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4.16 GEOLOGICAL HAZARDS AND RESOURCES

The geology discussion provides an evaluation of the geological conditions of the Project site and related facilities, effects of geological hazards on the proposed Project, and the Project's potential effects on geologic resources. Potential impacts are assessed for both the operation and construction of the Project. The results of a Preliminary Geotechnical Investigation of the Project Facilities area (Petra 2011) have been incorporated into this discussion and the full report is included in Appendix K. A Final Geotechnical Investigation will be completed to satisfy the requirements during detailed Project design and will include the final seismic, earthwork, and foundation design criteria. With incorporation of the mitigation measures proposed, there will be no significant impacts related to geological hazards and resources.

4.16.1 Affected Environment

The proposed Project will consist of power plant and access road, 230kV gen tie, 230kV utility switchyard, 8-inch natural gas pipeline lateral and associated construction. The proposed power plant site is located south of the Sycamore Canyon Landfill, approximately 1 mile northwest of the City of Santee in the eastern part of the City of San Diego (Figure 2.1-2). The proposed power plant will be located on a 21.6-acre parcel situated on the east side of Sycamore Landfill Road. The parcel is largely undisturbed land consisting of two low-lying northeast-southwest oriented ephemeral drainage areas and adjacent ridgelines. Topography in the drainage areas ranges in elevation from 390 feet to 500 feet AMSL. Adjacent ridge top elevations range up to 580 feet AMSL. The power plant is proposed to be located within the northerly drainage area. The access road is proposed to enter from Landfill Access Road along the southerly drainage area and traverse over the ridge to the power plant. The proposed gen tie will extend north from the plant to the south end of the landfill, then proceed west across Little Sycamore Canyon to the ridgeline along the west side of the canyon. The proposed gas pipeline lateral will extend south from the power plant along Sycamore Landfill Road. A temporary construction laydown area is proposed at the south end of the adjacent landfill.

The majority of the plant site is undisturbed. A concrete drainage ditch runs along the western boundary of the parcel and controls and directs runoff from the road and adjacent hillsides. Drainage through the parcel is from northeast to southwest toward Sycamore Landfill Road. Vegetation across the plant site consists of coastal sage scrub, mixed chaparral, native, and non-native grasses. The plant site is underlain primarily by interbedded sandstones and clay stones of the mid-Eocene age Friars Formation in the lower slopes and drainage areas, and by conglomeratic sandstones of the mid-Eocene age Stadium Conglomerate in the upper slopes and ridge tops.

4.16.1.1 Regional Geology

The Project is located within the Peninsular Range Geomorphic province. The province extends from the Santa Monica Mountains to the tip of Baja California. It is located on the Pacific (tectonic) Plate, which is moving to the northwest relative to the adjacent North American Plate. The boundary between the two tectonic plates is the San Andreas Fault Zone. The region is characterized by a relatively narrow coastal plain on the west, and rugged mountains with steep-walled narrow valleys inland. These northwest-trending mountain ranges and valleys are sub-parallel to the San Andreas Fault system and other regional complimentary fault systems.

Prior to the middle of the Mesozoic era (about 180 million years before present [BP]), the region was covered by seas and thick marine sedimentary and volcanic sequences were deposited. During the Cretaceous period (138 to 63 million years BP) extensive mountain building occurred along with the emplacement of the Southern California batholith (crystalline/granitic rocks). During the early Tertiary (Paleocene Epoch - 55 to 65 million years BP) the San Diego coastal margin underwent uplift and erosion until the middle Eocene (40 to 50 million years BP) when sedimentary sequences of siltstone, sandstone, and conglomerates were deposited as part of several transgressive-regressive cycles. In the Project region, the Cretaceous batholitic/granitic rocks are unconformably overlain by Tertiary sedimentary deposits. The present-day mountain ranges were faulted and uplifted during the late Tertiary and Quaternary (5 million years BP to present time) (Sutch and Dirth 2003). The region is seismically active and while there is significant late Quaternary deformation in the area, seismicity is considered low.

4.16.1.2 Regional Tectonic Setting

The tectonic framework of the Peninsular Ranges province is dominated by the overall right-lateral strike slip movement of the Pacific and North American tectonic plates along the San Andreas Fault System. Accordingly, the area is seismically active and there are multiple faults in the region capable of causing ground-shaking in the vicinity of Project components. The Project area occurs between two major active northwest-trending fault zones (USGS 2006): the Elsinore Fault Zone located about 30 miles to the northeast of the Project, and the Newport-Inglewood/Rose Canyon Fault Zone located about 11 miles to west of the Project. Both of these fault zones and other more distant regional fault zones, have displacement periodically to accommodate crustal stress accumulated from movement of the plates.

Based on the Quaternary Fault database for the United States (USGS 2006), the active fault closest to the Project is the Newport-Inglewood/Rose Canyon Fault zone approximately 11 miles to the west. Therefore, there is no indication that ground rupture could occur in the immediate vicinity while there is potential for ground-shaking to occur at the Project during construction and operations.

4.16.1.3 Local Geology

Geology within the hillside areas of the Project consists of relatively flat-lying Tertiary-age sedimentary units of the Poway and La Jolla Groups (Kennedy, et al 2008) that unconformably overlie Cretaceous-age granitic basement rocks, which are located at depth. Figure 4.16-1 shows a simplified columnar section of the geology of the San Diego Continental Margin (Kennedy 1975). Based on the Preliminary Geotechnical Investigation, younger alluvial sediments (Qya) underlie the low-lying drainage areas of the plant site parcel and the gen tie. The Site Geologic Map attached as Figure 4.16-2 provides a regional overview rather than site-specific data. The remainder of the Project is underlain by the Stadium Conglomerate (Tst) and the Friars Formation (Tf). The Stadium Conglomerate is the oldest member of the Eocene-age Poway Group and is located within the upper slope and ridge areas. The Friars Formation (Tf), which is the youngest member of the La Jolla Group, and which underlies the Stadium Conglomerate, is located within the lower slopes of the Project, including the gas pipeline lateral ROW. Figure 4.16-2 provides a geologic map that shows geology within 1 mile of the Project. A geology legend for Figure 4.16-2 is provided in Figure 4.16-3. Table 4.16.-1 provides a listing

of the mapped geologic units found within the Project area. Descriptions of each unit are provided below.

Table 4.16-1 Mapped Surficial Geologic Units

Map Unit	Inferred Age	Descriptive Name
Qya	Holocene to Late Quaternary	Young Alluvial Flood Plain Deposits
Tst	Middle to late Eocene	Stadium Conglomerate
Tf	Middle to late Eocene	Friars Formation

Young Alluvial Flood Plain Deposits (Qya). Sediments of this geologic unit consist of poorly consolidated and poorly sorted mixtures of sand and silt. These deposits are limited to the low-lying drainage areas of the site parcel and Little Sycamore Canyon wash area, over which the Project gen tie line crosses.

Stadium Conglomerate (Tst). Middle to late Eocene in age, the Stadium Conglomerate is the oldest member of the terrestrially-derived Poway Group, a massive to thickly-bedded cobble conglomerate within a dark yellowish-brown coarse-grained sandstone matrix. Fossiliferous exposures were reported in Murphy and Tecolote Canyons by Squires and Demere (1991) approximately 6 and 10 miles away, respectively.The fossils included Mollusca taxa (gastropods and bivalves). The unit is slightly cemented and dense. Cobbles typically range from 2 to 8 inches in diameter with rare boulders to 14 inches. The rhyolitic cobbles referred to as “Poway Clasts” have a distinctive purplish-pink color.

Friars Formation (Tf). Middle to late Eocene in age, the Friars Formation is the uppermost member of the La Jolla Group. The rocks consist of non-marine and near-shore facies made up of sandstone and claystone. The sandstone is typically massive, yellowish-gray, medium grained and poorly indurated. Caliche-rich sandstone beds are locally interlayered with dark greenish-gray sand claystone. As with the Stadium Conglomerate, fossiliferous sandstones were reported by Squires and Demere (1991) within the gradational boundary between the two units. It is not known if such fossils exist within the units on the Project site (see Section 4.15).

4.16.1.4 Local Faulting and Seismicity

The Project lies within a region that is considered to be seismically active but historically has experienced fewer earthquakes than other areas within southern California. Nevertheless, there are multiple, sufficiently active faults in the region that are capable of causing ground-shaking in the Project vicinity (Figure 4.16-4). The California Geological Survey defines a “sufficiently active fault” (previously referred to as an “active fault”) as a fault that has broken the surface in the past 11,000 years. A listing of sufficiently active faults in the region is provided in Table 4.16-2. The Newport-Inglewood Fault Zone and its southerly extension, the Rose Canyon Fault Zone, are located 11 miles west of the site; however historical events that have occurred along the fault in the San Diego region have had relatively low magnitudes of around 4.0 Richter Magnitude. Even the active Elsinore Fault Zone, located 30 miles to the northeast, has produced few historic earthquakes. The most significant earthquakes in the vicinity of the Project have occurred on the San Jacinto Fault Zone, the most active fault zone in the San Andreas Fault complex. The San Jacinto Fault, located 49 miles east of the Project, has produced numerous historical earthquakes of greater than 6.5 magnitude.

Table 4.16-2 Sufficiently Active Faults Within 100 Kilometers of the Project Site

Fault Name	Approximate Distance and Direction from Project Site	Slip Rate (mm/year)	Maximum Earthquake Magnitude
Newport-Inglewood/ Rose Canyon Fault	11 miles (18 km) west-southwest	1.5	6.9
Coronado Bank Fault	24 miles (39 km) southwest	3	7.4
Elsinore-Julian Fault	30 miles (48 km) east-northeast	3	7.5
San Jacinto Fault	49 miles (79 km) east	4	7.6

Notes:
Fault locations and Maximum Magnitude taken from USGS Earthquake Hazard Program Database Search (http://geohazards.usgs.gov/qfusion/hazfaults), using lat. 32.85, long. -117.03 as the Project site coordinates. Slip Rates taken from Southern California Earthquake Center (SCEC 2009).

4.16.2 Environmental Consequences

4.16.2.1 Geologic Hazards

Geologic hazards are normally related to seismicity (ground shaking, ground rupture, liquefaction, tsunami, or seiche), surface movement (slope instability, erosion/deposition, or mass wasting), or volume change (subsidence or expansive soils). The City of San Diego Seismic Safety Element (City of San Diego 2008b) indicates the Project is not located in Alquist-Priolo (active) Earthquake Fault Zones or liquefaction-prone zones. Portions of the Project, including areas associated with Project linear components, are mapped as being located on geologic formations that are prone to landslides. These hazard categories are discussed in more detail in the following sections. Guidelines for evaluating and mitigating seismic hazards are provided in California Geological Survey, Special Publication 117A (CGS 2008).

Seismic Ground Shaking. Like most areas in southern California, the Project is located in a region with numerous active faults; therefore, there is the potential for regional earthquakes and ground shaking during the Project lifetime.

A probabilistic seismic hazard analysis (PSHA) was performed for the Project in order to determine the ground motions for the Design-Basis Earthquake (DBE). The DBE ground motion is determined by probabilistic methods and defined as the event with a 10 percent chance of being equaled or exceeded in a 50-year period. Based on the PSHA, the estimated peak ground acceleration (pga) at the site was determined and the Maximum Credible Magnitude for the nearby Rose Canyon Fault was chosen by taking one standard deviation above the mean magnitude (Table 4.16-3).

Table 4.16-3 Magnitude and Ground Acceleration

Maxiumum Credible Magnitude	Peak Horizontal Ground Acceleration
7.2	0.25g

Project structures should be designed and constructed to resist the effects of seismic ground motions as provided in Section 1613 of the 2010 CBC. The CBC supersedes the federal requirements outlined in the latest International Building Code. Preliminary ground motion

parameters were calculated for the Project using a computer program, Earthquake Ground Motion Parameters Version 5.1.0, developed by the USGS, 2011a. Table 4.16-4 presents the seismic design parameters that may be used for design of the proposed structures where appropriate. On the basis of available information from subsurface exploration (Petra, 2011) and proposed development plans, the Project may be classified as site Class D, stiff soil (based on proposed site grading that will result in fill soils below proposed structures). The Project class and parameters listed below will be updated as appropriate based on the results of the Final Geotechnical Investigation for the proposed Project.

Table 4.16-4 2010 CBC Seismic Design Parameters

Parameter	Value
Site Class Definition	D
Ss- Mapped Spectral Response Acceleration, (Ss) for 0.2 second	0.999 g
S1- Mapped Spectral Response Acceleration, for 1.0 second	0.357 g
Fa-Site Coefficient, Short Period	1.1
Fv-Site Coefficient, 1-second Period	1.686
SDs-Design Spectral Response Acceleration, Short Period	1.099 second
SD1-Design Spectral Response Acceleration, Long Period	0.401 second
SMs-Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter,	0.574 second
SM1- Adjusted Maximum Considered Earthquake Spectral Response Acceleration Parameter	0.602 second

Notes:
Calculated using USGS Program "Earthquake Ground Motion Parameters" Version 5.1.0 based on the coordinates latitude 32.85, longitude -117.03.

Ground Rupture. The proposed Project is not located within a State of California Earthquake Fault Zone designated by the Alquist-Priolo Special Studies Zone Act of 1972 (City of San Diego 2008c), an area where the potential for fault rupture is considered probable. Additionally, no Quaternary or Sufficiently Active Faults are located under or near the Project components. Based on the available information and professional judgment, earthquake-induced ground rupture is not considered to be a significant hazard at the Project.

Liquefaction. Liquefaction is a soil condition in which seismically-induced ground motion causes an increase in soil water pressure in saturated, loose, uniformly-graded sands, resulting in loss of soil shear strength. As a result, the effects of liquefaction can include loss of bearing strength, differential settlement, ground oscillations, lateral spreading, and flow failures or slumping. Liquefaction occurs primarily in areas where the groundwater table is within approximately 50 feet of the surface. The City of San Diego Seismic Safety Study (City of San Diego 2008b) indicates that the plant site and related facilities are not located in an area prone to liquefaction. This was confirmed by the Preliminary Geotechnical Investigation and supported by the fact that the plant site is underlain by dense bedrock. A small area of the gen tie is mapped as an area of low potential for liquefaction. This is located in the Little Sycamore Canyon area where the gen tie crosses over the canyon on the west side of Sycamore Landfill Road. Based on this information and professional judgment, the potential for liquefaction hazard is considered negligible for the the Project with the exception of the gen tie, where the risk for liquefaction is low only where it crosses Little Sycamore Canyon. The potential for liquefaction will be further evaluated as part of the Final Geotechnical Investigation for the Project, and if

necessary, design parameters to address any identified conditions will be incorporated into the detailed Project design.

Tsumani/Seiche. No large bodies of water are located nearby that present a potential hazard of tsumani or seiche. Based on this fact, tsunami or seiche is not a hazard to the Project components.

Slope Stability. The City of San Diego Seismic Safety Study (City of San Diego 2008c) indicates that portions of the Project are within areas mapped as having slide-prone formational materials (Friars Formation). This was confirmed by the Preliminary Geotechnical Investigation, which identified the Friars Formation in the lower slopes areas. The Friars Formation is prone to landslide development and/or surficial failures, especially where it contacts the overlying Stadium Conglomerate. Based on this information, slopes that expose the Friars Formation will require stabilization in the form of remedial grading, which would include overexcavation and replacement of unstable slopes with a stabilization fill. Final determination of which slopes will require stability fills will be made when site grading plans are complete. At that time, a Final Geotechnical Investigation will be conducted that will include a grading plan review and remedial grading recommendations. All earthwork and grading will be performed in accordance with the recommendations provided in the Final Geotechnical Investigation and with all applicable requirements of the Grading Code of the City of San Diego. With these mitigation measures, potentially significant impacts associated with unstable slopes would be reduced to less than significant levels.

Erosion/Mass Wasting. Erosion and deposition is the displacement and movement of solids (soil, mud, rock, and other particles) as transported by wind, water, or ice. Mass wasting is a similar movement of solids downward or down-slope in response to gravity. Due to generally hilly terrain, the Project is prone to erosion and mass wasting. This is somewhat reduced by the generally well-vegetated surfaces that currently exist. The Project Soil Resource Report (NRCS 2011) indicates that site soils have a low to moderate overall potential for erosion and a low potential for wind erosion (see Section 4.14, Agriculture and Soils). Significant grading during construction may increase this potential.

Under current conditions, the soil loss is estimated to be approximately 3 tons per year from the Project. Construction activities without implementation of BMPs would result in a potential for soil loss of approximately 354 tons (Section 4.14.2.2). The implementation of BMPs is expected to reduce water and wind erosion of soils during construction to less than significant levels.

To address the management of erosion, sediment transport, and deposition during facility operations, the Project design will incorporate diversion berms, conveyance channels, detention basins, and dispersion structures as discussed in Section 4.13.2.3. The final design for these features will be developed during preparation of the detailed design, and will include industry-standard calculations and modeling to reduce the potential for erosion or sedimentation and the need for ongoing maintenance. Dirt roads and exposed surfaces will be periodically treated with dust palliatives as needed to reduce wind erosion. Construction and maintenance of the proposed drainage and sediment management system at the plant site is expected to reduce water and wind erosion at and downstream of the site to less than significant levels.

Subsidence. Subsidence, or a lowering of surface elevation due to removal of subsurface support, can result from several causes, and ranges from small or local collapses to broad regional lowering of the earth's surface. Potential causes of subsidence include tectonic movement, seismic compaction, hydrocompaction, consolidation induced by groundwater withdrawal, and consolidation under applied loads. Soils particularly susceptible to such consolidation and subsidence include compressible clays in a confined aquifer system. This type of deformation is most prevalent when confined alluvial aquifer systems are overdrafted, resulting in water level declines of tens or hundreds of feet.

Based on the dense nature of the underlying soils/bedrock within a majority of the Project and no proposal to withdraw groundwater, the potential for subsidence in all areas except Little Sycamore Canyon wash is negligible. Areas within Little Sycamore Canyon, where the gen tie is underlain by Quaternary Alluvium, may be at risk for subsidence and should be further evaluated for subsidence potential during the Final Geotechnical Investigation. Foundation construction recommendations provided in the Final Geotechnical Investigation will address potential subsidence issues. All foundation construction will be performed in accordance with the recommendations provided in the Final Geotechnical Investigation and with all applicable requirements of the California Building Code. With these mitigation measures, potentially significant impacts associated with ground subsidence would be reduced to less than significant levels.

Expansive Soil. Expansive soil is predominantly fine-grained and contains clay minerals capable of absorbing water in their crystal structure. It is often found in areas that were historically a flood plain or lake area, but can also be associated with some types of shale, volcanic ash, or other deposits, and can also occur in hillside areas. Expansive soil is subject to swelling and shrinkage, varying in proportion to the amount of moisture present in the soil. As water is initially introduced into the soil (by rainfall or watering), expansion takes place. If dried out, the soil will contract, often leaving small fissures or cracks. Excessive drying and wetting of the soil can progressively deteriorate structures that are not designed to resist this effect, and can lead to differential settlement under buildings and other improvements.

Based on lab data provided in the site-specific Preliminary Geotechnical Investigation, materials associated with the Stadium Conglomerate exhibit very low to low expansion potential and materials associated with the Friars Bedrock Formation exhibit a high expansion potential. Due to the potential for distress to building foundations and other critical structures due to the adverse effects of expansion and contraction, it is recommended that all building pads and other critical structural facilities, including the gas pipeline, be underlain by soil materials that exhibit low expansion potential. Therefore, highly expansive Friars Bedrock Formation materials should not be placed or should be over-excavated within the upper 5 feet of proposed finish grade within building/structural pad areas. The issue of expansive soils will be further evaluated as part of the Final Geotechnical Investigation for the Project, and design parameters to address identified conditions will be incorporated into the detailed Project design. All earthwork, grading and foundation construction will be performed in accordance with the recommendations provided in the Final Geotechnical Investigation and with all applicable requirements of the Grading Code of the City of San Diego and the California Building Code. With these mitigation measures, potentially significant impacts associated with expansive soil would be reduced to less than significant levels.

4.16.2.2 Geological Resources

According to the USGS Mineral Resources Data System (USGS 2011b), two areas were prospected or mined for sand and aggregate in the past by a company called Monarch Materials. One was located approximately 0.6 miles west of the plant site (Figure 4.16-5) and another was located approximately 1.4 miles east of the site. The State Surface Mining and Reclamation Act (SMARA) requires local agencies to incorporate mineral land classifications in their General Plan for the purpose of encouraging production and conservation of minerals and minimizing the adverse impacts of mining and promoting land reclamation. The Generalized Mineral Land Classification Map found in the City of San Diego General Plan, Conservation Element (City of San Diego 2008b), indicates that the plant site is classified as MRZ-2 (Mineral Resource Zone-2: areas where adequate information exists that significant mineral deposits are present). The classification is likely related to the aggregate resource that is potentially available in the Stadium Conglomerate and the clay resource that is potential to the Friars Formation (Kennedy 1975); however, the *Mineral Land Classification Map* also indicates that the Project is located within the Multi-Habitat Planning Area (MHPA), a core biological resource area targeted for conservation. This MHPA is shown on Figure 4.16-5. The Mineral Resource Zones were not included on Figure 4.16-5 because the information was not digitally available. Based on the MPHA Land Use Guidelines, any new or expanded mining operations are incompatible with MHPA preserve goals. Therefore, the Project will not impact a potential commercial mineral resource.

The geology underlying the proposed Project is common to the local area and therefore not unique from a recreational standpoint.

4.16.2.3 Cumulative Analysis

Cumulative effects refer to a proposed project's incremental effect combined with other closely related past, current, or reasonably foreseeable projects whose impacts could compound or increase the incremental effect of the proposed project. As described above, the proposed Project will not cause significant adverse impacts in terms of geological hazards or loss of resources. It is not anticipated that the Project will overlap in time or geographic extent with other activities that will adversely impact geological hazards or resources. It is also not anticipated that the Project will interact with or intensify any impact to geological hazards or resources in the area. Therefore, the Project would not contribute to a cumulative impact to geologic resources when considered in combination with projects or developments in the vicinity.

4.16.3 Mitigation Measures

Geologic impacts associated with the construction and operation of the proposed Project are expected to be less than significant. Project site-specific geotechnical and seismic conditions, as well as the potential for erosion, will be appropriately addressed during Project detailed design and during Project construction. The following mitigation measures are proposed to ensure impacts are less than significant.

GEOL–1: Power plant structures and equipment, as well as related facilities such as linear components (natural gas pipeline lateral and gen tie) will be designed in accordance with CBC 2010 requirements and City of San Diego construction standards, considering the San Diego Municipal Code, San Diego General Plan and Seismic Safety Element.

GEOL-2: Project foundations, underground utilities, and other improvements will be designed in accordance with recommendations provided in the Final Geotechnical Investigation. A geotechnical engineer will be assigned to the Project to carry out the duties required by the CBC and to assess geologic conditions during construction and ensure mitigation measures are completed per recommendations provided in the geotechnical report.

GEOL-3: All earthwork and grading will be performed in accordance with the recommendations provided in the Final Geotechnical Investigation and with all applicable requirements of the Grading Code of the City of San Diego. This will include grading activities associated with mitigation of potentially unstable slopes and expansive soils. A geotechnical engineer will be assigned to the project to carry out the duties required by the city Grading Code and to assess geologic conditions during construction and ensure mitigation measures are completed per recommendations provided in the geotechnical report.

Significant Unavoidable Adverse Impacts

The proposed Project will be designed and constructed to meet 2010 CBC requirements for industrial facilities and will adhere to sound professional practices and appropriate regulatory requirements related to geologic hazards (e.g., grading, slope stability). For these reasons and with implementation of the mitigation measures, the proposed Project is expected to have no significant impacts on geologic hazards or resources.

4.16.4 Laws, Ordinances, Regulations, and Standards

This section addresses the LORS applicable to geologic hazards and resources that are relevant to the Project. Table 4.16-5 summarizes the LORS that are expected to apply to the Project.

Table 4.16-5 Applicable LORS for Geological Hazards and Resources

LORS	Applicability	Administering Agency	Where Discussed in AFC
Federal			
No federal LORS are applicable	.		
State			
California Building Code, 2010, as amended by City of San Diego	The Code specifies acceptable design criteria for structures and excavations with respect to seismic design and load-bearing capacity.	City of San Diego	Section 4.16.1.5
Alquist-Priolo Earthquake Fault Zoning	The Act identifies areas subject to surface rupture from active faults, and	City of San Diego	Section 4.16.1.5

LORS	Applicability	Administering Agency	Where Discussed in AFC
Act	for those areas specifies required fault rupture hazard investigations and procedures.		
California Department of Conservation, California Geological Survey (Seismic Hazards Mapping Act)	The Act directs the state geological survey to identify and map areas prone to liquefaction and seismic-induced ground shaking. These areas are in-turn identified in the local Seismic Safety Element which must be utilized to assess seismic hazard risk.	City of San Diego	Section 4.16.1.5
Surface Mining and Reclamation Act	Addresses need for continuing supply of mineral resources while minimizing negative impacts of surface mining; Designates Mineral land Classification. Mineral Land Classification Zones must be reviewed to identify potential for mineral resources.	City of San Diego	Section 4.16.1.6
Local			
San Diego Municipal Code	Requires a grading permit for one or more of the following: • grading of more than 1 acre; • manufactured slopes with gradient of 25% or more • vertical grade changes of more than 5 feet. Grading and building plans must address the requirements of the City of San Diego Land Development Code.	City of San Diego	Section 4.16.2
San Diego General Plan, Seismic Safety Element	Dictates level of geotechnical study and review required for Land Development and Building Permits based on mapped hazard category (geologic conditions).	City of San Diego	Section 4.16.1.5

4.16.4.1 Local Authorities and Administering Agencies

The Project is subject to the City of San Diego Development Services Department requirements for building and grading. Projects must comply with the City of San Diego Municipal Code and the City of San Diego General Plan. The Municipal Code specifies building and grading permit requirements through the Land Development Code and submittal requirements through the Land Development Manual. The City of San Diego General Plan provides a Seismic Safety Element which utilizes a Seismic Safety Study to determine geologic conditions within the site in order to determine the required level of geotechnical study.

4.16.5 Agencies and Agency Contacts

The agency responsible for compliance with geological LORS is the City of San Diego Development Services Department, which administers the Project's compliance with the 2010 CBC, the Alquist-Priolo Earthquake Fault Zoning Act, the Seismic Hazards Mapping Act, the

City of San Diego Municipal Code, and the City of San Diego General Plan. Contact information is provided in Table 4.16-6.

Table 4.16-6 Agencies and Agency Contacts for Geological Hazards and Resources

Agency	Name	Title	Phone	Email	Mailing Address
City of San Diego Development Services Department	Patrick Thomas	Assistant Engineer – Civil	(619) 446-5296	PAThomas@sandiego.gov	1222 First Avenue San Diego, CA 92101
City of San Diego Development Services Department	James Quinn	Assistant Engineer – Civil	(619) 446-5334	JPQuinn@sandiego.gov	202 C Street, MS 5A, San Diego, CA 92101

4.16.6 Required Permits and Permitting Schedule

All construction elements associated with the grading and construction permits for the Project must comply with 2010 CBC standards. There are no other permit requirements that specifically address geologic resources and hazards.

Building and grading permits are required by the City of San Diego Development Services Department.

4.16.7 References

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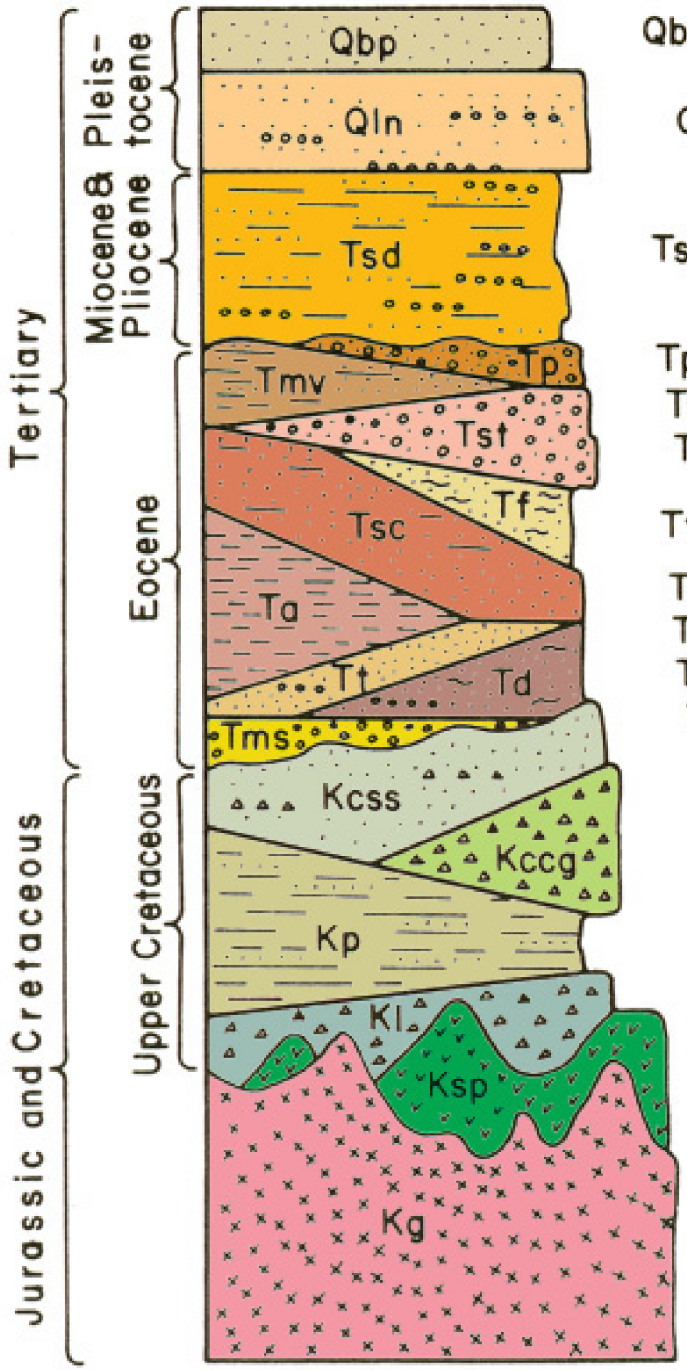
_____. 2011. Ground Motion Parameters Calculator, Available at: http://earthquake.usgs.gov/ hazards/designmaps/javacalc.php

FIGURES

COLUMNAR SECTION OF THE SAN DIEGO CONTINENTAL MARGIN



Qbp, Bay Point Formation

Qln, Lindavista Formation

Tsd, San Diego Formation

Poway Group:
- Tp, Pomerado Conglomerate
- Tmv, Mission Valley Formation
- Tst, Stadium Conglomerate

La Jolla Group:
- Tf, Friars Formation
- Tsc, Scripps Formation
- Ta, Ardath Shale
- Tt, Torrey Sandstone
- Td, Delmar Formation
- Tms, Mount Soledad Formation

Rosario Group:
- Kcss, Cabrillo Formation (sandstone part)
- Kccg, Cabrillo Formation (conglomerate part)
- Kp, Point Loma Formation
- Kl, Lusardi Formation

Ksp, Santiago Peak Volcanics

Kg, Granitic rocks of the southern California batholith

SOURCE:
California Department of Minerals and Geology - "Geology of the San Diego Metropolitan Area, Ca (Bulletin 200) (1975).

QUAIL BRUSH GENERATION PROJECT

FIGURE 4.16-1
COLUMNAR SECTION OF THE SAN DIEGO CONTINENTAL MARGIN

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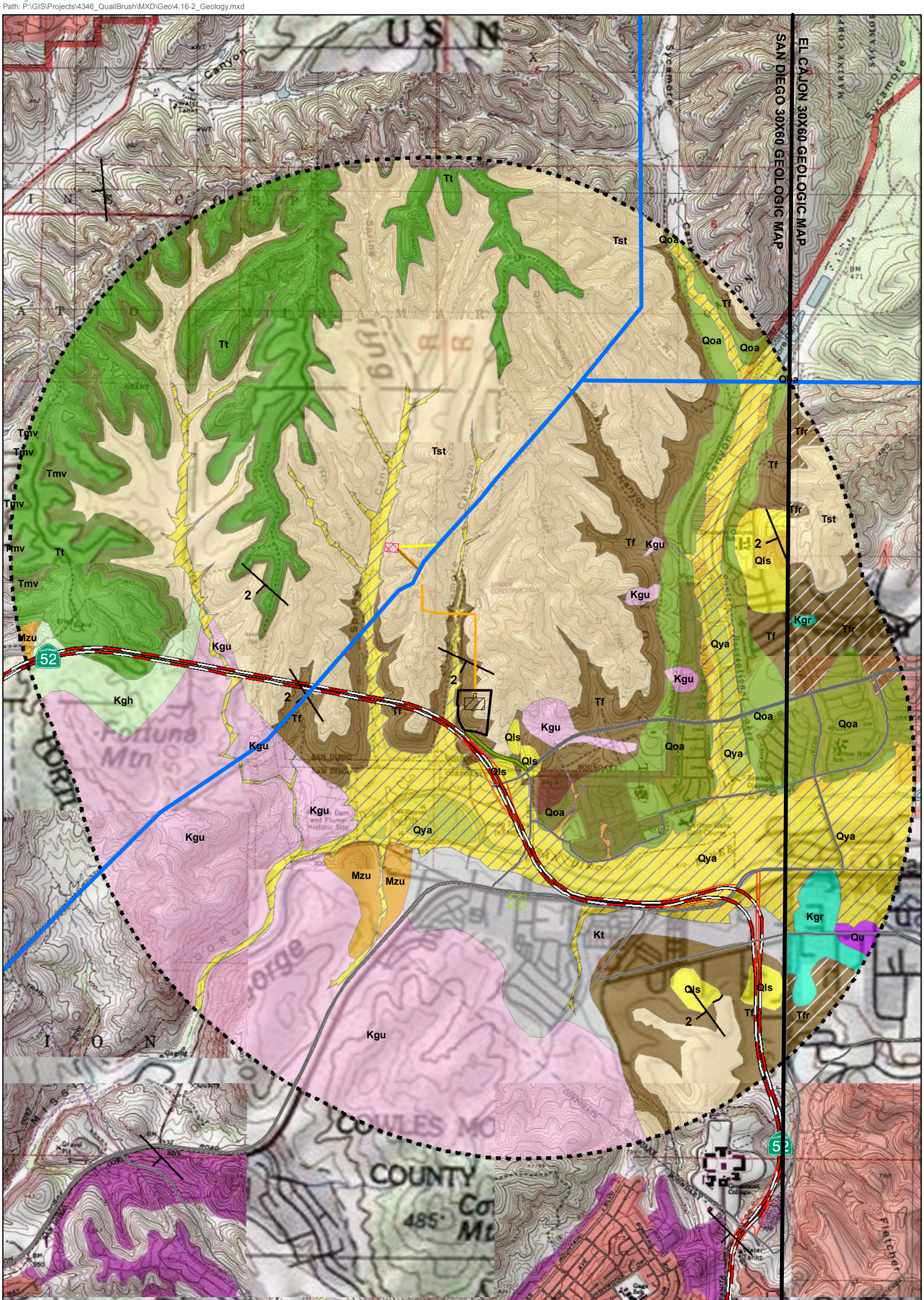

Legend

- Project Boundary
- 2-Mile Buffer
- Plant Site
- Offsite Parking
- Proposed Gas Lateral
- Overhead Gen Tie
- Underground Gen Tie
- North Loop Overhead Line
- South Loop Overhead Line
- Existing SDG&E 230 kV T-Lines (2)
- Preliminary SDG&E Switchyard

See Figure 4.16-3 for Geology Legend.

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QUAIL BRUSH GENERATION PROJECT

FIGURE 4.16-2
GEOLOGY WITHIN
1 MILE OF THE PROJECT

0 1,250 2,500 5,000
Feet

TETRA TECH EC, INC.

ABBREVIATED EXPLANATION

Approximate stratigraphic relationships only;
see Kennedy, 2005 (Sheet 2 of 2) and USGS OFR 2004-1361 (Sheet 2 of 2) for more detailed information

MODERN SURFICIAL DEPOSITS

Qls	Landslide deposits, undivided (Holocene and Pleistocene)

YOUNGER AND OLDER SURFICIAL DEPOSITS

Qya	Young alluvial flood-plain deposits (Holocene and late Pleistocene)
Qu	Younger and older alluvium and colluvium (Undifferentiated)
Qoa	Old alluvial flood-plain deposits, undivided (late to middle Pleistocene)

SEDIMENTARY AND VOLCANIC BEDROCK UNITS

Tmv	Mission Valley Formation (middle Eocene)
Tst	Stadium Conglomerate (middle Eocene)
Tf	Friars Formation (middle Eocene), Per San Diego Quad
Tfr	Friars Formation (middle Eocene), Per El Cajon Quad
Tt	Torrey Sandstone (middle Eocene)

UNNAMED CRETACEOUS ROCKS OF THE PENINSULAR RANGES BATHOLITH

Kgu	Granodiorite and tonalite, undivided (early-Cretaceous)
Kgu	Granodiorite and tonalite, undivided (mid-Cretaceous)
Kt	Tonalitle, undivided (mid-Cretaceous)
Kgh	Hypabyssal rocks, undivided (mid-Cretaceous)

JURASSIC AND CRETACEOUS METAMORPHOSED AND UNMETAMORPHOSED VOLCANIC AND SEDIMENTARY ROCKS

Mzu	Metamorphosed and unmetamorphosed volcanic and sedimentary rocks, undivided (Mesozoic)

MAP SYMBOLS

2 Strike and Dip of Beds

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QUAIL BRUSH GENERATION PROJECT

FIGURE 4.16-3
GEOLOGY LEGEND

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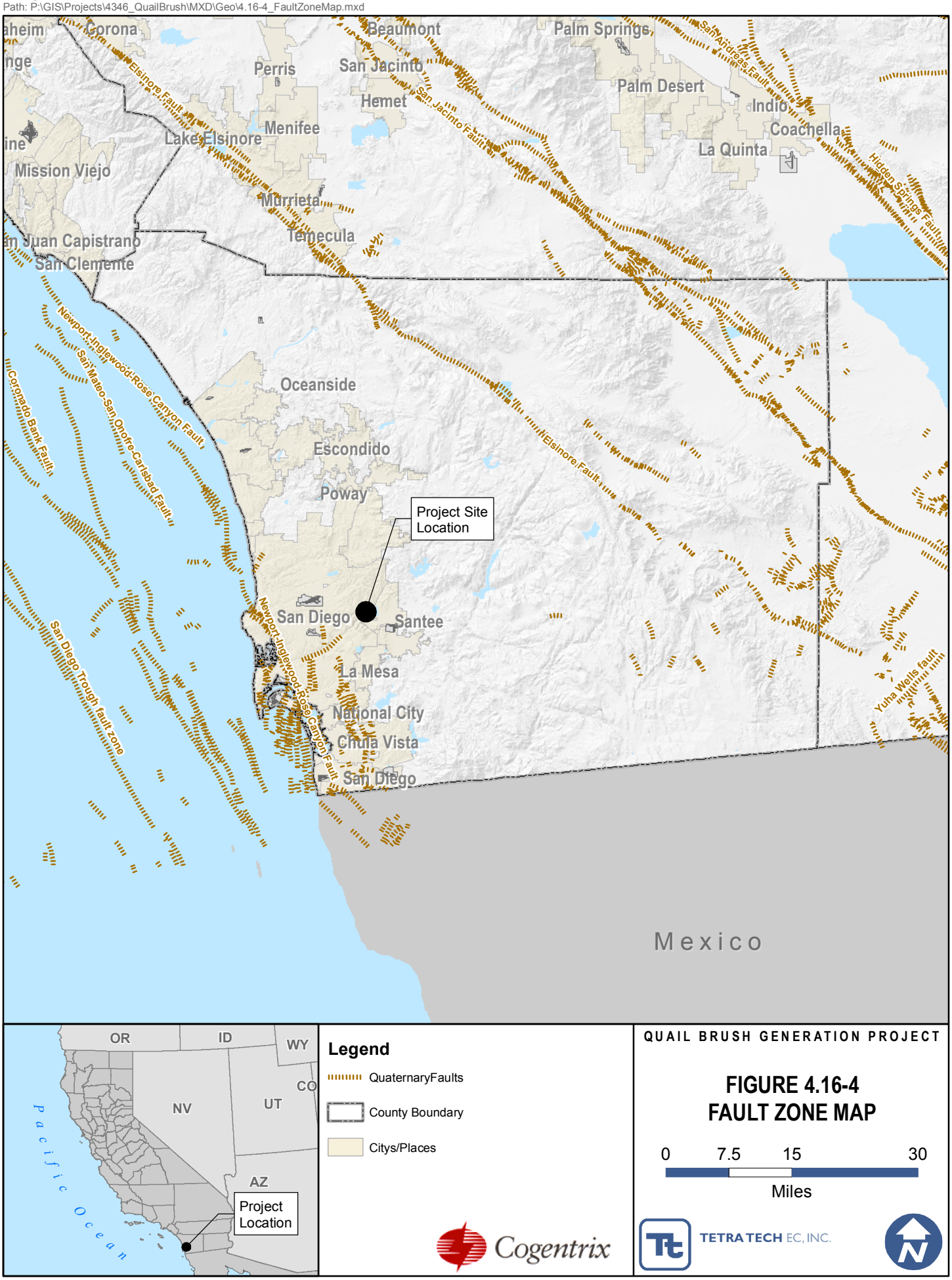

QUAIL BRUSH GENERATION PROJECT

FIGURE 4.16-4
FAULT ZONE MAP

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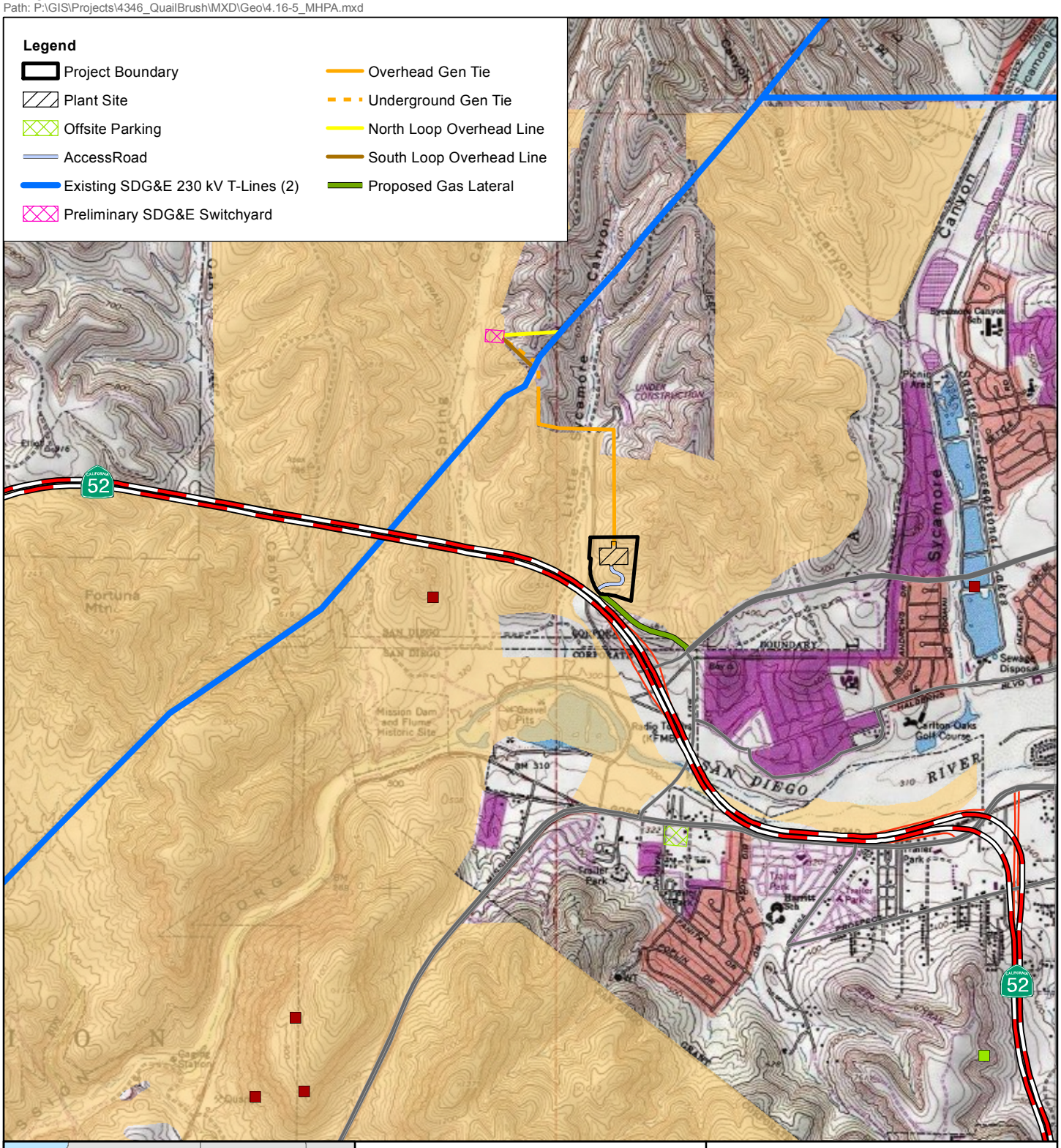

Legend

Multi-Habitat Planning Area (MHPA)

Mineral Resources Data

- Mine, Past or Present Producer
- Prospect or Occurrence
- Unknown

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QUAIL BRUSH GENERATION PROJECT

FIGURE 4.16-5
MINERAL RESOURCE DATA AND MULTI-HABITAT PLANNING AREAS (MHPA)

0 1,350 2,700 5,400
Feet

TETRA TECH EC, INC.

DATA ADEQUACY WORKSHEETS

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. 0 Date ____

Technical Area: **Geological Hazards** Project: ____ Technical Staff: ____

Project Manager: Eric Solorio Docket: ____ Technical Senior: ____

SITING REGULATIONS	INFORMATION	AFC PAGE NUMBER AND SECTION NUMBER	ADEQUATE YES OR NO	INFORMATION REQUIRED TO MAKE AFC CONFORM WITH REGULATIONS
Appendix B (g) (1)	...provide a discussion of the existing site conditions, the expected direct, indirect and cumulative impacts due to the construction, operation and maintenance of the project, the measures proposed to mitigate adverse environmental impacts of the project, the effectiveness of the proposed measures, and any monitoring plans proposed to verify the effectiveness of the mitigation.	4.16.1, 4.16.2		
Appendix B (g) (17) (A)	A summary of the geology, seismicity, and geologic resources of the project site and related facilities, including linear facilities.	4.16.1		
Appendix B (g) (17) (B)	A map at a scale of 1:24,000 and description of all recognized stratigraphic units, geologic structures, and geomorphic features within two (2) miles of the project site and along proposed facilities. Include an analysis of the likelihood of ground rupture, seismic shaking, mass wasting and slope stability, liquefaction, subsidence, tsunami runup, and expansion or collapse of soil structures at the plant site. Describe known geologic hazards along or crossing linear facilities.	4.16.1, Figure 4.16.2		
Appendix B (g) (17) (C)	A map and description of geologic resources of recreational, commercial, or scientific value which may be affected by the project. Include a discussion of the techniques used to identify and evaluate these resources.	4.16.1.6, Figure 4.16.5		

Adequacy Issue: Adequate ____ Inadequate ____

DATA ADEQUACY WORKSHEET

Revision No. 0 Date ____

Technical Area: **Geological Hazards** Project: ____ Technical Staff: ____

Project Manager: Eric Solorio Docket: ____ Technical Senior: ____

SITING REGULATIONS	INFORMATION	AFC PAGE NUMBER AND SECTION NUMBER	ADEQUATE YES OR NO	INFORMATION REQUIRED TO MAKE AFC CONFORM WITH REGULATIONS
Appendix B (i) (1) (A)	Tables which identify laws, regulations, ordinances, standards, adopted local, regional, state, and federal land use plans, leases, and permits applicable to the proposed project, and a discussion of the applicability of, and conformance with each. The table or matrix shall explicitly reference pages in the application wherein conformance, with each law or standard during both construction and operation of the facility is discussed; and	4.16.3		
Appendix B (i) (1) (B)	Tables which identify each agency with jurisdiction to issue applicable permits, leases, and approvals or to enforce identified laws, regulations, standards, and adopted local, regional, state and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the commission to certify sites and related facilities.	4.16.3		
Appendix B (i) (2)	The name, title, phone number, address (required), and email address (if known), of an official who was contacted within each agency, and also provide the name of the official who will serve as a contact person for Commission staff.	4.16.3		
Appendix B (i) (3)	A schedule indicating when permits outside the authority of the commission will be obtained and the steps the applicant has taken or plans to take to obtain such permits.	4.16.4		