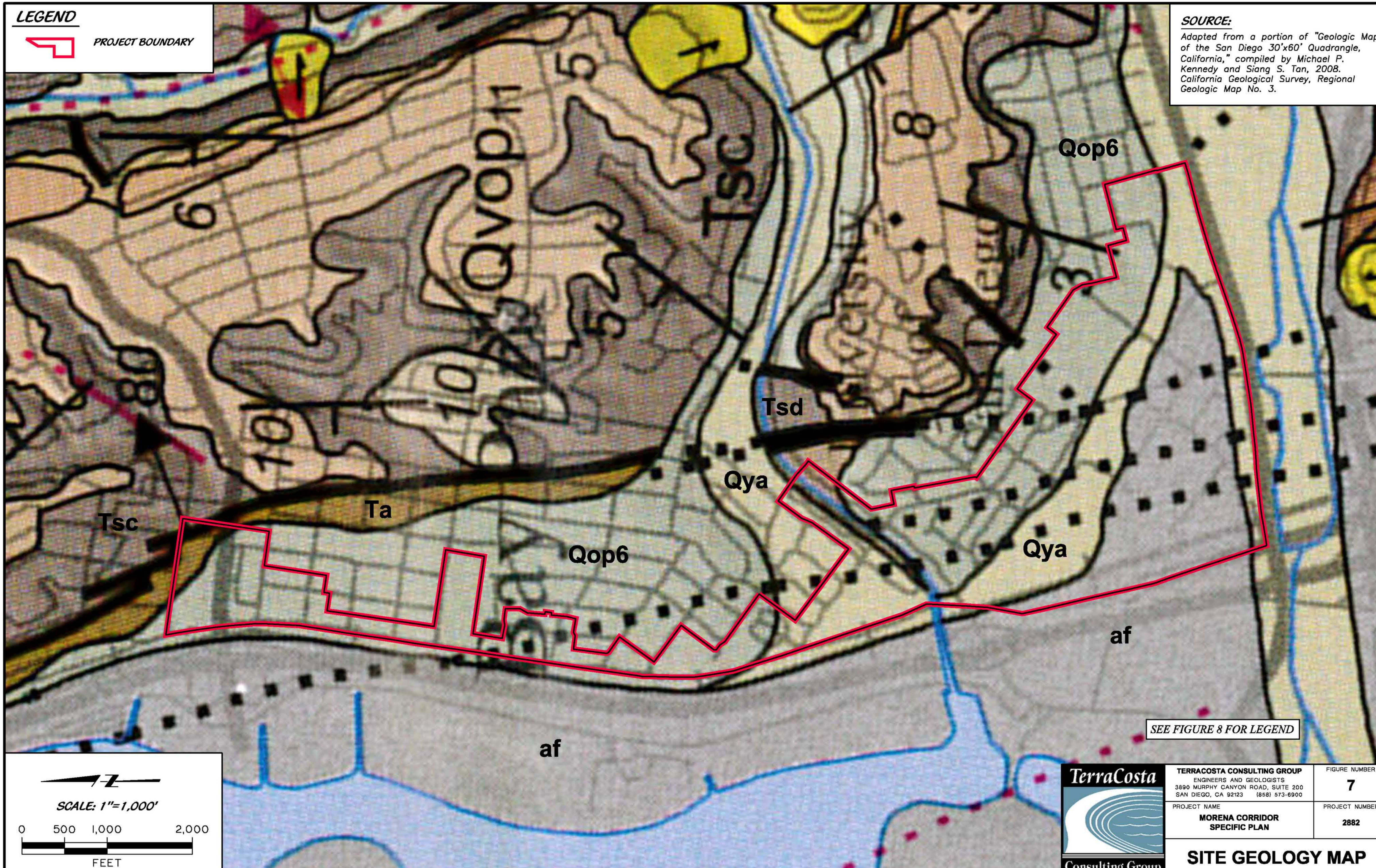
SAN DIEGO, CA 92123 (858) 573-6900

FIGURE NUMBER 6

PROJECT NAME: MORENA CORRIDOR SPECIFIC PLAN

PROJECT NUMBER: 2882

HISTORIC GEOLOGIC MAP
CIRCA 1970


LEGEND
PROJECT BOUNDARY
SOURCE:
Adapted from a portion of "Geologic Map of the San Diego 30'x60' Quadrangle, California," compiled by Michael P. Kennedy and Siang S. Tan, 2008. California Geological Survey, Regional Geologic Map No. 3.
Qvop11
Tsc
Qop6
Tsd
Qya
Ta
Tsc
Qop6
Qya
af
af
SEE FIGURE 8 FOR LEGEND
N
SCALE: 1"=1,000'
0 500 1,000 2,000
FEET
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SAN DIEGO, CA 92123 (858) 573-6900
FIGURE NUMBER
7
PROJECT NAME
MORENA CORRIDOR SPECIFIC PLAN
PROJECT NUMBER
2882
SITE GEOLOGY MAP

GEOLOGIC UNITS

af — **Artificial fill (late Holocene)**
Deposits of fill resulting from human construction, mining, or quarrying activities; includes compacting engineered and non-compacted, non-engineered fill. Some large deposits are mapped, but in some areas no deposits are shown.

Qya — **Young alluvial flood-plain deposits** (Holocene and late Pleistocene)
Poorly consolidated, poorly sorted, permeable flood-plain deposits of sandy, silty or clay-bearing alluvium.

Qop6 — **Old paralic deposits, Unit 6** (late to middle Pleistocene)
Poorly sorted, moderately permeable, reddish-brown, interfingered strandline, beach, estuarine and colluvial deposits composed of siltstone, sandstone and conglomerate. These deposits rest on the 22-23 m Nestor terrace.

Tsd
Tsdss
Tsdcg — **San Diego Formation** (early Pleistocene and late Pliocene)
Predominantly yellowish-brown and gray, fine- to medium-grained, poorly indurated fossiliferous marine sandstone (Tsdss) and reddish-brown, transitional marine and nonmarine pebble and cobble conglomerate (Tsdcg). In part of the area the sandstone and conglomerate are undivided (Tsd). The San Diego Formation consists of approximately 75 m of marine and 9 m of nonmarine sedimentary rocks (Demere, 1983). These rocks and their associated marine fossils were first described by Dall (1898) and given the name "San Diego Beds." The name San Diego Formation was given to these rocks in an extensive biostratigraphic study by Arnold (1903). Several comprehensive studies of the marine invertebrate fossil faunas of the San Diego Formation have been published subsequently by Grant and Gale (1931) and Hertlein and Grant (1944, 1960, 1972). Most recently Demere (1982, 1983) presents a concise discussion on the history of work, geologic setting, biostratigraphy and age of the San Diego Formation.

Tsc
Tscu — **Scripps Formation** (middle Eocene)
The Scripps Formation (Tsc) is mostly pale-yellowish-brown, medium-grained sandstone containing occasional cobble-conglomerate interbeds. It contains a middle Eocene Molluscan fauna (Givens and Kennedy, 1979). The Scripps Formation is 56 m thick at its type section, which is 1 km north of Scripps Pier, on the north side of the mouth of Blacks Canyon (Kennedy and Moore, 1971). Both the basal contact with the Ardath Shale and the upper contact with the Friars Formation are conformable. In upper Carroll Canyon, a tongue of the Scripps Formation (Tscu) exists above an intervening part of the Stadium Conglomerate. This "upper" tongue is difficult to separate from the main body of the Scripps Formation where the Stadium Conglomerate is absent.

Ta — **Ardath Shale** (middle Eocene)
Mostly uniform, weakly fissile olive-gray silty shale. The upper part contains thin beds of medium-grained sandstone, similar to thicker ones in the overlying Scripps Formation, and concretionary beds with molluscan fossils. The type section of the Ardath Shale is on the east side of Rose Canyon, 800 m south of the Ardath Road intersection with Interstate 5 (Kennedy and Moore, 1971).

SEE TEXT FOR ADDITIONAL EXPLANATION.

SOURCE:

"Geologic Map of the San Diego 30'x60' Quadrangle, California," compiled by Michael P. Kennedy and Siang S. Tan, 2008. California Geological Survey, Regional Geologic Map No. 3.

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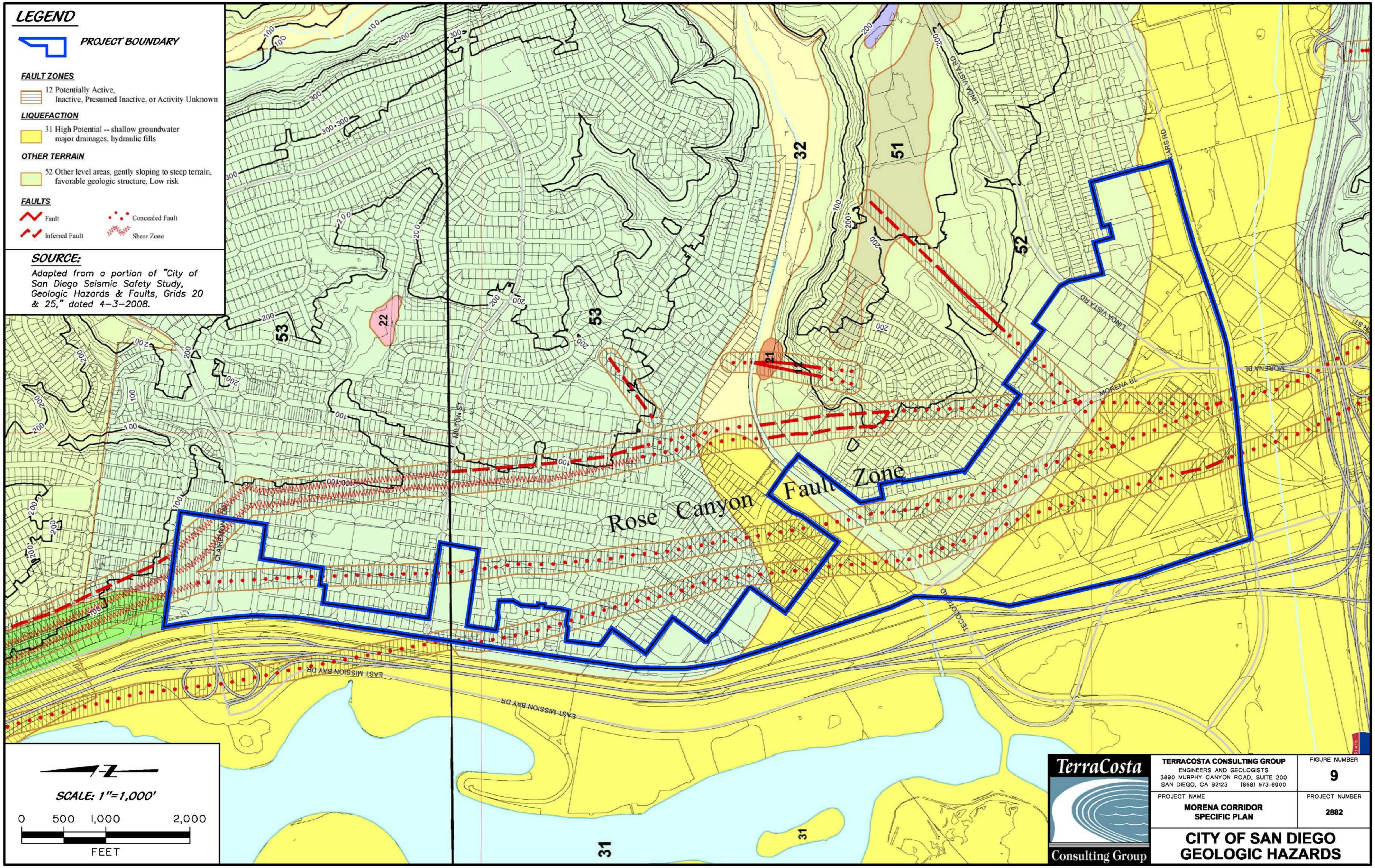
TERRACOSTA CONSULTING GROUP ENGINEERS AND GEOLOGISTS 3890 MURPHY CANYON ROAD, SUITE 200 SAN DIEGO, CA 92123 (858) 573-6900	FIGURE NUMBER **8**
PROJECT NAME **MORENA CORRIDOR SPECIFIC PLAN**	PROJECT NUMBER **2862**

SITE GEOLOGY MAP
LEGEND


LEGEND
PROJECT BOUNDARY
FAULT ZONES
12 Potentially Active, Inactive, Presumed Inactive, or Activity Unknown
LIQUEFACTION
31 High Potential -- shallow groundwater major drainages, hydraulic fills
OTHER TERRAIN
52 Other level areas, gently sloping to steep terrain, favorable geologic structure, Low risk
FAULTS
Fault
Concealed Fault
Inferred Fault
Shear Zone
SOURCE:
Adapted from a portion of "City of San Diego Seismic Safety Study, Geologic Hazards & Faults, Grids 20 & 25," dated 4-3-2008.
Rose Canyon Fault Zone
MORENA BL
LINDA VISTA RD
EAST MISSION BAY DR
MILTON ST
CLAIREMONT DR
SCALE: 1"=1,000'
0 500 1,000 2,000
FEET
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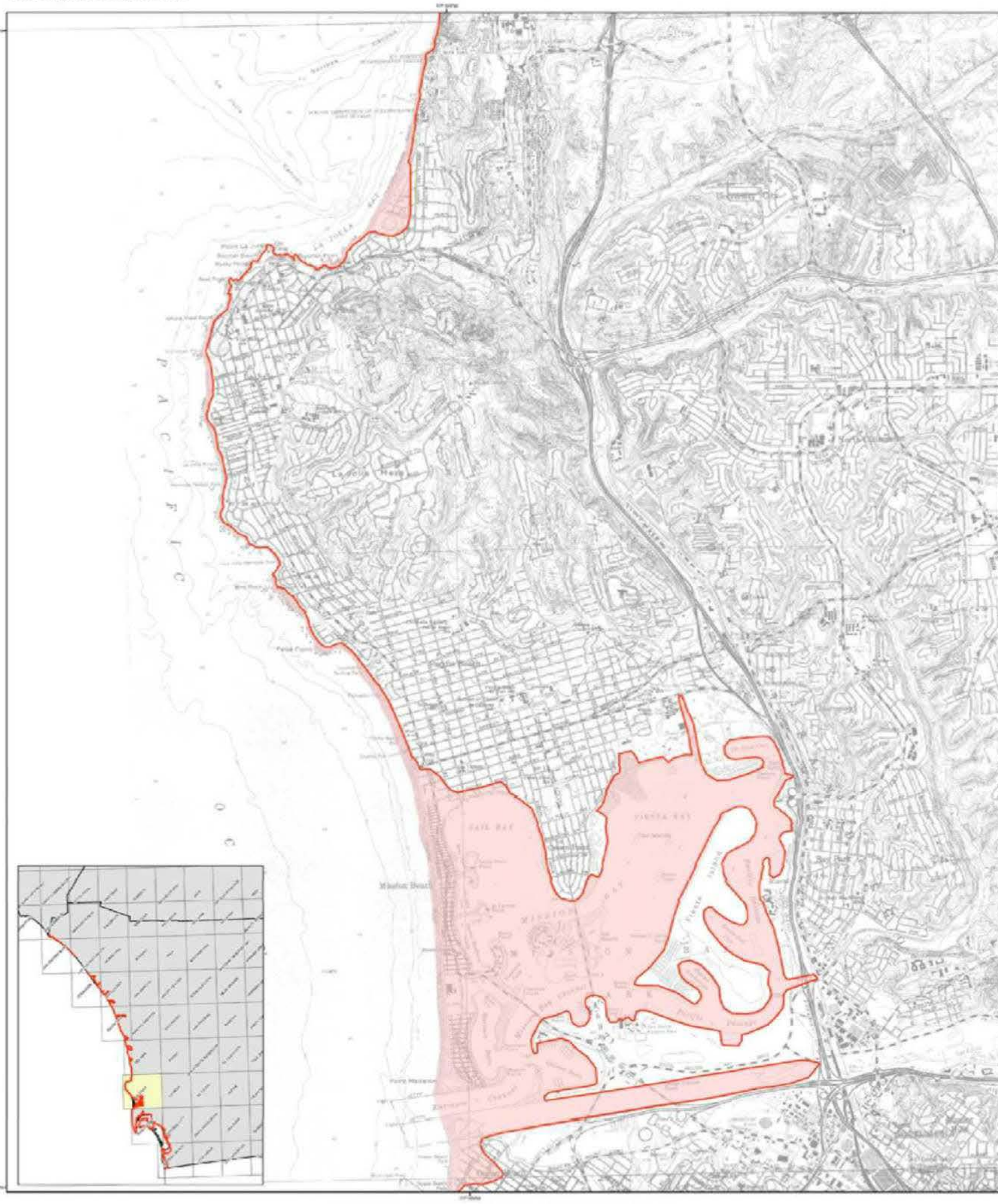
ENGINEERS AND GEOLOGISTS
3890 MURPHY CANYON ROAD, SUITE 200
SAN DIEGO, CA 92123 (858) 573-6900
FIGURE NUMBER
9
PROJECT NAME
MORENA CORRIDOR SPECIFIC PLAN
PROJECT NUMBER
2882
CITY OF SAN DIEGO
GEOLOGIC HAZARDS

California Emergency Management Agency
California Geological Survey
University of Southern California

Tsunami Inundation Map for Emergency Planning
La Jolla Quadrangle

State of California
County of San Diego



METHOD OF PREPARATION

Initial tsunami modeling was performed by the University of Southern California (USC) Tsunami Research Center funded through the California Emergency Management Agency (CalEMA) by the National Tsunami Hazard Mitigation Program. The tsunami modeling process utilized the MOST (Method of Splitting Tsunamis) computational program (Version 0), which allows for wave evolution over a variable bathymetry and topography used for the inundation mapping (Titov and Gonzalez, 1997; Titov and Synolakis, 1998).

The bathymetric/topographic data that were used in the tsunami models consist of a series of nested grids. Near-shore grids with a 3 arc-second (75- to 90-meters) resolution or higher, were adjusted to "Mean High Water" sea-level conditions, representing a conservative sea level for the intended use of the tsunami modeling and mapping.

A suite of tsunami source events was selected for modeling, representing realistic local and distant earthquakes and hypothetical extreme undersea, near-shore landslides (Table 1). Local tsunami sources that were considered include offshore reverse-thrust faults, restraining bends on strike-slip fault zones and large submarine landslides capable of significant seafloor displacement and tsunami generation. Distant tsunami sources that were considered include great subduction zone events that are known to have occurred historically (1960 Chile and 1964 Alaska earthquakes) and others which can occur around the Pacific Ocean "Ring of Fire."

In order to enhance the result from the 75- to 90-meter inundation grid data, a method was developed utilizing higher-resolution digital topographic data (3- to 10-meters resolution) that better defines the location of the maximum inundation line (U.S. Geological Survey, 1993; Intermap, 2003; NOAA, 2004). The location of the enhanced inundation line was determined by using digital imagery and terrain data on a GIS platform with consideration given to historic inundation information (Lander, et al., 1993). This information was verified, where possible, by field work coordinated with local county personnel.

The accuracy of the inundation line shown on these maps is subject to limitations in the accuracy and completeness of available terrain and tsunami source information, and the current understanding of tsunami generation and propagation phenomena as expressed in the models. Thus, although an attempt has been made to identify a credible upper bound to inundation at any location along the coastline, it remains possible that actual inundation could be greater in a major tsunami event.

This map does not represent inundation from a single scenario event. It was created by combining inundation results for an ensemble of source events affecting a given region (Table 1). For this reason, all of the inundation region in a particular area will not likely be inundated during a single tsunami event.

References:

Intermap Technologies, Inc., 2003, Intermap product handbook and quick start guide: Intermap NEXTmap document on 5-meter resolution data, 112 p.

Lander, J.F., Lockridge, P.A., and Kozuch, M.J., 1993, Tsunamis Affecting the West Coast of the United States 1806-1992: National Geophysical Data Center Key to Geophysical Record Documentation No. 29, NOAA, NESDIS, NGDC, 242 p.

National Atmospheric and Oceanic Administration (NOAA), 2004, Interferometric Synthetic Aperture Radar (IfSAR) Digital Elevation Models from GeoSAR platform (EarthData): 3-meter resolution data.

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TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING

State of California ~ County of San Diego

LA JOLLA QUADRANGLE

June 1, 2009

SCALE 1:24,000

Table 1. Tsunami sources modeled for the San Diego County coastline.

Sources (M = moment magnitude used in modeled event)		Areas of Inundation Map Coverage and Sources Used		
		Dana Point	Oceanside	San Diego
Local Sources	Carlsbad Thrust Fault		X	X
	Catalina Fault	X	X	X
	Coronado Bank Fault			X
	Lasuen Knoll Fault	X		X
	San Clemente Fault Bend Region			X
	San Clemente Island Fault			X
	San Mateo Thrust Fault	X	X	
	Coronado Canyon Landslide #1			X
Distant Sources	Cascadia Subduction Zone #3 (M9.2)	X		X
	Central Aleutians Subduction Zone#1(M8.9)	X	X	X
	Central Aleutians Subduction Zone#2(M8.9)	X		X
	Central Aleutians Subduction Zone#3(M9.2)	X	X	X
	Chile North Subduction Zone (M9.4)	X		X
	1960 Chile Earthquake (M9.3)	X		X
	1952 Kamchatka Earthquake (M9.0)	X		
	1964 Alaska Earthquake (M9.2)	X	X	X
	Japan Subduction Zone #2 (M8.8)	X		X
	Kuril Islands Subduction Zone #2 (M8.8)	X		X
	Kuril Islands Subduction Zone #3 (M8.8)	X		X
	Kuril Islands Subduction Zone #4 (M8.8)	X		X

Cal EMA

USC UNIVERSITY OF SOUTHERN CALIFORNIA

MAP EXPLANATION

Tsunami Inundation Line

Tsunami Inundation Area

PURPOSE OF THIS MAP

This tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional, coastal evacuation planning uses only. This map, and the information presented herein, is not a legal document and does not meet disclosure requirements for real estate transactions nor for any other regulatory purpose.

The inundation map has been compiled with best currently available scientific information. The inundation line represents the maximum considered tsunami runup from a number of extreme, yet realistic, tsunami sources. Tsunamis are rare events; due to a lack of known occurrences in the historical record, this map includes no information about the probability of any tsunami affecting any area within a specific period of time.

Please refer to the following websites for additional information on the construction and/or intended use of the tsunami inundation map:

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http://www.usc.edu/dept/tsunamis/2005/index.php

State of California Geological Survey Tsunami Information:
http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/index.htm

National Oceanic and Atmospheric Agency Center for Tsunami Research (MOST model):
http://nctr.pmel.noaa.gov/time/background/models.html

MAP BASE

Topographic base maps prepared by U.S. Geological Survey as part of the 7.5-minute Quadrangle Map Series (originally 1:24,000 scale). Tsunami inundation line boundaries may reflect updated digital orthophotographic and topographic data that can differ significantly from contours shown on the base map.

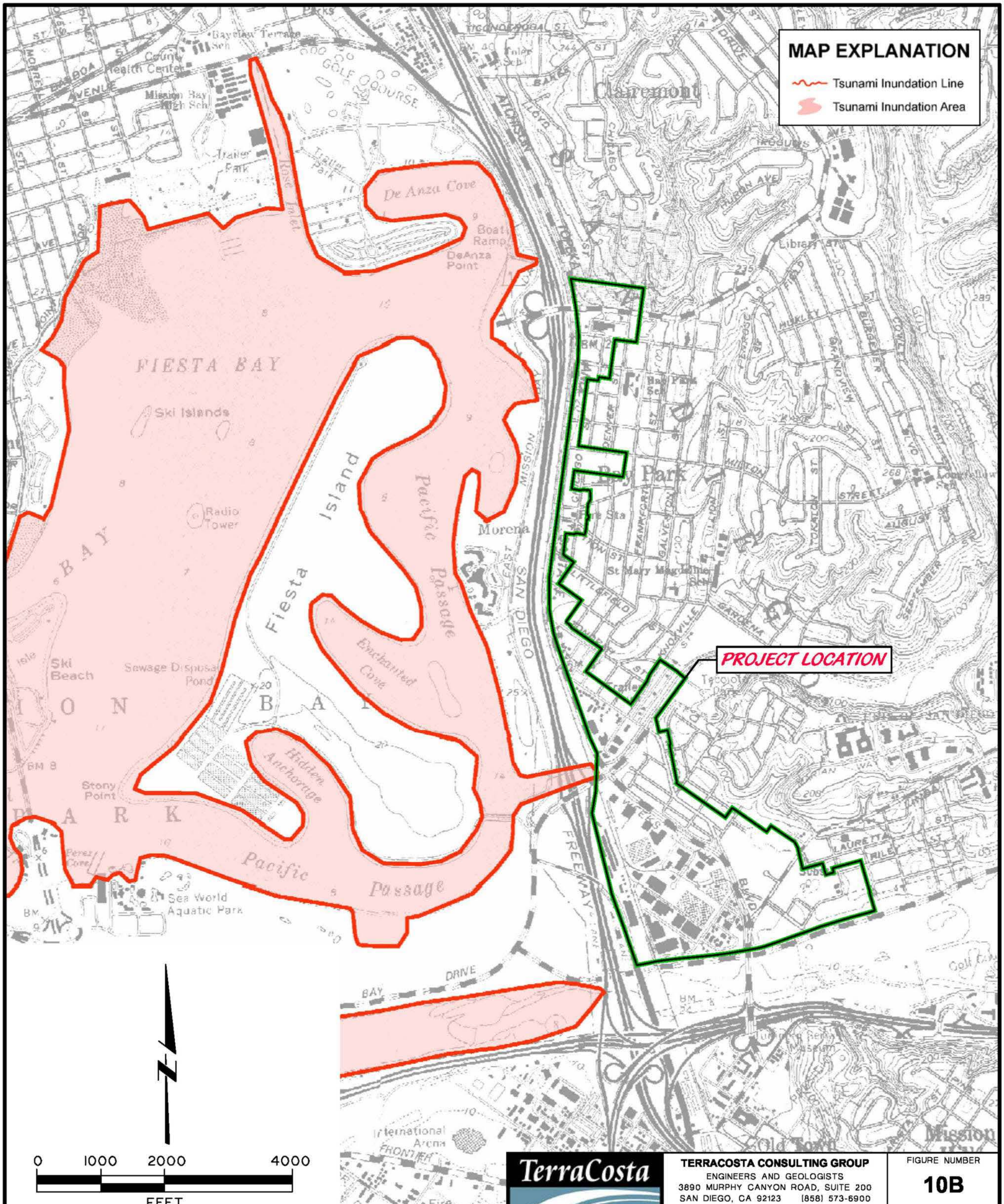
DISCLAIMER

The California Emergency Management Agency (CalEMA), the University of Southern California (USC), and the California Geological Survey (CGS) make no representation or warranties regarding the accuracy of this inundation map nor the data from which the map was derived. Neither the State of California nor USC shall be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of this map.

TerraCosta Consulting Group

FIGURE NUMBER
10A
PROJECT NUMBER
2882

TSUNAMI INUNDATION MAP
LA JOLLA



Reproduced from: "Tsunami Inundation Map for Emergency Planning, La Jolla Quadrangle," by the State of California, County of San Diego, dated June 1, 2009.

TerraCosta Consulting Group	TERRACOSTA CONSULTING GROUP ENGINEERS AND GEOLOGISTS 3890 MURPHY CANYON ROAD, SUITE 200 SAN DIEGO, CA 92123 (858) 573-6900	FIGURE NUMBER **10B**
	PROJECT NAME **MORENA CORRIDOR SPECIFIC PLAN**	PROJECT NUMBER **2882**
	TSUNAMI INUNDATION MAP	

METHOD OF PREPARATION

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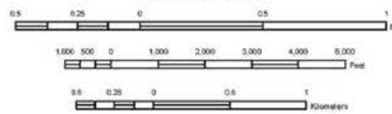
TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING

State of California ~ County of San Diego

LA JOLLA QUADRANGLE

June 1, 2009

SCALE 1:24,000



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	Kuril Islands Subduction Zone #2 (M8.8)	X		X
	Kuril Islands Subduction Zone #3 (M8.8)	X		X
	Kuril Islands Subduction Zone #4 (M8.8)	X		X

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CGS CALIFORNIA GEOLOGICAL SURVEY

USC UNIVERSITY OF SOUTHERN CALIFORNIA

MAP EXPLANATION

Tsunami Inundation Line

Tsunami Inundation Area

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TerraCosta Consulting Group

TERRACOSTA CONSULTING GROUP
ENGINEERS AND GEOLOGISTS
3890 MURPHY CANYON ROAD, SUITE 200
SAN DIEGO, CA 92123 (858) 573-6900

FIGURE NUMBER: 10C

PROJECT NAME: MORENA CORRIDOR SPECIFIC PLAN

PROJECT NUMBER: 2882

TSUNAMI INUNDATION MAP LEGEND