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SECTION ACRONYMS/ABBREVIATIONS

ACRONYM/ ABBREVIATION	DEFINITION
AFC	Application for Certification
amsl	Above Mean Sea Level
CBC	California Building Code
CBO	Chief Building Officer
CDMG	California Division of Mines and Geology
CEC	California Energy Commission
CEQA	California Environmental Quality Act
DPLU	San Diego County Department of Planning and Land Use
fbg	Feet Below Grade
LORS	Laws, Ordinances, Regulations and Standards
km	Kilometer
M	Magnitude Moment
MRZ	Mineral Resources Zone
Project	Subject of this AFC, Orange Grove Project
Project Site	Approximately 8.5 acre parcel to be leased for the power plant Site (a.k.a. "Site")
SCEDC	Southern California Earthquake Data Center
Site	Approximately 8.5 acre parcel to be leased for the power plant Site (a.k.a. "Site")
SMARA	Surface Mining and Reclamation Act
SR	State Route
UBC	Uniform Building Code
USGS	United States Geological Survey

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6.3 GEOLOGIC HAZARDS AND RESOURCES

6.3.1 Existing Conditions

The Site is situated on an old alluvial fan with a slope of approximately 10 percent, and surrounded on the east, north and west by moderately steep hillsides comprised of igneous basement rocks. There are no active surface fault traces, slope stability issues, or other particular geologic hazards at the Site. Regionally, important gem minerals, primarily tourmaline, are known to occur but no such resources occur at the Site or would be affected by the Project. The Site is located north of State Route (SR) 76. The south side of SR 76 in the immediate vicinity is a former aggregate mine in the bed of the San Luis Rey River. The aggregate mining facility has closed, and mining and processing equipment have been removed. The Project will not affect the aggregate resource that occurs in the riverbed.

The Project is designed to comply with geotechnical standards and other laws, ordinances, regulations and standards (LORS), and to minimize impacts on the environment. As described in this section, no geologic conditions occur that could result in significant impacts.

A geotechnical investigation (Appendix 6.3-A) conducted on the property for the construction of the Pala substation adjacent to the Site did not identify any geologic hazards in the immediate area other than ground shaking. Additional Project-specific geologic evaluations were conducted for this Application for Certification (AFC) including review of published literature, maps, aerial photographs, and other available information, and field reconnaissance.

6.3.1.1 Regional Geology

The Project occurs within the Peninsular Ranges geomorphic province of California (Figure 6.3-1). The Peninsular Ranges province occupies the southwestern corner of the State and is characterized by a relatively narrow coastal plain on the west, and rugged mountains with steep-walled narrow valleys inland. The Peninsular Ranges province shares a similar history with the Sierra Nevada province. Prior to the middle of the Mesozoic era (about 180 million years before present), the region was covered by seas and thick marine sedimentary and volcanic sequences were deposited. During the Cretaceous period (138 to 63 million years before present), extensive mountain building occurred during the emplacement of the Southern California batholith. Multiple pulses of intrusive activity resulted in compositional variations in the intrusive rocks. The present-day mountain ranges were faulted and uplifted during the late Tertiary and Quaternary (5 million years before present to current time) (Sutch & Dirth, 2003).

The Peninsular Ranges contain minor Jurassic rocks and extensive Cretaceous igneous rocks associated with Nevadan plutonism. In the Project region, Cretaceous and Jurassic igneous rocks are gabbro, tonalite, diorite, granodiorite and monzogranite. Metavolcanic and metasedimentary assemblages also occur. In the Project region, the Cretaceous and Jurassic igneous rocks are unconformably overlain by Quaternary alluvium (Norris & Webb, 1990; CDMG, 1977, 2000a and 2000b).

The Project region is known for pegmatite dikes that yield quartz, feldspar, mica, and lithium rich minerals. The network of dikes was created by hot watery solutions associated with the Nevadan plutonism. The solutions invaded joints and zones of weakness in wall rocks, crosscutting older formations and in some cases granitic parent rocks (Norris & Webb, 1990). The lithium rich pegmatite dikes are known for the valued gemstones, such as tourmaline, kunzite, garnet, beryl and topaz. Well-known gem localities occur near Pala, Mesa Grande, Rincon, and Ramona. The closest of these localities is approximately 1.5 miles north of Pala. These localities are far beyond the influence of the Project and will not be impacted.

6.3.1.2 Local Geology

The Site and Project linear facilities are within the Pala and Bonsall 7.5 minute United States Geological Survey (USGS) quadrangles (Figures 6.3-2 through 6.3-5). The reclaim and fresh water pickup stations are located within the Morro Hill and Temecula 7.5 minute USGS quadrangles. Geologic maps for portions of the Morro Hill and Temecula 7.5 minute USGS quadrangles are provided in Appendix 6.3-B, as well as for the Pechanga quadrangle.

The mountain slopes east, north and west of the Site are comprised of igneous gabbro and tonalite basement rock units (Figure 6.3-2). Locally, the only geologic units overlying basement rock are Quaternary alluvial and colluvial deposits. The Quaternary deposits are further classified as:

- "very old" alluvial and colluvial lithologies deposited during the early portion of the Pleistocene epoch (2 million years to 500,000 years before present);
- "older" alluvial and colluvial lithologies deposited during the late portion of the Pleistocene epoch (500,000 to 10,000 years before present);
- "young" alluvial and colluvial lithologies deposited during the Holocene epoch (10,000 years before present to modern time) or late Pleistocene; and
- Late Holocene age "active" alluvial deposits in active washes and streams, and young alluvial fans and flood plains.

The Site occurs on an old alluvial fan and surface deposits are mapped as "very old" alluvial fan deposits. These are among the oldest geologic units in the area except for basement rock. This is important because the very old alluvium has had geologic time to consolidate and lithify into a bedrock-type material. It is described as being "mostly very well-indurated" reddish-brown sand and cobbles (CDMG, 2000a). It is generally not thought of as water bearing (Moreland, 1974; San Luis Rey Municipal Water District, 2006).

The "very old" and "older" alluvial deposits underlie the young and active alluvial deposits that occur south of the Site, on the south side of SR 76, in the San Luis Rey River bed and flood plain. In the Project vicinity, the thickness of the Quaternary alluvium in the San Luis Rey River bed is more than 100 feet (Moreland, 1974; San Luis Rey Municipal Water District, 2006).

The northeast end of the gas pipeline traverses mountainous terrain comprised of igneous gabbro and tonalite basement rocks on the north side of SR 76. The remainder of the Project gas pipeline route is in relatively flat terrain with surface geologic material mapped as late Holocene alluvial deposits.

Both fresh water pickup stations are located in areas with surface geologic materials mapped as Cretaceous igneous basement rock.

6.3.1.3 Tectonic Framework

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 facilities. The Project area occurs between two major active northwest-trending fault zones: the Elsinore Fault Zone located about 8 kilometers (km) northeast of the Site, and the Inglewood/Rose Canyon Fault Zone located about 45 km to southwest of the Site. 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.

There are no known active faults closer to the Site than the Elsinore Fault zone to the east and the Inglewood/Rose Canyon Fault Zone to the southwest. Therefore, while there is potential for ground-shaking to occur at the Site and Project facilities during the life of the Project, there is no indication that ground rupture could occur in the immediate vicinity of the Site or any of the Project facilities.

6.3.1.4 Seismicity

Estimated locations of earthquakes of Magnitude Moment (M) 6.0 or greater during historic time within a 100-km radius of the Site are shown in Figure 6.3-6, and the earthquakes are summarized in Table 6.3-1. Table 6.3-2 identifies the key characteristics of active fault zones within a 100-km radius of the Site. The active fault zones within a 100-km radius are the Elsinore, San Jacinto, Newport-Inglewood-Rose Canyon, Coronado Bank-Palos Verde Hills, San Andreas and San Diego Trough Fault Zones. The San Andreas, San Jacinto and Elsinore Fault Zones are known to have had surface displacement in historic time within 100 km of the Site.

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Table 6.3-1 – Historical Earthquakes of Magnitude 6.0 and Greater (within 100 km radius)

EVENT	DATE	MAGNI-TUDE	APPROXIMATE LOCATION	DISTANCE FROM SITE (KM)	ASSOCIATED FAULT OR STRUCTURE
1	May 15, 1910	6	Northwest of Lake Elsinore about 15 miles (24 km) south of Riverside (33° 45' N, 117° 27' W)	70	Elsinore fault zone, Coyote Mountain Section
2	December 25, 1899	6.5	Approximately 16 km (10 miles) southeast of San Jacinto about 115 km (72 miles) ESE of Los Angeles (near 33° 40' N, 116° 50' W)	57	San Jacinto fault zone, Coyote Creek section
3	March 25, 1937	6	32 km (20 miles) south of Indio about 96 km (60 miles) northeast of San Diego (33° 24.5' N, 116° 16' W)	90	San Jacinto fault zone, Coyote Creek section
4	April 8, 1968	6.5	1 mile north of Ocotillo Wells about 64 km (40 miles) south of Indio (33° 09' N, 116° 07.5' W)	95	San Jacinto fault zone, Coyote Creek section
5	April 21, 1918	6.8	Near the town of San Jacinto about 112 km (70 miles) ESE of Los Angeles (33° 45' N, 116° 53' W)	60	San Jacinto fault zone, Coyote Creek section
6	October 21, 1942	6.6	About 45 km (28 miles) west of Brawley about 95 km (60 miles) east of San Diego (32° 58' N, 116° 00' W)	103	San Jacinto fault zone, Coyote Creek section
7	March 19, 1954	6.4	24 km (15 miles) west of Salton City about 48 (33° 17' N, 116° 11' W)	98	San Jacinto fault zone, Coyote Creek section
8	July 22, 1923	6.3	11 km (7 miles) south of San Bernardino about 88 km (55 miles) east of Los Angeles (34° 00' N, 117° 15' W)	80	San Jacinto fault zone, Coyote Creek section

Source: SCEDC, 2006.

Table 6.3-2 – Major Earthquake Fault Zones (within 100 km radius)

ASSOCIATED FAULT OR STRUCTURE	APPROXIMATE DISTANCE FROM THE SITE (KM)	LENGTH (KM)	FAULT TYPE	DIP ANGLE	SLIP RATE
Elsinore fault zone (Temecula section)	8	43	Right Lateral Strike Slip	90 (vertical)	5 mm/yr
San Jacinto fault zone (Anza section)	53	91	Right Lateral Strike Slip	90 (vertical)	12 mm/yr
Rose Canyon fault zone	45	70	Right Lateral Strike Slip	90 (vertical)	1.5 mm/yr
Coronado Bank Fault Zone	76	185	Right Lateral Strike Slip	90 (vertical)	3 mm/yr
San Andreas (San Bernardino Section)	79	103	Right Lateral Strike Slip	90 (vertical)	24 mm/yr
San Diego Trough Fault Zone	93	150	Right Lateral Strike Slip	NA	1.5 mm/yr

Source: CGSC 2007, San Diego Trough Fault Zone parameters taken from UGSG Earthquake Hazards Program, 2006, Quaternary fault and fold database for the United States, 3-28-2007, accessed at http//earthquakes.usgs.gov/regional/qfaults/.

6.3.1.5 Geologic Hazards

The following sections address geologic hazards. Surface water conditions and flood zone classification are discussed in Section 6.5, Water Resources.

6.3.1.5.1 Ground Rupture

There are no known active faults that intersect the ground surface in the vicinity of the Site or any of the Project facilities. The closest active fault to any of the Project facilities is the Elsinore Fault Zone located approximately 8 km east of the Site. Consequently, surface fault rupture is not a hazard to the Project.

6.3.1.5.2 Ground Shaking

The Project area, like most of California, is located in a seismically active region. Therefore, there is potential for regional earthquakes and ground shaking in the Project area during the Project lifetime.

Considering active faults throughout the California, the California Geological Survey has published a model of estimated probabilistic ground accelerations for California (http://www.consrv.ca.gov/CGS/rghm/pshamap/pshamain.html). Based on the California Geologic Survey seismic hazard analysis model, the estimated peak ground acceleration at the Site location with a 90 percent probability of not being exceeded in 50 years is 0.48 g, where "g" is the acceleration due to gravity (see Appendix 6.3-C). This value is based on near-surface geologic materials beneath the site consisting of "soft rock," considering the indurated characteristic of the "very old" alluvium. The 0.48 g peak ground acceleration has a 1 in 475 probability of occurrence each year. As shown in Appendix 6.3-C, estimated peak ground accelerations in the area become lower moving westward from the Site, so the accelerations that would be expected at the water pickup locations for the Project would be close to the same or less than identified herein for the Site.

The Project facilities are located within California Building Code (CBC) Seismic Zone 4. The CBC will require that Project structures be designed with adequate strength to withstand the lateral dynamic displacements induced by the Design Basis Ground Motion, which the CBC defines as the earthquake ground motion that has a 10 percent chance of being exceeded in 50 years.

6.3.1.5.3 Tsunami/Seiche

No large water bodies are located nearby that present a hazard of tsunami or seiche. Consequently, tsunami or seiche is not a hazard to the Project.

6.3.1.5.4 Mass Wasting and Slope Stability

The Site is situated at 400 feet above mean sea level (amsl) on an old alluvial fan surface surrounded by moderately steep hillsides on the north, east and west. The "very old" alluvium comprising the shallow geologic materials is indurated and the slope of the fan is approximately 10 degrees. With the low slope angle and the indurated nature of the geologic materials, the Site is not prone to mass wasting or slope instability. The moderately steep basement rock slopes that occur in the mountains east, north and west of the Site, and along the mountainous portion of the gas pipeline route, are composed of crystalline gabbro and tonalite rocks and a small area of metavolcanic rock (USGS, 2000). The crystalline basement rock most resistant to weathering appears as outcroppings and boulders in the hillsides and the rock least resistant to weathering has decomposed to thin veneer of reddish brown soil. These rocks have a high shear strength and are not exceptionally prone to substantial slope instability.

The most common cause of debris flows is the combination of heavy rainfall, steep slopes, and loose soil. The potential for a debris flow to affect the Site or Project facilities is minimal due to the geologic composition of the hillside (crystalline rock), consolidated rocky soil horizons, and small drainage basins and surface area.

6.3.1.5.5 Liquefaction

Liquefaction is the loss of soil shear strength due to increased pore water pressure from ground shaking generated during earthquakes. The liquefaction potential at a given site is dependant on earthquake sources, soil type, soil density and depth to groundwater.

The two primary conditions required for liquefaction potential are:

- Presence of low density poorly graded silt and sand.
- Shallow groundwater within 30 to 50 feet below the ground surface.

A geotechnical investigation for the Pala Substation was conducted in January 1994. The substation is located approximately 400 feet west of the Site. Twenty three soil borings and 12 exploratory trenches were advanced during the geotechnical investigation. Boring depths ranged to 39.5 feet below grade (fbg). No groundwater was encountered in any of the borings or trenches. Refusal occurred due to large cobble or crystalline basement rock in each of the soil borings at depths ranging from 2 to 39.5 fbg. Due to the relative high density soils encountered during the geotechnical investigation and lack of groundwater, the potential for liquefaction is not likely to occur at the Site (GeoCon, 1994). Similarly, both the fresh water pickup station and the reclaim water pickup station are located on igneous basement rock, which is not susceptible to liquefaction.

A report dated December 2007 is included in Appendix 6.3-A for a geotechnical investigation completed for the power plant. The investigation focused on the 8.5-acre Site and the adjacent area to the south and included 14 borings with depths to 40 feet. No groundwater was encountered in any of the borings. The geologic materials overall were characterized as 12 to 18 inches of topsoil over fanglomerate consisting of firm to hard sandy lean clay with gravel and rocks to soft weathered claystone and sandstone. The investigation concluded that liquefaction is not a significant hazard for this Site.

A portion of the gas pipeline route traverses late Holocene alluvium on the valley floor. These alluvial deposits are mapped as consisting primarily of sand and gravel. Sediments in these alluvial deposits were evaluated and tested for liquefaction potential as part of environmental evaluations for the nearby Gregory Canyon Landfill project. These evaluations included soil sampling from depths of 55 fbg from four geotechnical borings. Testing showed that the alluvial materials are not particularly susceptible to liquefaction (County of San Diego, 2002). Selected excerpts from that study are provided in Appendix 6.3-D.

6.3.1.5.6 Subsidence

Soils beneath the Site are relatively well consolidated and contain sufficient fines to bind framework grains, thus preventing substantial settlement and subsidence. The Project does not propose groundwater withdrawal and, therefore, does not have the potential to result in subsidence. Subsidence is not a consideration for this Project due to the dense underlying crystalline basement rock and lack of significant groundwater.

6.3.1.5.7 Expansive Soils

While Soil Conservation Service descriptions indicate that soils at the Site may be expansive, soil borings advanced at the adjacent substation (Appendix 6.3-A) primarily identified silty sand in the subsurface soils. The silty sand was composed of fine to coarse-grained sand with some angular gravel and cobble. Occasional thin, discontinuous clay or sandy clay lenses were encountered in near surface soil from 1 to 8 fbg. Borings completed for the power plant identified lean clay that is not high plasticity. Based on the results of borings, it does not appear that soils have a high enough expansive clay content to require special engineering measures.

6.3.1.6 Geologic Resources

There are no geologic resources of recreational or scientific value known to occur at the Site or close enough to any Project facilities to be impacted by the Project. This determination is made based on literature research, review of the County General Plan, review of mineral resource evaluations published by the State, and evaluation of the Site and Project facility locations by a California Professional Geologist. There are no unique geologic features or exposures that could be of recreational or scientific value that would be impacted by Project implementation.

Aggregate within the San Luis Rey River bed represents a potentially important mineral resource and has been mined in the past. The San Luis Rey River bed is mapped as a Mineral Resources Zone (MRZ) 2 (under the State Surface Mining and Reclamation Act (SMARA) resource mapping program (California Division of Mines and Geology, 1996). The Project will not impact this resource. The limits of the MRZ-2 area are shown in Figure 6.3-7.

Granite Construction has recently obtained permits to construct and operate Rosemary's Mountain Quarry on the north side of SR 76 approximately 1.7 (air) miles southwest of the Site. The location is shown in Figure 6.3-7. The Orange Grove Project will have no impact on the commercial viability or operation of this facility.

As described in Section 6.3.1.1, the region is known for a number of locales that have important gem mines. None of these locales are located close enough to the Site to be affected by the Project. The closest of these locales is approximately 1.5 miles north of Pala. While the closest location is well outside of the area of the Project's potential impacts for geologic resources, it is included in this description for completeness.

6.3.2 Impacts

Significance criteria were determined based on California Environmental Quality Act (CEQA) Guidelines, Appendix G, Environmental Checklist Form and on performance standards or thresholds adopted by responsible agencies. An impact may be considered significant if the Project results in:

- Severe damage or destruction to one or more project components as a direct consequence of a geologic event.
- Release of toxic or other damaging material into the environment as a result of a geologic event.
- Exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving:
    - Rupture of a known earthquake fault.
    - Strong seismic ground shaking.
    - Seismic-related ground failure, including liquefaction.
    - Inundation by seiche, tsunami or mudflow.
    - Landslides.
    - Flooding.
    - Loss of a unique geologic feature.
- Loss of availability of a known mineral resource classified MRZ-2 by the state geologist and of value to the region and residents of the state.
- Loss of availability of a locally important mineral resource recovery site.

6.3.2.1 Construction Impacts

There are no foreseeable geologic hazards that could impact construction. The Site and Project facilities are located in stable areas. Given the short period of construction the probability of substantial ground shaking or other hazard is low. No impact to construction is expected.

The Site and most Project facilities are located in areas that are above the 100-year flood zone except for the western portion of the gas pipeline that occurs in the area mapped as late Holocene alluvium on Figures 6.3-2 through 6.3-5. (A map of the 100-year flood zone is provided in Section 6.5, Water Resources.) Construction of the western portion of the gas pipeline will be within the 100-year flood zone but is not expected to be affected by flooding because pipeline construction will occur on ground that is elevated compared to the river channel. The extreme flood conditions required to inundate the construction area occur infrequently. Construction within the 100-year flood zone will not occur if flooding is present or imminent. When construction is complete, the pipeline will be underground and will not be affected by flooding or affect flood flows. Considering these factors, no impact related to flooding is expected for construction of any of the Project facilities.

As described in Section 6.3.1, ground surface rupture, tsunami, seiche, slope instability and liquefaction do not pose a hazard to the Project, and there are no geologic resources of recreational or scientific value known to occur in areas that would be disturbed by the Project. The geologic resource of Rosemary's Mountain Quarry and the gem locales of the region will not be impacted by the Project.

The gas pipeline is the only Project feature that will affect the designated MRZ-2 aggregate resource area in the San Luis Rey River bed. The western portion of the pipeline that occurs within the late Holocene alluvium is within the MRZ-2 area. At this time, there are no known mineral recovery proposals planned for the portion of the MRZ-2 area where the pipeline occurs. Where the pipeline is within the MRZ-2 area, most of the route is on private property owned by Gregory Canyon, Ltd. and is planned for use as wildlife habitat restoration as further described in Section 6.6, Biological Resources. In the unforeseen event that mining is proposed in the future where the gas pipeline is located, the pipeline could be relocated around the mining area. Therefore, the pipeline will not substantially hinder potential future utilization of the MRZ-2 resources. Since the Project will not result in a loss of the availability of the MRZ-2 resource, the impact will be less than significant.

A detailed geotechnical investigation will be completed for the gas pipeline route prior to construction. Investigations will focus on soil engineering characteristics. Geotechnical investigation within the late Holocene alluvium unit along the pipeline route will include evaluations to confirm that conditions susceptible to liquefaction do not occur. If needed, the pipeline would be weighted (e.g., cased in concrete) to prevent the potential for "floating" in the event of strong regional ground shaking.

Cut and fill slopes at the Site will be constructed to be stable with appropriate factors of safety for static and seismic conditions. Final grading plans and geotechnical data will be provided to the Chief Building Officer (CBO) and the County in association with the grading plan review process.

Project clearing and grading will be designed to conform to the CBC, Uniform Building Code (UBC) and County ordinances.

6.3.2.2 Operations and Maintenance-Related Impacts

The Site is located in a seismically active region of California. Consequently, there is reasonable likelihood of ground shaking at Project facilities within the lifetime of the Project. As described in Section 6.3.1.5, the CBC will require that structures be designed with adequate strength to withstand earthquake ground motion that has a 10 percent chance of being exceeded in 50 years, which is longer than the anticipated life of the Project. The likelihood of the Design Basis Ground Motion being exceeded during the life of the Project is low. Foundations and structures will be designed and constructed to limit ground shaking impacts to a level that is less than significant.

No other geologic hazards have a significant likelihood of affecting the Project. As described in Section 6.3.1, there is no indication that any Project facility could be affected by ground surface rupture, tsunami, seiche, slope instability or other mass wasting, or liquefaction. The gas pipeline will be buried a minimum of 3.0 fbg and isolation valves and the meter station exposed on the ground surface will be designed such that they would not be adversely impacted in the event that they are inundated by flooding, and they will not materially affect flood hydrology. The gas pipeline is located far from the active San Luis River Channel on the edge of the flood plain where flood plain sediments are most stable against reclamation by flood flows. At the only location where the pipeline will be close to the active river channel there is an engineered riprap embankment stabilizing the channel bank. No impacts related to geologic hazards are anticipated.

There will be no operations impacts to geologic resources. No unique geologic resources or geologic resources of recreational or scientific value will be impacted by the Project. Project operations will not conflict with or otherwise impact mineral resource recovery operations at Rosemary's Mountain Quarry. The west end of the gas pipeline will be present within the MRZ-2 area, but as described in Section 6.3.2.1, it will not substantially hinder potential future utilization of the MRZ-2 resources. Since the Project will not result in a loss of the availability of the MRZ-2 resource, the impact will be less than significant.

Power plant operations will not be incompatible with mining in the MRZ-2 area if future mining is proposed. The MRZ-2 area is located south of SR 76 and the power plant site is located approximately 0.1 mile north of SR 76. The power plant would not be a sensitive receptor for noise that might be generated by future mining operations. Such operations would meet required to meet County noise ordinances so they would not generate levels of noise that could be adverse to power plant operations. No conflict would occur.

6.3.2.3 Cumulative Impacts

The Project will not have the potential for cumulative impacts to geologic or mineral resources. The only impact identified is the location of the gas pipeline within the MRZ-2 area. In the event that mineral recovery is ever proposed at the location of the gas pipeline, the pipeline could be relocated. Consequently, there would be no geologic resource cumulative impacts.

6.3.2.4 Project Design Features

The following design and/or operational features of the Project avoid potentially significant environmental impacts and have been incorporated into the Project:

A geotechnical investigation has been conducted for the plant site (see Appendix 6.3-A) and relevant information from the investigation has been incorporated in grading, foundations, and seismic design for the Project. Grading plans and geotechnical data will be provided to the CBO and the County as part of plan review. An additional geotechnical investigation will be conducted for the gas pipeline route and will be provided to the CBO and the County.

The Project will be designed and constructed in accordance with the CBC and other relevant LORS.

6.3.3 Mitigation Measures

Based on the above analysis of impacts, Project design features, and LORS that apply to geotechnical Project design, no mitigation measures are required.

6.3.4 Significant Unavoidable Adverse Impacts

There are no significant unavoidable adverse impacts from geologic hazards or to geologic resources from the construction or operations of the Project.

6.3.5 Laws, Ordinances, Regulations and Standards

LORS related to geologic hazards and resources are identified in Table 6.3-3 along with names of the administering agencies and the Project's approach to compliance. The Project will comply with applicable LORS during project construction and operation.

The Site is not located within an Alquist-Priolo Special Studies Zone. Therefore, no site-specific fault studies are required. The Project will comply with applicable building codes to address power plant foundation and seismic structural design.

If not for the exclusive authority of the California Energy Commission (CEC) to certify sites and related facilities, a grading permit would be required by the County Department of Planning and Land Use (DPLU), and the DPLU would be the administering agency for conformance with the UBC and CBC. Contact information for DPLU is provided in Table 6.3-4. The Applicant is coordinating the Project with the County and anticipates applying for and receiving a grading permit.

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Table 6.3-3 – Geologic Hazards and Resources LORS and Compliance

JURIS-DICTION	AUTHORITY[1]	AGENCY	REQUIREMENTS	COMPLIANCE	AFC SECTIONS AND PAGES
Federal	None applicable.	None applicable.	None applicable.	None applicable.	None Applicable
State	CBC and UBC Chapter 33.	DPLU	Control excavation, grading and construction to safeguard life and property.	CBO will review grading and building plans for compliance with these requirements.	6.3.2.1, 6.3.5 Pages 6.3-8 to 6.3-9, 6.3-11 to 6.3-12
Local	San Diego County Code of Regulatory Ordinances, Title 8, Division 7 – Excavation and Grading, Clearing and Watercourses	DPLU	Establishes need for grading permit and requirements for clearing and grading.	CBO will review grading plans for compliance with these requirements.	6.3.2.1, 6.3.5 Pages 6.3-8 to 6.3-9, 6.3-11 to 6.3-12
Industry	None applicable.	None applicable.	None applicable.	None applicable.	None Applicable

Table 6.3-4 – Agency Contacts for Geologic Hazards and Resources

AGENCY	AUTHORITY
County of San Diego Department of Planning and Land Use 5201 Ruffin Road, Suite B San Diego, California 92123 J. Ramaiya (858) 694-2960	Compliance with UBC, CBC and County ordinances.

6.3.6 REFERENCES

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1 Pursuant to 20 CCR Chapter 5 Appendix B Section (i)(1)(B): Each agency with jurisdiction to issue applicable permits and approvals or to enforce identified LORS and adopted local, regional and federal land use plans, and agencies which would have permit approval or enforcement authority, but for the exclusive authority of the CEC to certify sites and related facilities.

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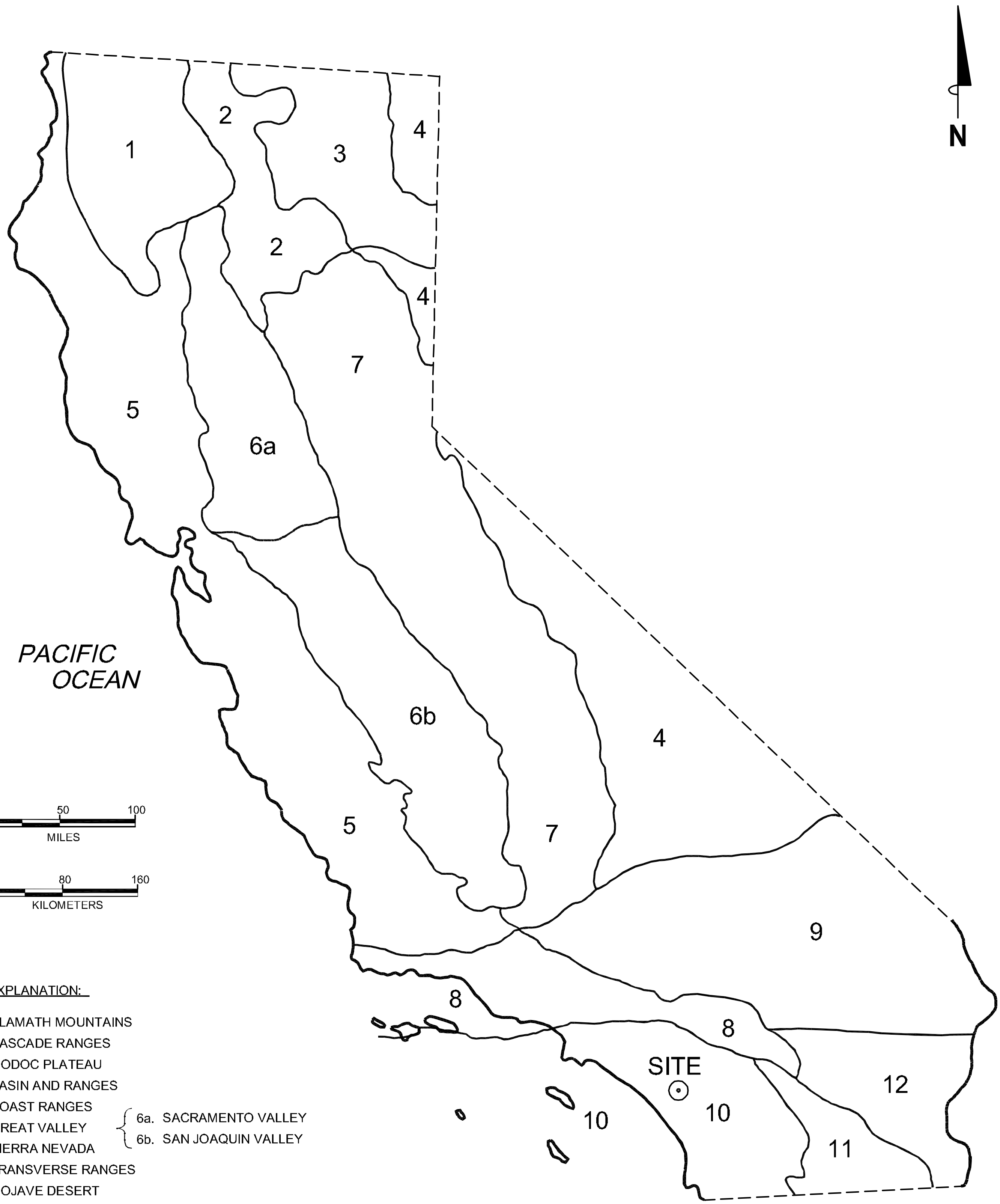
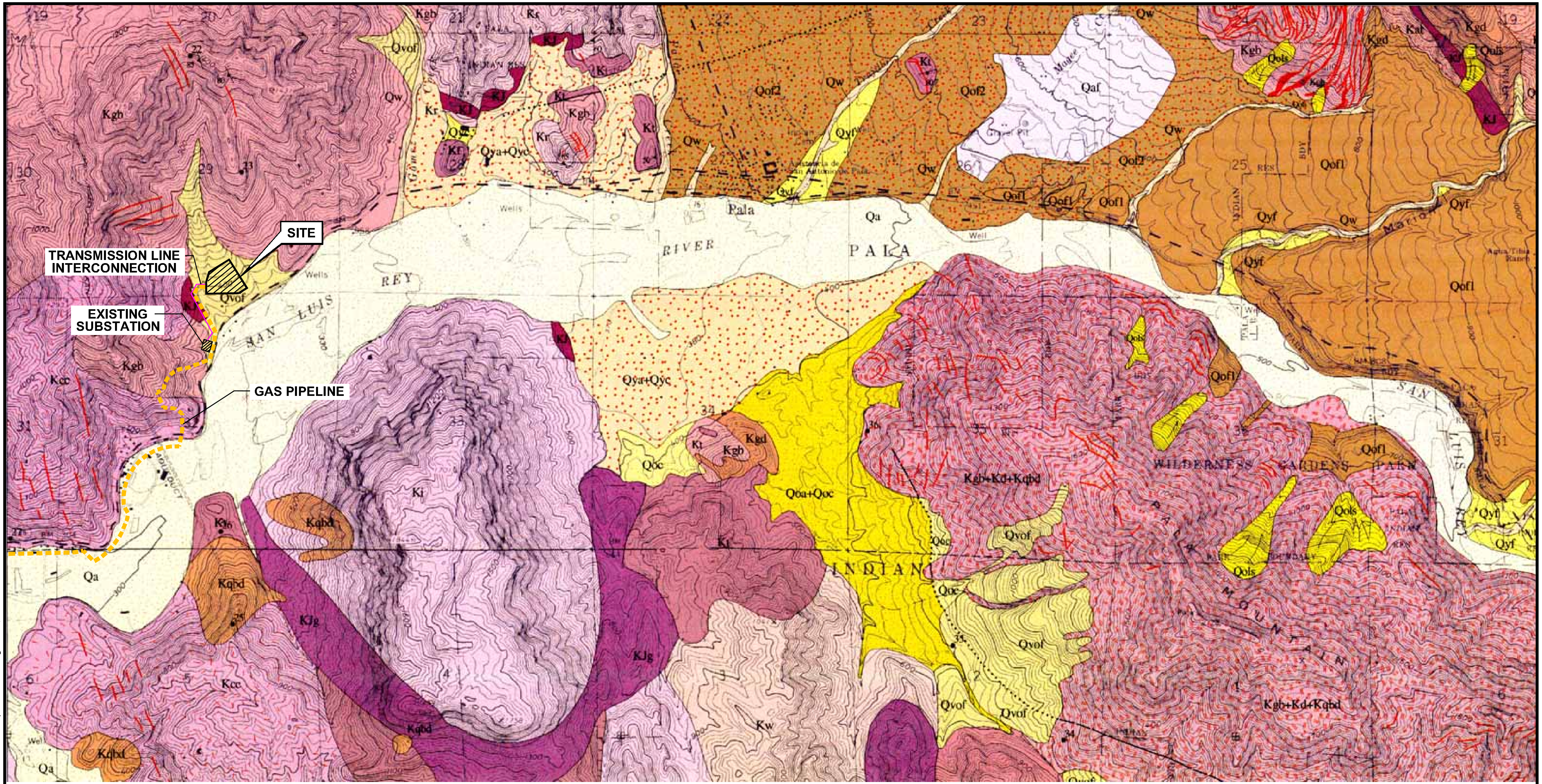


EXPLANATION:

1. KLAMATH MOUNTAINS
2. CASCADE RANGES
3. MODOC PLATEAU
4. BASIN AND RANGES
5. COAST RANGES
6. GREAT VALLEY { 6a. SACRAMENTO VALLEY; 6b. SAN JOAQUIN VALLEY }
7. SIERRA NEVADA
8. TRANSVERSE RANGES
9. MOJAVE DESERT
10. PENINSULAR RANGES
11. SALTON TROUGH
12. COLORADO DESERT

TRC	PROJECT: 125158	GEOMORPHIC PROVINCES OF CALIFORNIA
	FACILITY: ORANGE GROVE PROJECT SAN DIEGO COUNTY, CALIFORNIA	FIGURE 6.3-1

MS=1:1 L:Graphics\ProjectsByNumber\29-xxxx\29-0319\290319 Geomorphic Provinces.dwg Jun 02, 2008 - 2:23pm aakers



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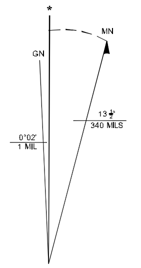
SOURCE:

United States Geological Survey
7.5 Minute Topographic Map:
Pala Quadrangle

Polyconic projection, contour interval 20 feet, dotted lines 10 feet.



UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF STREET

0 1/4 1/2 3/4 1 MILE

SCALE 1:24,000

TRC

This geologic map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, STATEMAP Award no. 99HQAG0134.

PROJECT: 29031902

FACILITY:

ORANGE GROVE PROJECT
SAN DIEGO COUNTY, CALIFORNIA

GEOLOGIC MAP
PALA QUADRANGLE

FIGURE 6.3-2

USGS
science for a changing world

DEPARTMENT OF CONSERVATION
Division of Mines and Geology

GEOLOGIC MAP OF THE PALA 7.5' QUADRANGLE SAN DIEGO COUNTY, CALIFORNIA: A DIGITAL DATABASE

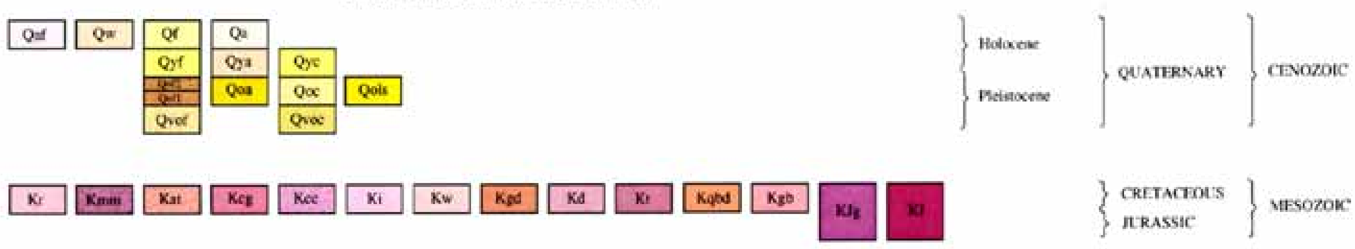
VERSION 1.0

By
Michael P. Kennedy[1]

Digital Database
by
Brad L.Nelson[2] and Rachel M. Hauser[2]
2000

1. California Division of Mines and Geology, Los Angeles, CA
2. U. S. Geological Survey, Riverside, CA

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

MODERN SURFICIAL DEPOSITS - Sediment that has been recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes and in artificial fills. Soil-profile development is non-existant. Includes:

Qaf — Man made "artificial cut and fill".

Qw — Active channel and wash deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand and gravel deposits in active washes of streams.

Qf — Active alluvial fan deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand, gravel, cobble and boulder deposits in active alluvial fans.

Qa — Active alluvial flood plain deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand and gravel deposits in active alluvial flood plains.

YOUNG SURFICIAL DEPOSITS - Sedimentary units that are slightly consolidated to cemented and slightly to moderately dissected. Alluvial fan deposits typically have high coarse:fine clast ratios. Younger surficial units have upper surfaces that are capped by slight to moderately developed soil profiles. Includes:

Qya — Young alluvial flood plain deposits (Holocene and late Pleistocene) - Mostly unconsolidated, poorly sorted, permeable flood plain sediment.

Qyc — Young colluvial deposits (Holocene and late Pleistocene) - Mostly poorly consolidated and poorly sorted slope wash and stream deposits.

Qyf — Young alluvial fan deposits (Holocene and late Pleistocene) - Mostly poorly consolidated and very poorly sorted sand, gravel, cobble and boulder deposits in young alluvial fans.

OLD SURFICIAL DEPOSITS - Sedimentary units that are moderately consolidated and slightly to moderately well dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed soils. Includes:

Qoa — Older alluvial flood plain deposits (Pleistocene, younger than 500,000 years) - Mostly moderately well consolidated, poorly sorted, permeable flood plain deposits.

Qoc — Older colluvial deposits (Pleistocene, younger than 500,000 years) - Mostly moderately well consolidated, poorly sorted slope wash and stream deposits.

Qof2 — Older fan deposits (Pleistocene, younger than 500,000 years) - Mostly poorly consolidated fan, debris flow and talus deposits. Clasts possess a moderately well developed clay coating but are otherwise fresh.

Qof1 — Older fan deposits (Pleistocene, younger than 500,000 years but older than Qof2 deposits) - Mostly poorly consolidated fan, debris flow and talus deposits. Clasts are distinctly deeply weathered and the matrix distinctly reddish brown in color.

Qols — Older landslide deposits (Holocene to Pleistocene) - Landslide slump and rock fall deposits.

VERY OLD SURFICIAL DEPOSITS - Sediments that are slightly to well consolidated to indurated, and moderately to well dissected. Upper surfaces are capped by moderate to well developed pedogenic soils. Includes:

Qvoc — Very old colluvial deposits (early Pleistocene) - Mostly well-indurated, clay and sand deposits that mantle early Pleistocene uplifted depressions.

Qvof — Very old alluvial fan deposits (early Pleistocene) - Mostly very well indurated, reddish-brown, sand and cobble, early Pleistocene alluvial fan deposits.

BEDROCK UNITS

Kr — Granodiorite of Rainbow (Cretaceous) - Leucocratic hornblende-biotite granodiorite; medium to coarse grained, massive.

Kmm — Monzogranite of Merriam Mountain (Cretaceous) - Leucocratic hornblende-biotite monzogranite; medium to coarse grained, massive.

Kat — Gabbro of the Agua Tibia Mountains (Cretaceous) - Hornblende gabbro; medium to coarse grained, massive to foliate. This gabbro often contains minor biotite and quartz (quartz bearing gabbro).

Kcg — Tonalite of Cole Grade (Cretaceous) - Hornblende-biotite tonalite; coarse grained and massive.

Kcc — Tonalite of Couser Canyon (Cretaceous) - Hornblende-biotite tonalite; coarse grained and massive. Contains some granodiorite and is characterized by an abundance of pegmatitic dikes.

Ki — Granodiorite of Indian Mountain (Cretaceous) - Biotite leucocratic granodiorite; white, fine to medium grained and massive.

Kw — Gabbro of Weaver Mountain (Cretaceous) - Hornblende gabbro; coarse grained and massive.

Kgd — Granodiorite undivided (Cretaceous) - Mostly hornblende-biotite granodiorite; coarse to medium grained.

Kd — Diorite undivided (Cretaceous) - Mostly hornblende diorite; medium to coarse grained, dark gray, massive.

Kt — Tonalite undivided (Cretaceous) - Mostly hornblende-biotite tonalite; coarse grained, light gray.

Kqbd — Quartz bearing diorite undivided (Cretaceous) - Mostly biotite-hornblende quartz bearing diorite; medium grained, dark gray, massive.

Kgb — Gabbro undivided (Cretaceous) - Mostly biotite-hornblende-hypersthene gabbro; coarse grained, dark gray, massive.

KJg — Metagranitic rocks (Cretaceous and Jurassic) - Mostly gneiss; very light gray to white, massive.

KJ — Metavolcanic and metasedimentary rocks undivided (Cretaceous and Jurassic) - Low grade (greenschist facies) rocks that are in part coeval with and in part older than the Cretaceous plutonic rocks they lie in contact with.

MAP SYMBOLS

Contact between map units.

Fault - dashed where inferred, dotted where concealed.

Strike and dip of foliation.

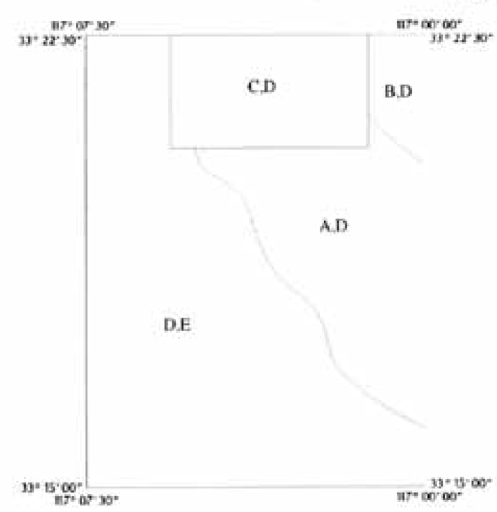
Landslide - arrows indicate principal direction of movement.

Air photo lineament - Mostly joints and minor folds.

Pegmatite dike.

Location of samples collected for thin section analysis

REFERENCES



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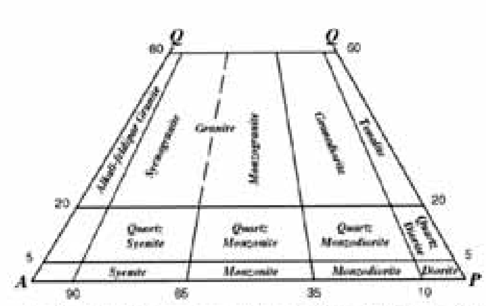
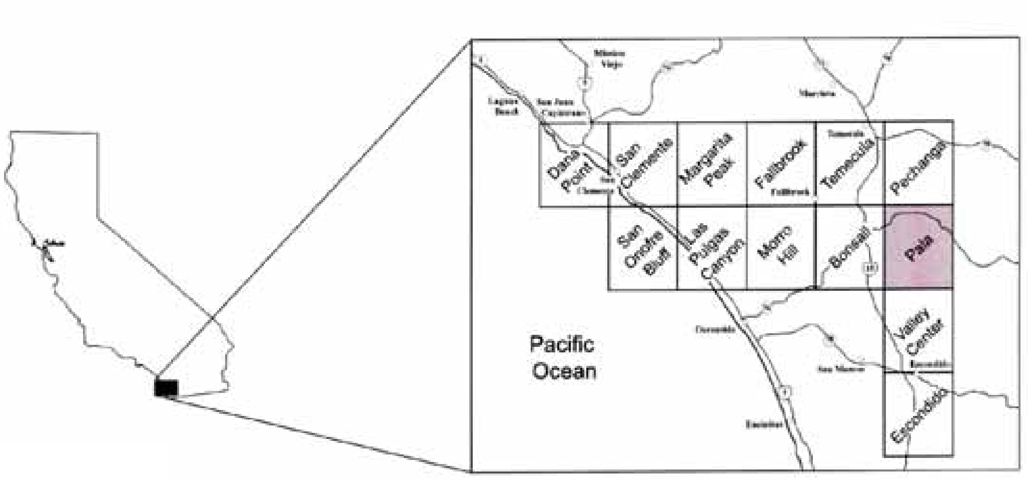


Classification of plutonic rock types (from IUGA, 1973, and *Streckeisen, 1973).
A, alkali feldspar; P, plagioclase feldspar; Q, quartz.

*Streckeisen, A.L., 1973, Plutonic rocks-Classification and nomenclature recommended by the IUGA Subcommission on Systematics of Igneous Rocks: Geotimes, vol.18, pp.26-30.



TRC

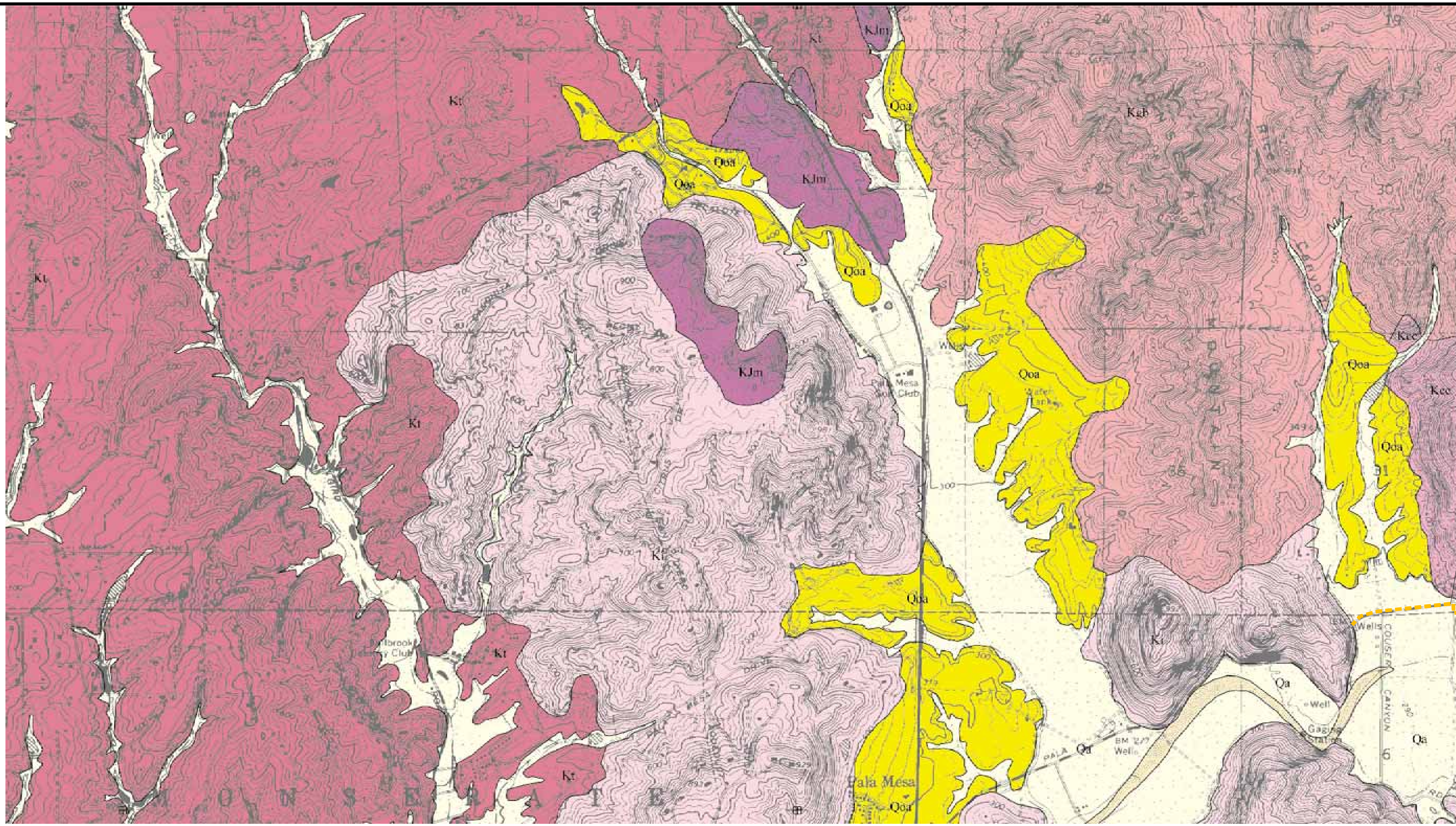
PROJECT: 125158

FACILITY:

ORANGE GROVE PROJECT
SAN DIEGO COUNTY, CALIFORNIA

GEOLOGIC MAP LEGEND
PALA QUADRANGLE

FIGURE 6.3-3

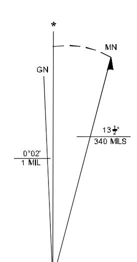


N

SOURCE:

United States Geological Survey
7.5 Minute Topographic Map:
Bonsall Quadrangle

Polyconic projection, contour interval 20 feet, dotted lines 10 feet.



UTM GRID AND 1988 MAGNETIC NORTH DECLINATION AT CENTER OF STREET

This geologic map was funded in part by the U.S. Geological Survey National Cooperative Geologic Mapping Program, STATEMAP Award no. 99HQAG0134.

0 1/4 1/2 3/4 1 MILE

SCALE 1:24,000

TRC

PROJECT: 29031902

FACILITY:

ORANGE GROVE PROJECT
SAN DIEGO COUNTY, CALIFORNIA

GEOLOGIC MAP
BONSALL QUADRANGLE

FIGURE 6.3-4

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GEOLOGIC MAP OF THE BONSALL 7.5' QUADRANGLE SAN DIEGO COUNTY, CALIFORNIA: A DIGITAL DATABASE

VERSION 1.0

By

Siang S. Tan[1]

Digital Database

by

Ursula Edwards[2] and Gary Patt[2]

2000

1. California Division of Mines and Geology, Los Angeles, CA
2. U. S. Geological Survey, Riverside, CA

DEPARTMENT OF CONSERVATION Division of Mines and Geology

CORRELATION OF MAP UNITS

Units	Epoch	Period	Era
Qw, Qa	Holocene	QUATERNARY	CENOZOIC
Qoa	Pleistocene	QUATERNARY	CENOZOIC
Kmm, Kcc, Ki, Kgd, Kt, Kgb		CRETACEOUS	MESOZOIC
KJm		CRETACEOUS / JURASSIC	MESOZOIC

MAP SYMBOLS

Contact between map units; generally approximately located of inferred.

18 — Strike and dip of inclined metamorphic foliation.

DESCRIPTION OF MAP UNITS

MODERN SURFICIAL DEPOSITS - Sediment that has been recently transported and deposited in channels and washes, on surfaces of alluvial fans and alluvial plains, and on hillslopes and in artificial fills. Soil-profile development is non-existant. Includes:

Qw — Active channel and wash deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand and gravel deposits in active washes of streams.

Qa — Active alluvial flood plain deposits (late Holocene) - Unconsolidated to locally poorly consolidated sand and gravel deposits in active alluvial flood plains.

OLD SURFICIAL DEPOSITS - Sedimentary units that are moderately consolidated and slightly to moderately well dissected. Older surficial deposits have upper surfaces that are capped by moderately to well-developed pedogenic soils. Includes:

Qoa — Older alluvial flood plain deposits (Pleistocene, younger than 500,000 years) - Mostly moderately well consolidated, poorly sorted, permeable flood plain deposits.

BEDROCK UNITS

Kmm — Monzogranite of Merriam Mountain (Cretaceous) -Leucocratic hornblende-biotite monzogranite; medium to coarse grained, massive.

Kcc — Tonalite of Couser Canyon (Cretaceous) - Hornblende-biotite tonalite; coarse grained and massive. Contains some granodiorite and is characterized by an abundance of pegmatite dikes.

Ki — Granodiorite of Indian Mountain (Cretaceous) - Biotite leucocratic granodiorite; white, fine to medium grained and massive.

Kgd — Granodiorite undivided (Cretaceous) - Mostly hornblende-biotite granodiorite; coarse to medium grained.

Kt — Tonalite undivided (Cretaceous) - Mostly hornblende-biotite tonalite; coarse grained, light gray.

Kgb — Gabbro undivided (Cretaceous) - Mostly biotite-hornblende-hypersthene gabbro; coarse grained, dark gray, massive.

KJm — Metavolcanic and metasedimentary rocks undivided (Cretaceous and Jurassic) - Low grade (greenschist facies) rocks that are in part coeval with and in part older than the Cretaceous plutonic rocks they lie in contact with.

REFERENCES

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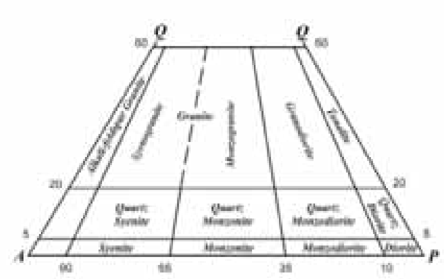
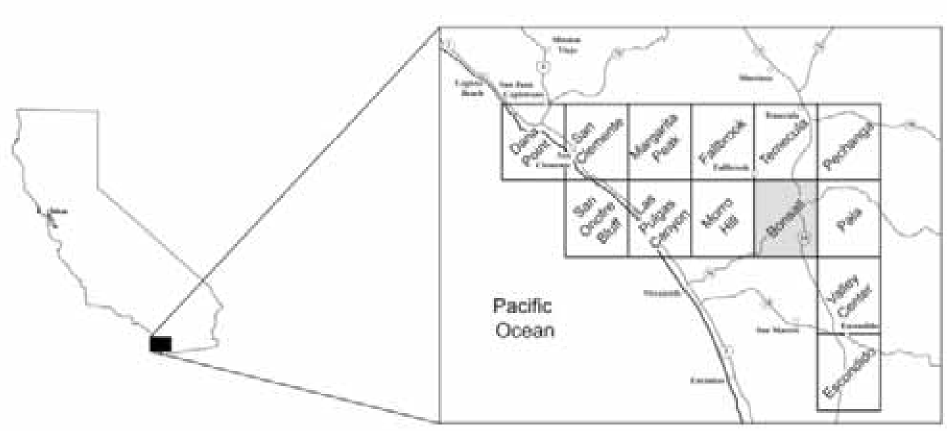


Classification of plutonic rock types (from IUGA, 1973, and *Streckeisen, 1973). A, alkali feldspar; P, plagioclase feldspar; Q, quartz.

*Streckeisen, A.L., 1973. Plutonic rocks- Classification and nomenclature by the IUGA Subcommission on Systematics of Igneous Rocks: Geotimes, vol 18, p.26-30.



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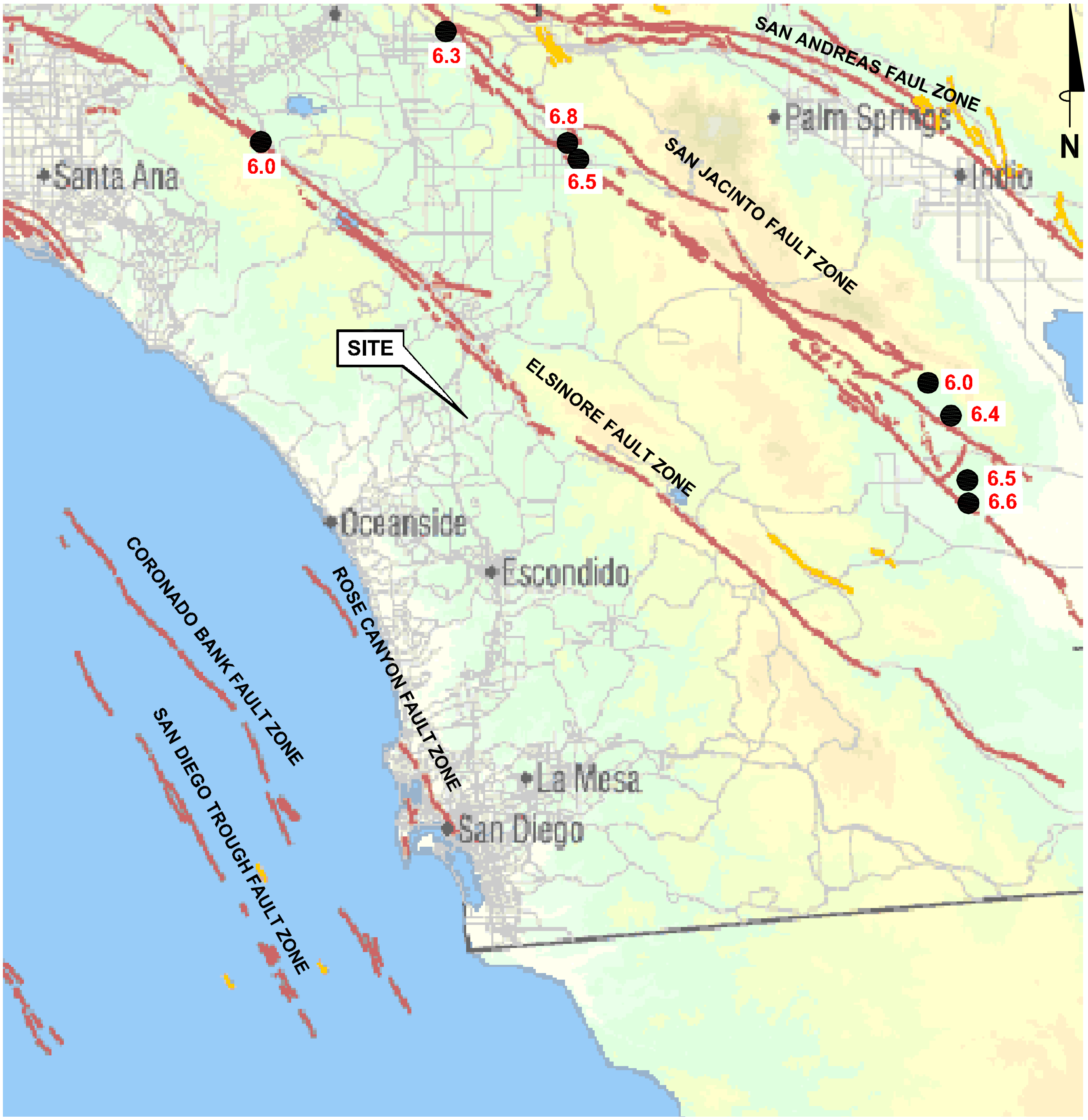
SAN DIEGO COUNTY, CALIFORNIA

GEOLOGIC MAP LEGEND BONSALL QUADRANGLE

FIGURE 6.3-5



LEGEND

● 6.8 Earthquake Epicenters and Magnitude

0 25 50 75 100 KM

APPROX. SCALE

SOURCE:

United States Geological Survey
Department of Conservation,
Interactive Ground Motion Map

TRC

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ORANGE GROVE PROJECT
SAN DIEGO COUNTY, CALIFORNIA

HISTORICAL EARTHQUAKES WITHIN 100 KILOMETER RADIUS WITH MAGNITUDE ≥ 6.0

FIGURE 6.3-6

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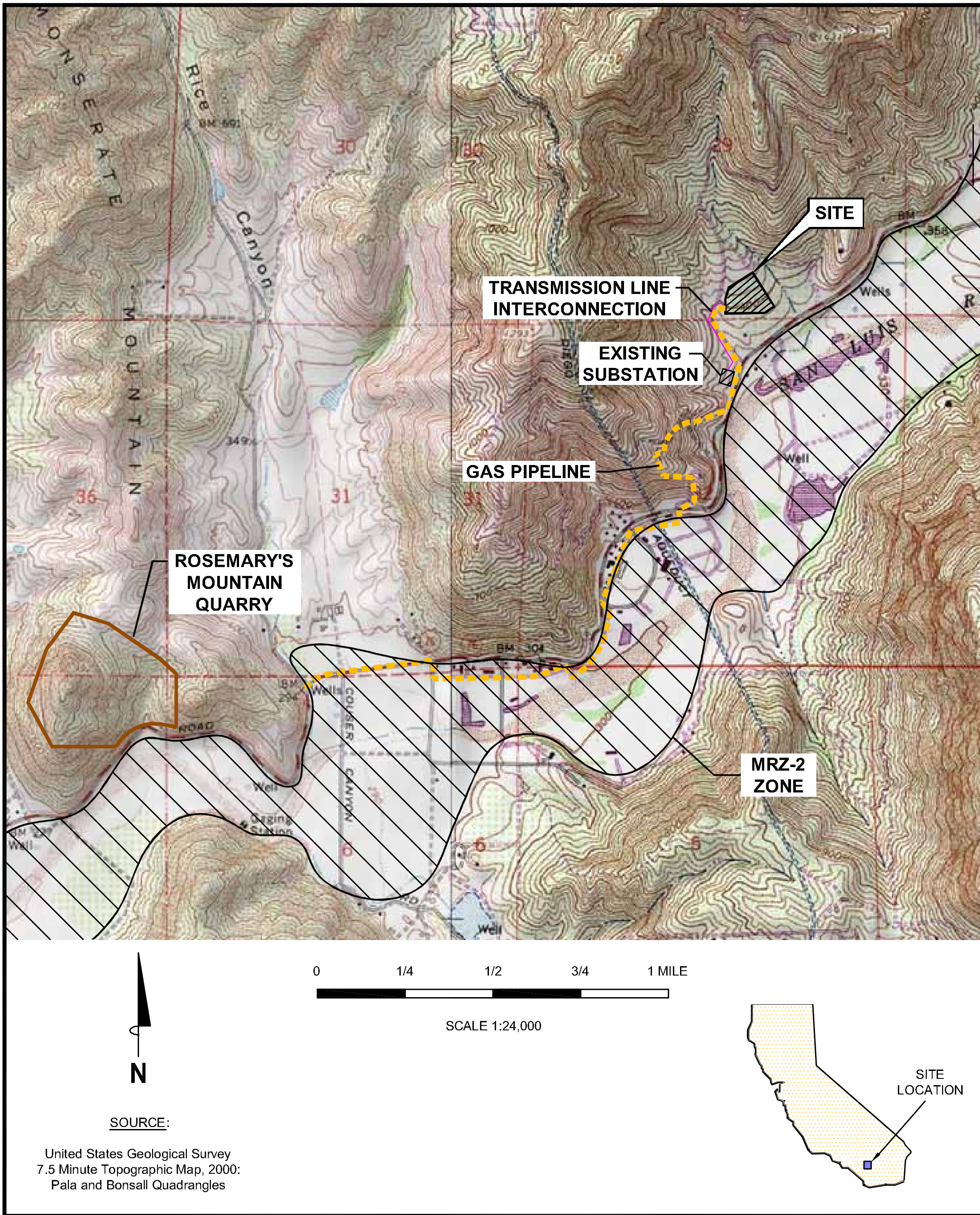

SOURCE:

United States Geological Survey
7.5 Minute Topographic Map, 2000:
Pala and Bonsall Quadrangles

PS=1:1 L:\Graphics\ProjectsByNumber\29-xxxx\29-0319\290319-GEOLOGIC RESOURCE.dwg Jun 02, 2008 - 3:03pm aakers

TRC

PROJECT: 125158

FACILITY:

ORANGE GROVE PROJECT
SAN DIEGO COUNTY, CALIFORNIA

COMMERCIAL GEOLOGIC RESOURCES IN THE PROJECT AREA

FIGURE 6.3-7