Jack Ranch San Luis Obispo Agricultural Cluster Project

Appendices for the Draft Environmental Impact Report

SCH#2016-051012

prepared by

County of San Luis Obispo
Department of Planning and Building
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San Luis Obispo, California 93408
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Appendix A

Notice of Preparation and Initial Study

NOTICE OF PREPARATION – DRAFT ENVIRONMENTAL IMPACT REPORT

SAN LUIS OBISPO COUNTY DEPARTMENT OF PLANNING AND BUILDING
976 OSOS STREET • ROOM 200 • SAN LUIS OBISPO • CALIFORNIA 93408 • (805) 781-5600

Promoting the Wise Use of Land • Helping to Build Great Communities

DATE: April 27, 2016

TO: Interested Parties

FROM: Department of Planning and Building
976 Osos St., Room 300
San Luis Obispo, CA 93408-2040

PROJECT TITLE: Jack Ranch Agricultural Cluster Subdivision, Vesting Tentative Tract Map, ED 02-288 (S000323U/TR 2429)

PROJECT APPLICANT: Orcutt Broad LLC & Erskine Property Trust
Agent: Dan Lloyd

RESPONSES DUE BY: May 27, 2016

The County of San Luis Obispo will be the Lead Agency and will prepare an Environmental Impact Report (EIR) for the above-referenced project. We need to know the views of your agency as to the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. Your agency will need to use the EIR prepared by our agency when considering your permit or other approval for the project.

Please provide us the following information at your earliest convenience, but not later than the 30-day comment period, which began with your agency's receipt of the Notice of Preparation (NOP).

1. NAME OF CONTACT PERSON. (Please include address, e-mail and telephone number)
2. PERMIT(S) or APPROVAL(S) AUTHORITY. Please provide a summary description of these and send a copy of the relevant sections of legislation, regulatory guidance, etc.
3. ENVIRONMENTAL INFORMATION. What environmental information must be addressed in the Environmental Impact Report to enable your agency to use this documentation as a basis for your permit issuance or approval?
4. PERMIT STIPULATIONS/CONDITIONS. Please provide a list and description of standard stipulations (conditions) that your agency will apply to features of this project. Are there other conditions that have a high likelihood of application to a permit or approval for this project? If so, please list and describe.
5. ALTERNATIVES. What alternatives does your agency recommend be analyzed in the EIR?
6. REASONABLY FORESEEABLE PROJECTS, PROGRAMS or PLANS. Please name any future project, programs or plans that you think may have an overlapping influence with the project as proposed.

7. RELEVANT INFORMATION. Please provide references for any available, appropriate documentation you believe may be useful to the county in preparing the EIR. Reference to and/or inclusion of such documents in an electronic format would be appreciated.

8. FURTHER COMMENTS. Please provide any further comments or information that will help the county to scope the document and determine the appropriate level of environmental assessment.

The project description, location, and the probable environmental effects are contained in the attached materials.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date, **but not later than 30 days after receipt of this notice**.

Please send your response to ___Stephanie Fuhs__ at the address shown above. As requested above, we will need the name for a contact person in your agency.

Signature____________________________

Project Manager
Telephone: (805) 781-5721
E-mail: sfuhs@co.slo.ca.us

Reference: California Administrative Code, Title 14, Section 15082

Attachments

Initial Study
Previous Agency Referral Response

Initial Study Summary – Environmental Checklist

SAN LUIS OBISPO COUNTY DEPARTMENT OF PLANNING AND BUILDING
976 OSOS STREET • ROOM 200 • SAN LUIS OBISPO • CALIFORNIA 93408 • (805) 781-5600

(ver 5.9)Using Form

Project Title & No. **Jack Ranch Agricultural Cluster, Conditional Use Permit and Vesting Tentative Tract Map ED 02-288 (S000323U/TR 2429)**

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED: The proposed project could have a "Potentially Significant Impact" for at least one of the environmental factors checked below. Please refer to the attached pages for discussion on mitigation measures or project revisions to either reduce these impacts to less than significant levels or require further study.

☒ Aesthetics	☒ Geology and Soils	☐ Recreation
☒ Agricultural Resources	☒ Hazards/Hazardous Materials	☒ Transportation/Circulation
☒ Air Quality	☒ Noise	☒ Wastewater
☒ Biological Resources	☒ Population/Housing	☐ Water /Hydrology
☒ Cultural Resources	☒ Public Services/Utilities	☒ Land Use

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation, the Environmental Coordinator finds that:

☐ The proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ Although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☒ The proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ The proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ Although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

John Larson (Rincon) for Stephanie Fuhs		4/27/16
Prepared by (Print)	Signature	Date

Stephanie Fuhs/John McKenzie	Ellen Carroll, Environmental Coordinator	4/27/2016
Reviewed by (Print)	Signature (for)	Date

Project Environmental Analysis

The County's environmental review process incorporates all of the requirements for completing the Initial Study as required by the California Environmental Quality Act (CEQA) and the CEQA Guidelines. The Initial Study includes staff's on-site inspection of the project site and surroundings and a detailed review of the information in the file for the project. In addition, available background information is reviewed for each project. Relevant information regarding soil types and characteristics, geologic information, significant vegetation and/or wildlife resources, water availability, wastewater disposal services, existing land uses and surrounding land use categories and other information relevant to the environmental review process are evaluated for each project. Exhibit A includes the references used, as well as the agencies or groups that were contacted as a part of the Initial Study. The County Planning Department uses the checklist to summarize the results of the research accomplished during the initial environmental review of the project.

Persons, agencies or organizations interested in obtaining more information regarding the environmental review process for a project should contact the County of San Luis Obispo Planning Department, 976 Osos Street, Rm. 200, San Luis Obispo, CA, 93408-2040 or call (805) 781-5600.

A. PROJECT

DESCRIPTION: Request by Orcutt Broad LLC and Erskine Property Trust for a Conditional Use Permit and Vesting Tentative Tract Map to allow for the Jack Ranch Agricultural Cluster Subdivision, which would contain 13 lots, each approximately one acre in size, within the 299-acre property. Remaining land would be retained in vineyards (160 acres) and natural open space (approximately 122 acres). The project is located at the end of Hacienda Avenue on the southeast side of Edna Road (SR 227) near its intersection with Los Ranchos Road. Hacienda Avenue extends approximately 2,500 feet southeast from Los Ranchos Road to the project site, which borders the Los Ranchos/Edna Village Reserve Line to the north and east, and is approximately one mile south of the San Luis Obispo Urban Reserve Line. The project site is within the San Luis Obispo Area Plan, San Luis Obispo North Sub-Area. Figures 1-1 and 1-2 show the Project Vicinity and Proposed Site Plan, respectively.

ASSESSOR PARCEL NUMBER(S): 044-081-040

Latitude: 35° 12' 50" N Longitude: 120 °38’13” W **SUPERVISORIAL DISTRICT** # 3

B. EXISTING SETTING

PLAN AREA: San Luis Obispo **SUB**: San Luis Obispo(North) **COMM:** Rural

LAND USE CATEGORY: Agriculture Rural Lands

COMB. DESIGNATION: Sensitive Resource Area Airport Review

PARCEL SIZE: 299 acres

TOPOGRAPHY: Gently sloping to steeply sloping

VEGETATION: Vineyards Riparian Scattered Oaks

EXISTING USES: Vacant agricultural uses

SURROUNDING LAND USE CATEGORIES AND USES:

North: Residential Suburban; single-family residence(s)	*East:* Recreation and Rural Residential, golf course and single family residences
South: Agriculture; vacant undeveloped	*West:* Agriculture; vacant

C. ENVIRONMENTAL ANALYSIS

During the Initial Study process, at least one issue was identified as having a potentially significant environmental effects (see following Initial Study). Those potentially significant items associated with the proposed uses can be minimized to less than significant levels.

COUNTY OF SAN LUIS OBISPO INITIAL STUDY CHECKLIST

1. AESTHETICS *Will the project:*	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Create an aesthetically incompatible site open to public view?	☒	☐	☐	☐
b) Introduce a use within a scenic view open to public view?	☒	☐	☐	☐
c) Change the visual character of an area?	☒	☐	☐	☐
d) Create glare or night lighting, which may affect surrounding areas?	☒	☐	☐	☐
e) Impact unique geological or physical features?	☐	☐	☒	☐
f) Other: ___________________________	☐	☐	☐	☐

Aesthetics

Setting. The project would be located on the southern edge of rural San Luis Obispo. A portion of the site extends into a County designated Sensitive Resource Area (SRA). This area has been designated as an SRA due to its visual qualities. Although developed areas such as the Rolling Hills subdivision and the San Luis Obispo County Club and Estates lie to the north and east of the site, the area is predominantly rural, with open space and agricultural operations common. The project site does not contain any unique geological or physical features relative to aesthetics of the area.

Impact. The proposed 13-lot residential subdivision would be developed at elevations generally below the County's designated SRA. Development on the lots would be intermittently visible from the SR 227 corridor for travelers heading north and south. This would alter the existing aesthetics of the area. The project may also result in the addition of water tanks and other infrastructure, and home and/or street lights at an elevation above existing homes and public roads, resulting in potential aesthetic impacts.

Mitigation/Conclusion. Strict landscaping, architectural and lighting standards for the subdivision may reduce impacts. Potential impacts and mitigation related to aesthetics and visual resources will be addressed in detail in the Environmental Impact Report (EIR) for the project.

2. AGRICULTURAL RESOURCES ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Convert prime agricultural land, per NRCS soil classification, to non-agricultural use?	☒	☐	☐	☐
b) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance to non-agricultural use?	☒	☐	☐	☐
c) Impair agricultural use of other property or result in conversion to other uses?	☒	☐	☐	☐
d) Conflict with existing zoning for agricultural use, or Williamson Act program?	☐	☒	☐	☐
e) Other: ______________________	☐	☐	☐	☐

Agricultural Resources

Setting.

Project Elements. The following area-specific elements relate to the property's importance for agricultural production:

Land Use Category: Agriculture (225 acres), Rural Lands (74 acres)

State Classification: Not prime farmland, Farmland of Statewide Importance, and Prime Farmland if irrigated.

Historic/Existing Commercial Crops: Irrigated vineyard

In Agricultural Preserve? No

Under Williamson Act contract? No

The soil type(s) and characteristics on the subject property include: Arnold loamy sand, Briones loamy sand, Briones-Pismo loamy sands, Cropley clay, Diablo clay, Nacimiento-Calodo complex, Tierra sandy loam, Tierra loam, and Zaca clay.

The northern portion of the project site is currently in use as an active vineyard, and operations are expected to continue under the project. Under the project, vineyard operations may be expanded to areas on the western portion of the project site, north of the proposed residential subdivision.

Impact. The project site consists of prime soils (Class II), prime farmland and farmland of statewide importance, some of which may be converted to non-agricultural uses upon development of the 13 proposed residential lots. The conversion of prime soils and agricultural land would result in potentially significant impacts to agricultural resources.

Mitigation/Conclusion. Potential impacts associated with the conversion of prime soils and farmland and measures to mitigate such impacts will be addressed in detail in the EIR for the project.

3. AIR QUALITY

Will the project:

	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Violate any state or federal ambient air quality standard, or exceed air quality emission thresholds as established by County Air Pollution Control District?	☐	☐	☒	☐
b) Expose any sensitive receptor to substantial air pollutant concentrations?	☐	☒	☐	☐
c) Create or subject individuals to objectionable odors?	☐	☒	☐	☐
d) Be inconsistent with the District's Clean Air Plan?	☒	☐	☐	☐
e) Result in a cumulatively considerable net increase of any criteria pollutant either considered in non-attainment under applicable state or federal ambient air quality standards that are due to increased energy use or traffic generation, or intensified land use change?	☐	☐	☐	☐
GREENHOUSE GASES				
f) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?	☐	☐	☒	☐
g) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?	☐	☐	☒	☐
h) Other: ___________________________	☐	☐	☐	☐

Air Quality

Setting. The San Luis Obispo County Air Pollution Control District (SLOAPCD) has developed and updated their CEQA Air Quality Handbook (2012) to evaluate project specific impacts and help determine if air quality mitigation measures are needed, or if potentially significant impacts could result. To evaluate long-term emissions, cumulative effects, and establish countywide programs to reach acceptable air quality levels, a Clean Air Plan has been adopted (SLOAPCD 2001).

Greenhouse Gas (GHG) Emissions are said to result in an increase in the earth's average surface temperature. This is commonly referred to as global warming. The rise in global temperature is associated with long-term changes in precipitation, temperature, wind patterns, and other elements of the earth's climate system, referred to as climate change. These changes are now thought to be broadly attributed to GHG emissions, particularly those emissions that result from the human production and use of fossil fuels.

The passage of Assembly Bill 32 (AB32), the California Global Warming Solutions Act (2006), recognized the need to reduce GHG emissions and set the GHG reduction goal for the State of

California into law. The law required that by 2020, State emissions must be reduced to 1990 levels. This is to be accomplished by reducing greenhouse gas emissions from significant sources via regulation, market mechanisms, and other actions. Subsequent legislation (e.g., SB97-Greenhouse Gas Emissions bill) directed the California Air Resources Board (CARB) to develop statewide thresholds.

In March 2012, the San Luis Obispo County Air Pollution Control District (APCD) approved thresholds for GHG emission impacts, and these thresholds have been incorporated the APCD's CEQA Air Quality Handbook. APCD determined that a tiered process for residential / commercial land use projects was the most appropriate and effective approach for assessing the GHG emission impacts. The tiered approach includes three methods, any of which can be used for any given project:

1. Qualitative GHG Reduction Strategies (e.g. Climate Action Plans): A qualitative threshold that is consistent with AB 32 Scoping Plan measures and goals; or,
2. Bright-Line Threshold: Numerical value to determine the significance of a project's annual GHG emissions; or,
3. Efficiency-Based Threshold: Assesses the GHG impacts of a project on an emissions per capita basis.

For most projects the Bright-Line Threshold of 1,150 Metric Tons CO2/year (MT CO2e/yr) will be the most applicable threshold. In addition to the residential/commercial threshold options proposed above, a bright-line numerical value threshold of 10,000 MT CO2e/yr was adopted for stationary source (industrial) projects.

It should be noted that projects that generate less than the above mentioned thresholds will also participate in emission reductions because air emissions, including GHGs, are under the purview of CARB (or other regulatory agencies) and will be regulated either by CARB, the Federal Government, or other entities. For example, new vehicles will be subject to increased fuel economy standards and emission reductions, large and small appliances will be subject to more strict emissions standards, and energy delivered to consumers will increasingly come from renewable sources. Other programs that are intended to reduce the overall GHG emissions include Low Carbon Fuel Standards, Renewable Portfolio standards and the Clean Car standards. As a result, even the emissions that result from projects that produce fewer emissions than the threshold will be subject to emission reductions.

Under CEQA, an individual project's GHG emissions will generally not result in direct significant impacts. This is because the climate change issue is global in nature. However, an individual project could be found to contribute to a potentially significant cumulative impact. Projects that have GHG emissions above the noted thresholds may be considered cumulatively considerable and require mitigation.

The project would be located in a rural area, and because bike trails and bus lines do not extend to the project, future residents of the subdivision will be dependent on private automobiles to reach essential services. The current vineyard operations on the project site would remain in operation upon buildout of the proposed residential subdivision onsite. Vineyard development and operation may also be expanded to other portions of the project site.

Impact. As proposed, the project would involve construction associated with the development of a 13-lot residential subdivision. This could potentially result in the creation of construction dust, as well as short- and long-term vehicle emissions. The project would be subject to standard dust and emission control measures during construction.

The residential subdivision would be potentially inconsistent with the goals and policies of the Clean Air Plan and the County's Energy Element, both of which encourage development to be focused in existing urban and village areas where alternative transportation is available. This would result in potential impacts to air quality in the region.

Using the GHG threshold information described above, the project is not expected to exceed the Bright-Line Threshold of 1,150 metric tons of GHG emissions. Therefore, the project's potential direct and cumulative GHG emissions are found to be less significant and would not be cumulatively considerable. As such, no mitigation would be required relative to potential GHG emissions impacts.

Mitigation/Conclusion. Land use strategies within the Clean Air Plan will be evaluated for consistency. Air quality emissions will be quantified and examined in further detail in the EIR for the project. If necessary, mitigation measures to reduce potential air quality impacts will also be included in the EIR.

4. BIOLOGICAL RESOURCES *Will the project:*	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Result in a loss of unique or special status species* or their habitats?	☒	☐	☐	☐
b) Reduce the extent, diversity or quality of native or other important vegetation?	☒	☐	☐	☐
c) Impact wetland or riparian habitat?	☒	☐	☐	☐
d) Interfere with the movement of resident or migratory fish or wildlife species, or factors, which could hinder the normal activities of wildlife?	☒	☐	☐	☐
e) Conflict with any regional plans or policies to protect sensitive species, or regulations of the California Department of Fish & Wildlife or U.S. Fish & Wildlife Service?	☐	☐	☒	☐
f) Other: ___________________________	☐	☐	☐	☐

* **Species – as defined in Section15380 of the CEQA Guidelines, which includes all plant and wildlife species that fall under the category of rare, threatened or endangered, as described in this section.**

Biological Resources

Setting. The following are existing elements on or near the proposed project relating to potential biological concerns:

On-site Vegetation: Irrigated vineyard, riparian vegetation, grassland, and oak woodland.

Name and distance from blue line creek(s): Davenport Creek – approximately 600 feet to the north

Habitat(s): Four habitat types are found on the project site including, annual grassland (dominated by exotics), coast live oak woodland, willow riparian, and wetland habitat.

Site's tree canopy coverage: approximately eight percent

The project site is located on the northeast facing slopes south of the City of San Luis Obispo. Twelve of the 13 proposed residential lots would be located to the south of the north-south drainage which runs on the property. The remaining lot would require access via an existing creek crossing. Based on an observational field survey, no sensitive species have been identified on the project site.

Impact. Development of the proposed residential subdivision may result in damage or loss of oak trees on the project site. Improvements to the existing access routes, including one across an intermittent drainage may result in additional impacts to riparian and wetland habitats.

Mitigation/Conclusion. Compliance with standard County measures would prevent significant impacts to oak trees. Drainage and sedimentation/erosion control plans would be required and should include methods to reduce impacts related to the drainage crossing. Permits from the United States Army Corps of Engineers (USACE), the California Department of Fish and Wildlife (CDFW), and the Regional Water Quality Control Board (RWQCB) may also be required for the crossing. Potential impacts and measures to mitigate impacts to sensitive species and their habitats will be further examined in the EIR for the project.

5. CULTURAL RESOURCES ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Disturb archaeological resources?	☐	☐	☒	☐
b) Disturb historical resources?	☐	☐	☒	☐
c) Disturb paleontological resources?	☒	☐	☐	☐
d) Cause a substantial adverse change to a Tribal Cultural Resource?	☒	☐	☐	☐
e) Other: ______________________	☐	☐	☐	☐

Cultural Resources

Setting. The project is located in an area historically occupied by the Obispeno Chumash. Most of the site is currently used for agricultural operation. A cultural resources survey prepared for the project found no evidence of cultural resources. Important paleontological resources have been previously identified on the site.

Impact. The location of the proposed residential lots would not overlap with the previously surveyed paleontological resources on the project site. However, because the residential lots would overly the same geologic formation and would be adjacent to existing resources, there is potential for paleontological resources to occur in those areas. Construction associated with development of the proposed residential subdivision has potential to impact paleontological resources.

Mitigation/Conclusion. Existing paleontological resources on the project site, potential impacts to such resources, and mitigation to avoid or reduce impacts will be addressed in detail in the EIR for the project. Potential for impacts to Tribal Cultural resources will also be examined in the EIR.

6. GEOLOGY AND SOILS ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Result in exposure to or production of unstable earth conditions, such as landslides, earthquakes, liquefaction, ground failure, land subsidence or other similar hazards?	☒	☐	☐	☐

6. GEOLOGY AND SOILS *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
b) Be within a California Geological Survey "Alquist-Priolo" Earthquake Fault Zone", or other known fault zones*?	☐	☐	☒	☐
c) Result in soil erosion, topographic changes, loss of topsoil or unstable soil conditions from project-related improvements, such as vegetation removal, grading, excavation, or fill?	☒	☐	☐	☐
d) Include structures located on expansive soils?	☒	☐	☐	☐
e) Be inconsistent with the goals and policies of the County's Safety Element relating to Geologic and Seismic Hazards?	☐	☒	☐	☐
f) Preclude the future extraction of valuable mineral resources?	☐	☐	☐	☒
g) Other: ___________________________	☐	☐	☐	☒

* **Per Division of Mines and Geology Special Publication #42**

Geology and Soils

Setting. The following relates to the project's geologic aspects or conditions:

Topography: Gently sloping to steeply sloping

Within County's Geologic Study Area?: No

Landslide Risk Potential: Low to high

Liquefaction Potential: Low to moderate

Nearby potentially active faults?: Yes Distance? Onsite

Area known to contain serpentine or ultramafic rock or soils?: No

Shrink/Swell potential of soil: High

Other notable geologic features? None

This project is proposed for an area with gentle to steep slopes. The southern edge of the parcel is composed of a series of small knolls which reach 500 to 600 feet above sea level. One canyon drains this southern side of the property, and joins a north trending tributary of Davenport Creek near the center of the property. The site contains soils with a high shrink-swell potential, active and ancient landslides, and a segment of a branch of the Los Osos Fault. No known mineral resources are present on the project site.

The project is within a high liquefaction area, and is subject to the preparation of a geological report per the County's Land Use Ordinance [LUO section 22.14.070 (c)] to evaluate the area's geological stability.

A sedimentation and erosion control plan is required for all construction and grading projects (LUO Sec. 22.52.120) to minimize these impacts. When required, the plan is prepared by a civil engineer to address both temporary and long-term sedimentation and erosion impacts.

Impact. The soils at this site have a high shrink-swell potential which can subject future development to uneven settling. In addition, grading activities associated with development of the site could result in erosion and increased sedimentation of local drainage swales. An engineering geology report noted that because of the local conditions the site is susceptible to ground-surface rupture and liquefaction hazards. These conditions could impact the residences and the internal infrastructure necessary for the development.

Mitigation/Conclusion. The geologic conditions of the site have potential to result in significant environmental impacts. Potential impacts and measure to mitigate impacts will be discussed further in the EIR for the project.

7. HAZARDS & HAZARDOUS MATERIALS - ***Will the project:***	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Create a hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☒	☐	☐
b) Create a hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☒	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within ¼-mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on, or adjacent to, a site which is included on a list of hazardous material/waste sites compiled pursuant to Gov't Code 65962.5 ("Cortese List"), and result in an adverse public health condition?	☐	☐	☒	☐
e) Impair implementation or physically interfere with an adopted emergency response or evacuation plan?	☒	☐	☐	☐
f) If within the Airport Review designation, or near a private airstrip, result in a safety hazard for people residing or working in the project area?	☒	☐	☐	☐

7. HAZARDS & HAZARDOUS MATERIALS - *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
g) Increase fire hazard risk or expose people or structures to high wildland fire hazard conditions?	☒	☐	☐	☐
h) Be within a 'very high' fire hazard severity zone?	☐	☐	☒	☐
i) Be within an area classified as a 'state responsibility' area as defined by CalFire?	☒	☐	☐	☐
j) Other: ___________________________	☐	☐	☐	☐

Hazards and Hazardous Materials

Setting. The project would include the development of residential units adjacent to an active vineyard. However, residential lots would be separated from agricultural operation by a buffer of at least 200 feet. In addition, the site is enrolled in the Irrigated Lands Regulatory Program (ILRP) which regulates discharge from irrigated agricultural land on the project site. The project site is not located in an area of known hazardous material contamination pursuant to the Cortese List.

The project site is located within a 'moderate' fire hazard severity zone within a state responsibility area (SRA), as defined by the California Department of Forestry and Fire Protection (CAL FIRE). Access to the residential subdivision portion of the project would be from Greystone Place, a narrow, dead-end road more than 1,300 feet from Los Ranchos Road. The California Department of Forestry and Fire Protection has expressed concern regarding the access constrains in the event that fire services are needed at the proposed residential properties.

The project is located within the County's Airport Review Area. No schools are located with ¼ mile of the project site.

Impact. Due to the close proximity of the proposed residential units to vineyard operations, there is risk of human and environment exposure to pesticides associated with such operations. In addition, the distance from access road to the proposed residential lots could impede adequate fire protection to residents, resulting in potential impacts to human health and property. The location of the subdivision would also put future residents at risk of aircraft accidents which could result in substantial impacts to property and potential loss of life.

Mitigation/Conclusion. The project would result in potentially significant impacts related to exposure of future residents on the project site to hazards and hazardous materials. Potential impacts and measure to mitigation those impacts will be addressed further in the EIR for the project.

8. NOISE *Will the project:*	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Expose people to noise levels that exceed the County Noise Element thresholds?	☒	☐	☐	☐

8. NOISE

Will the project:	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
b) Generate permanent increases in the ambient noise levels in the project vicinity?	☒	☐	☐	☐
c) Cause a temporary or periodic increase in ambient noise in the project vicinity?	☒	☐	☐	☐
d) Expose people to severe noise or vibration?	☒	☐	☐	☐
e) If located within the Airport Review designation or adjacent to a private airstrip, expose people residing or working in the project area to severe noise levels?	☒	☐	☐	☐
f) Other: ___________________________	☐	☐	☐	☐

Noise

Setting. The proposed residential lots would be located adjacent to existing agricultural operation and within the County's Airport Review Area. Additionally, construction of the project would occur near existing residential development and a golf course at the San Luis Obispo County Club and Estates.

Impact. Future residents on the project site may be exposed to noise impacts associated with air traffic from the San Luis Obispo Airport and adjacent agricultural operations. Construction on the project site may also result in potential impacts to nearby noise-sensitive receptors including residences and outdoor recreation areas.

Mitigation/Conclusion. Potential noise impacts and measures to mitigate potentially significant impacts will be identified in the EIR for the project.

9. POPULATION/HOUSING

Will the project:	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Induce substantial growth in an area either directly (e.g., construct new homes or businesses) or indirectly (e.g., extension of major infrastructure)?	☒	☐	☐	☐
b) Displace existing housing or people, requiring construction of replacement housing elsewhere?	☐	☐	☒	☐
c) Create the need for substantial new housing in the area?	☐	☐	☒	☐
d) Other: ___________________________	☐	☐	☐	☐

Population/Housing

Setting The proposed subdivision would be adjacent to the San Luis County Club and the Rolling Hills Estates. The project site is currently used for agricultural purposes and other agricultural parcels lies to the southwest and northwest. The project site is not located within the City of San Luis Obispo's Urban Reserve Line (URL), and unlike the County Club and Rolling Hills Estates, is also not located within the Los Ranchos-Edna Village Reserve Line (VRL) as described in the San Luis Obispo Area Plan. Greystone Place would serve as the primary access route for the proposed subdivision.

Impact. Development of the subdivision would require new fire protection infrastructure including fire hydrants, and potentially road improvements and extensions. These improvements may indirectly induce future development to the south and west of the site. The proposed residential subdivision would also directly induce growth on the site resulting in potentially significant impacts to population and housing.

Mitigation/Conclusion. The EIR will further address the potential of this project to induce growth on neighboring undeveloped parcels, and recommend mitigation measures to mitigate potential impacts. Prior to map recordation, the applicant will pay an affordable housing in-lieu fee consistent with the applicable fee ordinance.

10. PUBLIC SERVICES/UTILITIES *Will the project have an effect upon, or result in the need for new or altered public services in any of the following areas:*	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Fire protection?	☒	☐	☐	☐
b) Police protection (e.g., Sheriff, CHP)?	☐	☒	☐	☐
c) Schools?	☐	☒	☐	☐
d) Roads?	☐	☒	☐	☐
e) Solid Wastes?	☐	☒	☐	☐
f) Other public facilities?	☐	☒	☐	☐
g) Other: _________________________	☐	☐	☐	☐

Setting. The project area is served by the following public services/facilities:

Police: County Sheriff Location: San Luis Obispo (Kansas Ave.) (Approximately 8.5 miles to the north)

Fire: Cal Fire (formerly CDF) Hazard Severity: Moderate Response Time: 5-10 minutes

Location: (Approximately one miles to the north)

School District: San Luis Coastal Unified School District.

Public Services

Setting. The proposed residential subdivision would be located on an undeveloped parcel adjacent to the San Luis Country Club Estates. The project area is served by the County Sheriff's Department and CALFIRE/County Fire as the primary emergency responders. The nearest sheriff and fire stations are in the City of San Luis Obispo, approximately five miles and one mile from the project site, respectively. The project would be served by the San Luis Coastal School District. Solid waste disposal for the would be provided at the Cold Canyon Landfill, located adjacent to SR 227, approximately 3.5 miles south of the site.

Impact. Due to access constraints, the proposed residential subdivision would not meet fire safety standards. With identification of an alternative access route which meets minimum fire safety standards impacts would be reduced. However, the project may still result in impacts to fire protection services such that new facilities are needed as it would expand the list of rural location and residents that require fire protection.

Mitigation/Conclusion. The EIR for the project will identify potential impacts to public services and utilities, and mitigation measures to avoid potential impacts.

11. RECREATION

Will the project:	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Increase the use or demand for parks or other recreation opportunities?	☐	☒	☐	☐
b) Affect the access to trails, parks or other recreation opportunities?	☐	☐	☒	☐
c) Other ________________________	☐	☐	☐	☐

Recreation

Setting. There are no existing trails, parks, or other County maintained recreational facilities located in the project area. The proposed residential subdivision would create 13 new residential units in the County and future residents may utilize existing County parks and recreational facilities. In accordance with the Quimby Act, County ordinance requires the dedication of land or the imposition of mitigation fees on residential subdivisions as a means of providing park and recreation facilities to serve the subdivision's expanded population.

Impact. New residents generated by the project would increase the demand for and/ or use of County parks and recreational facilities.

Mitigation/Conclusion. Prior to final map recordation, County ordinance requires the payment of a fee for the improvement or development of neighborhood or community parks. The payment of Quimby Act fees would adequately mitigate the project's impact on recreational facilities. No significant recreation impacts are anticipated, and no mitigation measures are necessary. Impacts to recreation will not be examined further in the EIR for the project.

12. TRANSPORTATION/CIRCULATION

Will the project:	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Increase vehicle trips to local or areawide circulation system?	☒	☐	☐	☐
b) Reduce existing "Level of Service" on public roadway(s)?	☐	☒	☐	☐

12. TRANSPORTATION/CIRCULATION *Will the project:*	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
c) Create unsafe conditions on public roadways (e.g., limited access, design features, sight distance, slow vehicles)?	☐	☒	☐	☐
d) Provide for adequate emergency access?	☒	☐	☐	☐
e) Conflict with an established measure of effectiveness for the performance of the circulation system considering all modes of transportation (e.g. LOS, mass transit, etc.)?	☐	☐	☒	☐
f) Conflict with an applicable congestion management program?	☐	☐	☒	☐
g) Conflict with adopted policies, plans, or programs regarding public transit, bicycle, or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?	☒	☐	☐	☐
h) Result in a change in air traffic patterns that may result in substantial safety risks?	☐	☐	☒	☐
i) Other: ___________________________	☐	☐	☐	☐

Transportation

Setting. The County has established the acceptable Level of Service (LOS) on roads for this rural area as "C" or better. Access to the proposed residential subdivision would be from Greystone Place (a dead-end roadway). Existing single-family residences currently use this roadway for access. Greystone place connects with Los Ranchos Road, which in turn provides access to SR 227 (Broad Street), providing access to the City of San Luis Obispo to the north, and the City of Arroyo Grande to the south. The proposed subdivision would not have a secondary access point. The residents generated by the project would be dependent on automobile transportation and existing roadways for access to essential services.

The County's Energy Element Policy #1 encourages energy efficient land development by promoting compact residential areas and commercial service cores with non-vehicular linkages between them. This policy discourages remote residential development projects. One goal of the San Luis Obispo Area Plan is to establish land use patterns that minimize the need to use single-occupant vehicles and enhance transit use.

Impact. The project would add 13 new residential units whose residents would be reliant on automobile use for commuting. This project, in addition to other auto-oriented subdivisions may result in a potential impact to local and regional roadway traffic. In addition, the project would conflict with the goals of the San Luis Obispo Area Plan and the Energy Element of the County's General Plan.

Mitigation/Conclusion. Impacts and necessary mitigation measures related to transportation will be quantified and addressed in greater detail in the EIR for the project.

13. WASTEWATER

Will the project:	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
a) Violate waste discharge requirements or Central Coast Basin Plan criteria for wastewater systems?	☐	☒	☐	☐
b) Change the quality of surface or ground water (e.g., nitrogen-loading, day-lighting)?	☐	☒	☐	☐
c) Adversely affect community wastewater service provider?	☒	☐	☐	☐
d) Other: ___________________________	☐	☐	☐	☐

Wastewater

Setting. Currently, there is no existing sanitary sewer infrastructure on the project site. Annexation into County Service Area (CSA) 18 (Country Club) is proposed for sewer service to all proposed lots. The project would provide for upgrades to the existing treatment plant facility. Domestic wastewater would be collected in a below-grade gravity collection system and transported to the CSA-18 facility through connection to the existing sewer line at Greystone Place.

Impact. The project proposes to use a community system as its means to dispose of wastewater and impacts would be potentially significant.

Mitigation/Conclusion. Potential impacts and mitigation measures related to wastewater discharge and service providers will be examined in detail in the EIR for the project.

14. WATER & HYDROLOGY

Will the project:	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
QUALITY				
a) Violate any water quality standards?	☐	☒	☐	☐
b) Discharge into surface waters or otherwise alter surface water quality (e.g., turbidity, sediment, temperature, dissolved oxygen, etc.)?	☐	☒	☐	☐
c) Change the quality of groundwater (e.g., saltwater intrusion, nitrogen-loading, etc.)?	☐	☐	☒	☐
d) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide additional sources of polluted runoff?	☐	☒	☐	☐
e) Change rates of soil absorption, or amount or direction of surface runoff?	☐	☒	☐	☐

14. WATER & HYDROLOGY

Will the project:

	Potentially Significant	Impact can & will be mitigated	Insignificant Impact	Not Applicable
f) Change the drainage patterns where substantial on- or off-site sedimentation/ erosion or flooding may occur?	☐	☒	☐	☐
g) Involve activities within the 100-year flood zone?	☐	☐	☒	☐
QUANTITY				
h) Change the quantity or movement of available surface or ground water?	☐	☒	☐	☐
i) Adversely affect community water service provider?	☐	☒	☐	☐
j) Expose people to a risk of loss, injury or death involving flooding (e.g., dam failure,etc.), or inundation by seiche, tsunami or mudflow?	☐	☐	☒	☐
k) Other: ___________________________	☐	☐	☐	☐

Water

Setting. Currently, there is no existing potable water infrastructure onsite. The proposed project will use a community water supplier. Golden State Water Company, which currently serves the Rolling Hills development and San Luis County Club Estates, would extend the mainline from Greystone Place to the proposed project with a new 8-inch water main. Fire hydrants would be installed in accordance with County standards and CALFIRE requirements. A landscape irrigation system separate from the existing vineyard water system would be used for the proposed new residences.

The topography of the project is gently sloping to steeply sloping. The closest named creek from the proposed development is approximately 600 feet away.

Projects involving more than one acre of disturbance are subject to preparing a Storm Water Pollution Prevention Plan (SWPPP) to minimize on-site sedimentation and erosion. When work is done in the rainy season, the County's Land Use Ordinance requires that temporary erosion and sedimentation measures to be installed.

DRAINAGE – The following relates to the project's drainage aspects:

Within the 100-year Flood Hazard designation? No

Closest creek? Davenport Creek Distance? Approximately 600 feet to the north

Soil drainage characteristics: Well drained

For areas where drainage is identified as a potential issue, the Land Use Ordinance (LUO Sec. 22.52.110) includes a provision to prepare a drainage plan to minimize potential drainage impacts. When required, this plan would need to address measures such as: constructing on-site retention or detention basins, or installing surface water flow dissipaters. This plan would also need to show that the increased surface runoff would have no more impacts than that caused by historic flows. Currently there are two drainages on the parcel, one of which bisects the subdivision.

SEDIMENTATION AND EROSION – Soil type, area of disturbance, and slopes are key aspects to analyzing potential sedimentation and erosion issues. The project's soil types and descriptions are listed in the previous Agriculture section under "Setting". As described in the NRCS Soil Survey, the project's soil erodibility is as follows:

Soil erodibility: Low to high

A sedimentation and erosion control plan is required for all construction and grading projects (LUO Sec. 22.52.120, CZLUO Sec. 23.05.036) to minimize these impacts. When required, the plan is prepared by a civil engineer to address both temporary and long-term sedimentation and erosion impacts. Projects involving more than one acre of disturbance are subject to the preparation of a Storm Water Pollution Prevention Plan (SWPPP), which focuses on controlling storm water runoff. The Regional Water Quality Control Board is the local extension who monitors this program.

Impact

Water Quality/Hydrology

With regards to project impacts on water quality the following conditions apply:

- The project will be subject to standard County requirements for drainage, sedimentation and erosion control for construction and permanent use;
- The project will be disturbing over an acre and will be required to prepare a SWPPP, which will be implemented during construction;
- The project is not within a 100-year Flood Hazard designation;
- The project is more than 100 feet from the closest creek or surface water body;
- All disturbed areas will be permanently stabilized with impermeable surfaces and landscaping;
- Stockpiles will be properly managed during construction to avoid material loss due to erosion;
- The project is subject to the County's Plumbing Code (Chapter 7 of the Building and Construction Ordinance [Title 19]), and/or the "Water Quality Control Plan, Central Coast Basin" for its wastewater requirements, where wastewater impacts to the groundwater basin will be less than significant; and
- All hazardous materials and/or wastes will be properly stored on-site, which include secondary containment should spills or leaks occur.

Water Quantity

The project proposes to use a community water supplier as its water source. As proposed, the project will potentially result in 13 new parcels which would allow for one single family residence on each lot. As shown below, reasonable "worst case" indoor water usage would be about eleven acre-feet/year [AFY; 0.85 AFY x 13 lots; City of Santa Barbara Water Demand Factor & Conservation Study 'User Guide' (1989)]. A substantial portion of this indoor water could to be recharged back into the water table through the wastewater system. With use of a community system, approximately 80 percent of the water is expected to return to the wastewater treatment plant and then recharged back into the groundwater basin. Concentrated areas of recharge, such as community systems or large detention basins can increase the amount recharged back into the groundwater basin. The indoor water use estimate does not include water required for landscaping. Approximately 90 percent of landscape water would be lost through evapotranspiration, with about 10 percent recharged back into the groundwater table.

Based on available water information, there are no known constraints to prevent the project from obtaining its water demands.

Mitigation/Conclusion. As specified above, existing regulations and requirements would adequately address surface water quality impacts during construction and permanent use of the project. No additional measures above what are required or proposed are needed to protect water quality.

Based on the proposed amount of water to be use and the water source, no significant impacts from water use are anticipated. However, water quantity will be examined in detail in the EIR.

15. LAND USE

Will the project:	Inconsistent	Potentially Inconsistent	Consistent	Not Applicable
a) Be potentially inconsistent with land use, policy/regulation (e.g., general plan [County Land Use Element and Ordinance], local coastal plan, specific plan, Clean Air Plan, etc.) adopted to avoid or mitigate for environmental effects?	☒	☐	☐	☐
b) Be potentially inconsistent with any habitat or community conservation plan?	☐	☐	☐	☒
c) Be potentially inconsistent with adopted agency environmental plans or policies with jurisdiction over the project?	☐	☐	☒	☐
d) Be potentially incompatible with surrounding land uses?	☐	☒	☐	☐
e) Other: ___________________________	☐	☐	☐	☐

Land Use

Setting/Impact. Surrounding uses are identified on Page 2 of the Initial Study. The proposed project was reviewed for consistency with policy and/or regulatory documents relating to the environment and appropriate land use. The project would be located in the San Luis Obispo Planning Area - San Luis Obispo North Sub Area - and west of the Los Ranchos-Edna Village. The project site has current land use designations of Agriculture and Rural Land. The site is surrounded by residential, agricultural, and recreational uses.

The County Land Use Ordinance allows for the preservation of agricultural lands through various policy and regulatory techniques. One of these is the clustering of dwelling units on relatively small parcels in agricultural areas instead of dispersing such units on large parcels. The remaining open space areas of the parcel are then required to be maintained as open space or agriculture as long as the clustered lots exist. Although some productive land will be taken out of production for residential development, ninety-five percent of the land will remain in current use. Therefore the proposed clustered subdivision is consistent with the County’s General Plan goal to preserve agriculturally productive land.

The subdivision design and location do conflict with other goals of the County’s General Plan as they relate to transportation and land use. Goals 1 and 2 of the San Luis Obispo Planning Area include planning of compact communities with a mix of land uses that reduce vehicle trips by increasing access and opportunity for alternative forms of transportation.

Agricultural operations can be potentially incompatible with residential development. However, appropriate buffer zones and standards would be established and maintained to avoid potential incompatibilities with the uses proposed under the project.

The project is not within or adjacent to a Habitat Conservation Plan area. The project is consistent or compatible with the surrounding uses as summarized on page 2 of this Initial Study.

Mitigation/Conclusion. The EIR for the project will further address the projects overall impact on land use consistency and compatibility in the area, and determine what, if any, land use compatibility measures are appropriate.

16. MANDATORY FINDINGS OF SIGNIFICANCE *Will the project:*	**Potentially Significant**	**Impact can & will be mitigated**	**Insignificant Impact**	**Not Applicable**
a) Have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or pre-history?	☐	☒	☐	☐
b) Have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)	☐	☒	☐	☐
c) Have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☒	☐	☐

For further information on CEQA or the County's environmental review process, please visit the County's web site at "http://www.slocounty.ca.gov/planning.htm" under "Environmental Information", or the California Environmental Resources Evaluation System at: http://resources.ca.gov/ceqa for information about the California Environmental Quality Act.

Exhibit A - Initial Study References and Agency Contacts

The County Planning Department has contacted various agencies for their comments on the proposed project. With respect to the subject application, the following have been contacted (marked with an ☒) and when a response was made, it is either attached or in the application file:

Contacted	Agency	Response
☒	County Public Works Department	**NOP sent**
☒	County Environmental Health Services	**NOP sent**
☒	County Agricultural Commissioner's Office	**NOP sent**
☒	County Airport Manager	**NOP sent**
☒	Airport Land Use Commission	**NOP sent**
☒	Air Pollution Control District	**NOP sent**
☒	County Sheriff's Department	**NOP sent**
☒	Regional Water Quality Control Board	**NOP sent**
☐	CA Coastal Commission	**Not Applicable**
☒	CA Department of Fish and Wildlife	**NOP sent**
☒	CA Department of Forestry (Cal Fire)	**NOP sent**
☒	CA Department of Transportation	**NOP sent**
☐	Community Services District	**Not Applicable**
☒	Other Local Agency Formation Commission (LAFCo)	**NOP sent**
☐	Other ____	**Not Applicable**

*** "No comment" or "No concerns"-type responses are usually not attached*

The following checked ("☒") reference materials have been used in the environmental review for the proposed project and are hereby incorporated by reference into the Initial Study. The following information is available at the County Planning and Building Department.

☒ Project File for the Subject Application

County documents

☐ Coastal Plan Policies
☒ Framework for Planning (Coastal/Inland)
☒ General Plan (Inland/Coastal), includes all maps/elements; more pertinent elements:
- ☒ Agriculture Element
- ☒ Conservation & Open Space Element
- ☐ Economic Element
- ☒ Housing Element
- ☒ Noise Element
- ☒ Parks & Recreation Element/Project List
- ☒ Safety Element

☒ Land Use Ordinance (Inland/Coastal)
☒ Building and Construction Ordinance
☒ Public Facilities Fee Ordinance
☒ Real Property Division Ordinance
☒ Affordable Housing Fund
☒ San Luis Obispo Airport Land Use Plan
☒ Energy Wise Plan
☒ SLO Area Plan/SLO (north) sub area
☐ Design Plan
☐ Specific Plan
☒ Annual Resource Summary Report
☐ Circulation Study

Other documents

☒ Clean Air Plan/APCD Handbook
☒ Regional Transportation Plan
☒ Uniform Fire Code
☒ Water Quality Control Plan (Central Coast Basin – Region 3)
☒ Archaeological Resources Map
☒ Area of Critical Concerns Map
☒ Special Biological Importance Map
☒ CA Natural Species Diversity Database
☒ Fire Hazard Severity Map
☒ Flood Hazard Maps
☒ Natural Resources Conservation Service Soil Survey for SLO County
☒ GIS mapping layers (e.g., habitat, streams, contours, etc.)
☐ Other

Appendix B

Jack Ranch Visual Simulation

Jack Ranch Visual Simulation

Assumptions

The proposed residential lots do not have proposed architecture for the residences at this time. As a reasonable estimation of the scale and color of the kind of home that may be constructed, the digital model of the residence used in the simulations assumes:

• The building will be approximately 24 feet tall in the front elevation. The final height of the ridgeline would be set in final plans in order to meet ordinance height limits depending on the average natural grade and the way the home is designed to be set into the landform.

• The building model is a home of approximately 3,432 square feet footprint

• The buildings would use natural colors to blend into the natural landscape including sage greens, tan, brown and grey.

Methodology

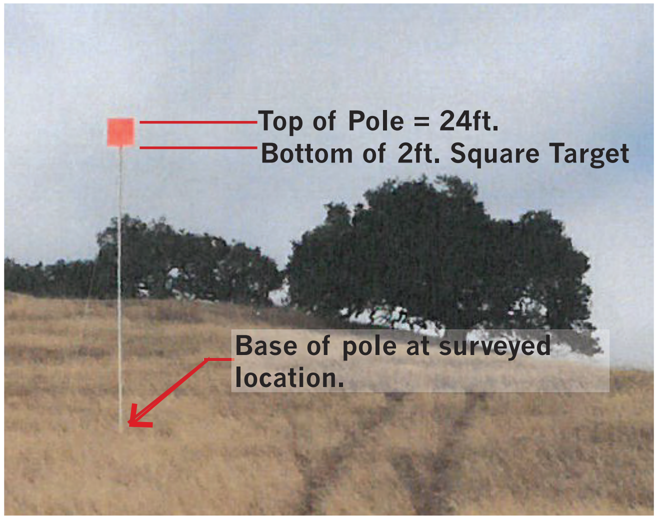
The digital model of the residence is positioned roughly in the center of the proposed building envelope on each lot.

To ensure reasonable accuracy of the simulation pylons of known heights were erected at surveyed points of a known elevation. The pylons serve as a vertical scale as well as a horizontal positioning reference. While it is not known where the final residence will be set on each lot, the simulation gives a reasonable illustration of the position and scale of potential development on the lots.

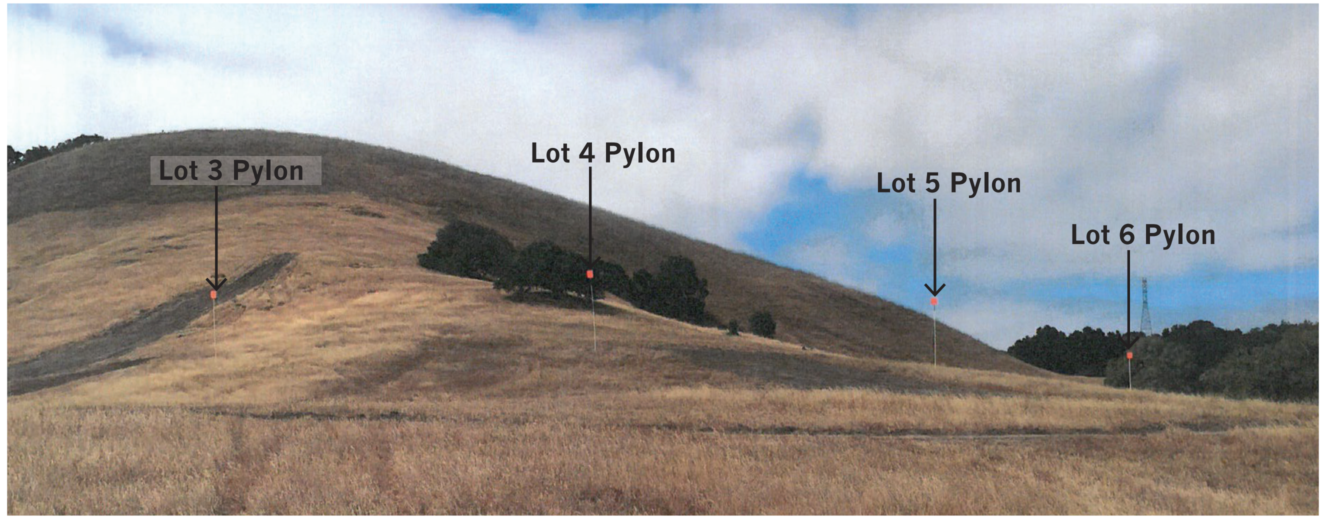
Key viewing areas as identified in the County Area Plan are along Highway 227 and the Union Pacific Railroad.

Conclusion

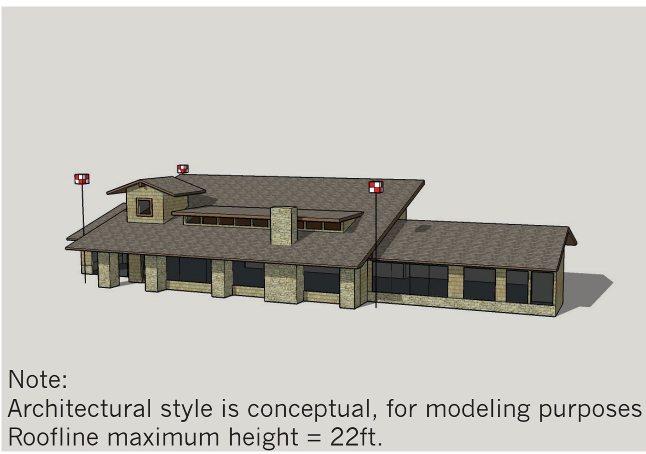
The site is not visible from the Union Pacific Railway due to intervening topography and the built environment. Most of the lots are not visible from Highway 227 key viewing areas. Where lots were visible as shown by the visibility of the reference pylons in the view, simulations were created to show the residence. Due to the long distances from the viewer to the proposed lots the residences are subordinate to the larger rural landscape, not visually intrusive and well below ridgelines.



Pylon



View from within project site showing pylons



Three Dimensional Model with Pylons

Distant view showing general location of proposed lots
Pylons not visible

LEGEND:

Proposed Residential Lot

Not to scale, diagrametic purposes only

North

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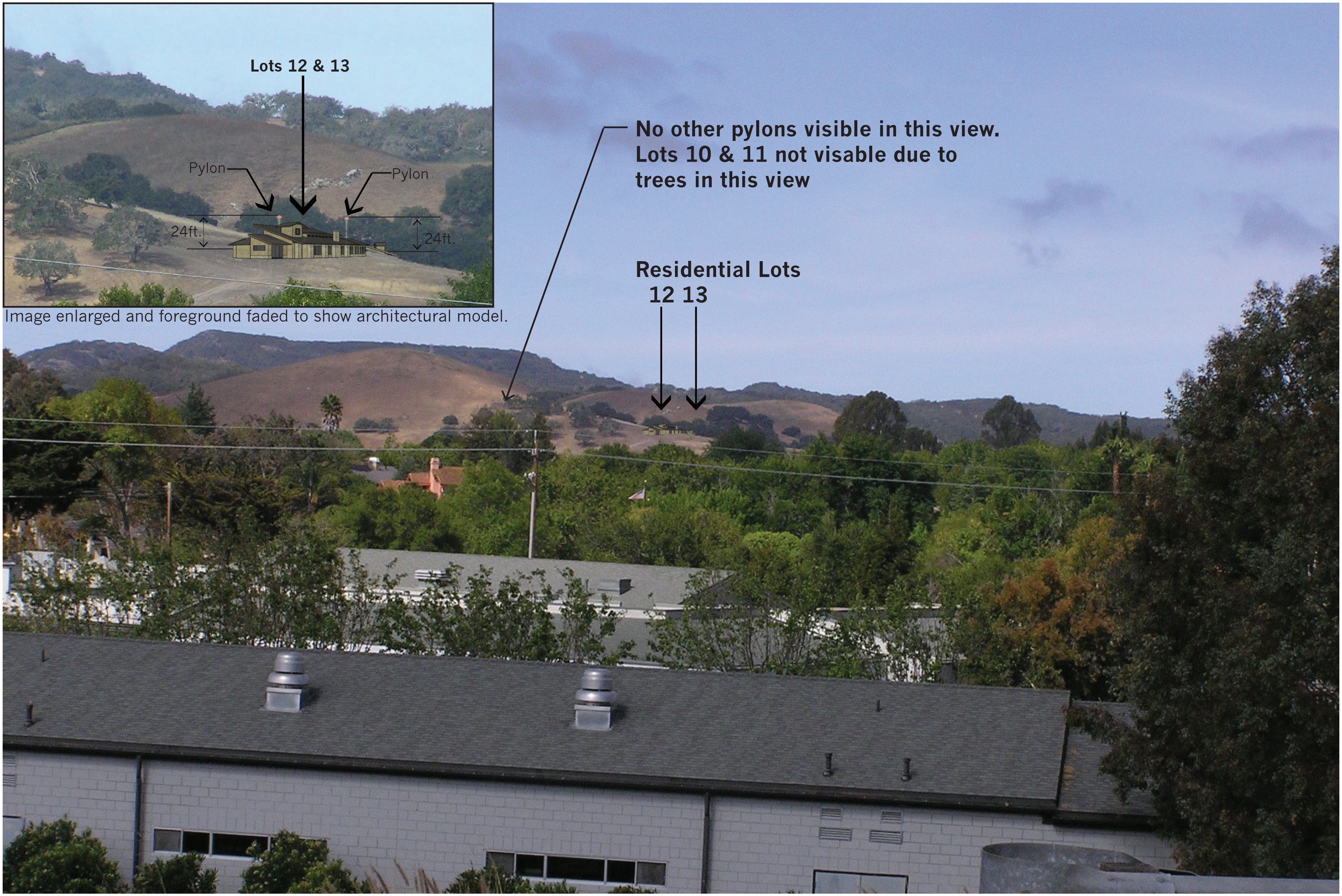
Jack Ranch Ranch Visual Study
San Luis Obispo, CA

Viewing Positions

Figure 2



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landscape architects
planning·environmental studies

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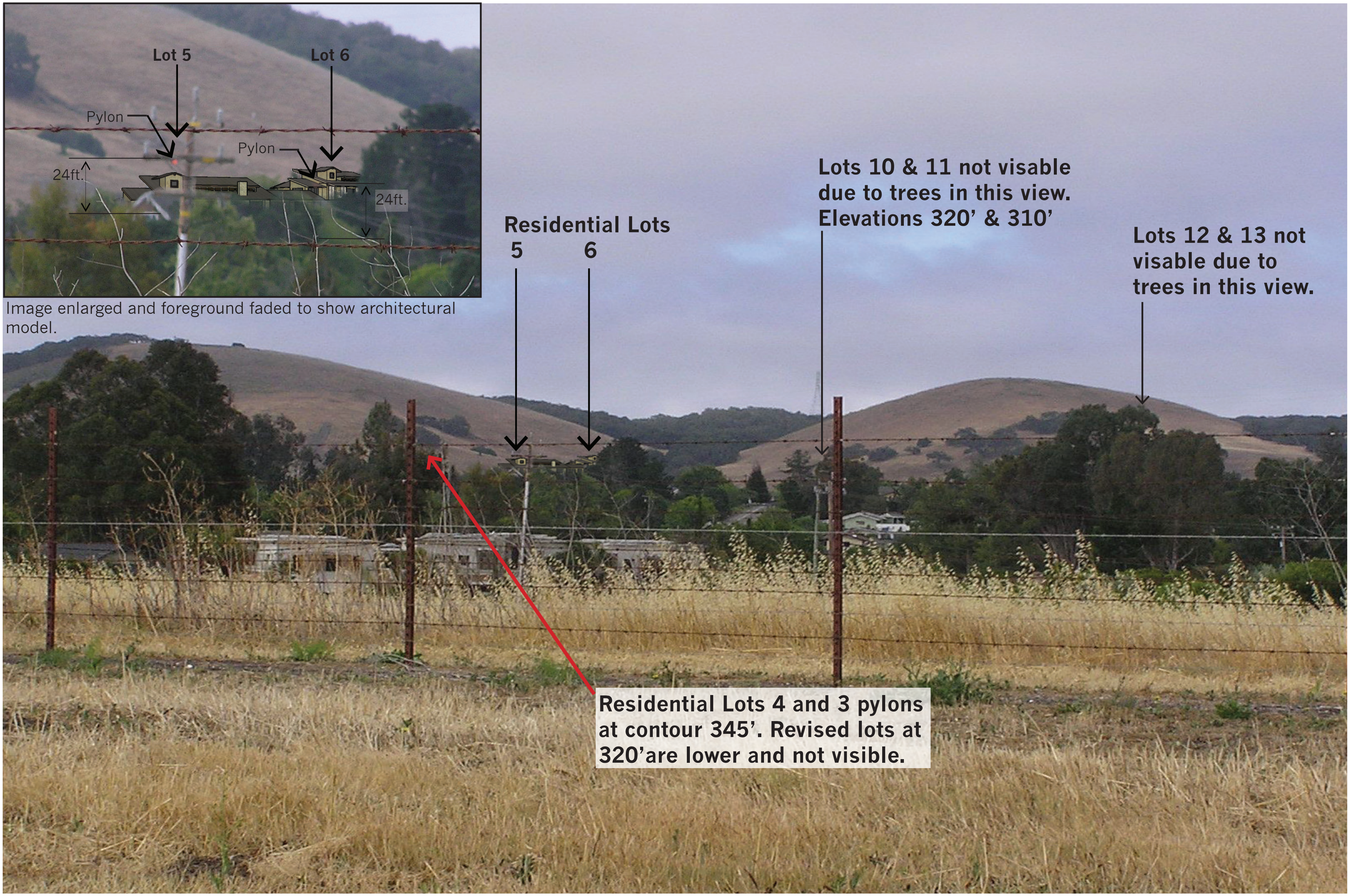
Jack Ranch Ranch Visual Study
San Luis Obispo, CA

View 1

Figure 3



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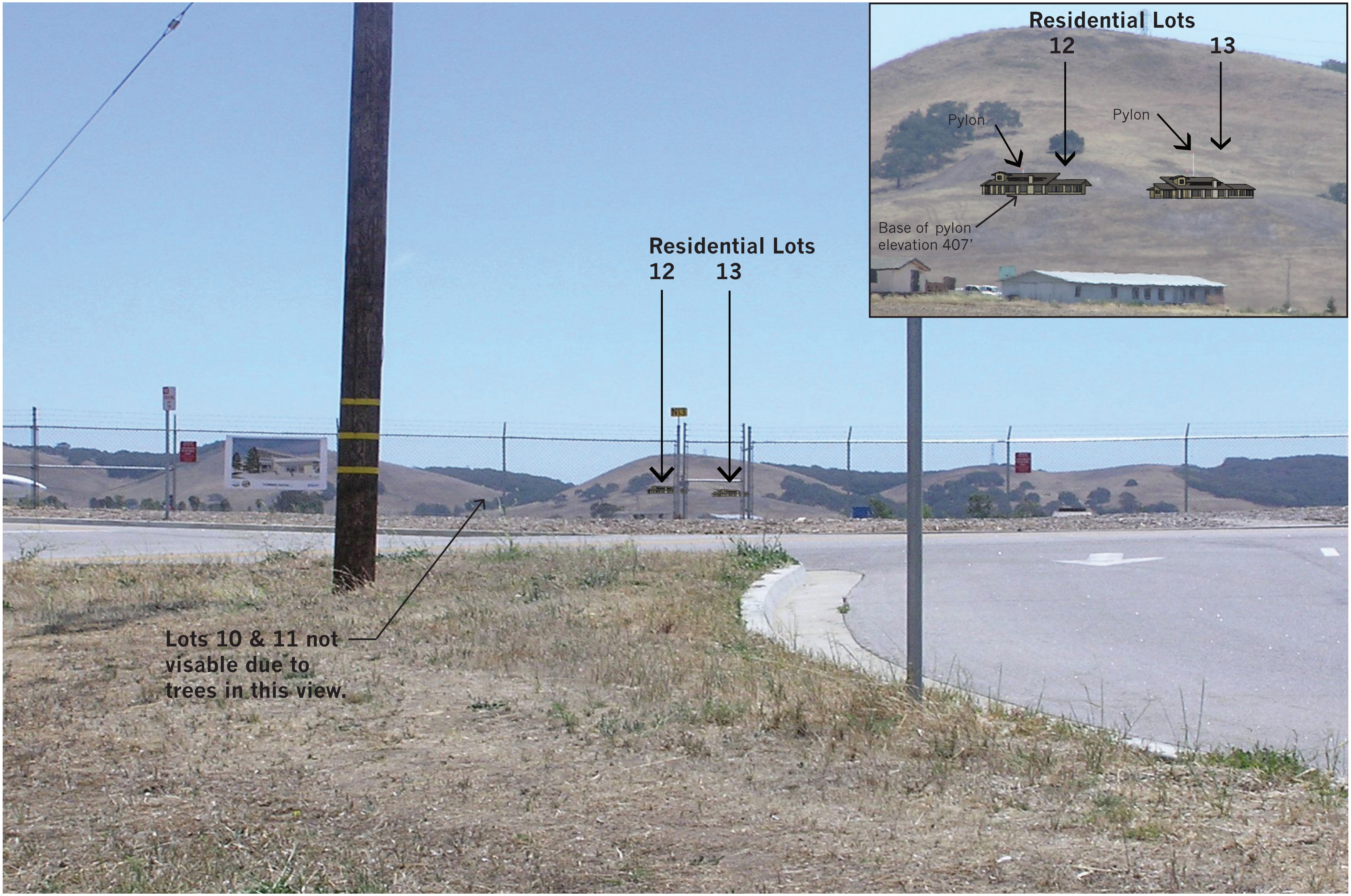
Jack Ranch Ranch Visual Study
San Luis Obispo, CA

View 2

Figure 4



Jack Ranch Ranch Visual Study
San Luis Obispo, CA

View 3

Figure 5

Appendix C

California Emissions Estimator Model (CalEEMod; v. 2016.3.1) output and NO_X calculations

Jack Ranch Agricultural Cluster Project

San Luis Obispo County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Single Family Housing	13.00	Dwelling Unit	13.00	23,400.00	37

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	3.2	**Precipitation Freq (Days)**	44
Climate Zone	4			**Operational Year**	2020
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	641.35	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Lot acreage based on gross lot development area from site plan.

Construction Phase -

Table Name	Column Name	Default Value	New Value
tblLandUse	LotAcreage	4.22	13.00
tblProjectCharacteristics	OperationalYear	2018	2020
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.3743	3.5106	2.4519	3.9600e-003	0.2302	0.2035	0.4337	0.1062	0.1902	0.2964	0.0000	353.2871	353.2871	0.0909	0.0000	355.5604
2019	0.5025	1.2259	1.0334	1.6500e-003	4.5100e-003	0.0735	0.0780	1.2100e-003	0.0690	0.0702	0.0000	144.9151	144.9151	0.0353	0.0000	145.7968
Maximum	**0.5025**	**3.5106**	**2.4519**	**3.9600e-003**	**0.2302**	**0.2035**	**0.4337**	**0.1062**	**0.1902**	**0.2964**	**0.0000**	**353.2871**	**353.2871**	**0.0909**	**0.0000**	**355.5604**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2018	0.3743	3.5106	2.4519	3.9600e-003	0.2302	0.2035	0.4337	0.1062	0.1902	0.2964	0.0000	353.2867	353.2867	0.0909	0.0000	355.5600
2019	0.5025	1.2259	1.0334	1.6500e-003	4.5100e-003	0.0735	0.0780	1.2100e-003	0.0690	0.0702	0.0000	144.9149	144.9149	0.0353	0.0000	145.7967
Maximum	**0.5025**	**3.5106**	**2.4519**	**3.9600e-003**	**0.2302**	**0.2035**	**0.4337**	**0.1062**	**0.1902**	**0.2964**	**0.0000**	**353.2867**	**353.2867**	**0.0909**	**0.0000**	**355.5600**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	1-1-2018	3-31-2018	1.3126	1.3126
2	4-1-2018	6-30-2018	0.8560	0.8560
3	7-1-2018	9-30-2018	0.8654	0.8654
4	10-1-2018	12-31-2018	0.8657	0.8657
5	1-1-2019	3-31-2019	0.7617	0.7617
6	4-1-2019	6-30-2019	0.7872	0.7872
7	7-1-2019	9-30-2019	0.1659	0.1659
		Highest	1.3126	1.3126

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.1334	2.0500e-003	0.1776	1.0000e-005		9.8000e-004	9.8000e-004		9.8000e-004	9.8000e-004	0.0000	0.2891	0.2891	2.8000e-004	0.0000	0.2961
Energy	2.5200e-003	0.0215	9.1600e-003	1.4000e-004		1.7400e-003	1.7400e-003		1.7400e-003	1.7400e-003	0.0000	57.6853	57.6853	1.9600e-003	7.6000e-004	57.9618
Mobile	0.0555	0.2832	0.7735	2.2000e-003	0.1939	2.7100e-003	0.1966	0.0519	2.5600e-003	0.0545	0.0000	201.2473	201.2473	8.0100e-003	0.0000	201.4476
Waste						0.0000	0.0000		0.0000	0.0000	3.0794	0.0000	3.0794	0.1820	0.0000	7.6290
Water						0.0000	0.0000		0.0000	0.0000	0.2687	1.8770	2.1457	0.0277	6.7000e-004	3.0372
Total	**0.1914**	**0.3068**	**0.9602**	**2.3500e-003**	**0.1939**	**5.4300e-003**	**0.1994**	**0.0519**	**5.2800e-003**	**0.0572**	**3.3481**	**261.0986**	**264.4467**	**0.2199**	**1.4300e-003**	**270.3718**

2.2 Overall Operational

Mitigated Operational

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	tons/yr										MT/yr					
Area	0.1334	2.0500e-003	0.1776	1.0000e-005		9.8000e-004	9.8000e-004		9.8000e-004	9.8000e-004	0.0000	0.2891	0.2891	2.8000e-004	0.0000	0.2961
Energy	2.5200e-003	0.0215	9.1600e-003	1.4000e-004		1.7400e-003	1.7400e-003		1.7400e-003	1.7400e-003	0.0000	57.6853	57.6853	1.9600e-003	7.6000e-004	57.9618
Mobile	0.0555	0.2832	0.7735	2.2000e-003	0.1939	2.7100e-003	0.1966	0.0519	2.5600e-003	0.0545	0.0000	201.2473	201.2473	8.0100e-003	0.0000	201.4476
Waste						0.0000	0.0000		0.0000	0.0000	3.0794	0.0000	3.0794	0.1820	0.0000	7.6290
Water						0.0000	0.0000		0.0000	0.0000	0.2687	1.8770	2.1457	0.0277	6.7000e-004	3.0372
Total	**0.1914**	**0.3068**	**0.9602**	**2.3500e-003**	**0.1939**	**5.4300e-003**	**0.1994**	**0.0519**	**5.2800e-003**	**0.0572**	**3.3481**	**261.0986**	**264.4467**	**0.2199**	**1.4300e-003**	**270.3718**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/27/2018	2/9/2018	5	10	
2	Grading	Grading	2/10/2018	3/23/2018	5	30	
3	Building Construction	Building Construction	3/24/2018	5/17/2019	5	300	
4	Paving	Paving	5/18/2019	6/14/2019	5	20	
5	Architectural Coating	Architectural Coating	6/15/2019	7/12/2019	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 0

Residential Indoor: 47,385; Residential Outdoor: 15,795; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Grading	Excavators	2	8.00	158	0.38
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Paving	Pavers	2	8.00	130	0.42
Paving	Rollers	2	8.00	80	0.38
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Grading	Graders	1	8.00	187	0.41
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Paving	Paving Equipment	2	8.00	132	0.36
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Architectural Coating	1	1.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	5.00	1.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0228	0.2410	0.1124	1.9000e-004		0.0129	0.0129		0.0119	0.0119	0.0000	17.3800	17.3800	5.4100e-003	0.0000	17.5152
Total	**0.0228**	**0.2410**	**0.1124**	**1.9000e-004**	**0.0903**	**0.0129**	**0.1032**	**0.0497**	**0.0119**	**0.0615**	**0.0000**	**17.3800**	**17.3800**	**5.4100e-003**	**0.0000**	**17.5152**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	4.6000e-004	4.0100e-003	1.0000e-005	8.7000e-004	1.0000e-005	8.7000e-004	2.3000e-004	1.0000e-005	2.4000e-004	0.0000	0.7707	0.7707	3.0000e-005	0.0000	0.7715
Total	**4.8000e-004**	**4.6000e-004**	**4.0100e-003**	**1.0000e-005**	**8.7000e-004**	**1.0000e-005**	**8.7000e-004**	**2.3000e-004**	**1.0000e-005**	**2.4000e-004**	**0.0000**	**0.7707**	**0.7707**	**3.0000e-005**	**0.0000**	**0.7715**

3.2 Site Preparation - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0228	0.2410	0.1124	1.9000e-004		0.0129	0.0129		0.0119	0.0119	0.0000	17.3799	17.3799	5.4100e-003	0.0000	17.5152
Total	**0.0228**	**0.2410**	**0.1124**	**1.9000e-004**	**0.0903**	**0.0129**	**0.1032**	**0.0497**	**0.0119**	**0.0615**	**0.0000**	**17.3799**	**17.3799**	**5.4100e-003**	**0.0000**	**17.5152**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.8000e-004	4.6000e-004	4.0100e-003	1.0000e-005	8.7000e-004	1.0000e-005	8.7000e-004	2.3000e-004	1.0000e-005	2.4000e-004	0.0000	0.7707	0.7707	3.0000e-005	0.0000	0.7715
Total	**4.8000e-004**	**4.6000e-004**	**4.0100e-003**	**1.0000e-005**	**8.7000e-004**	**1.0000e-005**	**8.7000e-004**	**2.3000e-004**	**1.0000e-005**	**2.4000e-004**	**0.0000**	**0.7707**	**0.7707**	**3.0000e-005**	**0.0000**	**0.7715**

3.3 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1301	0.0000	0.1301	0.0540	0.0000	0.0540	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0764	0.8928	0.5263	9.3000e-004		0.0395	0.0395		0.0364	0.0364	0.0000	84.9728	84.9728	0.0265	0.0000	85.6341
Total	**0.0764**	**0.8928**	**0.5263**	**9.3000e-004**	**0.1301**	**0.0395**	**0.1696**	**0.0540**	**0.0364**	**0.0903**	**0.0000**	**84.9728**	**84.9728**	**0.0265**	**0.0000**	**85.6341**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6100e-003	1.5500e-003	0.0134	3.0000e-005	2.8900e-003	2.0000e-005	2.9100e-003	7.7000e-004	2.0000e-005	7.9000e-004	0.0000	2.5689	2.5689	1.1000e-004	0.0000	2.5715
Total	**1.6100e-003**	**1.5500e-003**	**0.0134**	**3.0000e-005**	**2.8900e-003**	**2.0000e-005**	**2.9100e-003**	**7.7000e-004**	**2.0000e-005**	**7.9000e-004**	**0.0000**	**2.5689**	**2.5689**	**1.1000e-004**	**0.0000**	**2.5715**

3.3 Grading - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1301	0.0000	0.1301	0.0540	0.0000	0.0540	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0764	0.8928	0.5263	9.3000e-004		0.0395	0.0395		0.0364	0.0364	0.0000	84.9727	84.9727	0.0265	0.0000	85.6340
Total	**0.0764**	**0.8928**	**0.5263**	**9.3000e-004**	**0.1301**	**0.0395**	**0.1696**	**0.0540**	**0.0364**	**0.0903**	**0.0000**	**84.9727**	**84.9727**	**0.0265**	**0.0000**	**85.6340**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.6100e-003	1.5500e-003	0.0134	3.0000e-005	2.8900e-003	2.0000e-005	2.9100e-003	7.7000e-004	2.0000e-005	7.9000e-004	0.0000	2.5689	2.5689	1.1000e-004	0.0000	2.5715
Total	**1.6100e-003**	**1.5500e-003**	**0.0134**	**3.0000e-005**	**2.8900e-003**	**2.0000e-005**	**2.9100e-003**	**7.7000e-004**	**2.0000e-005**	**7.9000e-004**	**0.0000**	**2.5689**	**2.5689**	**1.1000e-004**	**0.0000**	**2.5715**

3.4 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2693	2.3507	1.7668	2.7000e-003		0.1507	0.1507		0.1417	0.1417	0.0000	238.9561	238.9561	0.0585	0.0000	240.4197
Total	**0.2693**	**2.3507**	**1.7668**	**2.7000e-003**		**0.1507**	**0.1507**		**0.1417**	**0.1417**	**0.0000**	**238.9561**	**238.9561**	**0.0585**	**0.0000**	**240.4197**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.0300e-003	0.0215	6.5200e-003	5.0000e-005	1.1800e-003	2.7000e-004	1.4500e-003	3.4000e-004	2.6000e-004	6.0000e-004	0.0000	4.3359	4.3359	2.1000e-004	0.0000	4.3411
Worker	2.6900e-003	2.5900e-003	0.0224	5.0000e-005	4.8400e-003	3.0000e-005	4.8700e-003	1.2900e-003	3.0000e-005	1.3200e-003	0.0000	4.3029	4.3029	1.8000e-004	0.0000	4.3073
Total	**3.7200e-003**	**0.0241**	**0.0289**	**1.0000e-004**	**6.0200e-003**	**3.0000e-004**	**6.3200e-003**	**1.6300e-003**	**2.9000e-004**	**1.9200e-003**	**0.0000**	**8.6388**	**8.6388**	**3.9000e-004**	**0.0000**	**8.6484**

3.4 Building Construction - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2693	2.3507	1.7668	2.7000e-003		0.1507	0.1507		0.1417	0.1417	0.0000	238.9558	238.9558	0.0585	0.0000	240.4194
Total	**0.2693**	**2.3507**	**1.7668**	**2.7000e-003**		**0.1507**	**0.1507**		**0.1417**	**0.1417**	**0.0000**	**238.9558**	**238.9558**	**0.0585**	**0.0000**	**240.4194**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	1.0300e-003	0.0215	6.5200e-003	5.0000e-005	1.1800e-003	2.7000e-004	1.4500e-003	3.4000e-004	2.6000e-004	6.0000e-004	0.0000	4.3359	4.3359	2.1000e-004	0.0000	4.3411
Worker	2.6900e-003	2.5900e-003	0.0224	5.0000e-005	4.8400e-003	3.0000e-005	4.8700e-003	1.2900e-003	3.0000e-005	1.3200e-003	0.0000	4.3029	4.3029	1.8000e-004	0.0000	4.3073
Total	**3.7200e-003**	**0.0241**	**0.0289**	**1.0000e-004**	**6.0200e-003**	**3.0000e-004**	**6.3200e-003**	**1.6300e-003**	**2.9000e-004**	**1.9200e-003**	**0.0000**	**8.6388**	**8.6388**	**3.9000e-004**	**0.0000**	**8.6484**

3.4 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1169	1.0434	0.8496	1.3300e-003		0.0639	0.0639		0.0600	0.0600	0.0000	116.3766	116.3766	0.0284	0.0000	117.0853
Total	**0.1169**	**1.0434**	**0.8496**	**1.3300e-003**		**0.0639**	**0.0639**		**0.0600**	**0.0600**	**0.0000**	**116.3766**	**116.3766**	**0.0284**	**0.0000**	**117.0853**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.4000e-004	9.9000e-003	2.8300e-003	2.0000e-005	5.8000e-004	1.1000e-004	6.9000e-004	1.7000e-004	1.1000e-004	2.7000e-004	0.0000	2.1232	2.1232	1.0000e-004	0.0000	2.1257
Worker	1.1900e-003	1.1200e-003	9.6700e-003	2.0000e-005	2.3800e-003	2.0000e-005	2.4000e-003	6.3000e-004	1.0000e-005	6.5000e-004	0.0000	2.0570	2.0570	8.0000e-005	0.0000	2.0590
Total	**1.6300e-003**	**0.0110**	**0.0125**	**4.0000e-005**	**2.9600e-003**	**1.3000e-004**	**3.0900e-003**	**8.0000e-004**	**1.2000e-004**	**9.2000e-004**	**0.0000**	**4.1803**	**4.1803**	**1.8000e-004**	**0.0000**	**4.1847**

3.4 Building Construction - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1169	1.0434	0.8496	1.3300e-003		0.0639	0.0639		0.0600	0.0600	0.0000	116.3764	116.3764	0.0284	0.0000	117.0852
Total	**0.1169**	**1.0434**	**0.8496**	**1.3300e-003**		**0.0639**	**0.0639**		**0.0600**	**0.0600**	**0.0000**	**116.3764**	**116.3764**	**0.0284**	**0.0000**	**117.0852**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.4000e-004	9.9000e-003	2.8300e-003	2.0000e-005	5.8000e-004	1.1000e-004	6.9000e-004	1.7000e-004	1.1000e-004	2.7000e-004	0.0000	2.1232	2.1232	1.0000e-004	0.0000	2.1257
Worker	1.1900e-003	1.1200e-003	9.6700e-003	2.0000e-005	2.3800e-003	2.0000e-005	2.4000e-003	6.3000e-004	1.0000e-005	6.5000e-004	0.0000	2.0570	2.0570	8.0000e-005	0.0000	2.0590
Total	**1.6300e-003**	**0.0110**	**0.0125**	**4.0000e-005**	**2.9600e-003**	**1.3000e-004**	**3.0900e-003**	**8.0000e-004**	**1.2000e-004**	**9.2000e-004**	**0.0000**	**4.1803**	**4.1803**	**1.8000e-004**	**0.0000**	**4.1847**

3.5 Paving - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0145	0.1524	0.1467	2.3000e-004		8.2500e-003	8.2500e-003		7.5900e-003	7.5900e-003	0.0000	20.4752	20.4752	6.4800e-003	0.0000	20.6371
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0145**	**0.1524**	**0.1467**	**2.3000e-004**		**8.2500e-003**	**8.2500e-003**		**7.5900e-003**	**7.5900e-003**	**0.0000**	**20.4752**	**20.4752**	**6.4800e-003**	**0.0000**	**20.6371**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.2000e-004	6.8000e-004	5.8600e-003	1.0000e-005	1.4400e-003	1.0000e-005	1.4500e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2467	1.2467	5.0000e-005	0.0000	1.2479
Total	**7.2000e-004**	**6.8000e-004**	**5.8600e-003**	**1.0000e-005**	**1.4400e-003**	**1.0000e-005**	**1.4500e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.2467**	**1.2467**	**5.0000e-005**	**0.0000**	**1.2479**

3.5 Paving - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0145	0.1524	0.1467	2.3000e-004		8.2500e-003	8.2500e-003		7.5900e-003	7.5900e-003	0.0000	20.4752	20.4752	6.4800e-003	0.0000	20.6371
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0145**	**0.1524**	**0.1467**	**2.3000e-004**		**8.2500e-003**	**8.2500e-003**		**7.5900e-003**	**7.5900e-003**	**0.0000**	**20.4752**	**20.4752**	**6.4800e-003**	**0.0000**	**20.6371**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	7.2000e-004	6.8000e-004	5.8600e-003	1.0000e-005	1.4400e-003	1.0000e-005	1.4500e-003	3.8000e-004	1.0000e-005	3.9000e-004	0.0000	1.2467	1.2467	5.0000e-005	0.0000	1.2479
Total	**7.2000e-004**	**6.8000e-004**	**5.8600e-003**	**1.0000e-005**	**1.4400e-003**	**1.0000e-005**	**1.4500e-003**	**3.8000e-004**	**1.0000e-005**	**3.9000e-004**	**0.0000**	**1.2467**	**1.2467**	**5.0000e-005**	**0.0000**	**1.2479**

3.6 Architectural Coating - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.3661					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.6600e-003	0.0184	0.0184	3.0000e-005		1.2900e-003	1.2900e-003		1.2900e-003	1.2900e-003	0.0000	2.5533	2.5533	2.2000e-004	0.0000	2.5587
Total	**0.3687**	**0.0184**	**0.0184**	**3.0000e-005**		**1.2900e-003**	**1.2900e-003**		**1.2900e-003**	**1.2900e-003**	**0.0000**	**2.5533**	**2.5533**	**2.2000e-004**	**0.0000**	**2.5587**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	5.0000e-005	3.9000e-004	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0831	0.0831	0.0000	0.0000	0.0832
Total	**5.0000e-005**	**5.0000e-005**	**3.9000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.0831**	**0.0831**	**0.0000**	**0.0000**	**0.0832**

3.6 Architectural Coating - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.3661					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.6600e-003	0.0184	0.0184	3.0000e-005		1.2900e-003	1.2900e-003		1.2900e-003	1.2900e-003	0.0000	2.5533	2.5533	2.2000e-004	0.0000	2.5586
Total	**0.3687**	**0.0184**	**0.0184**	**3.0000e-005**		**1.2900e-003**	**1.2900e-003**		**1.2900e-003**	**1.2900e-003**	**0.0000**	**2.5533**	**2.5533**	**2.2000e-004**	**0.0000**	**2.5586**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-005	5.0000e-005	3.9000e-004	0.0000	1.0000e-004	0.0000	1.0000e-004	3.0000e-005	0.0000	3.0000e-005	0.0000	0.0831	0.0831	0.0000	0.0000	0.0832
Total	**5.0000e-005**	**5.0000e-005**	**3.9000e-004**	**0.0000**	**1.0000e-004**	**0.0000**	**1.0000e-004**	**3.0000e-005**	**0.0000**	**3.0000e-005**	**0.0000**	**0.0831**	**0.0831**	**0.0000**	**0.0000**	**0.0832**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0555	0.2832	0.7735	2.2000e-003	0.1939	2.7100e-003	0.1966	0.0519	2.5600e-003	0.0545	0.0000	201.2473	201.2473	8.0100e-003	0.0000	201.4476
Unmitigated	0.0555	0.2832	0.7735	2.2000e-003	0.1939	2.7100e-003	0.1966	0.0519	2.5600e-003	0.0545	0.0000	201.2473	201.2473	8.0100e-003	0.0000	201.4476

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Single Family Housing	123.76	128.83	112.06	515,905	515,905
Total	123.76	128.83	112.06	515,905	515,905

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Single Family Housing	13.00	13.00	13.00	35.80	21.00	43.20	86	11	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Single Family Housing	0.559162	0.032279	0.198583	0.128083	0.030808	0.007362	0.013004	0.019140	0.002385	0.001267	0.005421	0.000811	0.001695

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	32.7439	32.7439	1.4800e-003	3.1000e-004	32.8722
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	32.7439	32.7439	1.4800e-003	3.1000e-004	32.8722
NaturalGas Mitigated	2.5200e-003	0.0215	9.1600e-003	1.4000e-004		1.7400e-003	1.7400e-003		1.7400e-003	1.7400e-003	0.0000	24.9414	24.9414	4.8000e-004	4.6000e-004	25.0896
NaturalGas Unmitigated	2.5200e-003	0.0215	9.1600e-003	1.4000e-004		1.7400e-003	1.7400e-003		1.7400e-003	1.7400e-003	0.0000	24.9414	24.9414	4.8000e-004	4.6000e-004	25.0896

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Single Family Housing	467384	2.5200e-003	0.0215	9.1600e-003	1.4000e-004		1.7400e-003	1.7400e-003		1.7400e-003	1.7400e-003	0.0000	24.9414	24.9414	4.8000e-004	4.6000e-004	25.0896
Total		**2.5200e-003**	**0.0215**	**9.1600e-003**	**1.4000e-004**		**1.7400e-003**	**1.7400e-003**		**1.7400e-003**	**1.7400e-003**	**0.0000**	**24.9414**	**24.9414**	**4.8000e-004**	**4.6000e-004**	**25.0896**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Single Family Housing	467384	2.5200e-003	0.0215	9.1600e-003	1.4000e-004		1.7400e-003	1.7400e-003		1.7400e-003	1.7400e-003	0.0000	24.9414	24.9414	4.8000e-004	4.6000e-004	25.0896
Total		**2.5200e-003**	**0.0215**	**9.1600e-003**	**1.4000e-004**		**1.7400e-003**	**1.7400e-003**		**1.7400e-003**	**1.7400e-003**	**0.0000**	**24.9414**	**24.9414**	**4.8000e-004**	**4.6000e-004**	**25.0896**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Single Family Housing	112556	32.7439	1.4800e-003	3.1000e-004	32.8722
Total		**32.7439**	**1.4800e-003**	**3.1000e-004**	**32.8722**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Single Family Housing	112556	32.7439	1.4800e-003	3.1000e-004	32.8722
Total		**32.7439**	**1.4800e-003**	**3.1000e-004**	**32.8722**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.1334	2.0500e-003	0.1776	1.0000e-005		9.8000e-004	9.8000e-004		9.8000e-004	9.8000e-004	0.0000	0.2891	0.2891	2.8000e-004	0.0000	0.2961
Unmitigated	0.1334	2.0500e-003	0.1776	1.0000e-005		9.8000e-004	9.8000e-004		9.8000e-004	9.8000e-004	0.0000	0.2891	0.2891	2.8000e-004	0.0000	0.2961

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0366					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0914					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	5.4100e-003	2.0500e-003	0.1776	1.0000e-005		9.8000e-004	9.8000e-004		9.8000e-004	9.8000e-004	0.0000	0.2891	0.2891	2.8000e-004	0.0000	0.2961
Total	**0.1334**	**2.0500e-003**	**0.1776**	**1.0000e-005**		**9.8000e-004**	**9.8000e-004**		**9.8000e-004**	**9.8000e-004**	**0.0000**	**0.2891**	**0.2891**	**2.8000e-004**	**0.0000**	**0.2961**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0366					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.0914					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	5.4100e-003	2.0500e-003	0.1776	1.0000e-005		9.8000e-004	9.8000e-004		9.8000e-004	9.8000e-004	0.0000	0.2891	0.2891	2.8000e-004	0.0000	0.2961
Total	**0.1334**	**2.0500e-003**	**0.1776**	**1.0000e-005**		**9.8000e-004**	**9.8000e-004**		**9.8000e-004**	**9.8000e-004**	**0.0000**	**0.2891**	**0.2891**	**2.8000e-004**	**0.0000**	**0.2961**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	2.1457	0.0277	6.7000e-004	3.0372
Unmitigated	2.1457	0.0277	6.7000e-004	3.0372

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Single Family Housing	0.847002 / 0.53398	2.1457	0.0277	6.7000e-004	3.0372
Total		**2.1457**	**0.0277**	**6.7000e-004**	**3.0372**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Single Family Housing	0.847002 / 0.53398	2.1457	0.0277	6.7000e-004	3.0372
Total		**2.1457**	**0.0277**	**6.7000e-004**	**3.0372**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	3.0794	0.1820	0.0000	7.6290
Unmitigated	3.0794	0.1820	0.0000	7.6290

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Single Family Housing	15.17	3.0794	0.1820	0.0000	7.6290
Total		**3.0794**	**0.1820**	**0.0000**	**7.6290**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Single Family Housing	15.17	3.0794	0.1820	0.0000	7.6290
Total		**3.0794**	**0.1820**	**0.0000**	**7.6290**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Jack Ranch Agricultural Cluster Project
San Luis Obispo County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Single Family Housing	13.00	Dwelling Unit	13.00	23,400.00	37

1.2 Other Project Characteristics

Urbanization Rural **Wind Speed (m/s)** 3.2 **Precipitation Freq (Days)** 44

Climate Zone 4 **Operational Year** 2020

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 641.35 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Lot acreage based on gross lot development area from site plan.

Construction Phase -

Table Name	Column Name	Default Value	New Value
tblLandUse	LotAcreage	4.22	13.00
tblProjectCharacteristics	OperationalYear	2018	2020
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2018	5.1948	59.6144	36.0026	0.0640	18.2442	2.6351	20.8223	9.9779	2.4243	12.3498	0.0000	6,440.8591	6,440.8591	1.9519	0.0000	6,489.6573
2019	36.8761	21.2950	17.4199	0.0278	0.1483	1.2924	1.3539	0.0393	1.2151	1.2317	0.0000	2,686.7934	2,686.7934	0.7193	0.0000	2,702.6750
Maximum	**36.8761**	**59.6144**	**36.0026**	**0.0640**	**18.2442**	**2.6351**	**20.8223**	**9.9779**	**2.4243**	**12.3498**	**0.0000**	**6,440.8591**	**6,440.8591**	**1.9519**	**0.0000**	**6,489.6573**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2018	5.1948	59.6144	36.0026	0.0640	18.2442	2.6351	20.8223	9.9779	2.4243	12.3498	0.0000	6,440.8591	6,440.8591	1.9519	0.0000	6,489.6573
2019	36.8761	21.2950	17.4199	0.0278	0.1483	1.2924	1.3539	0.0393	1.2151	1.2317	0.0000	2,686.7934	2,686.7934	0.7193	0.0000	2,702.6750
Maximum	**36.8761**	**59.6144**	**36.0026**	**0.0640**	**18.2442**	**2.6351**	**20.8223**	**9.9779**	**2.4243**	**12.3498**	**0.0000**	**6,440.8591**	**6,440.8591**	**1.9519**	**0.0000**	**6,489.6573**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783
Energy	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Mobile	0.3328	1.5602	4.5227	0.0131	1.1473	0.0156	1.1629	0.3067	0.0147	0.3214		1,321.0960	1,321.0960	0.0514		1,322.3821
Total	**1.0807**	**1.6906**	**5.6490**	**0.0139**	**1.1473**	**0.0311**	**1.1784**	**0.3067**	**0.0302**	**0.3368**	**0.0000**	**1,473.6746**	**1,473.6746**	**0.0562**	**2.7600e-003**	**1,475.9030**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783
Energy	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Mobile	0.3328	1.5602	4.5227	0.0131	1.1473	0.0156	1.1629	0.3067	0.0147	0.3214		1,321.0960	1,321.0960	0.0514		1,322.3821
Total	**1.0807**	**1.6906**	**5.6490**	**0.0139**	**1.1473**	**0.0311**	**1.1784**	**0.3067**	**0.0302**	**0.3368**	**0.0000**	**1,473.6746**	**1,473.6746**	**0.0562**	**2.7600e-003**	**1,475.9030**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/27/2018	2/9/2018	5	10	
2	Grading	Grading	2/10/2018	3/23/2018	5	30	
3	Building Construction	Building Construction	3/24/2018	5/17/2019	5	300	
4	Paving	Paving	5/18/2019	6/14/2019	5	20	
5	Architectural Coating	Architectural Coating	6/15/2019	7/12/2019	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 0

Residential Indoor: 47,385; Residential Outdoor: 15,795; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Jack Ranch Agricultural Cluster Project - San Luis Obispo County, Summer

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Grading	Excavators	2	8.00	158	0.38
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Paving	Pavers	2	8.00	130	0.42
Paving	Rollers	2	8.00	80	0.38
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Grading	Graders	1	8.00	187	0.41
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Paving	Paving Equipment	2	8.00	132	0.36
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Architectural Coating	1	1.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	5.00	1.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.5627	48.1988	22.4763	0.0380		2.5769	2.5769		2.3708	2.3708		3,831.6239	3,831.6239	1.1928		3,861.4448
Total	**4.5627**	**48.1988**	**22.4763**	**0.0380**	**18.0663**	**2.5769**	**20.6432**	**9.9307**	**2.3708**	**12.3014**		**3,831.6239**	**3,831.6239**	**1.1928**		**3,861.4448**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0942	0.0833	0.8219	1.7800e-003	0.1780	1.2200e-003	0.1792	0.0472	1.1200e-003	0.0483		176.7876	176.7876	7.1600e-003		176.9666
Total	**0.0942**	**0.0833**	**0.8219**	**1.7800e-003**	**0.1780**	**1.2200e-003**	**0.1792**	**0.0472**	**1.1200e-003**	**0.0483**		**176.7876**	**176.7876**	**7.1600e-003**		**176.9666**

3.2 Site Preparation - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.5627	48.1988	22.4763	0.0380		2.5769	2.5769		2.3708	2.3708	0.0000	3,831.6239	3,831.6239	1.1928		3,861.4448
Total	**4.5627**	**48.1988**	**22.4763**	**0.0380**	**18.0663**	**2.5769**	**20.6432**	**9.9307**	**2.3708**	**12.3014**	**0.0000**	**3,831.6239**	**3,831.6239**	**1.1928**		**3,861.4448**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0942	0.0833	0.8219	1.7800e-003	0.1780	1.2200e-003	0.1792	0.0472	1.1200e-003	0.0483		176.7876	176.7876	7.1600e-003		176.9666
Total	**0.0942**	**0.0833**	**0.8219**	**1.7800e-003**	**0.1780**	**1.2200e-003**	**0.1792**	**0.0472**	**1.1200e-003**	**0.0483**		**176.7876**	**176.7876**	**7.1600e-003**		**176.9666**

3.3 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.0901	59.5218	35.0894	0.0620		2.6337	2.6337		2.4230	2.4230		6,244.4284	6,244.4284	1.9440		6,293.0278
Total	**5.0901**	**59.5218**	**35.0894**	**0.0620**	**8.6733**	**2.6337**	**11.3071**	**3.5965**	**2.4230**	**6.0195**		**6,244.4284**	**6,244.4284**	**1.9440**		**6,293.0278**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1046	0.0926	0.9132	1.9800e-003	0.1977	1.3500e-003	0.1991	0.0524	1.2500e-003	0.0537		196.4307	196.4307	7.9500e-003		196.6295
Total	**0.1046**	**0.0926**	**0.9132**	**1.9800e-003**	**0.1977**	**1.3500e-003**	**0.1991**	**0.0524**	**1.2500e-003**	**0.0537**		**196.4307**	**196.4307**	**7.9500e-003**		**196.6295**

3.3 Grading - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.0901	59.5218	35.0894	0.0620		2.6337	2.6337		2.4230	2.4230	0.0000	6,244.4284	6,244.4284	1.9440		6,293.0278
Total	**5.0901**	**59.5218**	**35.0894**	**0.0620**	**8.6733**	**2.6337**	**11.3071**	**3.5965**	**2.4230**	**6.0195**	**0.0000**	**6,244.4284**	**6,244.4284**	**1.9440**		**6,293.0278**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1046	0.0926	0.9132	1.9800e-003	0.1977	1.3500e-003	0.1991	0.0524	1.2500e-003	0.0537		196.4307	196.4307	7.9500e-003		196.6295
Total	**0.1046**	**0.0926**	**0.9132**	**1.9800e-003**	**0.1977**	**1.3500e-003**	**0.1991**	**0.0524**	**1.2500e-003**	**0.0537**		**196.4307**	**196.4307**	**7.9500e-003**		**196.6295**

3.4 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6795	23.3900	17.5804	0.0269		1.4999	1.4999		1.4099	1.4099		2,620.935 1	2,620.935 1	0.6421		2,636.988 3
Total	**2.6795**	**23.3900**	**17.5804**	**0.0269**		**1.4999**	**1.4999**		**1.4099**	**1.4099**		**2,620.935 1**	**2,620.935 1**	**0.6421**		**2,636.988 3**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0102	0.2097	0.0627	4.5000e-004	0.0120	2.7000e-003	0.0147	3.4600e-003	2.5800e-003	6.0400e-003		47.8149	47.8149	2.2500e-003		47.8711
Worker	0.0262	0.0232	0.2283	4.9000e-004	0.0494	3.4000e-004	0.0498	0.0131	3.1000e-004	0.0134		49.1077	49.1077	1.9900e-003		49.1574
Total	**0.0363**	**0.2328**	**0.2910**	**9.4000e-004**	**0.0615**	**3.0400e-003**	**0.0645**	**0.0166**	**2.8900e-003**	**0.0195**		**96.9225**	**96.9225**	**4.2400e-003**		**97.0285**

3.4 Building Construction - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6795	23.3900	17.5804	0.0269		1.4999	1.4999		1.4099	1.4099	0.0000	2,620.9351	2,620.9351	0.6421		2,636.9883
Total	**2.6795**	**23.3900**	**17.5804**	**0.0269**		**1.4999**	**1.4999**		**1.4099**	**1.4099**	**0.0000**	**2,620.9351**	**2,620.9351**	**0.6421**		**2,636.9883**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0102	0.2097	0.0627	4.5000e-004	0.0120	2.7000e-003	0.0147	3.4600e-003	2.5800e-003	6.0400e-003		47.8149	47.8149	2.2500e-003		47.8711
Worker	0.0262	0.0232	0.2283	4.9000e-004	0.0494	3.4000e-004	0.0498	0.0131	3.1000e-004	0.0134		49.1077	49.1077	1.9900e-003		49.1574
Total	**0.0363**	**0.2328**	**0.2910**	**9.4000e-004**	**0.0615**	**3.0400e-003**	**0.0645**	**0.0166**	**2.8900e-003**	**0.0195**		**96.9225**	**96.9225**	**4.2400e-003**		**97.0285**

3.4 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635
Total	**2.3612**	**21.0788**	**17.1638**	**0.0269**		**1.2899**	**1.2899**		**1.2127**	**1.2127**		**2,591.5802**	**2,591.5802**	**0.6313**		**2,607.3635**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	8.7800e-003	0.1959	0.0552	4.5000e-004	0.0120	2.2100e-003	0.0142	3.4600e-003	2.1100e-003	5.5700e-003		47.5458	47.5458	2.1800e-003		47.6004
Worker	0.0235	0.0203	0.2009	4.8000e-004	0.0494	3.3000e-004	0.0498	0.0131	3.0000e-004	0.0134		47.6674	47.6674	1.7500e-003		47.7112
Total	**0.0323**	**0.2162**	**0.2562**	**9.3000e-004**	**0.0615**	**2.5400e-003**	**0.0640**	**0.0166**	**2.4100e-003**	**0.0190**		**95.2132**	**95.2132**	**3.9300e-003**		**95.3115**

3.4 Building Construction - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127	0.0000	2,591.5802	2,591.5802	0.6313		2,607.3635
Total	**2.3612**	**21.0788**	**17.1638**	**0.0269**		**1.2899**	**1.2899**		**1.2127**	**1.2127**	**0.0000**	**2,591.5802**	**2,591.5802**	**0.6313**		**2,607.3635**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	8.7800e-003	0.1959	0.0552	4.5000e-004	0.0120	2.2100e-003	0.0142	3.4600e-003	2.1100e-003	5.5700e-003		47.5458	47.5458	2.1800e-003		47.6004
Worker	0.0235	0.0203	0.2009	4.8000e-004	0.0494	3.3000e-004	0.0498	0.0131	3.0000e-004	0.0134		47.6674	47.6674	1.7500e-003		47.7112
Total	**0.0323**	**0.2162**	**0.2562**	**9.3000e-004**	**0.0615**	**2.5400e-003**	**0.0640**	**0.0166**	**2.4100e-003**	**0.0190**		**95.2132**	**95.2132**	**3.9300e-003**		**95.3115**

3.5 Paving - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.4544**	**15.2441**	**14.6648**	**0.0228**		**0.8246**	**0.8246**		**0.7586**	**0.7586**		**2,257.0025**	**2,257.0025**	**0.7141**		**2,274.8548**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0705	0.0608	0.6028	1.4400e-003	0.1483	9.8000e-004	0.1493	0.0393	9.1000e-004	0.0402		143.0023	143.0023	5.2500e-003		143.1336
Total	**0.0705**	**0.0608**	**0.6028**	**1.4400e-003**	**0.1483**	**9.8000e-004**	**0.1493**	**0.0393**	**9.1000e-004**	**0.0402**		**143.0023**	**143.0023**	**5.2500e-003**		**143.1336**

3.5 Paving - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586	0.0000	2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.4544**	**15.2441**	**14.6648**	**0.0228**		**0.8246**	**0.8246**		**0.7586**	**0.7586**	**0.0000**	**2,257.0025**	**2,257.0025**	**0.7141**		**2,274.8548**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0705	0.0608	0.6028	1.4400e-003	0.1483	9.8000e-004	0.1493	0.0393	9.1000e-004	0.0402		143.0023	143.0023	5.2500e-003		143.1336
Total	**0.0705**	**0.0608**	**0.6028**	**1.4400e-003**	**0.1483**	**9.8000e-004**	**0.1493**	**0.0393**	**9.1000e-004**	**0.0402**		**143.0023**	**143.0023**	**5.2500e-003**		**143.1336**

3.6 Architectural Coating - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.6049					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423
Total	**36.8714**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**		**281.4481**	**281.4481**	**0.0238**		**282.0423**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.7000e-003	4.0500e-003	0.0402	1.0000e-004	9.8900e-003	7.0000e-005	9.9500e-003	2.6200e-003	6.0000e-005	2.6800e-003		9.5335	9.5335	3.5000e-004		9.5422
Total	**4.7000e-003**	**4.0500e-003**	**0.0402**	**1.0000e-004**	**9.8900e-003**	**7.0000e-005**	**9.9500e-003**	**2.6200e-003**	**6.0000e-005**	**2.6800e-003**		**9.5335**	**9.5335**	**3.5000e-004**		**9.5422**

3.6 Architectural Coating - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.6049					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		282.0423
Total	**36.8714**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**	**0.0000**	**281.4481**	**281.4481**	**0.0238**		**282.0423**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.7000e-003	4.0500e-003	0.0402	1.0000e-004	9.8900e-003	7.0000e-005	9.9500e-003	2.6200e-003	6.0000e-005	2.6800e-003		9.5335	9.5335	3.5000e-004		9.5422
Total	**4.7000e-003**	**4.0500e-003**	**0.0402**	**1.0000e-004**	**9.8900e-003**	**7.0000e-005**	**9.9500e-003**	**2.6200e-003**	**6.0000e-005**	**2.6800e-003**		**9.5335**	**9.5335**	**3.5000e-004**		**9.5422**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Mitigated	0.3328	1.5602	4.5227	0.0131	1.1473	0.0156	1.1629	0.3067	0.0147	0.3214		1,321.0960	1,321.0960	0.0514		1,322.3821
Unmitigated	0.3328	1.5602	4.5227	0.0131	1.1473	0.0156	1.1629	0.3067	0.0147	0.3214		1,321.0960	1,321.0960	0.0514		1,322.3821

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Single Family Housing	123.76	128.83	112.06	515,905	515,905
Total	123.76	128.83	112.06	515,905	515,905

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Single Family Housing	13.00	13.00	13.00	35.80	21.00	43.20	86	11	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Single Family Housing	0.559162	0.032279	0.198583	0.128083	0.030808	0.007362	0.013004	0.019140	0.002385	0.001267	0.005421	0.000811	0.001695

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
NaturalGas Unmitigated	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1280.5	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Total		**0.0138**	**0.1180**	**0.0502**	**7.5000e-004**		**9.5400e-003**	**9.5400e-003**		**9.5400e-003**	**9.5400e-003**		**150.6474**	**150.6474**	**2.8900e-003**	**2.7600e-003**	**151.5426**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1.2805	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Total		**0.0138**	**0.1180**	**0.0502**	**7.5000e-004**		**9.5400e-003**	**9.5400e-003**		**9.5400e-003**	**9.5400e-003**		**150.6474**	**150.6474**	**2.8900e-003**	**2.7600e-003**	**151.5426**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783
Unmitigated	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.2006					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.5008					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0328	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003		1.9312	1.9312	1.8800e-003		1.9783
Total	**0.7341**	**0.0125**	**1.0761**	**6.0000e-005**		**5.9200e-003**	**5.9200e-003**		**5.9200e-003**	**5.9200e-003**	**0.0000**	**1.9312**	**1.9312**	**1.8800e-003**	**0.0000**	**1.9783**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.2006					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.5008					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0328	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003		1.9312	1.9312	1.8800e-003		1.9783
Total	**0.7341**	**0.0125**	**1.0761**	**6.0000e-005**		**5.9200e-003**	**5.9200e-003**		**5.9200e-003**	**5.9200e-003**	**0.0000**	**1.9312**	**1.9312**	**1.8800e-003**	**0.0000**	**1.9783**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Jack Ranch Agricultural Cluster Project

San Luis Obispo County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Single Family Housing	13.00	Dwelling Unit	13.00	23,400.00	37

1.2 Other Project Characteristics

Urbanization Rural **Wind Speed (m/s)** 3.2 **Precipitation Freq (Days)** 44

Climate Zone 4 **Operational Year** 2020

Utility Company Pacific Gas & Electric Company

CO2 Intensity (lb/MWhr) 641.35 **CH4 Intensity (lb/MWhr)** 0.029 **N2O Intensity (lb/MWhr)** 0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Land Use - Lot acreage based on gross lot development area from site plan.

Construction Phase -

Table Name	Column Name	Default Value	New Value
tblLandUse	LotAcreage	4.22	13.00
tblProjectCharacteristics	OperationalYear	2018	2020
tblProjectCharacteristics	UrbanizationLevel	Urban	Rural

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2018	5.2090	59.6269	35.9883	0.0639	18.2442	2.6351	20.8223	9.9779	2.4243	12.3498	0.0000	6,431.6867	6,431.6867	1.9518	0.0000	6,480.4804
2019	36.8767	21.2995	17.4194	0.0278	0.1483	1.2924	1.3539	0.0393	1.2152	1.2317	0.0000	2,683.9353	2,683.9353	0.7192	0.0000	2,699.8180
Maximum	**36.8767**	**59.6269**	**35.9883**	**0.0639**	**18.2442**	**2.6351**	**20.8223**	**9.9779**	**2.4243**	**12.3498**	**0.0000**	**6,431.6867**	**6,431.6867**	**1.9518**	**0.0000**	**6,480.4804**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2018	5.2090	59.6269	35.9883	0.0639	18.2442	2.6351	20.8223	9.9779	2.4243	12.3498	0.0000	6,431.6867	6,431.6867	1.9518	0.0000	6,480.4804
2019	36.8767	21.2995	17.4194	0.0278	0.1483	1.2924	1.3539	0.0393	1.2152	1.2317	0.0000	2,683.9353	2,683.9353	0.7192	0.0000	2,699.8180
Maximum	**36.8767**	**59.6269**	**35.9883**	**0.0639**	**18.2442**	**2.6351**	**20.8223**	**9.9779**	**2.4243**	**12.3498**	**0.0000**	**6,431.6867**	**6,431.6867**	**1.9518**	**0.0000**	**6,480.4804**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783
Energy	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Mobile	0.3256	1.6308	4.5141	0.0126	1.1473	0.0157	1.1630	0.3067	0.0148	0.3215		1,270.3800	1,270.3800	0.0512		1,271.6609
Total	**1.0735**	**1.7613**	**5.6404**	**0.0134**	**1.1473**	**0.0312**	**1.1785**	**0.3067**	**0.0303**	**0.3369**	**0.0000**	**1,422.9586**	**1,422.9586**	**0.0560**	**2.7600e-003**	**1,425.1818**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783
Energy	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Mobile	0.3256	1.6308	4.5141	0.0126	1.1473	0.0157	1.1630	0.3067	0.0148	0.3215		1,270.3800	1,270.3800	0.0512		1,271.6609
Total	**1.0735**	**1.7613**	**5.6404**	**0.0134**	**1.1473**	**0.0312**	**1.1785**	**0.3067**	**0.0303**	**0.3369**	**0.0000**	**1,422.9586**	**1,422.9586**	**0.0560**	**2.7600e-003**	**1,425.1818**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/27/2018	2/9/2018	5	10	
2	Grading	Grading	2/10/2018	3/23/2018	5	30	
3	Building Construction	Building Construction	3/24/2018	5/17/2019	5	300	
4	Paving	Paving	5/18/2019	6/14/2019	5	20	
5	Architectural Coating	Architectural Coating	6/15/2019	7/12/2019	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 0

Residential Indoor: 47,385; Residential Outdoor: 15,795; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Architectural Coating	Air Compressors	1	6.00	78	0.48
Grading	Excavators	2	8.00	158	0.38
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Paving	Pavers	2	8.00	130	0.42
Paving	Rollers	2	8.00	80	0.38
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Grading	Graders	1	8.00	187	0.41
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Paving	Paving Equipment	2	8.00	132	0.36
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Building Construction	Welders	1	8.00	46	0.45

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Architectural Coating	1	1.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	5.00	1.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	13.00	13.00	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Site Preparation - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.5627	48.1988	22.4763	0.0380		2.5769	2.5769		2.3708	2.3708		3,831.6239	3,831.6239	1.1928		3,861.4448
Total	**4.5627**	**48.1988**	**22.4763**	**0.0380**	**18.0663**	**2.5769**	**20.6432**	**9.9307**	**2.3708**	**12.3014**		**3,831.6239**	**3,831.6239**	**1.1928**		**3,861.4448**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1070	0.0946	0.8091	1.7000e-003	0.1780	1.2200e-003	0.1792	0.0472	1.1200e-003	0.0483		168.5325	168.5325	7.0000e-003		168.7073
Total	**0.1070**	**0.0946**	**0.8091**	**1.7000e-003**	**0.1780**	**1.2200e-003**	**0.1792**	**0.0472**	**1.1200e-003**	**0.0483**		**168.5325**	**168.5325**	**7.0000e-003**		**168.7073**

3.2 Site Preparation - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.5627	48.1988	22.4763	0.0380		2.5769	2.5769		2.3708	2.3708	0.0000	3,831.6239	3,831.6239	1.1928		3,861.4448
Total	**4.5627**	**48.1988**	**22.4763**	**0.0380**	**18.0663**	**2.5769**	**20.6432**	**9.9307**	**2.3708**	**12.3014**	**0.0000**	**3,831.6239**	**3,831.6239**	**1.1928**		**3,861.4448**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1070	0.0946	0.8091	1.7000e-003	0.1780	1.2200e-003	0.1792	0.0472	1.1200e-003	0.0483		168.5325	168.5325	7.0000e-003		168.7073
Total	**0.1070**	**0.0946**	**0.8091**	**1.7000e-003**	**0.1780**	**1.2200e-003**	**0.1792**	**0.0472**	**1.1200e-003**	**0.0483**		**168.5325**	**168.5325**	**7.0000e-003**		**168.7073**

3.3 Grading - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.0901	59.5218	35.0894	0.0620		2.6337	2.6337		2.4230	2.4230		6,244.4284	6,244.4284	1.9440		6,293.0278
Total	**5.0901**	**59.5218**	**35.0894**	**0.0620**	**8.6733**	**2.6337**	**11.3071**	**3.5965**	**2.4230**	**6.0195**		**6,244.4284**	**6,244.4284**	**1.9440**		**6,293.0278**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1189	0.1051	0.8989	1.8800e-003	0.1977	1.3500e-003	0.1991	0.0524	1.2500e-003	0.0537		187.2583	187.2583	7.7700e-003		187.4526
Total	**0.1189**	**0.1051**	**0.8989**	**1.8800e-003**	**0.1977**	**1.3500e-003**	**0.1991**	**0.0524**	**1.2500e-003**	**0.0537**		**187.2583**	**187.2583**	**7.7700e-003**		**187.4526**

3.3 Grading - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.6733	0.0000	8.6733	3.5965	0.0000	3.5965			0.0000			0.0000
Off-Road	5.0901	59.5218	35.0894	0.0620		2.6337	2.6337		2.4230	2.4230	0.0000	6,244.4284	6,244.4284	1.9440		6,293.0278
Total	**5.0901**	**59.5218**	**35.0894**	**0.0620**	**8.6733**	**2.6337**	**11.3071**	**3.5965**	**2.4230**	**6.0195**	**0.0000**	**6,244.4284**	**6,244.4284**	**1.9440**		**6,293.0278**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.1189	0.1051	0.8989	1.8800e-003	0.1977	1.3500e-003	0.1991	0.0524	1.2500e-003	0.0537		187.2583	187.2583	7.7700e-003		187.4526
Total	**0.1189**	**0.1051**	**0.8989**	**1.8800e-003**	**0.1977**	**1.3500e-003**	**0.1991**	**0.0524**	**1.2500e-003**	**0.0537**		**187.2583**	**187.2583**	**7.7700e-003**		**187.4526**

3.4 Building Construction - 2018

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6795	23.3900	17.5804	0.0269		1.4999	1.4999		1.4099	1.4099		2,620.9351	2,620.9351	0.6421		2,636.9883
Total	**2.6795**	**23.3900**	**17.5804**	**0.0269**		**1.4999**	**1.4999**		**1.4099**	**1.4099**		**2,620.9351**	**2,620.9351**	**0.6421**		**2,636.9883**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0105	0.2117	0.0670	4.5000e-004	0.0120	2.7300e-003	0.0148	3.4600e-003	2.6100e-003	6.0700e-003		47.2018	47.2018	2.3400e-003		47.2602
Worker	0.0297	0.0263	0.2247	4.7000e-004	0.0494	3.4000e-004	0.0498	0.0131	3.1000e-004	0.0134		46.8146	46.8146	1.9400e-003		46.8632
Total	**0.0402**	**0.2380**	**0.2918**	**9.2000e-004**	**0.0615**	**3.0700e-003**	**0.0645**	**0.0166**	**2.9200e-003**	**0.0195**		**94.0163**	**94.0163**	**4.2800e-003**		**94.1234**

3.4 Building Construction - 2018

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.6795	23.3900	17.5804	0.0269		1.4999	1.4999		1.4099	1.4099	0.0000	2,620.935 1	2,620.935 1	0.6421		2,636.988 3
Total	**2.6795**	**23.3900**	**17.5804**	**0.0269**		**1.4999**	**1.4999**		**1.4099**	**1.4099**	**0.0000**	**2,620.935 1**	**2,620.935 1**	**0.6421**		**2,636.988 3**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0105	0.2117	0.0670	4.5000e-004	0.0120	2.7300e-003	0.0148	3.4600e-003	2.6100e-003	6.0700e-003		47.2018	47.2018	2.3400e-003		47.2602
Worker	0.0297	0.0263	0.2247	4.7000e-004	0.0494	3.4000e-004	0.0498	0.0131	3.1000e-004	0.0134		46.8146	46.8146	1.9400e-003		46.8632
Total	**0.0402**	**0.2380**	**0.2918**	**9.2000e-004**	**0.0615**	**3.0700e-003**	**0.0645**	**0.0166**	**2.9200e-003**	**0.0195**		**94.0163**	**94.0163**	**4.2800e-003**		**94.1234**

3.4 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127		2,591.5802	2,591.5802	0.6313		2,607.3635
Total	**2.3612**	**21.0788**	**17.1638**	**0.0269**		**1.2899**	**1.2899**		**1.2127**	**1.2127**		**2,591.5802**	**2,591.5802**	**0.6313**		**2,607.3635**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	9.0700e-003	0.1977	0.0591	4.4000e-004	0.0120	2.2300e-003	0.0143	3.4600e-003	2.1400e-003	5.5900e-003		46.9174	46.9174	2.2700e-003		46.9741
Worker	0.0267	0.0230	0.1965	4.6000e-004	0.0494	3.3000e-004	0.0498	0.0131	3.0000e-004	0.0134		45.4377	45.4377	1.7100e-003		45.4804
Total	**0.0358**	**0.2207**	**0.2556**	**9.0000e-004**	**0.0615**	**2.5600e-003**	**0.0640**	**0.0166**	**2.4400e-003**	**0.0190**		**92.3551**	**92.3551**	**3.9800e-003**		**92.4545**

3.4 Building Construction - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day								lb/day		
Off-Road	2.3612	21.0788	17.1638	0.0269		1.2899	1.2899		1.2127	1.2127	0.0000	2,591.580 2	2,591.580 2	0.6313		2,607.363 5
Total	**2.3612**	**21.0788**	**17.1638**	**0.0269**		**1.2899**	**1.2899**		**1.2127**	**1.2127**	**0.0000**	**2,591.580 2**	**2,591.580 2**	**0.6313**		**2,607.363 5**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category						lb/day								lb/day		
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	9.0700e-003	0.1977	0.0591	4.4000e-004	0.0120	2.2300e-003	0.0143	3.4600e-003	2.1400e-003	5.5900e-003		46.9174	46.9174	2.2700e-003		46.9741
Worker	0.0267	0.0230	0.1965	4.6000e-004	0.0494	3.3000e-004	0.0498	0.0131	3.0000e-004	0.0134		45.4377	45.4377	1.7100e-003		45.4804
Total	**0.0358**	**0.2207**	**0.2556**	**9.0000e-004**	**0.0615**	**2.5600e-003**	**0.0640**	**0.0166**	**2.4400e-003**	**0.0190**		**92.3551**	**92.3551**	**3.9800e-003**		**92.4545**

3.5 Paving - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586		2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.4544**	**15.2441**	**14.6648**	**0.0228**		**0.8246**	**0.8246**		**0.7586**	**0.7586**		**2,257.0025**	**2,257.0025**	**0.7141**		**2,274.8548**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0802	0.0690	0.5896	1.3700e-003	0.1483	9.8000e-004	0.1493	0.0393	9.1000e-004	0.0402		136.3132	136.3132	5.1200e-003		136.4411
Total	**0.0802**	**0.0690**	**0.5896**	**1.3700e-003**	**0.1483**	**9.8000e-004**	**0.1493**	**0.0393**	**9.1000e-004**	**0.0402**		**136.3132**	**136.3132**	**5.1200e-003**		**136.4411**

3.5 Paving - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.4544	15.2441	14.6648	0.0228		0.8246	0.8246		0.7586	0.7586	0.0000	2,257.0025	2,257.0025	0.7141		2,274.8548
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.4544**	**15.2441**	**14.6648**	**0.0228**		**0.8246**	**0.8246**		**0.7586**	**0.7586**	**0.0000**	**2,257.0025**	**2,257.0025**	**0.7141**		**2,274.8548**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0802	0.0690	0.5896	1.3700e-003	0.1483	9.8000e-004	0.1493	0.0393	9.1000e-004	0.0402		136.3132	136.3132	5.1200e-003		136.4411
Total	**0.0802**	**0.0690**	**0.5896**	**1.3700e-003**	**0.1483**	**9.8000e-004**	**0.1493**	**0.0393**	**9.1000e-004**	**0.0402**		**136.3132**	**136.3132**	**5.1200e-003**		**136.4411**

3.6 Architectural Coating - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.6049					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288		281.4481	281.4481	0.0238		282.0423
Total	**36.8714**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**		**281.4481**	**281.4481**	**0.0238**		**282.0423**

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	5.3400e-003	4.6000e-003	0.0393	9.0000e-005	9.8900e-003	7.0000e-005	9.9500e-003	2.6200e-003	6.0000e-005	2.6800e-003		9.0876	9.0876	3.4000e-004		9.0961
Total	**5.3400e-003**	**4.6000e-003**	**0.0393**	**9.0000e-005**	**9.8900e-003**	**7.0000e-005**	**9.9500e-003**	**2.6200e-003**	**6.0000e-005**	**2.6800e-003**		**9.0876**	**9.0876**	**3.4000e-004**		**9.0961**

3.6 Architectural Coating - 2019

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	36.6049					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2664	1.8354	1.8413	2.9700e-003		0.1288	0.1288		0.1288	0.1288	0.0000	281.4481	281.4481	0.0238		282.0423
Total	**36.8714**	**1.8354**	**1.8413**	**2.9700e-003**		**0.1288**	**0.1288**		**0.1288**	**0.1288**	**0.0000**	**281.4481**	**281.4481**	**0.0238**		**282.0423**

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	5.3400e-003	4.6000e-003	0.0393	9.0000e-005	9.8900e-003	7.0000e-005	9.9500e-003	2.6200e-003	6.0000e-005	2.6800e-003		9.0876	9.0876	3.4000e-004		9.0961
Total	**5.3400e-003**	**4.6000e-003**	**0.0393**	**9.0000e-005**	**9.8900e-003**	**7.0000e-005**	**9.9500e-003**	**2.6200e-003**	**6.0000e-005**	**2.6800e-003**		**9.0876**	**9.0876**	**3.4000e-004**		**9.0961**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

Category	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
	lb/day										lb/day					
Mitigated	0.3256	1.6308	4.5141	0.0126	1.1473	0.0157	1.1630	0.3067	0.0148	0.3215		1,270.3800	1,270.3800	0.0512		1,271.6609
Unmitigated	0.3256	1.6308	4.5141	0.0126	1.1473	0.0157	1.1630	0.3067	0.0148	0.3215		1,270.3800	1,270.3800	0.0512		1,271.6609

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Single Family Housing	123.76	128.83	112.06	515,905	515,905
Total	123.76	128.83	112.06	515,905	515,905

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Single Family Housing	13.00	13.00	13.00	35.80	21.00	43.20	86	11	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Single Family Housing	0.559162	0.032279	0.198583	0.128083	0.030808	0.007362	0.013004	0.019140	0.002385	0.001267	0.005421	0.000811	0.001695

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
NaturalGas Unmitigated	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1280.5	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Total		**0.0138**	**0.1180**	**0.0502**	**7.5000e-004**		**9.5400e-003**	**9.5400e-003**		**9.5400e-003**	**9.5400e-003**		**150.6474**	**150.6474**	**2.8900e-003**	**2.7600e-003**	**151.5426**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1.2805	0.0138	0.1180	0.0502	7.5000e-004		9.5400e-003	9.5400e-003		9.5400e-003	9.5400e-003		150.6474	150.6474	2.8900e-003	2.7600e-003	151.5426
Total		**0.0138**	**0.1180**	**0.0502**	**7.5000e-004**		**9.5400e-003**	**9.5400e-003**		**9.5400e-003**	**9.5400e-003**		**150.6474**	**150.6474**	**2.8900e-003**	**2.7600e-003**	**151.5426**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783
Unmitigated	0.7341	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003	0.0000	1.9312	1.9312	1.8800e-003	0.0000	1.9783

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.2006					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.5008					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0328	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003		1.9312	1.9312	1.8800e-003		1.9783
Total	**0.7341**	**0.0125**	**1.0761**	**6.0000e-005**		**5.9200e-003**	**5.9200e-003**		**5.9200e-003**	**5.9200e-003**	**0.0000**	**1.9312**	**1.9312**	**1.8800e-003**	**0.0000**	**1.9783**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.2006					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	0.5008					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	0.0328	0.0125	1.0761	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003		1.9312	1.9312	1.8800e-003		1.9783
Total	**0.7341**	**0.0125**	**1.0761**	**6.0000e-005**		**5.9200e-003**	**5.9200e-003**		**5.9200e-003**	**5.9200e-003**	**0.0000**	**1.9312**	**1.9312**	**1.8800e-003**	**0.0000**	**1.9783**

7.0 Water Detail

7.1 Mitigation Measures Water

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Greenhouse Gas Emission Worksheet

N20 Mobile Emissions Jack Ranch Agricultural Subdivision

From CalEEMod Vehicle Fleet Mix Output:

Annual VMT: 515,905

Vehicle Type	Percent Type	CH4 Emission Factor (g/mile)*	CH4 Emission (g/mile)**	N2O Emission Factor (g/mile)*	N2O Emission (g/mile)**
Light Auto	55.9%	0.04	0.02236	0.04	0.02236
Light Truck < 3750 lbs	3.2%	0.05	0.0016	0.06	0.00192
Light Truck 3751-5750 lbs	19.9%	0.05	0.00995	0.06	0.01194
Med Truck 5751-8500 lbs	12.8%	0.12	0.01536	0.2	0.0256
Lite-Heavy Truck 8501-10,000 lbs	3.1%	0.12	0.00372	0.2	0.0062
Lite-Heavy Truck 10,001-14,000 lbs	0.7%	0.09	0.00063	0.125	0.000875
Med-Heavy Truck 14,001-33,000 lbs	1.3%	0.06	0.00078	0.05	0.00065
Heavy-Heavy Truck 33,001-60,000 lbs	1.9%	0.06	0.00114	0.05	0.00095
Other Bus	0.2%	0.06	0.00012	0.05	0.0001
Urban Bus	0.1%	0.06	0.00006	0.05	0.00005
Motorcycle	0.5%	0.09	0.00045	0.01	0.00005
School Bus	0.1%	0.06	0.00006	0.05	0.00005
Motor Home	0.3%	0.09	0.00027	0.125	0.000375
Total	**100.0%**		**0.0565**		**0.07112**

Total Emissions (metric tons) =
Emission Factor by Vehicle Mix (g/mi) x Annual VMT(mi) x 0.000001 metric tons/g

Conversion to Carbon Dioxide Equivalency (CO2e) Units based on Global Warming Potential (GWP)

CH4	25	GWP
N2O	298	GWP
1 ton (short, US) =	0.90718474	metric ton

Annual Mobile Emissions:

	Total Emissions		Total CO2e units	
N20 Emissions:	0.0367	metric tons N2O	**10.93**	metric tons CO2e
		Project Total:	***10.93***	***metric tons CO2e***

References

* from Table C.4: Methane and Nitrous Oxide Emission Factors for Mobile Sources by Vehicle and Fuel Type (g/mile).
in California Climate Action Registry General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009.
Assume Model year 2000-present, gasoline fueled.

** Source: California Climate Action Registry General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009.

*** From CalEEmod results for mobile sources

****Global Warming Potentials from 2007 IPCC AR4

Appendix D

Biological Report, Biological Resources Reconnaissance Survey results, and special status species database query results

Biological Report

for

Vesting Tentative Tract 2429
Jack Ranch Cluster Subdivision

APN 044-081-040

San Luis Obispo County

Prepared for

Jack Ranch SLO, LLC

by

ALTHOUSE AND MEADE, INC.
BIOLOGICAL AND ENVIRONMENTAL SERVICES
1602 Spring Street
Paso Robles, CA 93446
(805) 237-9626

June 2016

884.01

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Cover Page: View north of Study Area, spring 2015.

Synopsis

- This biological report examines a 295-acre property located in an unincorporated area of San Luis Obispo County, California. The property is situated southeast of Hacienda Avenue on Caballeros Avenue, off of Highway 227.
- The proposed Jack Ranch Cluster Subdivision project, Vesting Tentative Tract 2429, will create 13 one-acre development parcels and maintain 147 acres of planted vineyards.
- Habitat types identified and mapped on the property consist of vineyard, riparian, coast live oak woodland, California annual grassland, and anthropogenic. Sensitive natural communities listed by the California Natural Diversity Database (CNDDB) are not present on the property.
- Botanical surveys conducted on March 2 and April 28, 2015 identified 106 species, subspecies, and varieties of vascular plants on the property. Appropriate habitat and soil conditions are suitable for three special status plants. One special status plant, Cambria morning-glory (*Calystegia subacaulis* ssp. *episcopalis*), was mapped on the property.
- Wildlife species detected on the property include 1 amphibian, 2 reptiles, 37 birds, and 1 mammal. Appropriate habitat and soil conditions are present for 17 special status animals. No state or federally listed animals were detected on the property.

1.0 Introduction

This report provides information regarding biological resources associated with an approximately 295-acre parcel (Study Area) in San Luis Obispo County. Results are reported for botanical and wildlife surveys of the Study Area conducted from March and April 2015. A habitat inventory and results of database and literature searches of special status species reports within seven 7.5-minute quadrangle search area of the Study Area are also included. Special status species that could occur in the Study Area or be affected by the proposed project are discussed, and lists of plant and animal species that were identified or are expected in the Study Area are included.

We provide agencies and stakeholders with information regarding biological resources in the Study Area, and assess potential impacts to biological resources that could occur from the proposed project. An evaluation of the effect of the proposed project on biological resources is included, and mitigation measures are provided.

1.1 Project Location and Description

The Study Area is located in an unincorporated area of San Luis Obispo at the end of Caballeros Avenue, directly west of the San Luis Obispo Country Club (Figure 1). The northern boundary of the Study Area borders residential homes located on Caballeros Avenue. The Study Area consists of a 295-acreparcel (APN 044-081-040) known as the Jack Ranch. Approximate coordinates for the center of the Study Area are 35°12'50.27"N, 120°38'14.23"W. The Study Area is located within the Pismo Beach United States Geological Survey (USGS) 7.5 minute quadrangle. The elevation varies from approximately 170 to 490 feet above mean sea level.

The proposed project is a cluster subdivision of a 295-acre parcel that will create 13 one-acre development lots and maintain 147 acres of existing vineyards.

1.2 Responsible Parties

TABLE 1. RESPONSIBLE PARTIES. Applicant, agent, biological consultant, and lead agency are provided.

Applicant	Biological Consultant
Jack Ranch SLO, LLC	**Althouse and Meade, Inc.** 1602 Spring Street Paso Robles, CA 93446 (805) 237-9626 Dan Meade
Agent	**Lead Agency**
Dan Lloyd P.O. Box 378 Cayucos, CA 93430	**County of San Luis Obispo** Department of Planning & Building County Government Center San Luis Obispo, CA 93408

2.0 Methods

The Study Area was surveyed for biological resources on March 2 and April 28, 2015 (Table 2). Althouse and Meade, Inc. Biologists Jeremy Pohlman and Dustin Groh conducted the surveys. Biological surveys were conducted on foot in order to compile species lists, to search for special status plants and animals, to map habitats, and to photograph the Study Area. The entire Study Area was surveyed.

Each habitat type occurring in the Study Area was inspected, described, and catalogued (Section 5.0). All plant and animal species observed in the Study Area were identified and recorded (Sections 6.0 and 7.0). Reconnaissance transects were meandering with an emphasis on locating habitat appropriate for special status plants. Transects were utilized to map boundaries of different vegetation types, describe general conditions and dominant species, compile species lists, and evaluate potential habitat for special status species. Identification of botanical resources included field observations and laboratory analysis of collected material (Table 7). Botanical surveys were conducted in spring 2014 according to agency guidelines (United States Fish and Game 2000, California Department of Fish and Game 2009, and California Native Plant Society 2001). Botanical surveys were appropriately timed to identify all special status plant species known from the region (refer to Section 4.3, and Table 3) that have potential to occur in the Study Area. Botanical nomenclature used in this document follows the Jepson Manual, Second Edition (Baldwin et al. 2012). We also provide Jepson Manual First Edition names in brackets where nomenclature has recently changed.

Wildlife documentation included observations of animal presence, nests, tracks, and other wildlife sign. Observations of wildlife were recorded during field surveys in all areas of the Study Area (Table 8). Birds were identified by sight, using 10-power binoculars, or by vocalizations. Reptiles and amphibians were identified by sight, often using binoculars; traps were not used. Mammals recorded in the Study Area were identified by sight and tracks.

Maps were created using aerial photo interpretation, field notation, and GPS data imported to ArcGIS 10, a Geographic Information System (GIS) software program. Data were overlaid on a 2012 National Agriculture Imagery Program (NAIP) aerial of San Luis Obispo County (USDA 2012). .

The California Natural Diversity Database (CNDDB May 12, 2015 data) and the California Native Plant Society (CNPS) On-line Inventory of Rare and Endangered Plants of California were reviewed for special status species known to occur in seven USGS 7.5-minute quadrangles surrounding the Study Area: Morro Bay South, San Luis Obispo, Lopez Mtn., Port San Luis, Pismo Beach, Arroyo Grande NE, and Oceano.

Additional special status species research consisted of reviewing previous biological reports for the area and searching online museum and herbarium specimen records for locality data within San Luis Obispo county. We reviewed online databases of specimen records maintained by the Museum of Vertebrate Zoology at the University of California, Berkeley, the California Academy of Sciences, and the Consortium of California Herbaria. Additional special status species with potential to occur on or near the Study Area were added to our special status species list (refer to Table 3 and Table 4).

Special status species lists produced by database and literature searches were cross-referenced with the described habitat types in the Study Area to identify all potential special status species that could occur on or near the Study Area. Each special status species that could occur on or near the Study Area is individually discussed (refer to Sections 4.4 and 4.6).

TABLE 2. BIOLOGICAL SURVEYS. Biological survey dates, times, weather observations, and biologist(s) are provided.

Survey Date	Start Time Stop Time	Temp.	Wind	Weather Observations	Biologist(s)
3/2/2015	1:30 PM – 5:30 PM	60-65 °F	0-3 mph	Partly cloudy, warm	D.Groh J. Pohlman
4/28/2015	8:00 AM – 1:30 PM	60-70 °F	0-3 mph	Clear, warm	D.Groh J. Pohlman

3.0 Existing Conditions

3.1 Environmental Setting

The Study Area is located in San Luis Obispo county to the southeast of San Luis Obispo city limits. The entirety of the Study Area is located south and west of Caballeros Avenue. The northern edge of the study area is adjacent to residential homes while the eastern edge of the Study Area is adjacent to the San Luis Obispo Country Club. California annual grassland and coast live oak woodland border the south and west edges of the Study Area.

The northern two-thirds of the Study Area are rolling hills almost completely comprised of maintained vineyards. The understory of the vineyard section consists of weedy and invasive grasses and forbs. Running from the southeast through the vineyard section on the northern half of the Study Area is a seasonal drainage. The drainage is lined with willows (*Salix lasiolepis*), coast live oak trees (*Quercus agrifolia* var. *agrifolia*), and coyote bush (*Baccharis pilularis*) on the north and south edges. Depth of water in the drainage ranges from 1 to 18 inches and flows from east to west. Evidence exists of mowing annual grasses on the bank of the northeast side of the drainage.

The southern half of the Study Area are north facing hillsides consisting of a mix of coast live oak woodland and California annual grassland. Two large drainages dissect the hillsides on the western and eastern portions. The drainages run from the tops of the hills on the southern side of the Study Area to the dirt road that borders the vineyards. The drainages are dominated by large coast live oak trees reaching heights of above 60 to 70 feet. The understory in the drainages consists mostly of grasses and annual forbs. No water is present in either of the two large drainages. Grasslands on either side of the large drainages comprise approximately 93.9 acres in the southern section of the Study Area. The grassland is dominated by annual grasses with scattered coast live oaks along the hillsides.

On the second field site visit evidence of scraping with heavy equipment existed in various lot locations on the southern hillsides of the study area. Work done consisted of scraping top layer of vegetation where future lots are proposed, pushing soil over the banks of the large drainages, and cutting oak trees in the bottom of the drainages. (See photographs, Section 13.0).

3.2 Soils

The United States Department of Agriculture (USDA) Soil Survey Geographic (SSURGO) data (2007) and Soil Survey of San Luis Obispo County, California, Coastal Part (1984) and USDA SSURGO Data (Tabular data version 4, Spatial data version 1, 2008) delineate eight soil map units that intersect the Study Area boundaries (Figure 3). The majority of the Study Area is mapped as Diablo clay and Nacimiento-Calodo complex (129, 181 respectively). There are also some areas of Tierra sandy loam, Briones-Pismo loamy sands, Crople clay, Zaca clay, Tierra loam, and Briones sandy loam (216, 109, 127, 224, 218, 108, respectively). This soil survey was not meant to be applied at the acre-scale, but does indicate the soil map units in the vicinity of small properties.

Soil map units typically encompass one or two dominant soils that cover more than 50 percent of the mapped area, and one to several soils that occur in small patches not differentiated in mapping at the 1 to 24,000 scale used for Natural Resource Conservation Service (NRCS) soil maps. Due to the procedures followed in making a soil survey, users of soil survey data are cautioned that not all areas included within a soil survey are closely sampled using soil pits and site descriptions, and a specific site may not have been sampled at all. Therefore, care must be taken in drawing conclusions regarding site-specific soil resources based solely on NRCS soil survey work. Digitized spatial data from the Paso Robles Area are shown as an overlay of soil map units on an aerial photo of the region with the following caution from NRCS regarding maps: "Enlargement of these maps…could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale."

Diablo clay, five to nine percent slopes (129) is the dominant soil type found in the Study Area and is located throughout the southern half of the vineyard habitat. This soil is a deep, well drained soil on low lying foothills. Permeability in the Diablo soil is slow and the available water capacity is moderate to very high. Surface run-off is medium and the hazard of water erosion is slight or moderate. Local road and street design can require that the bas material be replaced or covered with a more suitable material so that maintenance is minimized. This soil is in capability units IIe-5 (15), irrigated, and IIIe-5 (15), non-irrigated.

Nacimiento-Calodo complex, 30 to 50 percent slopes (181), is a major soil type found along the hills of the southern portion of the Study Area. The complex is a steep soil on foothills and mountains. This complex is about 45 percent Nacimiento soil and 35 percent Calodo soil. Included in this complex are small areas of Gazos and Lodo clay loams, Santa Lucia shaly clay loam, and Zaca silt loam. Also included are a few small areas of a soil about 18 inches deep that has a clay loam surface layer underlain by a sand clay subsoil. The Nacimiento soil is moderately deep. Permeability is moderately slow, and the available water capacity is low or moderate. Surface runoff is rapid, and the hazard of water erosion is high. The Calodo soil is shallow and well drained. Permeability is moderately slow, and the available water capacity is very low or low. Surface runoff is rapid, and the hazard of water erosion is high.

Tierra sandy loam, 2 to 9 percent slopes (216) is found in various sections of the Study Area. The soil is a very deep, moderately well drained, gently sloping and moderately sloping soil on dissected terraces and hills. It formed in old alluvium weathered from sedimentary rocks. Included in the map unit are a few small areas of Briones loamy sand, Chamise shaly loam, Concepcion loam, and Diablo clay. Permeability of this Tierra soil is very slow and the available water capacity is low or moderate. Surface runoff is slow or medium. The hazard of soil blowing is moderate and the hazard of water erosion is slight or moderate.

Briones-Pismo loamy sands, 9 to 30 percent slopes (109) is found along the southwest corner of the Study Area. The soil is a strongly sloping to moderately steep soil on foothills and mountains. This soil complex is about 40 percent Briones loamy sand and about 30 percent Pismo loamy sand. Included in this complex are areas of a soil that is similar to Briones and Pismo soils but has a darker, sandy loam surface layer with a few small area of Arnold loamy sand. Permeability of the Briones soil is rapid, and available water capacity is very low or low. Surface runoff is medium or rapid. The hazard of water erosion is moderate or high, and the hazard of soil blowing is high.

Cropley clay on zero to two percent slopes (127) is found throughout the east west drainage that flows through the Study Area. The soil is a very deep and moderately well-drained soil. It occurs on alluvial fans and plains, having been formed in alluvium weathered from sedimentary rocks. The permeability is slow, the available water capacity high, and the erosion hazard is low. Included in this map unit are small areas of Concepcion loam, Diablo clay, and Salinas silty clay loam. This soil is in capability units IIs-5 (14), irrigated and IIIs-5 (14), non-irrigated. This soil type encompasses the historic barn and a portion of the grazed annual grassland field in the vicinity of the project site.

Zaca clay, 9 to 15 percent slopes (224) is found just north of the drainage, at the northern boundary of the Study Area. The soil is a deep, well drained, strongly sloping or rolling soil on low lying foothills. It formed in residual material weathered from calcareous sandstone, mudstone, or shale. Included in this map unit are small areas of Cropley clay, soils on lesser slopes, areas of soils similar to Zaca soil but moderately deep and having a clay loam surface layer, and Diablo clay. In the Nipomo Valley, there are minor areas of Santa Lucia shaly clay loam. Permeability of this Zaca soil is slow, and the available water capacity is high. Surface runoff is medium, and the hazard of water erosion is moderate.

Tierra loam, 15 to 30 percent slopes (218) is found along a small strip along the southern half of the Study Area. The soil is a very deep, moderately well drained, moderately steep soil on dissected terraces and hills. It formed in old alluvium weathered from sedimentary rocks. Included in this map unit are a few small areas of Briones loamy sand, Chamise shaly loam, and Diablo clay. Permeability of this Tierra soil is very slow, and the available water capacity is low or moderate. Surface runoff is medium, and the hazard of water erosion is moderate.

Briones loamy sand, 15 to 50 percent slopes (108) is found in a small section at the southeast corner of the Study Area. The soil is a moderately deep, somewhat excessively drained, moderately steep and steep soil on foothills and mountains. It is formed in residual material weathered from soft sandstone. Included in this map unit are a few areas of a soil that has an 8 to 16 inch clay layer above the sandstone, a few small areas of Arnold and Pismo loamy sands, a soil similar to Briones soil that has a darker sandy loam surface layer, and a few areas that have slopes of less than 15 percent. Permeability of this Briones soil is rapid, and the available water capacity is very low or low. Surface runoff is rapid. The hazards of water erosion and soil blowing are high.

4.0 Special Status Plants and Animals

The CNDDB and the CNPS On-line Inventory of Rare and Endangered Plants of California contain records for 156 special status species and 9 sensitive natural communities within the designated search area (Table 5). The search area included seven USGS 7.5 minute quadrangles surrounding the Study Area: Pismo Beach, Arroyo Grande NE, Oceano, Port San Luis, Morro Bay South, San Luis Obispo and Lopez Mountain. Suitable habitat and soil conditions are found on the property for three special status plants and ten special status animals. Section 12.0, Figures 4 and 5, depict the current GIS data for special status species in the vicinity of the property.

4.1 Introduction to California Rare Plant Ranks (Formerly CNPS lists)

Plant species are considered rare when their distribution is confined to localized areas, when there is a threat to their habitat, when they are declining in abundance, or are threatened in a portion of their range. The California Rare Plant Rank (CRPR) categories range from species with a low threat (CRPR 4) to species that are presumed extinct (CRPR 1A). The plants of CRPR 1B are rare throughout their range. All but a few species are endemic to California. All of them are judged to be vulnerable under present circumstances, or to have a high potential for becoming vulnerable.

4.2 Introduction to CNDDB Definitions

"Special Plants" is a broad term used to refer to all the plant taxa inventoried by the CNDDB, regardless of their legal or protection status (CDFG May 2012). Special plants include vascular plants and high priority bryophytes (mosses, liverworts, and hornworts).

"Special Animals" is a general term that refers to all of the animal taxa inventoried by the CNDDB, regardless of their legal or protection status (CDFG January 2011). The Special Animals list is also referred to by the California Department of Fish and Wildlife (CDFW) as the list of "species at risk" or "special status species". These taxa may be listed or proposed for listing under the California and/or Federal Endangered Species Acts, but they may also be species deemed biologically rare, restricted in range, declining in abundance, or otherwise vulnerable.

Each species included on the Special Animals list has a corresponding Global and State Rank (refer to Table 4). This ranking system utilizes a numbered hierarchy from one to five following the Global (G-rank) or State (S-rank) category. The threat level of the organism decreases with an increase in the rank number (1=Critically Imperiled, 5=Secure). In some cases where an uncertainty exists in the designation, a question mark (?) is placed after the rank. More information is available at www.natureserve.org.

Animals listed as California Species of Special Concern (SSC) may or may not be listed under California or Federal Endangered Species Acts. They are considered rare or declining in abundance in California. The Special Concern designation is intended to provide the California

Department of Fish and Wildlife, biologists, land planners and managers with lists of species that require special consideration during the planning process in order to avert continued population declines and potential costly listing under federal and state endangered species laws. For many species of birds, the primary emphasis is on the breeding population in California. For some species that do not breed in California but winter here, emphasis is on wintering range. The SSC designation thus may include a comment regarding the specific protection provided such as nesting or wintering.

Animals listed as Fully Protected are those species considered by CDFW as rare or faced with possible extinction. Most, but not all, have subsequently been listed under the California Endangered Species Act (CESA) or the Federal Endangered Species Act (FESA). Fully Protected species may not be taken or possessed at any time and no provision of the California Fish and Game code authorizes the issuance of permits or licenses to take any Fully Protected species.

4.3 Potential Special Status Plant List

Table 3 lists 107 special status plant species reported from the region. Federal and California State status, global and State rank, and CNPS rank status for each species are given. Typical blooming period, habitat preference, potential habitat on site, whether or not the species was detected in the Study Area, and effect of the proposed activity are also provided.

TABLE 3. SPECIAL STATUS PLANT LIST. The 107 special status plants reported from the region are listed. Potentially suitable habitat is present on the Study Area for 3 special status plant species.

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
1.	**Adobe Sanicle** *Sanicula maritima*	None/CR G2/CR 1B.1	February - May	Coastal, grassy, open wet meadows, ravines; ±150 m. CCo (SLO County)	No. Suitable habitat not present in the Study Area.	No	No Effect
2.	**Adobe Yampah** *Perideridia pringlei*	None/None G4/None 4.3	April – June	Grassy slopes, serpentine outcrops; 300-1800 m. SCoR, WTR.	No. Suitable habitat not present in the Study Area.	No	No Effect
3.	**Arroyo de la Cruz Manzanita** *Arctostaphylos cruzensis*	None/None G3/None 1B.2	December - March	Sandy bluffs; <150 m. c CCo (s Monterey, nw SLO Counties)	No. Suitable habitat not present in the Study Area.	No	No Effect
4.	**Beach Spectaclepod** *Dithyrea maritima*	None/CT G2/CT 1B.1	March - May	Sea shores, sandy soils on dunes near the shore; <50 m s CCo, SCo, Baja CA.	No. Suitable habitat not present in the Study Area.	No	No Effect
5.	**Betty's Dudleya** *Dudleya abramsii* ssp. *bettinae*	None/None G4T1/None 1B.2	May - July	Rocky outcrops in serpentine grassland; <50-180 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
6.	**Bishop Manzanita** *Arctostaphylos obispoensis*	None/None G4/None 4.3	February - March	Rocky, gen serpentine soils, chaparral, open close-cone forest near coast; 60-950 m; SCoRO	No. Suitable habitat not present in the Study Area.	No	No Effect
7.	**Black-flowered Figwort** *Scrophularia atrata*	None/None G2G3/None 1B.2	March - July	Closed-cone coniferous forest, riparian scrub, dune habitats; in sand, diatomaceous shales, calcareous and other soil types. 10-250 m. s SCoRO	No. Suitable habitat not present in the Study Area.	No	No Effect
8.	**Blochman's Dudleya** *Dudleya blochmaniae* ssp. *blochmaniae*	None/None G2T2/None 1B.1	April - June	Open, rocky slopes, often serpentine or clay soils; <450 m. s CCo, SCo	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
9.	**Blochman's Leafy Daisy** *Erigeron blochmaniae*	None/None G2/None 1B.2	July - August	Sand dunes and hills; <30 m. s CCo	No. Suitable habitat not present in the Study Area.	No	No Effect
10.	**Blochman's Ragwort** *Senecio blochmaniae*	None/None G3/None 4.2	May - October	Sand dunes, coastal floodplains.	No. Suitable habitat not present in the Study Area.	No	No Effect
11.	**Branching Beach Aster** *Corethrogyne leucophylla*	None/None G3Q/None 3.2	May - December	Coastal dunes, scrub. <2500 m. s SN, SnJV, CW, SW, n Baja.	No. Suitable habitat not present in the Study Area.	No	No Effect
12.	**Brewer's Calandrinia** *Calandrinia breweri*	None/None G4/None 4.2	February – May	Sandy to loamy soil, disturbed sites, burns; <1200m. NCoR, c SNF, SnFrB, SCoRO, SCo, WTR; n Baja CA	No. Suitable habitat not present in the Study Area.	No	No Effect
13.	**Brewer's Spineflower** *Chorizanthe breweri*	None/None G2/None 1B.3	May - August	Chaparral, foothill woodland on serpentine; <800 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
14.	**California Sawgrass** *Cladium californicum*	None/None G4/None 2B.2	June - September	Freshwater and alkali marshes and seeps.	No. Suitable habitat not present in the Study Area.	No	No Effect
15.	**California Seablite** *Suaeda californica*	FE/None G1/None 1B.1	July - October	Margins of coastal salt marshes; <5 m. CCo	No. Suitable habitat not present in the Study Area.	No	No Effect
16.	**California Spineflower** *Mucronea californica*	None/None G3/None 4.2	March - August	Sandy soil in coastal scrub, chaparral; 0-1400 m. CS, SW	No. Suitable habitat not present in the Study Area.	No	No Effect
17.	**Cambria Morning-glory** *Calystegia subacaulis* ssp. *episcopalis*	None/None G3T3/None 4.2	April - May	Dry, open scrub, woodland, or grassland; <500 m. c SCoRO Endemic to SLO County	Yes. Suitable habitat is present in the Study Area.	**Yes**	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
18.	**Caper-fruited Tropidocarpum** *Tropidocarpum capparideum*	None/None G1/None 1B.1	March - April	Alkaline clay soil in valley and foothill grassland; 1-455 m. SCoRO, nw SnJV	No. Suitable habitat not present in the Study Area.	No	No Effect
19.	**Carlotta Hall's Lace Fern** *Aspidotis carlotta-halliae*	None/None G3/None 4.2	N/A	Generally serpentine slopes, crevices, outcrops	No. Suitable habitat not present in the Study Area.	No	No Effect
20.	**Catalina Mariposa Lily** *Calochortus catalinae*	None/None G4/None 4.2	February - June	Heavy soil in open grassland or shrubland; <700 m.	No. Suitable habitat not present in the Study Area.	No	No Effect
21.	**Chaparral Ragwort** *Senecio aphanactis*	None/None G3?/None 2B.2	January - April	Drying alkaline flats, chaparral, cismontane woodland, coastal scrub; <400 m. CW, SCo, ChI	No. Suitable habitat not present in the Study Area.	No	No Effect
22.	**Club-haired Mariposa Lily** *Calochortus clavatus* var. *clavatus*	None/None G4T3/None 4.3	April – June	Generally serpentine; <1300m. s SCoRO, n SCoRI, WTR, SnGb	No. Suitable habitat not present in the Study Area.	No	No Effect
23.	**Coast Woolly-heads** *Nemacaulis denudata* var. *denudata*	None/None G3G4T2/None 1B.2	April-September	Coastal dunes; 0-100 m.	No. Suitable habitat not present in the Study Area.	No	No Effect
24.	**Coastal Goosefoot** *Chenopodium littoreum*	None/None G2/None 1B.2	June – October	Generally sandy soils, dunes; <40m. s CCo	No. Suitable habitat not present in the Study Area.	No	No Effect
25.	**Congdon's Tarplant** *Centromadia parryi* ssp. *congdonii*	None/None G3T2/None 1B.1	May - November	Mesic grassland, open ground; <100 m. CW	No. Suitable habitat not present in the Study Area.	No	No Effect
26.	**Coulter's Goldfields** *Lasthenia glabrata* ssp. *coulteri*	None/None G4T2/None 1B.1	February - June	Saline places, vernal pools; <1000 m. s SCoRO, SCo, n ChI, PR, w DMoj	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
27.	**Coulter's Saltbush** *Atriplex coulteri*	None/None G2/None 1B.2	March - October	Coastal bluff scrub, coastal dunes, coastal scrub, valley and foothill grassland;	No. Suitable habitat not present in the Study Area.	No	No Effect
28.	**Crisp Monardella** *Monardella undulata* ssp. *crispa*	None/None G3T2/None 1B.2	April – November	Active dunes; <100 m. s CCo (San Luis Obispo and Santa Barbara Counties)	No. Suitable habitat not present in the Study Area.	No	No Effect
29.	**Cuesta Pass Checkerbloom** *Sidalcea hickmanii* ssp. *anomala*	None/CR G3T1/CR 1B.2	May - June	Closed-cone-conifer forest, gen serpentine; 600-800 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
30.	**Cuesta Ridge Thistle** *Cirsium occidentale* var. *lucianum*	None/None G3G4T2/None 1B.2	April – July	Chaparral, woodland or forest openings, often on serpentine; 500-750m. s SCoRO (s Santa Lucia Range, San Luis Obispo, CA)	No. Suitable habitat not present in the Study Area.	No	No Effect
31.	**Dacite Manzanita** *Arctostaphylos tomentosa* ssp. *daciticola*	None/None G4T1/None 1B.1	March	Chaparral; <300 m. s CCo (w Los Osos Valley, SLO County)	No. Suitable habitat not present in the Study Area.	No	No Effect
32.	**Diablo Canyon Blue Grass** *Poa diaboli*	None/None G2/None 1B.2	March - April	Coastal scrub, chaparral, cismontane woodland in shale. San Luis Range	No. Suitable habitat not present in the Study Area.	No	No Effect
33.	**Douglas' Fiddleneck** *Amsinckia douglasiana*	None/None G3/None 4.2	March – June	Unstable shaly sedimentary slopes; (100) 150–1600 m. SCoR, w WTR	No. Suitable habitat not present in the Study Area.	No	No Effect
34.	**Douglas' Spineflower** *Chorizanthe douglasii*	None/None G4/None 4.3	April - July	Foothill woodland, pine forest, chaparral, sandy or gravelly soils; 200-1600 m. e SCoRO, SCoRI	No. Suitable habitat not present in the Study Area.	No	No Effect
35.	**Dune Larkspur** *Delphinium parryi* ssp. *blochmaniae*	None/None G4T2/None 1B.2	April - May	Coastal chaparral, sand. 0-200 m. s CCo	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
36.	**Dunedelion** *Malacothrix incana*	None/None G4/None 4.3	Year Round	Sandy coastal dunes; <300 m. CCo, Sco	No. Suitable habitat not present in the Study Area.	No	No Effect
37.	**Dwarf Calycadenia** *Calycadenia villosa*	None/None G3/None 1B.1	May - October	Dry, rocky hills, ridges, in chaparral, woodland, meadows and seeps; <1100 m. c&s SCoRO	No. Suitable habitat not present in the Study Area.	No	No Effect
38.	**Dwarf Soaproot** *Chlorogalum pomeridianum* var. *minus*	None/None G5T2/None 1B.2	May - August	Serpentine outcrops in chaparral; gen <750 m. NCoRI, SnFrB, SCoRO	No. Suitable habitat not present in the Study Area.	No	No Effect
39.	**Eastwood's Larkspur** *Delphinium parryi* ssp. *eastwoodiae*	None/None G4T2/None 1B.2	March – May	Coastal chaparral, grassland, on serpentine; 100-500m sCCo, SCoRO (San Luis Obispo County)	No. Suitable habitat not present in the Study Area.	No	No Effect
40.	**False Gray Horsehair Lichen** *Bryoria pseudocapillaris*	None/None G3/None 3.2	none	Usually on conifers. Found on coastal dunes and North Coast coniferous forest. NCo, CCo	No. Suitable habitat not present in the Study Area.	No	No Effect
41.	**Gambel's Water Cress** *Nasturtium gambelii*	FE/CT G1/CT 1B.1	April - September	Marshes, stream banks, lake margins; <1250 m. s CCo, SCo, to Mexico	No. Suitable habitat not present in the Study Area.	No	No Effect
42.	**Guirado's Goldenrod** *Solidago guiradonis*	None/None G3G4/None 4.3	September – October	Near streams in asbestos-laden soils; 600-900 m. SCoRI	No. Suitable habitat not present in the Study Area.	No	No Effect
43.	**Hardham's Evening-primrose** *Camissoniopsis hardhamiae*	None/None G1Q/None 1B.2	April - May	Decomposed carbonate soils, in chaparral, cismontane woodland. Monterey, SLO Counties	No. Suitable habitat not present in the Study Area.	No	No Effect
44.	**Hoffmann's Sanicle** *Sanicula hoffmannii*	None/None G3/None 4.3	March – May	Shrubby coastal hills, pine woodland; <500m. CCo, SCo, n ChI	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
45.	**Hooked Popcornflower** *Plagiobothrys uncinatus*	None/None G2/None 1B.2	April - May	Canyon sides, chaparral; on sandstone 300-600 m. n SCoR (Gabilan Range, Santa Lucia Mountains)	No. Suitable habitat not present in the Study Area.	No	No Effect
46.	**Hoover's Bent Grass** *Agrostis hooveri*	None/None G2/None 1B.2	April - July	Sandy soil in oak woodland habitat; <600 m. Endemic to SLO & SB Counties.	Yes. Suitable habitat is present in the Study Area for this species.	No	No Effect
47.	**Hoover's Button-celery** *Eryngium aristulatum* var. *hooveri*	None/None G5T1/None 1B.1	July	Vernal pools, lagunas; 0-1000 m. s SnFrB, SCoR	No. Suitable habitat not present in the Study Area.	No	No Effect
48.	**Indian Knob Mountainbalm** *Eriodictyon altissimum*	FE/CE G1/CE 1B.1	March - June	Sandstone ridges, chaparral; 250± m. Endemic to SLO County	No. Suitable habitat is not present in the Study Area.	No	No Effect
49.	**Island Mountain-Mahogany** *Cercocarpus betuloides* var. *blancheae*	None/None G5T4/None 4.3	March - April	Chaparral; <600 m.	No. Suitable habitat not present in the Study Area.	No	No Effect
50.	**Jones' Bush-mallow** *Malacothamnus jonesii*	None/None G4/None 4.3	May - July	Open chaparral in foothill woodland; 250-830 m. SCoRO (Monterey, SLO Counties).	No. Suitable habitat not present in the Study Area.	No	No Effect
51.	**Jones' Layia** *Layia jonesii*	None/None G2/None 1B.2	March - May	Open serpentine or clay slopes; <400 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
52.	**Kellogg's Horkelia** *Horkelia cuneata* var. *sericea*	None/None G4T2/None 1B.1	April - September	Old dunes, coastal sand hills; <200 m. CCo	No. Suitable habitat not present in the Study Area.	No	No Effect
53.	**La Graciosa Thistle** *Cirsium scariosum* var. *loncholepis*	FE/CT G5T1/CT 1B.1	April – September	Marshes, dune wetlands; <50m. s CCo (sw San Luis Obispo, nw Santa Barbara counties)	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
54.	**La Panza Mariposa Lily** *Calochortus simulans*	None/None G2/None 1B.3	April - May	Grassland, oak woodland & pine forest, on sand, granite, or serpentine; <1100 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
55.	**Lompoc Ceanothus** *Ceanothus cuneatus* var. *fascicularis*	None/None G5T4/None 4.2	February - April	Chaparral on coastal sandy mesas; <400 m. s Cco	No. Suitable habitat not present in the Study Area.	No	No Effect
56.	**Marsh Sandwort** *Arenaria paludicola*	FE/CE G1/CE 1B.1	May - August	Boggy meadows, marshes; <300 m. s CCo (Nipomo Mesa, SLO County, Santa Ana River, SCo)	No. Suitable habitat not present in the Study Area.	No	No Effect
57.	**Mesa Horkelia** *Horkelia cuneata* var. *puberula*	None/None G4T1/None 1B.1	February - September	Dry, sandy coastal chaparral; gen 70-700 m. SCoRO, SCo.	No. Suitable habitat not present in the Study Area.	No	No Effect
58.	**Michael's Rein Orchid** *Piperia michaelii*	None/None G3/None 4.2	April - August	Dry oak woodland habitat in SLO County; 3-915 m. NCo, SNF, CCo, SnFrB, n SCo, WTR, S. Cruz Is.	No. Suitable habitat not present in the Study Area.	No	No Effect
59.	**Miles' Milk-vetch** *Astragalus didymocarpus* var. *milesianus*	None/None G5T2/None 1B.2	March - June	Clay or serpentine soils in coastal scrub, grassy areas near coast. 0-90 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
60.	**Monkey-flower Savory** *Clinopodium mimuloides*	None/None G3/None 4.2	June – October	Moist places, streambanks, chaparral, woodland; 400-1800 m. CCo, SCoRO, WTR, SnGb	No. Suitable habitat not present in the Study Area.	No	No Effect
61.	**Monterey Ceanothus** *Ceanothus rigidus*	None/None G4/None 4.2	February - June	Sandy soils, closed-cone coniferous forest, chaparral, coastal scrub; <550 m.	No. Suitable habitat not present in the Study Area.	No	No Effect
62.	**Morro Manzanita** *Arctostaphylos morroensis*	FT/None G2/None 1B.1	December - March	Sand dunes; <200 m. s CCo (Morro Bay, SLO County)	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
63.	**Most Beautiful Jewelflower** *Streptanthus albidus* ssp. *peramoenus*	None/None G2T2/None 1B.2	April - June	Open, grassy or ±barren slopes, often serpentine; ±150-800 m. c SCoRO	No. Suitable habitat not present in the Study Area.	No	No Effect
64.	**Mouse-gray Dudleya** *Dudleya abramsii* ssp. *murina*	None/None G4T2/None 1B.3	May - June	Serpentine outcrops; 120-300 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
65.	**Nipomo Mesa Lupine** *Lupinus nipomensis*	FE/CE G1/CE 1B.1	March - May	Stabilized sand dunes; <25m. s CCo (Nipomo dunes, sw SLO County)	No. Suitable habitat not present in the Study Area.	No	No Effect
66.	**Ocean Bluff Milk-vetch** *Astragalus nuttallii* var. *nuttallii*	None/None G4T4/None 4.2	January - November	Rocks, coastal bluff scrub, coastal dunes; 3-120 m.	No. Suitable habitat not present in the Study Area.	No	No Effect
67.	**Ojai Fritillary** *Fritillaria ojaiensis*	None/None G2/None 1B.2	March - May	Rocky slopes, river basins; 300-500 m. SCoRO, WTR	No. Suitable habitat not present in the Study Area.	No	No Effect
68.	**Oso Manzanita** *Arctostaphylos osoensis*	None/None G1/None 1B.2	February - March	Chaparral, woodland; 300-500m. s CCo (w Los Osos Valley, SLO County)	No. Suitable habitat not present in the Study Area.	No	No Effect
69.	**Palmer's Monardella** *Monardella palmeri*	None/None G2/None 1B.2	June - August	Serpentine soils in chaparral, forest; 200-800 m. SCoRO	No. Suitable habitat not present in the Study Area.	No	No Effect
70.	**Palmer's Spineflower** *Chorizanthe palmeri*	None/None G4?/None 4.2	May – August	Serpentine; 60-700m. SCoRO (w Monterey, w San Luis Obispo cos.)	No. Suitable habitat not present in the Study Area.	No	No Effect
71.	**Paniculate Tarplant** *Deinandra paniculata*	None/None G4/None 4.2	May - November	Vernally mesic or sandy soils in coastal scrub and grassland habitats; <1320 m.	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
72.	**Pecho Manzanita** *Arctostaphylos pechoensis*	None/None G2/None 1B.2	November - March	Shale outcrops, chaparral, coniferous forest; <850 m. s CCo (Pecho Hills, SLO)	No. Suitable habitat not present in the Study Area.	No	No Effect
73.	**Peninsular Spineflower** *Chorizanthe leptotheca*	None/None G3/None 4.2	May - August	Alluvial fan, granitic soils, sand or gravel; chaparral, coast scrub, lower montane coniferous forest; 300-1900 m. c PR	No. Suitable habitat not present in the Study Area.	No	No Effect
74.	**Pismo Clarkia** *Clarkia speciosa* ssp. *immaculata*	FE/CR G4T1/CR 1B.1	May - July	Sandy hills near coast; <100 m. s CCo (±Pismo to Edna, SLO County)	Yes. Moderately suitable grassland habitat is present in the Study Area.	No	No Effect
75.	**Point Reyes Ceanothus** *Ceanothus gloriosus* var. *gloriosus*	None/None G4T4/None 4.3	March - May	Sandy places, coastal bluffs, closed-cone-pine forest; < 500 m. s NCo, n CCo (Marin Co.)	No. Suitable habitat not present in the Study Area.	No	No Effect
76.	**Popcorn Lichen** *Cladonia firma*	None/None G4/None 2B.1	n/a	Reported in maritime chaparral and dune scrub typically in stabilized dunes, grows on soil and detritus.	No. Suitable habitat not present in the Study Area.	No	No Effect
77.	**Potbellied Spineflower** *Chorizanthe ventricosa*	None/None G4/None 4.3	May - Sept	Serpentine; 500-1000 m. SCoRI	No. Suitable habitat not present in the Study Area.	No	No Effect
78.	**Red Sand-verbena** *Abronia maritima*	None/None G4/None 4.2	February - October	Coastal dunes; <100m sCCo, Sco, ChI; Baja CA	No. Suitable habitat not present in the Study Area.	No	No Effect
79.	**Saline Clover** *Trifolium hydrophilum*	None/None G2/None 1B.2	April – June	Salt marshes, open areas in alkaline soils; <300m. ScV, nw SnJV, CW	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
80.	**Salt Marsh Bird's-beak** *Chloropyron maritimum* ssp. *maritimum*	FE/CE G4?T1/CE 1B.2	May - October	Coastal salt marshes;<10 m. SCo, n Baja CA	No. Suitable habitat not present in the Study Area.	No	No Effect
81.	**San Benito Fritillary** *Fritillaria viridea*	None/None G2/None 1B.2	March - May	Serpentine slopes; 200-1500 m. SCoR (San Benito, SLO Counties)	No. Suitable habitat not present in the Study Area.	No	No Effect
82.	**San Bernardino Aster** *Symphyotrichum defoliatum*	None/None G2/None 1B.2	July - November	Vernally mesic grasslands near ditches, streams, springs, or disturbed areas; 2-2040 m.	No. Suitable habitat not present in the Study Area.	No	No Effect
83.	**San Francisco Gumplant** *Grindelia hirsutula var. maritima*	None/None G5T1Q/None 3.2	August - September	Sandy or serpentine slopes, sea bluffs; <400 m. n CCo	No. Suitable habitat not present in the Study Area.	No	No Effect
84.	**San Joaquin Spearscale** *Extriplex joaquinana*	None/None G2/None 1B.2	April - September	Alkaline soils; < 350(840) m. NCoRI, SnJV, CCo, SnFrB, SCoRI	No. Suitable habitat not present in the Study Area.	No	No Effect
85.	**San Luis Mariposa Lily** *Calochortus obispoensis*	None/None G2/None 1B.2	May - July	Chaparral, coastal scrub, valley and foothill grassland, often on serpentine but also sandstone; 100-500 m. SCoRO Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
86.	**San Luis Obispo County Lupine** *Lupinus ludovicianus*	None/None G1/None 1B.2	April - July	Open, grassy limestone in oak woodland; 50-500 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
87.	**San Luis Obispo Fountain Thistle [Chorro Creek bog thistle]** *Cirsium fontinale* var. *obispoense*	FE/CE G2T2/CE 1B.2	February - July	Serpentine seeps and streams; <300 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
88.	**San Luis Obispo Monardella** *Monardella undulata* ssp. *undulata*	None/None G2/None 1B.2	April - September	Stabilized dunes, coastal scrub, stabilized sandy soils; <200 m. CCo.	No. Suitable habitat not present in the Study Area.	No	No Effect
89.	**San Luis Obispo Owl's-clover** *Castilleja densiflora* var. *obispoensis*	None/None G5T2/None 1B.2	April	Coastal grassland, <100 m. Endemic to SLO County.	Yes. Suitable habitat is present in the Study Area for this species.	No	No Effect
90.	**San Luis Obispo Sedge** *Carex obispoensis*	None/None G2G3/None 1B.2	April - June	Serpentine springs, stream sides; <600 m. Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect
91.	**Sand Almond** *Prunus fasciculata* var. *punctata*	None/None G5T4/None 4.3	March – April	Sandy soils in maritime chaparral, cismontane woodland, coastal dunes, coastal scrub.	No. Suitable habitat not present in the Study Area.	No	No Effect
92.	**Sand Mesa Manzanita** *Arctostaphylos rudis*	None/None G2/None 1B.2	November - February	Sandy soils, chaparral. <100m. s CCo (Nipomo, Burton Mesa, Pt. Sal, sw SLO, nw SB Counties	No. Suitable habitat not present in the Study Area.	No	No Effect
93.	**Santa Lucia Manzanita** *Arctostaphylos luciana*	None/None G3/None 1B.2	February - March	Shale outcrops, slopes, chaparral, 500-700 m. Cuesta Pass, SLO County.	No. Suitable habitat not present in the Study Area.	No	No Effect
94.	**Santa Margarita Manzanita** *Arctostaphylos pilosula*	None/None G3/None 1B.2	December - March	Shale outcrops, slopes, chaparral; 300-1100 m. s SCoRO Endemic to SLO County	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
95.	**Short-lobed Broomrape** *Orobanche parishii* ssp. *brachyloba*	None/None G4?T4/None 4.2	April-October	Sandy habitats; coastal bluff scrub; coastal dunes. Parasitic on shrubs. 3-305 m. SCo; ChI; Baja.	No. Suitable habitat not present in the Study Area.	No	No Effect
96.	**Slender Bush-mallow** *Malacothamnus gracilis* (=*Malacothamnus jonesii*)	None/None G1Q/None 1B.1	May-July	Open chaparral in foothill woodland; 250-830 m. SCoRO (Monterey, SLO Counties).	No. Suitable habitat not present in the Study Area.	No	No Effect
97.	**Small-leaved Lomatium** *Lomatium parvifolium*	None/None G4/None 4.2	February – May	Pine woodland, serpentine outcrops; 70-150 m. CCo, SCoR	No. Suitable habitat not present in the Study Area.	No	No Effect
98.	**South Coast Branching Phacelia** *Phacelia ramosissima* var. *austrolitoralis*	None/None G5?T3/None 3.2	March – August	Chaparral, Coastal dunes, coastal scrub, coastal salt marshes and swamps; rocky or sandy. 5-300 m. CCo, SCo, ChI.	No. Suitable habitat not present in the Study Area.	No	No Effect
99.	**Southern Curly-leaved Monardella** *Monardella sinuata* ssp. *sinuata*	None/None G3T2/None 1B.2	April - September	Sandy soils, coastal strand, dune and sagebrush scrub, coastal chaparral and woodland; <300 m. Cco, SCoRO, extirpated Sco.	No. Suitable habitat not present in the Study Area.	No	No Effect
100	**Splitting Yarn Lichen** *Sulcaria isidiifera*	None/None G1/None 1B.1	n/a	Chaparral, cismontane woodland, on branches of oaks, chamise, Ceanothus; 20-30 m. Los Osos, SLO County.	No. Suitable habitat not present in the Study Area.	No	No Effect
101	**Stinkbells** *Fritillaria agrestis*	None/None G3/None 4.2	March – June	Clay (gen serpentine) banks, depressions; <500 m. NCoRO , SNF, GV, CW	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CRPR	Blooming Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
102	**Straight-awned Spineflower** *Chorizanthe rectispina*	None/None G1/None 1B.3	May - July	Chaparral, dry woodland in sandy soil; 200-600 m. SCoRO	No. Suitable habitat not present in the Study Area.	No	No Effect
103	**Suffrutescent Wallflower** *Erysimum suffrutescens*	None/None G3/None 4.2	January - July	Coastal dunes and bluffs; 0 - 150 m. CCo, SCo	No. Suitable habitat not present in the Study Area.	No	No Effect
104	**Surf Thistle** *Cirsium rhothophilum*	None/CT G1/CT 1B.2	April - June	Dunes, bluffs; <20 m. s CCo (s SLO, n SB Counties)	No. Suitable habitat not present in the Study Area.	No	No Effect
105	**Twisted Horsehair Lichen** *Bryoria spiralifera*	None/None G3/None 1B.1	none	Usually on conifers. North Coast coniferous forest. Nco, Cco	No. Suitable habitat not present in the Study Area.	No	No Effect
106	**Umbrella Larkspur** *Delphinium umbraculorum*	None/None G3/None 1B.3	April - June	Moist oak forest; 400-1600 m.	No. Suitable habitat not present in the Study Area.	No	No Effect
107	**Woodland Woollythreads** *Monolopia gracilens*	None/None G2G3/None 1B.2	March – July	Chaparral, serpentine grassland, cismontane woodland, sandy to rocky soils; SnFrB, SCoR	No. Suitable habitat not present in the Study Area.	No	No Effect

Habitat Preference Abbreviations:

CCo: Central Coast	SnFrB: San Francisco Bay	SLO: San Luis Obispo	CW: Central West
SCo: South Coast	TR: Transverse Ranges	SN: Sierra Nevada	SW: South West
SCoR: South Coast Ranges	WTR: Western Transverse Ranges	SnJt: San Jacinto Mtns	DMoj: Mojave Desert
SCoRO: Outer South Coast Ranges	SnJV: San Joaquin Valley	SnBr: San Bernardino	PR: Peninsular Range
SCoRI: Inner South Coast Ranges	ScV: Sacramento Valley	Teh: Tehachapi Mtn Area	

State/Rank Abbreviations:

FE: Federally Endangered	PT: Proposed Federally Threatened	CT: California Threatened
FT: Federally Threatened	CE: California Endangered	Cand. CE: Candidate for California Endangered
PE: Proposed Federally Endangered	CR: California Rare	Cand. CT: Candidate for California Threatened

California Rare Plant Ranks:
CRPR 1A: Plants presumed extirpated in California and either rare or extinct elsewhere
CRPR 1B: Plants rare, threatened, or endangered in California and elsewhere
CRPR 2A: Plants presumed extirpated in California, but common elsewhere
CRPR 2B: Plants rare, threatened, or endangered in California, but more common elsewhere
CRPR 4: Plants of limited distribution - a watch list

CRPR Threat Ranks:
0.1 - Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
0.2 - Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
0.3 - Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

4.4 Special Status Plants Discussion

Three special status plant species could potentially occur in the Study Area based on an analysis of known ecological requirements of these species and the habitat conditions that were observed in the Study Area. We discuss each species and describe habitat, range restrictions, known occurrences, and survey results for the Study Area. In addition, we include discussion of two federally listed species, Chorro Creek bog thistle and Indian Knob mountain balm, that are known from the region but suitable habitat is not present in the Study Area.

A. **Cambria Morning-glory** (*Calystegia subacaulis* ssp. *episcopalis*) is a CRPR 4.2 subspecies known only from San Luis Obispo County. It occurs in coastal grassland and open scrub and woodland habitats. Its rarity status relates to the limited distribution of this subspecies, although it may be found commonly within its range and preferred habitat type. The plant forms a small rosette and a conspicuous cream colored flower. Two patches of Cambria morning-glory were mapped in the Study Area, with a combined total of approximately 500 individual plants (Figure 6).

B. **Hoover's Bent Grass** (*Agrostis hooveri*) is a CRPR 1B.2 species endemic to San Luis Obispo and Santa Barbara Counties. It is a perennial bunchgrass that occurs on coastal mountains in dry sandy soils of open chaparral and oak woodlands below 600 meters in elevation. It typically flowers from April to July. The CNPS considers this species to be "fairly endangered in California," with an estimated 20 to 80 percent of the known occurrences threatened (Rank 1B.2). The closest reported occurrence of Hoover's bent grass to the Study Area is approximately one mile to the southeast (CNDDB 10). Habitat within the Study Area is suitable for Hoover's bent grass. Because several perennial bunchgrass species occur in the Study Area, identification of Hoover's bent grass required an appropriately timed survey during the blooming period. Our botanical surveys in April 2015, appropriately timed to identify Hoover's bent grass, determined this species is not present in the Study Area.

C. **San Luis Obispo Owl's-clover** (*Castilleja densiflora* ssp. *obispoensis*) is a CRPR 1B.2 subspecies endemic to San Luis Obispo County. It is an annual wildflower that occurs in coastal grasslands in sandy or clay soils. The closest reported occurrence is from about 2 miles southeast of the Study Area, east of Pismo Creek and north of Canada Verde (CNDDB 26). Appropriate habitat is present in the Study Area for this rare subspecies. San Luis Obispo owl's-clover was not found in the Study Area during appropriately timed surveys in the spring of 2015. Althouse and Meade, Inc. conducted reference site visits at known populations in April 2015 and found this species was not present in most areas. San Luis Obispo Owl's-clover occurrence and density varies greatly from year to year, with its poorest showings during drought periods.

D. **Chorro Creek Bog Thistle** (*Cirsium fontinale* var. *obispoense*) is a federally listed endangered species that is endemic to San Luis Obispo County. It only occurs in streams and seeps where serpentine soil is present. Appropriate habitat for this species does not occur in the Study Area. Chorro Creek bog thistle does not occur in the Study Area.

E. **Indian Knob Mountain Balm** (*Eriodictyon altissimum*) is a federally listed endangered species known from only 6 localities. The largest known population is in the vicinity of Indian Knob and Squire Canyon (CNDDB 5, 7). Appropriate habitat for this endangered shrub is not present in the Stud Area. Botanical surveys conducted in April confirmed Indian Knob mountain balm does not occur in the Study Area.

F. **Pismo Clarkia** (*Clarkia speciosa* ssp. *immaculata*) is a federally listed endangered species endemic to southern San Luis Obispo County. The Study Area is moderately appropriate for Pismo clarkia. Botanical surveys were conducted in late April, concurrent with the blooming period for Pismo Clarkia, and confirmed this endangered species does not occur in the Study Area.

4.5 Potential Special Status Animals List

Table 4 lists 49 special status animal species reported from the region. Federal and California State status, global and State rank, and CDFW listing status for each species are given. Typical nesting or breeding period, habitat preference, potential habitat on site, and whether or not the species was observed on the Study Area are also provided.

TABLE 4. SPECIAL STATUS ANIMAL LIST. The 49 of special status animals known or reported from the region are listed. There are 15 special status animals that could potentially occur within the Study Area based on review of preferred habitat types.

	Common and Scientific Names	Fed/State Status Global/State Rank CDFW Rank	Nesting/ Breeding Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
1.	**American Badger** *Taxidea taxus*	None/None G5/S3 SSC	February – May	Needs friable soils in open ground with abundant food source such as California ground squirrels.	No. Suitable habitat not present in the Study Area.	No	No Effect
2.	**Atascadero June Beetle** *Polyphylla nubila*	None/None G1/S1 SA	n/a	Known only from sand dunes in Atascadero and San Luis Obispo, San Luis Obispo County.	No. Suitable habitat not present in the Study Area.	No	No Effect
3.	**Big Free-tailed Bat** *Nyctinomops macrotis*	None/None G5/S3 SSC	Spring - Summer	Low lying arid areas in Southern California with rock outcrops or cliffs.	No. Suitable habitat not present in the Study Area.	No	No Effect
4.	**Black Legless Lizard** *Anniella pulchra nigra*	None/None G3G4T2T3Q/S2 SSC	May - September	Inhabits sandy soil/dune areas with bush lupine and mock heather, from Morro Bay to Monterey Bay.	No. Suitable habitat not present in the Study Area.	No	No Effect
5.	**Burrowing Owl** *Athene cunicularia*	None/None G4/S3 SSC	March 15 - August 15	Burrows in squirrel holes in open habitats with low vegetation.	Unlikely. Available grassland habitat is on slopes with few burrows.	No	No Effect
6.	**California Black Rail** *Laterallus jamaicensis coturniculus*	None/CT G3G4T1/S1 FP	March 15 - August 15	Occurs in tidal salt marsh heavily grown to pickleweed, also in freshwater and brackish marshes near the coast.	No. Suitable habitat not present in the Study Area.	No	No Effect
7.	**California Clapper Rail** *Rallus longirostris obsoletus*	FE/CE G5T1/S1 FP	March 15 - August 15	Saltwater & brackish marshes traversed by tidal sloughs.	No. Suitable habitat not present in the Study Area.	No	No Effect
8.	**California Horned Lark** *Eremophila alpestris actia*	None/None G5T3Q/S3 WL	March 15 - August 15	Nests on the ground in open habitats. More common in the interior.	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CDFW Rank	Nesting/ Breeding Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
9.	**California Least Tern** *Sternula antillarum browni*	FE/CE G4T2T3Q/S2 FP	March 15 - August 15	Nests on sand beaches, alkali flats, bare flat ground from San Francisco Bay to N. Baja California. Colonial breeder.	No. Suitable habitat not present in the Study Area.	No	No Effect
10.	**California Linderiella** *Linderiella occidentalis*	None/None G2G3/S2S3 SA	Rainy season	Seasonal pools in unplowed grasslands with alluvial soils.	No. Suitable habitat not present in the Study Area.	No	No Effect
11.	**California Red-legged Frog** *Rana draytonii*	FT/None G2G3/S2S3 SSC	January - September	Lowlands and foothills in or near sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks for larval development.	Unlikely. Moderately suitable non-breeding habitat present for this species.	No	No Effect
12.	**Coast Horned Lizard** *Phrynosoma blainvillii*	None/None G3G4/S3S4 SSC	May - September	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes.	No. Suitable habitat not present in the Study Area.	No	No Effect
13.	**Coast Range Newt** *Taricha torosa*	None/None G4/S4 SSC	December - May	Slow moving streams, ponds, and lakes with surrounding evergreen/oak forests along coast.	No. Suitable habitat not present in the Study Area.	No	No Effect
14.	**Cooper's Hawk** *Accipiter cooperii*	None/None G5/S4 WL	March 15 - August 15	Oak woodland, riparian, open fields. Nests in dense trees, esp. coast live oak.	Yes. Suitable nesting habitat is present in oak woodland habitat within the Study Area.	No	Potential Adverse Effect Can Be Mitigated
15.	**Ferruginous Hawk** *Buteo regalis*	None/None G4/S3S4 WL	October - April (Wintering)	Winters locally in open grassland or savannah habitats. More common in interior SLO County than coast.	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CDFW Rank	Nesting/ Breeding Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
16.	**Foothill Yellow-legged Frog** *Rana boylii*	None/None G3/S2S3 SSC	March - September	Partly shaded, shallow streams and riffles with rocky substrate. Min. 15 weeks for larval development.	No. Suitable habitat not present in the Study Area.	No	No Effect
17.	**Globose Dune Beetle** *Coelus globosus*	None/None G1G2/S1S2 SA	n/a	Coastal sand dune habitat. Inhabits foredunes and sand hummocks.	No. Suitable habitat not present in the Study Area.	No	No Effect
18.	**Grasshopper Sparrow*** *Ammodramus savannarum*	None/None G5/S3 SSC	March 15 - August 15	Nests in dense grassland habitat on rolling hills, lowland plains, lower mountain slopes	Yes. Suitable nesting habitat is present on hillside grassland habitat within the Study Area.	Yes (not nesting)	Potential Adverse Effect Can Be Mitigated
19.	**Lark Sparrow*** *Chondestes grammacus*	None/None G5/S4S5 SA (nesting)	March 15 - August 15	Nests in oak woodland and oak woodland savannah habitats, edges of grassland/oak woodland	Yes. appropriate nesting habitat is present in the willow riparian habitat present in the Study Area.	Yes (not nesting)	Potential Adverse Effect Can Be Mitigated
20.	**Loggerhead Shrike** *Lanius ludovicianus*	None/None G4/S4 SSC	March 15 - August 15	Open areas with appropriate perches, near shrubby vegetation for nesting.	No. Suitable nesting habitat is not present in the Study Area	No	No Effect
21.	**Merlin** *Falco columbarius*	None/None G5/S3S4 WL	September - April (Wintering)	Winters on seacoasts, estuaries, woodlands, savannas, grassland edges, deserts.	Yes. Suitable wintering habitat is present in the Study Area.	No	No Effect
22.	**Mimic tryonia (=California Brackishwater Snail)** *Tryonia imitator*	None/None G2/S2 SA	n/a	Inhabits coastal lagoons, estuaries, salt marshes from Sonoma to San Diego Counties.	No. Suitable habitat not present in the Study Area.	No	No Effect
23.	**Morro Bay Blue Butterfly** *Plebejus icarioides moroensis*	None/None G5T2/S2 SA	n/a	Inhabits stabilized dunes and surrounding areas in coastal SLO County (Morro Bay) and nw SB County.	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CDFW Rank	Nesting/ Breeding Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
24.	**Morro Bay Kangaroo Rat** *Dipodomys heermanni morroensis*	FE/CE G3G4TH/SH FP	n/a	Coastal sage scrub on the south side of Morro Bay. Needs sandy soil, but nor active dunes, prefers early seral stages.	No. Suitable habitat not present in the Study Area.	No	No Effect
25.	**Morro Shoulderband (=Banded Dune) Snail** *Helminthoglypta walkeriana*	FE/None G1/S1 SA	n/a	Restricted to the coastal strand and sage scrub habitats in the immediate vicinity of Morro Bay.	No. Suitable habitat not present in the Study Area.	No	No Effect
26.	**Nuttall's Woodpecker*** *Picoides nuttallii*	None/None G5/SNR SA (Nesting)	March 15 - August 15	Nests in standing snag or hollow tree in oak woodland and oak forest habitats.	Yes. Suitable nesting habitat is present in oak woodland habitat within the Study Area.	Yes (not nesting)	Potential Adverse Effect Can Be Mitigated
27.	**Oak Titmouse*** *Baeolophus inornatus*	None/None G5/S3? SA (Nesting)	March 15 - August 15	Nests in cavities in oak woodland habitat. Non-migratory.	Yes. Suitable nesting habitat is present in oak woodland habitat within the Study Area.	Yes (not nesting)	Potential Adverse Effect Can Be Mitigated
28.	**Oso Flaco Flightless Moth** *Areniscythris brachypteris*	None/None G1/S1 SA	n/a	Open, coastal sand dune slopes in San Luis Obispo County.	No. Suitable habitat not present in the Study Area.	No	No Effect
29.	**Oso Flaco Patch Butterfly** *Chlosyne leanira elegans*	None/None G4G5T1T2/S1S2 SA	n/a	Sand dune habitat around Oso Flaco Lake, SLO County. Larval food plant is Castilleja affinis.	No. Suitable habitat not present in the Study Area.	No	No Effect
30.	**Oso Flaco Robber Fly** *Ablautus schlingeri*	None/None G1/S1 SA	n/a	Sand dunes.	No. Suitable habitat not present in the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CDFW Rank	Nesting/ Breeding Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
31.	**Pallid Bat** *Antrozous pallidus*	None/None G5/S3 SSC	Spring - Summer	Rock crevices, caves, tree hollows, mines, old buildings, and bridges.	Yes. Suitable roosting habitat is present in oak woodland habitat within the Study Area.	No	Potential Adverse Effect Can Be Mitigated
32.	**Prairie Falcon** *Falco mexicanus*	None/None G5/S4 WL	March 15 - August 15	Inhabits dry, open terrain. Nests on cliffs near open areas for hunting.	No. Suitable habitat not present in the Study Area.	No	No Effect
33.	**Purple Martin** *Progne subis*	None/None G5/S3 SSC	March 15 - August 15	In San Luis Obispo County prefers nesting in Sycamore trees along riparian corridors.	No. Suitable habitat not present in the Study Area.	No	No Effect
34.	**San Diego Desert Woodrat** *Neotoma lepida intermedia*	None/None G5T3T4/S3S4 SSC	n/a	Moderate to dense canopies preferred. Abundant in rocky areas, outcrops. Ranges from San Diego to SLO Counties.	No. Suitable habitat not present in the Study Area.	No	No Effect
35.	**San Luis Obispo Pyrg** *Pyrgulopsis taylori*	None/None G1/S1 SA	n/a	Freshwater habitats in San Luis Obispo County.	No. Suitable habitat not present in the Study Area.	No	No Effect
36.	**Sandy Beach Tiger Beetle** *Cicindela hirticollis gravida*	None/None G5T2/S1 SA	n/a	Adjacent to non-brackish water near the coast from San Francisco to N. Mexico. Clean, dry, light-colored sand in the upper zone.	No. Suitable habitat not present in the Study Area.	No	No Effect
37.	**Sharp-shinned Hawk** *Accipiter striatus*	None/None G5/S4 WL	March 15 - August 15	Riparian, coniferous, and deciduous woodlands near water.	No. Suitable habitat not present in the Study Area.	No	No Effect
38.	**Silvery Legless Lizard** *Anniella pulchra pulchra*	None/None G3G4T3T4Q/S3 SSC	May - September	Sandy or loose loamy soils under coastal scrub or oak trees.	Yes. Suitable habitat is present in oak woodland habitat within the Study Area.	No	No Effect

	Common and Scientific Names	Fed/State Status Global/State Rank CDFW Rank	Nesting/ Breeding Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
39.	**Steelhead - south/central California Coast DPS** *Oncorhynchus mykiss irideus*	FT/None G5T2Q/S2 SSC	February - April	Fed listing refers to runs in coastal basins from Pajaro River south to, but not including, the Santa Maria River.	No. Suitable habitat not present in the Study Area.	No	No Effect
40.	**Tidewater Goby** *Eucyclogobius newberryi*	FE/None G3/S2S3 SSC	n/a	Found in shallow lagoons and lower stream reaches, they need fairly still but not stagnant water and high oxygen levels.	No. Suitable habitat not present in the Study Area.	No	No Effect
41.	**Townsend's Big-eared bat** *Corynorhinus townsendii*	None/C and. CT G3G4/S2 SSC	Spring - Summer	Caves, buildings, and mine tunnels. Cave like attics as day roosts. On coast roosts are normally within 100 m. of creeks.	No. Suitable habitat not present in the Study Area.	No	No Effect
42.	**Tricolored Blackbird** *Agelaius tricolor*	None/CE G2G3/S1S2 SSC	March 15 - August 15	Requires open water, protected nesting substrate, & foraging area with insect prey near nesting colony.	No. Suitable habitat not present in the Study Area.	No	No Effect
43.	**Vernal Pool Fairy Shrimp** *Branchinecta lynchi*	FT/None G3/S2S3 SA	Rainy Season	Clear water sandstone depression pools, grassed swale, earth slump, or basalt flow depression pools.	No. Suitable habitat not present in the Study Area.	No	No Effect
44.	**Western Mastiff Bat** *Eumops perotis californicus*	None/None G5T4/S3S4 SSC	Spring-Fall	Roosts in crevices in cliff faces, high buildings, trees, and tunnels. Inhabits many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, and chaparral.	Yes. Suitable roosting habitat is present in oak trees within the Study Area	No	Potential Adverse Effect Can Be Mitigated

	Common and Scientific Names	Fed/State Status Global/State Rank CDFW Rank	Nesting/ Breeding Period	Habitat Preference	Potential Habitat?	Detected Within Study Area?	Effect of Proposed Activity
45.	**Western Pond Turtle** *Emys marmorata*	None/None G3G4/S3 SSC	April - August	Permanent or semi-permanent streams, ponds, lakes.	Unlikely. Moderately suitable seasonal habitat may be present in the riparian habitat within the Study Area.	No	No Effect
46.	**Western Snowy Plover** *Charadrius alexandrinus nivosus*	FT/None G3T3/S2 SSC	March 15 - August 15	Sandy beaches, salt pond levees, and shorelines of large alkali lakes. Needs friable soils for nesting.	No. Suitable habitat not present in the Study Area.	No	No Effect
47.	**Western Yellow-billed Cuckoo** *Coccyzus americanus occidentalis*	FT/CE G5T3Q/S1 WL	March 15 - August 15	Nests in riparian jungles of willow, cottonwood, w/ blackberry, nettles, or wild grape understory. Typically found in larger river systems.	No. Suitable habitat not present in the Study Area.	No	No Effect
48.	**White Sand Bear Scarab Beetle** *Lichnanthe albipilosa*	None/None G1/S1 SA	n/a	Found only in coastal sand dunes of SLO County, near Dune Lake, some distance from the surf.	No. Suitable habitat not present in the Study Area.	No	No Effect
49.	**White-tailed Kite** *Elanus leucurus*	None/None G5/S3S4 FP	March 15 - August 15	Nests in dense tree canopy near open foraging areas	Yes. Suitable nesting habitat is present in oak trees within the Study Area.	No	Potential Adverse Effect Can Be Mitigated

Habitat characteristics are from the Jepson Manual and the CNDDB.
*not listed in the CNDDB or CNPS for the search area, but possibly for the location.

Abbreviations:

FE: Federally Endangered
FT: Federally Threatened
PE: Proposed Federally Endangered
PT: Proposed Federally Threatened
CE: California Endangered
CT: California Threatened
Cand. CE: Candidate for California Endangered
Cand. CT: Candidate for California Threatened
SA: CDFW Special Animal
SSC: CDFW Species of Special Concern
FP: CDFW Fully-Protected
WL: CDFW Watch List

4.6 Special Status Animals Discussion

Ten special status animals could potentially occur in the Study Area. Two additional species that are not expected but are discussed further here due to the soil and habitat conditions present in the Study Area: western pond turtle and California red-legged frog. We discuss each species and describe habitat, range restrictions, known occurrences, and survey results.

A. **Cooper's Hawk** (*Accipiter cooperii*) is a Watch List species that occurs regularly in San Luis Obispo County during the winter months and during spring and fall migration. It is generally regarded as a regular but uncommon nesting species in San Luis Obispo County. Cooper's hawks frequent oak and riparian woodland habitats, and increasingly urban areas, where they prey primarily upon small birds. Appropriate tree canopy is present in the Study Area for nesting Cooper's hawks. The closest CNDDB occurrence of a nesting Cooper's was located about 12 miles to the northwest in the Morro Bay area (CNDDB 24). Cooper's hawks were not observed in the Study Area during our surveys in the spring of 2015. Pre-construction surveys are recommended prior to activities that affect oak trees during the nesting season (refer to section 10.4).

B. **Grasshopper Sparrow** (*Ammodramus savannarum*) is a California Species of Special Concern that breeds in grassland habitats in San Luis Obispo County. Grasshopper sparrows have been extirpated from much of their former range in Southern California but continue to breed locally, usually in un-grazed native grassland stands. Moderately appropriate nesting habitat is present in the Study Area. Grasshopper sparrows were detected in the Study Area during our surveys in the spring of 2015, but were not observed nesting. Pre-construction surveys are recommended prior to activities that affect grassland habitat during the nesting season (refer to section 10.4).

C. **Silvery Legless Lizard** (*Anniella pulchra pulchra*) is a California Species of Special Concern that inhabits friable soils in a variety of habitats from coastal dunes to oak woodlands and chaparral. Sandy soils in the oak woodland habitat within the Study Area are adequate for silvery legless lizard. The closest reported occurrence is from about 8.5 miles northwest of the Study Area, southwest of O'sullivan Airfield in 1998 (CNDDB 10). Silvery legless lizard was not detected in the Study Area in spring 2015 but could occur in leaf litter beneath oak trees. It would be unlikely to occur in the open grassland areas. Pre-construction surveys are recommended prior to activities that affect soil beneath oak trees (refer to sections 9.5.4 and 10.5.4).

D. **Pallid Bat** *(Antrozous pallidus)* is a California Species of Special Concern. This is a large, long-eared bat occurring throughout the state from deserts to moist forests. *Antrozous pallidus* is primarily a crevice roosting species and selects roosts where they can retreat from view. They frequently occur in oak woodlands where they roost in tree cavities. These roosts are generally day or night roosts for one or a few bats. Attics may be used as roosts and during hot days they may emerge from crevices and roost on open rafters. Communal wintering or maternity colonies are more common in rock crevices and caves. The closest reported occurrence of roosting pallid bats is from about 4 miles north of the Study Area in an underground tunnel under Marsh Street in San Luis Obispo (CNDDB 77). Pallid bat could occur in oak tree cavities in the Study Area. Pre-construction surveys are recommended prior to activities that affect oak trees (refer to sections 9.5.3 and 10.5.3).

E. **California Red-legged Frog** *(Rana draytonii)* is a federally listed threatened species known from sporadic occurrences documented throughout San Luis Obispo County. It generally requires seasonal pools or streams that hold water until late summer for successful breeding. Bullfrogs and introduced fish are detrimental to its breeding success, and have severely reduced many populations in larger watercourses and perennial ponds. The seasonal drainage in the Study Area does not provide adequate pool habitat for breeding red-legged frogs; however, during the rainy season, transient individuals could move through the drainage intermittently, if they are present in the area. The drainage connects to Davenport creek, approximately 0.75 miles downstream. San Luis Creek is the closest occurrence of red-legged frogs, approximately 2.5 miles northwest of the Study Area (CNDDB 895).

F. **Western Pond Turtle** (*Actinemys marmorata,* [=*Emys marmorata*]) is a California Species of Special Concern that inhabits ponds, lakes, reservoirs, marshes, brackish lagoons, and slow moving streams with adequate pools. In colder environments these pond turtles are active February to November, but in coastal San Luis Obispo County they can be active year-round where water is present. In areas where surface water dries out during summer months, pond turtles can aestivate in wooded areas. Mating is in the spring, eggs are laid in shallowly dug nests near water during the summer, and hatchlings emerge in the fall or overwinter in the nest. The closest CNDDB occurrence is about 1.2 miles north of the Study Area in a creek off Lomita Ranch. The drainage in the Study Area does not provide adequate perennial water for western pond turtle; however, transient individuals could use this habitat during the rainy season.

G. **Oak Titmouse** (*Baeolophus inornatus*) is a Special Animal that is an oak woodland obligate, nesting in cavities in oak trees. It is a common species in oak woodlands in San Luis Obispo County, but is tracked by the CDFW due to state-wide losses of oak woodland habitat. Oak titmouse was observed in the Study Area in 2015, however nesting was not confirmed. Pre-construction surveys are recommended prior to activities that affect oak trees during the nesting season (refer to sections 9.4 and 10.4).

H. **Lark Sparrow** (*Chondestes grammacus*) is a Special Animal tracked by CDFW due to declining state-wide populations. It remains a fairly common breeder in Santa Barbara and San Luis Obispo Counties, nesting on the ground in grassland habitats with adjacent oaks. Lark sparrows were observed in the Study Area during spring 2015 surveys and it is likely that they nest in the grassland habitat adjacent to coast-live oak woodland habitat. Pre-construction surveys are recommended prior to activities that affect oak trees during the nesting season (refer to sections 9.4 and 10.4).

I. **White-tailed Kite** (*Elanus leucurus*) is a Fully Protected species that nests primarily in evergreen trees, especially coast live oaks, near meadows, marshes, or grasslands. The closest reported occurrence of nesting white-tailed kites is from about 7 miles north of the Study Area, 0.5 miles east of Cerro Romualdo (CNDDB 55). Appropriate foraging and nesting habitat is present in the Study Area. Kites were not observed in the Study Area during our surveys in spring 2015, but could occur. Pre-construction surveys are recommended prior to activities that affect oak trees during the nesting season (refer to sections 9.4 and 10.4).

J. **Merlin** (*Falco columbarius*) is a Watch List species that winters in various habitats in San Luis Obispo County. Merlins do not breed locally. Appropriate wintering habitat is present within the Study Area. Merlins were not observed during spring 2015 surveys.

K. **Western Mastiff Bat** (*Eumops perotis californicus*) is a California Species of Special Concern that roosts in crevices in a variety of materials, including buildings, tunnels, boulders, and trees. This species could occur in existing buildings and in trees with loose bark in the Study Area. The closest CNDDB occurrence of a roosting western mastiff bat was about 3 miles to the north of the Study Area from 1991 (CNDDB 180). Western mastiff bats were not observed during spring 2015 surveys. Pre-construction surveys are recommended prior to activities that affect oak trees (refer to sections 9.5.3 and 10.5.3).

L. **Nuttall's Woodpecker** (*Picoides nuttallii*) is a Special Animal tracked by the CDFW due to statewide reduction in preferred oak woodland habitats. Nuttall's woodpeckers remain fairly common residents in oak woodland habitats throughout Santa Barbara and San Luis Obispo Counties. Nuttall's woodpecker was observed in oak woodland habitat in the Study Area, where it may breed. Nesting cavities were not found, however. Pre-construction surveys are recommended prior to activities that affect oak woodland habitat or individual oak trees (refer to section 9.4 and 10.4).

M. **Vernal Pool Fairy Shrimp** (*Branchinecta lynchi*) is a small freshwater crustacean that is federally listed as threatened. The species is endemic to California and southern Oregon and has an ephemeral life cycle, existing only in vernal pools or vernal pool-like habitats. The vernal pool fairy shrimp occurs only in cool-water pools. Individuals hatch from cysts during cold-weather winter storms; they require water temperatures of 50°F or lower to hatch (Helm 1998; Eriksen and Belk 1999). The time to maturity and reproduction is temperature dependent, varying between 18 days and 147 days, with a mean of 39.7 days and immature and adult shrimp are known to die off when water temperatures rise to approximately 75°F (Helm 1998). The species is typically associated with smaller and shallower vernal pools (typically about 6 inches deep) that have relatively short periods of inundation (Helm 1998) and relatively low to moderate total dissolved solids (TDS) and alkalinity (Eriksen and Belk 1999). The Study Area primarily consists of gradual to dramatic sloping hillsides with the vineyard at the base of the Study Area on the north side. A drainage bisects the vineyard running east to west and continues out of the Study Area. Vernal pools were not observed in the Study Area and there were no locations observed where pooling water existed.

4.7 Special Status Species Not Expected to Occur

The remaining 132 special status species reported to occur in the Morro Bay South, San Luis Obispo, Lopez Mtn., Port San Luis, Pismo Beach, Arroyo Grande NE, Oceano quadrangles are not expected to occur in the Study Area due to the absence of required soil type, lack of appropriate habitat, or because the Study Area is substantially outside the known range of the species.

4.8 Potential Sensitive Natural Communities

The CNDDB reports nine sensitive natural communities in the Morro Bay South, San Luis Obispo, Lopez Mtn., Port San Luis, Pismo Beach, Arroyo Grande NE, Oceano quadrangles (Table 5). Sensitive natural communities are not present in the Study Area.

TABLE 5. SENSITIVE NATURAL COMMUNITIES. Nine sensitive natural communities reported from the region are listed.

	Common Name	Federal/State Status Global/State Rank	Potential Habitat?	Effect of Proposed Activity
1.	**Central Dune Scrub**	G2/S2.2	No. Central dune scrub is not present in the Study Area.	No Effect
2.	**Central Foredunes**	G1/S1.2	No. Central foredunes are not present in the Study Area.	No Effect
3.	**Central Maritime Chaparral**	G2/S2.2	No. Central chaparral habitat is not present in the Study Area.	No Effect
4.	**Coastal And Valley Freshwater Marsh**	G3/S2.1	No. Freshwater marshes are not present in the Study Area.	No Effect
5.	**Coastal Brackish Marsh**	G2/S2.1	No. Brackish Marsh habitat is not present in the Study Area.	No Effect
6.	**Northern Coastal Salt Marsh**	G3/S3.2	No. Coastal salt marsh habitat is not present in the Study Area.	No Effect
7.	**Northern Interior Cypress Forest**	G2/S2.2	No. cypresses are not present in the Study Area.	No Effect
8.	**Serpentine Bunchgrass**	G2/S2.2	No. Serpentine habitat is not present in the Study Area.	No Effect
9.	**Valley Needlegrass Grassland**	G3/S3.1	No. Needlegrass habitat (10% cover needlegrass) is not present in the Study Area.	No Effect

5.0 Habitat Types

Five habitat types are described and mapped within the Study Area (Table 6): vineyard, riparian, coast live oak woodland, California annual grassland, and anthropogenic. Approximate acreages for each habitat type are included in the table. The Biological Constraints Map provided in Section 12.0 (Figure 6) indicates the locations of each habitat type in the Study Area. Sensitive natural communities do not occur in the Study Area.

TABLE 6. HABITAT TYPES. The approximate acreage and location are provided for all habitat types occurring in the Study Area.

Habitat Type	Approx. Acreage	Location
Vineyard	160.5	Northern half of the Study Area
Riparian	10	East/west strip in northern portion of Study Area
Oak Woodland	25	Patches in southern half of the Study Area

Habitat Type	Approx. Acreage	Location
California Annual Grassland	94	Several patches in the southern half of the Study Area
Anthropogenic	2.5	Small patch adjacent to Willow Riparian Corridor

5.1 Vineyard

Vineyard occupies approximately 160.5 acres in the northern portion of the Study area, adjacent to residential housing. A gated entrance from the northeast corner of the Study Area allows access to the vineyard and Study Area. Vines are planted in long rows in various aspects. Weedy forbs and non-native annual grasses occur in the understory of the vineyard, the margins of the vineyard, and along the edges of the unpaved roads throughout the vineyard.

5.2 Riparian

Riparian habitat occupies approximately 10 acres of the Study Area where it is associated with a westward flowing seasonal drainage that bisects the vineyard in the northern end of the Study Area. Gradient across the Study Area is very low, and consequently water flows slowly and accumulates in small pools up to 18 inches in depth. Arroyo willow (*Salix lasiolepis*) is the dominant tree cover, occurring in patches throughout the drainage. Coast live oak (*Quercus agrifolia*) is also present, as well as patches of and coyote bush (*Baccharis pilularis*). Species indicative of wetland are present including cattail (*Typha angustifolia*) and rush (*Juncus* effusus). Other abundant species around the drainage include California blackberry (*Rubus ursinus*), fennel (*Foeniculum vulgare*), and mugwort (*Artemisia douglasiana*).

Special status plants are not expected to occur in the riparian habitat within the Study Area. Pool habitat in the drainage is not suitable or breeding California red-legged frogs, but it could be used as a movement corridor or as seasonal non-breeding habitat.

5.3 Oak Woodland

Oak Woodland occupies approximately 25 acres on hillsides in the southern portion of the Study Area. Coast live oak is the only oak species present, but California bay (*Umbellularia californica*) also occurs in this habitat. Understory vegetation includes a variety of annual species. The woodland habitat ranges from very dense with overlapping canopies along the drainages, to loosely grouped on grassy hillsides. Individual oaks are generally large mature trees reaching heights of over 100 feet.

Special status birds such as oak titmouse, Nuttall's woodpecker and white-tailed kit could nest in oak woodland habitat in the Study Area.

5.4 California Annual Grassland

California annual grassland occupies approximately 94 acres of hilly terrain in the southern portion of the Study Area. Introduced annual grasses are characteristic of this habitat type, with dominant species including wild oat (*Avena fatua*) and ripgut brome (*Bromus diandrus*). Other common grasses present include annual fescue (*Festuca microstachys*) and redtop brome (*Bromus madritensis* ssp. *rubens*).

Cambria morning glory (*Calystegia subacaulis* ssp. *episcopalis*) is a special status plant that was mapped in grassland habitat within the Study Area (see Figure 6 in Section 12.0).

5.5 Anthropogenic

An approximately 2.5 acre area with outbuildings, water tanks and a well, associated with the existing vineyard, is mapped as anthropogenic habitat.

5.6 Potential Wetlands and Jurisdictional Waters

Three waterways are present in the Study Area, a seasonal drainage that bisects the vineyard (see Section 5.2 above), and two ephemeral waterways in the southern portion of the site. The seasonal drainage has hydrophytic vegetation, wetland hydrology and connectivity with a navigable waterway downstream from the Study Area. This drainage would likely be jurisdictional under the Clean Water Act.

Two ephemeral waterways are located at the southern end of the Study Area where the proposed project development will occur. The eastern waterway is the smaller of the two, only has a bed or bank in the upper (southern) end, and does not connect to a potential navigable water of the U.S. The western waterway is larger, with an incised and eroded channel, and connectivity to a potential water of the U.S. about a half mile west of the Study Area.

Isolated wetlands outside of the waterways described above are not present. A formal wetland delineation was not conducted as part of this report.

5.7 Wildlife Movement Corridors

The Study Area is situated between an area of rural residential development to the north and east and large tracts of open grassland, woodland and chaparral to the south and west. Common wildlife species such as coyote, red fox, bobcat and mule deer may move through the Study Area to access water and food on the adjacent golf course or neighborhoods. The Study Area is not part of a significant or specific wildlife movement corridor.

6.0 Botanical Inventory

Botanical surveys conducted in March and April 2015 identified 106 species, subspecies and varieties of vascular plants in the Study Area (Table 7). The list includes 62 species native to California and 44 introduced (naturalized or planted) species. Native plant species account for approximately 58 percent of the taxa within the Study Area; introduced species account for approximately 42 percent. One Special status plant species, Cambria morning-glory, was mapped in the Study Area during the seasonally timed botanical surveys.

TABLE 7. VASCULAR PLANT LIST. The 106 species of vascular plants identified at the Study Area consist of 62 native species and 44 introduced species. The vascular plant list is separated into general life form categories, within which the taxa are listed alphabetically by scientific name.

Scientific Name	Status	Origin	Common Name
Ferns – 1 species			
Pentagramma triangularis ssp. *triangularis*	None	Native	Goldback fern
Trees – 5 species			
Populus fremontii ssp. *fremontii*	None	Native	Fremont cottonwood
Quercus agrifolia var. *agrifolia*	None	Native	Coast live oak
Salix laevigata	None	Native	Red willow
Salix lasiolepis	None	Native	Arroyo willow
Umbellularia californica	None	Native	California bay
Shrubs – 6 species			
Baccharis pilularis	None	Native	Coyote brush
Frangula [=Rhamnus] californica	None	Native	Coffeeberry
Heteromeles arbutifolia	None	Native	Toyon
Rosa californica	None	Native	California rose
Rubus ursinus	None	Native	California blackberry
Sambucus nigra ssp. *caerulea [=S. mexicana]*	None	Native	Blue elderberry
Herbs – 82 species			
Achillea millefolium	None	Native	Yarrow
Achyrachaena mollis	None	Native	Blow wives
Agoseris grandiflora	None	Native	Giant dandelion
Ambrosia psilostachya	None	Native	Western ragweed
Amsinckia menziesii	None	Native	Common fiddleneck
Anagallis arvensis	None	Introduced	Scarlet pimpernel
Ancistrocarphus filagineus	None	Native	Woolly fish-hooks
Anthemis cotula	None	Introduced	Mayweed

Scientific Name	Status	Origin	Common Name
Artemisia douglasiana	None	Native	Mugwort
Artemisia dracunculus	None	Native	Tarragon
Asclepias eriocarpa	None	Native	Indian milkweed
Berula erecta	None	Native	Cutleaf water-parsnip
Bloomeria crocea	None	Native	Common goldenstar
Brassica nigra	None	Introduced	Black mustard
Calandrinia ciliate	None	Native	Red maids
Calystegia macrostegia	None	Native	Morning glory
Calystegia subacaulis ssp. *episcopalis*	**List 4.2**	Native	Cambria morning glory
Carduus pycnocephalus	None	Introduced	Italian thistle
Chlorogalum pomeridianum var. *pomeridianum*	None	Native	Amole lily
Clarkia affinis	None	Native	Chaparral fairyfan
Clarkia purpurea ssp. *Quadrivulnera*	None	Native	Four spot
Claytonia perfoliata	None	Native	Miner's lettuce
Collinsia heterophylla	None	Native	Chinese houses
Conium maculatum	None	Introduced	Poison hemlock
Convolvulus arvensis	None	Introduced	Bindweed
Croton californicus	None	Native	California croton
Cyperus eragrostis	None	Native	Umbrella sedge
Dichelostemma capitatum	None	Native	Blue dicks
Erodium botrys	None	Introduced	Filaree
Erodium cicutarium	None	Introduced	Redstem filaree
Erodium moschatum	None	Introduced	Filaree
Eschscholzia californica	None	Native	California poppy
Foeniculum vulgare	None	Introduced	Fennel
Galium aparine	None	Native	Goose grass
Geranium dissectum	None	Introduced	Geranium
Geranium molle	None	Introduced	Geranium
Helminthotheca [=Picris] echioides	None	Introduced	Bristly ox-tongue
Hirschfeldia incana	None	Introduced	Mustard
Juncus effusus	None	Native	Pacific rush
Lactuca serriola	None	Introduced	Prickly lettuce
*Lagophylla ramosissima [=*ssp. *ramosissima]*	None	Native	Slender hareleaf
Lasthenia gracilis	None	Native	Common goldfields

Scientific Name	Status	Origin	Common Name
Layia platyglossa	None	Native	Tidy tips
Lomatium utriculatum	None	Native	Lomatium
Lupinus succulentus	None	Native	Arroyo lupine
Malva parviflora	None	Introduced	Cheeseweed
Marrubium vulgare	None	Introduced	Horehound
Matricaria discoidea [=Chamomilla suaveolens]	None	Introduced	Pineapple weed
Medicago polymorpha	None	Introduced	California burclover
Mimulus aurantiacus	None	Native	Bush monkeyflower
Oxalis pilosa	None	Native	Pilose wood-sorrel
Plantago erecta	None	Native	California plantain
Plantago lanceolata	None	Introduced	English plantain
Pseudognaphalium [=Gnaphalium] californicum	None	Native	California everlasting
Pseudognaphalium luteoalbum [=Gnaphalium luteoalbum]	None	Introduced	Jersey cudweed
Ranunculus californicus	None	Native	California buttercup
Raphanus sativus	None	Introduced	Wild radish
Rumex acetosella	None	Introduced	Sheep sorrel
Rumex crispus	None	Introduced	Curly dock
Salvia spathacea	None	Native	Hummingbird sage
Sanicula argute	None	Native	Black snakeroot
Sanicula crassicaulis	None	Native	Sanicle
Senecio vulgaris	None	Introduced	Common groundsel
Sidalcea malviflora	None	Native	Checker-bloom
Silybum marianum	None	Introduced	Milk thistle
Sisymbrium orientale	None	Introduced	Oriental rocket
Sonchus asper ssp. *asper*	None	Introduced	Prickly sow-thistle
Sonchus oleraceus	None	Introduced	Common sow thistle
Spergula arvensis	None	Introduced	Stickwort
Stellaria media	None	Introduced	Chickweed
Toxicodendron diversilobum	None	Native	Poison oak
Tragopogon porrifolius	None	Introduced	Salsify
*Trifolium gracilentum [=*var. *gracilentum]*	None	Native	Pinpoint clover
Trifolium hirtum	None	Introduced	Rose clover
Trifolium sp.	None	Native	Clover
Typha angustifolia	None	Native	Narrow-leaved cattail

Scientific Name	Status	Origin	Common Name
Urtica dioica ssp. *holosericea*	None	Native	Stinging nettle
Urtica urens	None	Introduced	Dwarf nettle
Vicia sativa	None	Introduced	Common vetch
Vicia villosa	None	Introduced	Winter vetch
Viola pedunculata	None	Native	Johnny jump-up
Xanthium spinosum	None	Native	Spiny cocklebur
Grasses – 12 species			
Avena fatua	None	Introduced	Wild oat
Bromus carinatus var. *carinatus*	None	Native	California brome
Bromus diandrus	None	Introduced	Ripgut brome
Bromus madritensis ssp. *rubens* [= *B. rubens*]	None	Introduced	Red top brome
Festuca [=Vulpia] microstachys	None	Native	Annual fescue
Festuca [=Vulpia] myuros	None	Introduced	Rattail sixweeks grass
Festuca perennis [=*Lolium multiflorum*]	None	Introduced	Italian rye grass
Hordeum murinum	None	Introduced	Foxtail barley
Hordeum vulgare	None	Introduced	Barley
Poa annua	None	Introduced	Annual bluegrass
Stipa [=Nassella] lepida	None	Native	Foothill needlegrass
Stipa [=Nassella] pulchra	None	Native	Purple needlegrass

7.0 Wildlife Inventory

Based on the March and April 2015 wildlife surveys, at least 69 animal species are listed that could potentially occur in the Study Area (Table 8). Small mammal trapping studies were beyond the scope of this report, although several rodent species are likely to be present. We provide this list as a guide to the wildlife observed in the Study Area and to the species that could potentially be present at least seasonally. Other species could occur as transients, particularly avian fauna.

Wildlife species detected in the Study Area include 1 amphibian, 2 reptiles, 37 birds, and 1 mammal. Many oak trees found in the Study Area have cavities that provide nesting habitat for songbirds and potential roosting habitat for bats. Special status bird species grasshopper sparrow, lark sparrow, oak titmouse, were Nuttall's woodpecker were observed foraging in the Study Area and potentially suitable nesting habitat is present in the coast live oak woodland and grassland habitats.

TABLE 8. WILDLIFE LIST. At least 69 animal species have the potential to occur within the Study Area. The Special Status column indicates listing status of the organism under the Federal Endangered Species Act, the California Endangered Species Act, or by CDFW. Species observed at the site during our surveys are designated by the check symbol (✓) in the fourth column.

Common Name	Scientific Name	Special Status	Found On-site?	Habitat Type
Amphibians – 2 Species				
California (Western) Toad	*Anaxyrus [=Bufo] boreas halophilus*	None		Grassland, woodland
Sierran Treefrog	*Pseudacris sierra*	None	✓	Many habitats near water
Reptiles – 3 Species				
Coast Range [=Western] Fence Lizard	*Sceloporus occidentalis bocourtii*	None	✓	Wide range; variety of habitats
Pacific Gopher Snake	*Pituophis catenifer catenifer*	None		Woodland, grassland, rural
Side-blotched Lizard	*Uta stansburiana*	None	✓	Dry habitats
Birds – 51 Species				
Acorn Woodpecker	*Melanerpes formicivorus*	None	✓	Oak woodland
American Crow	*Corvus brachyrhynchos*	None	✓	Many habitats, esp. urban
American Goldfinch	*Carduelis tristis*	None	✓	Weedy fields, woodlands
American Kestrel	*Falco sparverius*	None	✓	Open, semi-open country
American Robin	*Turdus migratorius*	None	✓	Streamsides, woodlands
Anna's Hummingbird	*Calypte anna*	None	✓	Many habitats
Black Phoebe	*Sayornis nigricans*	None	✓	Near water
Black-headed Grosbeak	*Pheucticus melanocephalus*	None	✓	Woodlands
Blue-gray gnatcatcher	*Polioptila caerulea*	None	✓	Chaparral
Brewer's Blackbird	*Euphagus cyanocephalus*	None	✓	Open habitats

Common Name	Scientific Name	Special Status	Found On-site?	Habitat Type
Bullock's Oriole	*Icterus bullockii*	None		Oak, riparian woodlands
Bushtit	*Psaltriparus minimus*	None	✓	Woodlands, chaparral
California Quail	*Callipepla californica*	None	✓	Shrubby habitats
California Towhee	*Pipilo crissalis*	None	✓	Brushy habitats
Chestnut-backed Chickadee	*Poecile rufescens*	None	✓	Mixed woods
Cooper's Hawk	*Accipiter cooperii*	Special Animal[1] (Nesting)		Oak, riparian woodland
Dark-eyed Junco	*Junco hyemalis*	None		Oak woodland
Eurasian Collared Dove	*Streptopelia decaocto*	None	✓	Urban areas
European Starling	*Sturnus vulgaris*	None	✓	Agricultural, livestock areas
Grasshopper Sparrow	*Ammodramus savannarum*	SSC (Nesting)	✓	Grassland hillsides
Great Horned Owl	*Bubo virginianus*	None		Woodland, grassland
House Finch	*Carpodacus mexicanus*	None	✓	Riparian, grasslands, chaparral, and woodlands
Lark Sparrow	*Chondestes grammacus*	Special Animal (Nesting)	✓	Woodland edges
Lesser Goldfinch	*Carduelis psaltria*	None	✓	Riparian, oak woodlands
Loggerhead Shrike	*Lanius ludovicianus*	SSC		Nests in shrubs, trees near open areas
Mourning Dove	*Zenaida macroura*	None	✓	Open and semi-open habitats
Northern Flicker	*Colaptes auratus*	None	✓	Woodlands
Northern Flicker	*Colaptes auratus*	None	✓	Woodlands
Northern Mockingbird	*Mimus polyglottos*	None	✓	Riparian, chaparral and woodlands. Also urban
Nuttall's Woodpecker	*Picoides nuttallii*	Special Animal (Nesting)	✓	Oak, riparian woodlands
Oak Titmouse	*Baeolophus inornatus*	Special Animal (Nesting)	✓	Oak woodland
Orange-crowned Warbler	*Vermivora celata*	None		Oak, riparian woodlands
Pacific-slope Flycatcher	*Empidonax difficilis*	None	✓	Riparian, oak woodlands
Red-shouldered Hawk	*Buteo lineatus*	None		Oak, riparian woodlands
Red-tailed Hawk	*Buteo jamaicensis*	None	✓	Open, semi-open country
Ruby-crowned Kinglet	*Regulus calendula*	None		Oak, riparian woodlands
Say's Phoebe	*Sayornis saya*	None	✓	Open country, grassland

1 Special Animal refers to all of the animal taxa inventoried by the CNDDB, regardless of their legal or protection status. Refer to discussion of Special Animals in Section 4.2.

Common Name	Scientific Name	Special Status	Found On-site?	Habitat Type
Sharp-shinned Hawk	*Accipiter striatus*	Special Animal (Nesting)		Oak, riparian woodland
Song Sparrow	*Melospiza melodia*	None	✓	Oak, riparian woodland
Tree Swallow	*Tachycineta bicolor*	None		Oak, riparian woodlands, open areas near water
Turkey Vulture	*Cathartes aura*	None	✓	Open country
Violet-green Swallow	*Tachycineta thalassina*	None		Oak, riparian woodlands, open areas near water
Western Bluebird	*Sialia mexicana*	None	✓	Woodland near open areas
Western Kingbird	*Tyrannus verticalis*	None	✓	Grasslands, savanna
Western Meadowlark	*Sturnella neglecta*	None		Open habitats, grasslands
Western Scrub-Jay	*Aphelocoma californica*	None	✓	Oak, riparian woodlands
Western Tanager	*Piranga ludoviciana*	None		Oak, riparian woodlands
Western Wood Pewee	*Contopus sordidulus*	None		Riparian woodlands
White-breasted Nuthatch	*Sitta carolinensis*	None	✓	Oak savannah, woodland
White-crowned Sparrow	*Zonotrichia leucophrys*	None	✓	Oak, riparian woodlands
Yellow-rumped Warbler	*Setophaga coronata*	None	✓	Woodlands, brush, open country
Mammals – 13 Species				
Big-eared Woodrat	*Neotoma macrotis*	None		Wooded habitats
Brush Rabbit	*Sylvilagus bachmani*	None		Brushy habitats
California Ground Squirrel	*Spermophilus beecheyi*	None	✓	Grasslands
California Mouse	*Peromyscus californicus*	None		Oak woodland, chaparral
California Vole	*Microtus californicus*	None		Grassland meadows
Deer Mouse	*Peromyscus maniculatus*	None		All dry land habitats
Hoary Bat	*Lasiurus cinereus*	None		Variety of habitats, roosts in foliage
Mule Deer	*Odocoileus hemionus*	None		Many habitats
Pallid Bat	*Antrozous pallidus*	SSC		Riparian, woodland, urban
Raccoon	*Procyon lotor*	None		Streams, lakes, rock cliffs, dens in trees
Striped Skunk	*Mephitis mephitis*	None		Mixed woods, brush, semi-open country
Western Mastiff Bat	*Eumops perotis californicus*	SSC		Roosts in cliffs, buildings, trees, and tunnels
Wild Boar	*Sus scrofa*	None		Woodlands

8.0 Project Overview

8.1 Discussion

Biological surveys for special status wildlife and plant species were conducted throughout the 295-acre parcel in spring 2015. Wildlife surveys did not include focused protocol level efforts for listed species, but did evaluate the Study Area for potential habitat for all special status species. Special status birds do occur at the site. Botanical surveys were conducted according to agency guidelines to adequately document and map special status plants in the Study Area. Rainfall was slightly less than average this year, which can affect which species are detectable. Of the three special status plants that could occur in the Study Area, Cambria morning-glory was detected and mapped on the site, Hoover's bentgrass was determined to be absent, and San Luis Obispo owls-clover was not present this year but has a low potential to be present in years with above-average rainfall.

Two ephemeral waterways are located at the southern end of the Study Area where the proposed project development will occur. Permits may be required for activities that affect jurisdictional drainages.

8.2 Regulatory Framework

8.2.1 CEQA guidance

The California Environmental Quality Act (CEQA) requires the lead agency to evaluate potential environmental effects of the project. The lead agency must also identify other State and local agencies (known as responsible agencies) that will be issuing a discretionary approval subject to CEQA for an activity that is part of the project. The following section of the State CEQA Guidelines provides general direction for the evaluation of biological resource impacts as a part of the environmental review of proposed projects.

CEQA Guidelines Section 15065 states that a Lead Agency shall find that a project may have a significant effect on the environment and thereby require an Environmental Impact Report (EIR) be prepared for the project where "there is substantial evidence, in light of the whole record," that the project, among other things, has the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, or substantially reduce the number or restrict the range of an endangered, rare or threatened species.

A significant effect may also be identified by considerable cumulative environmental effects, even if the individual effect is limited. The following definition of a significant effect is defined in Section 15382 of the CEQA Guidelines:

> *"Significant effect on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance.*

All of the plants constituting CNPS CRPR 1B meet the definitions of Section 1901, Chapter 10 of the California Native Plant Protection Act (CNPPA) in the California Fish and Game Code or Secs. 2062 and 2067 (California Endangered Species Act) of the California Fish and Game Code, and are eligible for State listing.

8.2.2 Federal and state resource protections

The agencies that administer the Federal Endangered Species Act (FESA) and California Endangered Species Act (CESA) formally list plant and animal species determined to be Threatened or Endangered, and they have adopted regulations to implement these laws to protect such species.

Other federal statutes that provide protection for species and/or their habitats include, but are not limited to, the National Environmental Policy Act (NEPA), the Clean Water Act (for protection of federal wetlands), Bald and Golden Eagle Protection Act (BGEPA), Migratory Bird Treaty Act (MBTA), Executive Order 11990 (wetlands protection), and California Fish and Game Code sections 1601, 1602, and 1603 (Streambed Alteration Agreements).

Wetlands:

In conjunction with adopting a wetlands policy on March 9, 1987 the California Fish and Game Commission assigned the CDFG the task of recommending a wetlands definition. CDFG found the USFWS wetland definition and classification system to be the most biologically valid. The CDFG staff use this definition as a guide in identifying wetlands while conducting on-site inspections for the implementation of its Commission's wetlands policy. The California State Water Resources Control Board is in the process of adopting a uniform state wetlands definition based on the Section 404 standards used by the U.S. Army Corps of Engineers in administering Section 404 of the Clean Water Act.

Flora and fauna:

Listed plants and animals under the Federal Endangered Species Act (FESA) have certain protections as specified therein (refer to Section 4.0). The United States Fish and Wildlife Service is the agency that regulates activities affecting terrestrial-based, Federally-listed species.

Certain species of nesting birds are protected from disturbance by The Migratory Bird Treaty Act of 1918, (as regulated by the United States Fish and Wildlife Service) and by sections 3503, 3503.5, and 3800 of the California Fish and Game Code. Special protections for bald and golden eagles are also contained in the federal Bald and Golden Eagle Protection Act.

9.0 Potential Impacts to Biological Resources

The proposed residential project could affect common and special status animal species, nesting birds, annual grassland habitat and oak trees. Impact calculations are based on project layers provided by the applicant overlaid in ArcGIS on habitat and special status plant layers (see Biological Constraints Map in Section 12.0).

9.1 Potential Habitat Impacts

Most of the Study Area is an active vineyard operation that would not be modified as part of the currently proposed residential project. The riparian habitat that bisects the vineyard also would not be affected. Construction of access roads and residential lots would permanently affect approximately 15 acres of annual grassland habitat. An access road would pass through oak woodland habitat in the eastern waterway. Impacts to oak woodland habitat are expected to be very small, and would be assessed as impacts to individual oak trees. An assessment of oak tree impacts should be conducted upon completion of final grading plans.

9.2 Potential Impacts to Wetlands and Jurisdictional Waters

The proposed project would require a road crossing of an ephemeral waterway in the southeast end of the Study Area. The waterway is not likely to be jurisdictional under the Clean Water Act or California Department of Fish and Wildlife code 1600. No other impacts to potential jurisdictional wetlands or waters are anticipated.

9.3 Potential Impacts to Wildlife Movement Corridors

The Study Area is not part of a significant wildlife movement corridor and the proposed project would not significantly affect the ability for local wildlife to access preferred habitat areas.

9.4 Potential Impacts to Nesting Birds

Construction activities that result in impacts to annual grassland habitat or oak trees could impact nesting birds if conducted during nesting season (March 15 through August 15). The potential for the Project to adversely affect nesting birds can be avoided (refer to Section 10.4).

9.5 Potential Impacts to Special Status Species

One special status plant species, Cambria morning-glory, was mapped in the Study Area in 2015. Ten special status animals species have the potential to occur in the Study Area, four of which were observed during surveys.

9.5.1 Special status plants

Two patches of Cambria morning-glory, a CRPR list 4.2 subspecies, were mapped in the Study Area in California annual grassland habitat. The smaller of the two patches consists of approximately 40 individuals. The larger patch consists of approximately 460 individuals. Cambria morning-glory would not be impacted by the proposed project; therefore no mitigation is required.

9.5.2 Special status birds

Nesting and wintering habitat for special status birds is present in the Study Area. Construction activities could result in nest abandonment or loss of special status bird species if appropriate preconstruction surveys, setback requirements, and management practices are not implemented (refer to Sections 10.4 and 10.5.2).

9.5.3 Special status bats

Pallid bat and western mastiff bat could potentially occur in oak trees within the Study Area. Maternal bat colonies are protected by the California Department of Fish and Wildlife but are not expected to occur in the Study Area. Adverse effects to special status bats and maternal bat colonies can be avoided (see Section 10.5.3).

9.5.4 Special status reptiles and amphibians

California red-legged frog could potentially occur in the riparian habitat seasonally when sufficient water is present. Suitable habitat is not present in the two ephemeral waterways in the southern end of the Study Area, and therefore development of the proposed project would not affect California red-legged frog.

Western pond turtle is unlikely to occur in the riparian habitat that bisects the vineyard. Suitable habitat is not present in the two ephemeral waterways in the southern end of the Study area, and therefore development of the proposed project would not affect Western pond turtle.

Silvery legless lizard could occur in sandy soil and leaf litter in the oak woodland habitat. Impacts to oak woodland understory could impact legless lizards (see Section 10.4.5).

10.0 Recommendations and Mitigations

This section provides recommendations and mitigations to reduce potential impacts of the proposed project on biological resources.

10.1 Habitats

Impacts to annual grassland habitat do not require mitigation except where they affect special status species or sensitive natural communities. Impacts to special status species are addressed in Sections 6.4 and 6.5.

If project construction requires impacts or removal of native oak or foothill pine trees, the following mitigation recommendations shall be implemented.

BR-1. Prior to issuance of grading permits, oak and pine tree canopies and trunks within 50 feet of proposed disturbance zones shall be mapped and numbered by a qualified biologist or arborist and a licensed land surveyor. Data collected for each tree shall include diameter at breast height (4.5 feet) of each stem/trunk, canopy diameter, tree height, tree health, and habitat notes (cavities for birds or bats), raptor nests, wood rat nests, and unique features. The tree map shall be used to determine impacts to trees from the project and will inform the mitigation plan.

BR-2. A native tree mitigation and monitoring plan shall be prepared for the project according to the County guidelines for mitigation plans (San Luis Obispo County, Department of Planning and Building 2006) The plan shall be reviewed and approved by the County prior to implementation. The mitigation plan shall incorporate the most current County standards for mitigating impacts to oak and pine trees, and oak woodland habitat.

BR-3. Impacts to tree canopies or root zones shall be avoided where practicable. Impacts include any ground disturbance within 1.5 times the diameter of the canopy drip-line.

BR-4. Impacts to native trees shall be mitigated by planting additional trees on-site. Oaks removed shall be replaced in kind at a 4:1 ratio. Oaks impacted shall be replaced in kind at a 2:1 ratio. Foothill pines removed shall be replaced at a 1:1 ratio if the diameter at breast height is five inches or greater. Replacement trees shall be of one gallon size, of local origin, and of the same species as was impacted. Replacement trees shall be seasonally maintained (browse protection, weed reduction and irrigation, as needed) and monitored annually for at least seven years.

10.2 Wetlands and Jurisdictional Waters

Where the proposed project impacts potentially jurisdictional ephemeral drainages and/or wetland habitats, the Applicant shall obtain authorization, as required, from the U.S. Army Corps of Engineers, California Department of Fish and Wildlife, and certification from the Regional Water Quality Control Board. Jurisdictional status of the ephemeral waterways near the project area has not been determined.

10.3 Wildlife Movement Corridors

Significant wildlife movement corridors are not present within the Study Area and would not be affected by the proposed project; therefore no mitigation measures are required.

10.4 Nesting Birds

Migratory non-game native bird species are protected by international treaty under the Federal Migratory Bird Treaty Act (MBTA) of 1918 (50 C.F.R. Section 10.13). Sections 3503, 3503.5 and 3513 of the California Fish and Game Code prohibit take (as defined therein) of all native birds and their active nests, including raptors and other migratory non-game birds (as listed under the Federal MBTA).

BR-5. Within one week of ground disturbance activities, if work occurs between March 15 and August 15, nesting bird surveys shall be conducted. If surveys do not locate nesting birds, construction activities may be conducted. If nesting birds are located, no construction activities shall occur within 100 feet of nests until chicks are fledged. A pre-construction survey report shall be submitted to the lead agency immediately upon completion of the survey. The report shall detail appropriate fencing or flagging of the buffer zone and make recommendations on additional monitoring requirements. A map of the Project site and nest locations shall be included with the report. The Project biologist conducting the nesting survey shall have the authority to reduce or increase the recommended buffer depending upon site conditions.

10.5 Special Status Species

10.5.1 Special status plants

The proposed project would not affect special status plants; therefore no mitigation recommendations are required.

10.5.2 Special status birds

In order to reduce the potential for disturbance of special status birds during nesting season, the applicant shall implement BR-5 one week prior to ground disturbance or tree pruning activities (refer to Section 10.4). If nests of sensitive birds are identified in the work area, the following additional mitigation measures shall be implemented:

BR-6. Occupied nests of special status bird species shall be mapped using GPS or survey equipment. Work shall not be allowed within a 100 foot buffer for songbirds and 300 foot buffer for raptors while the nest is in use. The buffer zone shall be delineated on the ground with orange construction fencing where it overlaps work areas

BR-7. Occupied nests of special status bird species that are within 100 feet of project work areas shall be monitored at least every two weeks through the nesting season to document nest success and check for project compliance with buffer zones. Once burrows or nests are deemed inactive and/or chicks have fledged and are no longer dependent on the nest, work may commence in these areas.

10.5.3 Special status bats

The following mitigation measure is provided if impacts to large oak trees are proposed:

BR-8. Prior to removal of any trees over 20 inches dbh, a survey shall be conducted by a qualified biologist to determine if any of the trees proposed for removal or trimming harbor sensitive bat species or maternal bat colonies. If a non-maternal roost is found, the qualified biologist, with prior approval from California Department of Fish and Game, will install one-way valves or other appropriate passive relocation method. For each occupied roost removed, one bat box shall be installed in similar habitat and should have similar cavity or crevices properties to those which are removed, including access, ventilation, dimensions, height above ground, and thermal conditions. Maternal bat colonies may not be disturbed.

10.5.4 Special status reptiles and amphibians

California red-legged frog and western pond turtle would not be affected by the proposed project, therefore no mitigation recommendations are provided.

Potentially suitable soils and habitat are present beneath oak trees for silvery legless lizard. Prior to grading that would affect oak woodland understory, a qualified biologist should review the location for suitability. Recommendations for further evaluation should be made at that time.

11.0 References

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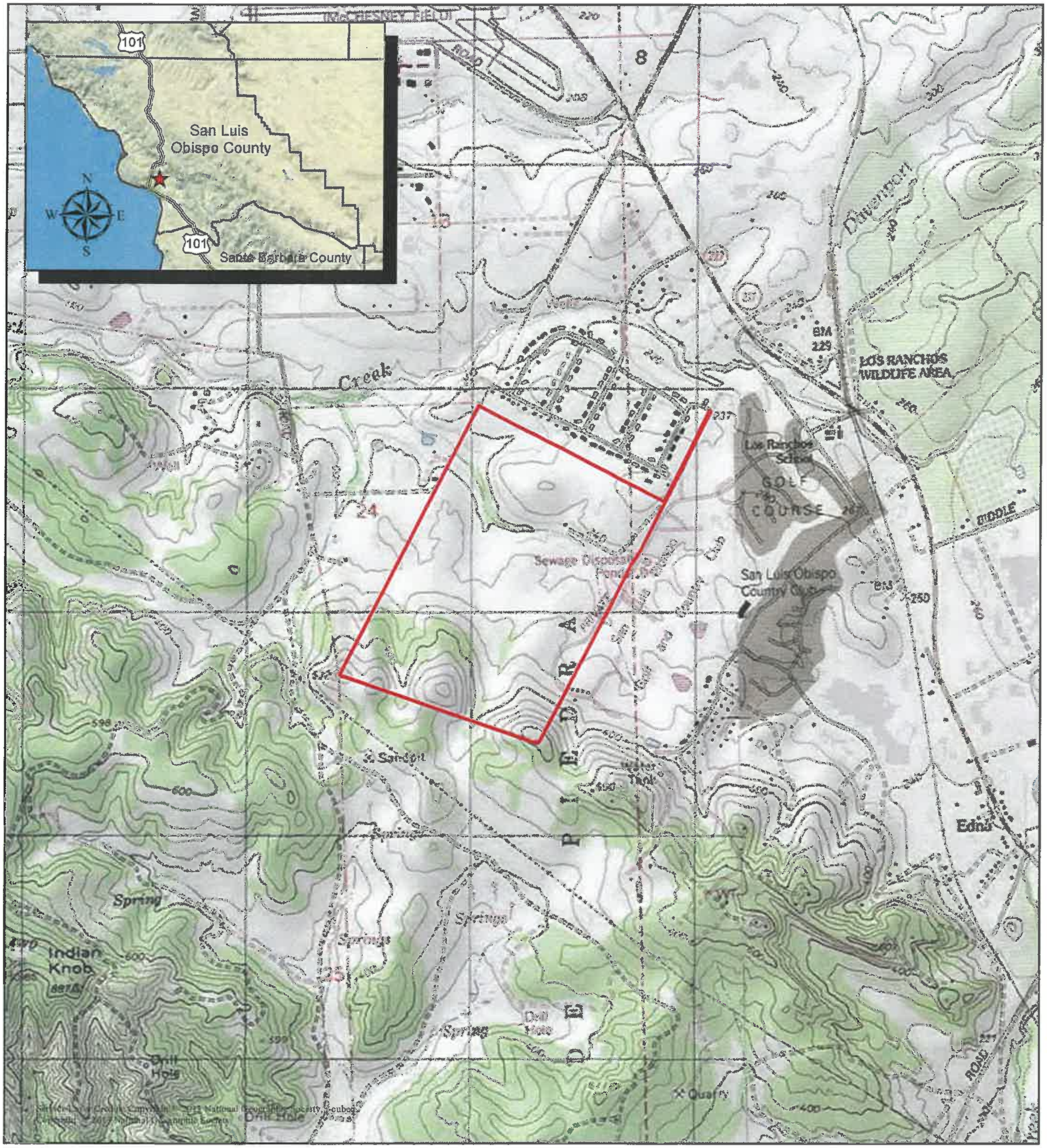
12.0 Figures

- Figure 1. USGS Topographic Map
- Figure 2. Aerial Photograph
- Figure 3. USDA Soils Map
- Figure 4. Animals - CNDDB & USFWS Critical Habitat Map
- Figure 5. Plants - CNDDB & USFWS Critical Habitat Map
- Figure 6. Biological Constraints Map
- Vesting Tentative Tract Map – Tract 2429

Figure 1. USGS Topographic Map



0 1,500 3,000 6,000 Feet

★ Project Location — Study Area

Jack Ranch
APN 044-081-040

Map Updated: February 23, 2015, 10:50 AM

ALTHOUSE AND MEADE, INC.
BIOLOGICAL AND ENVIRONMENTAL SERVICES

Figure 2. Aerial Photograph

Jack Ranch
APN 044-081-040

2014 San Luis Obispo County
NAIP Aerial Imagery
Map Updated: February 23, 2015, 10:57 AM

ALTHOUSE AND MEADE, INC.
BIOLOGICAL AND ENVIRONMENTAL SERVICES

Figure 3. USDA Soils Map

102: Arnold loamy sand, 5 to 15 percent slopes
108: Briones loamy sand, 15 to 50 percent slopes
109: Briones-Pismo loamy sands, 9 to 30 percent slopes
127: Cropley clay, 0 to 2 percent slopes
128: Cropley clay, 2 to 9 percent slopes
129: Diablo clay, 5 to 9 percent slopes
135: Elder sandy loam, 2 to 5 percent slopes
180: Nacimiento-Calodo complex, 15 to 30 percent slopes
181: Nacimiento-Calodo complex, 30 to 50 percent slopes
216: Tierra sandy loam, 2 to 9 percent slopes
224: Zaca clay, 9 to 15 percent slopes

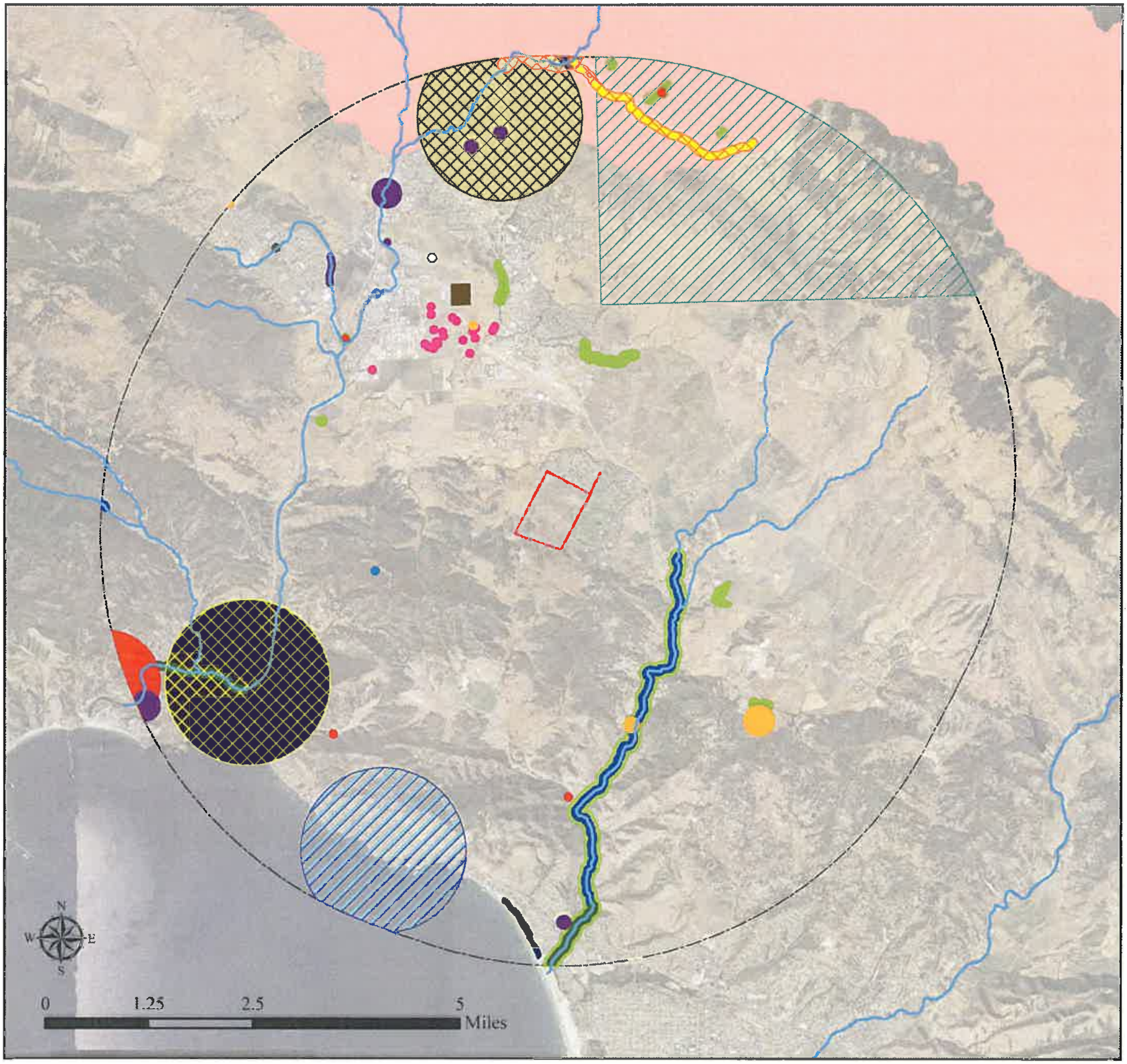
Soil Survey of San Luis Obispo County
Coastal Part

Jack Ranch
APN 044-081-040

2014 San Luis Obispo County
NAIP Aerial Imagery
Map Updated: February 23, 2015, 11:31 AM

ALTHOUSE AND MEADE, INC.
BIOLOGICAL AND ENVIRONMENTAL SERVICES

Figure 4. CNDDB Animals & USFWS Critical Habitat



Critical Habitat
- Steelhead
- California red-legged frog

CNDDB
- American badger
- Atascadero June beetle
- California red-legged frog
- Coast Range newt
- Coast horned lizard
- Ferruginous hawk
- Foothill yellow-legged frog
- Loggerhead shrike
- Monarch - California overwintering population
- Obscure bumble bee
- Pallid bat
- Prairie falcon
- Sandy beach tiger beetle
- Steelhead - south-central California coast DPS
- Tidewater goby
- Townsend's big-eared bat
- Vernal pool fairy shrimp
- Western bumble bee
- Western mastiff bat
- Western pond turtle
- Western snowy plover
- Western yellow-billed cuckoo

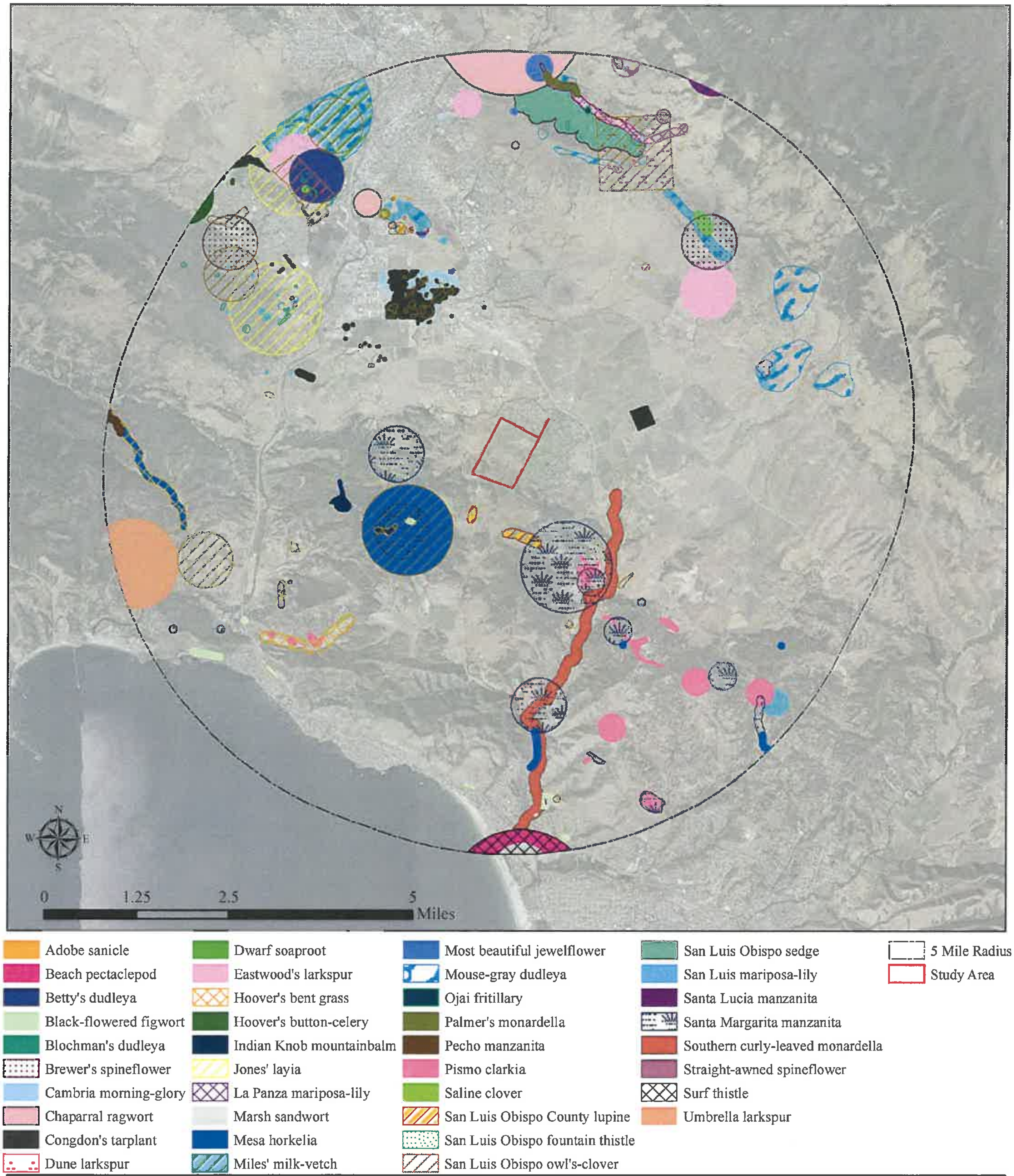
- 5 Mile Radius
- Study Area

Jack Ranch
APN 044-081-040

2014 San Luis Obispo County
NAIP Aerial Photography
Map Updated: June 21, 2016, 01:44 PM

ALTHOUSE AND MEADE, INC.
BIOLOGICAL AND ENVIRONMENTAL SERVICES

Figure 5. CNDDB Plants

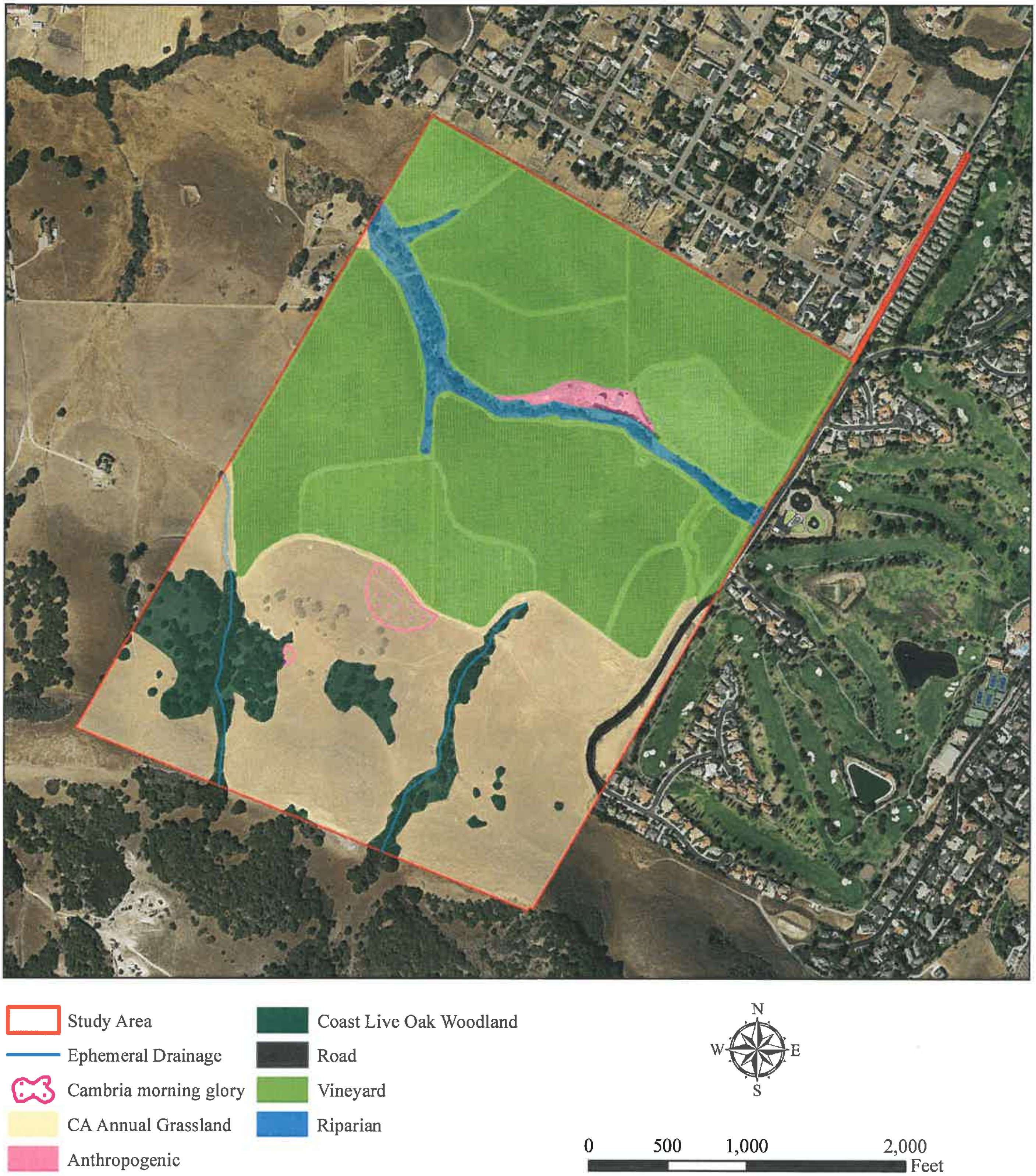


Jack Ranch
APN 044-081-040

2014 San Luis Obispo County
NAIP Aerial Photography
Map Updated: June 21, 2016, 01:08 PM

ALTHOUSE AND MEADE, INC.
BIOLOGICAL AND ENVIRONMENTAL SERVICES

Figure 6. Biological Constraints Map



Jack Ranch
APN 044-081-040

2014 San Luis Obispo County
NAIP Aerial Imagery
Map Updated: July 06, 2016, 09:45 AM

ALTHOUSE AND MEADE, INC.
BIOLOGICAL AND ENVIRONMENTAL SERVICES

PROJECT DATA

1. PROJECT LOCATION: LOS RANCHOS ROAD AND HIGHWAY 227
2. ASSESSOR'S PARCEL NO: 044-050-040
3. TOTAL PARCEL SIZE: LOT M = 298.88 ± ACRES

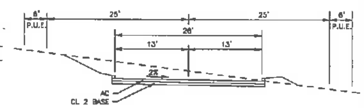
DEVELOPMENT AREA STATISTICS				
	NET		GROSS	
LOT	S.F.	ACRES	S.F.	ACRES
1	36,898	0.85	43,620	1.00
2	39,080	0.90	43,560	1.00
3	38,731	0.89	43,563	1.00
4	33,548	0.77	43,619	1.00
5	38,418	0.88	43,674	1.00
6	43,593	1.00	43,593	1.00
7	38,807	0.89	43,560	1.00
8	38,807	0.89	43,560	1.00
9	37,625	0.86	43,560	1.00
10	43,588	1.00	43,560	1.00
11	43,568	1.00	43,560	1.00
12	39,930	0.92	43,560	1.00
13	43,565	1.00	43,560	1.00
TOTAL	516,992	11.88	566,549	13.00

DEVELOPMENT AREA CALCULATIONS:

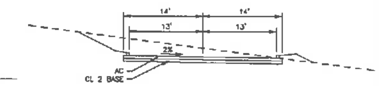
GROSS BASE PARCEL AREA: ———— 298.88 AC
ALLOWABLE DEVELOPMENT AREA (5%): ———— 14.93 AC
ROADWAY AREA EXCLUSIVE OF GROSS LOT AREA: 0.93 AC
GROSS LOT AREA: ———— 14.00 AC

NOTES:

1. BOUNDARY INFORMATION SHOWN HEREON WAS COMPILED FROM RECORD DATA SOURCES AND SHOWN ON THE RECORD OF SURVEY RECORDED AUGUST 25, 2000 IN BOOK 80 AT PAGE 1 OF RECORDS OF SURVEY FILED IN THE OFFICE OF THE COUNTY RECORDER, COUNTY OF SAN LUIS OBISPO, STATE OF CALIFORNIA.
2. TOPOGRAPHIC INFORMATION BASED ON AERIAL SURVEY INFORMATION PROVIDED BY GOLDEN STATE AERIAL SURVEYS, 6/21/99.
3. BENCHMARK: NAVD 88 TIED TO SLO CITY BENCHMARK BEING A LEAD AND TACK AT THE NORTH END OF THE CATCH BASIN ON THE NORTHEAST CURB RETURN OF POINSETTIA AT HUTTON: EL=181.47
4. EXISTING UTILITIES AS INDICATED.
5. ALL EXISTING TREE TRUNKS CLEAR OF PROPOSED PROPERTY LINES AND ARE TO BE MAINTAINED IN THEIR PRESENT LOCATION.
6. PRIVATE DRIVES AND EMERGENCY VEHICLE ROADS TO BE CONSTRUCTED TO COUNTY PUBLIC WORKS AND CDF STANDARDS.
7. PROPOSED ROAD LENGTH FROM INTERSECTION OF GREYSTONE PLACE TO LOT 12 = 2,860 LF
8. ALL WATER SYSTEM IMPROVEMENTS SHALL BE CONSTRUCTED PER SLO CO. DWG AND SPECS.
9. ALL WIRE UTILITIES (CATV, ELEC & TELEPHONE) SHALL BE CONSTRUCTED PER RESPECTIVE UTILITY CO. STANDARDS AND SPECS.
10. L.I.D. BASINS TO BE MAINTAINED BY NEW HOME OWNERS ASSOCIATION



CUL-DE-SAC: TYPICAL SECTION A-1b
NO SCALE

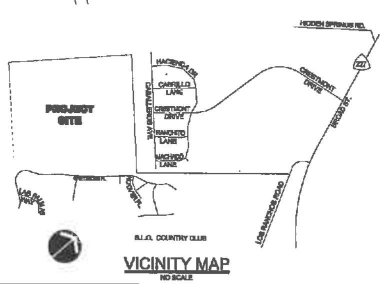


PRIVATE DRIVEWAY: TYPICAL SECTION A-1b
NO SCALE

LEGEND

ABBREVIATIONS:

EASEMENTS:



VICINITY MAP
NO SCALE

SCALE: 1"=200'

VESTING TENTATIVE TRACT 2429 FOR JACK RANCH

IN THE UNINCORPORATED TERRITORY OF THE COUNTY OF SAN LUIS OBISPO

LOT M AND A PORTION OF LOT N OF THE MAP OF THE PARTITION OF THE HOLLISTER TRACT, RANCHO CORRAL DE PIEDRA, IN THE UNINCORPORATED TERRITORY OF THE COUNTY OF SAN LUIS OBISPO, STATE OF CALIFORNIA AS RECORDED IN BOOK J OF THE DEEDS AT PAGE 367, RECORDS OF SAID COUNTY.

PREPARED FOR:
OWNERS/APPLICANT:
ORCUTT BROAD LLC & ERSKINE PROPERTY TRUST
P.O. BOX 510
PASO ROBLES, CA. 93447

CONTACT PERSON: DAN LLOYD
P.O. BOX 378
CAYUCOS, CA 93430

PREPARED BY:
GREGG HOVERSTEN
CIVIL ENGINEER RCE C52378
2409 IRONWOOD AVE.
MORRO BAY, CA 93442
805-440-3800
gregg001@sbcglobal.net

PLAN REVIEW: 4-18-16

LANDSITE INCORPORATED
Planning • Design • Permitting

TRACT 2429
VESTING TENTATIVE TRACT MAP

SCALE: 1"=400'
DATE: 04-27-16
SHEET 1 OF 1

13.0 Photographs

Photo 1. View north from drainage looking at vineyard. Photo taken March 2, 1015.

Photo 2. View east, north side of drainage. Photo taken March 2, 2015.

Photo 3. View south, looking at vineyard and grassland hills. Photo taken March 2, 2015.

Photo 4. View north through coast live oak looking at grassland and vineyard to far north. Photo taken March 2, 2015.

Photo 5. View north with shots of grassland hillsides, large eastern drainage, and vineyard to far north. Photo taken March 2, 2015.

Photo 6. View east of grassland, oak woodland and grassland hills in distance. Photo taken April 28, 2015.

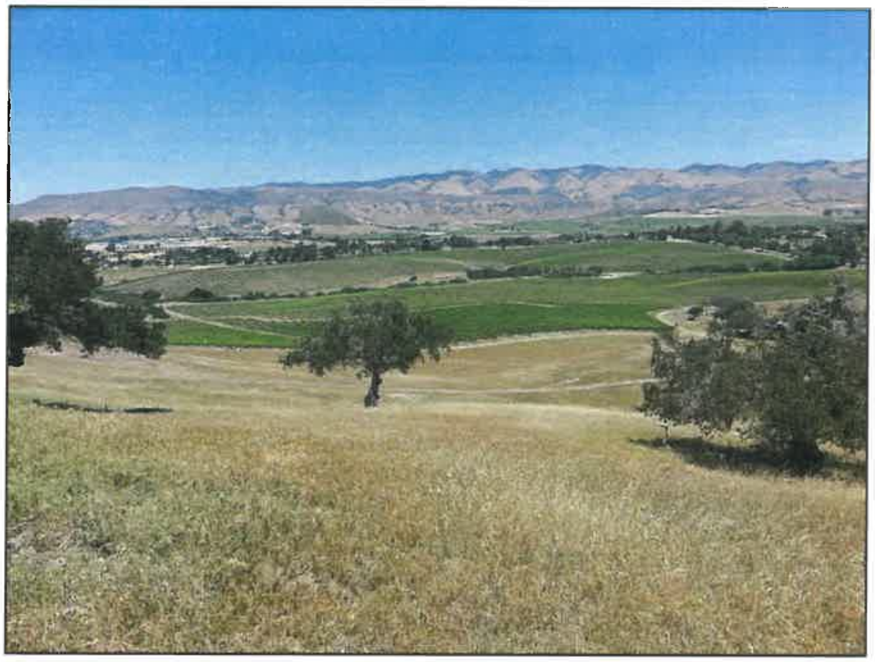


Photo 7. View northeast, grassland with occasional coast live oak, vineyard to far north. Photo taken April 28, 2015.

Photo 8. Cambria morning glory. Photo taken March 2, 2015.

Appendix A – CNDDB Online Field Survey Form Report

CNDDB Online Field Survey Form Report for Cambria morning-glory (*Calystegia subacaulis ssp. episcopalis*). Submitted July 21, 2015.

CNDDB Online Field Survey Form Report

California Natural Diversity Database
Department of Fish and Wildlife
1416 9th Street, Suite 1266
Sacramento, CA 95814
Fax: 916.324.0475

Email: cnddb@wildlife.ca.gov
www.dfg.ca.gov/biogeodata/cnddb/

Source code POH15F0002
Quad code 3512026
Occ. no.
EO index no.
Map index no.

Scientific name: *Calystegia subacaulis ssp. episcopalis*

Common name: Cambria morning-glory

Date of field work: 04-28-2015

Comment about field work date(s):

Observer: Jeremy J. Pohlman

Affiliation:

Address: 1325 Breck Street , San Luis Obispo, CA 93401

Email: jpohlman2011@gmail.com

Phone: (805) 237-9626

Other observers: Dustin T. Groh

How identified:

Keyed in: Jepson Manual 2nd edition

Compared w/ specimen at:

Compared w/ image in: Calflora.org

By another person: Jason Dart

Other:

Identification explanation:

Identification confidence: Very confident

Species found: Yes

Total no. individuals: 300-400

Collection? Yes

Collection no.: Dustin Groh

Museum/Herbarium: To be sent to Robert F. Hoover Herbarium

Plant Information

Phenology:	vegetative	flowering	fruiting
	30 %	70 %	0 %

Site Information

Habitat description: Coast live oak woodland with CA annual grassland understory

Slope: 30 degrees

Land owner/manager: Private

Aspect: North

Site condition + population viability: Good

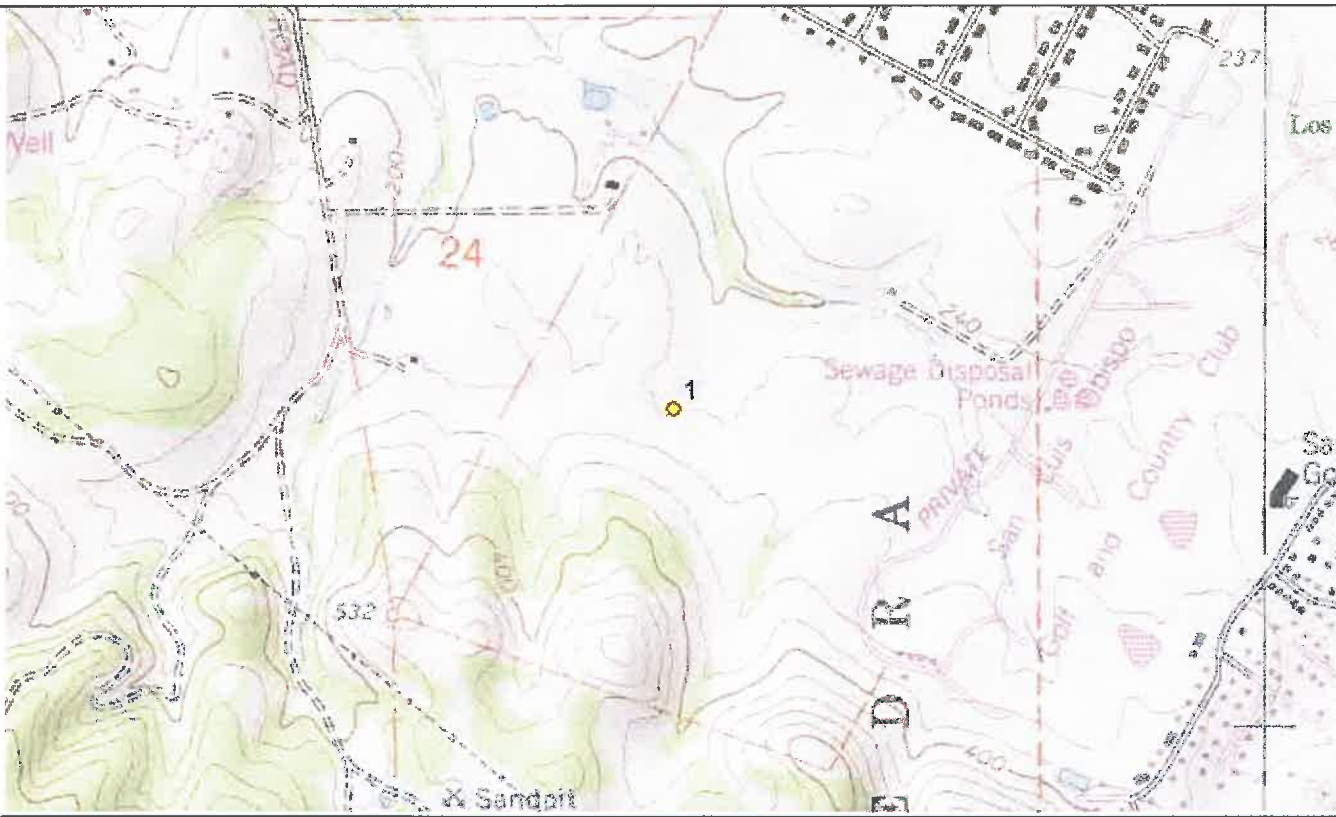
Immediate & surrounding land use: urban development, golf course, vineyard

Visible disturbances: dirt roads

Threats:

General comments:

Image URL: https://nrm.dfg.ca.gov/fieldSurvey/File.ashx?id=1777



ID	County	24K Quadrangle	Elev. (ft)	Latitude NAD83	Longitude NAD83	UTM E NAD83	UTM N NAD83	UTM Zone
1	San Luis Obispo	Pismo Beach	242	35.21410	-120.63930	714875	3899340	10
	Public Land Survey	**Feature Comment**						
	M T31S R12E 24							

The mapped feature is accurate within: 100 m

Source of mapped feature: CNDDB online field survey tool

Mapping notes: Localized 300-400 indv. within 250 ft. radius

Location/directions comments:

Attachment(s): 20150428_Calystegiasubacaulisssp.episcopalis.jpg

Rincon Consultants, Inc.
1530 Monterey Street, Suite D
San Luis Obispo, California 93401

805 547 0900 OFFICE AND FAX

info@rinconconsultants.com
www.rinconconsultants.com

February 28, 2017
Rincon Project No. 15-01566

Stephanie Fuhs,
Planner
County of San Luis Obispo,
Planning and Building Department
976 Osos Street, Room 300
San Luis Obispo, CA 93408
Via email: sfuhs@co.slo.ca.us

Subject: **Jack Ranch Agricultural Cluster Project EIR: Results of Biological Resources Reconnaissance Survey**
County of San Luis Obispo, CA

Dear Ms. Fuhs:

During our review of the applicant-submitted Biological Report for the proposed Jack Ranch Agricultural Cluster Project EIR, we noted a few conflicting statements as well as some resource areas requiring clarification or additional information. The report was prepared by Althouse and Meade, Inc. (A&M) and is dated June 2016. Specifically, the following elements of the report require additional information or clarification: status and description of reported ground disturbance; conflicting statements regarding potential jurisdictional status of drainages and wetlands; conflicting statements about rare plants; and vagueness about locations of native grassland species reported in the species list but not discussed fully in the report.

Background

Characterization of Site Disturbance. In Section 3.0, Existing Conditions, the report states that between the first and second site visits conducted to prepare the report (March 2 and April 28, 2015, respectively), evidence of scraping with heavy equipment was observed in various lot locations on southern hillsides of the study area. The report states that work consisted of scraping the top layer of vegetation in future lot areas, pushing soil over banks, and cutting oak trees (page 3). Additionally, the report states that photos are enclosed; however, no photos documenting this are included, and the disturbance areas are not mapped or quantified. The report does not explain if this disturbance invalidated results of the botanical survey or clarify the nature and extent of the disturbance, nor does it explain if the activities were associated with existing agricultural operations on the site.

Drainages and Wetlands. In Section 3.0, Existing Conditions, the report characterizes the site as containing a seasonal drainage bisecting the vineyard, and an additional two large drainages flowing from the southern hillsides northward toward the vineyard (page 3). In Section 5.6, the report states that the northern seasonal drainage is hydrologically connected to downstream navigable waterways and is likely jurisdictional under the Clean Water Act, but suggests that the southeastern drainage lacks such a connection (page 36). The report goes on to state that no isolated wetlands outside the drainage are present, but a jurisdictional delineation was not conducted. In Section 8.1, the report indicates that ephemeral drainages are present in areas of proposed development, and that permits may be required. However, in Section 9.2, the report states that the southeastern drainage would not likely be jurisdictional under the Clean Water Act or Fish and Game Code. This assertion is not explained or supported with data or agency correspondence.

Rare Plants. In Section 4.4, the report states that appropriate habitat is present for San Luis Obispo owl's clover (*Castilleja densiflora* ssp. *obispoensis*), and that the species was not found in 2015 (page 22). The same section also discloses that reference site visits to known populations found that the species was not present in most areas, and the species is poorly expressed during droughts. Section 8.1 states that this species could be present in years with above-average rainfall (page 44). However, the impact analysis does not discuss the species and no recommendation for follow-up survey or mitigation is made.

Habitat Types and Native Grasses. In Section 4.4, the report states that several perennial bunchgrasses occur in the study area. The plant list on page 40 indicates that two species of needlegrass were observed, *Stipa pulchra* and *Stipa lepida.* In a separate table on page 34, the report states that needlegrass habitat, defined in the report as 10% cover, is not present. The report does not include a discussion of the location and distribution of native grasses to clarify whether any areas meeting membership rules for native grasslands are present.

Methodology

In order to obtain the information necessary to resolve these elements and complete evaluation of potential effects on biological resources, Rincon Consultants Inc. (Rincon) first completed a review of aerial photographs of the site, and then conducted a field survey focused on the development footprint and potential agricultural expansion areas.

Rincon Senior Botanist Meg Perry reviewed historical aerial photographs available through Google Earth and the USDA National Agricultural Imagery Program (NAIP) to observe site conditions over time and look for aerial photo documentation that could help clarify statements about site disturbance that occurred between the March 2 and April 28, 2015 site visits by A&M. Printouts of aerial photos evaluated during this exercise from August 23, 2013, and from April 2, 2015, are appended.

Ms. Perry and Rincon Associate Biologist Kyle Weichert then conducted a field survey on February 23, 2017 between 10:30 a.m. and 3:30 p.m. The survey focused on the proposed development footprint and potential agricultural expansion areas in the southern portion of the site. During the site visit, Rincon staff documented current site conditions in these areas and documented current extent of active agricultural operations using a Trimble Global Positioning System (GPS) unit with sub-meter accuracy. Proposed roads and lots were walked following systematic transects to evaluate current conditions, verify extent and classification of habitat types, and to search for wetland vegetation and native grasses. Where native grasses were found, percent cover and extent were evaluated to determine if abundance, extent, and associate species were consistent with native grassland habitats. Similarly, where hydrophytic vegetation was observed within the area evaluated on February 23, GPS data was collected documenting its presence. Rincon staff evaluated conditions in both southern drainages, and looked for signs of connectivity between the southeastern drainage and other local waterways. Rincon staff also photographed the current condition of proposed development areas.

The existing vineyard and northern seasonal drainage were not evaluated in detail, nor were open space areas outside the proposed development area. Focused surveys and technical studies, including protocol-level botanical survey and jurisdictional delineation, were beyond the scope of this effort.

Findings

Aerial Photograph Review Findings

The most recent aerial photo available for review is dated April 2, 2015, retrieved through Google Earth historical imagery. This photo falls within the window between the March 2 and April 28, 2015 site visits documented in the A&M report. For comparison, Rincon reviewed previous aerial imagery, including a 2014 NAIP image and a 2013 photo available through Google Earth historical imagery.

Rincon identified an area of then-recent disturbance and some changes in oak tree canopy through the aerial photograph review. Specifically, an area near the proposed access road, at the east end of the proposed development footprint near existing vineyard, adjacent to Greystone Road, shows visible disturbance on the April 2, 2015 aerial photograph. Additionally, changes in oak canopy show that approximately 25 oak canopies visible in the 2013 image are not present in the 2015 image, though some indication of the former canopy locations are visible on the 2015 photo as differences in vegetation patterns where the oaks once stood. A site overlay indicates that the majority of trees that are absent from the April 2015 photo are not within proposed development areas; rather, 17 of these trees appear to be in an area of vineyard expansion, while eight of the removed trees are in the vicinity of proposed lots and roads. The diameter of the removed trees is not known; however, based on canopy size and leaf density in the August 2013 photo, some of the trees were mature oaks, and some were likely senescent. Copies of the 2013 and 2015 aerials with a plan sheet overlay are attached, with changes in oak canopy and the ground disturbance areas noted.

Field Survey Findings

Ms. Perry and Mr. Weichert conducted the field survey on February 23, 2017 between 10:30 a.m. and 3:30 p.m. Weather was fair, with sunny conditions, temperatures between 50 and 60 degrees Fahrenheit and cloud cover between 5 and 10 percent. Winds ranged between 0 and 5 miles per hour. The most recent rain occurred two days prior to the site visit, and soils were still saturated from the recent rains. The current wet season is the first above-average rainfall year following several years of extreme drought.

Characterization of Site Disturbance.

The property is currently zoned for agricultural uses. Vineyard expansion areas were noted south of the established vineyards, extending up a hillside adjacent to proposed development areas. In this area, the site has been plowed in recent years and planted with a cover crop that includes barley (*Hordeum vulgare*) and some annual grasses, including rattail fescue (*Festuca myuros*). Vineyard stakes and posts have been placed, although vines are not yet planted and not all posts and stakes are fully installed. Rincon staff used the Trimble GPS unit to map this vineyard expansion area based on locations of vineyard stakes and the extent of plowed ground and the cover crop.

Rincon also reviewed the disturbance area near Greystone Road. Barley and annual grasses were present, though no sign of vineyard preparations was noted. Rincon also noted existing electric fencing dividing pastures in the review area. Rincon did not document other areas that appeared to have been used for continued vineyard or agricultural purposes. Rincon did not observe evidence of soil being pushed into drainages, or clear signs that oaks were pushed into drainages; however, unstable banks in the drainages have caused some oaks to fall.

Drainages and Wetlands.

Rincon evaluated the two southern drainages to document current conditions and consider connectivity. The southwestern drainage originates in the hills south of the site in a highly erodible area where headcutting and unstable banks are notable. The banks are unstable throughout the reach of this stream that is on the subject property. Oak woodland canopy is present, with an understory primarily consisting of annual grasses. The bed of the channel was largely unvegetated, and flowing water was present on February 23. Sedges (*Carex* spp.) and rushes (*Juncus* spp.) are present in some areas along the edge of the streambed. The banks are unstable and some oak trees have fallen over due to undercutting. This drainage flows northwest. Near the western property boundary, canopy over this stream shifts from oak woodland to willow riparian scrub. A surface connection can be traced on aerial photos to streams west of the site.

The southeastern drainage also originates in the hills south of the site, and also has highly erodible banks near its origin. Oak woodland canopy is present, with scattered willows. Near the proposed crossing location, oak trees are present, with five oaks ranging in size from 6 inches to approximately 28 inches in diameter near the proposed footprint of the crossing. At this location, no willows are present, and annual grasses and herbs are dominant on the banks. The water flows into an existing culvert where it meets the vineyard. Rincon identified the probable outfall of this culvert on the north side of the drainage, in the northern seasonal stream. Thus, the stream is connected with the seasonal tributary to Davenport Creek.

The northern seasonal stream that flows westward through the vineyard was confirmed to have well developed willow riparian canopy, with an understory of wetland species, including cattail (*Typha* sp.) and tule (*Schoenoplectus californicus*), and facultative species including California blackberry (*Rubus ursinus*). The northern drainage is outside the proposed development footprint and so was not evaluated in detail during this site visit.

Rincon also documented several areas with hydrophytic vegetation that are potential seep wetlands. These areas were also saturated and seeping water; however, due to the recent rains and saturated soil conditions site wide, definitive conclusions about wetland hydrology in these locations could not be made. The seep areas are vegetated with a mosaic of facultative and hydrophytic vegetation, including brown-headed rush (*Juncus phaeocephalus*), western rush (*Juncus occidentalis*), spikerush (*Eleocharis* sp.), dock (*Rumex* sp.), and loosestrife (*Lythrum* sp.), in addition to facultative and upland species such as filaree (*Erodium* sp.), Italian rye (*Festuca perennis*), and bristly ox tongue (*Helminthotheca echioides*). Spikerush, brown-headed rush, and western rush are perennial species that typically require soils that are moist to saturated for long durations to persist, indicating these locations are typically wetter than surrounding areas. It is possible that these perennial wetland plants died back during the drought and were difficult to detect during the 2015 site visit, and have recovered with the return of normal rains.

Existing Conditions in Development Footprint

Rincon documented the existing conditions within the proposed development footprint.

Proposed Lots 1 through 9, located in the southeastern corner of the survey area, contain disturbed annual grassland consisting primarily of annual grasses such as bromes (*Bromus* spp.) and slender wild oats (*Avena barbata*) and ruderal forbs such as filaree. Grassland in this area also contained small, concentrated patches of needlegrass grassland with purple needlegrass (*Stipa pulchra*). However, these patches were small and discontinuous as patches up to approximately 10 feet by 40 feet in size with large spaces (over an acre) between patches, with native grassland species forming less than 10 percent cover and extent well under 0.1 acre at each location. Small patches were noted in the vicinity of Lot 9, Lot 7, Lot 1, and the LID features near Lots 1 through 9. Because of the limited extent and low percent cover, these areas did not meet membership rules identified in the Manual of California Vegetation, 2nd Edition for native grassland.

During the evaluation of these lots, Rincon also performed a brief evaluation of surrounding vegetation, and noted intact native grassland dominated by purple needlegrass on the hillside south of Lot 6, with cover of needlegrass exceeding 30 percent and other native grassland species, including snakeroot (*Sanicula* sp.), lupines (*Lupinus* spp.), and soaproot (*Chlorogalum pomeridianum* var. *pomeridianum*) notable in this area. This patch of native grassland covered more than a quarter acre on the hillside and meets membership rules identified in the Manual of California Vegetation, 2nd Edition, for purple needlegrass grassland, a sensitive natural community. This patch would be preserved because it is outside the proposed development footprint. It is possible additional stands of native grassland are present in the open space portions of the site as these were not inventoried in full

Special status plant species Cambria morning-glory (*Calystegia subacaulis* subsp. *episcopalis*; California Rare Plant Rank 4.2) was present in patches along the northeastern border of this development footprint area at the margin of one of the LID features. This location was not previously mapped by A&M.

The proposed road traverses through annual grassland in the vicinity of Lots 1 through 9 before crossing over the southeastern drainage. At this location, up to five coast live oak trees could be impacted by crossing improvements.

Proposed Lots 10 and 11 are located northwest of Lots 1 through 9 and the southeastern drainage. Vegetation within Lots 10 and 11 also consists primarily of disturbed annual grassland dominated by annual grasses and ruderal forbs. Lot 11 contains two patches of hydrophytic vegetation containing brown-headed rush. The margin of Lot 10 is immediately adjacent to the vineyard expansion area.

As the road continues westward, it traverses an area of annual grassland dominated by non-native annual grasses and herbs similar to the species composition in Lots 10 and 11.

Proposed Lots 12 and 13 are located northwest of Lots 10 and 11. Vegetation within this area is particularly disturbed, with dense, localized patches of milk thistle (*Silybum marianum*) and dwarf nettle (*Urtica urens*) in distinct ring-like distributions and appear to be previously included in the understories tree canopies. The vineyard expansion area and cover crop extends to the immediate north edge of these lots.

The western vineyard expansion area shown on the site plan contains coast live oak trees and annual grassland dominated by non-native annual grasses and herbs, especially wild oats, bromes, and filaree. To access this area, a new stream crossing would be needed as there is not currently a crossing that could accommodate farm equipment. The western Wet Weather Treated Effluent Storage Basin is in an area dominated by non-native annual grasses and herbs, including vetch (*Vicia sativa*), plantain (*Plantago lanceolata*), oats and bromes. This area is immediately adjacent to and partially overlaps one of the hillside seep mosaics, which supports spikerush, brown-headed rush, and western rush.

A habitat map depicting updated habitat types, with an emphasis on the development footprint is attached. This figure also displays locations where Cambria morning glory was found, and depicts the location of an active red-tailed hawk (*Buteo jamaicensis*) nest observed during the site visit.

Rincon also recorded all plant species observed during the site visit to the taxonomic level that could be determined. For some species, it is too early to make a final determination of identity as the plants are not yet in bloom. Approximately 90 species were identified during the survey. A table of species observations is appended.

Rincon confirmed the presence of Cambria morning glory, in additional locations beyond those noted in the 2016 biological report. One of the previous locations reported in the A&M report is now a vineyard expansion area.

Rincon also confirmed that grassland habitats are suitable for San Luis Obispo owl's clover; however, the site visit was conducted too early in the season to detect this plant. This species is a California Rare Plant Rank 1B species. Non-listed CRPR 1 and 2 species are typically analyzed under CEQA.

Discussion.

Based on the results of the site survey and mapping of the vineyard expansion work that has already occurred, Lots 10, 12, and 13 are immediately adjacent to agricultural uses. Lot 10 appears to overlap the vineyard expansion area slightly, and Lots 12 and 13 are set back by less than 50 feet from edge of lot line. Setback requirements should be reviewed to determine if this is compatible with County policy.

Oak tree removals occurred prior to submittal of the application and prior to implementation of the emergency Oak Tree Ordinance, and appear to have been primarily associated with vineyard expansion. Oak tree removals associated with the project would require mitigation consistent with current County ordinances and policies.

Wetlands and seeps are sensitive habitat types and should be avoided to the extent feasible. Where impacts cannot be avoided, mitigation would be recommended at a minimum two to one ratio in kind (same type of habitat created or enhanced to compensate for habitat impacted). A full delineation was not completed as part of the A&M report. A jurisdictional delineation will be required to identify and avoid all wetland and other aquatic resources to the extent feasible, to obtain permits for impacts that are not avoidable, and to quantify the amount of mitigation area required.

Finally, the A&M report states that reference sites for San Luis Obispo owl's clover were not documented to have detectable individuals at most reference sites during the 2015 site visit. Grasslands in the lots are suitable for this species. Therefore, a seasonally timed botanical survey, and if needed, a mitigation plan to offset impacts will be required.

We would be happy to discuss the findings of the site survey further if you have any questions.

Sincerely,

Rincon Consultants, Inc.

Meg Perry
Biological Program Manager/ Senior Botanist

Kyle Weichert, MS
Associate Biologist

Attachments: Photo Plate
Plant List
Aerial Imagery Comparison
Habitat Map

Photographs

Photo 1: View northwest of the disturbed area near Greystone Road on the southeastern edge of the study area.

Photo 2: View north of the annual grassland in the southern corner of the study area at the proposed site of Lots 1, 2, 3, 6, and 7.

Photo 3: View southwest of the annual grassland at the proposed site of Lots 1 and 9 and the LID features near lots 1 through 9.

Photo 4: View northwest of the southeastern drainage where it enters a culvert running under the vineyard to the north. This drainage flows into the tributary to Davenport Creek.

Photo 5: View southwest of the southeastern drainage near the proposed crossing.

Photo 6: View east of disturbed annual grassland at the proposed site of Lot 10, near the current vineyard expansion area.

Photo 7: View west of the annual grassland at the proposed site of Lot 11. The proposed access road would be located near the right edge of this photograph, north of the oaks visible in this view.

Photo 8: View east of disturbed annual grassland, with patches of thistle, at the proposed site of Lots 12 and 13.

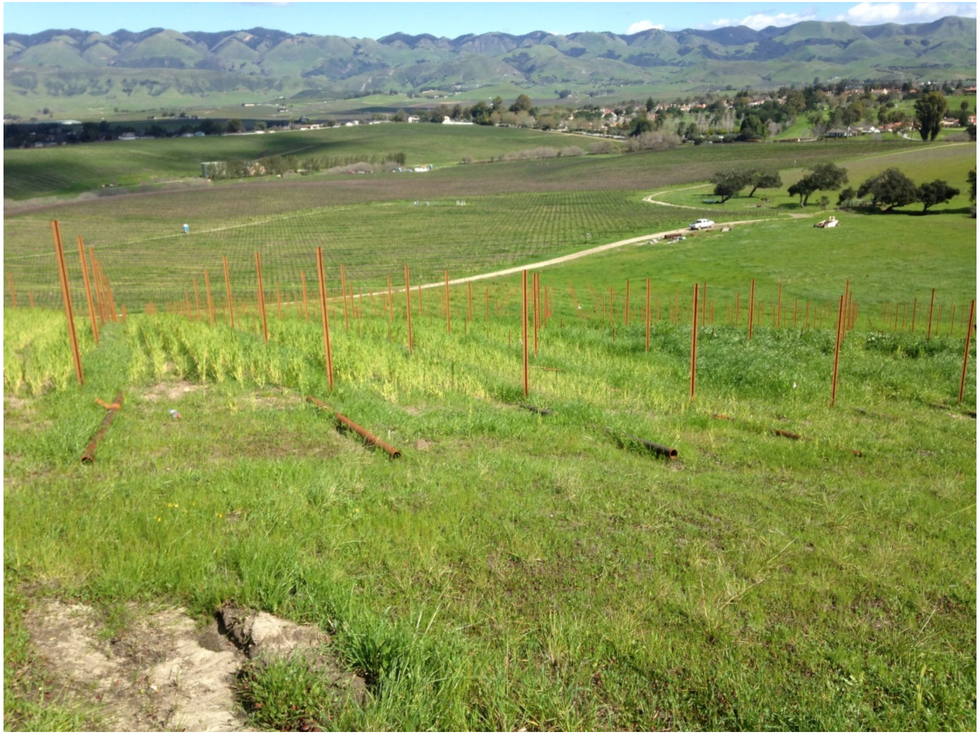


Photo 9: View north of the vineyard expansion area southeast of the southern vineyard road.

Photo 10: View north of the proposed western vineyard expansion area, in the southwestern corner of the site.

Photo 11: View southeast of the hillside seep in the western portion of the study area. Western rush, spikerush, and brown-headed rush are present intermixed with annual grasses and herbs.

Photo 12: Perennial native grassland dominated by purple needlegrass (*Stipa pulchra*), south of lot 6 in open space.

All photos were taken on February 23, 2017.

Table. Plant Species Observed During Reconnaissance-Level Site Visit Completed 2/23/2017.

Plant Family	Scientific Name	Common Name	Origin, Status	Life Form	Habitats
Agavaceae	*Chlorogalum pomeridianum* var. *pomeridianum*	soap root	Native	Bulb	ANGR; PNGR
Anacardiaceae	*Toxicodendron diversilobum*	western poison oak	Native	shrub/woody vine	CLOW
Apiaceae	*Anthriscus caucalis*	bur chervil	Introduced	Herb	ANGR, CLOW
Apiaceae	*Foeniculum vulgare*	fennel	Introduced, Cal-IPC High	herb	ANGR
Apiaceae	*Sanicula crassiculis*	sanicle	Native	herb	ANGR, PNGR
Asteraceae	*Agoseris* sp. (or *Microseris* sp.)	native dandelion	Native	herb	ANGR
Asteraceae	*Ambrosia psilostachya*	western ragweed	Native	herb	ANGR
Asteraceae	*Anthemis cotula*	mayweed	Introduced	herb	ANGR, RUD
Asteraceae	*Baccharis pilularis*	coyote brush	Native	shrub	ANGR
Asteraceae	*Carduus pycnocephalus*	Italian thistle	Introduced, Cal-IPC Moderate	herb	ANGR
Asteraceae	*Cirsium vulgare*	bull thistle	Introduced, Cal-IPC Moderate	herb	ANGR
Asteraceae	*Helminthotheca echioides*	bristly ox-tongue	Introduced; Cal-IPC Limited	herb	ANGR
Asteraceae	*Hypochaeris glabra*	smooth cat's ear	Introduced; Cal-IPC Limited	herb	ANGR
Asteraceae	*Matricaria discoidea*	pineapple weed	Introduced	herb	ANGR, RUD
Asteraceae	*Pseudognaphalium californicum*	California everlasting	Native	herb	CLOW
Asteraceae	*Pseudognaphalium luteoalbum*	cudweed	Introduced	herb	ANGR
Asteraceae	*Senecio vulgaris*	groundsel	Introduced	herb	ANGR, RUD
Asteraceae	*Silybum marianum*	milk thistle	Introduced; Cal-IPC Limited	herb	ANGR
Asteraceae	*Sonchus oleraceus*	common sow thistle	Introduced	herb	ANGR, RUD
Asteraceae	*Xanthium strumarium*	cocklebur	Native	herb	ANGR
Boraginaceae	*Amsinckia menziesii*	small-flowered fiddleneck	Native	herb	ANGR
Boraginaceae	*Plagiobothrys canescens*	popcornflower	Native	herb	ANGR
Brassicaceae	*Brassica nigra*	black mustard	Introduced, Cal-IPC Moderate	herb	ANGR
Brassicaceae	*Capsella bursa-pastoris*	shepherd's purse	Introduced	herb	ANGR
Brassicaceae	*Lepidium nitidum*	peppergrass	Native	herb	ANGR, RUD
Caryophyllaceae	*Cerastium glomeratum*	mouse-eared chickweed	Introduced	herb	ANGR, RUD, AG
Caryophyllaceae	*Silene gallica*	windmill pinks	Introduced	herb	ANGR, RUD, AG
Caryophyllaceae	*Spergula arvensis*	stickwort	Introduced	herb	ANGR, RUD, AG
Caryophyllaceae	*Stellaria media*	common chickweed	Introduced	herb	ANGR, AG
Chenopodiaceae	*Chenopodium album*	lamb's quarters	Introduced	herb	ANGR
Convolvulaceae	*Calystegia subacaulis* ssp. *episcopalis*	Cambria morning glory	Native, **CRPR 4**	herb	ANGR
Convolvulaceae	*Convolvulus arvensis*	bindweed	Introduced	herb	ANGR
Cyperaceae	*Carex* sp.	sedge	TBD (Likely Native)	herb	WET
Cyperaceae	*Eleocharis macrostachya*	spikerush	Native	herb	WET
Cyperaceae	*Schoenoplectus californicus*	southern bulrush	Native	herb	RIP/WET
Euphorbiaceae	*Croton californicus*	croton	Native	herb/subshrub	ANGR
Euphorbiaceae	*Croton setiger*	dove weed	Native	herb	ANGR
Euphorbiaceae	*Ricinus communis*	castor bean	Introduced; Cal-IPC Limited	shrub	RIP

Plant Family	Scientific Name	Common Name	Origin, Status	Life Form	Habitats
Fabaceae	*Acmispon brachycarpus*	hill lotus	Native	herb	ANGR
Fabaceae	*Lupinus bicolor*	miniature lupine	Native	herb	ANGR, PNGR
Fabaceae	*Lupinus microcarpus*	chick lupine	Native	herb	ANGR, CLOW
Fabaceae	*Lupinus nanus*	sky lupine	Native	herb	ANGR, CLOW
Fabaceae	*Medicago polymorpha*	bur clover	Introduced; Cal-IPC Limited	herb	ANGR, RUD, AG
Fabaceae	*Trifolium* sp.	clover	Introduced	herb	ANGR
Fabaceae	*Vicia sativa* ssp. *sativa*	winter vetch	Introduced	herb	ANGR
Fabaceae	*Vicia villosa* ssp. *varia*	hairy vetch	Introduced	herb	ANGR
Fagaceae	*Quercus agrifolia* var. *agrifolia*	coast live oak	Native	tree	CLOW
Geraniaceae	*Erodium botrys*	Storksbill	Introduced	herb	ANGR
Geraniaceae	*Erodium brachycarpum*	filaree	Introduced	herb	ANGR, RUD, AG
Geraniaceae	*Erodium cicutarium*	redstem filaree	Introduced; Cal-IPC Limited	herb	ANGR
Geraniaceae	*Erodium moschatum*	greenstem filaree	Introduced	herb	ANGR
Geraniaceae	*Geranium dissectum*	cut-leaf geranium	Introduced; Cal-IPC Limited	herb	ANGR
Geraniaceae	*Geranium molle*	dovefoot geranium	Introduced	herb	ANGR
Juncaceae	*Juncus occidentalis*	western rush	Native	herb	WET
Juncaceae	*Juncus phaeocephalus*	brown-headed rush	Native	herb	WET
Lythraceae	*Lythrum hyssopifolia*	loosestrife	Introduced; Cal-IPC Limited	herb	WET
Malvaceae	*Malva parviflora*	cheeseweed	Introduced	herb	ANGR
Malvaceae	*Sidalcea malviflora*	checkerbloom	Native	herb	ANGR, PNGR
Montiaceae	*Calandrinia ciliata*	red maids	Native	herb	ANGR, RUD, AG
Montiaceae	*Claytonia perfoliata*	miner's lettuce	Native	herb	ANGR, CLOW, RIP
Myrsinaceae	*Lysimachia arvensis*	scarlet pimpernel	Introduced	herb	ANGR, RIP
Oxalidaceae	*Oxalis corniculata*	sorrel	Introduced	herb	ANGR
Phrymaceae	*Mimulus aurantiacus*	sticky monkeyflower	Native	shrub	ANGR, PNGR
Plantaginaceae	*Plantago lanceolata*	English plantain	Introduced; Cal-IPC Limited	herb	ANGR, WET
Poaceae	*Avena barbata*	slender wild oat	Introduced, Cal-IPC Moderate	grass	ANGR, PNGR
Poaceae	*Avena sativa*	cultivated oat	Introduced	grass	ANGR, AG
Poaceae	*Briza minor*	small quaking grass	Introduced	grass	ANGR, AG
Poaceae	*Bromus diandrus*	ripgut brome	Introduced, Cal-IPC Moderate	grass	ANGR
Poaceae	*Bromus madritensis* ssp. *rubens*	red brome	Introduced, Cal-IPC High	grass	ANGR
Poaceae	*Ehrharta calycina*	veldt grass	Introduced, Cal-IPC High	grass	ANGR
Poaceae	*Elymus triticoides*	creeping wild rye	Native	grass	ANGR
Poaceae	*Festuca microstachys*	small fescue	Native	Grass	ANGR
Poaceae	*Festuca myuros*	rattail fescue	Introduced, Cal-IPC Moderate	grass	ANGR
Poaceae	*Festuca perennis*	ryegrass	Introduced, Cal-IPC Moderate	grass	ANGR
Poaceae	*Hordeum murinum* ssp. *leporinum*	hare barley	Introduced, Cal-IPC Moderate	grass	ANGR
Poaceae	*Hordeum vulgare*	cultivated barley	Introduced	grass	ANGR, AG
Poaceae	*Poa annua*	annual bluegrass	Introduced	grass	ANGR
Poaceae	*Poa secunda* ssp. *secunda*	blue grass	Native	grass	PNGR

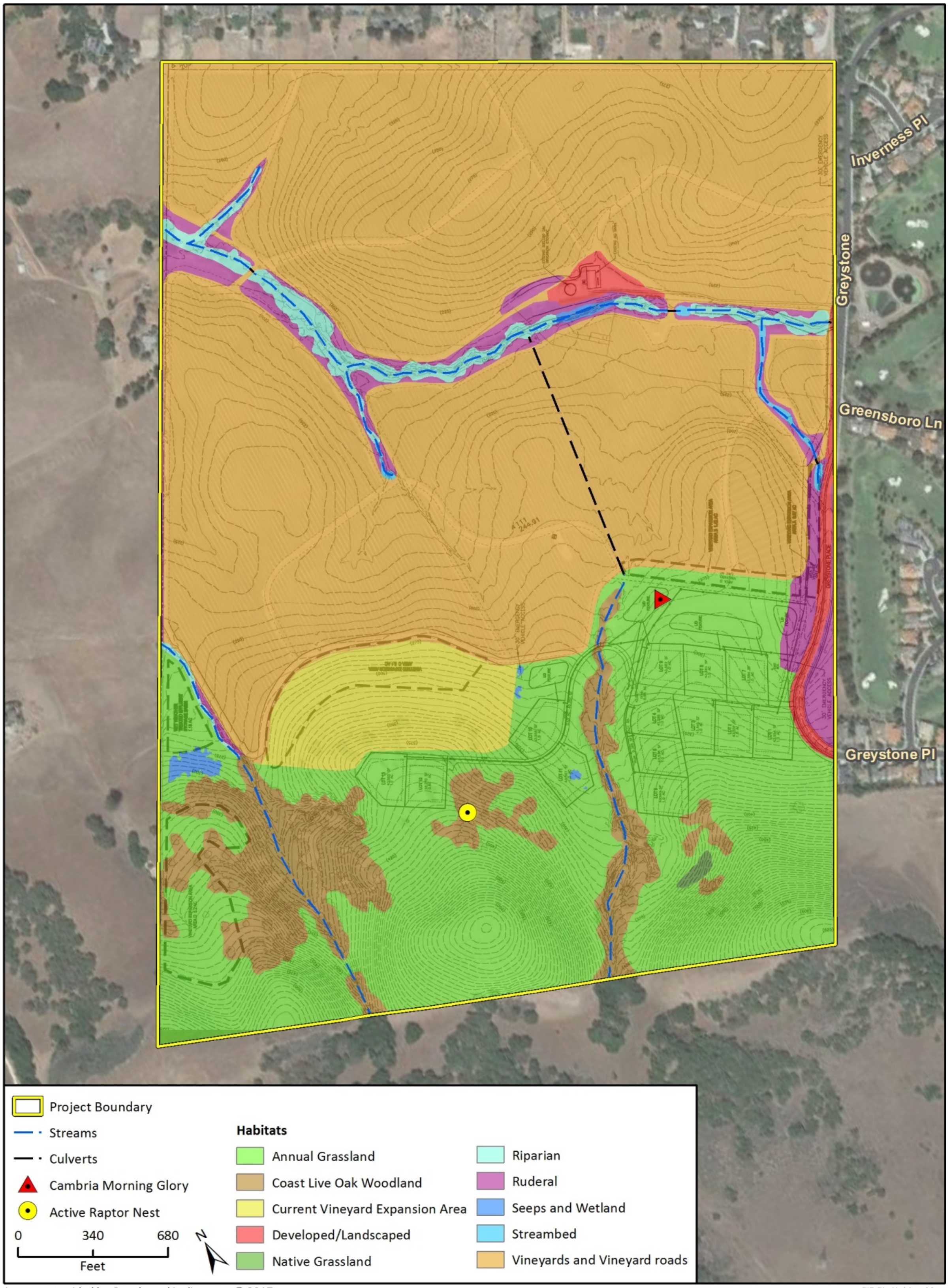
Plant Family	Scientific Name	Common Name	Origin, Status	Life Form	Habitats
Poaceae	*Stipa lepida*	foothill needlegrass	Native	grass	ANGR, PNGR
Poaceae	*Stipa pulchra*	purple needlegrass	Native	grass	ANGR, PNGR
Polygonaceae	*Polygonum aviculare*	common knot weed	Introduced	herb	WET
Polygonaceae	*Rumex acetosella*	sheep sorrel	Introduced, Cal-IPC Moderate	herb	ANGR
Polygonaceae	*Rumex crispus*	curly dock	Introduced; Cal-IPC Limited	herb	ANGR, WET
Pteridaceae	*Pentagramma triangularis* ssp. *triangularis*	goldback fern	Native	herb	CLOW
Ranunculaceae	*Ranunculus californicus*	California buttercup	Native	herb	ANGR, PNGR
Rosaceae	*Heteromeles arbutifolia*	toyon	Native	shrub	CLOW
Rosaceae	*Rosa californica*	California wild rose	Native	shrub	CLOW
Rosaceae	*Rubus ursinus*	California blackberry	Native	shrub	RIP
Rubiaceae	*Galium aparine*	goose grass	Native	herb	ANGR, CLOW
Salicaceae	*Salix lasiolepis*	arroyo willow	Native	shrub	RIP
Themidaceae	*Dichelostemma capitatum*	blue-dicks	Native	bulb	ANGR, PNGR
Typhaceae	*Typha* sp.	cattail	Native	herb	WET
Urticaceae	*Urtica urens*	dwarf nettle	Introduced	herb	ANGR, CLOW
Violaceaea	*Viola pedunculata*	Johnny jump-up	Native	herb	ANGR, PNGR, CLOW
Vitaceae	*Vitis vinifera*	grape	Introduced	vine	AG

Abbreviations:
CRPR: California Rare Plant Rank
Cal-IPC: California Invasive Plant Council designation of ecological threat level (Limited, Moderate, High threat)

Habitat Codes:
AG- Agricultural (primarily vineyard, inter-rows, and margins of vineyard roads)
ANGR – Annual grassland
CLOW – Coast live oak woodland
PNGR – Perennial native grassland
RUD – Ruderal
RIP – Riparian
WET – Wetland and seeps


August 23, 2013 Aerial
Google Earth Historic Imagery - August 2013
Legend
Disturbance area
Tree removals noted on 2015 aerial
Disturbance area seen on 2015 photo
Google earth
900 ft
N


April 2, 2015 Aerial
Google Earth Historic Imagery - April 2015
Legend
Disturbance area
Tree removals noted on 2015 aerial
Disturbance area seen on 2015 photo
Google earth
900 ft
N



Imagery provided by Google and its licensors © 2017.
Additional data provided by Althouse and Meade, Inc. 2016

Figure: Habitat Map

Table D3-1 Special Status and Rare Plant Species Known to Occur in the Vicinity of the Project Site: CNDDB, CNPS, and IPaC Query Results

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Agrostis hooveri Hoover's bent grass	None/None G2 / S2 1B.2	Chaparral, cismontane woodland, closed-cone coniferous forest, valley and foothill grassland. Sandy sites. 60-765 m.	Moderate. Suitable foothill grassland is present in the Study Area. This species was not observed during surveys.
Arctostaphylos cruzensis Arroyo de la Cruz manzanita	None/None G3 / S3 1B.2	Broadleafed upland forest, coastal bluff scrub, closed-cone coniferous forest, chaparral, coastal scrub, & valley and foothill grassland. On sandy soils in several different habitat types from chaparral to coastal scrub to woodland. 60-310 m.	Absent. Suitable scrub, chaparral, or forest habitat is not present in the Study Area. This species was not observed during surveys.
Arctostaphylos luciana Santa Lucia manzanita	None/None G3 / S3 1B.2	Chaparral, cismontane woodland. On shale (one site says serpentine) outcrops, on slopes, in chaparral. 105-795 m.	Absent. Suitable chaparral or woodland habitat is not present in the Study Area. This species was not observed during surveys.
Arctostaphylos morroensis Morro manzanita	FT/None G1 / S1 1B.1	Chaparral, cismontane woodland, coastal dunes, coastal scrub. On Baywood sands, usually with chaparral associates. 30-125 m.	Absent. Suitable chaparral, woodland, dune, or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Arctostaphylos osoensis Oso manzanita	None/None G1 / S1 1B.2	Chaparral, cismontane woodland. Usually occurs in openings w/in oak woodland on dacite porphyry buttes. 180-275 m.	Absent. Suitable chaparral or woodland habitat is not present in the Study Area. This species was not observed during surveys.
Arctostaphylos pechoensis Pecho manzanita	None/None G2 / S2 1B.2	Closed-cone coniferous forest, chaparral, coastal scrub. Grows on siliceous shale with other chaparral associates. 60-855 m.	Absent. Suitable chaparral, woodland, or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Arctostaphylos pilosula Santa Margarita manzanita	None/None G2? / S2? 1B.2	Closed-cone coniferous forest, chaparral, broadleaved upland forest, cismontane woodland. Shale outcrops & slopes; reported growing on decomposed granite or sandstone. 60-1220 m.	Absent. Suitable chaparral or woodland habitat is not present in the Study Area. This species was not observed during surveys.
Arctostaphylos rudis sand mesa manzanita	None/None G2 / S2 1B.2	Chaparral, coastal scrub. On sandy soils in Lompoc/Nipomo area. 20-335 m.	Absent. Suitable chaparral or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Arctostaphylos tomentosa ssp. *daciticola* dacite manzanita	None/None G4T1 / S1 1B.1	Chaparral, cismontane woodland. Only known from one site in SLO County on dacite porphyry buttes. About 120m.	Absent. Suitable chaparral or woodland habitat is not present in the Study Area. This species was not observed during surveys.
Arenaria paludicola marsh sandwort	FE/CE G1 / S1 1B.1	Marshes and swamps. Growing up through dense mats of Typha, Juncus, Scirpus, etc. in freshwater marsh. Sandy soil. 3-170 m.	Absent. Suitable marsh or swamp habitat is not present in the Study Area. This species was not observed during surveys.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Astragalus didymocarpus var. *milesianus* Miles' milk-vetch	None/None G5T2 / S2 1B.2	Coastal scrub and grasslands. Clay soils. 50-385 m.	Low. Marginally suitable grassland habitat and clay soils are present in the Study Area. This species was not observed during surveys.
Atriplex coulteri Coulter's saltbush	None/None G3 / S1S2 1B.2	Coastal bluff scrub, coastal dunes, coastal scrub, valley and foothill grassland. Ocean bluffs, ridgetops, as well as alkaline low places. Alkaline or clay soils. 2-460 m.	Absent. Suitable dune or scrub habitat and alkaline soils are not present in the Study Area. This species was not observed during surveys.
Bryoria spiralifera twisted horsehair lichen	None/None G3 / S1S2 1B.1	North coast coniferous forest. Usually on conifers. 0-30 m.	Absent. Suitable coniferous forest habitat is not present in the Study Area. This species was not observed during surveys.
Calochortus obispoensis San Luis mariposa lily	None/None G2 / S2 1B.2	Chaparral, coastal scrub, valley and foothill grassland. Often in serpentine grassland. 50-730 m.	Absent. Suitable serpentine soils and outcrops are not present in the Study Area. This species was not observed during surveys.
Calochortus simulans La Panza mariposa lily	None/None G2 / S2 1B.3	Valley and foothill grassland, cismontane woodland, chaparral, lower montane coniferous forest. Decomposed granite. 50-1160 m.	Absent. The Study Area is outside the known range of this species. This species was not observed during surveys.
Calycadenia villosa dwarf calycadenia	None/None G3 / S3 1B.1	Chaparral, cismontane woodland, valley and foothill grassland, meadows and seeps. Open, dry meadows, hillsides, gravelly outwashes. 240-1350 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Calystegia subacaulis ssp. *episcopalis* Cambria morning glory	--/-- G3T2 / S2 4.2	Chaparral, Cismontane woodland, Coastal prairie, Valley & foothill grassland. Bloom period: April-June. Elevation: 0-500 m.	Present. Suitable habitat is present on the project site. This species was observed during botanical surveys (Althouse and Meade, 2016).
Camissoniopsis hardhamiae Hardham's evening-primrose	None/None G2 / S2 1B.2	Chaparral, cismontane woodland. Sandy, decomposed carbonate. 140-945 m.	Absent. Suitable chaparral and woodland habitat and soils are not present in the Study Area. This species was not observed during surveys.
Carex obispoensis San Luis Obispo sedge	None/None G3? / S3? 1B.2	Closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, valley and foothill grassland. Usually in transition zone on sand, clay, serpentine, or gabbro. In seeps. 5-845 m.	Absent. Suitable seep habitat is present in the Study Area. This species was not observed during surveys.
Castilleja densiflora var. *obispoensis* San Luis Obispo owl's-clover	None/None G5T2 / S2 1B.2	Valley and foothill grassland, meadows and seeps. Sometimes on serpentine. 10-485 m.	Moderate. Suitable foothill grassland habitat is present in the Study Area. This species was not observed during surveys.
Caulanthus californicus California jewelflower	FE/SE G1 / S1 1B.1	Chenopod scrub, valley and foothill grassland, pinyon and juniper woodland. Sandy soils. 65-1860 m.	Absent. The Study Area is outside the known range of this species. This species was not observed during surveys.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Centromadia parryi ssp. *congdonii* Congdon's tarplant	None/None G3T2 / S2 1B.1	Valley and foothill grassland. Alkaline soils, sometimes described as heavy white clay. 0-230 m.	Absent. Suitable alkaline soils and mesic habitat is not present in the Study Area. This species was not observed during surveys.
Chenopodium littoreum coastal goosefoot	None/None G2 / S2 1B.2	Coastal dunes. 10-30 m.	Absent. Suitable dune habitat is not present in the Study Area. This species was not observed during surveys.
Chlorogalum pomeridianum var. *minus* dwarf soaproot	None/None G5T2T3 / S2S3 1B.2	Chaparral. Serpentine. 305-1000 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Chloropyron maritimum ssp. *maritimum* salt marsh bird's-beak	FE/CE G4?T1 / S1 1B.2	Marshes and swamps, coastal dunes. Limited to the higher zones of salt marsh habitat. 0-10 m. Syn: *Chordylanthus maritimus* ssp. *maritimus*	Absent. Suitable marsh, swamp, or dune habitat is not present in the Study Area. This species was not observed during surveys.
Chorizanthe breweri Brewer's spineflower	None/None G3 / S3 1B.3	Chaparral, cismontane woodland, coastal scrub, closed-cone coniferous forest. Rocky or gravelly serpentine sites; usually in barren areas. 45-765 m.	Absent. Suitable chaparral, woodland, or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Chorizanthe rectispina straight-awned spineflower	None/None G1 / S1 1B.3	Chaparral, cismontane woodland, coastal scrub. Often on granite in chaparral. 50-1040 m.	Absent. Suitable chaparral, woodland, or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Cirsium fontinale var. *obispoense* San Luis Obispo fountain thistle	FE/CE G2T2 / S2 1B.2	Chaparral, cismontane woodland, coastal scrub, valley and foothill grassland. Serpentine seeps. 5-385 m.	Absent. Suitable serpentine seep habitat is not present in the Study Area. This species was not observed during surveys.
Cirsium occidentale var. *lucianum* Cuesta Ridge thistle	None/None G3G4T2 / S2 1B.2	Chaparral. Openings; on serpentinite. Often on steep rocky slopes and along disturbed roadsides. 485-765 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Cirsium rhothophilum Surf thistle	None/CT G1 / S1 1B.2	Coastal dunes, coastal bluff scrub. Open areas in central dune scrub; usually in coastal dunes. 3-60 m.	Absent. Suitable dune or scrub habitat are not present in the Study Area. This species was not observed during surveys.
Cirsium scariosum var. *loncholepis* La Graciosa thistle	FE/CT G5T1 / S1 1B.1	Coastal dunes, coastal scrub, brackish marshes, valley and foothill grassland, cismontane woodland. Lake edges, riverbanks, other wetlands; often in dune areas. Mesic, sandy sites. 4-220 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.
Cladium californicum California sawgrass	None/None G4 / S2 2B.2	Meadows and seeps, marshes and swamps (alkaline or freshwater). Freshwater or alkaline moist habitats. -20-2135 m.	Absent. Suitable seep, marsh, or swamp habitat is not present in the Study Area. This species was not observed during surveys.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Cladonia firma popcorn lichen	None/None G4 / S1 2B.1	Coastal dunes, coastal scrub. On soil and detritus on stabilized sand dunes, in pure stands or intermixed with other lichens and mosses forming biotic soil crusts, covering areas up to several meters. 30-80 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.
Clarkia speciosa ssp. *immaculata* Pismo clarkia	FE/CR G4T1 / S1 1B.1	Chaparral, cismontane woodland, valley and foothill grassland. On ancient sand dunes not far from the coast. Sandy soils, openings. 25-185 m.	Moderate. Suitable foothill grassland is present in the Study Area. This species was not observed during surveys.
Delphinium parryi ssp. *blochmaniae* dune larkspur	None/None G4T2 / S2 1B.2	Chaparral, coastal dunes (maritime). On rocky areas and dunes. 15-375 m.	Absent. Suitable chaparral or dune habitat is not present in the Study Area. This species was not observed during surveys.
Delphinium parryi ssp. *eastwoodiae* Eastwood's larkspur	None/None G4T2 / S2 1B.2	Chaparral, valley and foothill grassland. Serpentine. Openings. 60-640 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Delphinium umbraculorum umbrella larkspur	None/None G3 / S3 1B.3	Cismontane woodland. Mesic sites. 400-1600 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.
Dithyrea maritima beach spectaclepod	None/CT G1 / S1 1B.1	Coastal dunes, coastal scrub. Sea shores, on sand dunes, and sandy places near the shore. 3-65 m.	Absent. Suitable dune or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Dudleya abramsii ssp. *bettinae* Betty's dudleya	None/None G4T2 / S2 1B.2	Coastal scrub, valley and foothill grassland, chaparral. On rocky, barren exposures of serpentine within scrub vegetation. 20-250 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Dudleya abramsii ssp. *murina* mouse-gray dudleya	None/None G4T2 / S2 1B.3	Chaparral, cismontane woodland, valley and foothill grassland. Serpentine outcrops. 25-535 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Dudleya blochmaniae ssp. *blochmaniae* Blochman's dudleya	None/None G3T2 / S2 1B.1	Coastal scrub, coastal bluff scrub, chaparral, valley and foothill grassland. Open, rocky slopes; often in shallow clays over serpentine or in rocky areas with little soil. 5-450 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Erigeron blochmaniae Blochman's leafy daisy	None/None G2 / S2 1B.2	Coastal dunes, coastal scrub. Sand dunes and hills. 3-45 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Eriodictyon altissimum Indian Knob mountainbalm	FE/CE G1 / S1 1B.1	Chaparral (maritime), cismontane woodland, coastal scrub. Ridges in open, disturbed areas within chaparral on Pismo sandstone. 90-270 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Eryngium aristulatum var. *hooveri* Hoover's button-celery	None/None G5T1 / S1 1B.1	Vernal pools. Alkaline depressions, vernal pools, roadside ditches and other wet places near the coast. 1-50 m.	Absent. Suitable venal pool habitat is not present in the Study Area. This species was not observed during surveys.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Extriplex joaquinana San Joaquin spearscale	None/None G2 / S2 1B.2	Chenopod scrub, alkali meadow, playas, valley and foothill grassland. In seasonal alkali wetlands or alkali sink scrub with Distichlis spicata, Frankenia, etc. 1-835 m.	Absent. Suitable alkaline soils are not present in the Study Area. This species was not observed during surveys.
Fritillaria ojaiensis Ojai fritillary	None/None G2? / S2? 1B.2	Broadleaved upland forest (mesic), chaparral, lower montane coniferous forest, cismontane woodland. Usually loamy soil. Sometimes on serpentine; sometimes along roadsides. 225-1000 m.	Absent. Suitable chaparral, woodland, or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Fritillaria viridea San Benito fritillary	None/None G2 / S2 1B.2	Chaparral, cismontane woodland. Serpentine slopes. Sometimes on rocky streambanks. 365-1360 m.	Absent. Suitable chaparral or woodland habitat is not present in the Study Area. This species was not observed during surveys.
Horkelia cuneata var. *puberula* mesa horkelia	None/None G4T1 / S1 1B.1	Chaparral, cismontane woodland, coastal scrub. Sandy or gravelly sites. 15-1645 m.	Absent. Suitable chaparral, woodland, or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Horkelia cuneata var. *sericea* Kellogg's horkelia	None/None G4T1? / S1? 1B.1	Closed-cone coniferous forest, coastal scrub, coastal dunes, chaparral. Old dunes, coastal sandhills; openings. 5-215 m.	Absent. Suitable chaparral, woodland, dune, or scrub habitat is not present in the Study Area. This species was not observed during surveys.
Lasthenia californica ssp. *macrantha* perennial goldfields	None/None G3T2 / S2 1B.2	Coastal bluff scrub, coastal dunes, coastal scrub. 5-185 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.
Lasthenia glabrata ssp. *coulteri* Coulter's goldfields	None/None G4T2 / S2 1B.1	Coastal salt marshes, playas, vernal pools. Usually found on alkaline soils in playas, sinks, and grasslands. 1-1375 m.	Absent. Suitable alkaline soils are not present in the Study Area. This species was not observed during surveys.
Layia jonesii Jones' layia	None/None G2 / S2 1B.2	Chaparral, valley and foothill grassland. Clay soils and serpentine outcrops. 5-400 m.	Absent. Suitable foothill grassland and serpentine-influenced clay soils are not present in the Study Area. This species was not observed during surveys.
Lupinus ludovicianus San Luis Obispo County lupine	None/None G1 / S1 1B.2	Chaparral, cismontane woodland. Open areas in sandy soil, Santa Margarita formation. 85-525 m.	Moderate. Suitable grassland habitat and sandy soils are present in the Study Area. This species was not observed during surveys.
Lupinus nipomensis Nipomo Mesa lupine	FE/CE G1 / S1 1B.1	Coastal dunes. Dry sandy flats, restricted to back dunes, associated with central dune scrub habitat - a rare community type. 10-50 m.	Absent. Suitable dune habitat is not present in the Study Area. This species was not observed during surveys.
Malacothamnus gracilis slender bush-mallow	None/None G1Q / S1 1B.1	Chaparral. Dry, rocky slopes. 190-575 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Monardella palmeri Palmer's monardella	None/None G2 / S2 1B.2	Cismontane woodland, chaparral. On serpentine, often found associated with Sargent cypress forests. 200-800 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Monardella sinuata ssp. *sinuata* southern curly-leaved monardella	None/None G3T2 / S2 1B.2	Coastal dunes, coastal scrub, chaparral, cismontane woodlands. Sandy soils. 0-300 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Monardella undulata ssp. *crispa* crisp monardella	None/None G3T2 / S2 1B.2	Coastal dunes, coastal scrub. Often on the borders of open, sand areas, usually adjacent to typical backdune scrub vegetation. 10-120 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Monardella undulata ssp. *undulata* San Luis Obispo monardella	None/None G2 / S2 1B.2	Coastal dunes, coastal scrub. Stabilized sand of the immediate coast. 10-200 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Monolopia gracilens woodland woolythreads	None/None G3 / S3 1B.2	Chaparral, valley and foothill grassland, cismontane woodland, broadleafed upland forest, north coast coniferous forest. Grassy sites, in openings; sandy to rocky soils. Often seen on serpentine after burns but may have only weak affinity to serpentine. 1	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Nasturtium gambelii Gambel's water cress	FE/CT G1 / S1 1B.1	Marshes and swamps. Freshwater and brackish marshes at the margins of lakes and along streams, in or just above the water level. 5-330 m.	Absent. Suitable marsh or swamp habitat is not present in the Study Area. This species was not observed during surveys.
Navarretia fossalis Spreading navarretia	FT/None G2 / S2 1B.1	Vernal pools, chenopod scrub, marshes and swamps, playas. San Diego hardpan and San Diego claypan vernal pools; in swales and vernal pools, often surrounded by other habitat types. 15-850 m.	Absent. Suitable habitat or soils are present in the Study Area. This species was not observed during surveys.
Nemacaulis denudata var. *denudata* coast woolly-heads	None/None G3G4T2 / S2 1B.2	Coastal dunes. 0-100 m.	Absent. Suitable dune habitat is not present in the Study Area. This species was not observed during surveys.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Plagiobothrys uncinatus hooked popcornflower	None/None G2 / S2 1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Sandstone outcrops and canyon sides; often in burned or disturbed areas. 300-760 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Poa diaboli Diablo Canyon blue grass	None/None G2 / S2 1B.2	Chaparral (mesic sites), cismontane woodland, coastal scrub, closed-cone coniferous forest. Shale, sometimes burned areas. 120-400 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Sanicula maritima adobe sanicle	None/CR G2 / S2 1B.1	Meadows and seeps, valley and foothill grassland, chaparral, coastal prairie. Moist clay or ultramafic soils. 30-240 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Scrophularia atrata black-flowered figwort	None/None G2? / S2? 1B.2	Closed-cone coniferous forest, chaparral, coastal dunes, coastal scrub, riparian scrub. Sand, diatomaceous shales, and soils derived from other parent material; around swales and in sand dunes. 10-245 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Senecio aphanactis chaparral ragwort	None/None G3 / S2 2B.2	Chaparral, cismontane woodland, coastal scrub. Drying alkaline flats. 20-855 m.	Absent. Suitable alkaline soils are not present in the Study Area. This species was not observed during surveys.
Sidalcea hickmanii ssp. *anomala* Cuesta Pass checkerbloom	None/CR G3T1 / S1 1B.2	Closed-cone coniferous forest, chaparral Rocky serpentine soil; associated with Sargent cypress forest. 600-800 m.	Absent. Suitable habitat and soils are not present in the Study Area. This species was not observed during surveys.
Streptanthus albidus ssp. *peramoenus* most beautiful jewelflower	None/None G2T2 / S2 1B.2	Chaparral, valley and foothill grassland, cismontane woodland. Serpentine outcrops, on ridges and slopes. 95-1000 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CRPR	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Suaeda californica California seablite	FE/None G1 / S1 1B.1	Marshes and swamps. Margins of coastal salt marshes. 0-5 m.	Absent. Suitable marsh or swamp habitat is not present in the Study Area. This species was not observed during surveys.
Sulcaria isidiifera splitting yarn lichen	None/None G1 / S1 1B.1	Coastal scrub. On branches of oaks and shrubs in old growth coastal scrub. 20-55 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.
Symphyotrichum defoliatum San Bernardino aster	None/None G2 / S2 1B.2	Meadows and seeps, cismontane woodland, coastal scrub, lower montane coniferous forest, marshes and swamps, valley and foothill grassland. Vernally mesic grassland or near ditches, streams and springs; disturbed areas. 2-2040 m.	Absent. Suitable habitat is not present in the Study Area. This species was not observed during surveys.
Trifolium hydrophilum saline clover	None/None G2 / S2 1B.2	Marshes and swamps, valley and foothill grassland, vernal pools. Mesic, alkaline sites. 0-300 m.	Absent. Suitable alkaline soils are not present in the Study Area. This species was not observed during surveys.
Tropidocarpum capparideum caper-fruited tropidocarpum	None/None G1 / S1 1B.1	Valley and foothill grassland. Alkaline clay. 0-360 m.	Absent. Suitable alkaline soils are not present in the Study Area. This species was not observed during surveys.

Table D3-2 Special Status Wildlife Species Known to Occur in the Vicinity of the Project Site (CNDDB and IPaC query Results)

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CDFW	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Amphibians			
Ambystoma californiense California tiger salamander	FT/ST G2G3 / S2S3 WL	Vernal and seasonal pools and associated grasslands, oak savanna, woodland, and coastal scrub. Needs underground refuges (i.e., small mammal burrows, pipes, etc.) in upland areas such as grassland and scrub habitats.	Absent. The nearest CNDDB occurrences are east of the Temblor Range near the Kern and San Luis Obispo County border and south near Santa Maria each over approximately 30 miles or more from the project site.
Rana boylii foothill yellow-legged frog	--/-- G3 / S3 SSC	Partly-shaded, shallow streams & riffles with a rocky substrate in a variety of habitats. Need at least some cobble-sized substrate for egg-laying. Need at least 15 weeks to attain metamorphosis.	Absent. Suitable rocky stream habitat is not present.
Rana draytonii California red-legged frog	FT/-- G2G3 / S2S3 SSC	Lowlands & foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. must have access to aestivation habitat.	Low. Dispersal habitat is present; however sufficient pools for breeding are not present in the Study Area. A stock pond is present on an adjacent parcel. Davenport Creek may serve as a dispersal corridor.
Taricha torosa Coast Range newt	--/-- G4 / S4 SSC	Coastal drainages from Mendocino County to San Diego County. Lives in terrestrial habitats & will migrate over 1 km to breed in ponds, reservoirs & slow moving streams.	Absent. Suitable aquatic habitat is not present. The nearest CNDDB populations are approximately 8.5 miles east of the project site in drainages associated with Lopez Lake.
Fish			
Eucyclogobius newberryi tidewater goby	FE/-- G3 / S3 SSC	Brackish water habitats along the Calif coast from Agua Hedionda Lagoon, San Diego Co. to the mouth of the Smith River. Found in shallow lagoons and lower stream reaches,	Absent. Suitable brackish water habitat is not present.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CDFW	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
		they need fairly still but not stagnant water & high oxygen levels.	
Oncorhynchus mykiss irideus south-central California DPS	FT/-- G5T2Q / S2	Federal listing refers to runs in coastal basins from the Pajaro River south to, but not including, the Santa Maria River.	Absent. Suitable aquatic habitat is not present.
Invertebrates			
Branchinecta lynchi vernal pool fairy shrimp	Threatened/-- G3 / S3	Endemic to the grasslands of the Central Valley, Central Coast mtns, and South Coast mtns, in static rain-filled pools. Inhabit small, clear-water sandstone-depression pools and grassed swale, earth slump, or basalt-flow depression pools.	Absent. Suitable vernal pool habitat is not present.
Euproserpinus euterpe Kern primrose sphinx moth	FT/---- G1G2 / S1	Found in Walker Basin, Kern, Co., and several other scattered locations such as Carrizo Plain and Pinnacles National Monument. Host plant is evening primrose (*Camissonia contorta epilobioides*).	Absent. The Study Area is outside the known range of this species.
Helminthoglypta walkeriana Morro shoulderband (=banded dune) snail	Endangered/-- G1 / S1S2	Restricted to the coastal strand in the immediate vicinity of Morro Bay. Inhabits the duff beneath Haplopappus, Salvia, Dudleya, and Mesembryanthemum.	Absent. The Study Area is outside the known range of this species.
Birds			
Agelaius tricolor tricolored blackbird	--/Candidate Endangered G2G3 / S1S2 SSC	Highly colonial species, most numerous in Central Valley & vicinity. Largely endemic to California. Requires open water, protected nesting substrate, & foraging area with insect prey within a few km of the colony.	Absent (nesting). Suitable nesting habitat is not present in the Study Area. Species may use grasslands as forage sites, if nesting colonies are present nearby, and during migration season.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CDFW	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Athene cunicularia burrowing owl	--/-- G4 / S3 SSC	Open, dry annual or perennial grasslands, deserts & scrublands characterized by low-growing vegetation. Subterranean nester, dependent upon burrowing mammals, most notably, the California ground squirrel.	Moderate. Suitable grassland habitat and ground squirrel burrows are present.
Brachyramphus marmoratus Marbled murrelet	FT/SE G3G4 / S1	Feeds near-shore; nests inland along coast from Eureka to Oregon border and from Half Mon Bay to Santa Cruz. Nests in old-growth redwood-dominated forests, up to six miles inland, often in Douglas-fir.	Absent. Suitable habitat is not present.
Charadrius alexandrinus nivosus western snowy plover	FT/-- G3T3 / S2S3 SSC	Sandy beaches, salt pond levees & shores of large alkali lakes. Needs sandy, gravelly or friable soils for nesting.	Absent. Suitable habitat is not present.
Coccyzus americanus occidentalis western yellow-billed cuckoo	FT/SE G5T2T3 / S1	Riparian forest nester, along the broad, lower flood-bottoms of larger river systems. Nests in riparian jungles of willow, often mixed with cottonwoods, w/ lower story of blackberry, nettles, or wild grape.	Absent. Suitable habitat is not present.
Elanus leucurus white-tailed kite	--/-- G5 / S3S4 FP	Rolling foothills and valley margins with scattered oaks & river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	Moderate. Suitable nest and foraging habitat is present.
Empidonax traillii extimus Southwestern willow flycatcher	FE/SE G5T2 / S1	Requires dense riparian habitats associated with rivers, swamps, and lakes.	Absent (nesting). Suitable nest habitat is not present. This species may occur

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CDFW	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
		Wintering habitat is not well known, but is considered to be brushy savannah edges, second growth, shrubby clearings and pastures, and woodlands near water.	during migration in the riparian corridor.
Lanius ludovicianus loggerhead shrike	--/-- G4 / S4 SSC	Broken woodlands, savannah, pinyon-juniper, Joshua tree, & riparian woodlands, desert oases, scrub & washes. Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting.	Low (nesting). Suitable habitat is present.
Laterallus jamaicensis coturniculus California black rail	--/ST G3G4T1 / S1 FP	Inhabits freshwater marshes, wet meadows & shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that do not fluctuate during the year & dense vegetation for nesting habitat.	Absent. Suitable habitat is not present.
Progne subis purple martin	--/-- G5 / S3 SSC	Inhabits woodlands, low elevation coniferous forest of Douglas-fir, ponderosa pine, & Monterey pine. Nests in old woodpecker cavities mostly, also in human-made structures. Nest often located in tall, isolated tree/snag.	Absent (nesting). Suitable conifer nest habitat is not present; however, this species may forage over the site.
Rallus longirostris obsoletus California clapper rail	FE/SE G5T1 / S1 FP	Salt-water & brackish marshes traversed by tidal sloughs in the vicinity of San Francisco Bay. Associated with abundant growths of pickleweed, but feeds away from cover on invertebrates from mud-bottomed sloughs.	Absent. Suitable habitat is not present.
Sternula antillarum browni California least tern	FE/SE G4T2T3Q / S2	Nests along the coast from San Francisco Bay south to	Absent. Suitable nesting and aquatic habitat is not

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CDFW	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
	FP	northern Baja California. Colonial breeder on bare or sparsely vegetated, flat substrates: sand beaches, alkali flats, landfills, or paved areas.	present.
Vireo bellii pusillus Least Bell's vireo	FE/SEd G5T2 / S2	Low dense brushy riparian vegetation in vicinity of water or in dry river bottoms; below 2000 feet elevation.	Absent. Suitable habitat is not present.
Reptiles			
Anniella pulchra nigra black legless lizard	--/-- G3G4T2T3Q / S2 SSC	Sand dunes and sandy soils in the Monterey Bay and Morro Bay regions. Inhabit sandy soil/dune areas with bush lupine and mock heather as dominant plants. Moist soil is essential.	Absent. Suitable habitat is not present.
Anniella pulchra pulchra silvery legless lizard	--/-- G3G4T3T4Q / S3 SSC	Sandy or loose loamy soils under sparse vegetation. Soil moisture is essential. Prefer soils with a high moisture content.	Moderate. Suitable habitat is present in the trees in the Study Area. This species was not observed during surveys.
Emys marmorata western pond turtle	--/-- G3G4 / S3 SSC	A thoroughly aquatic turtle of ponds, marshes, rivers, streams & irrigation ditches, usually with aquatic vegetation, below 6000 ft elevation. Need basking sites and Absent. Suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for e	Low. Suitable aquatic habitat is present for dispersal when water is present.
Phrynosoma blainvillii coast horned lizard	--/-- G3G4 / S3S4 SSC	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes. Open areas for sunning, bushes for cover, patches of loose soil for burial, & abundant supply of ants & other insects.	Absent. Suitable habitat is not present.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CDFW	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
Mammals			
Antrozous pallidus pallid bat	--/-- G5 / S3 SSC	Deserts, grasslands, shrublands, woodlands & forests. Most common in open, dry habitats with rocky areas for roosting. Roosts must protect bats from high temperatures. Very sensitive to disturbance of roosting sites.	Low. May forage over the site. Suitable woodland habitat is present and some trees may be appropriate for roosting.
Corynorhinus townsendii Townsend's big-eared bat	--/-- G3G4 / S2 SSC	Throughout California in a wide variety of habitats. Most common in mesic sites. Roosts in the open, hanging from walls & ceilings. Roosting sites limiting. Extremely sensitive to human disturbance.	Absent (roosts). May forage over the project site; however, open roosting habitat is not present. Nearest CNDDB recorded occurrence is approximately 3.5 miles southwest on
Dipodomys heermanni morroensis Morro Bay kangaroo rat	FE/SE G3G4TH / SH FP	Coastal sage scrub on the south side of Morro Bay. Needs sandy soil, but not active dunes, prefers early seral stages.	Absent. Suitable habitat is not present. Study Area is outside the known range of the species.
Dipodomys ingens Giant kangaroo rat	FE/SE G1G2 / S1S2	Annual grasslands on the western side of the San Joaquin Valley, marginal habitat in alkali scrub. Need moderately level terrain and sandy loam soils for burrowing.	Absent. The Study Area is outside the known range of the species. This species was not observed during surveys.
Enhydra lutris nereis Southern sea otter	FT/None G4T2 / S2 FP	Near marine environments from about Ano Nuevo, San Mateo Co. to Point Sal, Santa Barbara Co. Needs canopies of giant kelp and bull kelp for rafting and feeding.	Absent. Suitable habitat is not present.
Eumops perotis californicus western mastiff bat	--/-- G5T4 / S3S4 SSC	Many open, semi-arid to arid habitats, including conifer & deciduous woodlands, coastal scrub, grasslands, chaparral etc. Roosts in crevices in cliff faces, high buildings, trees	Absent (roosts). May forage over grasslands and roost in trees on the project site.

Scientific Name / Common Name	Status Fed / State ESA G-Rank / S-Rank CDFW	Habitat Preference / Requirements	Potential for Occurrence / Basis for Determination
		& tunnels.	
Neotoma lepida intermedia San Diego desert woodrat	--/-- G5T3T4 / S3S4 SSC	Coastal scrub of Southern California from San Diego County to San Luis Obispo County. Moderate to dense canopies preferred. They are particularly abundant in rock outcrops & rocky cliffs & slopes.	Absent. Suitable habitat is not present.
Nyctinomops macrotis big free-tailed bat	--/-- G5 / S3 SSC	Low-lying arid areas in Southern California. Need high cliffs or rocky outcrops for roosting sites. Feeds principally on large moths.	Absent. Suitable habitat is not present.
Taxidea taxus American badger	--/-- G5 / S3 SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Needs sufficient food, friable soils & open, uncultivated ground. Preys on burrowing rodents. Digs burrows.	Moderate. Suitable grassland habitat is present.

Regional Vicinity refers to seven USGS quad search area. Species denoted with a * represent species added to the tables that are present on the study area or species with the potential to occur based on the presence of suitable habitats.

FT = Federally Threatened SE = State Endangered
FC = Federally Candidate ST = State Threatened
FE = Federally Endangered SR = State Rare
FD = Federally Delisted SD = State Delisted
SSC = CDFW Species of Special Concern FP = CDFW Fully Protected
WL: CDFW Watch List
G-Rank/S-Rank = Global Rank and State Rank as per NatureServe and CDFW's CNDDB RareFind 5.
G1 or S1 - Critically Imperiled Globally or Subnationally (state)
G2 or S2 - Imperiled Globally or Subnationally (state)
G3 or S3 - Vulnerable to extirpation or extinction Globally or Subnationally (state)
G4 or S4 - Apparently secure Globally or Subnationally (state)
G5 or S5 - Secure Globally or Subnationally (state)
CRPR (CNPS California Rare Plant Rank):
1A=Presumed Extinct in California
1B=Rare, Threatened, or Endangered in California and elsewhere
2=Rare, Threatened, or Endangered in California, but more common elsewhere
3=Need more information (a Review List)
4=Plants of Limited Distribution (a Watch List)
CRPR Threat Code Extension:
.1=Seriously endangered in California (over 80 percent of occurrences threatened / high degree and immediacy of threat)
.2=Fairly endangered in California (20-80 percent occurrences threatened)

Appendix E

Engineering Geologic and Geotechnical Feasibility Investigation

GEOINSITE

REPORT

ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION

Proposed 13-Lot Subdivision
Jack Ranch Property
APN 044-080-040
San Luis Obispo County, California

Prepared for:
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Project No. C1501
June 2016

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EXECUTIVE SUMMARY

This report provides the findings of an engineering geologic and geotechnical feasibility investigation for a proposed 13-lot subdivision on property known as Jack Ranch, in San Luis Obispo County, California. Conclusions and recommendations from this feasibility investigation are provided in Section 5.0 of this report.

The ~299-acre property is located about 2 miles south of the City of San Luis Obispo, and is accessed from Highway 227 (Edna Road) via Los Ranchos Road and Ketzel Lane. The northeastern 2/3 of the property is occupied by vineyards and the southwestern 1/3 of the property (location of proposed subdivision) is an undeveloped hillside. According to the San Luis Obispo Planning Area Land-Use and Combining Designations Maps, the property is not located in a designated Geologic Study Area (GSA).

Subsurface exploration for the investigation included seven (7) exploratory trenches, six (6) test pits, nine (9) large-diameter auger borings, ten (10) small-diameter geotechnical borings, all logged by a team of State-certified engineering geologists, and twelve (12) Cone Penetrometer Testing (CPT) probes. In addition, the scope included acquisition and analysis of LiDAR imagery, historical aerial photography, results of previous investigations, laboratory testing, and technical analyses.

The proposed subdivision is located on the north-facing slopes of the San Luis Range, with generally steep to moderate slope gradients. A central drainage ravine separates Lots 1-9 from Lots 10-13, and will be crossed by the proposed access road.

We have not been provided with a grading plan, but generally understand that subdivision grading will involve minor cuts and fills for the access road, and filling or spanning the central drainage ravine where the road crosses the ravine. According to our clients, grading for individual lots will not be included in the subdivision development, but will be performed as needed during lot-specific construction.

The property is located on the northern limb of the Pismo syncline. Geologic units on the property include the Monterey Formation, Pismo Formation, and Paso Robles Formation. Alluvium is present along the central drainage ravine.

The property is not within a State-designated Earthquake Fault Hazard Zone, and no fault has been mapped across the property by previous regional geologic mappers. However, traces of the Los Osos fault and Edna fault are mapped in the vicinity. The Los Osos fault zone is a southwest-dipping, blind thrust fault that likely projects to near or along the northern front of the San Luis Range. The Edna fault zone is a steep, south-dipping inter-range fault zone that may consist of two traces in the property vicinity. Geomorphic lineaments that may be indicative of faulting or other geologic structure have been mapped on the property, and were identified in this feasibility investigation.

The proposed development is feasible from an engineering geologic and geotechnical engineering standpoint. The primary potential geotechnical constraints to all or portions of the proposed subdivision include strong earthquake ground shaking and liquefaction, with potential slope instability and secondary seismic ground deformation as secondary constraints. We anticipate that these constraints can be reduced to an acceptable level, if recommendations presented in this report are followed. The primary identified hazards are described below:

Seismic ground shaking - The project area is situated in an area of moderate seismic activity. It should be anticipated that the property will experience moderate to strong ground shaking during the life of the project. Ground motion parameters should be incorporated into the design of future structures.

Liquefaction – The majority of the subject site was found to have a low liquefaction potential. However, areas adjacent to the drainage channel that are underlain by alluvial soils have a high liquefaction potential when ground water is high at the site. The access road segment across the drainage channel, access to Lots 4-6, and a portion of Lot 11 will require further evaluation during design-level investigations to formulate appropriate mitigation measures.

Secondary seismic ground deformation - Secondary deformation typically is characterized by minor to insignificant displacements that may be distributed over a wide area. The potential for secondary deformation in the development area, which may include fissuring or fracturing associated with tectonic movement in the near vicinity, is low to moderate. Potential displacements associated with secondary deformation can be mitigated through appropriate foundation design and construction.

Landslides – Four landslides were identified in the vicinity of the development. Landslide A, located upslope from the entrance road is a shallow, recently active slide. Landslide B is a shallow, creeping landslide south of Lot 6. Two dormant landslides were also identified: Landslide C is located downslope of Lot 12, and Landslide D is located southwest of Lots 12-13.

No mitigation may be necessary for the landslides identified on the property; however, Landslide C could be impacted by road grading and should be considered during subdivision-level design. All landslides should be considered during design-level investigations for proposed lots.

Surface fault rupture - The potential for surface fault rupture associated with primary tectonic faulting within the proposed development is low, due to the lack of defined Holocene fault traces crossing the development. However, we recommend a fault setback distance of 100 feet upslope and 200 feet downslope from a possible fault contact located upslope from the subdivision. The setback distance is a reflection of the relative uncertainty in the location of the contact, and uncertain relationship with nearby geomorphic lineaments. A fault investigation should be performed if future potential development is planned for the setback zone.

Roadway earthwork - Earthwork for the access road through areas underlain by alluvium and colluvium will require overexcavation of the surficial soils, excavation of a keyway for the roadway fill, and replacement with engineered fill for this road segment. Retaining walls may be required to support some roadway segments. Road design criteria, including retaining wall parameters, should be formulated based on a design-level investigation of the road.

TECHNICAL REPORT

1.0 INTRODUCTION AND SCOPE OF WORK

This report presents a summary of an Engineering Geologic and Geotechnical Feasibility Investigation performed by Geoinsite, Inc. (Geoinsite) for Mr. Tom Erskine and Mr. John Wilson. The feasibility investigation addresses the property known as Jack Ranch, located in San Luis Obispo County, California. Our work was conducted in general accordance with Proposals for Professional Services dated March 30, 2015, April 28, 2015, and January 15, 2016, and verbal discussions with our clients during the course of the investigation. Geoinsite was assisted in this investigation by Cal Engineering and Geology, Inc. (CEG), San Jose, California.

The objective of the feasibility investigation was to identify and characterize the engineering geologic conditions that have potential to impact or influence proposed development of a 13-lot residential subdivision on the subject property. Conclusions and recommendations based on this feasibility investigation are provided in Section5.0 of this report.

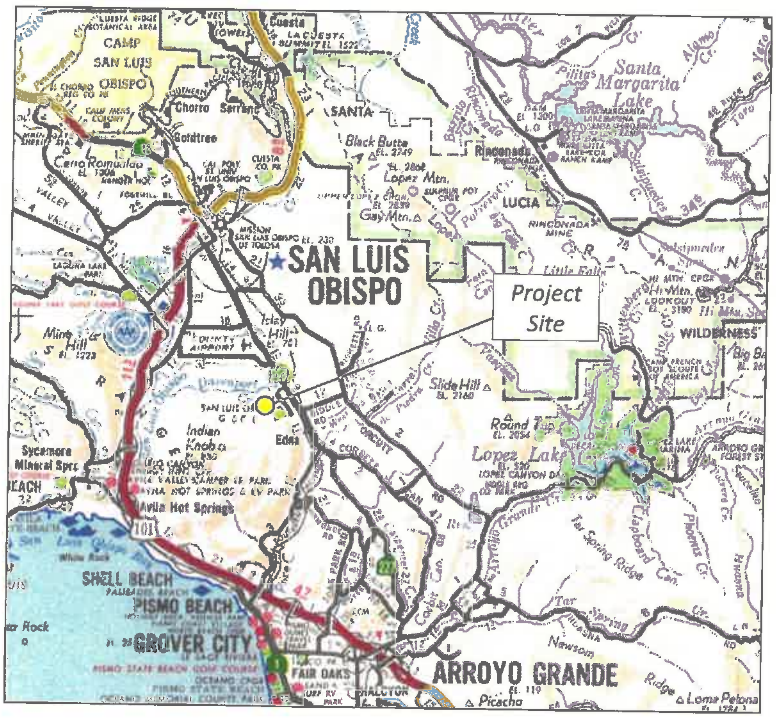
The scope of services for the feasibility investigation included the following tasks:

1. Research, acquisition and stereoscopic analysis of historical aerial photography.
2. Review of pertinent published geologic literature, and previous consultant reports provided by our clients.
3. Development of a base map using development plan and topographic contours provided by our clients, and LiDAR imagery.
4. Engineering geologic field mapping of the property and surrounding vicinity.
5. Subsurface exploration, including seven (7) exploratory fault trenches, six (6) test pits, nine (9) large-diameter auger borings, and ten (10) small-diameter geotechnical borings, as well as twelve (12) Cone Penetrometer Testing (CPT) probes.
6. Laboratory testing of selected samples from the subsurface exploration.
7. Geologic and geotechnical analysis of acquired field, laboratory and research data, and preparation of geologic cross sections and site engineering geologic map.
8. Evaluation of engineering geologic hazards and geotechnical constraints.
9. Preparation of this report summarizing the findings the feasibility investigation services.

2.0 SITE LOCATION AND PROJECT DESCRIPTION

The Jack Ranch property is located approximately 2 miles south of the City of San Luis Obispo in the northeastern quadrant of the Pismo Beach 7.5-minute quadrangle in San Luis Obispo County, California. The latitude-longitude coordinates for the approximate center of the proposed development are 35.211^{O} North and 120.636^{O} West. The property is accessed from Highway 227 (Edna Road) via Los Ranchos Road and Ketzel Lane. The property incorporates approximately 299 acres, with the northeastern 2/3 of the property occupied by vineyards and the southwestern 1/3 of the property consisting of undeveloped hillside. The proposed residential lots are located within the southwestern hillside portion of the property. According to the San Luis Obispo Planning Area Land-Use and Combining Designations Maps, the property is not located in a designated Geologic Study Area (GSA).

Figure 2-1. Location Map



Review of historical aerial photography indicates that the property is agricultural and largely undeveloped. Farm buildings are present in the north-central portion of the property, along the west-flowing creek in the earliest photographs (1939), and structures (barn and water tanks) are present there today. The adjacent properties to the north (residential subdivision) and east (golf course and country club development) are not present in 1939, but are under construction in 1969. By 1987, those developments appear to have been completed. The current Jack Ranch vineyard was planted sometime between 1994 and 2002.

According to the latest development plan (Vesting Tentative Tract 2429 dated May 28, 2016) provided to us by the Project Civil Engineer on 6/10/2016, the project involves development of 13 residential lots and a central roadway providing access from Greystone Place, along the southeastern property boundary. Individual lot sizes about 1.0 acre in size. Nine of the lots are located in a cluster arranged between Greystone Place (east) and a central drainage ravine (west). Lots 1 through 6 are located on the uphill (south) side of the road, and Lots 7 through 9 are located on the downslope (north) side of the road. Four of the lots (Lots 10, 11, 12 and 13) are located west of the drainage ravine. Future residences will be serviced by a local sanitary sewer district. The access for the four western lots will cross the central drainage ravine in the location of the existing ranch road crossing.

We have not been provided with a grading plan, but generally understand that subdivision grading will involve minor cuts and fills for the access road, and filling or spanning the central drainage ravine where the road crosses the ravine. According to our clients, grading for individual lots is not a part of the subdivision improvements, but may be performed as needed during lot-specific construction.

Previous geologic investigation of an earlier proposed development plan was performed by GeoSolutions, Inc. for a former property owner. GeoSolutions' findings are summarized in three reports dated July 31, 2000; December 5, 2005; and May 2, 2007. Those reports are primarily based on geologic trenching conducted in May and June 2000. The 2005 and 2007 reports appear to be revisions and updates of the original 2000 report with regard to engineering geology hazards.

At an unknown time after May 2007, GeoSolutions performed supplemental geologic trenching on the property. The locations of those supplemental trenches are shown on an undated engineering geologic map provided to us by our clients. We understand, based on discussion with GeoSolutions, that a corresponding report resulting from the supplemental trenching was not prepared. The logs for those supplemental trenches were not available for our use in this investigation.

In addition to investigating the engineering geologic conditions, GeoSolutions also investigated local ground water and percolation rates for evaluation of an onsite septic system. We note that septic percolation and evaluation of septic systems are not included in the scope of work performed for the feasibility investigation summarized herein. We have been informed that onsite septic systems are no longer required for the proposed development, because the new subdivision intends to connect to an existing sanitary sewer system.

A review letter by the San Luis Obispo County Geologist (LandSet Engineers, July 3, 2007) provides comments on the three previous engineering geologic reports and concludes that "*the engineering geologic work performed at the site is inaccurate and incomplete*". The County Geologist letter recommended that an additional engineering geologic and geotechnical investigation be completed and submitted to the County prior to review and approval of the proposed subdivision.

Research and planning for this feasibility investigation included discussions with the County Geologist regarding his review comments, previous investigation findings, and the scope of work required to evaluate geologic and geotechnical feasibility of the proposed development. On March 19, 2015, we met with the County Geologist to present our preliminary findings based on site reconnaissance, aerial photographic examination, and document review, and to discuss our intended subsurface exploration program. Following that discussion, we performed field investigations of the property. Trenching and large-diameter drilling took place between April 13 and 21, 2015, and geotechnical drilling on May 8, 2015. Following revisions to the development plan, supplemental exploration, including additional trenches, test pits, drilling and CPT probes, took place in February 2016. Exploratory trenches and our geologic field logs were observed by the County Geologist on April 20, 2015 and February 25, 2016.

Figure 2-2. Photograph of Jack Ranch Property.

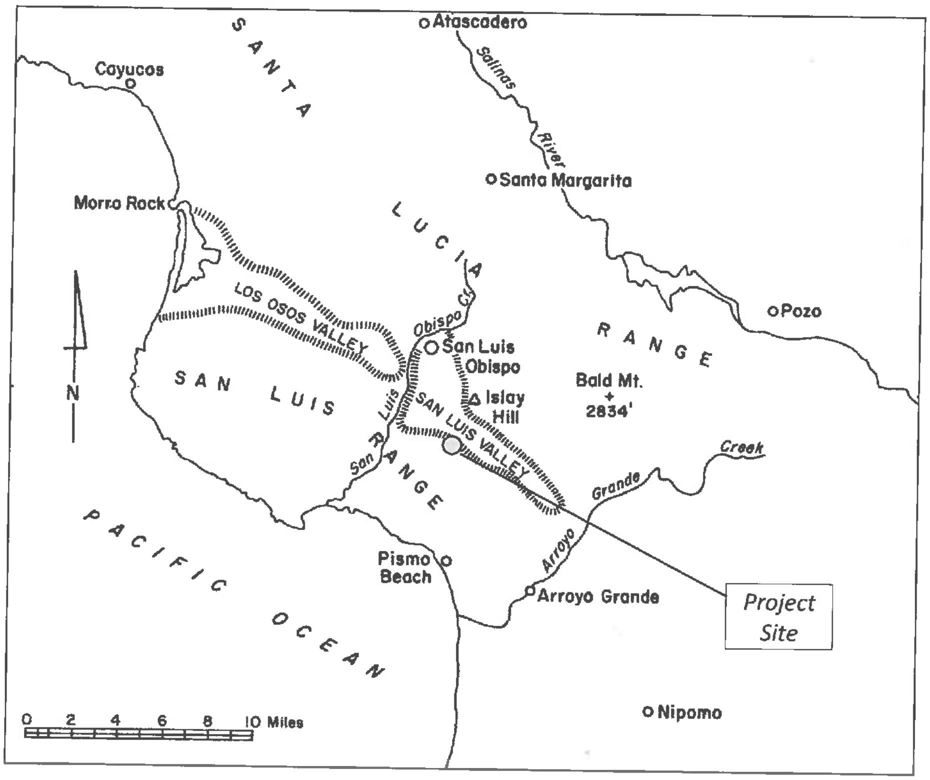
View toward NE from southern hillside. Greystone Place and golf course are on the right (east). Lots 1-9 are sited in grassy area in foreground. Lots 10-13 are located outside the photo and left (west) of central drainage gully (tree line on left). Vineyard in background is the northern portion of the property.

3.0 DESCRIPTION OF ENGINEERING GEOLOGIC CONDITIONS

3.1 Regional Geology

The San Luis Obispo area is located in the Coast Ranges geomorphic province, which is characterized by northwest-trending, elongate mountain ranges separated by narrow valleys. The subject property is located on the northern slopes of the San Luis Range, a rugged upland range that bounds the southwestern margin of San Luis Valley. San Luis Valley, lying between the San Luis Range and the Santa Lucia Range (to the north), is an alluvial valley which is punctuated by Oligocene volcanic plugs that extend from Islay Hill, north of the subject property, to Morro Rock. The subject property lies between San Luis Creek and Arroyo Grande Creek, both of which flow southwestward through the San Luis Range to the Pacific Ocean (Figure 3-1).

Figure 3-1. Physiographic map of site vicinity (Source: Hall, 1973).



The San Luis Range is characterized by a thick sequence of folded Tertiary strata known as the Pismo syncline. The Pismo syncline is the dominant structural element of the uplifted San Luis Range. It is an open, doubly plunging syncline composed of numerous small folds. The syncline was a marine depocenter from Miocene to Pliocene, and possibly into early Quaternary, time. Uplift and deformation began in late Miocene to early Pliocene, and ended in the early Quaternary, based on the presence of undeformed marine terrace deposits across the axis of the syncline. In the vicinity of the subject property, the Tertiary strata consist of the Obispo Formation (Miocene), Monterey Formation (Miocene), and Edna and Squire Members of the Pismo Formation (Miocene to Pliocene). The older rocks are locally overlain by Pleistocene-age Paso Robles Formation (Plate 1, Regional Geology Map).

Geologically, the San Luis Range is referred to as the "San Luis-Pismo Structural Block" (Lettis et al., 1994). The portion of the San Luis-Pismo Structural Block incorporating Jack Ranch and surrounding properties was identified as the "Edna Subblock" by Lettis and Hall (1994) in order to distinguish it from the adjacent subblocks to the northwest ("Irish Hills Subblock") and southeast ("Newsom Ridge Subblock"). The so-called "Edna Subblock" is bounded on the northwest by San Luis Creek and on the southeast by Arroyo Grande Creek.

No fault has been mapped across the property by previous regional geologic mappers, including Fairbanks (1904), Hall (1973), Lettis and Hall (1994), and Dibblee (2005), and the property is not within a State-designated Earthquake Fault Hazard Zone. Geomorphic lineaments that may be indicative of faulting or other geologic structure have been mapped on the property by Lettis and Hall (1994), and were identified in this feasibility investigation. In addition, the contact between the Monterey and Pismo (Squire) Formations may be faulted. Further discussion of local faults is presented in Section 3.2.1 of this report.

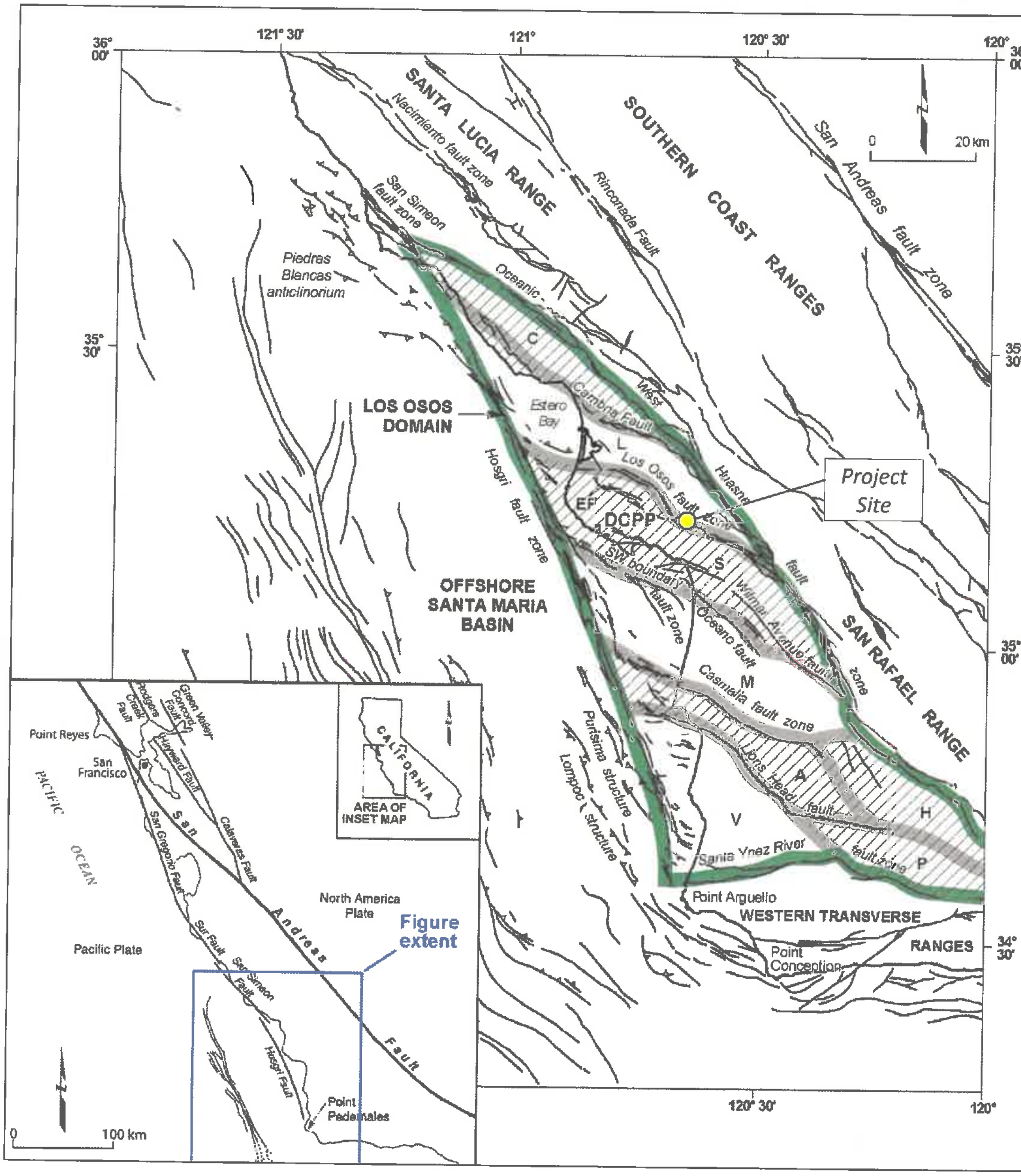
3.2 Seismotectonic Setting

Ongoing geologic and geophysical research of the Central Coast region for seismic hazard evaluations of the Diablo Canyon Power Plant (DCPP) has led to significant new findings regarding the local seismotectonic environment (e.g., PG&E, 2014). The region is characterized by transpressional deformation between the San Andreas fault zone (SAFZ) to the east and the San Gregorio–San Simeon–Hosgri system of offshore and near-coastal faults to the west. The transpressional deformation has produced several distinct but interacting crustal domains and tectonic structures (Lettis et al., 2004). The San Luis Range and San Luis Valley are located within the "Los Osos Domain", which consists of northwest-striking reverse, oblique, and strike-slip faults that border uplifted blocks and subsiding basins within the domain.

The San Luis Range forms the core of the San Luis–Pismo Structural Block in the Los Osos Domain. The range is uplifting as a relatively rigid crustal block bordered by the Los Osos and Southwestern Boundary zone faults. The Irish Hills, in the northern portion of the range, is uplifting at rates of between 0.1 mm/yr to the southeast to 0.2 mm/yr to the northwest, with little or no observable internal deformation. Major geologic structures within the range, including the Pismo syncline, and the San Miguelito, Edna, and Pismo faults, do not deform Quaternary deposits or landforms and are not active structures in the contemporary tectonic setting (Lettis et al., 1994).

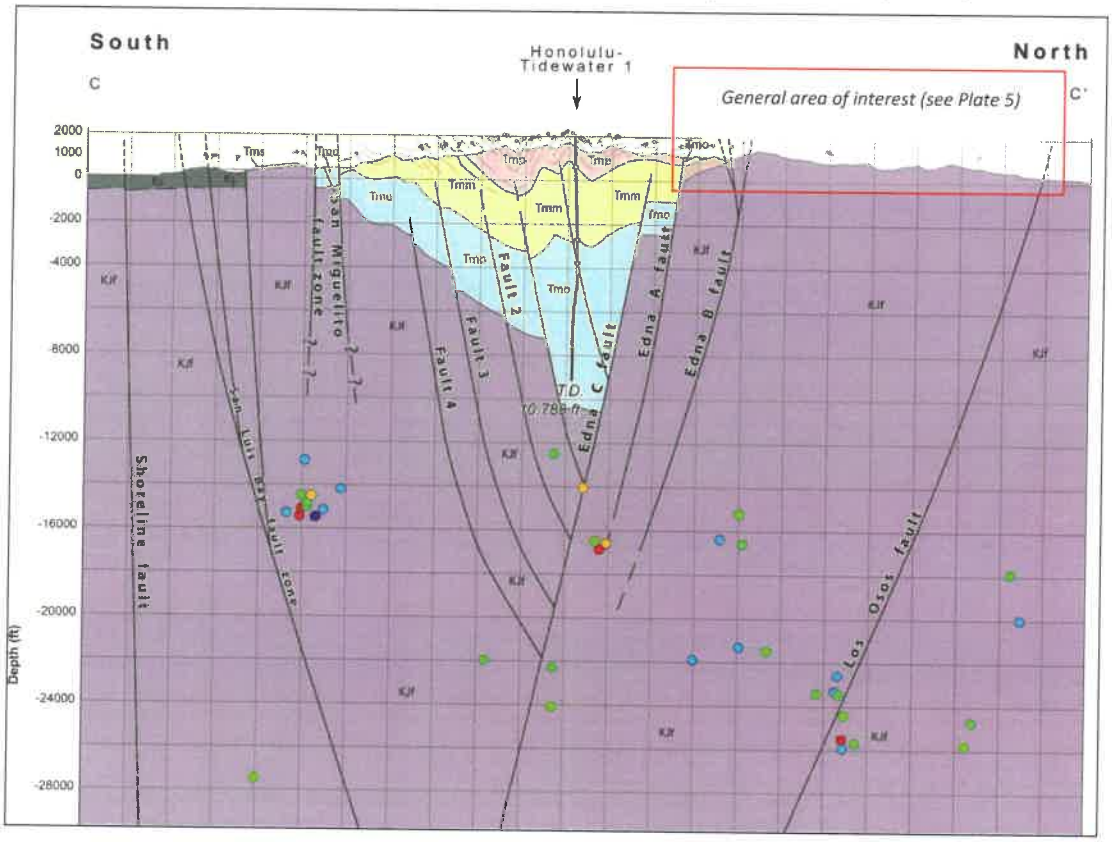
Active fault zones bordering the San Luis–Pismo Structural Block to the northeast, southwest, and west are the Los Osos, Southwestern Boundary (including the San Luis Bay fault zone), and Hosgri fault zones, respectively (Figure 3-2). Recent seismic data indicate that the bounding faults (Los Osos and Southwestern Boundary faults) dip steeply inward toward the core of the range (Unruh et al., 2015). Detailed mapping of Quaternary deposits and surfaces shows that deformation is concentrated along the block-bounding faults and little or no deformation is occurring within the blocks themselves. Sparse seismicity is concentrated primarily within the uplifting blocks (Lettis et al., 2004).

Figure 3-2. Structural blocks of the Los Osos Domain (Source: PG&E, 2014)



Structural blocks in Los Osos Domain: A=Casmalia, C=Cambria, H=Solomon Hills, L=Los Osos, M=Santa Maria Valley, P=Purisima, S=San Luis/Pismo, V=Vandenburg/Lompoc. DCPP=Diablo Canyon Power Plant.

Figure 3-3. Regional geologic cross section (Source: PG&E, 2014)



Regional cross section (above) through the Irish Hills (northern San Luis Range) shows the relationships between range-bounding faults (Los Osos and San Luis Bay faults) and older internal faults (e.g., Edna fault zone). "Honolulu Tidewater 1" is deep boring drilled in center of the range. Colored circles represent micro-seismicity beneath the range.

3.2.1 Major Faults in Project Vicinity

The following section describes the most significant faults in the region with respect to the subject property.

<u>Los Osos Fault Zone</u>

The Los Osos fault zone is a range-bounding, southwest-dipping reverse fault with a late Quaternary slip rate of 0.2 to 0.5 mm/yr. The Los Osos fault consists of multiple fault traces along a generally northwest-southeast-trending zone along the northwestern edge of the San Luis Range. The fault zone has had a complex history of both strike-slip and dip-slip displacement (Lettis and Hall, 1994). As currently characterized, the fault zone is a 50 km long, 2 km wide system of discontinuous, subparallel, and en echelon fault traces extending from Estero Bay on the north to an intersection with the West Huasna fault southeast of San Luis

Valley. Results from new geomorphic mapping, interpretation of reprocessed seismic-reflection data, analysis of seismicity data, and structural analysis suggest that the fault zone dips steeply to the southwest (45 to 70 degrees or possibly steeper), and may be primarily an oblique-slip fault, with a significant component of dip slip to accommodate uplift of the range. Late Cenozoic activity of the Los Osos fault is expressed along the northwestern range front by uplift, tilting and folding above a blind fault tip (Unruh et al, 2015).

Lettis and Hall (1994) divide the Los Osos fault zone into four segments based on differences in physical and behavioral characteristics. From the northwest to the southeast, the four segments are the Estero Bay (offshore), Irish Hills, Lopez Reservoir, and Newsom Ridge. The relationships of the Los Osos fault zone, Edna fault zone and mapped geomorphic lineaments that may be associated with faulting in the project vicinity are depicted on the Quaternary Geologic Map of Los Osos Fault Zone (Plate 4).

The most active fault segment is the Irish Hills segment, which is where uplift rates of 0.1 to 0.2 mm/year have been estimated. The subject property is located with the "Lopez Reservoir Segment", which is not well expressed topographically, and where "*geomorphic features suggestive of faulting are sparse, laterally discontinuous and poorly defined*" (Lettis and Hall, 1994).

Edna Fault

The Edna fault is mapped by Hall (1973) as a west- to northwest-trending zone of multiple fault traces extending through the San Luis Range along the northern limb of the Pismo syncline. It is interpreted by Hall (1973) to be a high-angle, down-to-the-southwest normal fault that displaces Pliocene and lower Pleistocene strata. Also according to Hall (1973), the northwestern and southeastern ends of the Edna fault are truncated by the range-bounding and more sinuous Los Osos fault zone. The fault is not considered to be Holocene active, because it is overlain by unfaulted marine terraces (Hanson et al., 1994).

The Edna fault is not shown to be a through-going fault by Dibblee (2005). Recent geophysical data acquired for the DCPP studies indicate the "Edna fault" is characterized by several structural features in the northwestern part of the San Luis Range (see Figure 3-3). Lettis and Hall (1994) show the Edna fault to lie at the southwestern margin of the broad range-front bounding Los Osos fault zone (Plate 5).

Southwestern Boundary Fault Zone

The southwestern margin of the San Luis Range is bordered by a complex zone of late Quaternary reverse, oblique-slip, and possibly strike-slip faults. Grouped together, these faults separate the San Luis–Pismo Structural Block from the subsiding Santa Maria Valley Block to the southwest. The zone of faults is collectively called the Southwestern Boundary fault zone and is 4–10 km wide and over 60 km long (Lettis et al., 2004). The faults generally strike west-northwest and dip steeply to the northeast. Principal structures within this fault zone include the Wilmar Avenue, San Luis Bay, Pecho, Los Berros, Oceano, and Nipomo faults. The cumulative rate of vertical separation across the fault zone, based primarily on deformation of the marine terrace sequence along the coast and southwest side of the range onshore, ranges from about 0.1 to 0.2 mm/yr; the rate for each fault is generally 0.04–0.1 mm/yr.

Hosgri Fault Zone

The Hosgri fault zone is the southern portion of the larger 410 km long San Gregorio–San Simeon–Hosgri fault system. It is an active transpressional, convergent right-slip fault zone that extends southeastward approximately 110 km from a location 6 km offshore of Cambria to a point 5 km northwest of Point Pedernales (Hanson et al., 2004). The Hosgri fault zone lies offshore for its total length. As described above, the fault zone separates two tectonic domains of contrasting styles and rates of crustal deformation: the offshore Santa Maria basin on the western side of the fault zone and the onshore Los Osos domain on the eastern side (PG&E, 2014, Lettis et al., 2004). To the east, the fault zone truncates a marine bedrock platform associated with uplift of the San Luis–Pismo Structural Block.

The Hosgri and San Simeon fault zones are characterized by 1–3 millimeters per year (mm/yr) of right-lateral slip, with the rate of slip increasing from south to north along the San Gregorio–San Simeon–Hosgri fault system, ultimately to 6–8 mm/yr on the San Gregorio fault zone to the north in the San Francisco Bay area (Hanson et al., 2004).

Oceanic-West Huasna Fault Zone

The Oceanic-West Huasna fault zone forms the east margin of the Los Osos Domain, and is characterized by multiple reverse faults and near-vertical faults that separate Franciscan Complex melange on the southwest from younger Mesozoic and Cenozoic rocks on the northeast (Hall, 1973).

Late Cenozoic uplift of the Santa Lucia Range is accommodated primarily by reverse displacement on the Oceanic-West Huasna fault system. The 2003 San Simeon earthquake (M=6.5) has been attributed to the Oceanic fault due to its proximity to the epicenter. However, the dip and thrust movement of the 2003 earthquake are not consistent with movement on a vertical fault. Researchers have concluded that the 2003 earthquake likely occurred on a blind thrust fault in the Santa Lucia Mountains.

The West Huasna fault zone is characterized by dextral, strike-slip earthquakes and forms the eastern boundary of northwest-southeast trending ranges and range-bounding faults (e.g., Los Osos fault) within the Los Osos Domain.

Nacimiento and Rinconada Faults

The Nacimiento fault and Rinconada faults comprise the tectonic boundary between the coastal Franciscan Complex and the Salinian granitic basement. The Nacimiento fault zone is characterized by multiple, northwest-striking faults and varying styles of earthquake modes, including strike-slip, reverse and normal displacements. Although Quaternary displacement has not been documented, low to moderate seismicity along the fault trend indicates some degree of ongoing strain release (Clark et al., 1994).

The Rinconada fault is an important element of the San Andreas fault system, and has accommodated about 18 km of post-Miocene offset (Rosenberg and Bryant, 2003). Fault displacement has continued into the late Quaternary and possibly into the Holocene.

San Andreas Fault Zone

The San Andreas fault zone is the principal element of a network of dextral strike-slip faults that collectively accommodates the majority of relative motion between the Pacific and North American tectonic plates, extending for about 1,100 km along the western side of California. The total fault length can be divided into segments based on historical ruptures.

The closest segment to the project area is the Cholame-Carrizo Plain section, which extends southeastward about 200 km from the southern end of Cholame Valley. The most recent rupture event on the Cholame-Carrizo section is the M=7.9 1857 Fort Tejon earthquake, which produced shaking that lasted 1 to 3 minutes and was felt over more than 350,000 square kilometers of central and southern California. The maximum fault movement of about 9 meters occurred in the Carrizo Plain section, 90 to 130 kilometers southeast of Parkfield, and slip on the Cholame section is estimated at 3 to 7 meters (Sieh, 1978). The estimated recurrence interval for large earthquakes on this segment is 100 to 450 years (Bryant and Lundberg, 2002).

Table 1. Summary of major faults in region with respect to project site.

Fault	Activity Category	Approximate Site to Fault Distance, miles (km)	Site to Fault Direction	Estimated Magnitude
Los Osos	Active	0.2 (0.3)	N	7.0
Hosgri (offshore)	Active	14.5 (23.5)	W	7.5
West Huasna	Potentially Active	4.3 (7.0)	NE	7.0
Rinconada	Potentially Active	10.0 (16.0)	NE	7.3
San Andreas (Cholame-Carrizo segment)	Historically Active	38.2 (61.5)	NE	6.9
San Andreas (1857 rupture)	Historically Active	38.2 (61.5)	NE	7.8

3.2.2 Historic Seismicity

Historically, significant earthquake activity in the project vicinity is generally sparse, as depicted on the Regional Seismicity Map (Plate 3). Micro-earthquake activity west of the San Andreas fault zone is concentrated in several areas: (1) within the Santa Lucia Range, north of the subject property: (2) west of the San Simeon area (offshore); (3) along and east of the Hosgri fault zone within the western Los Osos Domain; and (4) in the southwestern offshore region, west of Pt. Arguello (Hardebeck 2010). A dense cluster of earthquakes along the Santa Lucia Range contains primarily aftershocks from the 2003 M_W 6.5 San Simeon earthquake.

The San Simeon earthquake is the largest event recorded in the region since the 1927 M_W 7.2 Lompoc earthquake, which was located further away, in the southern offshore region southwest of Point Conception. A study of the elastic- waves radiated from the source indicates that the San Simeon earthquake was caused by reverse faulting. Rupture propagated to the southeast from the hypocenter over a distance of approximately 20 km. The nearest mapped fault is part of the Oceanic fault zone, a system of vertical strike-slip faults. However, the dip and thrust movement of the 2003 earthquake are not consistent with movement on a vertical fault, and the earthquake may have been generated by a blind thrust fault.

Within the Los Osos Domain, earthquakes occur primarily within the San Luis–Pismo, Casmalia, and western Los Osos (Estero Bay) blocks (Figure 3-2), and they extend to a depth of 12 to 15 km. The San Luis–Pismo and Casmalia block activity is consistent with active uplifting blocks. There is a relative lack of seismic activity within the eastern half of the Los Osos block and within the onshore Santa Maria basin. The lower rates of seismic activity in these areas suggest low rates of deformation within the down-dropped blocks of the Los Osos Domain. However, the seismic activity in Estero Bay (western half of the Los Osos block) is an exception to this generalization and suggests locally active deformation within this down-dropped block.

Focal mechanisms of the region are predominantly reverse and strike-slip and are consistent with dextral transpressional deformation. Mechanisms beneath the Santa Lucia Range from the San Simeon aftershock zone to the area northeast of the San Simeon fault zone show predominantly reverse motion along west-northwest-trending fault planes.

There are numerous strike-slip mechanisms along the Hosgri fault zone between Estero Bay and Pt. San Luis, and directly east of the Hosgri in Estero Bay, along the Shoreline fault zone, and onshore within the Irish Hills. Generally, the Hosgri mechanisms have nodal planes that strike more north-northwesterly compared to the northwesterly striking focal mechanisms directly east of the Hosgri fault zone. Strike-slip mechanisms along the West Huasna fault zone change from nearly north-south-striking nodal planes east of San Luis Obispo to west-northwest-striking nodal planes north of San Luis Obispo to the southern end of the 2003 San Simeon earthquake aftershock zone.

3.3 Local Conditions

3.3.1 Site Topography and Drainage

We utilized a 1999 site survey provided by the Project Civil Engineer, historical stereoscopic aerial photography, publically available LiDAR (Light Detection and Ranging) imagery, and the 7.5-minute Pismo Beach quadrangle for review and analysis of site topography and surface features of the subject property and surrounding vicinity. In addition, we created an ArcInfo GIS base map database by incorporating the site survey topographic contours, orthorectified aerial photography, LiDAR imagery, and proposed development layout. The database forms the base for our portrayal of geologic conditions on the property (Plate 6, Engineering Geologic Map).

The property is located on a north-facing hillside with generally steep to gentle slope gradients. The southern property boundary roughly follows the axis of a northwest-trending ridge line with several peaks between elevations 525 and 625 feet and incised, north-flowing drainages. The southern one-third of the property slopes northward from the ridge line at gradients of 25 to 50 percent (14 to 26 degrees inclination), with the steeper slope gradients found in the upslope portion of the hillside (generally above elevation 425 feet). The northern portion of the property is characterized by low rolling hills between elevations 200 and 300 feet, and with gradients of about 8 to 17 percent (5 to 10 degrees inclination).

At the time of our field mapping in March to May 2015 and February 2016, the southern hillside was covered with weeds, wildflowers and grass. Several clusters of mature oak trees are present on the slopes, generally between elevations 350 and 450 feet, and in the incised drainage ravines. The northern two-thirds of the property is a working vineyard.

Drainage on the property is characterized by a west-flowing creek in the northern portion of the property. The creek drains properties to the east, and was flowing water at the time of our field observations. Hillside drainage is characterized by sheetflow towards well-developed drainage channels that flow into the west-flowing creek. Three incised, north-flowing drainage gullies emanate from a broad linear depression lying south of the southern ridgeline and property boundary. These drainages form gentle swales in the southernmost portions of the property where underlain by the Monterey Formation, and are locally incised up to as much as 15- to 25-feet where underlain by friable sandstone of the Pismo Formation. The 1969 aerial photographs, taken during the wet rainy season of 1968-1969, portray recent sedimentation in the downstream portion of the central gully, and local incision of minor tributary gullies. Since development of the vineyard in the 1990s, the sections of the drainages in the northern portion of the property have been slightly modified by grading.

3.3.2 Geomorphology

Local geomorphology is expressed by northwest-trending lineaments and physiographic features that are indicative of underlying geologic structure. Individual geomorphic features can be grouped into the following areas:

1. Northwest-trending ridgeline and steep-sided hillsides flanking the north and south sides of the ridgeline, indicating the distribution of resistant diatomaceous siltstone of the Monterey Formation.
2. Northwest-trending, broad, low-lying (down-dropped), linear feature located adjacent to and south of the southern ridge crest. This feature is closely associated with the mapped trace of the Edna fault (Hall, 1973) and Tmm-Tmpe contact by Dibblee (2005).
3. Discontinuous zone of well-expressed, northwest-trending geomorphic tonal and vegetative lineament extending across the southern hillside, mapped by Lettis and Hall (1994) and observed in this study. This trend of lineaments is close to the interpreted contact between the Tmm and Tpps on the property, and roughly parallels the upslope limit of oak tree clusters on the hillslope.
4. Discontinuous and only moderately expressed lineaments in the northern two-thirds of the property. In general, lineaments in the younger geologic units (e.g., Paso Robles Formation) are not as well expressed as those in older geologic units. However, the lineaments in the northern portion of the property may be related to identified faults and similar lineaments mapped to the west, and could indicate deformation associated with a blind thrust fault extending further north of the property, possibly surfacing at the range front margin adjacent to Davenport Creek and the edge of the San Luis Valley (Plates 4 and 5).

3.3.3 Geologic Conditions

As described in Section 3.1, the property is located on the northern limb of the Pismo syncline, and along the north-facing slopes of the San Luis Range. Geologic units on the property include the Monterey Formation, Pismo Formation, and Paso Robles Formation. In addition, alluvium is present along the central drainage ravine.

The Monterey Formation underlies the southernmost portion of the subject property and the Paso Robles Formation (which locally may also be equivalent to Pleistocene-age "Older Alluvium") underlies the northern two-thirds of the property. The Squire Member of the Pismo Formation is present downslope from the Monterey Formation and upslope of the Paso Robles Formation. [Note: *The Squire is considered to be the uppermost of four distinct members of the Pismo Formation by Hall (1973), but is considered to be a separate formation ("Squire Sandstone") by Dibblee (2005). The nomenclature of Hall (1973) is the standard usage in published literature, and is used in this report.*]

Descriptions of the geologic units on or adjacent to the subject property are provided below (listed in order of youngest to oldest age):

- Artificial Fill (Af) – Two small areas of artificial fill were identified in the development area. One of these is a shallow fill prism beneath the existing farm road across the drainage channel, and the second is an area of recent grading and clearing near Lot 6. The road fill will need to be reengineered as part of subdivision road construction. The area near Lot 6 does not appear to impact the development.
- Soil and Colluvium – Soil and colluvium overlie the Quaternary deposits and Tertiary rock units in the project area. The soil is generally two to three feet in thickness on the hillsides, and locally deeper on lower, gentler slopes and intervening drainages. Where the soil overlies fine-grained rock units, such as mudstone units encountered in Trench GT-1, the soil profile includes a well-developed "A" and "B" horizon. Where the soil overlies the Tpps sandy units, such as in Trenches GT-3, GT-4 and GT-5, the soil profile is characterized by a sandy "A" horizon underlain by a leached or "E" horizon and then a poorly developed "B" horizon. The "E" horizon is a zone of clay removal, and the "B" horizon is a zone of clay accumulation. The soil material on the hillslopes appears to be actively creeping downslope, and thus can also be considered colluvium. On the lower hillslope west of the drainage ravine, a relatively thick (typically greater than 5 feet and up to about 8 feet in thickness) was encountered in exploratory trenches and borings. The area of relatively thick colluvium is designated "Qc" on Plate 6 (Engineering Geologic Map).
- Landslides (Als, Dls) – Several areas of downslope movement were observed on the property (designated Landslides A through D). These include two active landslides (Als) and two dormant (Dls) landslides. The two Als's are characterized by shallow slope failures which have resulted in subtle landslide scarps (evacuation zones) and downslope accumulations of transported material. Landslide A is a shallow Als located upslope from Lot 1. Landslide A does not appear to be currently moving, but is considered "active", because movement probably occurred within the past century. Landslide B, a shallow Als on the slope south of Lot 6, is characterized by shallow (less than approximately 6 feet) creep in hillside colluvium. Landslide C is a Dls located downslope of Lot 12. Landslide D is observed in aerial photography and LiDAR imagery as a very subtle, shallow, bowl-shaped feature suggestive of past movement. Exploration of Landslide C shows extensive soil development, indicating significant movement has not occurred in the past hundreds to thousands of years. Landslide D is mapped on the west-facing slope to the southwest of Lot 13, and further away from the proposed development. A previously mapped landslide in the vicinity of Lots 10 and 11 was investigated by borings and trenches for this study, and no obvious rupture surface or shearing was encountered that would be indicative of landsliding.

- Alluvium (Qal) – Generally unconsolidated sand, silty and fine-grained to locally coarse-grained, loose to medium dense, well sorted (poorly graded), horizontally stratified with laminae and thin interbeds of sandy clay, also locally with thin seams containing rounded rock fragments (sandstone, chert). In the development area, alluvium is located along the central drainage gully. Alluvium is also present along drainages throughout the property. Properties for alluvial materials encountered in the geotechnical borings are provided in Sections 3.3.4.3 and 3.3.4.4.
- Paso Robles Formation (QTp) – Orange to yellow brown gravel or conglomerate, sandstone and mudstone; poorly to moderately well consolidated, but uncemented; conglomerate contains rock clasts of chert, tuffaceous sandstone, siliceous shale, serpentinite, chlorite, and mafic rocks.
- Squire Member, Pismo Formation (Tpps) – Light grey to white, arkosic, fine to coarse-grained sandstone, generally friable, weak and deeply weathered to sand, but also includes thin beds of resistant, well cemented, coarse sandstone with rounded to subrounded rock fragments (primarily chert). The Squire also includes interbedded sandy mudstone units. The Squire Member appears to be the primary host rock for mature oak trees on the hillside; no oaks appear to be present where the hillside is underlain by Monterey or Paso Robles Formations.
- Edna Member, Pismo Formation (Tmpe) – Where observed in contact with the Monterey Formation south of the property boundary, the Edna Member consists of a distinctive bituminous medium to coarse-grained sandstone, with characteristic light to dark brownish grey staining. The Edna outcrops are south-dipping at a slightly different angle than the adjacent Monterey Formation rocks, indicating an angular unconformity between the two geologic units.
- Monterey Formation (Tmm) – The Monterey Formation underlies the southern ridge and forms high, steep-sided hillslopes. Where observed on and adjacent to the property, the unit consists of thin-bedded, resistant beds of diatomaceous siltstone and siliceous shale that dip southward at moderate to steep inclinations. The Monterey Formation is the oldest geologic unit observed on the property, and is in contact with the Pismo Formation Edna Member (Tmpe) on the south side of the ridge and with the younger Squire Member (Tpps) on the north side of the ridge.

Local geologic structure was determined from bedrock orientations that were measured across much of the southern portion of the property where outcrops could be observed, in trench and boring excavations, and locally in incised drainage gullies. Our interpretation of the local geologic conditions is shown on the Vicinity Geologic Cross Section (Plate 5).

The Tmm, Tmpe and Tpps units were observed to be south-dipping in the southern portion of the property. Tpps is younger than Tmm but occurs structurally below Tmm. Therefore, the contact between Tmm and Tpps must either be an overturned fold or faulted (or both). It is possible that the Tmm-Tpps contact is shown as unfaulted on Hall (1973) and Dibblee (2005) because sparse bedrock orientations on their maps indicate strata dipping northward, rather than south-dipping as we observed during this study. (If Tmms and Tpps both were dipping northward, then the Tpps would lie structurally above Tmms, in conformance with their respective stratigraphic positions). We note that Dibblee (2005, 2006) does show the Tmm-Tpps contact to be faulted to the east of the property, calling this contact the "Edna fault", but queries and ends the fault before the contact reaches the property (Plate 1, Regional Geologic Map).

It is uncertain whether the Edna fault of Hall (1973) or the faulted Tmm-Tpps contact (Edna fault of Dibblee, 2005) are related to the range-front Los Osos fault. Recent geophysical studies of the geologic structure of the Irish Hills, to the northwest of the property, indicate that all faults are steeply dipping and separate structures (e.g., Unruh et al., 2015).

3.3.4 Subsurface Exploration

Subsurface conditions were investigated at locations shown on Plate 6 (Engineering Geologic Map). Exploration siting, contractor supervision and geologic logging were performed by a team of up to six engineering geologists. Exploration took place in two phases: The first phase occurred in April and May 2015 to address a 2015 development plan. Later exploration occurred in February 2016 to aid in our evaluation of a revised development plan and included a more focused investigation of liquefaction conditions using CPT probes. The exploration included:

- Seven (7) trenches and six (6) test pits, totaling approximately 930 lineal feet, were cleaned and logged by State-certified engineering geologists. Most excavations were generally oriented perpendicular to topographic contours. Trench locations were established to gain understanding of subsurface geologic conditions and to investigate features interpreted from previous fault trenching on the property. Field logs of the trenches and test pits, showing mapped features and descriptions of materials, are included in Appendix A. The depths of the trenches typically were 6 to 9 feet, with some sections deepened to 10 to 11 feet to allow better evaluation of observed features. One large-diameter boring (LD-9) was drilled and downhole logged to a depth of about 15 feet adjacent to Trench GT-1 to allow observation of conditions below the trench depth.
- Nine (9) 30-inch-diameter auger borings (LD-1 to LD-9) were cleaned and downhole logged by State-certified engineering geologists. The two shallowest holes encountered drilling refusal at shallow depths (8 feet in LD-1 and 4 feet in LD-8), and the remaining holes were drilled and logged to depths of 14.6 to 20.5 feet. Large-diameter boring locations were sited to aid in our understanding of subsurface geologic and geotechnical conditions across the proposed development area. Logs are provided in Appendix B.

- Subsurface soil conditions at the project site were explored by drilling and sampling ten (10) 6-inch and 8-inch diameter, geotechnical (hollow stem auger) borings (GB-1 to GB-10). The borings were sampled, tested and cuttings logged to depths of 20.5 to 50.5 feet by a State-certified engineering geologist. The geotechnical borings primarily were located to investigate material properties of alluvium, to characterize the geotechnical conditions of the central drainage gully for the proposed access road crossing, and to supplement geotechnical characterization of the soil and underlying bedrock in the cluster residential lots. Boring logs are provided in Appendix B.
- The subsurface conditions in the vicinity of the drainage channel that bisects the project site were explored by advancing twelve (12) cone penetrometer test (CPT) soundings. The CPTs reached depths between 7.9 and 54.5 feet. Each of these CPTs was essentially pushed until "practical" refusal was encountered. CPT Logs are provided in Appendix D.

In addition to the recent 2015-2016 exploration, we reviewed reports and logs of previous trenches and piezometers completed by GeoSolutions (2000, 2005, 2007). Logs of trenches completed in 2000 are contained in the available reports. Trenches completed by GeoSolutions after the latest (2007) report are shown on an undated map provided to us by our clients. Although we do not have GeoSolutions' logs for those supplemental (post-2007) trenches, we sited several of our recent trenches to investigate interpreted geologic features shown on the undated map as being encountered in those trenches.

3.3.4.1 Ground Water

During our field exploration performed in April and May 2015, subsurface water was encountered in only two of the 13 borings (and no water was encountered in exploratory trenches). Water was encountered at depths of 38 feet in boring GB-2 (25 feet after drilling) and 16 feet in boring GB-3 (water not detected in boring after drilling). Both of these borings are located in alluvium adjacent to the central drainage channel.

During our field exploration performed in February 2016, no water was encountered in the 6 borings (GB-5 to GB-10), but saturated colluvium was encountered in trenches GT-6 and GT-7, and in test pits T-5 and T-6. In addition, two pore pressure dissipation (PPD) tests were conducted in two of the CPT soundings. The PPD tests yielded an estimated depth to groundwater of 38.9 feet in CPT-1 and an estimated depth of 21.4 feet in CPT-3.

GeoSolutions (2000, 2005) installed and monitored four standpipe piezometers for a period of time from November 2000 to January 2002 (PZ-1 2000 and PZ-2 2000), and from May to August 2005 (PZ-1 2005 and PZ-2 2005), at the locations shown on the Engineering Geologic Map (Plate 1). Only PZ-2 (2000) showed a consistent water level during the monitoring period, at a depth of about 34 to 37 feet (1.5 to 4.5 feet of water in the piezometer). PZ-1 (2000) varied from dry to 3 feet of water measured in January 2002. Both 2005 piezometers were dry for all three measurements from May to August 2005.

GeoSolutions also encountered ground water at the downslope end of their exploratory trench T-6, and wet material at the downslope end of trench T-7, which were excavated in June 2000 (GeoSolutions, 2000, 2005). Wet colluvium was encountered in trenches GT-6 and GT-7, and in test pits TP-5 and TP-6 in the same general area as GeoSolutions trench T-7 during our exploration in February 2016. Underlying bedrock materials were observed to be dry.

We note that the water levels reported above and in previous reports represent the levels measured at the time and location indicated. Fluctuations in ground water levels often occur due to seasonal variations in rainfall, drainage and irrigation. The reported measurements may not reflect typical or common water conditions. However, the ground water information indicates that variable ground water conditions may be present in the project area. In general, it should be anticipated that transient shallow ground water conditions may exist during and following heavy periods of rain, and deeper ground water conditions are present during longer, dry periods.

3.3.4.2 Description of Trench Exposures

Our interpretation of geologic conditions on the property is depicted on the Engineering Geologic Map and Cross Sections (Plates 6, 7A, 7B, 7C, and 7D). In general, we encountered mostly Tpps rock units and overlying soil and colluvium in the subsurface excavations. One trench also encountered QTp units, and several borings penetrated alluvium. Trench logs are presented in Appendix A.

Trench GT-1

GT-1 was excavated parallel to and between GeoSolutions trenches T-1 and T-5, in order to observe features previously interpreted as fault features. Logs for the GeoSolutions' trenches in this area show several south-dipping shears in T-5, one shear near the upslope end of T-1, and no shears in T-4.

GT-1 exposed south-dipping Tpps sandstone and mudstone units. Numerous discontinuous fractures and clay partings were observed, indicating dilation associated with hillside creep. Although most partings and fractures were observed to be discontinuous, several south-dipping clayey laminae and partings that are continuous from the base of the soil horizon to the base of the trench also were observed. The continuous features appear to be bedding surfaces that may be sheared due to past tectonic folding (bedding plane shears). No primary tectonic fault rupture, which typically is indicated by displacement of strata, well-developed or thick gouge, or changes in structure across the discontinuity, were observed. We infer that the "faults" interpreted on the GeoSolutions trench logs (T-1 and T-5) are similar to the bedding plane shears and fractures observed in GT-1.

Trench GT-2

GT-2 was excavated parallel to and adjacent to the downslope portion of GeoSolutions trench T-1 and across a possible fault zone projected by GeoSolutions based on post-2007 trenching located further west. GeoSolutions Trench T-1, which also intersects the projected fault zone, does not show any faults.

GT-2 exposed silty sandstone and sandy conglomerate. The upslope silty sandstone unit is well indurated with manganese oxide staining of fractures, and is interpreted to be Tpps. The downslope portion of the trench exposes less indurated and more deeply weathered conglomerate and sandstone that is interpreted to be QTp. In general, the soil profile is thinner over the Tpps silty sandstone unit and thicker over the downslope QTp sandstone units. The upslope sandstone unit contains abundant fractures, which are locally manganese stained or clay-lined. Two downslope-dipping fractures were observed 10 to 15 feet downslope from the upslope end of the trench; however, the same fractures were not observed on the opposite side of the trench. No shearing, platiness or rotated clasts were observed along the fractures. The remainder of the trench exposed unfractured to little-fractured QTp conglomerate and sandstone.

Trench GT-3

GT-3 was excavated between post-2007 trenches T-14 and T-15 and across a fault zone projected by GeoSolutions, presumably based on one or both of those two trenches.

GT-3 exposed massive, Tpps sandstone that is weathered to a medium dense to locally loose sand and clayey sand with local blocks of hard, cemented sandstone. Two isolated zones of loose sand were encountered on the west wall of the trench, but were not continuous across to the east wall. The trench was deepened and widened in this area to further investigate these features and they were found to be laterally and vertically discontinuous, transitioning into the surrounding medium dense sand (weathered sandstone). The features were not present in the trench floor. A sandy conglomerate was encountered at the downslope end of the trench. No faults were observed in the trench.

Trench GT-4

GT-4 was excavated along the eastern margin of proposed Lot 15, and across two projected fault zones by GeoSolutions. No previous trenching had been performed in the immediate vicinity.

GT-4 exposed south-dipping, weathered Tpps conglomerate and sandstone that varied from slightly cemented and deeply weathered to locally decomposed to medium dense and dense sand. At approximately 105 and 115 feet downslope from the upslope end of the trench, two abrupt changes in shallow (soil and colluvium) stratigraphy were observed. This section of the trench was deepened for further evaluation, and revealed continuous and undisturbed sandstone seams and iron-stained laminae extending beneath the uneven stratigraphy. Due to the continuous nature of the underlying strata across this interval, the shallow stratigraphic features are not tectonic faults, but are interpreted to be depositional or syndeformational features within the rock unit, possibly accentuated by weathering and leaching of the rock mass. We observed that the "B" soil horizon is discontinuous, and not present where the underlying rock unit is coarse-grained (in GT-4 and other trenches). The "E" horizon is continuous across all sandy units. The trends of the two features, measured across the trench, are N29W and N5W, respectively.

Cross-bedding was observed locally in the primary sandstone unit exposed in the trench.

Trench GT-5

GT-5 was excavated on a spur ridge and along the boundary between proposed Lots 15 and 16 in order to investigate the features observed in GT-4. The trench was sited to intersect the strikes of the features observed in GT-4, allowing for variation in the strike across the nose of the spur ridge. The features were not observed in GT-5.

GT-5 exposed sandstone and conglomerate units similar to those encountered in GT-4. The soil profile in GT-5 was locally thicker than that encountered in GT-4, probably due to proximity to a cluster of oak trees. Roots and abundant krotovina (filled burrows) were observed up to several feet below the soil-rock contact.

Trench GT-6

GT-6 was excavated near GeoSolutions trench T-7, and across a fault zone projected by GeoSolutions on their undated, post-2007 map. A south-dipping shear shown on the log for T-7 had been interpreted as a landslide shear by GeoSolutions (see Appendix F), and later as a possible fault feature according to the undated, post-2007 map. Previous trenches GT-3, GT-4 and GT-5 also had been excavated along the postulated fault zone, with no fault shearing encountered in those trenches.

GT-6 exposed weathered Tpps sandstone and pebbly sandstone bedrock that is poorly to weakly cemented with local blocks of hard, cemented sandstone. Stratification was observed in the upslope portion of the trench. No continuous shear or fracture surface was observed on either sidewall of the trench. A south-dipping, discontinuous fracture with thin clay film along its surface was encountered at approximately 53 feet in GT-6, but the fracture does not extend to the base of the trench. It is possible that this fracture is the south-dipping shear observed at the base of trench T-7 by GeoSolutions, but that trench was not excavated to below the depth of the fracture to reveal that it is discontinuous. The lower part of the trench is characterized by an increasing thickness of colluvium, which exhibits internal stratigraphy, possibly associated with individual depositional events.

Trench GT-7 and Test Pits TP-5 and TP-6

GT-7 was excavated to investigate a possible landslide in the vicinity of Lots 10 and 11 (along with GT-6, and nearby borings). GT-7 was initially excavated generally parallel to contour. However, the trench experienced rapid caving in the shallow, wet sandy colluvium, and the excavation direction was shifted to be more perpendicular to contour to reduce the caving potential. Test pits TP-5 and TP-6 were excavated perpendicular to the original GT-7 alignment to further explore subsurface conditions. In general, all three excavations encountered thick colluvium over sandstone bedrock. The colluvium was observed to be a loose to moderately dense sand, moist to wet, with some seeping water observed in TP-5. Together with nearby borings LD-4, LD-5, GB-8 and GB-9, we did not encounter conditions attributed to landsliding. However, the exploration led us to identify an area of thick, weak colluvium that should be considered a geotechnical constraint to development.

Test Pits TP-1 through TP-4

Test pits TP-1 through TP-4 were excavated to investigate the margin of Landslide A, an area of active slope movement identified during geologic field mapping. The test pits confirmed that the slope movement is confined to shallow colluvium, and does not extend onto the nearby Lot 6.

The four test pits encountered a surficial layer of poorly graded sand with local clay seams (colluvium) overlying weathered sandstone bedrock (Tpps). The colluvium is thickest in test pits TP-1 and TP-2, which were excavated within the mapped Landslide A, and becomes thinner with more rock fragments in TP-3 and TP-4. The underlying sandstone is weathered with indistinct bedding observed locally.

3.3.4.3 Materials Encountered in GB-1 through GB-10

Geotechnical borings GB-1 to GB-10 were drilled to depths ranging between 20.5 and 50.5 feet below existing grade. Deposits of colluvium and/or slopewash materials overlying alluvial soils were encountered in the borings. The colluvium/slopewash materials consist of silty sand, sandy silt, clayey sand, and poorly graded sand with silt. The alluvial materials consist of clayey sand, silty sand, sandy lean clay, lean clay with sand, poorly graded sand with silt, and sandy fat clay. In Borings GB-2 through GB10, the surficial alluvial soils overlie weathered bedrock comprised of silty sandstone, clayey sandstone and claystone, which are identified as Tpps and QTp). Boring GB-4 also encountered approximately 1 foot of undocumented artificial fill at the existing ground surface, associated with recent minor grading in this area.

Groundwater was encountered at approximately 38.0 feet in boring GB-2 during the drilling operation and equalized to 25.0 feet below existing grade at the end of drilling. Ground water was also encountered in boring GB-3 at 16.0 feet below during the drilling of the exploratory boring. This was likely a perched zone as the ground water was not encountered at the end of the drilling operation. Ground water was not encountered in boring GB-1, GB-4, and GB-5 thru GB-10. Descriptions of the materials encountered in the borings are included on boring logs in Appendix B.

3.3.4.4 Laboratory Test Program

Laboratory testing was performed to obtain information regarding the physical and index properties of selected soil and bedrock samples recovered from the exploratory borings. Tests performed included natural moisture content, dry unit weight, wash over #200 sieve, Atterberg Limits and unconsolidated undrained triaxial compression tests. Tests were completed in general conformance with applicable ASTM standards. The Atterberg limits tests results ranged between a liquid limit of 22 and 66 percent with a plasticity index ranging between 6 and 39 percent. The results of the sieve over #200 wash indicate that the materials are sands and clays with fines contents ranging between 6.8 and 78.1 percent. The unconsolidated undrained triaxial compression tests (TXUU) were conducted on clay soil samples in the upper 5 feet of the site soils. The TXUU tests yielded undrained shear strengths ranging from 384 psf to 6014 psf, with an average undrained shear strength of 2067 psf. The results of the laboratory tests are summarized on the boring logs in Appendix C.

3.3.4.5 Materials Encountered in CPT-1 through CPT-12

Cone penetration test (CPT) soundings CPT-1 to CPT-12 were extended to depths ranging between 7.9 and 54.5 feet below existing grade. CPT Logs are provided in Appendix D.

Similar soil and bedrock conditions as those found in the borings were encountered in the CPTs. Deposits of colluvium and/or young alluvial soils overlying weathered bedrock were encountered in the CPTs. The colluvium and alluvial soils consist of sand, silty sand, sandy silt, clay and silty clay. The weathered bedrock was interpreted to be fine-grained, likely claystone weathered to sandy clay soil, based on our previous borings. Descriptions of the materials encountered in the CPTs are included in Appendix D.

Pore water dissipation tests were conducted in CPT-1 and CPT-3. Based on these tests, the groundwater was interpreted to be at encountered at a depth of 38.9 feet in CPT-1 and at a depth of 21.4 feet in CPT-3.

4.0 EVALUATION OF POTENTIAL GEOLOGIC HAZARDS

4.1 Faulting and Surface Fault Rupture

Movement along an active tectonic fault that intersects the ground surface can result in permanent ground displacements which may severely damage built structures. The most common method of mitigating the hazard of primary surface fault rupture is to avoid active tectonic fault traces.

Faults are considered to be "active" if they display evidence of movement within Holocene time (the last 11,000 years), and "potentially active" if they display evidence of movement within Quaternary time (i.e., within the last 1.6 million years). The State of California regulates development near known active faults through the Alquist-Priolo Special Studies Zone Act. "Special Study Zones" have been established around known active faults by the California Division of Mines and Geology. Construction of structures for human occupancy are not permitted within a Special Study Zone until a site-specific geologic study has been performed which concludes that a specific site does not lie on or across an active fault trace. The proposed development is not located within a defined State Special Study Zone or County fault zone.

Fault traces associated with the Edna fault zone and Los Osos fault zone are present in the vicinity. The Los Osos fault zone is a southwest-dipping, blind thrust fault that likely projects to near or along the northern front of the San Luis Range. Holocene activity on the local segment of the Los Osos fault zone is equivocal. The Edna fault zone is a steep, south-dipping inter-range fault zone that may consist of two traces in the property vicinity. The two traces are the trace of Hall (1973), extending south of the property, and the trace projected from Dibblee (2005, 2006) which coincides with the Tmm-Tpps contact on the property. Because of the structural relationship indicating possible faulting and previous mapping by Dibblee, we interpret the Tmm-Tpps contact on the property to be faulted. Although the fault is likely not to be Holocene-active, it was not investigated by trenching and is in relative close proximity to the proposed development. Consequently, we recommend a fault setback distance of 100 feet upslope and 200 feet downslope from the mapped contact (Plate 8, Geologic Hazards and Constraints Map). The setback distance is a reflection of the relative uncertainty in the location of the contact, and uncertain relationship with nearby geomorphic lineaments. The current development plan does not indicate any development within the Edna fault setback zone. However, a fault investigation should be performed if future potential development is planned for the setback zone.

No primary fault traces associated with the two identified fault zones cross the proposed development area, based on previous mapping and results of this investigation. The potential for surface fault rupture associated with primary tectonic faulting within the proposed development is low, due to the lack of defined Holocene fault traces crossing the development.

4.2 Secondary Seismic Ground Deformation

Large earthquakes sometimes cause secondary ground deformation, in addition to primary surface fault rupture. Secondary deformation typically is characterized by minor to insignificant displacements that may be distributed over a wide area. The future locations of possible secondary deformation are difficult to predict, due to the discontinuous and transient nature of such deformation. The potential for secondary deformation in the development area, which may include fissuring or fracturing associated with tectonic movement in the near vicinity, is low to moderate. Potential displacements associated with secondary deformation can be mitigated through appropriate foundation design and construction.

4.3 Seismic Ground Motion

The project area is situated in an area of moderate seismic activity. It should be anticipated that the property will experience moderate and strong ground shaking that may be generated by earthquakes on any one of several major active and potentially active faults during the life of the project.

The closest active or potentially active fault to the project site is the Los Osos fault (M=7.0), which is a southwest-dipping reverse fault that is interpreted to underlie the property. The distance to the Los Osos fault at depth is estimated to be 1,000 feet. Other active and potentially active faults are present in the region. The closest, major well-defined active fault is the Hosgri fault (M=7.5), which is located approximately 14 miles (23 km) west of the project site. The San Andreas fault (M=7.8), which is the most significant active fault in the region, is located approximately 38 miles (61 km) northeast of the project site.

The NEHRP soil type for the majority of the subject property is Soil Type D. The NEHRP soil type for the younger alluvial soils along the drainage channel is Soil Type F, due to the high potential for liquefaction. Refer to Section 4.4.2 below for probabilistic ground motions to be used for design at the site.

4.4 Liquefaction and Lateral Spreading

4.4.1 Liquefaction Susceptibility

Liquefaction is a soil behavior phenomenon in which a soil located below the groundwater surface loses a substantial amount of strength due to high excess pore-water pressure generated and accumulated during strong earthquake ground shaking. During and immediately following earthquake ground shaking, induced cyclic shear creates a tendency in most soils to change volume by rearrangement of the soil-particle structure. The potential for excess pore-water pressure generation and strength loss associated with this volume change tendency is highly dependent on the gradation and density of the soil, with greater potential in looser generally cohesionless soils. Recently deposited (i.e., geologically young) and relatively loose natural soils, and uncompacted or poorly compacted artificial fills located below the groundwater table, are potentially susceptible to liquefaction.

4.4.2 Probabilistic Ground Motions

The site ground motions used in our liquefaction assessment were evaluated using two methods. The first method assumes the earthquake event having a 10 percent chance of being exceeded in 50 years, or a return period of 475 years. The ground acceleration used for the liquefaction analyses is consistent with CGS Special Publication 117A. Using tools contained on the USGS website (USGS, 2015), we completed a probabilistic assessment of the earthquake shaking hazard at the site. According to the USGS website, the anticipated peak ground acceleration is 0.28g from a 6.7 magnitude earthquake.

The second method is based on ASCE 7-10, which was adopted in the 2013 California Building Code, and uses a different threshold than an event having an interval of occurrence of 1 in 2,475 years (2% chance of exceedance in 50 years). ASCE 7-10 requires that the maximum considered earthquake geometric mean (MCEG) peak ground acceleration be used for seismic categories D though F (ASCE 7-10 Section 11.8.3). The following website was used to obtain seismic parameters: http://earthquake.usgs.gov/designmaps/us/application.php. For this project, the website results in a PGA of 0.53g. This value is considerably higher than the SP117A threshold. For this site, the two PGA are not very close, 0.28g versus 0.53g, due to the difference in the probability of exceedance. Liquefaction analyses were performed on the geotechnical borings using the ground motions listed above.

4.4.3 SPT Analysis Methodology

The liquefaction analysis was completed using methods described by Youd et.al., (2001). That empirical method was developed using field observations and laboratory test data in conjunction with results from SPT $(N_1)_{60}$ values. The measured SPT N-values were corrected to $(N_1)_{60CS}$ as recommended by Idriss and Boulanger (2004). The hammer energy efficiency correction CE was evaluated by estimating a standard penetration energy measurement of 80%. Further corrections were made for the reported SPT N-values for the effect of overburden pressure, short rod length, non-standardized sampler configuration and borehole diameter. All the correction factors used in the liquefaction analysis are listed below:

$$(N_1)_{60} = N \cdot C_N \cdot C_R \cdot C_S \cdot C_B \cdot C_E$$

where:

C_N = correction for overburden pressure

C_R = correction for short rod length

C_S = correction for non-standardized sampler configuration

C_B = correction for borehole diameter and

C_E = correction for hammer energy efficiency

The index properties of the soil layers including soil classification, unit weight, and percent fines of soil samples obtained from each of the borings (GB-1 though GB-10) were used to complete the liquefaction analysis (Plate 6). In cases where lab tests were not performed, the soil characteristics were estimated based on lab tests on same or similar soil material at the same depth in nearby borings.

For the purposes of the liquefaction analysis it was assumed that ground water will be at or near a depth of 10 feet below the ground surface.

Liquefaction susceptibility at each boring location was analyzed using a spreadsheet that takes measured field SPT data and assesses liquefaction potential, and post-earthquake vertical settlement given a user-defined earthquake magnitude and PGA. The spreadsheet utilizes the NCEER method (Youd et.al., 2001) for liquefaction susceptibility and (Tokimatsu & Seed, 1987) for liquefaction-induced settlement.

Granular materials, including fine sands and low-plasticity silts that, when saturated, are potentially susceptible to liquefaction from strong earthquake shaking were encountered in the borings GB-1, GB-2 and GB-3. These conditions were pervasive within the loose younger alluvial sediments along the drainage channel that traverses the site. In GB-4 to GB-10, the alluvial sediments were found to be too dense to be susceptible to liquefaction.

4.4.4 CPT Analysis Methodology

Cone penetration tests were also performed in the site by Middle Earth Geo Testing, Inc. The CPT sounding results are included in Appendix D. Geotechnical data from CPT-1 thru CPT-12, all located in close proximity to the drainage channel that bisects the project site, were used to evaluate liquefaction potential for this area (Plate 6). The analysis was performed according to the method of Robertson (1998), based on a PGA value of 0.53 g and an earthquake moment magnitude of 6.7. A ground water depth of 10 feet bgs was used in CPT-based liquefaction analyses; this groundwater depth represents the highest ground water level in the vicinity of the site that we have in our records. The liquefaction analysis results per Robertson (1998) are presented in Appendix E.

Granular materials, including fine sand, silty sand and sandy silt that, when saturated, are potentially susceptible to liquefaction from strong earthquake shaking were encountered in the CPT soundings CPT-1, CPT-2, CPT-3, CPT-6, and CPT-12, and to a lesser extent in CPT 4, CPT-5, CPT-10, and CPT-11. These conditions were pervasive within the loose younger alluvial sediments along the drainage channel that bisects the site, and generally become more pronounced closer to the channel. In CPT-7, CPT, 8, and CPT-9, the alluvial sediments were found to be too dense to be susceptible to liquefaction.

4.4.5 Liquefaction-Induced Settlement

The principal consequence of liquefaction in the sandy alluvial soil layers adjacent to the drainage channel at the site is liquefaction-induced settlement. The liquefaction-induced settlement of these soils was estimated based on the evaluation method developed by Tokimatsu & Seed (1987).

The liquefaction analysis for Borings GB-1 to GB-10 are provided in Appendix E. Based on our analyses, there is a potential for significant settlement to occur in the alluvial soils flanking the drainage channel when the ground water is high (10 feet below the surface), which we assume can happen during very wet rainy periods. When the ground water is at 30 feet below the ground surface, the amount of settlement anticipated is less and the settlement that remains is primarily due to seismic densification of the loose sandy alluvial soils above the ground water table.

The maximum anticipated liquefaction-induced settlement when ground water is at 10 feet below the ground surface is 7 inches, which is considered unacceptable without appropriate mitigation. The following tables are a summary of the calculated settlements due to liquefaction and seismic densification.

Table 2A. Estimated settlement based on liquefaction analysis of SPT borings.

Boring	Estimated Settlement (inches) based on ground water at 10 feet below the ground surface and PGA=0.28	Estimated Settlement (inches) based on ground water at 10 feet below the ground surface and PGA=0.53	Estimated Settlement (inches) based on ground water at 30 feet below the ground surface and PGA=0.28
GB-1	2.8	4.6	0.8
GB-2	7.0	8.8	4.1
GB-3	3.5	5.1	0.2
GB-4	0.0	0.0	0.0
GB-5	0.0	0.0	0.0
GB-6	0.0	0.0	0.0
GB-7	0.0	0.1	0.0
GB-8	0.0	0.0	0.0
GB-9	0.0	0.0	0.0
GB-10	0.0	0.1	0.0

Table 2B. Estimated settlement based on liquefaction analysis of CPT soundings.

CPT	Estimated Settlement (inches) based on ground water at 10 feet below the ground surface and PGA=0.53
CPT-1	4.5
CPT -2	4.0
CPT -3	1.9
CPT -4	0.3
CPT -5	0.4
CPT-6	2.8
CPT -7	0.0
CPT -8	0.0
CPT -9	0.0
CPT-10	0.2
CPT-11	0.2
CPT-12	1.1

4.4.6 Lateral Spreading

Lateral spreading is a phenomenon associated with strength loss following liquefaction and the presence of a free face. Lateral spreading involves the lateral movement of a liquefied soil layer (and overlying layers) toward a free face, such as the drainage channel through the site. Our lateral spreading analysis included performing computer slope stability analyses using residual shear strengths for the liquefied soil layers. The residual shear strengths were obtained using a method by Seed & Harder (1990) that correlates corrected SPT blow counts to residual undrained shear strength. Our slope stability analysis obtained factors of safety less than 1.0, indicating failure of the slopes in the alluvial area adjacent to the drainage channel.

Based on our analysis, there is a potential for lateral spreading to occur however, for it to occur, both very high ground water conditions and a very strong earthquake would need to occur simultaneously. We judge the potential for lateral spreading to adversely affect the vicinity of the drainage channel to be high. The impact of lateral spreading on areas adjacent to the drainage channel (including Lot 11) was not quantified during this feasibility-level investigation, but should be further evaluated prior to site construction.

4.4.7 Liquefaction Discussion

Based on the liquefaction analysis and subsurface exploration we conducted at the project site, we make the following conclusions regarding liquefaction susceptibility:

- Soils susceptible to liquefaction are limited to the younger alluvial soil deposits adjacent to the drainage channel that bisects the site.
- The area where the proposed access road crosses the drainage channel is not considered susceptible to significant liquefaction, as evidenced by CPT-7 and CPT-8, which did not encounter significant amounts of liquefaction-susceptible soils.
- For the portion of access road within the drainage channel that is within the liquefaction hazard zone (as shown on Plate 8), some form of mitigation should be implemented to prevent liquefaction, seismic densification, and the associated post-liquefaction secondary effects such as lateral spreading. Mitigation would involve, at a minimum, subexcavation and recompaction of the alluvial soils underlying the roadway alignment. Other methods of mitigation to be considered may be include ground improvement techniques, such as vibro compaction, dynamic compaction, or compaction grouting.
- The current lot layout shows Lot 11, located on the west side of the drainage channel, to be underlain by a significant amount of liquefiable soils, as evidenced by CPT-2, CPT-3, and CPT-6. Due to the high potential for liquefaction and lateral spreading in the loose sandy soils along the drainage channel, design for Lot 11 should include additional subsurface exploration and engineering analysis to assess liquefaction. Based on the additional analysis, mitigation measures may be required to assure stable structures, foundations and other improvements. Likely mitigation may involve subexcavation and recompaction. However, other methods of mitigation, such as the ground improvement techniques also may be considered.
- The roadway that provides access to Lots 4, 5, and 6 is partially underlain by the younger alluvial deposits along the drainage channel, and this roadway is also impacted by the potential liquefaction-induced settlement and lateral spreading. Development of those lots is considered feasible from a geotechnical standpoint; however, liquefaction impacts to the roadway that provides vehicular access to these lots should be assessed in more detail prior to design and construction.

4.4.8 Seismic Densification Discussion

Dynamic densification is the densification of unsaturated, loose granular soils due to strong vibration such as that resulting from earthquake shaking. Granular soils and loose fills above ground water may be subject to such phenomenon. The potential for ground settlement to significantly affect the proposed improvements as a result of dynamic densification of native granular soils under the site is judged to be moderate. Using the method developed by Pradel (1998), we evaluated the settlement due to the seismic densification of the sand layers underlying the site and judge this settlement will be less than ½ to 1-inch within the younger alluvial soil deposits adjacent to the drainage channel.

4.5 Landslides and Slope Instability

In general, the hillslopes are judged to be relatively stable in the development area. However, four probable landslides were identified, indicating past instability. These landslides are located in colluvium and deeply weathered Tpps sandstone (Plate 8).

The two "active" (Als) landslides are both shallow features that are visible on 1939 aerial photography, and neither of them shows signs of significant movement since that time. Landslide A does not appear to significantly impact the development as currently proposed. Landslide B appears to be an area of accelerated creep within shallow colluvium above the central drainage channel, but does not appear to impact development of Lot 6.

The two "dormant" (Dls) landslides located on the west side of the central gully are both very old features based on subtle geomorphology and soil profile development. Exploration performed during this feasibility-level investigation indicates that Landslide C is not likely to significantly impact the proposed improvements. However, due to unforeseen results of grading, we recommend further evaluation of Landslide C during the design-level investigation for the subdivision road. No further evaluation appears to be necessary for Landslide D, which is located a significant distance from the proposed improvements.

4.6 Inundation and Flooding

Inundation occurs when the ground surface becomes submerged by flood waters. The proposed development is located on a hillside, at elevations above 300 feet and outside of mapped flood and inundation zones. Hillside drainage ravines (gullies) in the vicinity of the development are ephemeral, and flow only during heavy rains. It is anticipated that flows during rainy periods will be confined to the gullies and other incised drainages on the property. The proposed lots are situated outside of the gullies and should not be impacted by high flows. The potential for inundation due to natural flooding at the project site is nil.

The access road crosses the central gully, which is about 60 feet wide and 15 feet deep at the planned crossing. Refer to Section 4.4.7 above for a general description of liquefaction mitigation required for the loose sandy alluvial soils adjacent to the drainage channel.

4.7 Hazards from Geologic Materials

4.7.1 Expansive Materials

Highly expansive materials on the property generally are not present due to the granular nature of the underlying bedrock formations and overlying soils. Some very thin (less than 1 foot in thickness), soil horizons in the upper two to four feet of the surficial soils may be expansive. These materials should be removed during site grading for the road and structures, as part of standard stripping operations. It is anticipated that no special treatment of expansive materials will be required for the subdivision road. However, there is a potential for mudstone units to underlie portions of the development and should be tested for expansibility if encountered during site-specific geotechnical engineering investigations. The project geotechnical engineers for individual lot developments should provide site-specific geotechnical design criteria and construction recommendations based on their independent evaluations.

4.7.2 Naturally Occurring Asbestos

Naturally occurring asbestos is associated with ultramafic bedrock, which is not present at the project site. Therefore, the potential for naturally occurring asbestos to impact the development is nil.

4.7.3 Radon and Other Gases

Radon is a radioactive gas formed by decay of small amounts of uranium and thorium naturally present in rock and soil. Sometimes radon gas can move out from underlying soil and rock into houses and become concentrated in the indoor air, posing a health risk for occupants. According to Churchill (2008), four radon potential categories defined by the percentage of homes with indoor radon likely to equal or exceed 4.0 pCi/L are identified in State surveys: high (≥ 20 percent), moderate (≥ 5.0 to 19.9 percent), low (< 5 percent), and unknown (for geologic units with few or no data). According to a radon potential survey conducted for San Luis Obispo County, the Monterey Formation, which underlies the southernmost part of the property but does not underlie the proposed development area, is in the "high" category. The Pismo Formation, which underlies most of the development area, is considered to have insufficient data to be classified, but is shown as being in the "high" category on the map accompanying the report (Churchill, 2008). The Paso Robles Formation, which underlies portions of the proposed development, is in the "moderate" category.

For more information on radon, see the California Geological Survey website at http://www.conservation.ca.gov/cgs/minerals/hazardous_minerals/radon/Pages/Index.aspx.

The potential for the occurrence for other naturally-occurring potential hazardous gases, such as methane and hydrogen sulfide, is judged to be low.

4.7.4 Other Potential Hazards

Other potential geologic hazards, including hazards posed by tsunamis, seiches, and volcanic activity, were evaluated and found to be not significant to the project site.

The project site is not located on the coastline or near a large body of water; consequently, the potential hazards from tsunamis or seiches is judged to be nil.

Hazards associated with active volcanoes include inundation by ash, pyroclastic flows, and mudflows. The severity of volcanic hazards is associated with distance to the volcanic source, magnitude and type of volcanic activity, and direction of prevailing winds. No geologically recent volcanic deposits or other indications of recent volcanic activity are present in the San Luis Obispo area. Due to the lack of major volcanic activity in the vicinity, the potential for the site to be impacted by volcanic hazards is judged to be negligible.

4.8 Anticipated Geologic Constraints during Grading Operations

Thick colluvium was identified in the western part of the proposed development, and in the vicinity of the western access road and Lots 10 and 11. The colluvium is relatively weak, locally saturated, and prone to slow downslope creep. Design of the road sections and residential structures underlain by thick colluvium should consider the presence of this weak material, and be based on appropriate design-level investigations for the road and individual lots.

Subdivision grading is anticipated to be relatively minimal, with minor excavation and subgrade preparation for the road. Cuts and fills will be required for the western access road where it traverses the hillside up to Lots 12 and 13, and up to approximately 8 feet overexcavation will be required where the road crosses the hillside in the vicinity of Lots 10 and 11.

5.0 FINDINGS

5.1 Conclusions

1. In general, the proposed development is feasible from an engineering geologic and geotechnical engineering standpoint. Primary potential geotechnical constraints to all or portions of the proposed subdivision include strong earthquake ground shaking and liquefaction. In general, we anticipate that these potential geologic constraints can be reduced to an acceptable level, if recommendations presented in this report are followed.

2. Although unlikely based on age and hillslope evolution, potential shallow slope instability may be associated with existing colluvial landslides that are described in the text of this report. Additional geotechnical analyses should be performed during a design-level investigation to determine the appropriate type of mitigation measures for any road sections that are impacted by potential earth movement.

3. Significant portions of Lot 11, a smaller portion of Lot 6, and an approximately 50-foot section of the access road on the east side of the drainage channel are underlain by potentially liquefiable materials. Impacts of potential liquefaction include ground settlement up to 8 inches, when assuming high ground water levels at the time of strong earthquake ground shaking. The expected liquefaction-induced settlement diminishes with distance from the drainage channel. High ground water is an infrequent occurrence in the area, thus the likelihood of maximum settlement occurring is low. Supplemental investigation of liquefaction and lateral spreading impacts on Lots 4, 5, 6, 9, 10 and 11, and the portion of the access road crossing the alluvial materials around the central drainage channel, were performed to demonstrate geotechnical feasibility of those areas.

4. An approximately 400-foot-long section of the western access road, and portions of Lots 10 and 11 is underlain by relatively weak, hillside colluvium that is anticipated to be greater than approximately 5 feet in thickness. Design of this section of road and residential structures should consider the presence of this weak material, and be based on a design-level investigation for the road and individual lots.

5.2 Recommendations

1. We recommend that a design-level geotechnical investigation be performed to formulate site-appropriate geotechnical design criteria and construction recommendations for the proposed road.

2. The subdivision improvements do not include grading or pad preparation for residential structures. Following completion of subdivision improvements, design-level geotechnical engineering investigations should be performed for each lot.

Structures and foundations should be in conformance with the California Building Code guidelines, and based on geotechnical design criteria provide by the project geotechnical engineer for each lot.

3. The site-specific characteristics of earthquake ground shaking should be quantified and incorporated into structural design of the site structures, as part of site-specific engineering evaluations for individual lot development.
4. A plan for mitigation of potential liquefaction impacts to the affected improvements should be determined during the design-level geotechnical engineering investigation for the subdivision. In general, mitigation may involve subexcavation and recompaction of some portion of the alluvial soils underlying the improvements. It is recommended that potential liquefaction impacts on Lot 11 be evaluated as part of design-level geotechnical engineering investigations, and appropriate mitigation measures be developed.
5. Site development should incorporate sufficient surface and subsurface drainage improvements. Surface and subsurface water that is intercepted and collected by drainage improvements shall not be allowed to discharge onto, or upslope from, the artificial (cut and fill) slopes or landslide areas.
6. No development is currently proposed for the recommended fault setback zone. If future development is considered for the setback zone, then a fault investigation should be performed to identify and evaluate potential fault rupture hazard impacts on the proposed development.

5.3 Supplemental Services

Future engineering geologic and geotechnical services that are beyond the scope of our current contract may include one or more of the following:

- Consultation with the project civil engineer, owner and contractor, and possible discussions with County representatives regarding subdivision improvements.
- Review of the final subdivision development plans and preparation/submittal of a Geologic and Geotechnical Plan Review letter(s).
- During-construction engineering geologic and geotechnical observations and mapping.
- Documentation of as-built geologic and geotechnical conditions, including potential revisions to the engineering geologic map and cross sections presented in this report.

6.0 CLOSURE AND LIMITATIONS

Our services consist of professional opinions and recommendations made in accordance with generally accepted engineering geologic and geotechnical engineering principles and practices. No warranty, expressed or implied, or merchantability of fitness, is made or intended in connection with our work, by the proposal for consulting or other services, or by the furnishing of oral or written reports or findings.

This report has been prepared in order to provide our client with a feasibility-level engineering geologic hazards evaluation for the site(s) identified herein. Evaluations of other geologic hazards or conditions that are not specifically addressed in this report are beyond the scope of this investigation. Observations, findings and conclusions regarding this investigation are based on surface and subsurface investigations described herein. Numerical slope stability analyses would be required to develop a quantitative risk assessment of the slope.

In performing our work, we relied on information provided by our clients regarding the size, scope and location of proposed development site(s). Our findings pertain only to the specific development plan addressed herein, including lot locations and configurations, building envelopes, road alignment, etc. In the event that any new information pertaining to site conditions or proposed improvements is formulated, our conclusions and recommendations will not be considered valid unless the changes are reviewed and our conclusions are modified or approved in writing. Unanticipated soil and geologic conditions are commonly encountered during earthwork and construction, which cannot be fully determined from review of existing data. Such conditions may require additional expenditures during grading or construction to obtain a properly constructed project.

This report is issued with the understanding that it is the responsibility of the owner(s), or owner representative(s), to ensure that the information and recommendations contained herein are called to the attention of the project engineer(s) and incorporated into plans. Furthermore, it is also the responsibility of the owner(s), or owner representative(s), to ensure that contractors and subcontractors carry out such recommendations in the field. The owner's contractor should be informed of the need for geologic and geotechnical inspections. Conclusions and recommendations provided in this report are contingent on Geoinsite, Inc. reviewing drawings that may be prepared and submitted for permit applications.

The findings of this report are valid for the present time for the site and structures identified herein. With the passage of time, changes in site conditions can occur, whether they are due to natural processes or to human activities on this or adjacent properties. Therefore, this report should not be relied upon after a period of one year, or if changes become evident prior to the passage of one year, without our express consent.

PROFESSIONAL GEOLOGIST
WILLIAM F. COLE
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CERTIFIED
ENGINEERING
GEOLOGIST
STATE OF CALIFORNIA

Respectfully,

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Certified Hydrogeologist 403

REGISTERED PROFESSIONAL ENGINEER
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GE 2367
GEOTECHNICAL
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CAL ENGINEERING & GEOLOGY, INC.

Daniel Peluso, GE 2367
Associate Engineer

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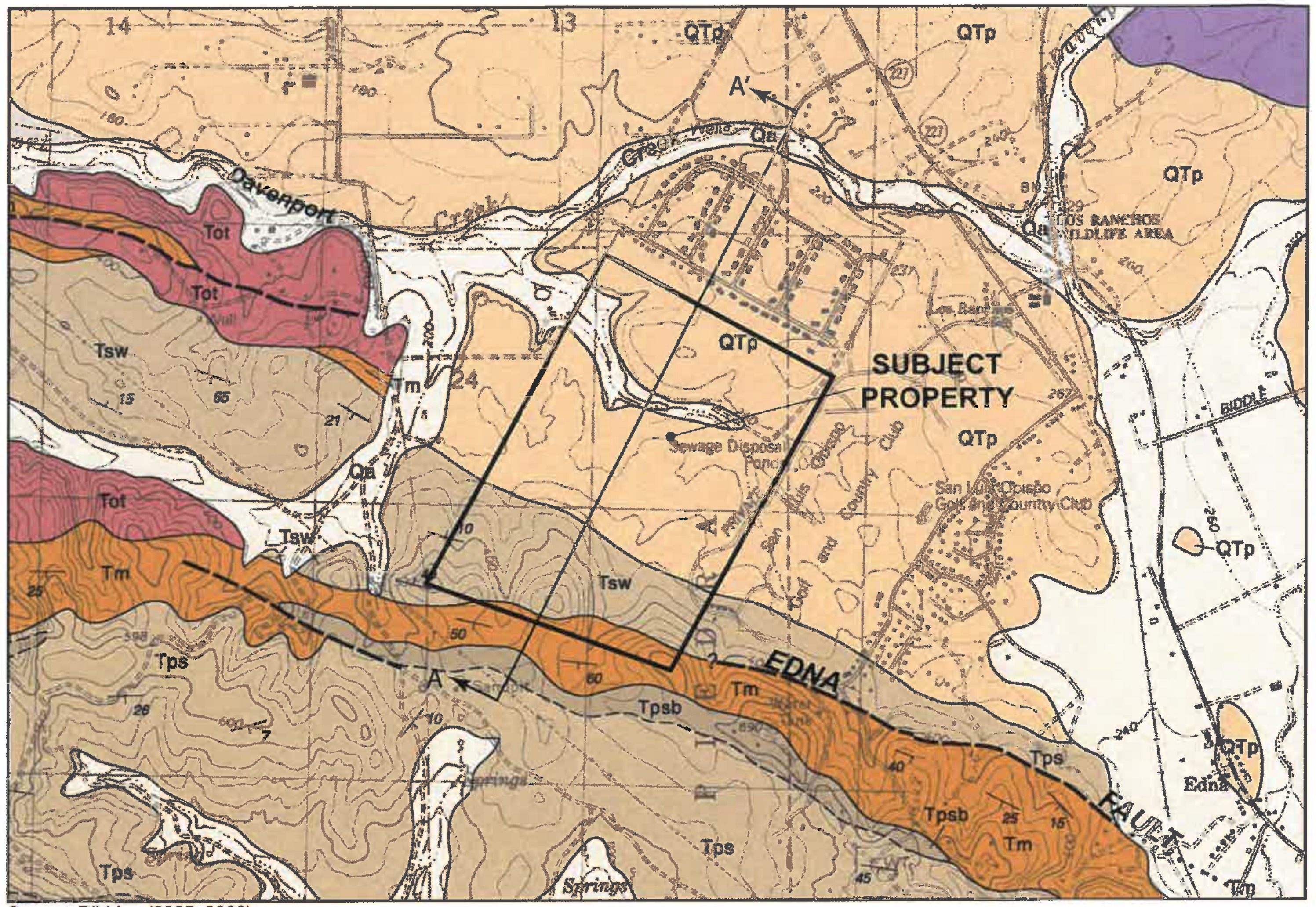
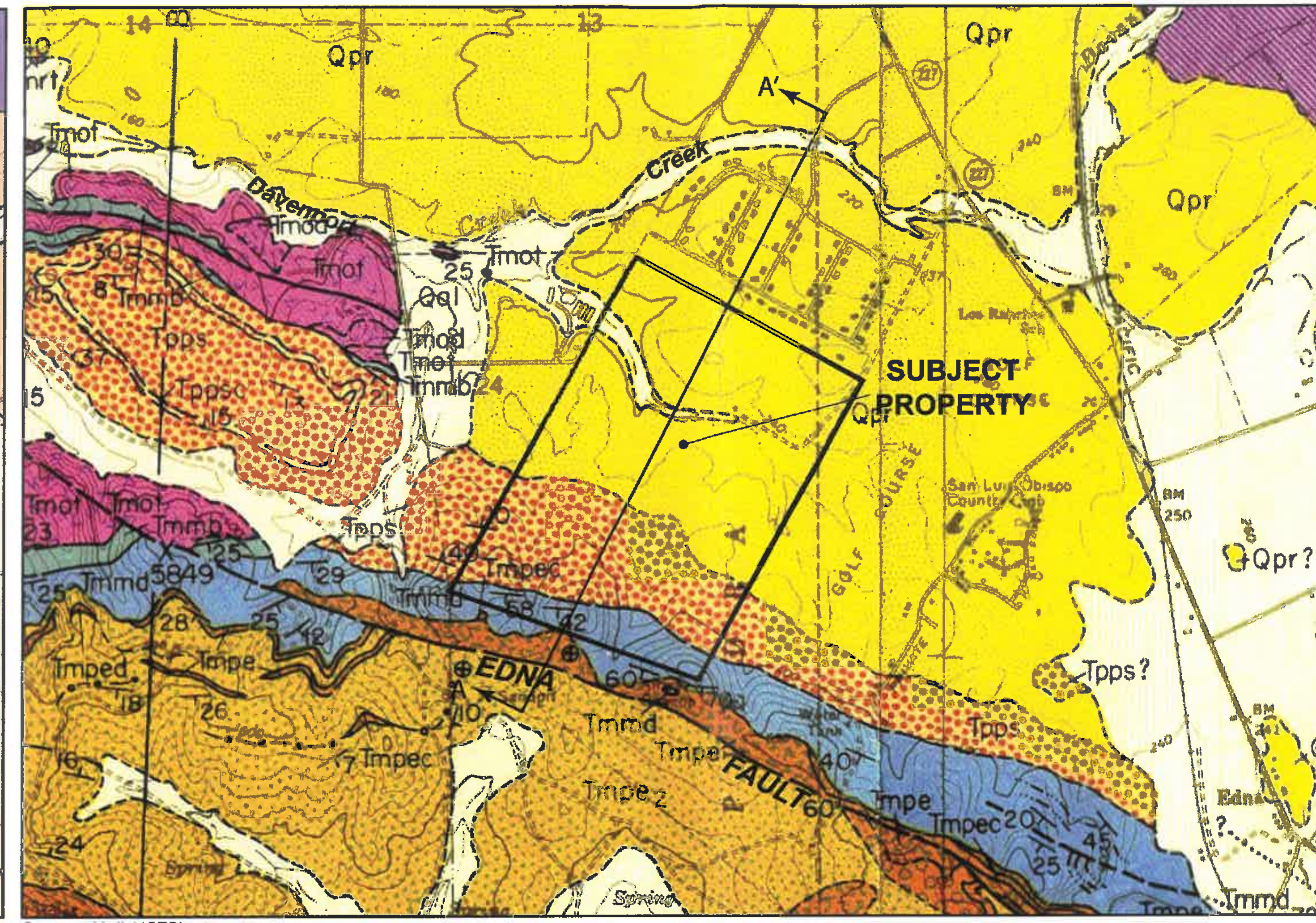
Aerial Photographs

Date	Type	Approximate Scale	Identification	Source
1939	b&w	1:20,000	AXH-1939-ARMY-102-107, 108, 125, 126	U.C. Santa Barbara
2/13/1969	b&w	1:12,000	HB-OE-30, 31	U.C. Santa Barbara
8/21/1987	b&w	1:24,000	GS-VFLO-C-4-86, 87, 88	U.C. Santa Barbara
7/1/1999	color	1:12,000	GS-3913 1-1, 3-1	Golden State Aerial

PLATES



Source: Dibblee (2005, 2006)



Source: Hall (1973)

EXPLANATION

Symbol	Unit
Qa	Surficial Sediments
QTp	Paso Robles Formation
Tsw	Squire Sandstone
Tps / Tpsb	Pismo Formation
Tm	Monterey Formation
Tot	Obispo Formation
fm	Franciscan Assemblage

- Contact
- Fault
- 26 Strike and dip of bedding
- A A' Vicinity geologic cross section

EXPLANATION

Symbol	Unit
Qal	Alluvial Deposits
Qpr	Paso Robles Formation
Tpps	Squire Member, Pismo Formation
Tmpe	Edna Member, Pismo Formation
Tmmc	Monterey Formation
Tmo	Obispo Formation
mv	Franciscan rocks

- Contact
- Fault
- 26 Strike and dip of bedding
- A A' Vicinity geologic cross section

N

1,000 0 1,000 2,000

Scale in Feet

GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			REGIONAL GEOLOGY MAP
	Scale: As Noted	C1501	June 2016	Plate 1

EXPLANATION

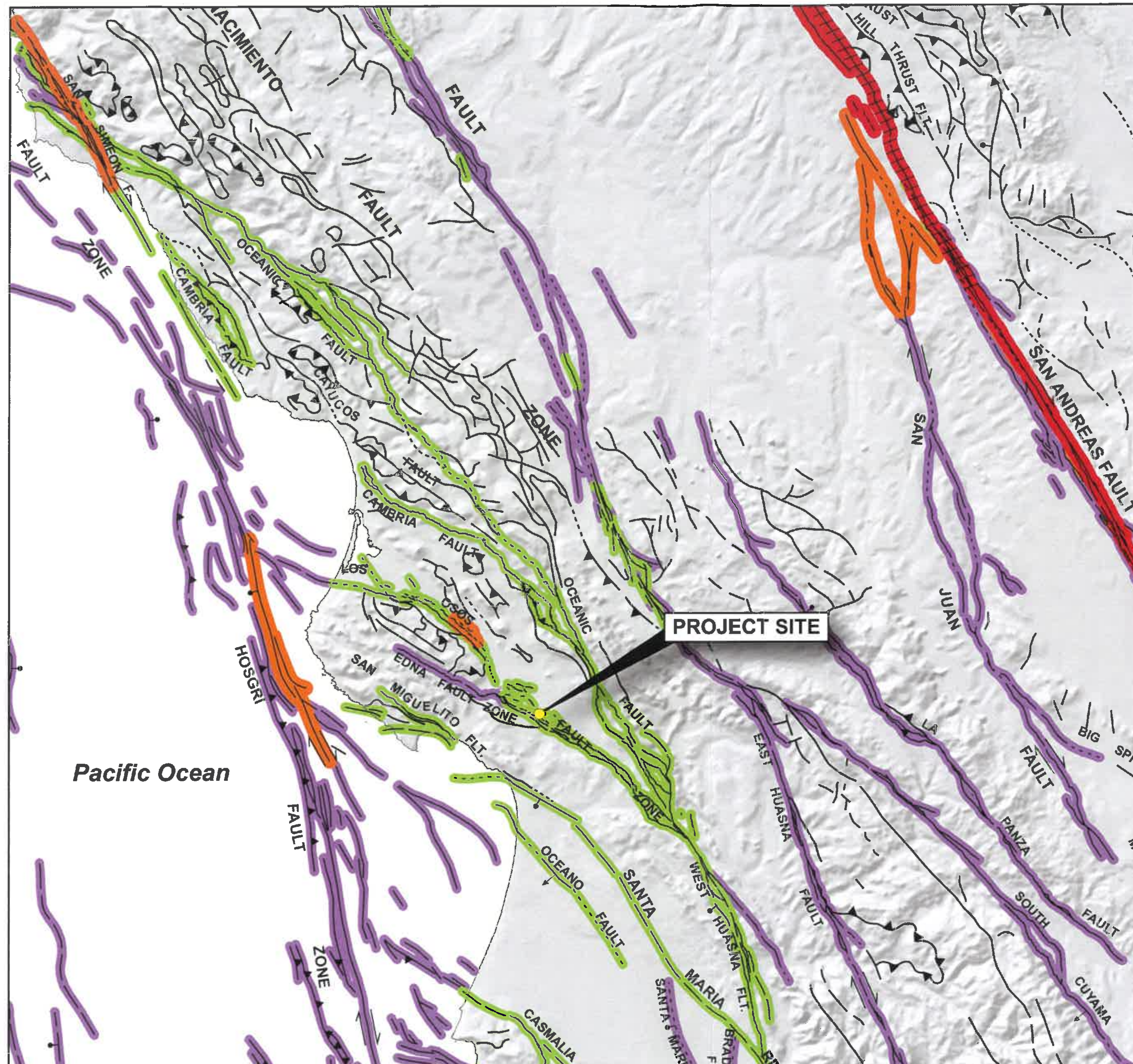
Geologic Time Scale			Years Before Present (Approx.)	Fault Symbol	Recency of Movement	DESCRIPTION ON LAND	DESCRIPTION OFFSHORE
Quaternary	Late Quaternary	Historic	200			Displacement during historic time (e.g. San Andreas fault 1906). Includes areas of known fault creep.	
Quaternary	Late Quaternary	Holocene	11,700			Displacement during Holocene time.	Fault offsets seafloor sediments or strata of Holocene age.
Quaternary	Late Quaternary	Pleistocene	700,000			Faults showing evidence of displacement during late Quaternary time.	Fault cuts strata of Late Pleistocene age.
Quaternary	Early Quaternary	Pleistocene	1,600,000*			Undivided Quaternary faults - most faults in this category show evidence of displacement during the last 1,600,000 years; possible exceptions are faults which displace rocks of undifferentiated Plio-Pleistocene age.	Fault cuts strata of Quaternary age.
Pre-Quaternary			4.5 billion (Age of Earth)			Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.	Fault cuts strata of Pliocene or older age.

* Quaternary now recognized as extending to 2.6 Ma (Walker and Geissman, 2009). Quaternary faults in this map were established using the previous 1.6 Ma criterion.

N

0 5 10 15

Scale in Miles



Base Map: Jennings and Bryant (2010)

GEOINSITE

ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION
Jack Ranch Property
San Luis Obispo County, CA

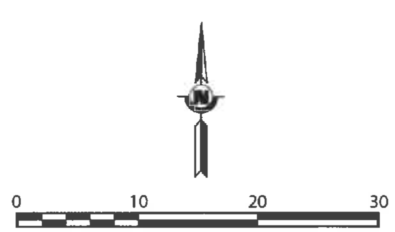
REGIONAL FAULT MAP

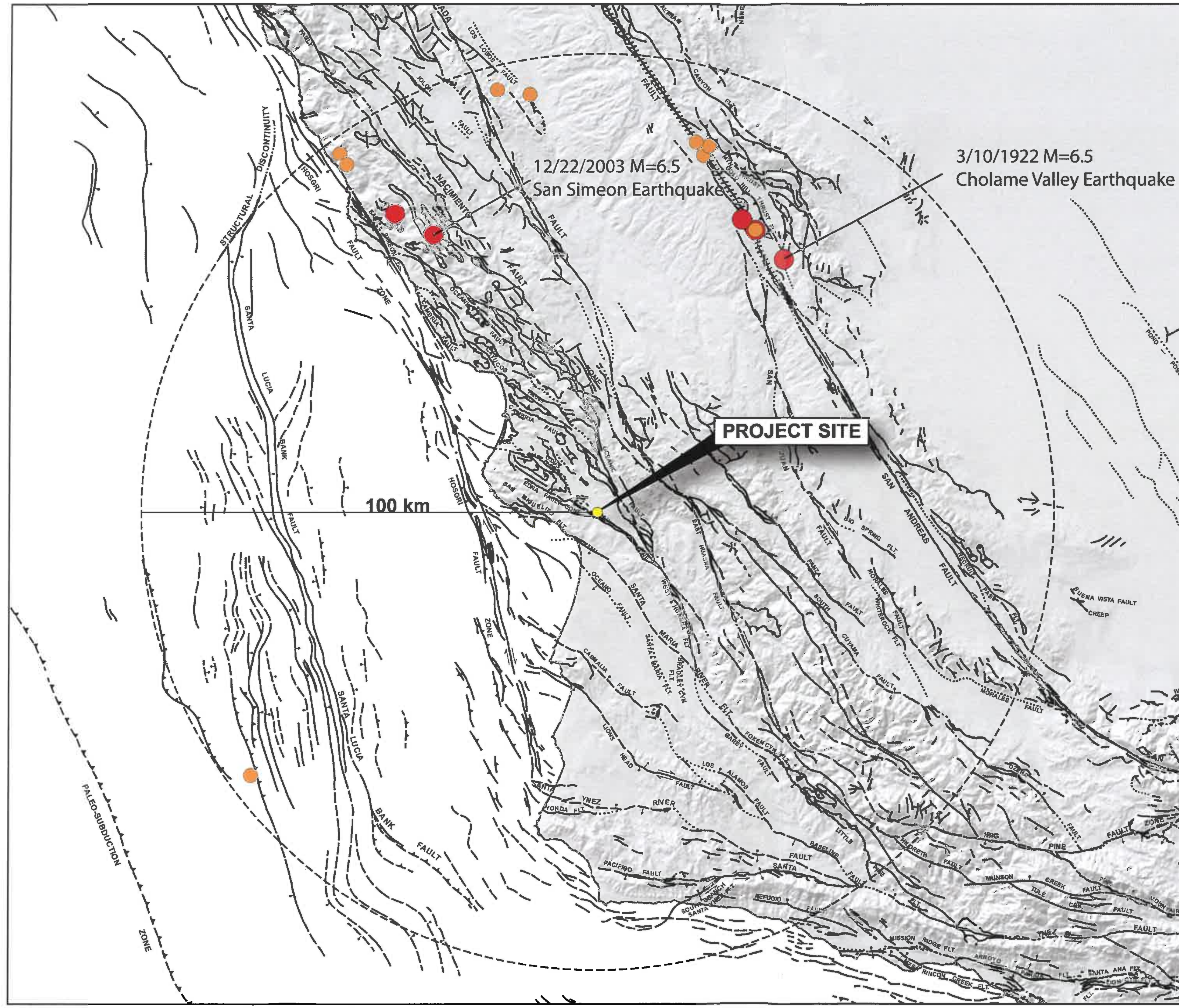
Scale: As Noted	C1501	June 2016	Plate 2

EXPLANATION

- Earthquake magnitude 5.0 - 5.9
- Earthquake magnitude 6.0 - 6.9
- Fault – solid where well located, dashed where approximate or inferred, dotted where concealed. Bar and ball on downthrown side. Barbs on upper plate of low angle fault.

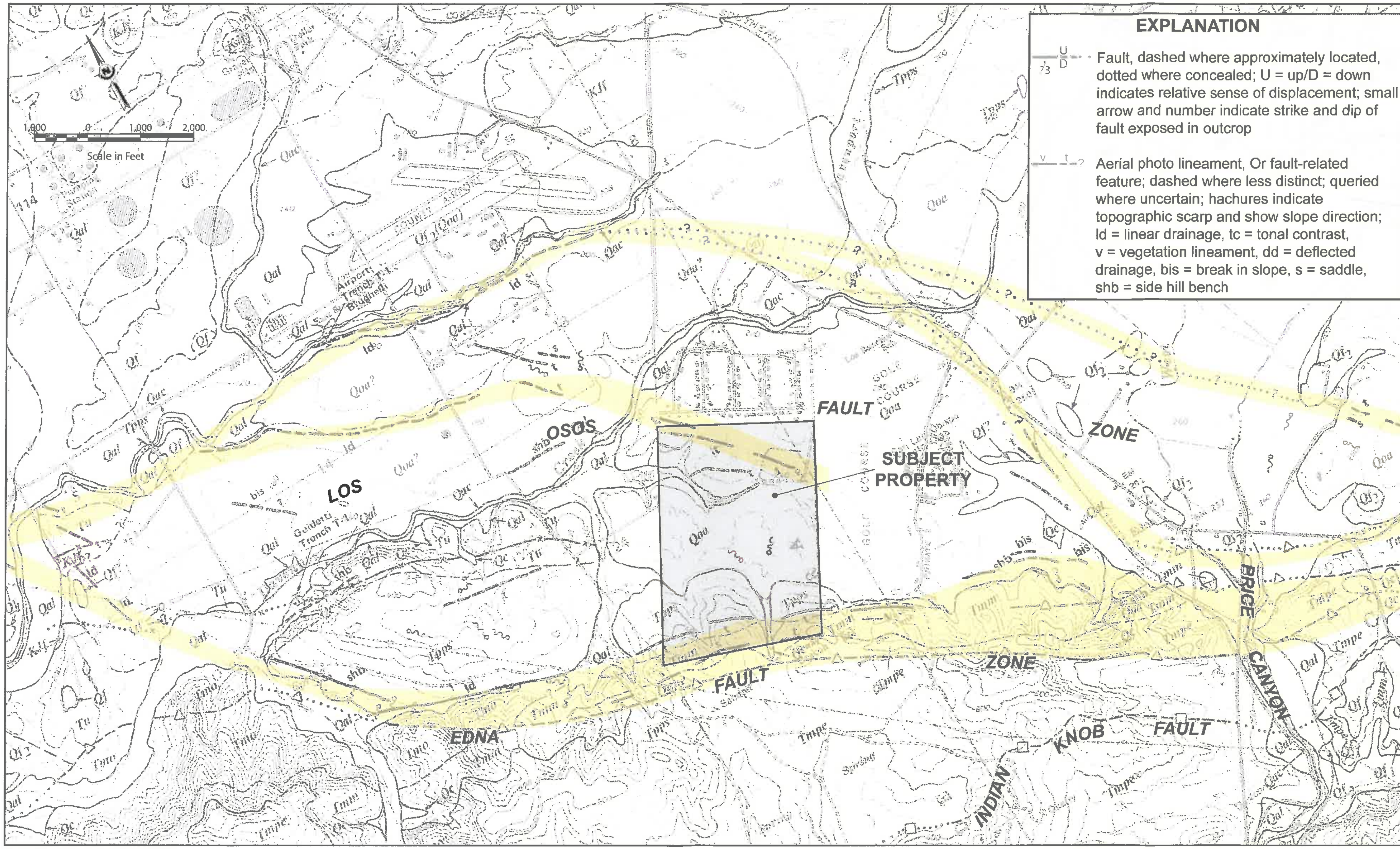
Note: This map depicts earthquakes within 100 km of the project site with magnitude ≥ 5.0 between January 1898 and May 2015 (ANNS catalog). The largest earthquakes in the area were two magnitude 6.5 events (labeled on map).





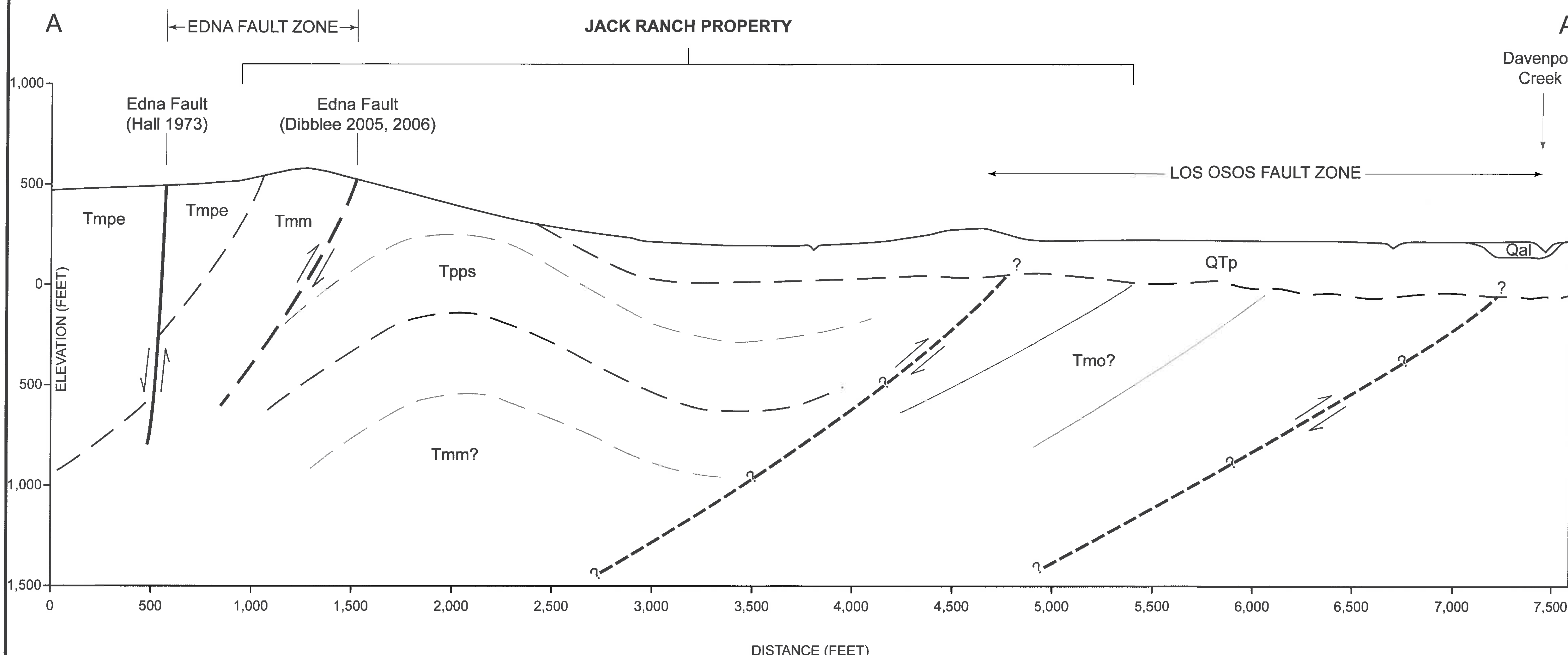
Base Map: Jennings and Bryant (2010)

GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			REGIONAL SEISMICITY MAP
	Scale: As Noted	C1501	June 2016	Plate 3



Base Map: Lettis and Hall (1994)

GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			QUATERNARY GEOLOGIC MAP OF THE LOS OSOS FAULT ZONE
	Scale: As Noted	C1501	June 2016	Plate 4



GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			VICINITY GEOLOGIC CROSS SECTION
	Scale: As Noted	C1501	June 2016	Plate 5

EXPLANATION

EARTH MATERIALS:

Af	Artificial fill
Als/Dls	Probable Landslide, Als=active landslide; Dls=dormant landslide (Holocene)
Qc	Colluvium, typ. >5 feet in thickness (Holocene)
Qal	Alluvium (Holocene)
QTp	Paso Robles Formation (Pleistocene-Pliocene)
Tpps	Squire Member, Pismo Formation (Pliocene)
Tmpe	Edna Member, Pismo Formation (Miocene)
Tmm	Monterey Formation (Miocene)

SYMBOLS:

	Geologic contact, approximate; dotted where concealed, queried where uncertain.
U / D	Fault, dashed where approximate, dotted where concealed. U on upthrown side, D on downthrown side.
	Geomorphic lineament (Lettis and Hall, 1994 and this study).
××××	Prominent bedrock outcrop
(A)	Landslide described in report text
40	Strike and dip of stratification
TP-6	Test pit location (this study)
GT-5	Trench location (this study)
LD-9	Large-Diameter Boring location (this study)
GB-4	Geotechnical Boring location (this study)
CPT-12	Cone Penetration Test (this study)
T-8	Trench location (GeoSolutions 2000)
PZ1 (2000)	Piezometer location (GeoSolutions 2000, 2005)
4 — 4'	Engineering geologic cross section
Lot 13	Proposed residential lot and building envelope
	Proposed road

N

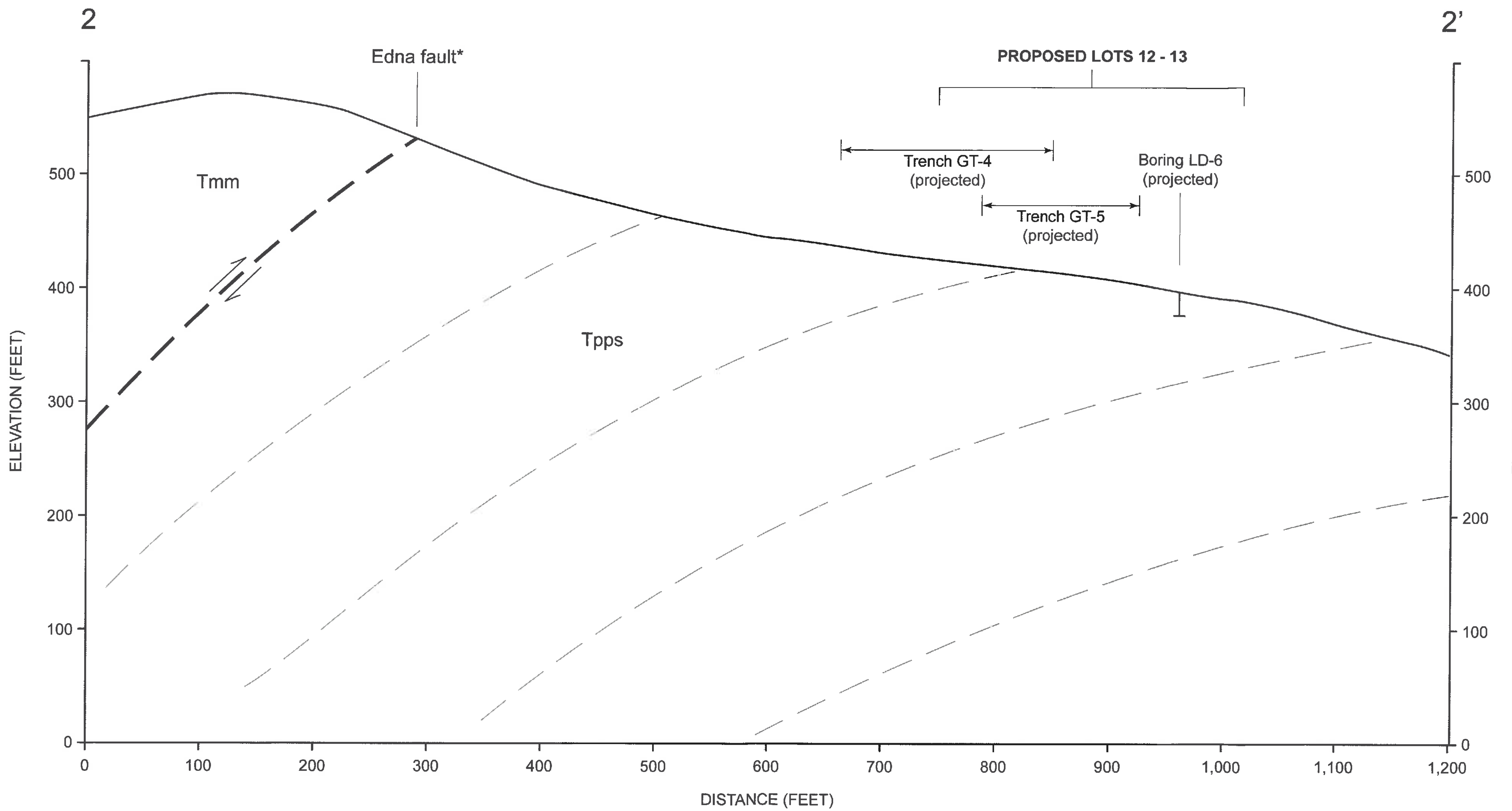
0 100 200 400 Feet

GEOINSITE

ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION
Jack Ranch Property
San Luis Obispo County, CA

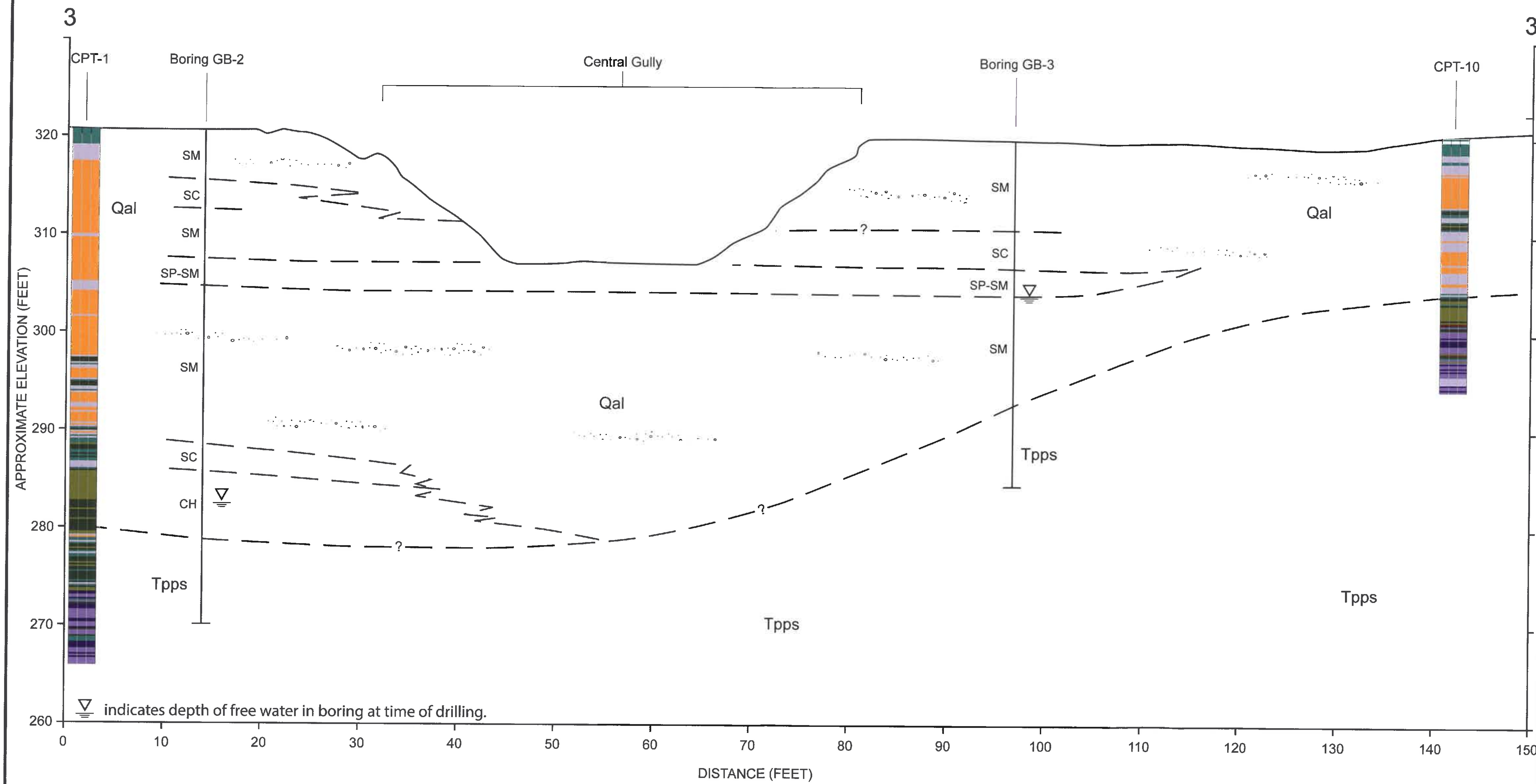
ENGINEERING GEOLOGIC MAP

Scale: As Noted	C1501	June 2016	Plate 6

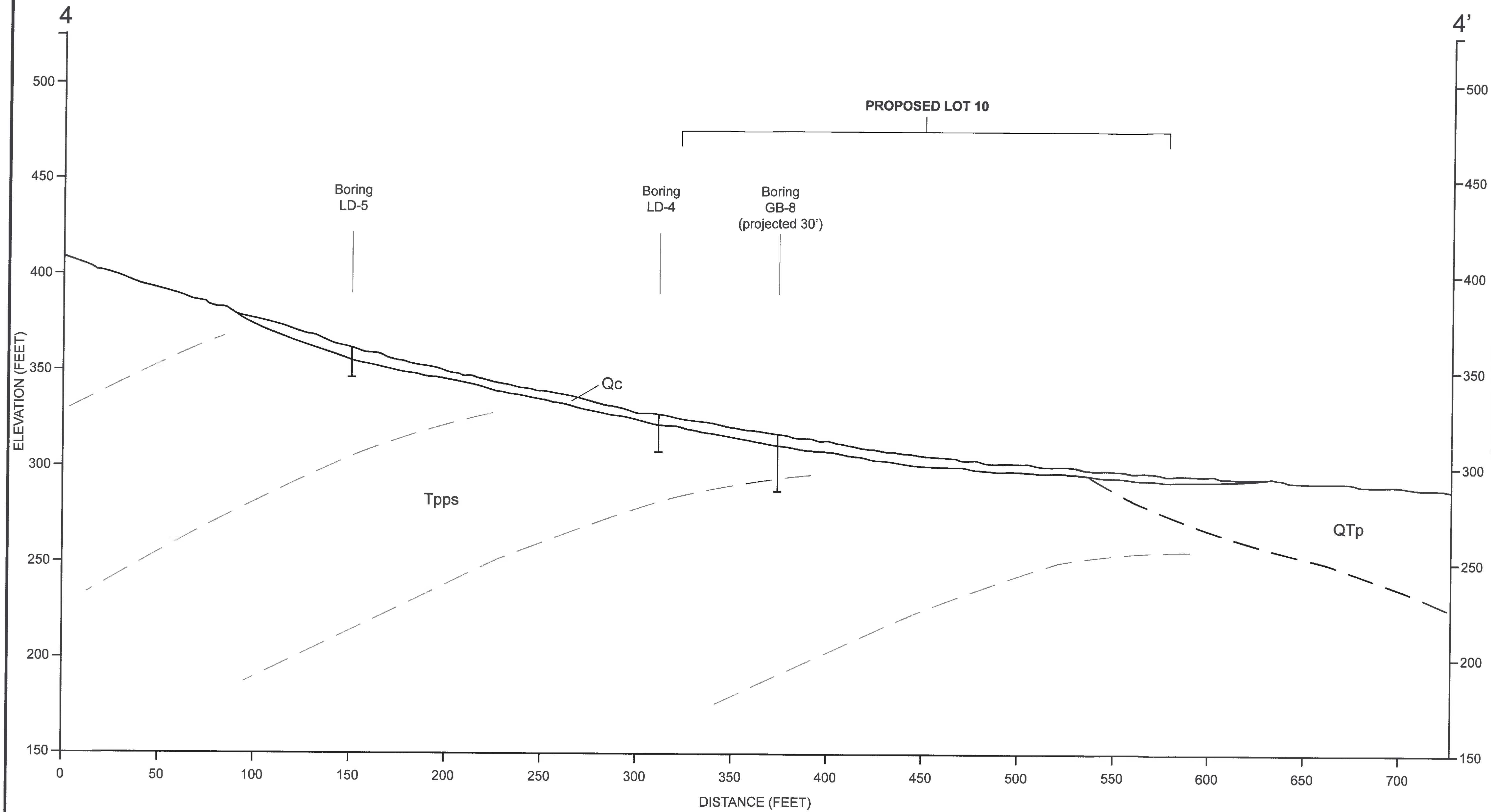


*Note: Edna fault location is based on faulted Tmm-Tpps contact from Dibblee (2005, 2006) and results of this study.

GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			ENGINEERING GEOLOGIC CROSS SECTION 2 -2'
	Scale: As Noted	C1501	June 2016	Plate 7B



GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			ENGINEERING GEOLOGIC CROSS SECTION 3 -3'
	Scale: As Noted	C1501	June 2016	Plate 7C



GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			ENGINEERING GEOLOGIC CROSS SECTION 4 - 4'
	Scale: As Noted	C1501	June 2016	Plate 7D

GEOINSITE

ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION
Jack Ranch Property
San Luis Obispo County, CA

GEOLOGIC HAZARDS AND CONSTRAINTS MAP

Scale: As Noted	C1501	June 2016	Figure 8

APPENDIX A

FIELD INVESTIGATION

EXPLORATORY TRENCH LOGS

UNIT DESCRIPTIONS GT-1:

Soil:

"A" horizon – Sandy Clay; mottled moderate yellow brown to pale yellow brown (10 YR 5/4 - 6/2); with rootlets; friable, dry, desiccated with random fissures; lower contact distinct and gradational.

"B_1" horizon – Silty Clay, dark yellow brown (10 YR 4/2); plastic, stiff, damp; fissured zone of illuviation; lower contact distinct and gradational.

"B_2" horizon – Gravelly Clay; thin, local transition between soil and weathered rock.

Rock units:

Ⓐ – Siltstone-Mudstone; grayish orange to very pale orange (10 YR 5/4 – 8/2); stratified, tuffaceous, low density, low hardness, weak-moderate strength, closely fractured; deeply weathered, oxidized with Mn staining on fracture surfaces, some clay-filled laminae and fractures; dry. Abrupt contacts along bedding planes. (Tpps)

Ⓑ – Sandstone; pale yellow brown to grayish orange (10 YR 6/2 – 5/4); mostly massive but with local indistinct pebbles and clayey sandstone interbeds; dense, friable strength, closely fractured, deeply weathered, dry. (Tpps)

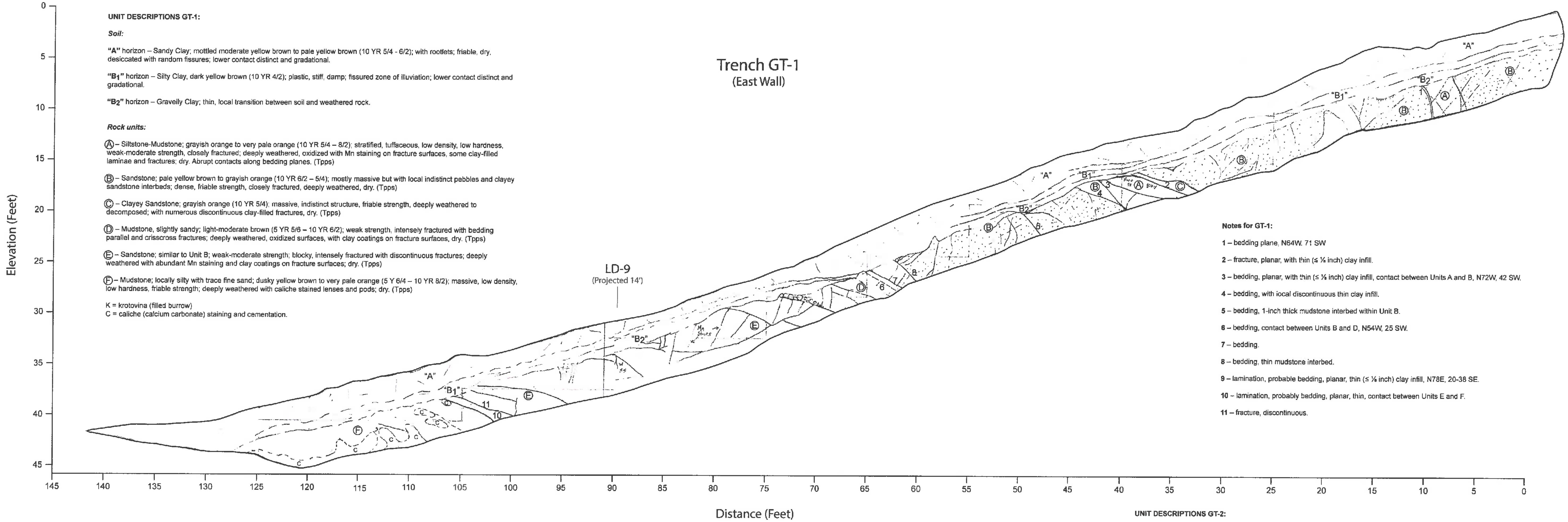
Ⓒ – Clayey Sandstone; grayish orange (10 YR 5/4); massive, indistinct structure, friable strength, deeply weathered to decomposed; with numerous discontinuous clay-filled fractures, dry. (Tpps)

Ⓓ – Mudstone, slightly sandy; light-moderate brown (5 YR 5/6 – 10 YR 6/2); weak strength, intensely fractured with bedding parallel and crisscross fractures; deeply weathered, oxidized surfaces, with clay coatings on fracture surfaces, dry. (Tpps)

Ⓔ – Sandstone; similar to Unit B; weak-moderate strength; blocky, intensely fractured with discontinuous fractures; deeply weathered with abundant Mn staining and clay coatings on fracture surfaces; dry. (Tpps)

Ⓕ – Mudstone; locally silty with trace fine sand; dusky yellow brown to very pale orange (5 Y 6/4 – 10 YR 8/2); massive, low density, low hardness, friable strength; deeply weathered with caliche stained lenses and pods; dry. (Tpps)

K = krotovina (filled burrow)
C = caliche (calcium carbonate) staining and cementation.



Notes for GT-1:

1 – bedding plane, N64W, 71 SW

2 – fracture, planar, with thin (≤ ⅛ inch) clay infill.

3 – bedding, planar, with thin (≤ ⅛ inch) clay infill, contact between Units A and B, N72W, 42 SW.

4 – bedding, with local discontinuous thin clay infill.

5 – bedding, 1-inch thick mudstone interbed within Unit B.

6 – bedding, contact between Units B and D, N54W, 25 SW.

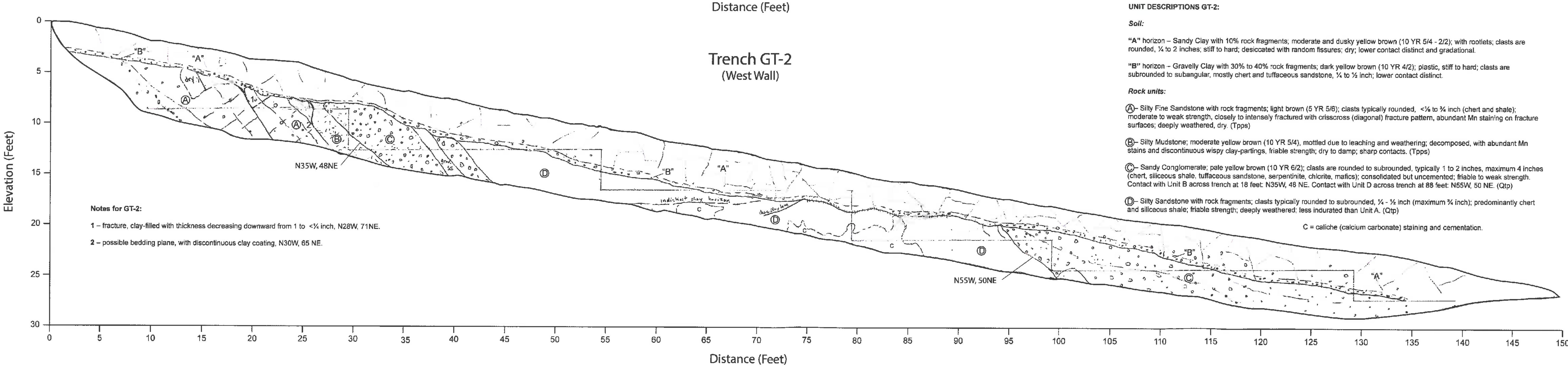
7 – bedding.

8 – bedding, thin mudstone interbed.

9 – lamination, probable bedding, planar, thin (≤ ⅛ inch) clay infill, N78E, 20-38 SE.

10 – lamination, probably bedding, planar, thin, contact between Units E and F.

11 – fracture, discontinuous.



Notes for GT-2:

1 – fracture, clay-filled with thickness decreasing downward from 1 to <¼ inch, N28W, 71NE.

2 – possible bedding plane, with discontinuous clay coating, N30W, 65 NE.

UNIT DESCRIPTIONS GT-2:

Soil:

"A" horizon – Sandy Clay with 10% rock fragments; moderate and dusky yellow brown (10 YR 5/4 - 2/2); with rootlets; clasts are rounded, ¼ to 2 inches; stiff to hard; desiccated with random fissures; dry; lower contact distinct and gradational.

"B" horizon – Gravelly Clay with 30% to 40% rock fragments; dark yellow brown (10 YR 4/2); plastic, stiff to hard; clasts are subrounded to subangular, mostly chert and tuffaceous sandstone, ¼ to ½ inch; lower contact distinct.

Rock units:

Ⓐ – Silty Fine Sandstone with rock fragments; light brown (5 YR 5/6); clasts typically rounded, <⅛ to ¾ inch (chert and shale); moderate to weak strength, closely to intensely fractured with crisscross (diagonal) fracture pattern, abundant Mn staining on fracture surfaces; deeply weathered, dry. (Tpps)

Ⓑ – Silty Mudstone; moderate yellow brown (10 YR 5/4), mottled due to leaching and weathering; decomposed, with abundant Mn stains and discontinuous wispy clay-partings, friable strength; dry to damp; sharp contacts. (Tpps)

Ⓒ – Sandy Conglomerate; pale yellow brown (10 YR 6/2); clasts are rounded to subrounded, typically 1 to 2 inches, maximum 4 inches (chert, siliceous shale, tuffaceous sandstone, serpentinite, chlorite, mafics); consolidated but uncemented; friable to weak strength. Contact with Unit B across trench at 18 feet: N35W, 48 NE. Contact with Unit D across trench at 88 feet: N55W, 50 NE. (Qtp)

Ⓓ – Silty Sandstone with rock fragments; clasts typically rounded to subrounded, ¼ - ½ inch (maximum ¾ inch); predominantly chert and siliceous shale; friable strength; deeply weathered; less indurated than Unit A. (Qtp)

C = caliche (calcium carbonate) staining and cementation.

Note: Field logging on April 12 - 18, 2015

GEOINSITE

ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION
Jack Ranch Property
San Luis Obispo County, CA

LOGS OF EXPLORATORY TRENCHES
GT-1 & GT-2

Scale: As Noted	C1501	June 2016	Figure A1

UNIT DESCRIPTIONS:

Soil:

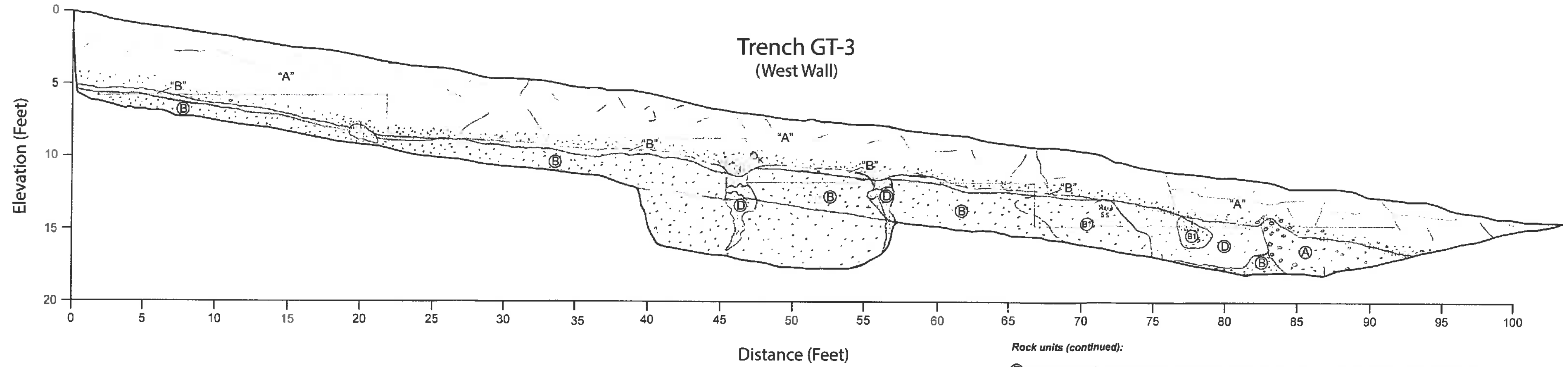
"A" horizon – Clayey Sand, locally Sandy Clay, locally with trace rock fragments; dusky brown (5 YR 2/2); with roots, rootlets and open and filled burrows; friable, dry, desiccated with random fissures; lower contact distinct and gradational.

"E" horizon – Clayey Sand with rock fragments, clasts typically ≤ ¼ inch; moderate brown (5 YR 4/4); leached horizon, moderately dense; distinct upper and lower contacts; dry. Horizon is thicker over sandier intervals.

"B" horizon – Sandy Silty Clay; Gravelly clay; moderate brown (5 YR 4/4); stiff to hard, plastic, with angular sandstone clasts < 4 inches in upslope 10 feet of trench; distinct and abrupt lower contact; dry.

Rock units:

Ⓐ – Sandy Conglomerate; very light grey to grayish orange (N3 - 5 YR 7/2), and light brown to pale yellow brown (5 YR 5/6 – 10 YR 6/2); generally massive, slightly cemented; clasts typically ⅛- 1 inches (consisting of quartz, siliceous shale, tuff), angular to subrounded; low hardness, weak-moderate strength, closely fractured; upper 2 feet generally very deeply weathered to decomposed; deep to moderately weathered below 2 feet; dry. (Tpps)



Rock units (continued):

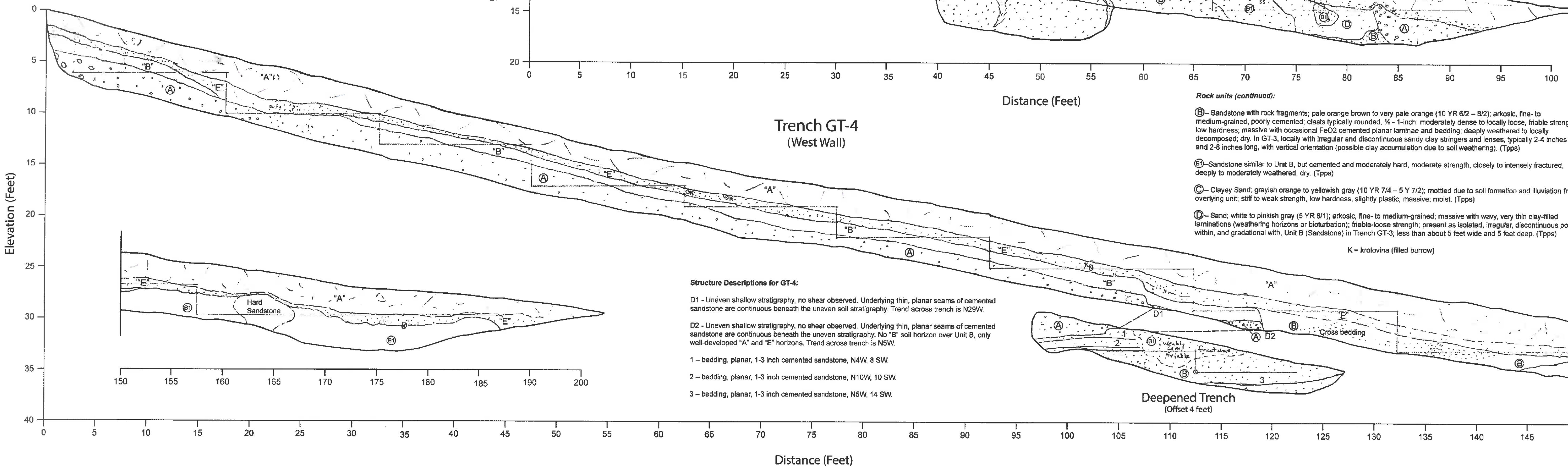
Ⓑ – Sandstone with rock fragments; pale orange brown to very pale orange (10 YR 6/2 – 8/2); arkosic, fine- to medium-grained, poorly cemented; clasts typically rounded, ½ - 1-inch; moderately dense to locally loose, friable strength, low hardness; massive with occasional FeO2 cemented planar laminae and bedding; deeply weathered to locally decomposed; dry. In GT-3, locally with irregular and discontinuous sandy clay stringers and lenses, typically 2-4 inches wide and 2-8 inches long, with vertical orientation (possible clay accumulation due to soil weathering). (Tpps)

Ⓑ1 – Sandstone similar to Unit B, but cemented and moderately hard, moderate strength, closely to intensely fractured, deeply to moderately weathered, dry. (Tpps)

Ⓒ – Clayey Sand; grayish orange to yellowish gray (10 YR 7/4 – 5 Y 7/2); mottled due to soil formation and illuviation from overlying unit; stiff to weak strength, low hardness, slightly plastic, massive; moist. (Tpps)

Ⓓ – Sand; white to pinkish gray (5 YR 8/1); arkosic, fine- to medium-grained; massive with wavy, very thin clay-filled laminations (weathering horizons or bioturbation); friable-loose strength; present as isolated, irregular, discontinuous pods within, and gradational with, Unit B (Sandstone) in Trench GT-3; less than about 5 feet wide and 5 feet deep. (Tpps)

K = krotovina (filled burrow)



Structure Descriptions for GT-4:

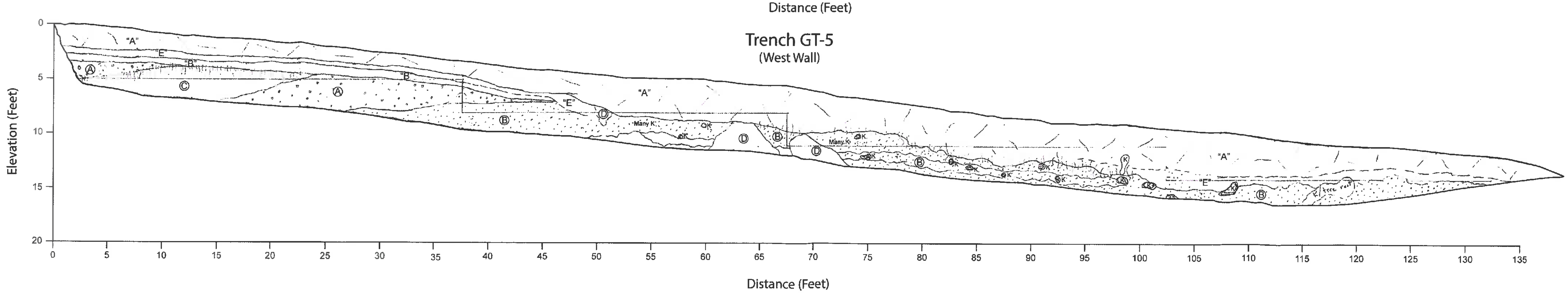
D1 - Uneven shallow stratigraphy, no shear observed. Underlying thin, planar seams of cemented sandstone are continuous beneath the uneven soil stratigraphy. Trend across trench is N29W.

D2 - Uneven shallow stratigraphy, no shear observed. Underlying thin, planar seams of cemented sandstone are continuous beneath the uneven stratigraphy. No "B" soil horizon over Unit B, only well-developed "A" and "E" horizons. Trend across trench is N5W.

1 – bedding, planar, 1-3 inch cemented sandstone, N4W, 8 SW.

2 – bedding, planar, 1-3 inch cemented sandstone, N10W, 10 SW.

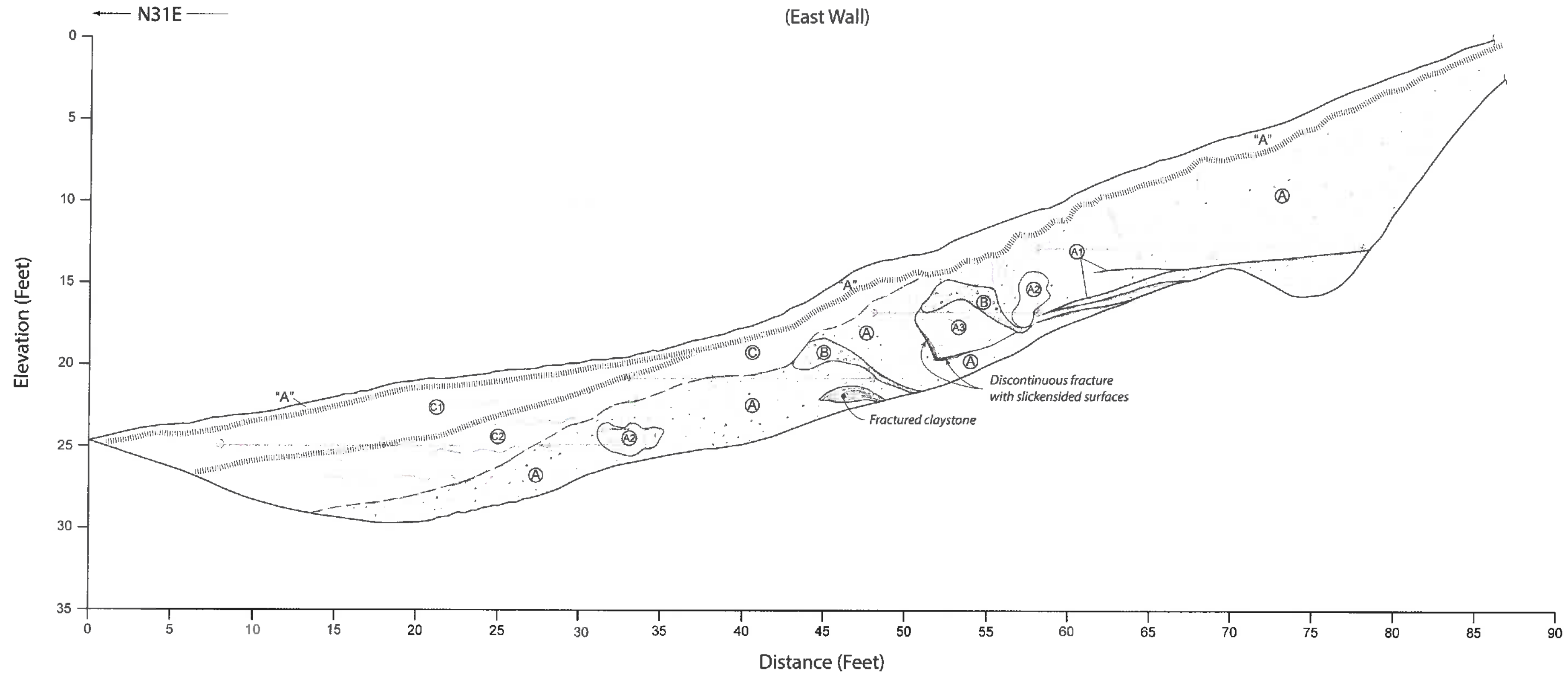
3 – bedding, planar, 1-3 inch cemented sandstone, N5W, 14 SW.



Note: Field logging on April 12 - 18, 2015

GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA		LOGS OF EXPLORATORY TRENCHES GT-3, GT-4 & GT-5
	Scale: As Noted	C1501	June 2016	Figure A2

Trench GT-6
(East Wall)



UNIT DESCRIPTIONS GT-6 & GT-7 and TP-5 & TP-6:

Soil:

"A" horizon – Fine Sand with clay, locally with trace rock fragments; dusky brown (5 YR 2/2); with roots, rootlets and disseminated organics; friable, loose, dry, desiccated with random fissures; lower contact distinct and gradational.

Colluvium:

Ⓒ– Poorly Graded Sand with clay and rock fragments, moderate brown to moderate yellowish brown (5 YR 5/4 – 10 YR 5/4); fine- to medium-grained sand with estimated 10-20% fines and 5-10% clasts; clasts typically ¼ to 1-inch, angular; larger clasts (up to several inches) in GT-7; indistinct stone lines locally; distinct upper and lower contacts are gradational; loose, moist to dry, wet locally; with wavy discontinuous dark seams which may be clay-accumulation horizons associated with soil development.

In GT-6, Unit C can be subdivided into upper (C1) and lower (C2) sub-units. C1 is darker, more organic (dark yellow brown, 10 YR 4/2), and C2 is lighter, less organic (moderate yellow brown, 10 YR 5/4). Contacts are distinct and gradational.

Rock units:

Ⓐ – Sandstone to Pebbly Sandstone; grayish orange to dark yellow orange (10 YR 7/4 – 10 YR 6/6); arkosic, fine- to medium grained sand, with estimated 10=15% fines and 10-15% clasts; clasts typically ⅛ to ¼ inch, rounded (consisting of quartz, siliceous shale, tuff); generally massive but with local stratification visible, poorly to weakly cemented;, low hardness, weak-moderate strength, deeply weathered to decomposed; dry, becoming moist in lower part of GT-6 and GT-7.

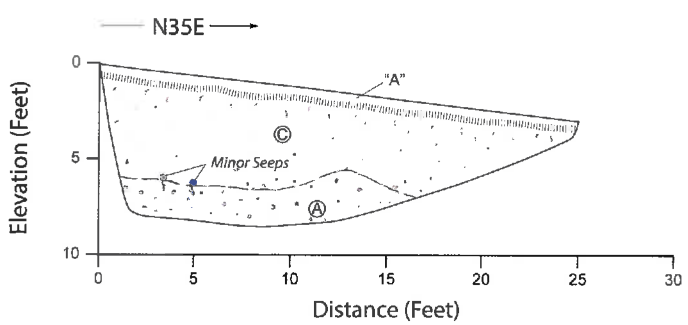
(A1) – Claystone seams (thin beds) within Unit A, generally ½ to 1-inch thick, subparallel stratification, weathered.

(A2) – Sandy Siltstone; grayish orange (10 YR 7/4); weakly cemented; massive, weak strength, friable hardness, deeply weathered, dry.

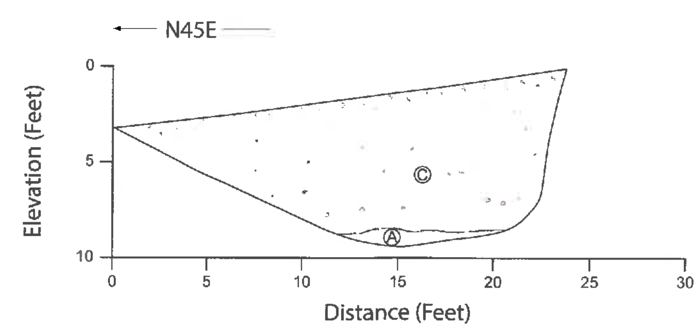
(A3) – Sandstone to Pebbly Sandstone, similar to Unit A, but well-cemented, hard and with thin, discontinuous, dark yellow brown claystone stringers.

Ⓑ– Sandy Conglomerate; grayish orange (10 YR 7/4); estimated 50-60% rock clasts, 30-40% medium- to coarse-grained sand, 5% fines; clasts are rounded to subrounded, ¼ to ¾ inch; weakly cemented; low hardness, weak strength, deeply weathered with discontinuous, irregular clay stringers; dry.

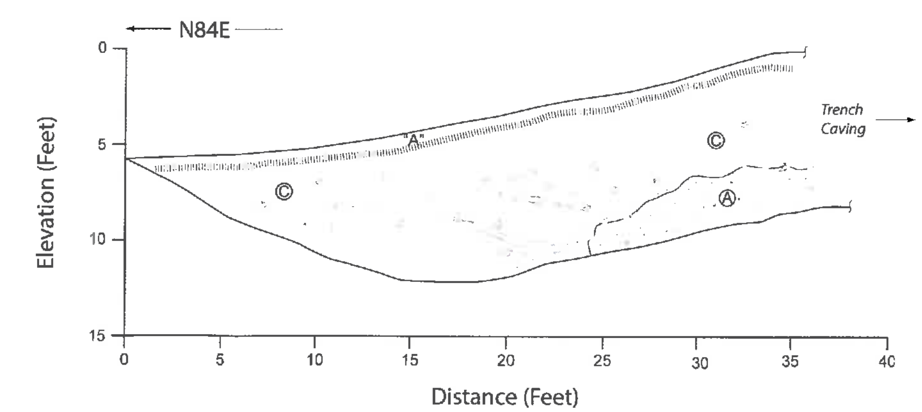
Test Pit TP-5
(West Wall)



Test Pit TP-6
(East Wall)



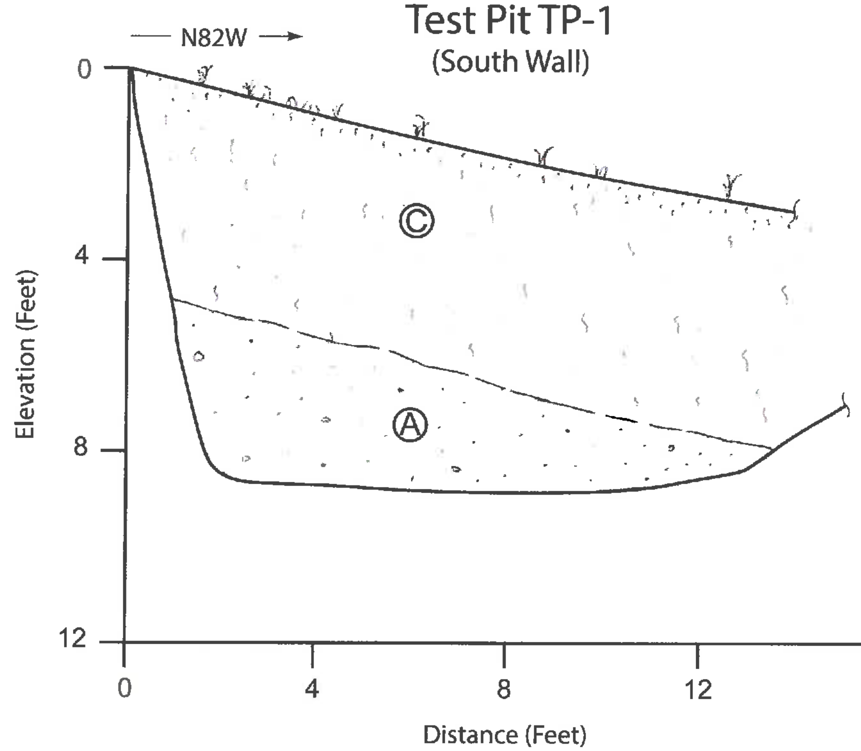
Trench GT-7
(South Wall)



Note: Field logging on Feb. 23 - 25, 2016

GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			LOGS OF EXPLORATORY TRENCHES GT-6 & GT-7, and TEST PITS TP-5 & TP-6
	Scale: As Noted	C1501	June 2016	Figure A3

Test Pit TP-1
(South Wall)



UNIT DESCRIPTIONS TP-1, 2, 3 & 4

Colluvium & Soil:

Ⓒ– Poorly Graded Sand with clay, locally with rock fragments; dusky brown (5 YR 2/2); fine- to medium-grained sand with estimated 10-15% fines; loose, moist to dry, wet locally; roots and rootlets in upper 6-8 inches (soil). Lower contact with weathered sandstone is distinct, and wavy to irregular.

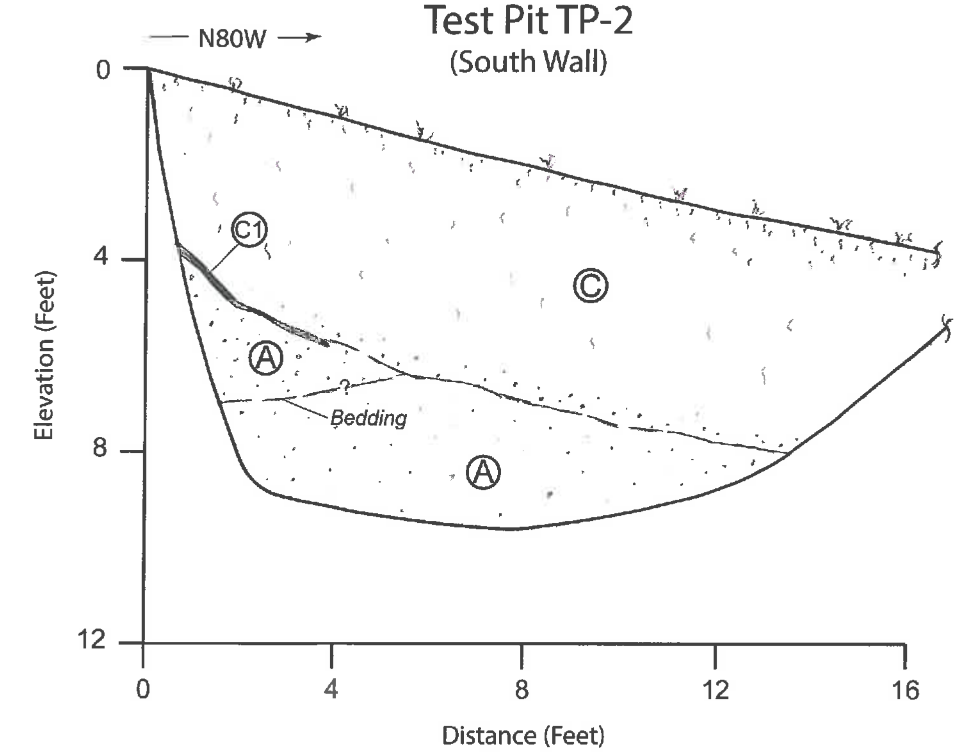
(C1) – Thin plastic clay seams present along upslope portion of colluvium-bedrock contact. Clay seams are ½ to ¾ inches thick, discontinuous, irregular (observed in TP-2).

Rock units:

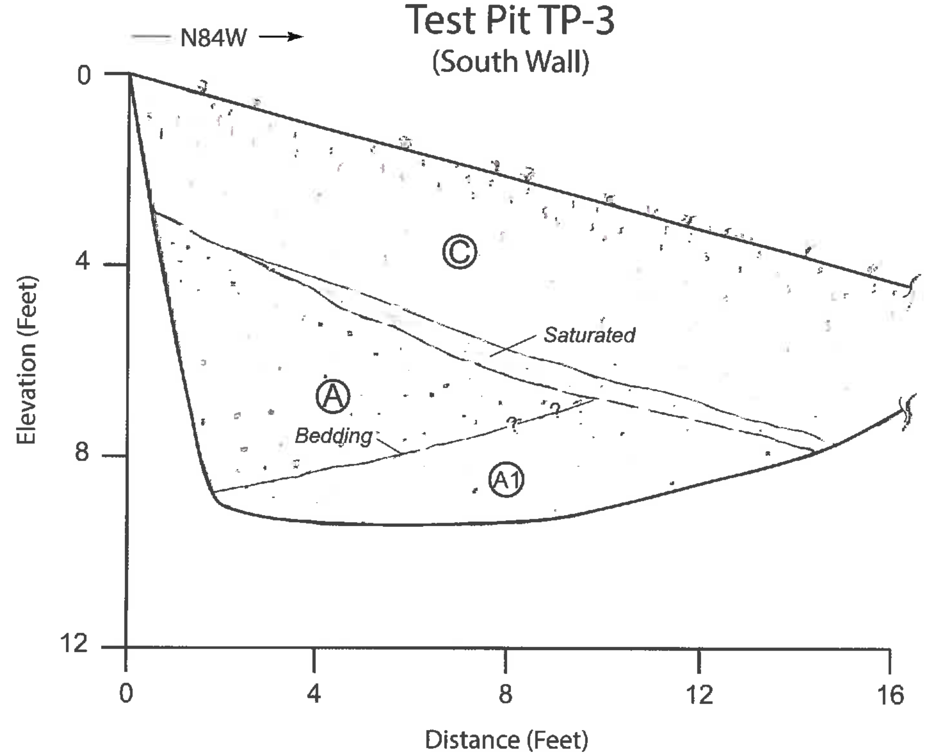
Ⓐ – Sandstone and Pebbly Sandstone; pale orange brown to very pale orange (10 YR 5/4 – 4/2); arkosic, fine- to medium-grained, poorly cemented; clasts typically rounded, ½ - 1-inch; moderately dense friable strength, low hardness; generally massive with occasional indistinct bedding; deeply weathered to locally decomposed; dry. Locally with irregular and discontinuous clay stringers and lenses (clay accumulation due to soil weathering).

(A1) – Sandstone, similar to Unit A, but with <2% gravel clasts, with weathered haloes around gravel clasts.

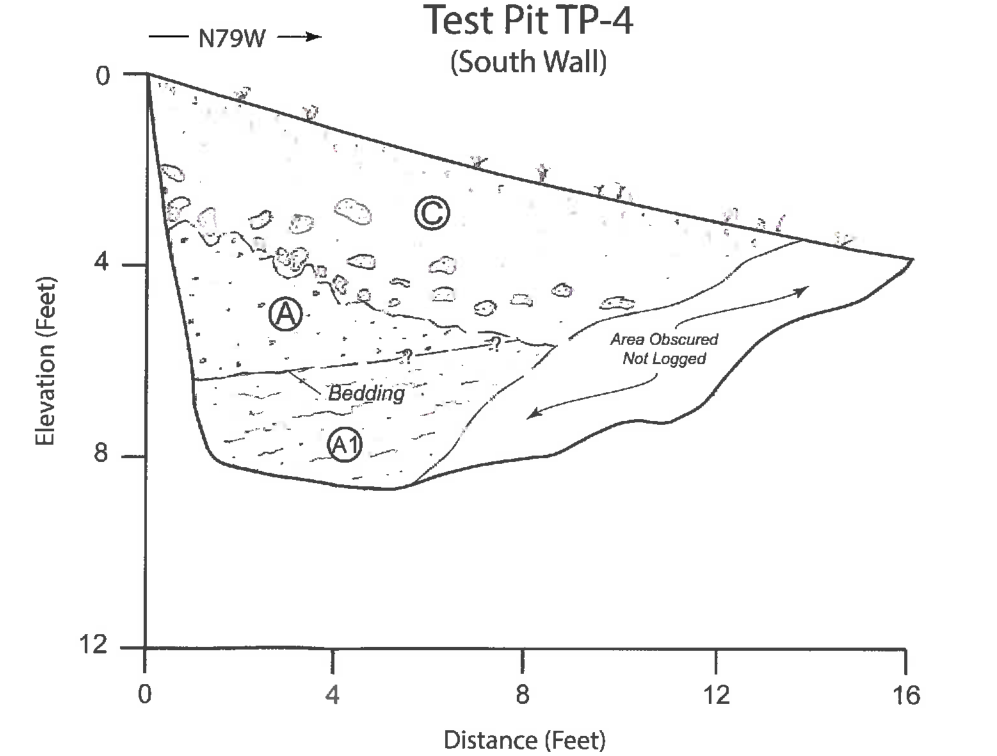
Test Pit TP-2
(South Wall)



Test Pit TP-3
(South Wall)



Test Pit TP-4
(South Wall)



Note: Field logging on Feb. 23 - 25, 2016

GEOINSITE	ENGINEERING GEOLOGIC AND GEOTECHNICAL FEASIBILITY INVESTIGATION Jack Ranch Property San Luis Obispo County, CA			LOGS OF EXPLORATORY TEST PITS TP-1, TP-2, TP-3 & TP-4
	Scale: As Noted	C1501	June 2016	Figure A4

APPENDIX B

FIELD INVESTIGATION

EXPLORATORY BORING LOGS

CE&G
Cal Engineering & Geology

BORING NUMBER GB-01

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 5/8/2015 COMPLETED 5/8/2015
GROUND ELEVATION 333 ft DATUM From Surveyor HOLE SIZE 6 in.
DRILLING CONTRACTOR S/G Drilling Company
COORDINATES: LATITUDE 35.210196 LONGITUDE -120.638131
DRILLING RIG/METHOD CME-75 Truck-Mount/6-in. Hollowstem Auger
GROUNDWATER AT TIME OF DRILLING --- Not Encountered
LOGGED BY D. Burger CHECKED BY D. Peluso
GROUNDWATER AT END OF DRILLING --- Not Encountered
HAMMER TYPE 140 lb hammer with 30 in. autotrip
GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	FINES CONTENT (%)
0		SILTY SAND (SM), dark gray brown, dry (COLLUVIUM / SLOPEWASH)									
		Color change to gray brown at 3 feet.									
5		SILTY SAND (SM), light gray with brown mottling, dry to moist, medium dense, clayey sand to sandy clay stringers, isolated subrounded fine to medium gravel, fine to coarse sand	CM	11-10-13							
		Abundant light gray sandstone rock fragments between 6 and 7 ft in silty sand matrix. Trace angular to subrounded fine gravel near 7 ft.	SPT	4-4-4							17
10		SILTY SAND (SM), brown, moist to wet, loose, very fine to medium sand, trace coarse sand (ALLUVIUM)	CM	3-6-7		109	19				
		Grades to wet at 11 ft.	SPT	3-3-3							27
15		POORLY GRADED SAND with SILT (SP-SM), brown with lens of light gray, moist to wet, medium dense, light gray sandstone rock fragments near 15.5 ft, very fine to medium sand	SPT	3-5-6							10
20		POORLY GRADED SAND with SILT (SP-SM), brown, moist to wet, medium dense, sandstone rock fragments in lenses, very fine to medium sand, lamination near 19.5 ft	SPT	4-8-8							9
25		SILTY SAND (SM), brown, moist, medium dense, fine to medium sand, color change to dark brown poorly graded medium to coarse sand at 25.25 ft, trace light gray sandstone rock fragments	SPT	3-6-7							16
30		SILTY SAND (SM), brown to light gray, moist to wet, loose, medium to coarse sand	SPT	4-3-3							23

Bottom of borehole at 30.5 ft. Borehole backfilled with grout.

BORING NUMBER GB-02

CE&G
CAL ENGINEERING & GEOLOGY

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 5/8/2015 **COMPLETED** 5/8/2015
GROUND ELEVATION 321 ft **DATUM** From Surveyor **HOLE SIZE** 6 in.
DRILLING CONTRACTOR S/G Drilling Company
COORDINATES: LATITUDE 35.210567 **LONGITUDE** -120.637864
DRILLING RIG/METHOD CME-75 Truck-Mount/6-in. Hollowstem Auger
▽ **GROUNDWATER AT TIME OF DRILLING** 38.0 ft / Elev 283.0 ft
LOGGED BY D. Burger **CHECKED BY** D. Peluso
▼ **GROUNDWATER AT END OF DRILLING** 25.0 ft / Elev 296.0 ft
HAMMER TYPE 140 lb hammer with 30 in. autotrip
GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	FINES CONTENT (%)
0–5	SILTY SAND (SM), dark brown gray, dry, medium dense, very fine to medium sand, trace roots, trace sandstone rock fragments (COLLUVIUM / ALLUVIUM)	CM	7-9-13		105	4				
		SPT	7-7-6							15
5	SILTY SAND (SM), very light gray, dry, medium dense, arkosic sand likely derived from Pismo Formation, brown sandy clay seams	CM	8-13-16		114	8				
5–8	CLAYEY SAND (SC), dark brown, moist, medium dense, very fine to medium sand, trace sandstone rock fragments, grades to poorly graded sand with clay near 7 ft (ALLUVIUM)	SPT	5-7-6							18
10	SILTY SAND (SM), brown, moist to wet, medium dense, very fine to medium sand with trace coarse sand	CM	6-7-10		109	13				15
		SPT	3-5-8							
12	Chert and claystone rock fragments near 12 ft.									
15	POORLY GRADED SAND with SILT (SP-SM), gray brown, moist to wet, medium dense grades to loose, very fine to medium sand, trace rounded to subrounded fine gravel near 15 ft, slightly arkosic sand with color grading to light gray at 15.5 ft	CM	5-10-9		101	14				7
16	Thin lenses of angular to subangular fine gravel at 16 ft	SPT	3-4-4							
20	SILTY SAND (SM), brown, wet, loose, light gray, wet, completely weathered sandstone lens	SPT	3-7-6							15
25 ▼	SILTY SAND (SM), gray brown, wet, very loose, isolated angular fine gravel, very fine to medium sand, water within sampler but no free water in borehole	SPT	3-3-2							37
30	SILTY SAND (SM), gray brown, wet, medium dense, trace angular to subrounded fine gravel, very fine to medium sand	SPT	6-10-11							19
35	CLAYEY SAND (SC), very dark gray, wet, very loose, fine to coarse	SPT	0-0-2				31	15	16	32

(Continued Next Page)

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CAL ENGINEERING & GEOLOGY

BORING NUMBER GB-02

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	FINES CONTENT (%)
35		sand, odorous									
		SANDY FAT CLAY (CH), black, moist, very soft consistency, fine to medium sand, trace very fine sand, odorous									
40		CLAYEY SAND (SC), very dark gray, wet, very loose, very fine to medium sand, odorous	SPT	0-0-1				26	15	11	35
45		CLAYEY SANDSTONE, green gray, moist, soft rock, very intensely weathered, claystone lenses, fine to medium sand (WEATHERED BEDROCK)	SPT	5-13-21							
50		CLAYEY SANDSTONE, green gray, soft rock, very intensely weathered, friable	SPT	11-15-17							

Bottom of borehole at 50.5 ft. Borehole backfilled with grout.

CE&G
CAL ENGINEERING & GEOLOGY

BORING NUMBER GB-03

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 5/8/2015 COMPLETED 5/8/2015
GROUND ELEVATION 321 ft DATUM From Surveyor HOLE SIZE 6 in.
DRILLING CONTRACTOR S/G Drilling Company
COORDINATES: LATITUDE 35.210524 LONGITUDE -120.637545
DRILLING RIG/METHOD CME-75 Truck-Mount/6-in. Hollowstem Auger
GROUNDWATER AT TIME OF DRILLING 16.0 ft / Elev 305.0 ft Likely Perched Z
LOGGED BY D. Burger CHECKED BY D. Peluso
GROUNDWATER AT END OF DRILLING --- Not Encountered
HAMMER TYPE 140 lb hammer with 30 in. autotrip
GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	FINES CONTENT (%)
0	SILTY SAND (SM) to SANDY SILT (ML), gray brown, dry, loose to firm, very fine sand (COLLUVIUM / ALLUVIUM)	CM	4-4-9		96	5				
	SILTY SAND (SM), very dark gray, dry, loose, very fine to medium sand									
5	SILTY SAND (SM) to CLAYEY SAND (SC), brown to dark gray brown, dry, medium dense, trace caliche, fine to coarse sand, trace sandstone rock fragments	CM	19-20-21		111	7				
		SPT	10-14-11							
	Lens of sandstone at 7 ft consisting of light gray to gray, dry, soft rock, very intensely weathered, friable, moderately to weakly cemented, arkosic									
10	CLAYEY SAND (SC), dark brown mottled with light gray sandstone rock fragments, moist, medium dense, very fine to medium sand, trace caliche	CM	8-9-10		103	8				13
	Sandstone rock fragments in a poorly graded sand matrix, light brown gray, moist, with sandy clay seams	SPT	4-5-8							
15	POORLY GRADED SAND with SILT (SP-SM), brown, moist grades to wet at 16 ft, medium dense with loose zone near 16 feet, lamination observed between 16 and 17 ft, trace sandstone rock fragments, fine to medium sand	CM	6-9-12		97	15				10
		SPT	2-3-7							14
	Grades to SILTY SAND (SM)									
20	SILTY SAND (SM) Sandstone rock fragment lens near 20 ft, light gray and brown, moist, medium dense, fine to medium sand	CM	5-8-7		102	18				15
	No recovery with SPT sampler between 20.5 and 22 ft.	SPT	2-2-2							
25	SILTY SAND (SM), brown, moist to wet, medium dense, very fine to medium sand, isolated chert rock fragments	SPT	4-6-5							23
30	SILTY SANDSTONE, light olive gray, moist to wet, soft rock, very intensely weathered, very weakly to non cemented, medium to very coarse sand grades to fine to medium sand, trace yellow brown clasts (WEATHERED BEDROCK)	SPT	6-7-7							20
35	SILTY SANDSTONE, light gray, moist, soft rock, very intensely	SPT	10-18-27							

(Continued Next Page)

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BORING NUMBER GB-03

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	FINES CONTENT (%)
35		weathered, friable, very weakly cemented, lenses of tan sandstone, fine to medium sand, arkosic, trace MnO2 nodules									
		Bottom of borehole at 35.5 ft. Borehole backfilled with grout.									

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BORING NUMBER GB-04

CLIENT Erskine Property Trust

PROJECT NAME Jack Ranch Proposed Subdivision

PROJECT NUMBER 160140

PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA

DATE STARTED 5/8/2015 COMPLETED 5/8/2015

GROUND ELEVATION 305 ft DATUM From Surveyor HOLE SIZE 6 in.

DRILLING CONTRACTOR S/G Drilling Company

COORDINATES: LATITUDE 35.211169 LONGITUDE -120.637213

DRILLING RIG/METHOD CME-75 Truck-Mount/6-in. Hollowstem Auger

GROUNDWATER AT TIME OF DRILLING --- Not Encountered

LOGGED BY D. Burger CHECKED BY D. Peluso

GROUNDWATER AT END OF DRILLING --- Not Encountered

HAMMER TYPE 140 lb hammer with 30 in. autotrip

GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	FINES CONTENT (%)
0		SANDY SILT (ML), gray brown, dry (ARTIFICIAL FILL / ALLUVIUM)									
		SILTY SAND (SM), dark brown, dry grades to moist (ALLUVIUM)									
		POORLY GRADED SAND with SILT (SP-SM), brown gray, moist									
5		CLAYEY SAND (SC), brown gray, dry to moist, dense, very fine to medium sand, trace to few sandstone rock fragments, FeO2 and MnO2 stains	CM	20-32-26		114	10				
		CLAYEY SAND (SC), brown to dark brown, moist, medium dense, very fine to fine sand, trace caliche, trace coarse sand	SPT	6-6-10				38	14	24	43
10		CLAYEY SAND (SC), gray brown, moist, dense, few angular fine gravel consisting of chert and claystone rock fragments, trace rounded gravel, very fine to fine sand, gravel content decreased to trace at 11 ft (WEATHERED BEDROCK)	CM	11-24-26		115	14				
			SPT	9-15-21				34	15	19	45
15		CLAYEY SAND (SC), gray brown, moist, dense, trace to few angular to subangular rock fragments consisting of tan sandstone, claystone, and chert, very fine to medium sand, trace coarse sand lenses in the clay matric, trace caliche	SPT	7-12-13							37
20		CLAYEY SANDSTONE, light brown, moist, soft rock, intensely weathered, friable, very fine to fine sand, trace subhorizontal clay seams, trace caliche	SPT	9-19-28							
25		CLAYSTONE, light brown mottled with light gray, moist, soft rock, very intensely weathered, friable, poorly indurated	SPT	10-17-21							

Bottom of borehole at 25.5 ft. Borehole backfilled with grout.

BORING NUMBER GB-05

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CLIENT Erskine Property Trust	PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140	PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 2/11/2016 COMPLETED 2/11/2016	GROUND ELEVATION 283 ft DATUM From Surveyor HOLE SIZE 8 in.
DRILLING CONTRACTOR S/G Drilling Company	COORDINATES: LATITUDE 35.211029 LONGITUDE -120.634825
DRILLING RIG/METHOD CME-75 Truck-Mount/8-in. Hollowstem Auger	GROUNDWATER AT TIME OF DRILLING --- Not Encountered
LOGGED BY D. Burger CHECKED BY D. Peluso	GROUNDWATER AT END OF DRILLING --- Not Encountered
HAMMER TYPE 140 lb hammer with 30 in. autotrip	GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	FINES CONTENT (%)
0		FAT CLAY with SAND (CH), very dark gray, moist, soft grades to firm, trace organics, rounded to subangular coarse sand and isolated fine gravel (NATIVE SOIL / COLLUVIUM)	CM	2-4-6	1.75	88	31	66	27	39	78
		LEAN CLAY (CL), dark brown, moist, firm, trace fine to medium sand, lenses of medium to high plasticity clay, trace caliche (WEATHERED BEDROCK)	SPT	1-3-4		89	29				
5		SANDY SILT (ML), olive brown, dry, hard, caliche stringers, 30-40% very fine sand	CM	3-16-22		93	22				
		Medium to fine silty sand lens near 6 and 6.4 ft	SPT	8-12-19							
		SILT witH SAND (ML), light brown, dry, firm to hard, caliche, very fine sand									
10		SILT with SAND (ML) to SANDY SILT (ML), light brown, dry to slightly moist, hard, very fine sand between 20-40%, trace caliche, lens of silt with trace to few very fine sand	CM	7-24-42		108	18				
15		Driller indicated clayey conditions. SILT to SILT with SAND (ML), light brown, dry, hard, very fine sand, trace caliche	CM	4-14-27		101	21				
		LEAN CLAY (CL), brown, moist, hard, few fine to coarse sand, caliche nodules									
		SILT (ML), brown, dry, hard, few very fine sand									
20		Assumed contact at 18 ft. POORLY GRADED SAND with SILT (SP-SM) to SILTY SAND (SM), light brown, dry, dense, very fine to fine sand	SPT	15-27-27							
		POORLY GRADED SAND (SP), light brown, dry, dense, medium to fine sand, trace fines									

Bottom of borehole at 20.5 ft. Borehole backfilled with grout.

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BORING NUMBER GB-06

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 2/11/2016 **COMPLETED** 2/11/2016
GROUND ELEVATION 296 ft **DATUM** From Surveyor **HOLE SIZE** 8 in.
DRILLING CONTRACTOR S/G Drilling Company
COORDINATES: LATITUDE 35.211438 **LONGITUDE** -120.635292
DRILLING RIG/METHOD CME-75 Truck-Mount/8-in. Hollowstem Auger
GROUNDWATER AT TIME OF DRILLING — Not Encountered
LOGGED BY D. Burger **CHECKED BY** D. Peluso
GROUNDWATER AT END OF DRILLING — Not Encountered
HAMMER TYPE 140 lb hammer with 30 in. autotrip
GROUNDWATER AFTER DRILLING — N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	FINES CONTENT (%)
0											
		SANDY FAT CLAY (CH), very dark gray, moist, soft grades to firm grades to hard, isolated subangular gravel up to 1/2 in. (COLLUVIUM)	CM	2-5-8	2.5			61	26	35	63
		Trace subangular to subrounded gravel up to 1/2 in., trace medium to coarse sand	SPT	1-2-5	2.5	95	26				
5		Color grades to gray with increased coarse sand. LEAN CLAY (CL), brown, moist, hard, trace to few medium to coarse sand, trace caliche nodules (WEATHERED BEDROCK)	CM	4-13-19	3.5	84	25				
		SILTY SAND (SM), light brown, dry, dense, well cemented with caliche, caliche lens between 6 and 6.25 ft.	SPT	6-8-9							
		SILT (ML) to SILT with SAND (SM), olive brown, dry to slightly moist, hard, very fine sand, caliche nodules									
		LEAN CLAY (CL), brown, moist, hard									
10		Carbonate, white, dry, friable, trace clay intrusions, poorly indurated, talc like, tuffaceous lens	CM	20-42-50/2"		98	17				
		LEAN CLAY (CL), brown, moist, hard, trace sand, some silt									
15		LEAN CLAY (CL), olive brown, mist, hard, trace very fine sand, iron staining, trace carbonate with nodules at 14.5 ft, some silt	SPT	6-11-14							
20		LEAN CLAY (CL) to WEATHERED CLAYSTONE, olive brown, moist, hard or soft rock, trace rock fabric near 21.5 ft, tuffaceous fragments near 19.5 ft, some silt	CM	8-18-22		89	33				
25		SANDY LEAN CLAY (CL), olive brown, moist, hard, fine to medium sand, isolated caliche near 24.5 ft	SPT	5-9-12							

Bottom of borehole at 25.5 ft. Borehole backfilled with grout.

BORING NUMBER GB-07

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CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 2/11/2016 **COMPLETED** 2/11/2016
GROUND ELEVATION 296 ft **DATUM** From Surveyor **HOLE SIZE** 8 in.
DRILLING CONTRACTOR S/G Drilling Company
COORDINATES: LATITUDE 35.211592 **LONGITUDE** -120.636466
DRILLING RIG/METHOD CME-75 Truck-Mount/8-in. Hollowstem Auger
GROUNDWATER AT TIME OF DRILLING --- Not Encountered
LOGGED BY D. Burger **CHECKED BY** D. Peluso
GROUNDWATER AT END OF DRILLING --- Not Encountered
HAMMER TYPE 140 lb hammer with 30 in. autotrip
GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	FINES CONTENT (%)
0		FAT CLAY (CH), gray brown, moist, soft, some silt, trace to few fine to coarse sand, trace subrounded to subangular gravel up to 1/2 in. (COLLUVIUM / NATIVE SOIL)	CM	0-2-3	0.8	88	31				
		Trace sandstone rock fragments and increased to firm at 3.5 ft, decreased gravel below.	SPT	0-1-3	1.5		31				
5		CLAYEY SAND (SC), orange brown, moist, hard, fine to coarse sand, subrounded to angular quartz and chert rock fragments up to 1/2 in. (WEATHERED BEDROCK)	CM	2-6-15		92	23				
			SPT	5-10-14				47	27	20	46
		trace iron stains, chert rock fragments, sandstone rock fragments, and silty sand lens near 6 to 6.25 ft.									
10		LEAN CLAY (CL), brown, slightly moist, hard, extensive caliche, carbonate stringers along approximately 30 degree off horizontal shear/joint fracture plain, appearance of claystone rock fabric, trace coarse sand	CM	10-23-41		92	28				
15		SILT (ML) to LEAN CLAY (CL), orange brown, dry, moist, hard, siltstone rock fabric, trace to few very fine sand, trace caliche, trace medium to coarse sand	CM	12-29-53		107	19				
20		SANDY LEAN CLAY (CL) to SANDY SILT (ML), brown, dry, hard, very fine to fine sand	SPT	10-17-28			14				
		SILTY SAND (SM) to SILTY SANDSTONE, reddish brown, dry, dense to soft rock, very fine to fine sand									
25		SANDY SILTSTONE, orange brown, moist, soft rock, friable, very severely weathered, fine to medium sand	SPT	9-12-17							

Bottom of borehole at 25.5 ft. Borehole backfilled with grout.

BORING NUMBER GB-08

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CLIENT Erskine Property Trust
PROJECT NUMBER 160140
DATE STARTED 2/11/2016 COMPLETED 2/11/2016
DRILLING CONTRACTOR S/G Drilling Company
DRILLING RIG/METHOD CME-75 Truck-Mount/8-in. Hollowstem Auger
LOGGED BY D. Burger CHECKED BY D. Peluso
HAMMER TYPE 140 lb hammer with 30 in. autotrip

PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
GROUND ELEVATION 315 ft DATUM From Surveyor HOLE SIZE 8 in.
COORDINATES: LATITUDE 35.211608 LONGITUDE -120.63847
GROUNDWATER AT TIME OF DRILLING --- Not Encountered
GROUNDWATER AT END OF DRILLING --- Not Encountered
GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	FINES CONTENT (%)
0–3	SILTY SAND (SM), dark gray, dry grades to wet at 2 ft, very fine to medium sand, trace rootlets, trace sandstone rock fragments (COLLUVIUM)	CM	5-7-5		109	11				29
	Grades to dark brown, moist to wet, fine to coarse sand	SPT	1-2-6	2.0		11				
5	SILTY SAND (SM) with SANDSTONE rock fragments, mottled dark brown and light gray, dry, soft rock and dense sand, very weakly cemented rock fragments, rootlets at 4 ft, friable, fine to medium sand, silty sand to sand with silt lenses (SLOPEWASH)	CM	13-25-35		108	3				
	Grades to dark brown with dark gray inclusions, orange brown sandstone rock fragments, friable, medium to very coarse sand	SPT	16-23-22			9				28
	SANDSTONE, gray, weakly cemented, friable, medium to coarse sand, trace chert fragments (WEATHERED BEDROCK)									
10	SANDSTONE, light gray, dry to slightly moist, very weakly cemented, medium to coarse sand, friable, severely weathered	CM	27-54		115	7				
15	WELL GRADED SAND (SW) from complete weathering of sandstone, gray brown, moist, dense, very weakly to non-cemented, medium to coarse sand, friable, trace caliche	SPT	9-15-24			11				
20	SANDSTONE, light gray, moist, soft to medium dense, completely weathered to well graded sand, fine to coarse sand, trace muscovite, trace subrounded to subangular fine gravel, trace caliche	SPT	8-10-11			10				
25	SANDSTONE, gray, moist, soft to dense, very weakly cemented, very severely to completely weathered, friable, fine to coarse sand, trace rounded to subrounded very coarse sand to fine gravel up to 1/4 in. trace iron stains along bedding planes observed in shoe of sampler, trace chert rock fragments	CM	10-20-22		103	11				
30	SANDSTONE, yellowish brown, moist, soft, very weakly cemented, friable, medium to coarse sand, very severely to severely weathered, silty sandstone near 29-29.5 ft with very fine to medium sand	SPT	8-27-17			16				

Bottom of borehole at 30.5 ft. Borehole backfilled with grout.

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BORING NUMBER GB-09

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 2/12/2016 COMPLETED 2/12/2016
GROUND ELEVATION 330 ft DATUM From Surveyor HOLE SIZE 8 in.
DRILLING CONTRACTOR S/G Drilling Company
COORDINATES: LATITUDE 35.211046 LONGITUDE -120.638493
DRILLING RIG/METHOD CME-75 Truck-Mount/8-in. Hollowstem Auger
GROUNDWATER AT TIME OF DRILLING --- Not Encountered
LOGGED BY D. Burger CHECKED BY D. Peluso
GROUNDWATER AT END OF DRILLING --- Not Encountered
HAMMER TYPE 140 lb hammer with 30 in. autotrip
GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	FINES CONTENT (%)
0		SANDY SILT (ML), dark brown, moist, soft, organics (NATIVE SOIL)									
		SILTY SAND (SM) grades to POORLY GRADED SAND with SILT (SP-SM), brown, moist, loose, very fine to fine sand (COLLUVIUM/SLOPEWASH)	CM	4-4-5		101	9				14
		SILTY SAND (SM), gray brown, moist, loose, fine to medium sand, trace to few fines, color grades to brown at 3 ft	SPT	1-2-8			13				
5		CLAYEY SAND (SC), strong brown, moist, loose to medium dense, very fine to fine sand	CM	4-12-20		104	20				43
		Grades to gray brown, moist, dense, fine to coarse sand, trace subrounded fine gravel up to 1/4 in., trace clay strings	SPT	10-8-13			15				
		CLAYEY SAND (SC), olive gray brown, moist, dense, friable (SLOPEWASH)									
		SANDSTONE weathered to POORLY GRADED SAND with SILT (SP-SM), brown, slightly moist, medium dense, fine to medium sand, trace clay, caliche stringers, friable, trace rounded very course sand, iron staining at 7 ft (WEATHERED BEDROCK)									
10		CLAYEY SANDSTONE, olive brown, dry, medium dense, numerous clay inclusions at top of sample, carbonate near 10 ft, very severely weathered	CM	6-14-24		102	19				
		SILTY SANDSTONE, light olive brown, dry, soft, friable, very severely weathered, very weakly cemented, fine to medium sand									
15		SILTY SANDSTONE to SANDSTONE, light olive brown to light gray, moist, soft, very severely to completely weathered, silty sand to poorly graded sand with silt lenses, iron stains in bands, fine to medium sand, isolated trace angular chert fragments, friable	SPT	8-13-13			20				
20		SILTY SANDSTONE to SANDSTONE, light olive brown, slightly moist, soft, dense, very weakly cemented, fine to medium sand, very severely weathered, friable, dark brown inclusions at 20 ft, trace caliche near 19 ft	CM	12-27-54		100	10				
25		SILTY SANDSTONE and SANDSTONE, light yellow brown, dry, soft, dense, very weakly cemented, friable, trace iron stains, carbonate lens near 24-24.5 ft, fine to medium sand with lens of coarse sand, very severely weathered	SPT	13-25-24			10				
30		SANDSTONE, light yellow brown, moist, soft, dense, friable, very weakly cemented, medium to coarse sand lenses of silty sandstone, iron stains in bands, trace caliche, very severely weathered	SPT	10-15-21			20				

Bottom of borehole at 30.5 ft. Borehole backfilled with grout.

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BORING NUMBER GB-10

CLIENT Erskine Property Trust
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 160140
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA
DATE STARTED 2/12/2016 COMPLETED 2/12/2016
GROUND ELEVATION 313 ft DATUM From Surveyor HOLE SIZE 8 in.
DRILLING CONTRACTOR S/G Drilling Company
COORDINATES: LATITUDE 35.210172 LONGITUDE -120.635146
DRILLING RIG/METHOD CME-75 Truck-Mount/8-in. Hollowstem Auger
GROUNDWATER AT TIME OF DRILLING --- Not Encountered
LOGGED BY D. Burger CHECKED BY D. Peluso
GROUNDWATER AT END OF DRILLING --- Not Encountered
HAMMER TYPE 140 lb hammer with 30 in. autotrip
GROUNDWATER AFTER DRILLING --- N/A

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE	BLOW COUNTS (FIELD VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)	MOISTURE CONTENT (%)	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTIC LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	FINES CONTENT (%)
0		SANDY SILT (ML), dark gray brown, moist (NATIVE SOIL)									
		CLAYEY SAND (SC), dark brown, moist, soft, very fine to coarse sand, trace organics (NATIVE/COLLUVIUM)	CM	0-1-2	1.5	105 108	18 19	22	16	6	42 43
		LEAN CLAY (CL), strong brown, moist, firm, fine to medium sand, trace sandstone rock fragments (COLLUVIUM)	SPT	1-1-4			18				
5		LEAN CLAY (CL), strong brown grades to brown, moist, hard, trace to few very fine to fine sand, angular chert and sandstone fragments	CM	1-3-8	2.75	87	31				
		LEAN CLAY (CL) to LEAN CLAY with SAND, brown, moist, hard, very fine to medium sand, angular to subangular sandstone fragments	SPT	2-5-8			28				
10		LEAN CLAY (CL) to LEAN CLAY with SAND (CL), light olive brown, moist, hard, trace to few very fine sand up to 20%, isolated organics(WEATHERED BEDROCK)	CM	6-14-19	4.25	84	28				
		Tone change in rig while drilling at 12 ft.									
15		LEAN CLAY with SAND (CL), light olive brown, moist, hard, little silt, very fine to medium sand, trace caliche, trace rock fabric, bedrock completely weathered to soil	CM	5-12-18		105	19				
20		SANDY LEAN CLAY (CL), olive brown, moist, hard, very fine to medium sand, trace iron staining, latent rock fragment near 19.5 ft	SPT	5-8-14							

Bottom of borehole at 20.5 ft. Borehole backfilled with grout.

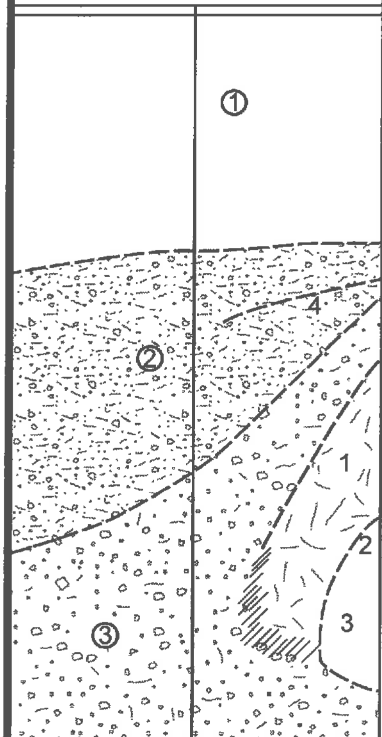
CAL ENGINEERING & GEOLOGY

BORING NO.: LD-1
PAGE 1 OF 1

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: J. Feltman

SURFACE ELEVATION:
DATE STARTED: 4-13-15
DATE FINISHED: 4-13-15
GW DEPTH: None
TOTAL DEPTH: 8'

LARGE DIAMETER BORING GRAPHIC LOG
View Looking N34°E



DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
0 – 2.5		CH	①**Fat CLAY**, dark brown, moist, very stiff to hard, trace sand and fine gravel (colluvium) Gradational contact over approx. 2 - 3"	1. Weathered with pervasive dark gray MnO_2 2. Cobble 3. Zone of caliche cemented claystone, soft (rock), massive 4. 1/8" thick black clay seam, no observed shearing, discontinuous, dips at 18° to the north, no strike measured
2.5 – 8			②**BEDROCK** **Sandy CLAYSTONE** (Tpps), yellowish brown to olive brown, soft (rock), very stiff to hard soil, very intensely weathered, 10 -15% fine gravel, moist, massive, fractures indeterminate, variably clayey ③**Clayey Gravelly CONGLOMERATE** (Tpps), yellowish brown to orange brown, dense, moist, subrounded to angular, clasts up to 6" observed, massive, 50% clay and 50% gravel, mottled locally with MnO_2, weathered with MnO_2 in clay seams	
8			BOH at 8 Feet	

Depth scale (feet): 0, 2, 4, 6, 8, 10, 12, 14, 16

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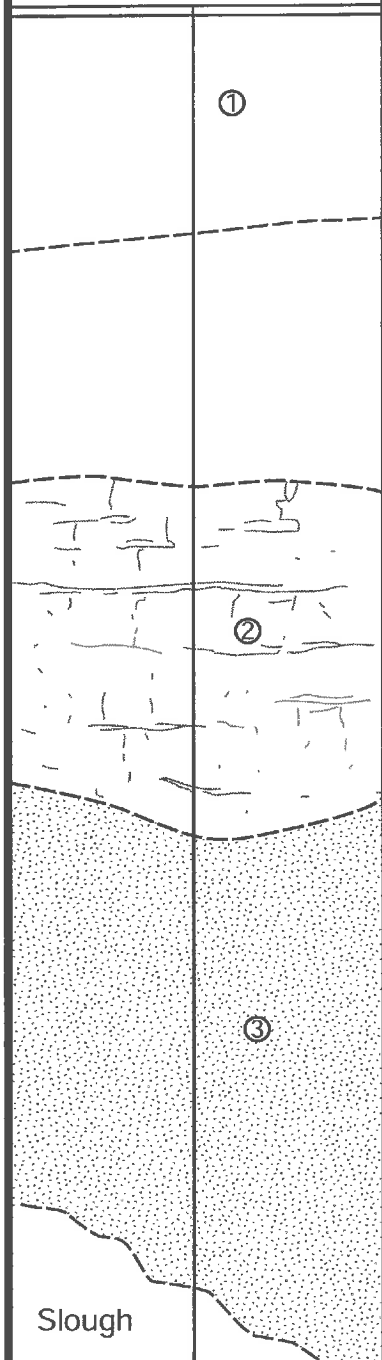
BORING NO.: LD-2

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: J. Feltman

SURFACE ELEVATION:
DATE STARTED: 4-13-15
DATE FINISHED: 4-13-15
GW DEPTH: None
TOTAL DEPTH: 15'

LARGE DIAMETER BORING GRAPHIC LOG
View Looking N85°W



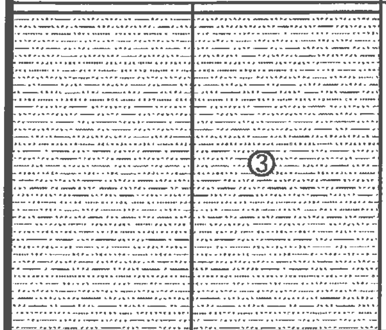
DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
0		SM	①**Silty SAND to Sandy SILT**; dark brown to gray brown, dry, loose; few sandstone fragments; rootlets throughout (colluvium)	
2		SM	Sandstone blocks in silty sand matrix; sandstone is light brown, moderately cemented, soft, very fine to fine-grained sand; loose matrix, matrix is brown, dry; roots throughout (colluvium)	
4			**BEDROCK** ②**SANDSTONE** (Tpps); mottled light brown with gray brown, soft (rock), poorly to moderately cemented; trace roots; intensely weathered; gray brown silty sand occurs in sporadic subvertical and subhorizontal healed fractures which form blocky fabric	
6				
8			③**SANDSTONE** (Tpps); very light gray brown, moist, soft (rock); weakly to poorly cemented; very fine to medium-grained; internally massive; moderately weathered	
10				
12				
14				
16			BOH at 15 Feet	

CAL ENGINEERING & GEOLOGY

BORING NO.: LD-3

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: J. Feltman, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-14-15
DATE FINISHED: 4-14-15
GW DEPTH: None
TOTAL DEPTH: 19.5'

LARGE DIAMETER BORING GRAPHIC LOG View Looking Due South	DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
 ③	16–19.5		SC	③As above; Clayey **SAND**; brown, dense, moist, contains sparse rounded pebbles and angular clasts of Monterey Formation	
	19.5–32			BOH at 19.5 Feet	

Depth scale: 16, 18, 20, 22, 24, 26, 28, 30, 32

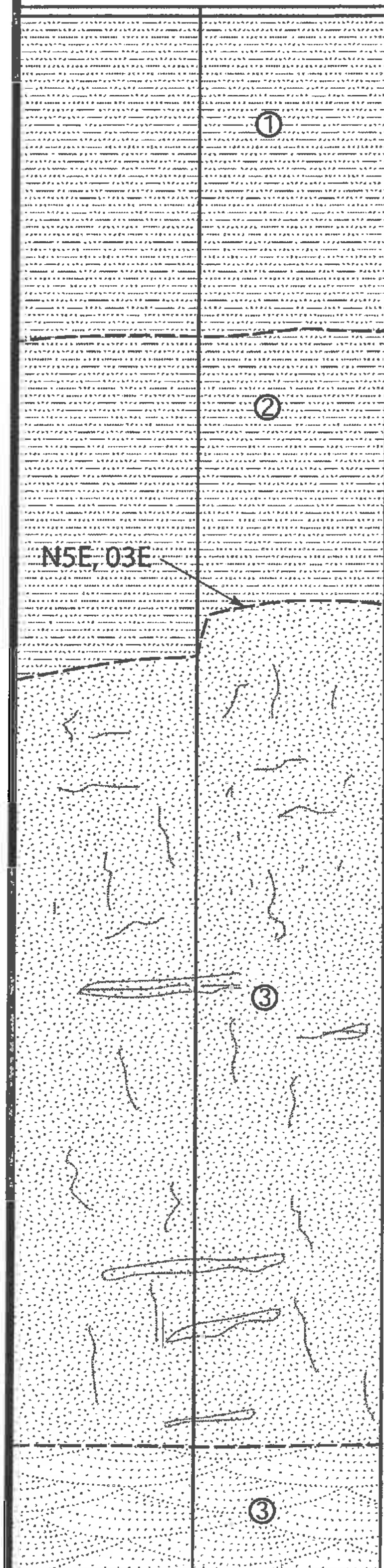
CAL ENGINEERING & GEOLOGY

BORING NO.: LD-4

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: J. Feltman, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-15-15
DATE FINISHED: 4-15-15
GW DEPTH: None
TOTAL DEPTH: 19.7'

LARGE DIAMETER BORING GRAPHIC LOG
View Looking S32°E



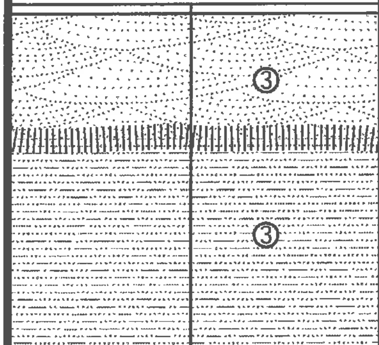
DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
0		SC	①**Silty clayey SAND**; medium dense, dry, fine-grained sand, porous, trace fine gravel (colluvium)	
4		SC	②**Silty clayey SAND;** pale gray to tan, medium dense, dry, with few subhorizontal clay lenses, few rounded sandstone clasts, sharp, undulating basal contact (colluvium)	
6			**BEDROCK** ③**Clayey SANDSTONE** (Tpps); completely weathered to clayey sand, mottled gray and yellow brown, medium dense, moist, discontinuous subhorizontal beds and lenses 1 - 3" thick, few discontinuous subvertical fractures 1/8 - 1/4" thick infilled with clay	
16			- distinct bedding plane - laminated and cross-bedded	

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16

CAL ENGINEERING & GEOLOGY

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: J. Feltman, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-15-15
DATE FINISHED: 4-15-15
GW DEPTH: None
TOTAL DEPTH: 19.7'

LARGE DIAMETER BORING GRAPHIC LOG View Looking S32°E	DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
	16				
				- gradational, diffuse contact	
	18			③**Clayey SANDSTONE**; mottled gray and orange, weak horizontal beds 1 - 3", no visible fracturing, soft, weak, severely weathered	
	20			BOH at 19.7 Feet	
	22				
	24				
	26				
	28				
	30				
	32				

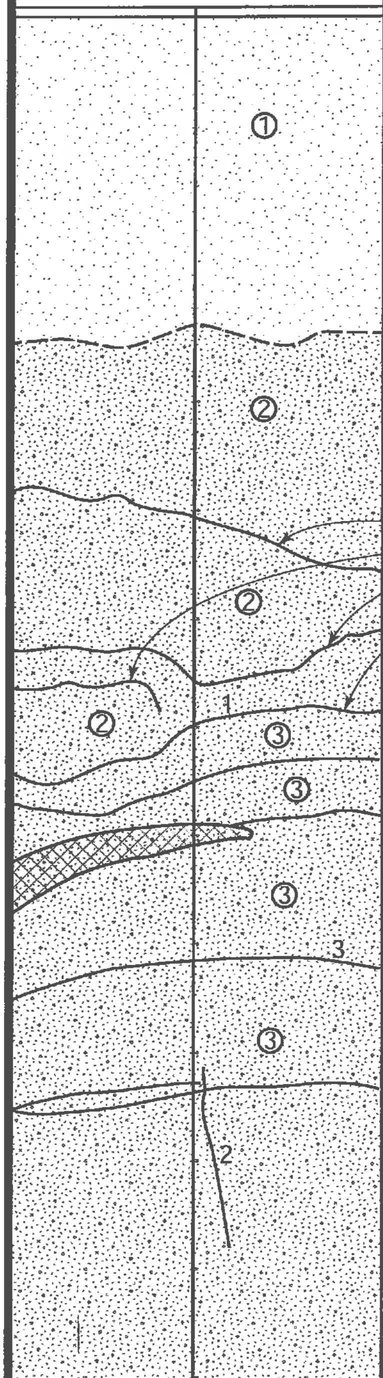
CAL ENGINEERING & GEOLOGY

BORING NO.: LD-5
PAGE 1 OF 1

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: J. Feltman, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-15-15
DATE FINISHED: 4-15-15
GW DEPTH: None
TOTAL DEPTH: 15.5'

LARGE DIAMETER BORING GRAPHIC LOG
View Looking S8°E



DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
0–3.5		SM/ ML	①**Silty SAND to sandy SILT**; very dark gray brown grading to light gray, loose to medium dense, slightly moist, trace sandstone fragments (colluvium)	1. N28W, 27NE 2. Dark gray 1/2" clay seam 3. Bedding plane undulates; locally N45E, 6NW
3.5			- faint contact between colluvium packets	
3.5–7.7		SP	②Poorly graded **SAND**; light gray, medium dense, dry, trace sandstone fragments (colluvium)	
6			- 1/2" thick clay seams, dark gray brown, (colluvial slopewash interbeds?)	
7.7–15.5			**BEDROCK** ③**Clayey SANDSTONE** (Tpps); mottled dark brown and yellow brown, beds 8", soft, weak, severely weathered - caliche overprint (crosshatch)	
11			- pebbly sandstone bed	
13			- sandstone bed	
15.5			BOH at 15.5 Feet	

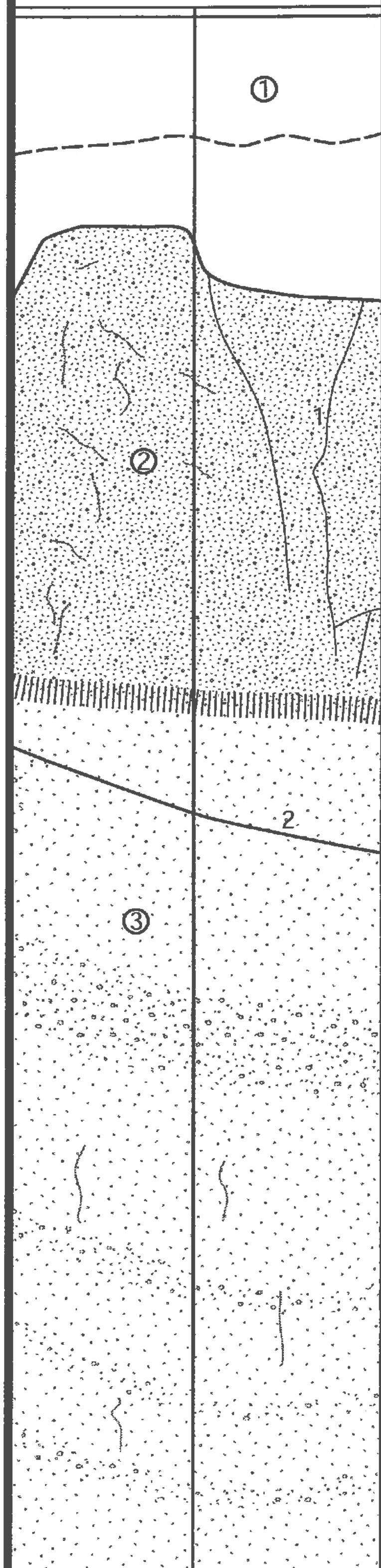
Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16

CAL ENGINEERING & GEOLOGY

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: B. Treece, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-16-15
DATE FINISHED: 4-16-15
GW DEPTH: None
TOTAL DEPTH: 20.0'

LARGE DIAMETER BORING GRAPHIC LOG
View Looking N44°W



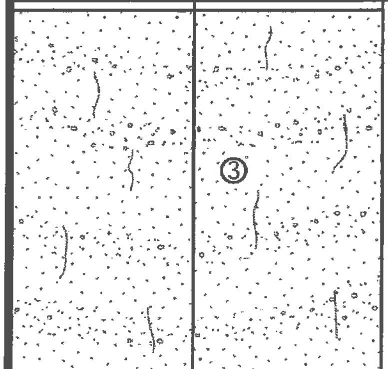
DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
0		CL	①**Silty CLAY**; brown, hard, dry (colluvium)	1. Fat clay fracture infills 1/2"
2			- increasing iron oxide mottling downward	2. Erosional bedding contact
4			**BEDROCK** ②**Silty SANDSTONE** (Tpps); light brown to light gray, massive, irregular fracturing, moderately hard to soft, weak, severely weathered, with dilated fractures infilled with dark brown clay	
6				
8			- diffuse lower contact; clayey ③**SANDSTONE** - as above except bedded with coarse sand laminae	
10			- repeated scour infill sequences of coarse sand finning upward to fine sand with upward lessening lamination dips	
12				
14			- scattered subvertical, discontinuous dilated fractures infilled with dark brown clay, up to 3/8" thick	
16				

CAL ENGINEERING & GEOLOGY

BORING NO.: LD-6

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: B. Treece, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-16-15
DATE FINISHED: 4-16-15
GW DEPTH: None
TOTAL DEPTH: 20.0'

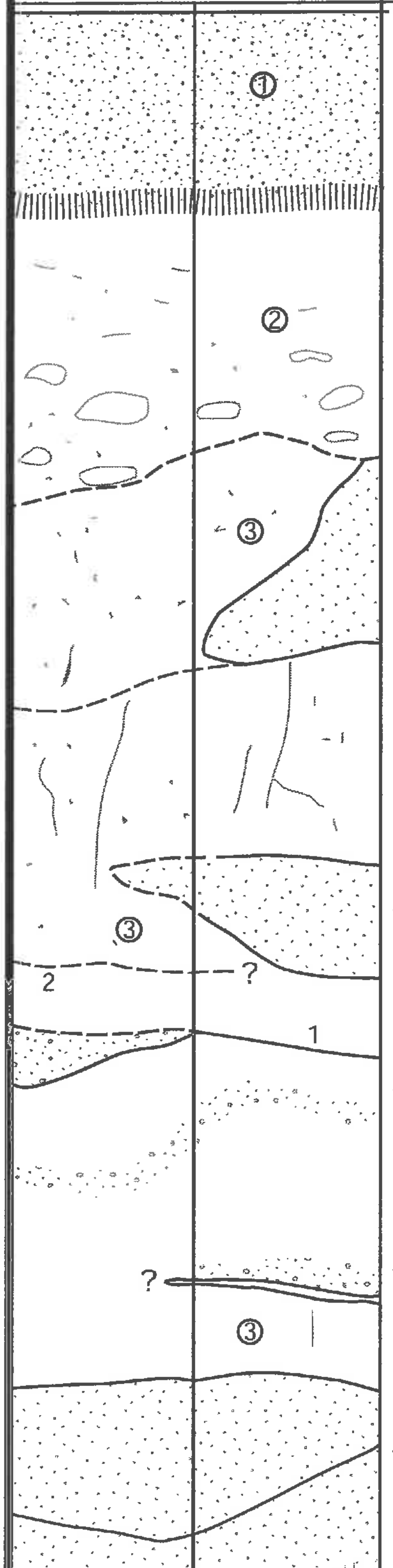
LARGE DIAMETER BORING GRAPHIC LOG View Looking N44°W	DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
	16			③**SANDSTONE** - as above	
	18				
	20			BOH at 20.0 Feet	
	22				
	24				
	26				
	28				
	30				
	32				

CAL ENGINEERING & GEOLOGY

BORING NO.: LD-7

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: B. Treece, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-16-15
DATE FINISHED: 4-16-15
GW DEPTH: None
TOTAL DEPTH: 20.5'

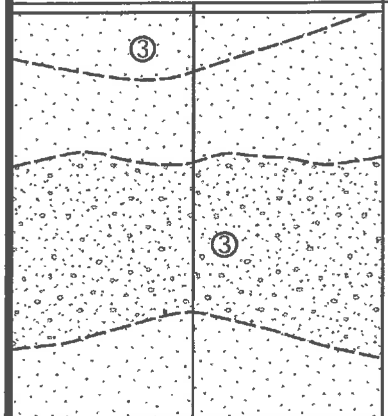
LARGE DIAMETER BORING GRAPHIC LOG View Looking N77°E	DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
	0		ML	①**Sandy SILT**; dark grayish brown, loose to medium dense, dry (colluvium)	1. Erosional contact 2. Subhorizontal pebbly clay bed
	2		CH	②**Fat CLAY;** very dark gray, hard, moist, trace caliche near 4' (colluvium) - Sandstone blocks below about 4' - Sandstone bed at about 6'	
	4–16			**BEDROCK** ③**Clayey SANDSTONE** (Tpps); brown, massive to beds 12 - 18", fracture indeterminate, low hardness, weak with dilated fractures infilled with dark brown clay; completely weathered down to 7.0' except for block - lenses and beds of clayey sandstone, silty sandstone, rare coarse sand stringers - caliche nodules along bedding - beds visible on basis of silt/sand content	

CAL ENGINEERING & GEOLOGY

BORING NO.: LD-7
PAGE 2 OF 2

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: B. Treece, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-16-15
DATE FINISHED: 4-16-15
GW DEPTH: None
TOTAL DEPTH: 20.5'

LARGE DIAMETER BORING GRAPHIC LOG View Looking N77°E	DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
	16 18 20			③- thick beds of sandstone and clayey sandstone, gray brown to brown, thick bedded (~1 1/2 - 2'), fracture indeterminate, low hardness, weak, severely weathered, variable cementation	
	22 24 26 28 30 32			BOH at 20.5 Feet	

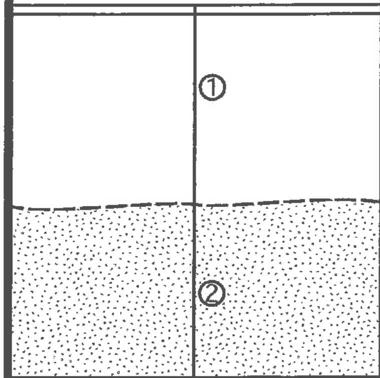
CAL ENGINEERING & GEOLOGY

BORING NO.: LD-8
PAGE 1 OF 1

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: B. Treece, D. Burger

SURFACE ELEVATION:
DATE STARTED: 4-16-15
DATE FINISHED: 4-16-15
GW DEPTH: None
TOTAL DEPTH: 4.0'

LARGE DIAMETER BORING GRAPHIC LOG
View Looking N/A



DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION	COMMENTS
0		CL	①**Sandy CLAY**; dark grayish brown, very stiff, moist (colluvium)	
2			②**BEDROCK** **SANDSTONE** (Tpps); difficult drilling, refusal at ~4.0'	
4			BOH at 4 Feet	
6				
8				
10				
12				
14				
16				

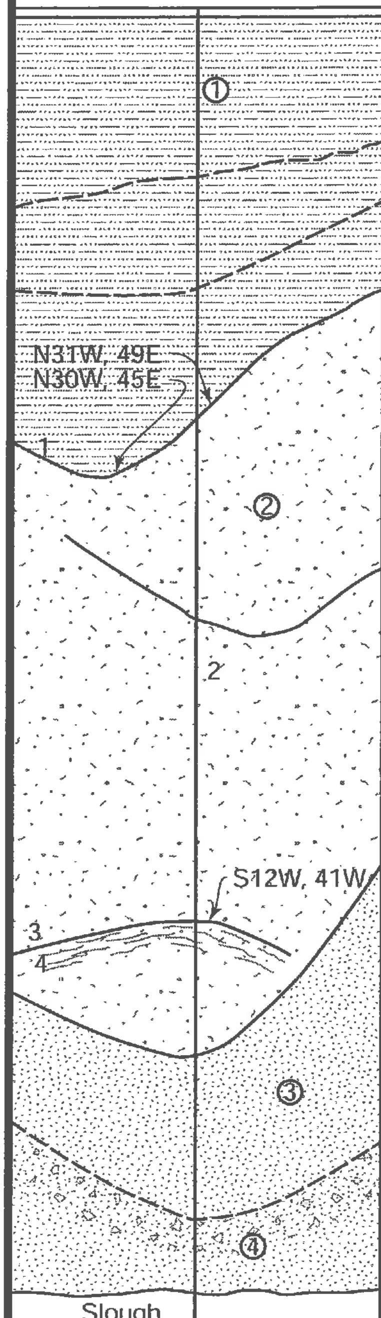
CAL ENGINEERING & GEOLOGY

BORING NO.: LD-9
PAGE 1 OF 1

JOB NO.: 150321
SITE LOCATION: Jack Ranch, San Luis Obispo
DRILLING METHOD: 30" auger
CONTRACTOR: CF
LOGGED BY: J. Feltman

SURFACE ELEVATION:
DATE STARTED: 4-14-15
DATE FINISHED: 4-14-15
GW DEPTH: None
TOTAL DEPTH: 14.6'

LARGE DIAMETER BORING GRAPHIC LOG
View Looking N33°E



DEPTH (feet)	ELEVATION	USCS CLASSIFICATION	DESCRIPTION
0–6		CL	①**Silty Clay with SAND**; dark brown, dry, grades to dark brown, stiff, roots, dessicated upper 1' (colluvium) - slick surfaces within lowermost colluvium or uppermost severely weathered sandy claystone (creep or shallow landslide) - dark brown clay seam (1/8 - 1/4")
6–9.5			**BEDROCK** ②**Sandy CLAYSTONE** (Tpps); yellowish brown, soft, moist, severely weathered, massive, crushed; above slick surface at 6' random irregular slick fracture surfaces, mottled with irregular dark brown clay seams - multiple discontinuous clay seams between 7.5 and 10'
9.5–12.5			③**Clayey SANDSTONE** (Tpps); yellowish brown, slightly gradational contact with claystone above, soft (rock), intensely weathered, weakly cemented, massive
12.5–14.6			④**Silty SANDSTONE** (Tpps); white to light brown, dry, soft (rock), poorly cemented, fine to medium-grained sand, very intensely weathered, caliche overprint, bleached
14.6			BOH at 14.6 Feet

COMMENTS

1. Dark brown clay seam continuous on all sides of hole 1/8 - 1/4" thick and up to 1/2" in some places, no shearing, sharp boundary 1/8 - 1/4" dark brown clay seam, no shearing, planar, sharp
2. Less dark brown mottling above 7.5'
3. Polished fracture surface
4. Subparallel slick surfaces are variably coated with MnO_2 or FeO_2, in some cases just glassy with no coatings

APPENDIX C

LABORATORY TESTING

CE&G

CAL ENGINEERING & GEOLOGY

SUMMARY OF LABORATORY RESULTS

CLIENT Erskine Property Trust

PROJECT NAME Jack Ranch Proposed Subdivision

PROJECT NUMBER 160140

PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA

Borehole	Depth	Date Tested	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Screen Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
GB-01	5.5	5/15/2015				0.075	17					
GB-01	10.0	5/18/2015							19.1	109.3		
GB-01	10.5	5/15/2015				0.075	27					
GB-01	14.0	5/18/2015				0.075	10					
GB-01	19.0	5/15/2015				0.075	9					
GB-01	24.0	5/15/2015				0.075	16					
GB-01	29.0	5/15/2015				0.075	23					
GB-02	2.0	5/15/2015							4.3	104.6		
GB-02	2.5	5/18/2015				0.075	15					
GB-02	5.0	5/19/2015							7.6	113.5		
GB-02	5.5	5/15/2015				0.075	18					
GB-02	10.0	5/15/2015				0.075	15		13.3	109.1		
GB-02	15.0	5/18/2015				0.075	7		14.4	101.3		
GB-02	19.0	5/15/2015				0.075	15					
GB-02	24.0	5/15/2015				0.075	37					
GB-02	29.0	5/15/2015				0.075	19					
GB-02	34.0	5/18/2015	31	15	16	0.075	32	SC				
GB-02	39.0	5/18/2015	26	15	11	0.075	35	SC				
GB-03	1.0	5/15/2015							5.5	95.6		
GB-03	5.0	5/18/2015							6.7	110.8		
GB-03	10.0	5/18/2015				0.075	13		8.1	103.2		
GB-03	15.0	5/15/2015				0.075	10		14.9	97.0		
GB-03	15.5	5/15/2015				0.075	14					
GB-03	20.0	5/18/2015				0.075	15		18.0	101.7		
GB-03	24.0	5/15/2015				0.075	23					
GB-03	29.0	5/15/2015				0.075	20					
GB-04	5.0	5/15/2015							9.9	113.7		
GB-04	5.5	5/15/2015	38	14	24	0.075	43	SC				
GB-04	10.0	5/15/2015							14.3	114.7		
GB-04	10.5	5/15/2015	34	15	19	0.075	45	SC				
GB-04	14.0	5/18/2015				0.075	37					
GB-05	2.0	3/1/2016	66	27	39	0.075	78	CH	30.6	87.7		
GB-05	2.5	3/8/2016							28.9	89.3		
GB-05	5.0	3/1/2016							22.1	92.6		
GB-05	10.0	3/1/2016							18.5	108.4		
GB-05	15.0	3/1/2016							20.7	101.3		

SUMMARY OF LABORATORY RESULTS

CE&G
CAL ENGINEERING & GEOLOGY

CLIENT Erskine Property Trust

PROJECT NAME Jack Ranch Proposed Subdivision

PROJECT NUMBER 160140

PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA

Borehole	Depth	Date Tested	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Screen Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
GB-06	2.0	3/1/2016	61	26	35	0.075	63	CH				
GB-06	2.5	3/1/2016							26.2	94.9		
GB-06	4.5	3/1/2016							25.2	84.4		
GB-06	9.3	3/1/2016							17.5	98.0		
GB-06	20.0	3/1/2016							33.0	88.7		
GB-07	2.0								31.1	88.3		
GB-07	2.5	3/1/2016							30.8			
GB-07	5.0	3/1/2016							22.7	91.7		
GB-07	5.5	3/3/2016	47	27	20	0.075	46	SC				
GB-07	10.0	3/1/2016							27.6	92.1		
GB-07	15.0	3/1/2016							18.8	106.9		
GB-07	19.0	3/1/2016							14.4			
GB-08	2.0	3/2/2016				9.5	29		11.4	108.8		
GB-08	2.5	3/2/2016							11.0			
GB-08	5.0	3/2/2016							3.4	107.7		
GB-08	5.5	3/2/2016				9.5	28		8.7			
GB-08	9.5	3/2/2016							7.1	114.5		
GB-08	14.0	3/2/2016							11.0			
GB-08	19.0	3/2/2016							9.6			
GB-08	25.0	3/2/2016							10.9	102.6		
GB-08	29.0	3/2/2016							16.0			
GB-09	2.0					0.075	14		9.3	101.4		
GB-09	2.5	3/2/2016							13.4			
GB-09	5.0					0.075	43		19.5	103.9		
GB-09	5.5	3/2/2016							15.2			
GB-09	10.0	3/2/2016							18.7	101.9		
GB-09	14.0	3/2/2016							20.2			
GB-09	20.0	3/2/2016							9.5	100.3		
GB-09	24.0	3/2/2016							9.7			
GB-09	29.0	3/2/2016							19.5			
GB-10	1.5	3/3/2016	22	16	6	0.075	42	SC-SM	17.7	105.3		
GB-10	2.0					0.075	43		18.6	107.8		
GB-10	2.5	3/2/2016							17.7			
GB-10	5.0	3/2/2016							31.2	87.2		
GB-10	5.5	3/2/2016							27.9			
GB-10	10.0	3/2/2016							27.6	84.4		
GB-10	15.0	3/2/2016							19.3	105.1		

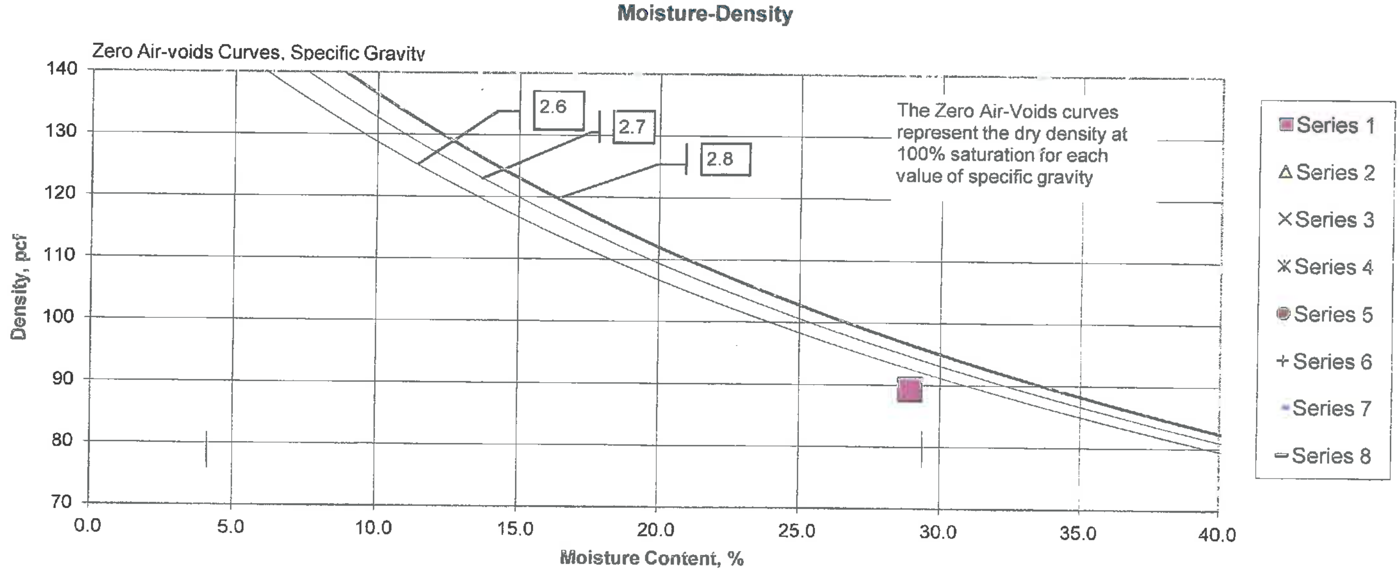
Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D7263b)

CTL Job No:	471-144	**Project No.**	160140
Client:	Cal Engineering & Geology	**Date:**	03/08/16
Project Name:	Jack Ranch	**Remarks:**	

By: RU

Boring:	GB-5							
Sample:								
Depth, ft:	2.5							
Visual Description:	Black CLAY, trace Sand							
Actual G_s								
Assumed G_s	2.70							
Moisture, %	28.9							
Wet Unit wt, pcf	115.2							
Dry Unit wt, pcf	89.3							
Dry Bulk Dens.pb, (g/cc)	1.43							
Saturation, %	87.9							
Total Porosity, %	47.0							
Volumetric Water Cont,Θw,%	41.4							
Volumetric Air Cont., Θa,%	5.7							
Void Ratio	0.89							
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.



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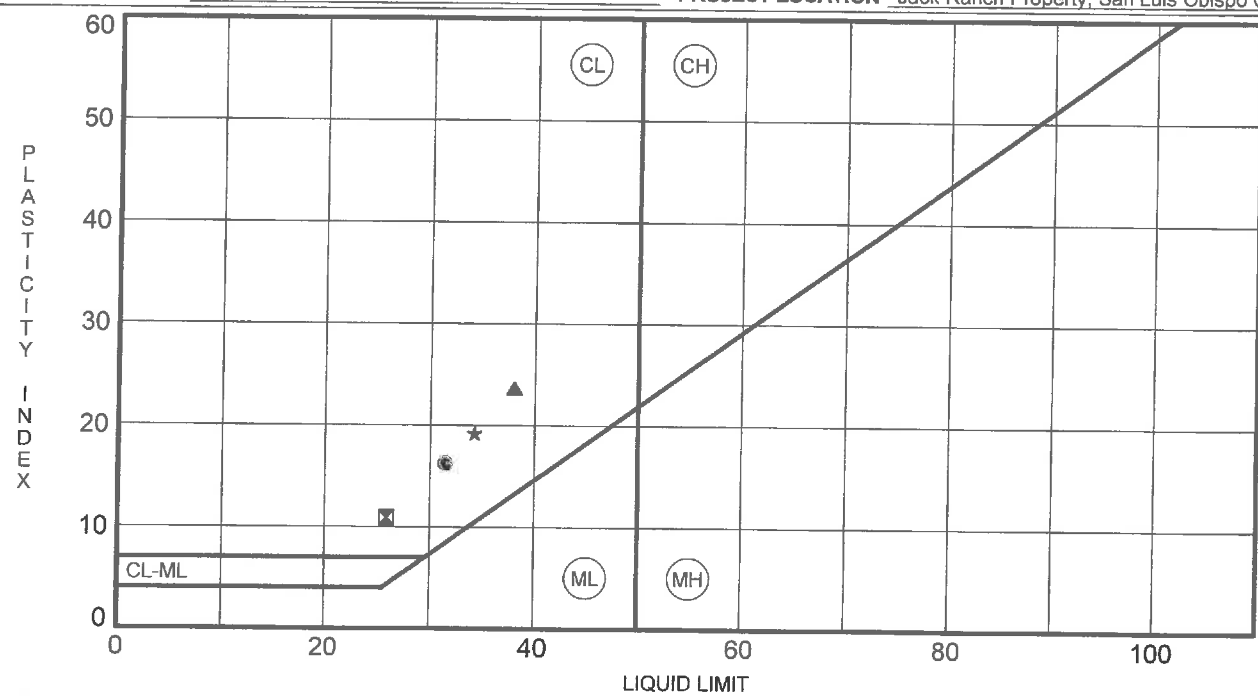
ATTERBERG LIMITS RESULTS

CLIENT GeoInsite, Inc.
PROJECT NUMBER 150321
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA

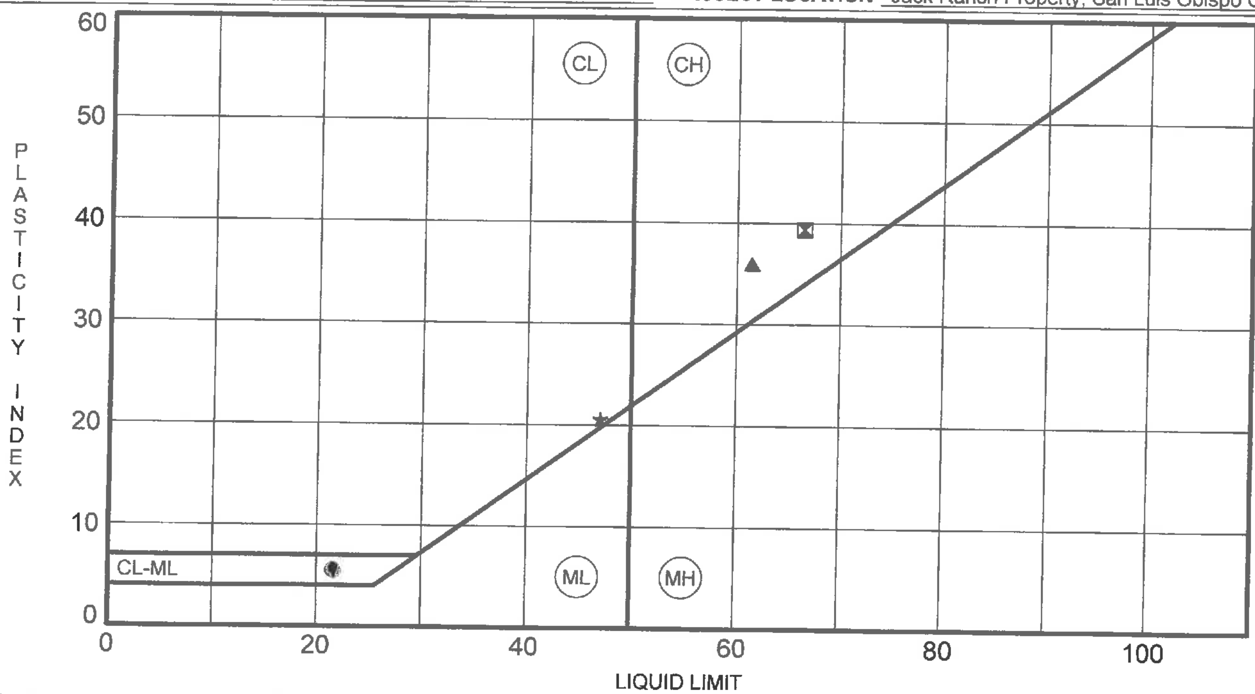


	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification	Date Tested
●	GB-2	34.0	31	15	16	32	very dark gray lean clayey sand	5/15/2015
⧗	GB-2	39.0	26	15	11	35	very dark gray lean clayey sand	5/15/2015
▲	GB-4	5.5	38	14	24	43	brown gray lean clayey sand	5/15/2015
★	GB-4	10.5	34	15	19	45	gray brown lean clayey sand	5/15/2015

CE&G
CAL ENGINEERING & GEOLOGY

ATTERBERG LIMITS RESULTS

CLIENT Erskine & Wilson
PROJECT NUMBER 160140
PROJECT NAME Jack Ranch Supplemental Feasability Investigation
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA.



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification	Date Tested
●	GB-10	1.5	22	16	6	42	Very Dark Gray Clayey Silty Sand	3/3/2016
⊠	GB-5	2.0	66	27	39	78	Very Dark Gray Fat Clay with Sand	3/3/2016
▲	GB-6	2.0	61	26	35	63	Very Dark Gray Sandy Fat Clay	3/3/2016
★	GB-7	5.5	47	27	20	46	Orange Brown Clayey Sand	3/3/2016

CE&G
CAL ENGINEERING & GEOLOGY

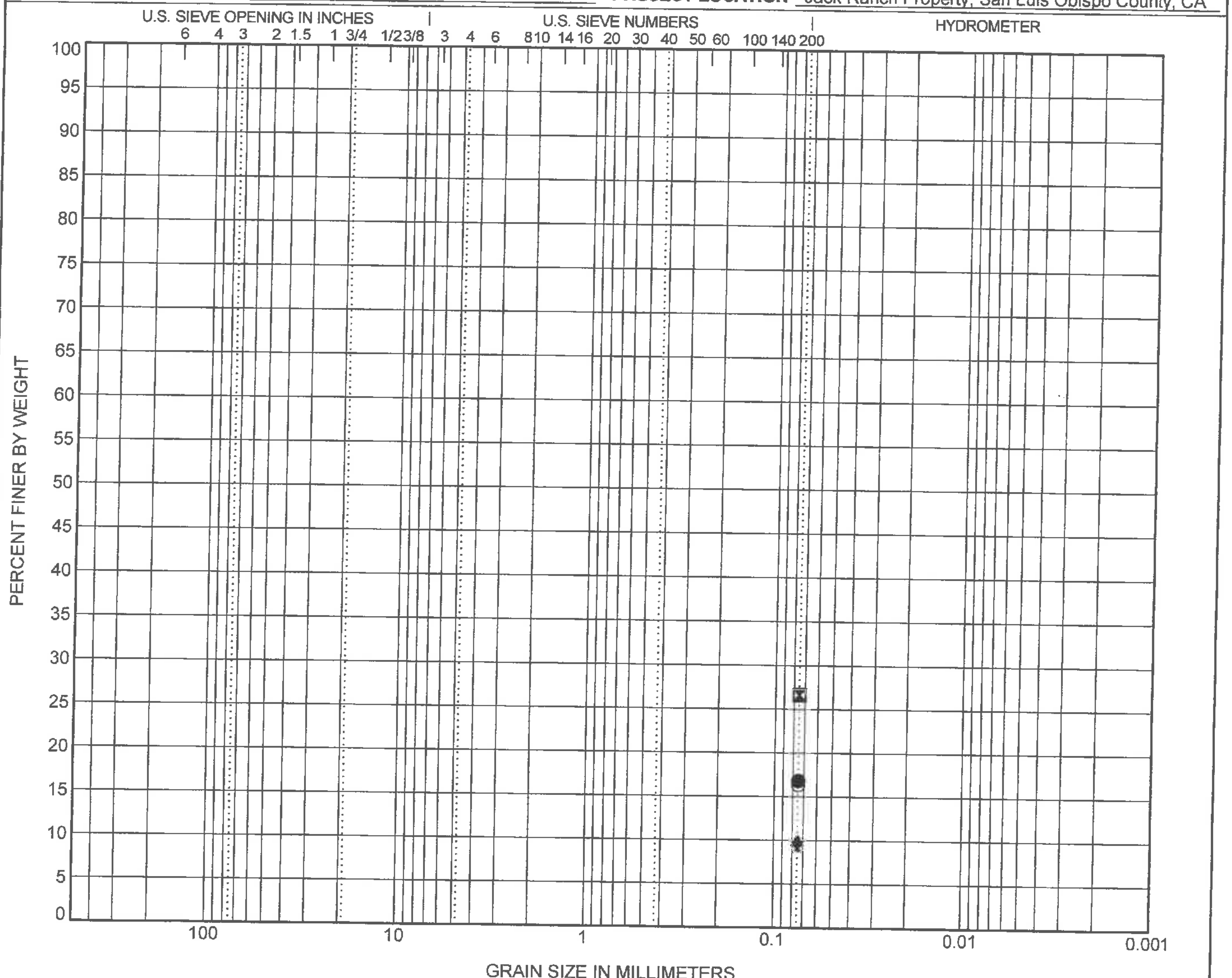
GRAIN SIZE DISTRIBUTION

CLIENT GeoInsite, Inc.

PROJECT NAME Jack Ranch Proposed Subdivision

PROJECT NUMBER 150321

PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
●	GB-1	5.5	5/15/2015						
⊠	GB-1	10.5	5/15/2015						
▲	GB-1	14.0	5/15/2015						
★	GB-1	19.0	5/15/2015						
⊙	GB-1	24.0	5/15/2015						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	GB-1	5.5	0.075						16.8	
⊠	GB-1	10.5	0.075						26.6	
▲	GB-1	14.0	0.075						10.0	
★	GB-1	19.0	0.075						9.3	
⊙	GB-1	24.0	0.075						16.3	

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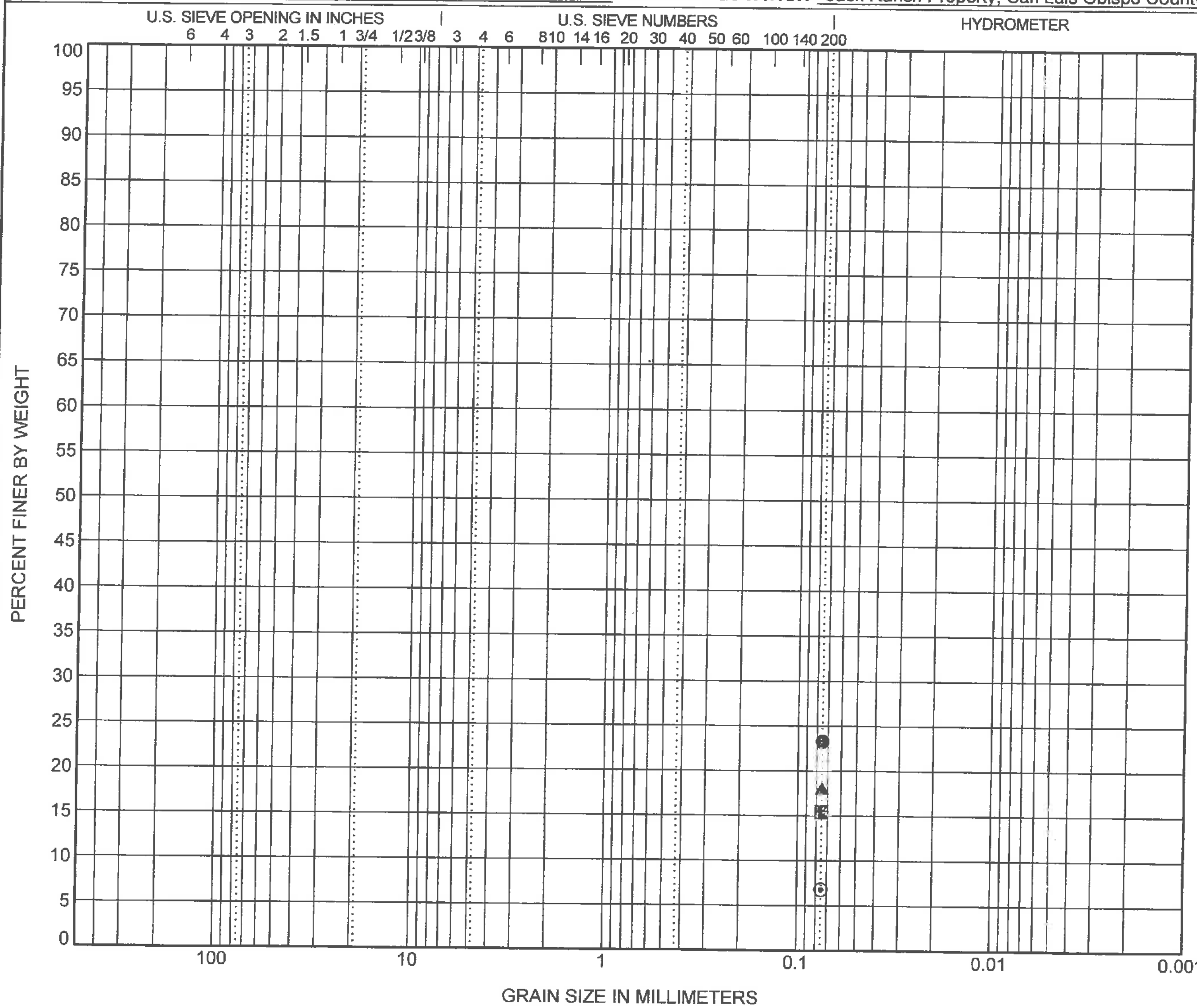
CAL ENGINEERING & GEOLOGY

GRAIN SIZE DISTRIBUTION

CLIENT GeoInsite, Inc.
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 150321
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

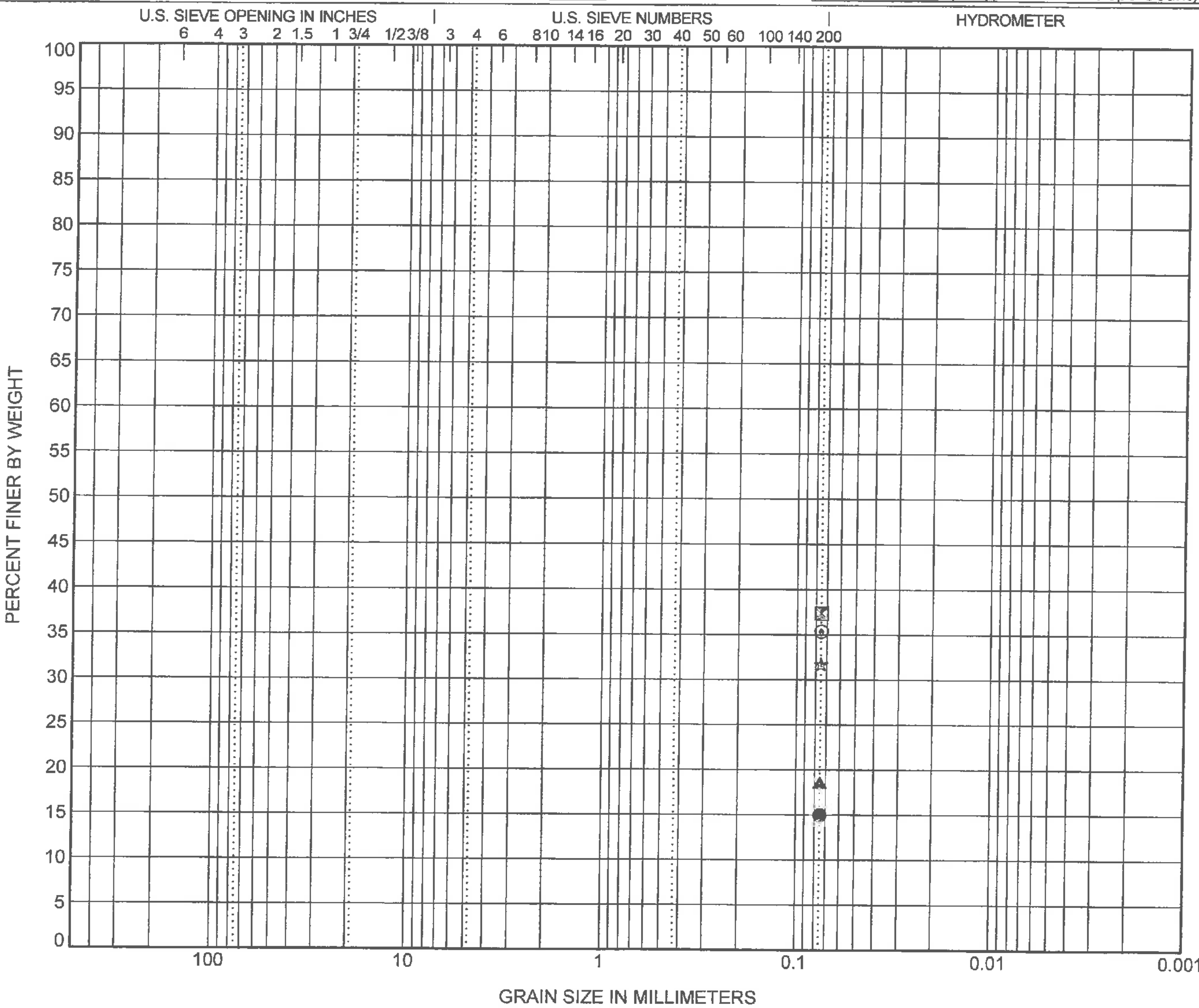
	BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
●	GB-1	29.0	5/18/2015						
⊠	GB-2	2.5	5/18/2015						
▲	GB-2	5.5	5/18/2015						
★	GB-2	10.0	5/18/2015						
⊙	GB-2	15.0	5/18/2015						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	GB-1	29.0	0.075						23.3	
⊠	GB-2	2.5	0.075						15.5	
▲	GB-2	5.5	0.075						18.1	
★	GB-2	10.0	0.075						15.4	
⊙	GB-2	15.0	0.075						6.8	

![CE&G Cal Engineering & Geology]

GRAIN SIZE DISTRIBUTION

CLIENT GeoInsite, Inc.
PROJECT NAME Jack Ranch Proposed Subdivision
PROJECT NUMBER 150321
PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
●	**GB-2**	**19.0**	**5/18/2015**						
⊠	**GB-2**	**24.0**	**5/18/2015**						
▲	**GB-2**	**29.0**	**5/18/2015**						
★	**GB-2**	**34.0**	**5/18/2015**	**black lean clayey sand**	**31**	**15**	**16**		
⊙	**GB-2**	**39.0**	**5/18/2015**	**black lean clayey sand**	**26**	**15**	**11**		

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**GB-2**	**19.0**	**0.075**						**15.0**	
⊠	**GB-2**	**24.0**	**0.075**						**37.4**	
▲	**GB-2**	**29.0**	**0.075**						**18.6**	
★	**GB-2**	**34.0**	**0.075**						**31.7**	
⊙	**GB-2**	**39.0**	**0.075**						**35.3**	

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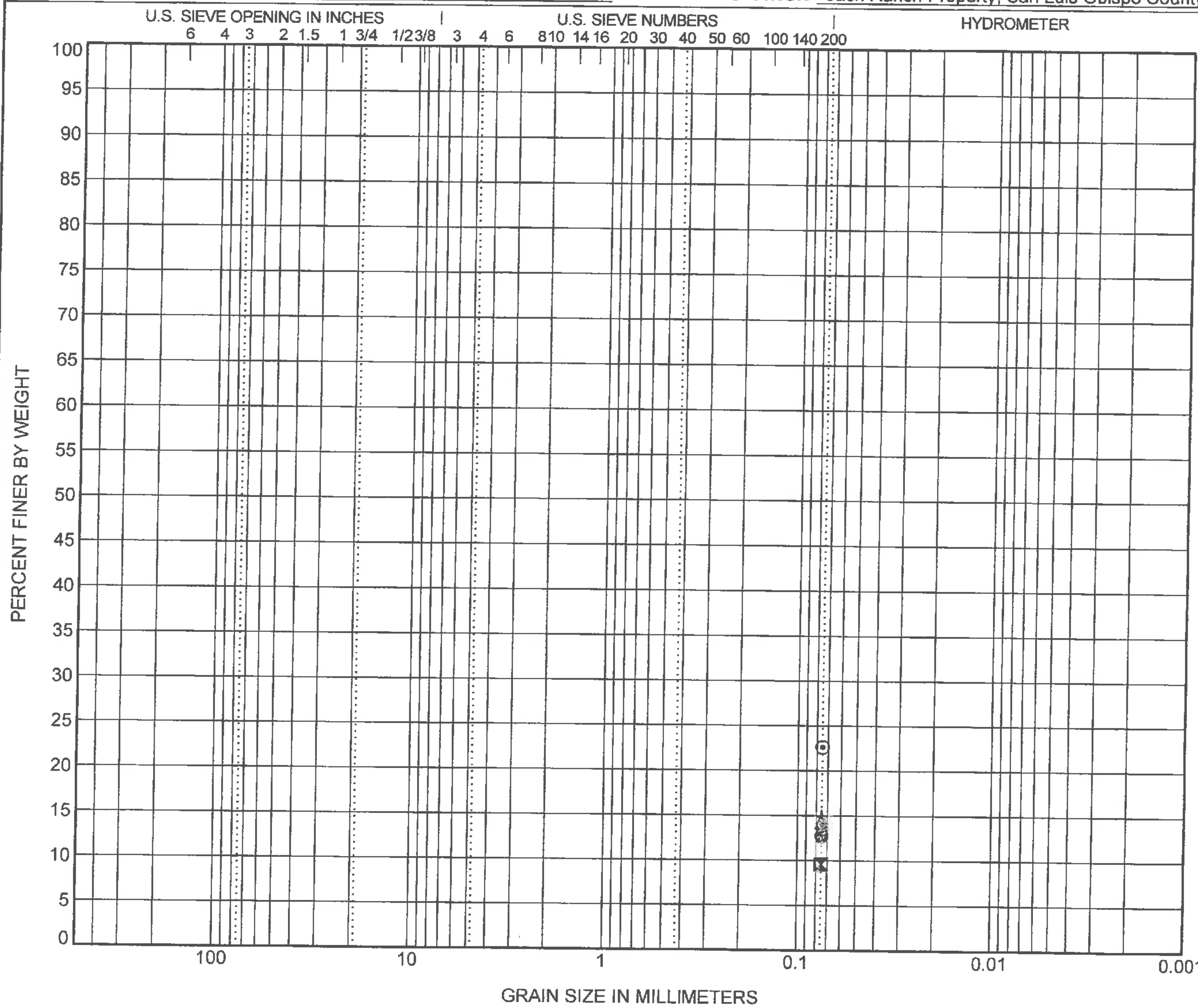
GRAIN SIZE DISTRIBUTION

CLIENT GeoInsite, Inc. **PROJECT NAME** Jack Ranch Proposed Subdivision

PROJECT NUMBER 150321 **PROJECT LOCATION** Jack Ranch Property, San Luis Obispo County, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
● GB-3	10.0	5/15/2015						
⊠ GB-3	15.0	5/15/2015						
▲ GB-3	15.5	5/15/2015						
★ GB-3	20.0	5/15/2015						
⊙ GB-3	24.0	5/15/2015						

BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
● GB-3	10.0	0.075						12.7	
⊠ GB-3	15.0	0.075						9.6	
▲ GB-3	15.5	0.075						14.2	
★ GB-3	20.0	0.075						14.9	
⊙ GB-3	24.0	0.075						22.6	

GRAIN SIZE DISTRIBUTION

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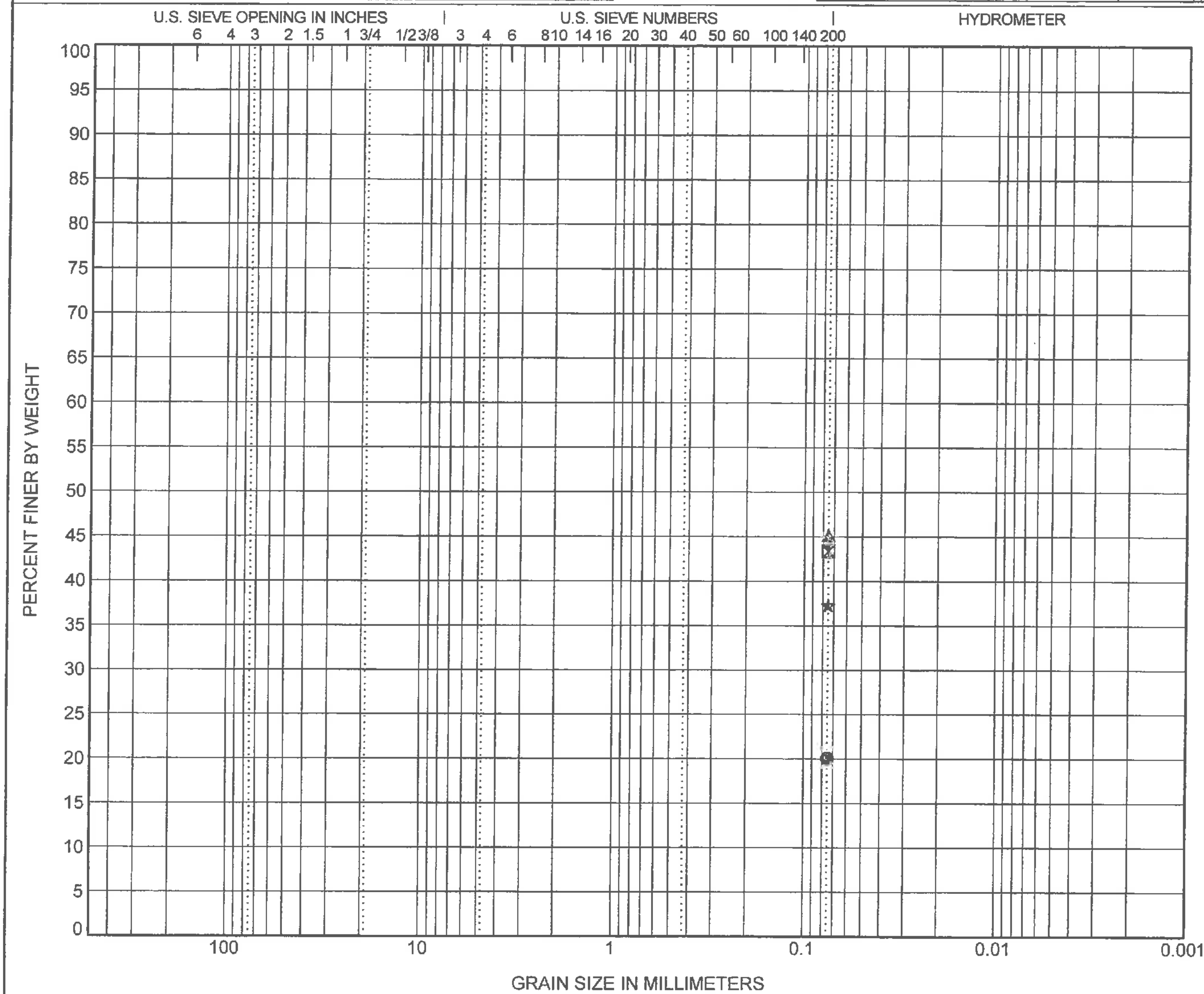
CLIENT GeoInsite, Inc. | PROJECT NAME Jack Ranch Proposed Subdivision

PROJECT NUMBER 150321 | PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
●	GB-3	29.0	5/18/2015						
⊠	GB-4	5.5	5/18/2015	very dark gray brown lean clayey sand	38	14	24		
▲	GB-4	10.5	5/18/2015	dark gray brown lean clayey sand	34	15	19		
★	GB-4	14.0	5/18/2015						

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	GB-3	29.0	0.075						20.1	
⊠	GB-4	5.5	0.075						43.3	
▲	GB-4	10.5	0.075						45.1	
★	GB-4	14.0	0.075						37.3	

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CAL ENGINEERING & GEOLOGY

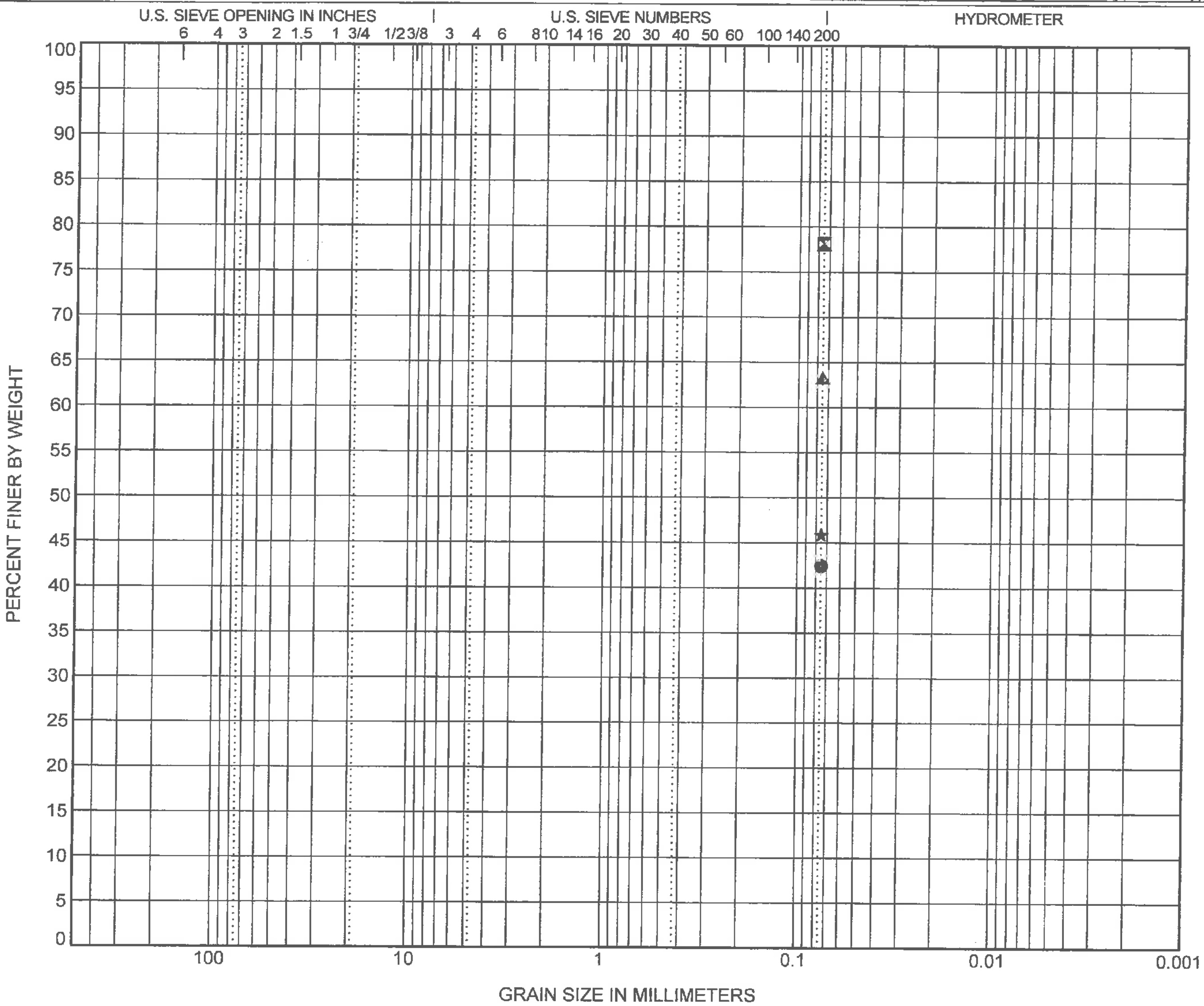
GRAIN SIZE DISTRIBUTION

CLIENT Erskine & Wilson

PROJECT NAME Jack Ranch Supplemental Feasability Investigation

PROJECT NUMBER 160140

PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA.



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
●	**GB-10**	**1.5**	**3/3/2016**	**Very Dark Gray Clayey Silty Sand**	**22**	**16**	**6**		
⊠	**GB-5**	**2.0**	**3/3/2016**	**Very Dark Gray Fat Clay with Sand**	**66**	**27**	**39**		
▲	**GB-6**	**2.0**	**3/3/2016**	**Very Dark Gray Sandy Fat Clay**	**61**	**26**	**35**		
★	**GB-7**	**5.5**	**3/3/2016**	**Orange Brown Clayey Sand**	**47**	**27**	**20**		

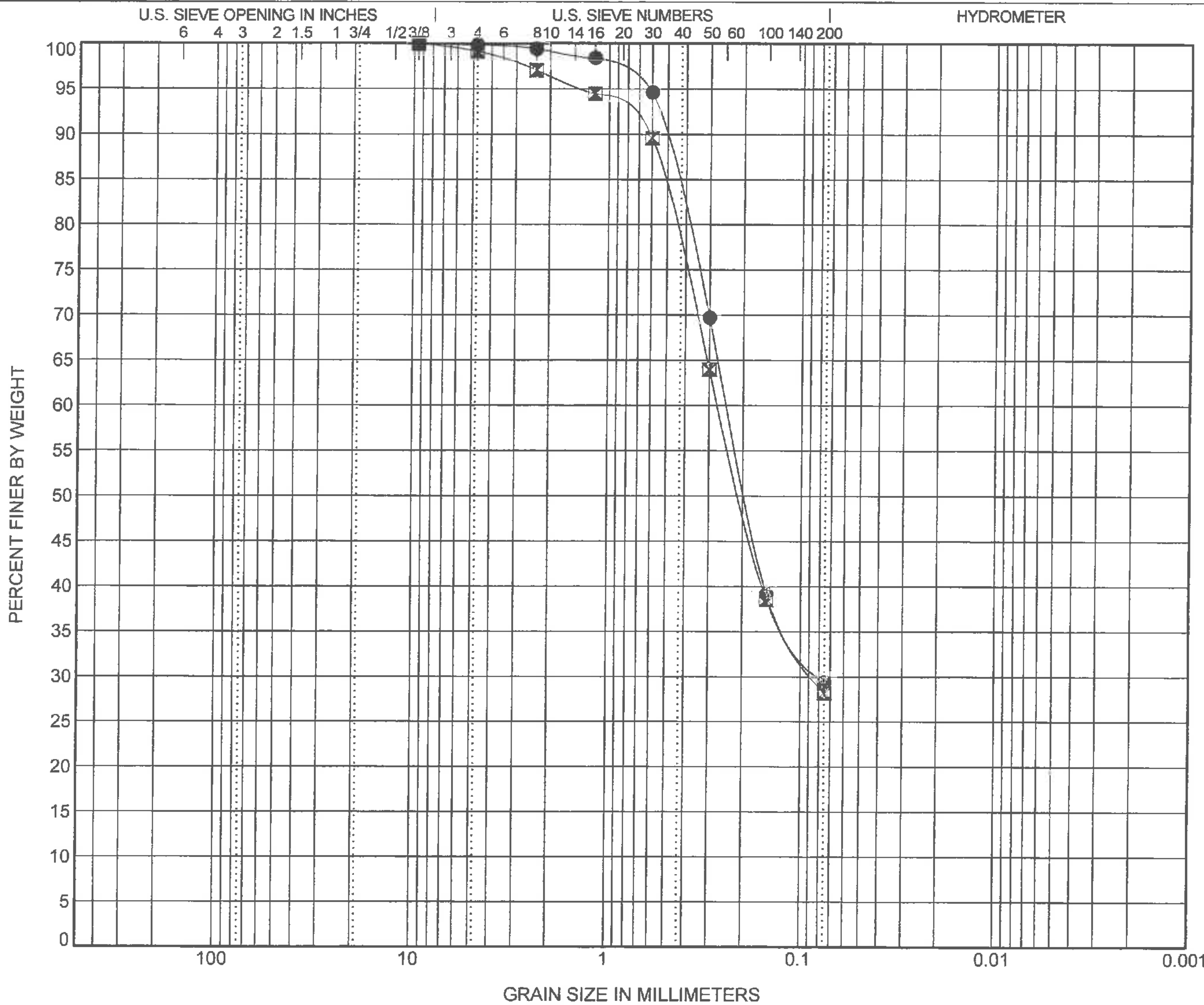
	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**GB-10**	**1.5**	**0.075**						**42.4**	
⊠	**GB-5**	**2.0**	**0.075**						**78.1**	
▲	**GB-6**	**2.0**	**0.075**						**63.3**	
★	**GB-7**	**5.5**	**0.075**						**45.9**	

GRAIN SIZE DISTRIBUTION

CE&G
CAL ENGINEERING & GEOLOGY

CLIENT Erskine & Wilson PROJECT NAME Jack Ranch Supplemental Feasability Investigation

PROJECT NUMBER 160140 PROJECT LOCATION Jack Ranch Property, San Luis Obispo County, CA.

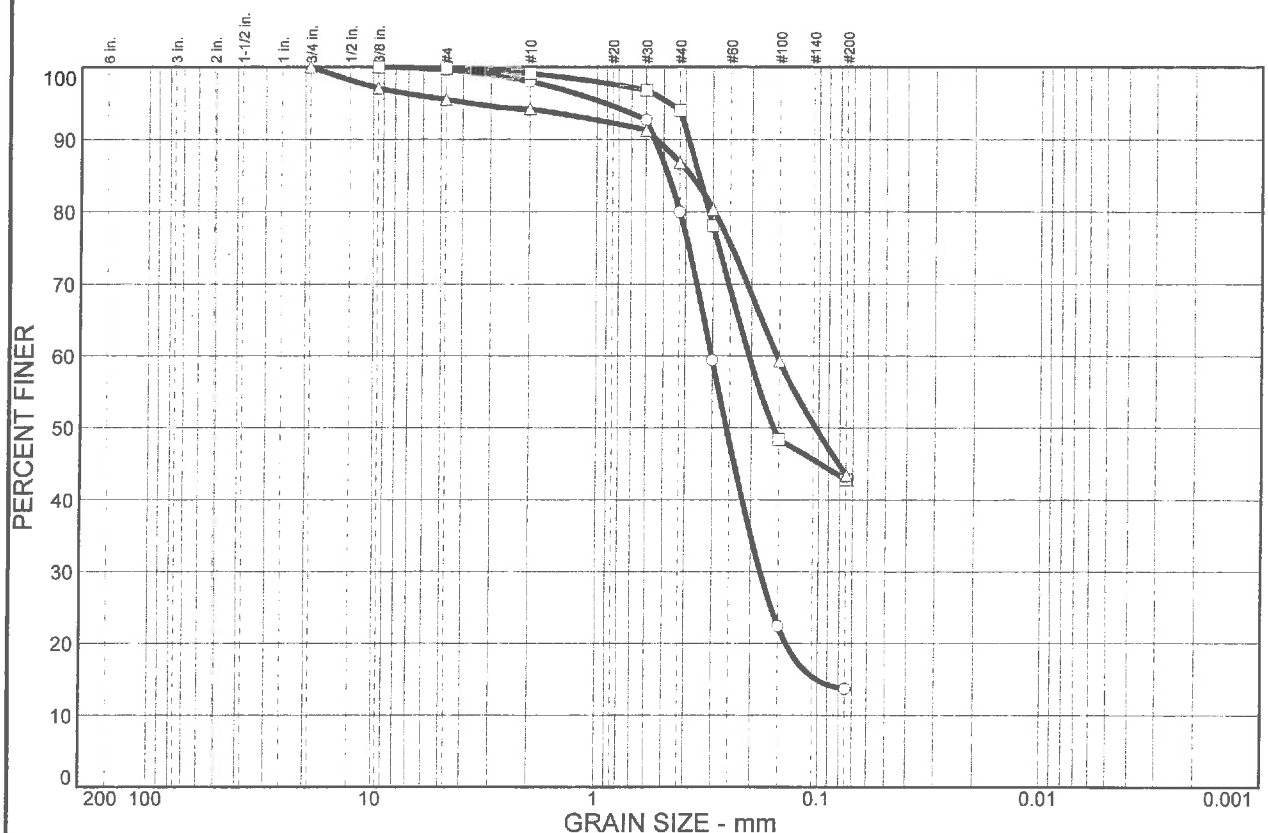


COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	DATE TESTED	Classification	LL	PL	PI	Cc	Cu
●	GB-8	2.0	3/2/2016	Very Dark Brown Silty Sand					
⊠	GB-8	5.5	3/2/2016	Dark Brown Silty Sand					

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	GB-8	2.0	9.5	0.241	0.078		0.1	70.5	29.4	
⊠	GB-8	5.5	9.5	0.269	0.085		0.8	71.0	28.2	

Particle Size Distribution Report



	% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY	USCS	AASHTO	PL	LL
○		0.4	85.9	13.7					
□		0.2	57.0	42.8					
△		4.5	52.1	43.4					

SIEVE inches size	PERCENT FINER ○	□	△
3/4"			100.0
3/8"	100.0	100.0	97.1
	GRAIN SIZE		
D_{60}	0.303	0.206	0.154
D_{30}	0.181		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIEVE number size	PERCENT FINER ○	□	△
#4	99.6	99.8	95.5
#10	98.0	99.1	94.2
#30	92.7	96.8	91.3
#40	80.0	94.0	86.8
#50	59.4	78.1	80.4
#100	22.4	48.4	59.3
#200	13.7	42.8	43.4

SOIL DESCRIPTION

○ Dark Brown Silty SAND

□ Dark Brown Clayey SAND

△ Dark Brown Clayey SAND

REMARKS:

○

□

△

○ Source: GB-9 Sample No.: 9-2 Elev./Depth: 2.0'

□ Source: GB-9 Sample No.: 9-4 Elev./Depth: 5.0'

△ Source: GB-10 Sample No.: 10-2 Elev./Depth: 2.0'

COOPER TESTING LABORATORY

Client: Cal Engineering & Geology

Project: Jack Ranch - 160140

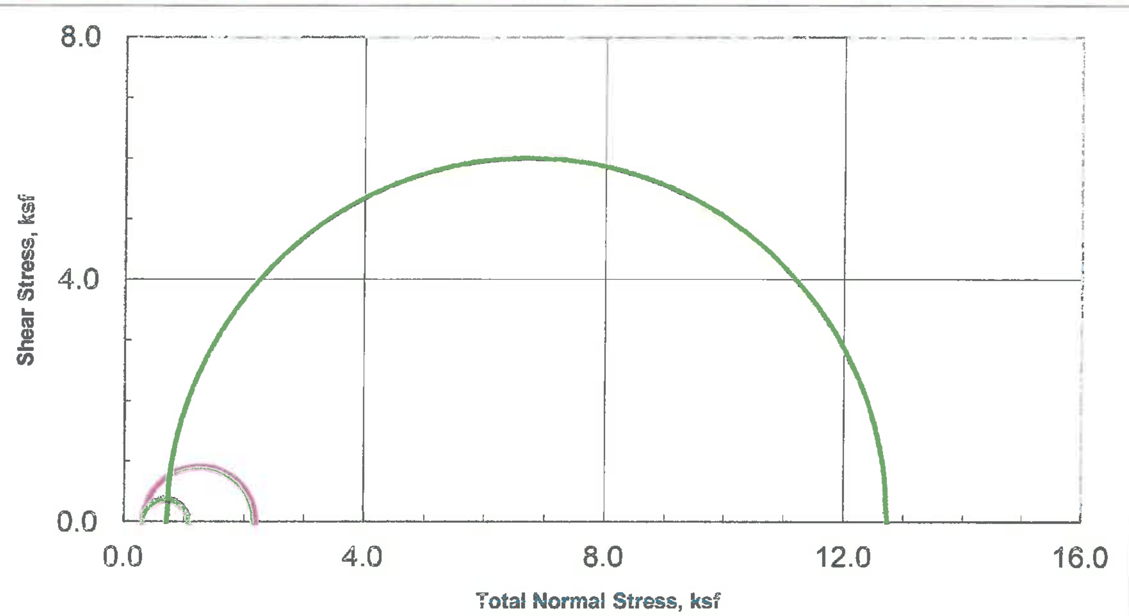
Project No.: 471-144

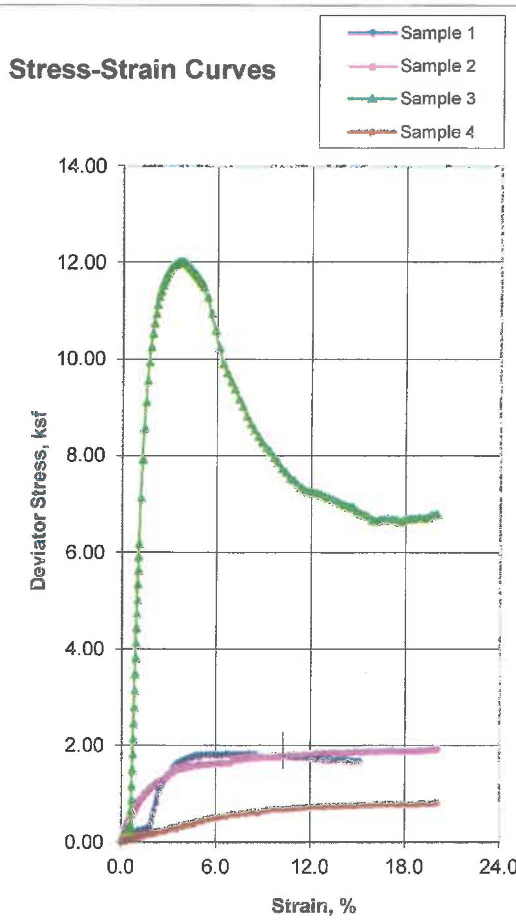
Figure

Cooper Testing Labs, Inc.
937 Commercial Street
Palo Alto, CA 94303

COOPER

Unconsolidated-Undrained Triaxial Test
ASTM D2850





Sample Data	1	2	3	4
Moisture %	31.1	9.3	19.5	18.6
Dry Den,pcf	88.3	101.4	103.9	107.8
Void Ratio	0.908	0.663	0.622	0.564
Saturation %	92.5	37.8	84.8	89.2
Height in	5.15	5.00	5.03	5.00
Diameter in	2.37	2.42	2.42	2.40
Cell psi	2.1	2.1	4.9	2.1
Strain %	8.05	15.00	3.64	15.00
Deviator, ksf	1.845	1.893	12.027	0.768
Rate %/min	1.00	1.00	1.00	1.00
in/min	0.051	0.050	0.050	0.050

Job No.:	471-144			
Client:	Cal Engineering & Geology			
Project:	Jack Ranch - 160140			
Boring:	GB-7	GB-9	GB-9	GB-10
Sample:		9-2	9-4	10-2
Depth ft:	2.0	2.0	5.0	2.0

Visual Soil Description

Sample #	
1	Dark Gray Brown CLAY w/ Sand
2	Dark Brown Silty SAND
3	Olive Gray Brown Clayey SAND
4	Dark Brown Clayey SAND

Remarks:

Note: Strengths are picked at the peak deviator stress or 15% strain which ever occurs first per ASTM D2850.

APPENDIX D

FIELD INVESTIGATION

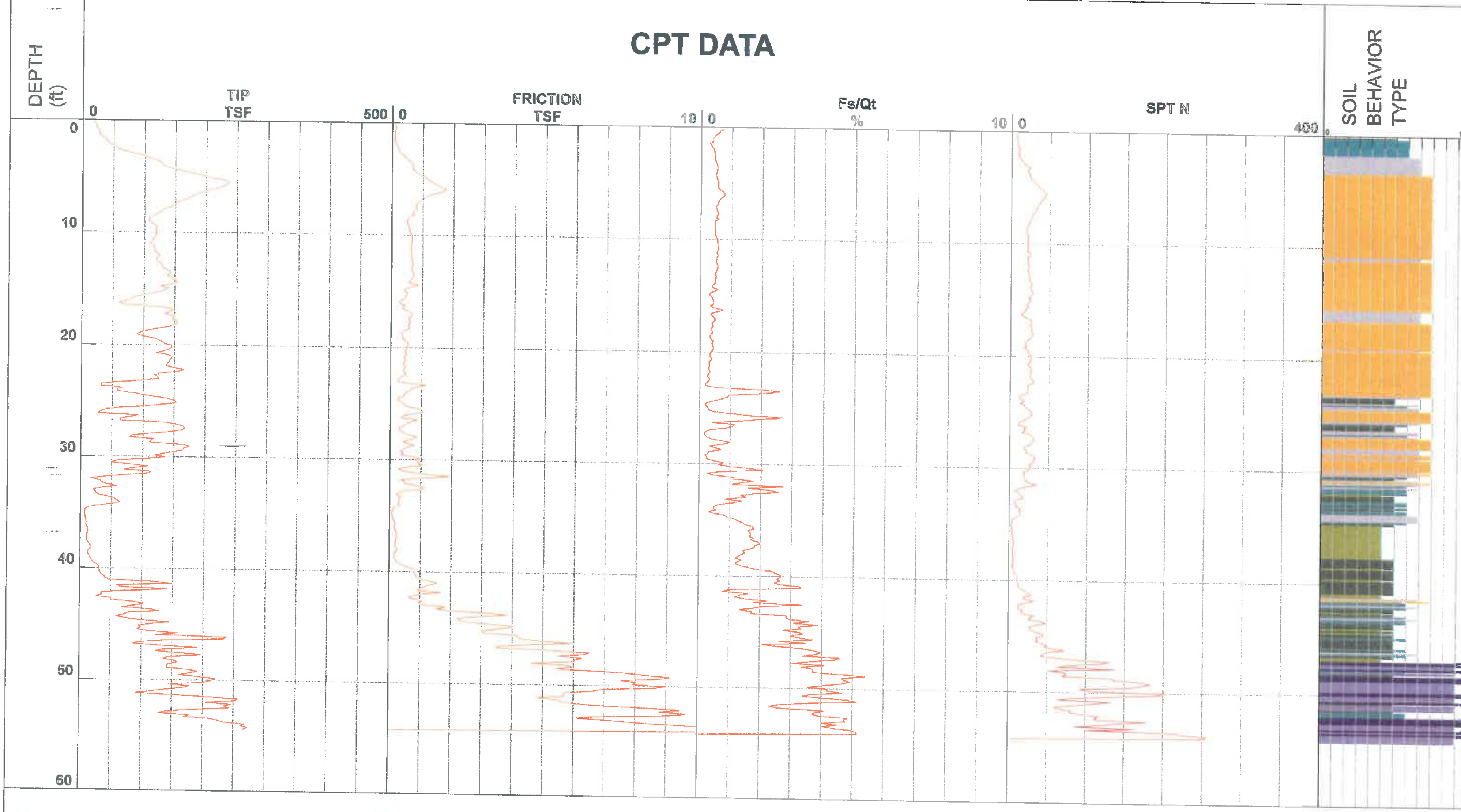
CONE PENETRATION TEST (CPT) RESULTS

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(165).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-01	Date and Time	2/23/2016 10:30:44 AM	Maximum Depth	54.46 ft
EST GW Depth During Test	38.00 ft				

Net Area Ratio .8

CPT DATA



- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

Cone Size 10cm squared

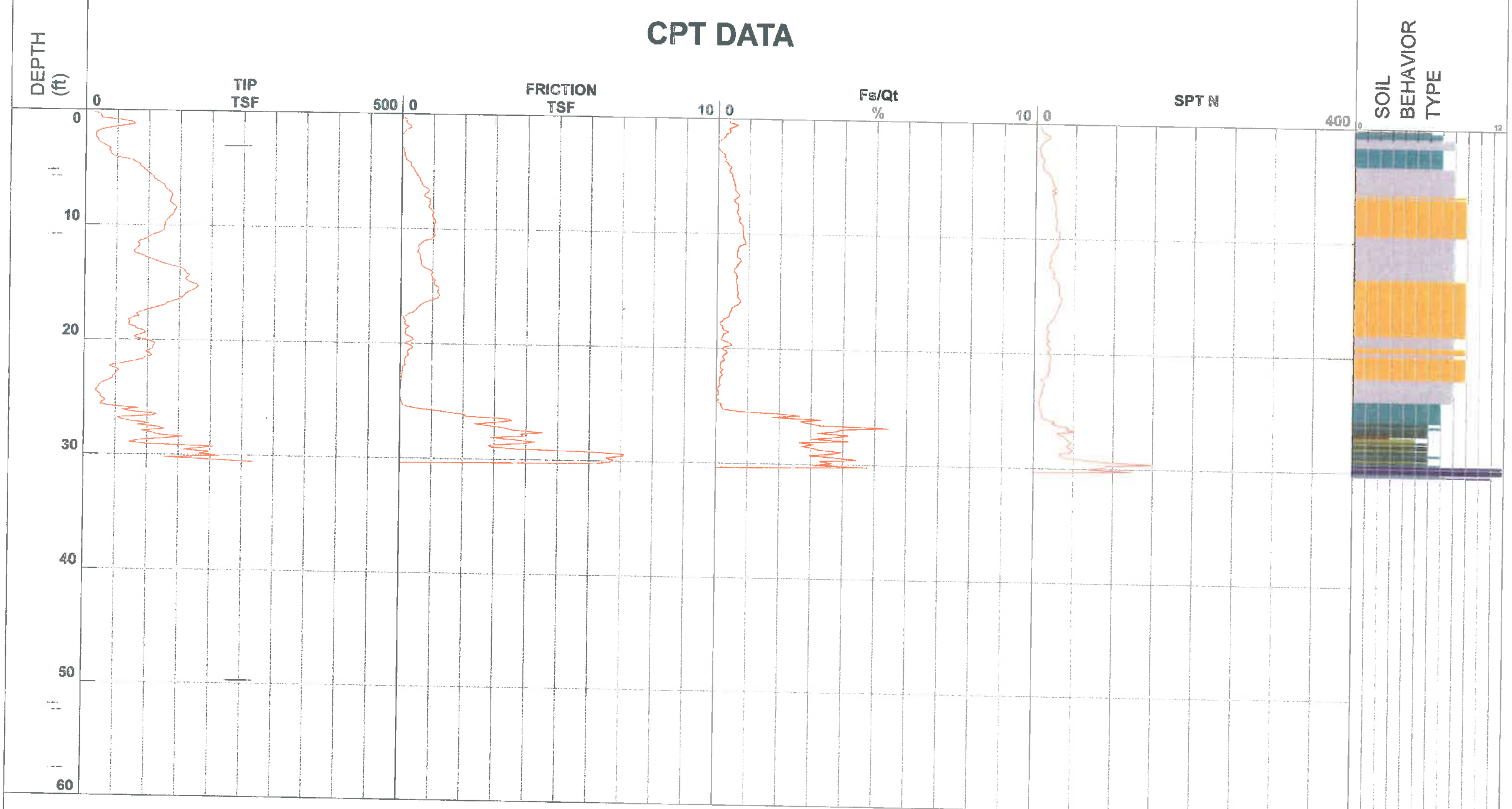
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(166).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-02	Date and Time	2/23/2016 11:43:40 AM	Maximum Depth	30.51 ft
EST GW Depth During Test	38.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

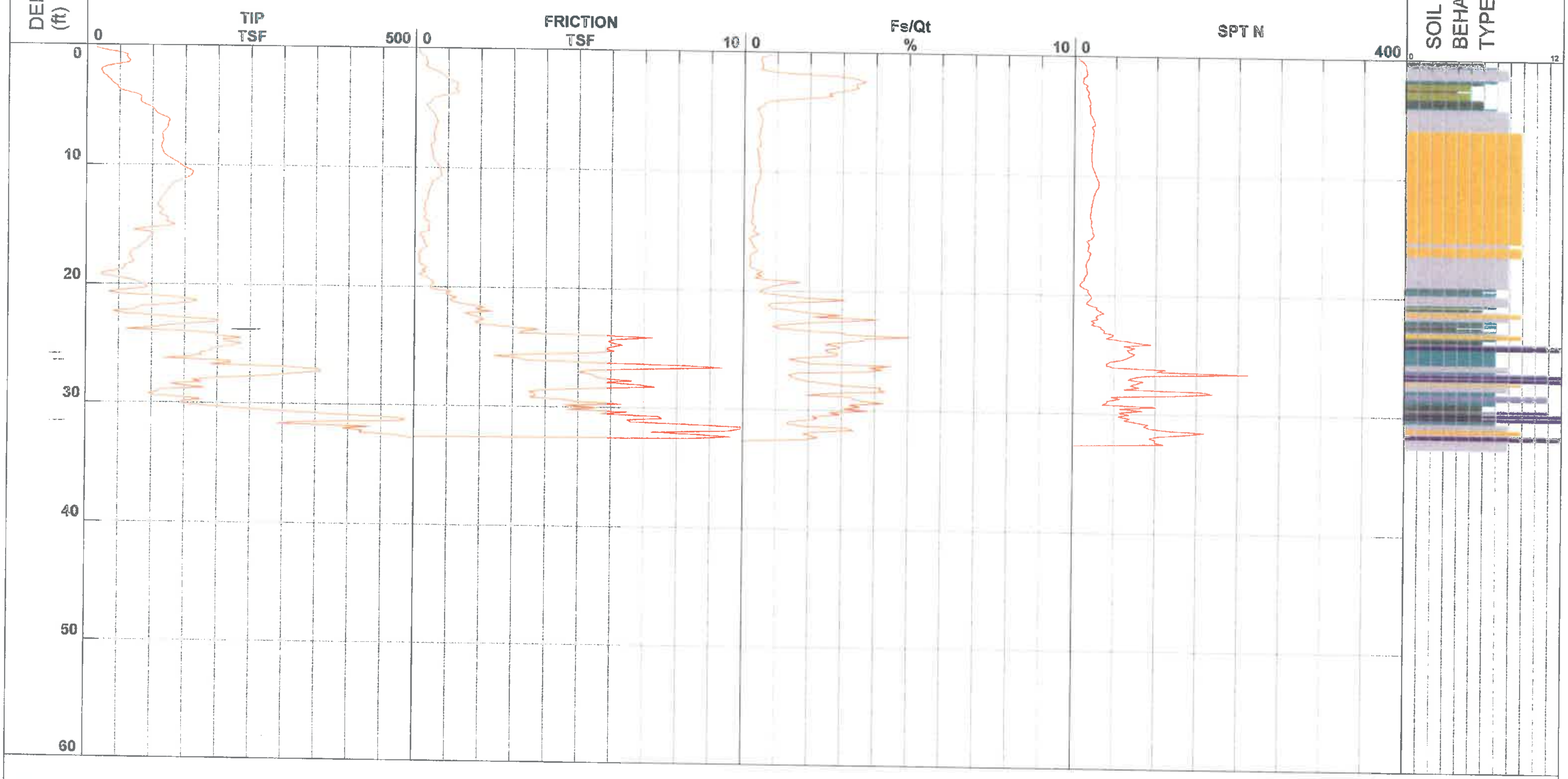
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(167).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-03	Date and Time	2/23/2016 12:07:29 PM	Maximum Depth	32.81 ft
EST GW Depth During Test	21.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

Cone Size 10cm squared

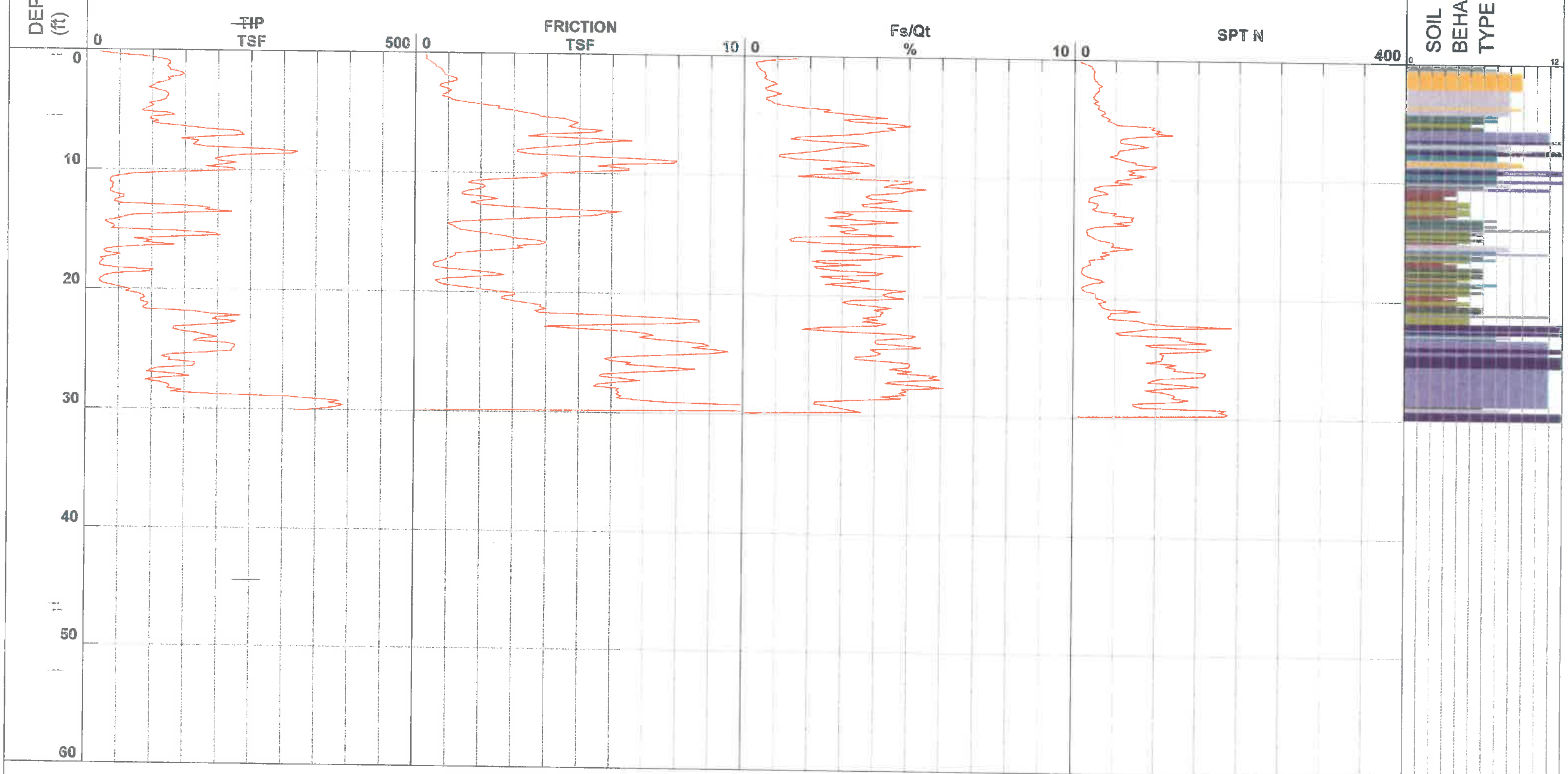
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(168).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-04	Date and Time	2/23/2016 12:50:20 PM	Maximum Depth	30.02 ft
EST GW Depth During Test	20.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

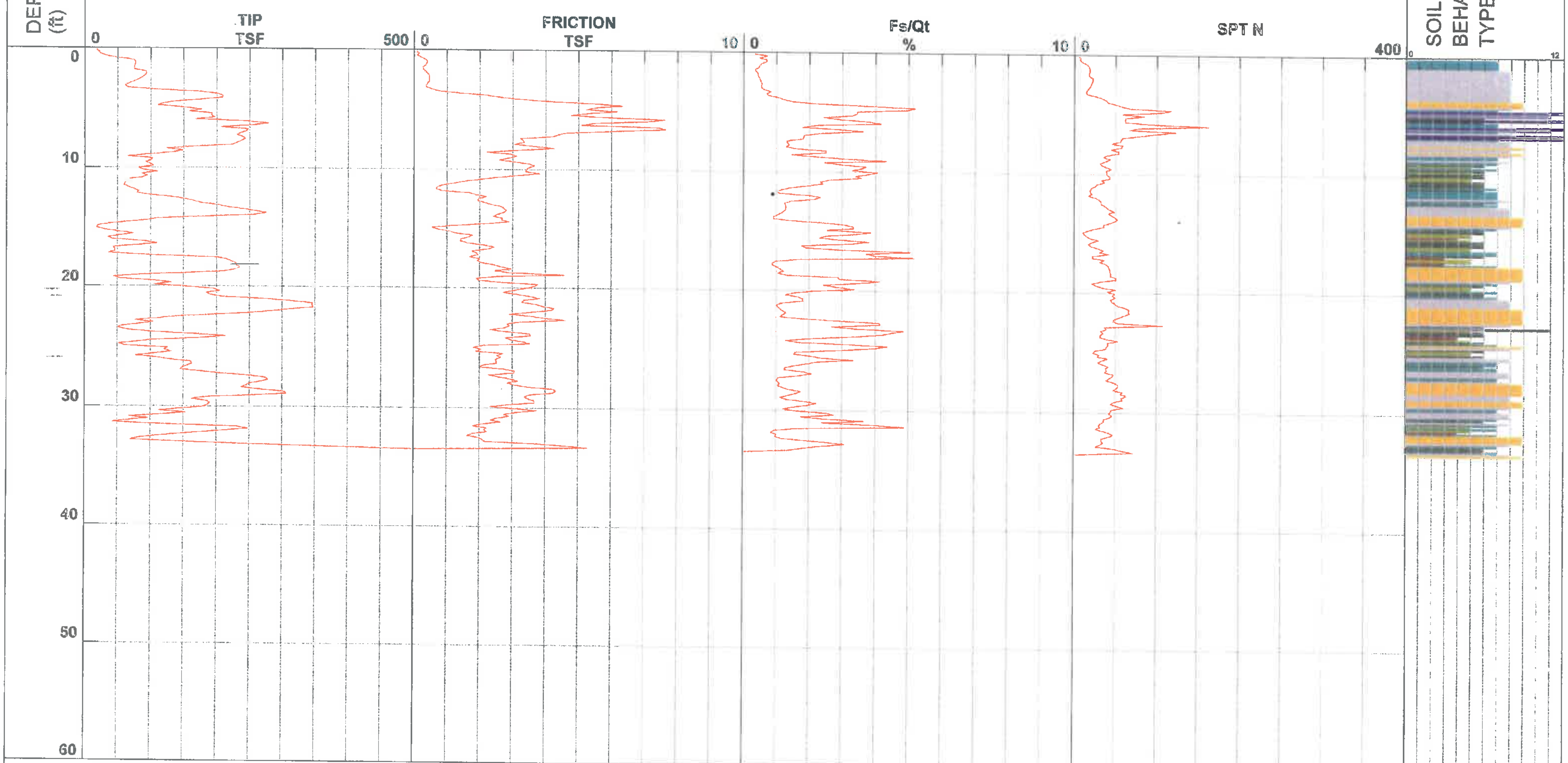
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(169).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-05	Date and Time	2/23/2016 1:15:00 PM	Maximum Depth	33.63 ft
EST GW Depth During Test	20.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

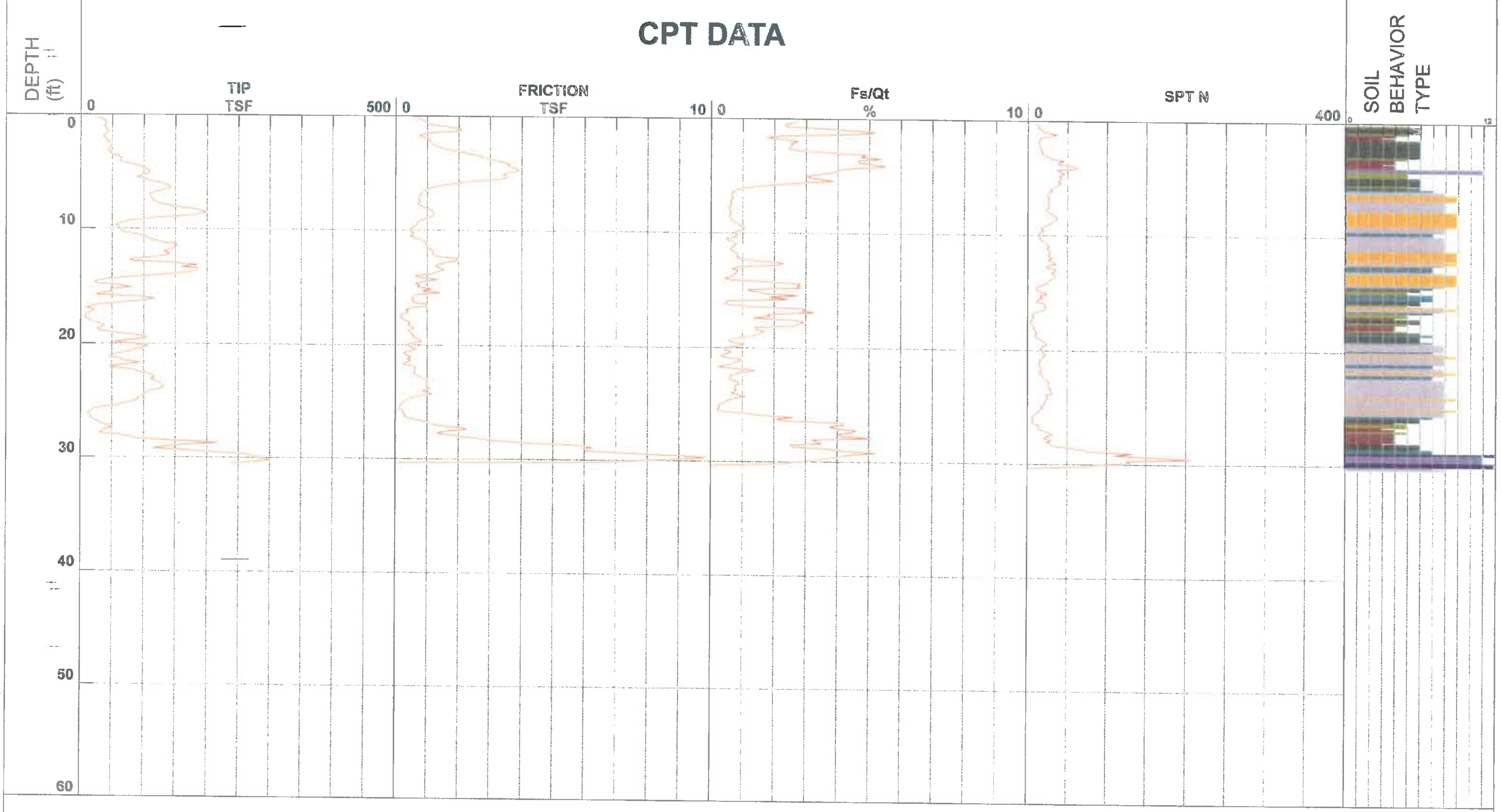
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(170).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-06	Date and Time	2/23/2016 1:41:22 PM	Maximum Depth	30.51 ft
EST GW Depth During Test		20.00 ft			

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

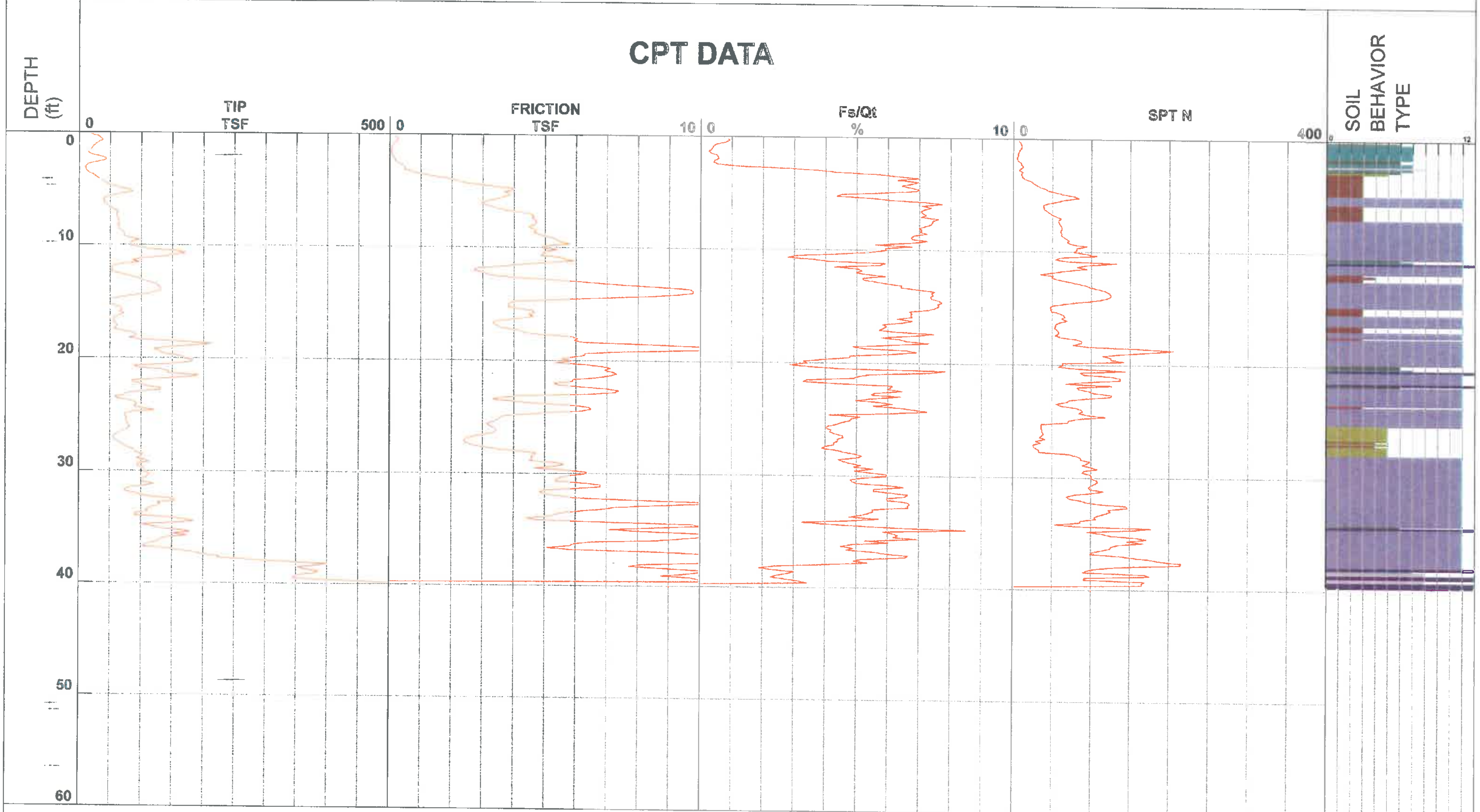
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(171).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-07	Date and Time	2/23/2016 2:06:53 PM	Maximum Depth	39.86 ft
EST GW Depth During Test	20.00 ft				

Net Area Ratio .8

CPT DATA



- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

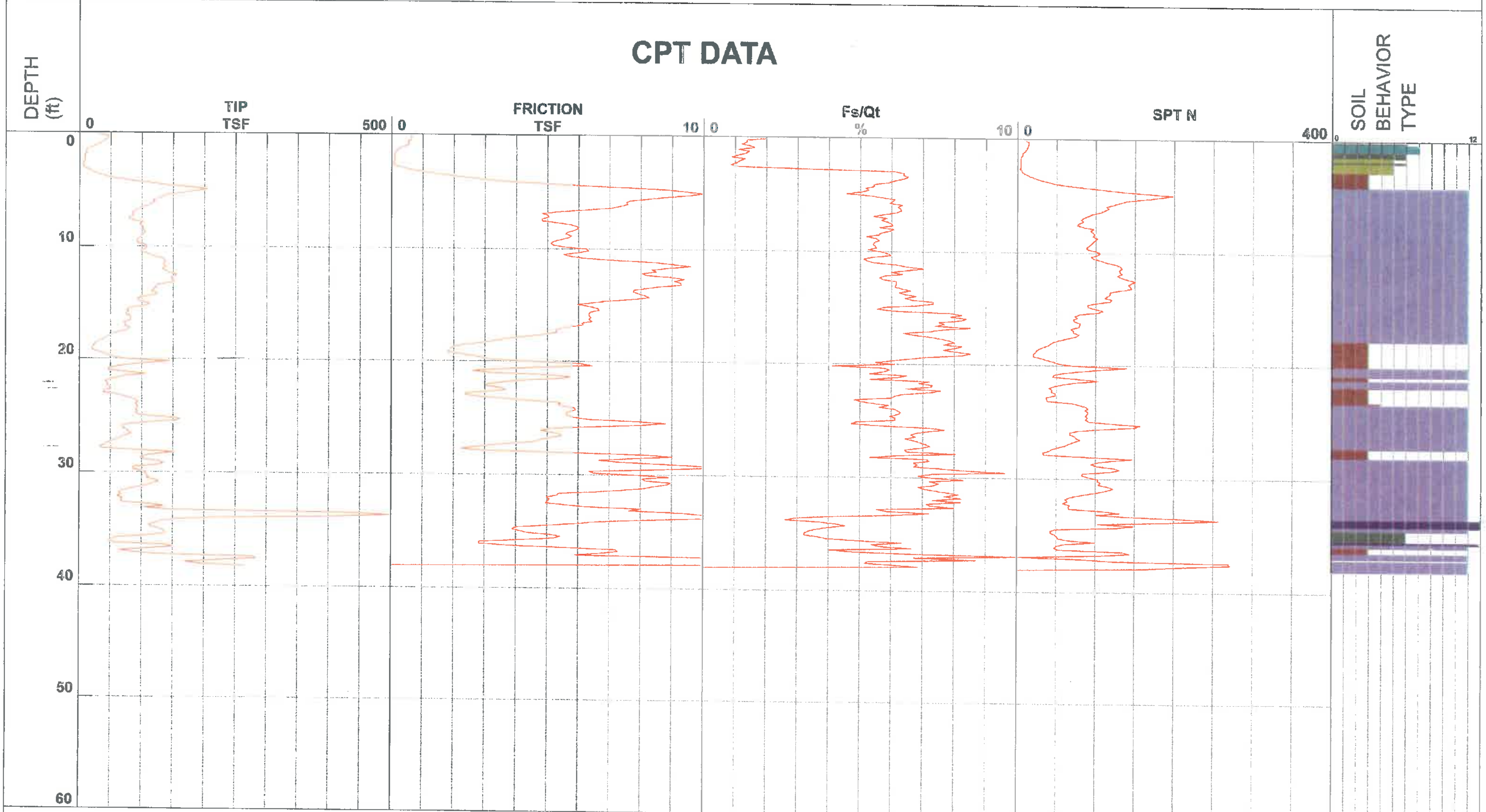
Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(172).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-08	Date and Time	2/24/2016 6:50:46 AM	Maximum Depth	38.22 ft
EST GW Depth During Test		20.00 ft			

Net Area Ratio .8



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

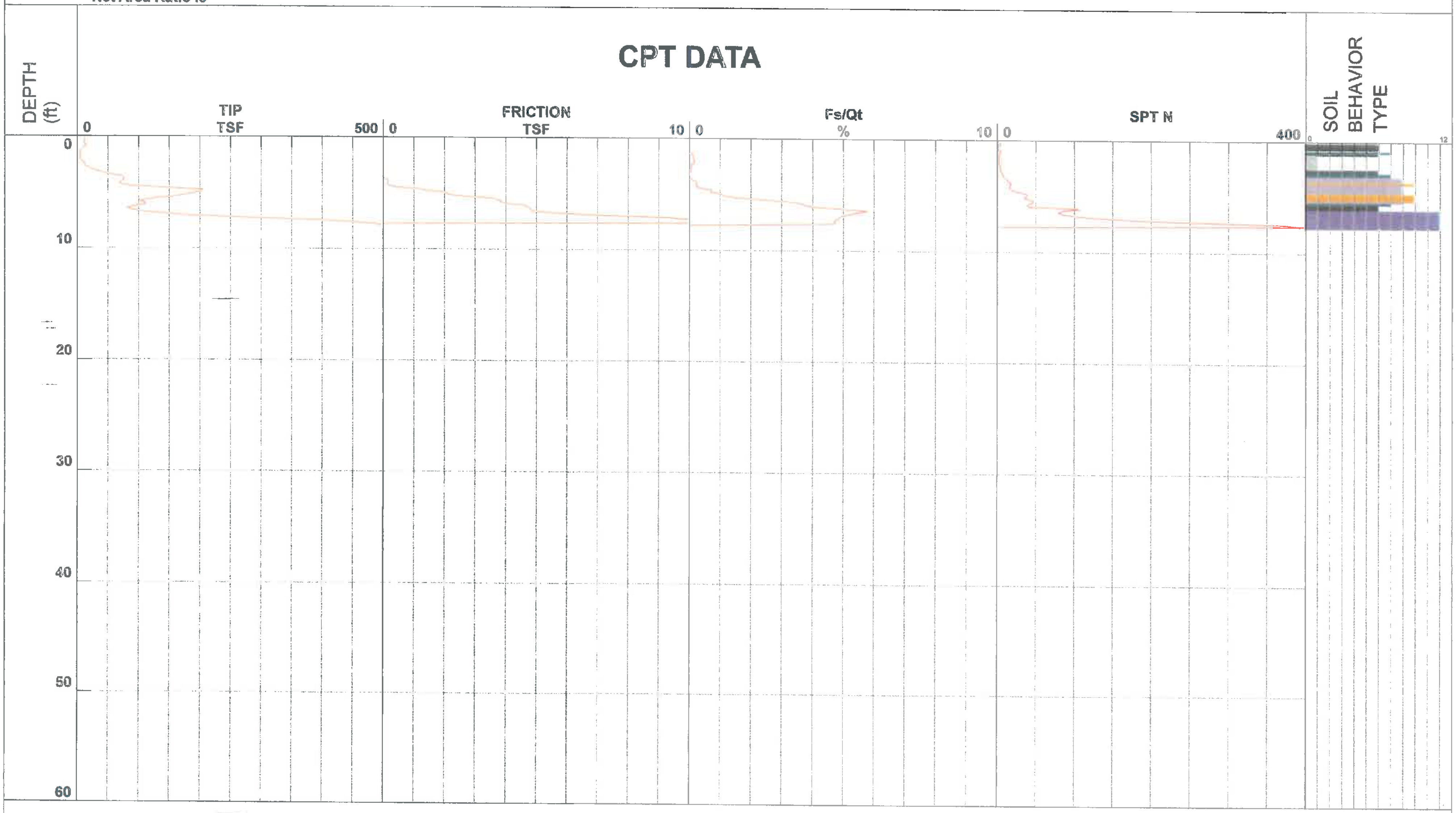
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(175).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-09	Date and Time	2/24/2016 8:19:32 AM	Maximum Depth	7.87 ft
EST GW Depth During Test	20.00 ft				

Net Area Ratio .8

CPT DATA



1 - sensitive fine grained
2 - organic material
3 - clay
4 - silty clay to clay
5 - clayey silt to silty clay
6 - sandy silt to clayey silt
7 - silty sand to sandy silt
8 - sand to silty sand
9 - sand
10 - gravelly sand to sand
11 - very stiff fine grained (*)
12 - sand to clayey sand (*)

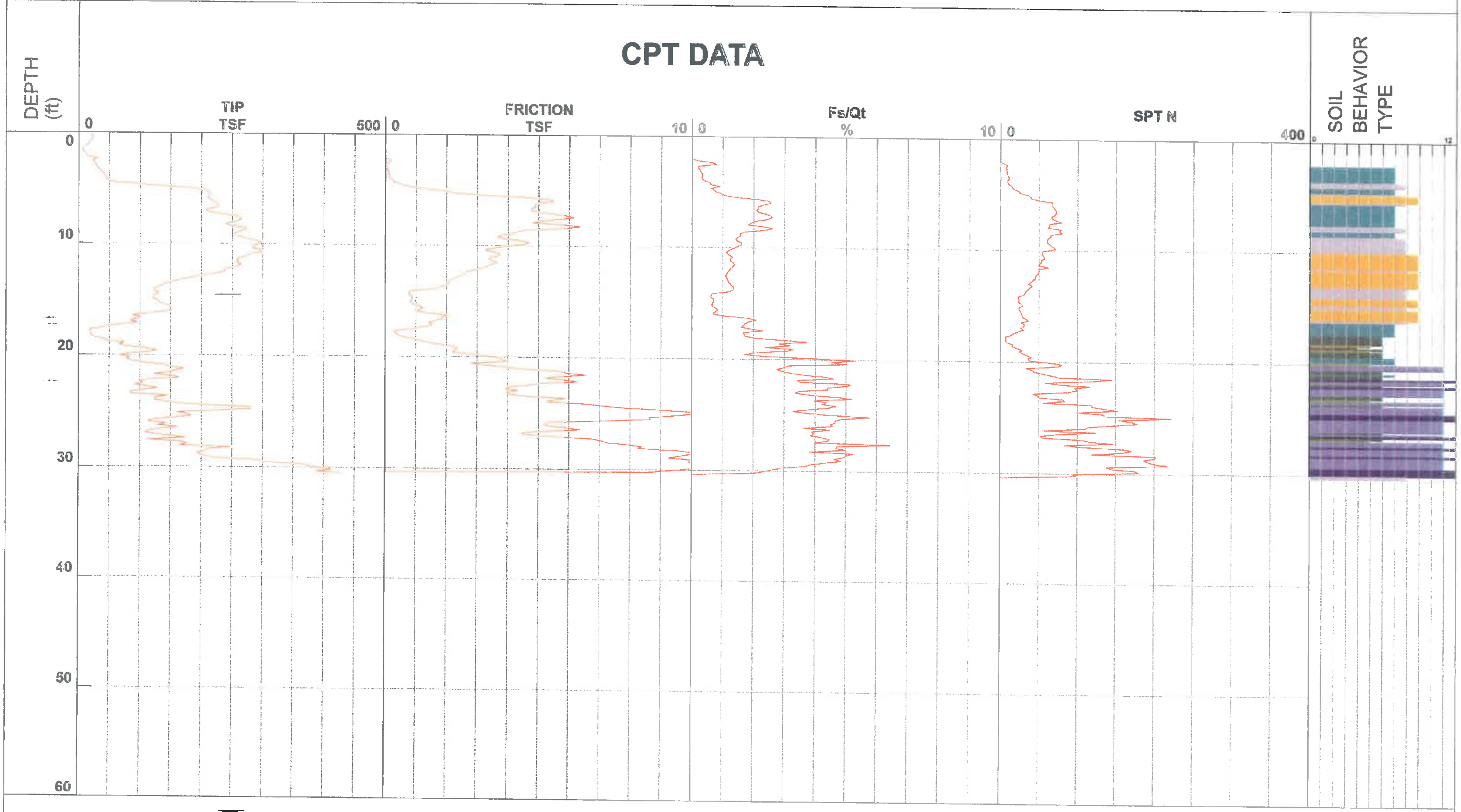
Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(173).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-11	Date and Time	2/24/2016 7:30:07 AM	Maximum Depth	30.51 ft
EST GW Depth During Test		20.00 ft			

Net Area Ratio .8



1 - sensitive fine grained	4 - silty clay to clay	7 - silty sand to sandy silt	10 - gravelly sand to sand
2 - organic material	5 - clayey silt to silty clay	8 - sand to silty sand	11 - very stiff fine grained (*)
3 - clay	6 - sandy silt to clayey silt	9 - sand	12 - sand to clayey sand (*)

Cone Size 10cm squared

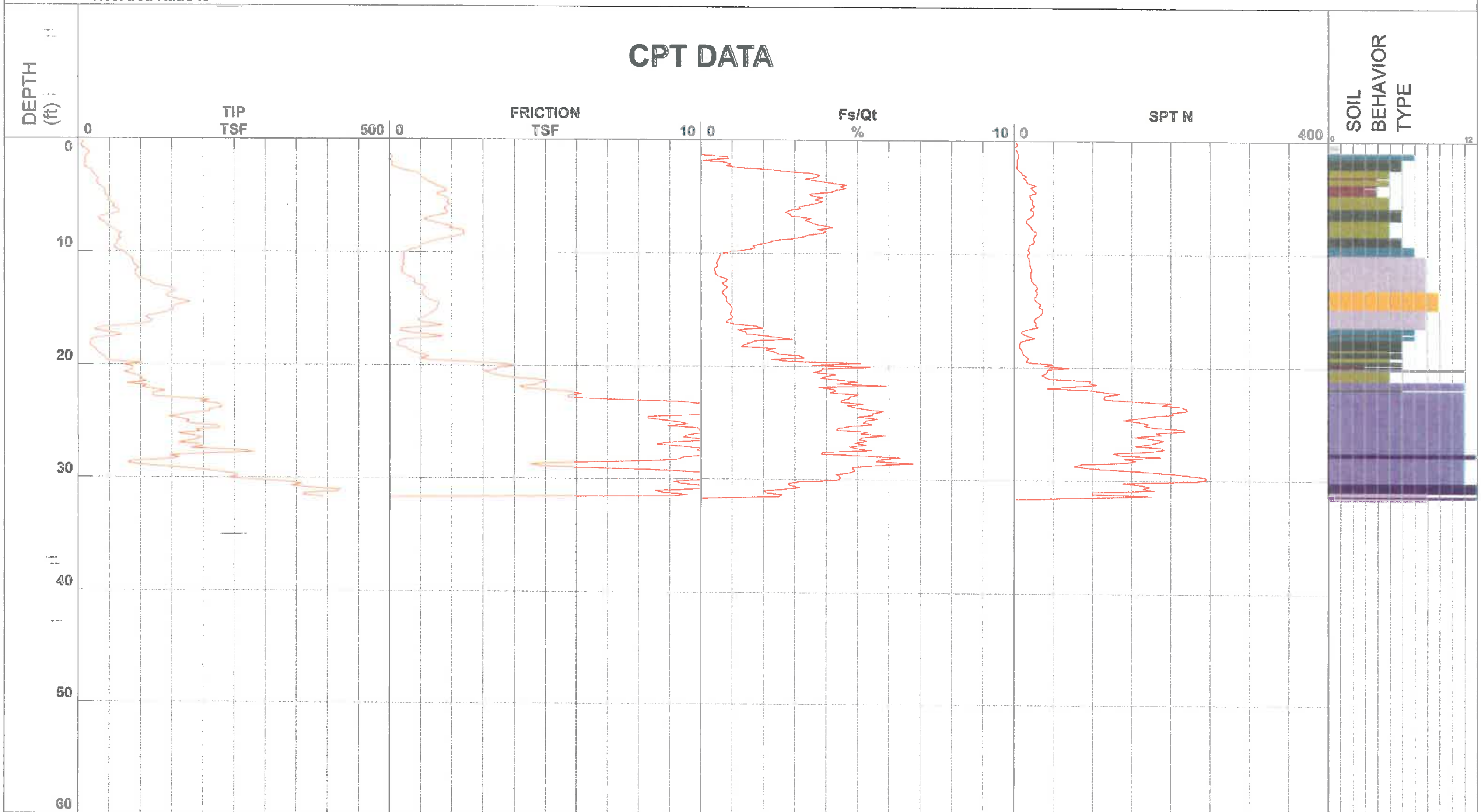
S*Soil behavior type and SPT based on data from UBC-1983

Cal Engineering & Geology, Inc.

Project	Jack Ranch	Operator	DG-RC	Filename	SDF(176).cpt
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-12	Date and Time	2/24/2016 8:31:43 AM	Maximum Depth	31.82 ft
EST GW Depth During Test	20.00 ft				

Net Area Ratio .8

CPT DATA



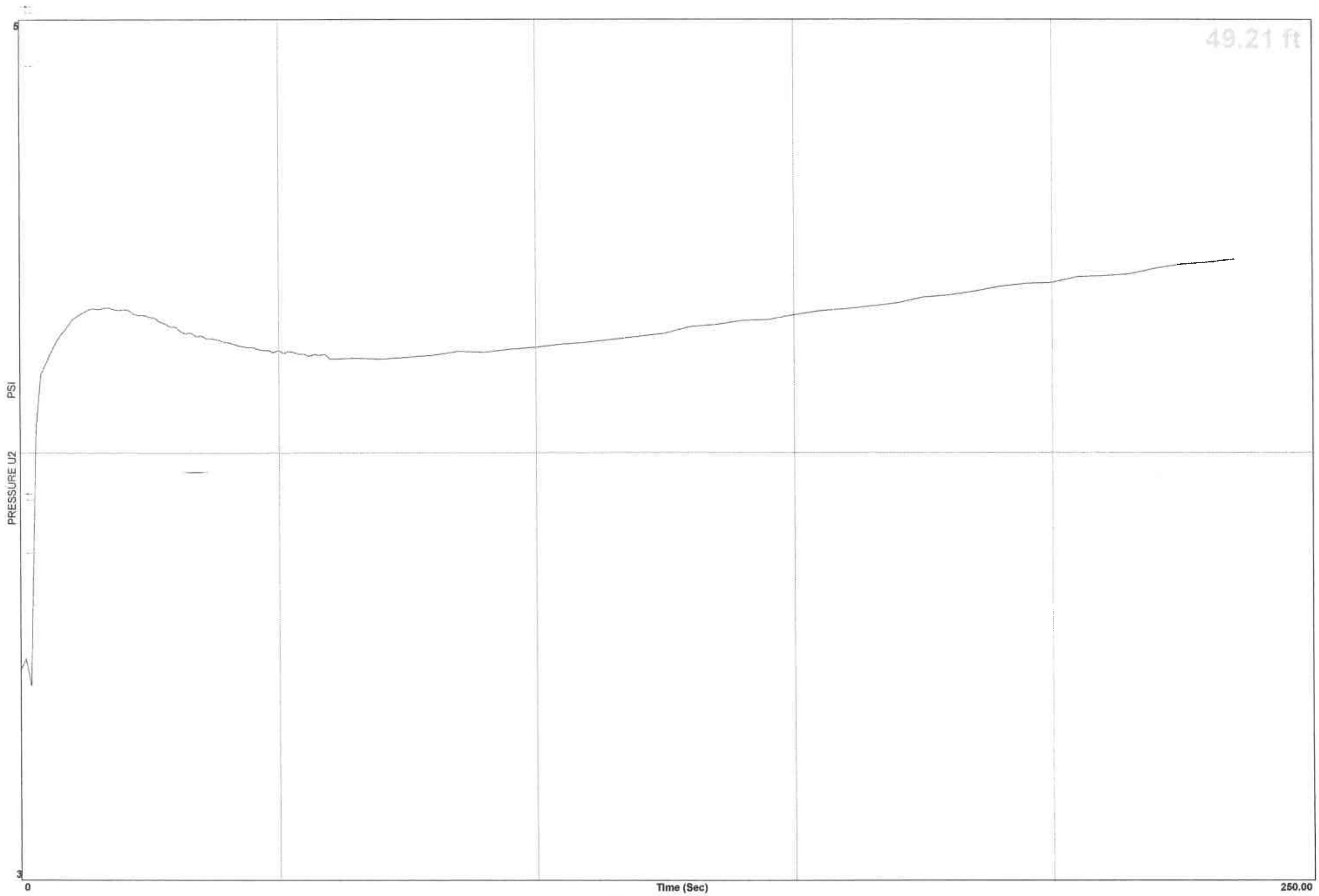
- 1 - sensitive fine grained
- 2 - organic material
- 3 - clay
- 4 - silty clay to clay
- 5 - clayey silt to silty clay
- 6 - sandy silt to clayey silt
- 7 - silty sand to sandy silt
- 8 - sand to silty sand
- 9 - sand
- 10 - gravelly sand to sand
- 11 - very stiff fine grained (*)
- 12 - sand to clayey sand (*)

Cone Size 10cm squared

S*Soil behavior type and SPT based on data from UBC-1983

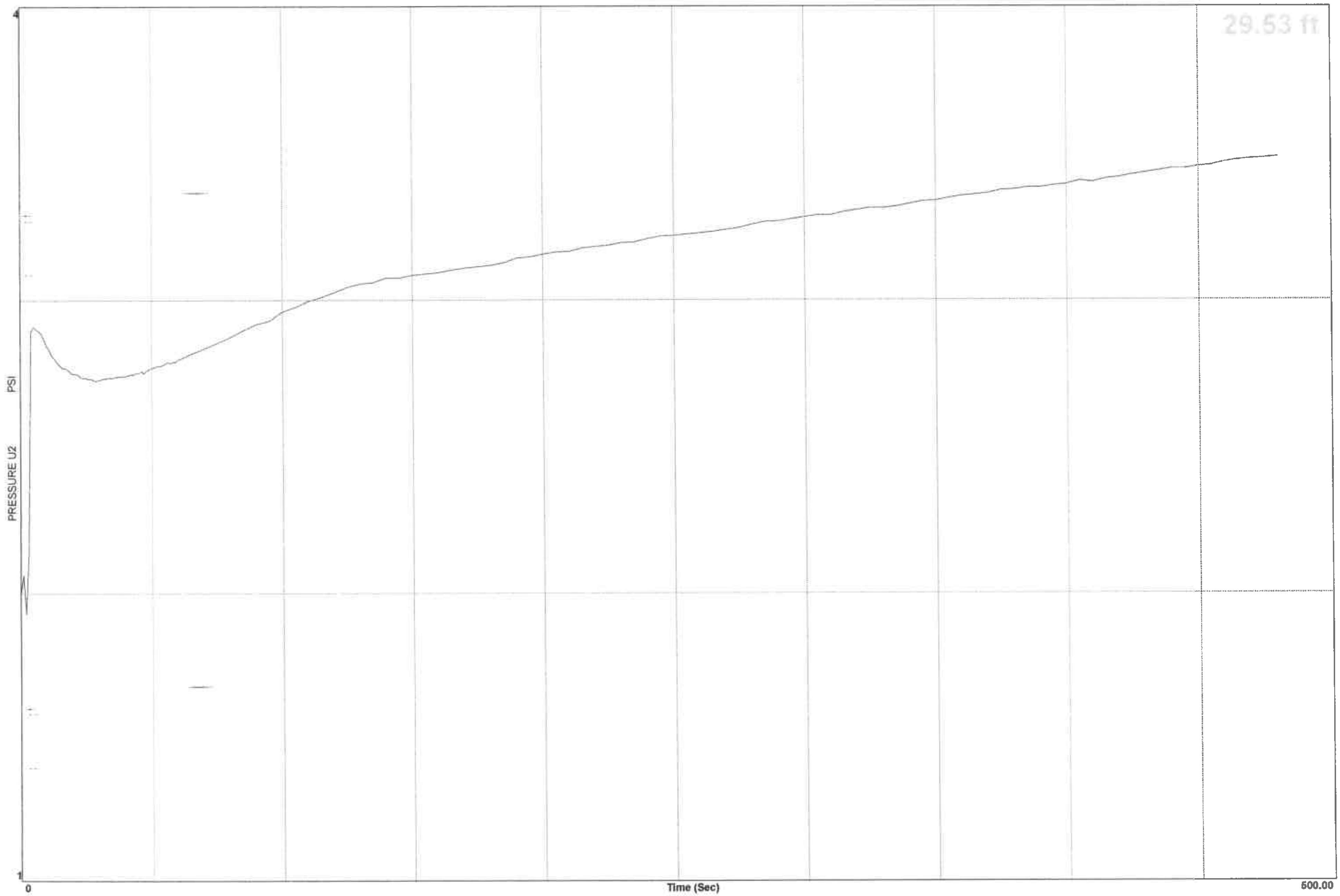
Cal Engineering & Geology, Inc.

Location	Jack Ranch	Operator	DG-RC		
Job Number	150322	Cone Number	DDG1333	GPS	
Hole Number	CPT-01	Date and Time	2/23/2016 10:30:44 AM		
Equilized Pressure	4.4	EST GW Depth During Test	38.9		



Cal Engineering & Geology, Inc.

Location	Jack Ranch	Operator	DG-RC	GPS	
Job Number	150322	Cone Number	DDG1333		
Hole Number	CPT-03	Date and Time	2/23/2016 12:07:29 PM		
Equilized Pressure	3.4	EST GW Depth During Test	21.4		



APPENDIX E

LIQUEFACTION CALCULATIONS

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Oakland, CA 510.451.2350
Walnut Creek, CA 925.935.9771
San Jose, CA 408.440.4542

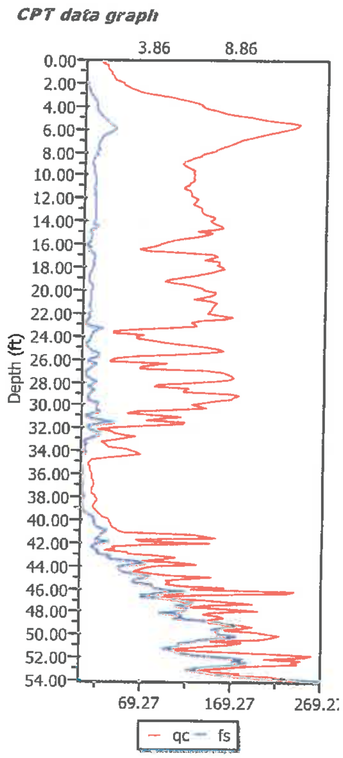
LIQUEFACTION ANALYSIS REPORT

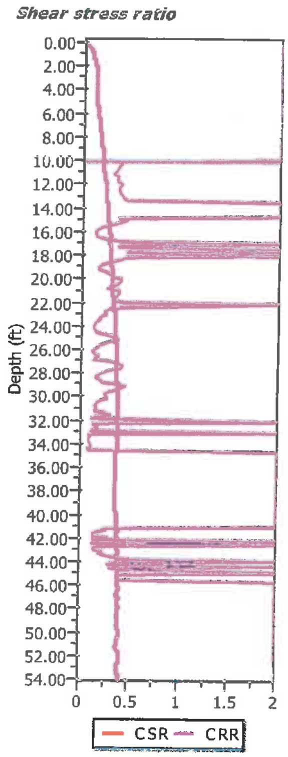
Project title : CPT-01

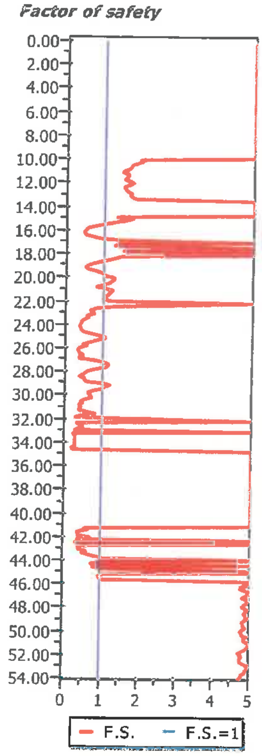
Project subtitle : Jack Ranch-San Luis Obispo, CA

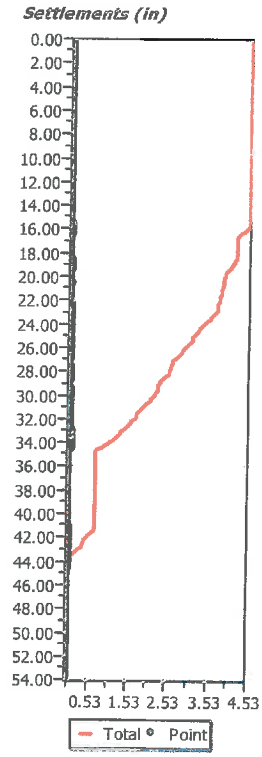
Input parameters and analysis data

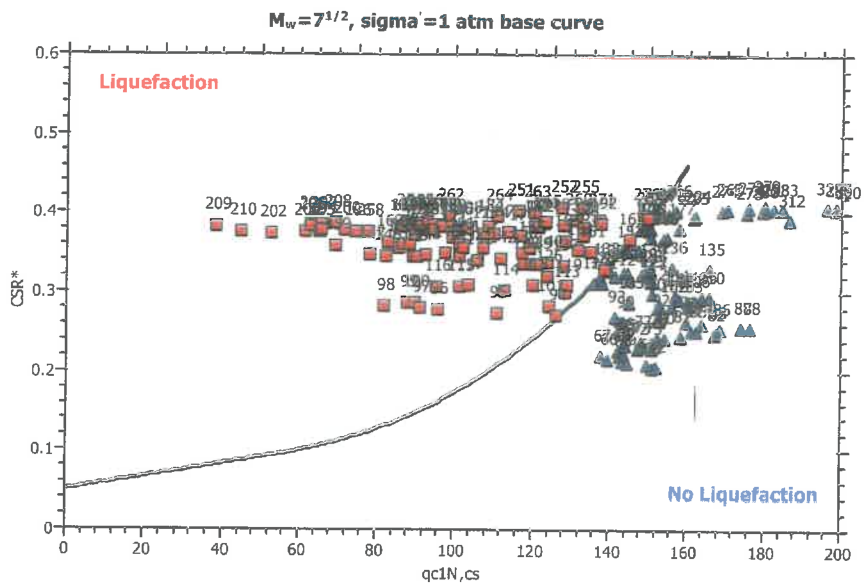
In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00

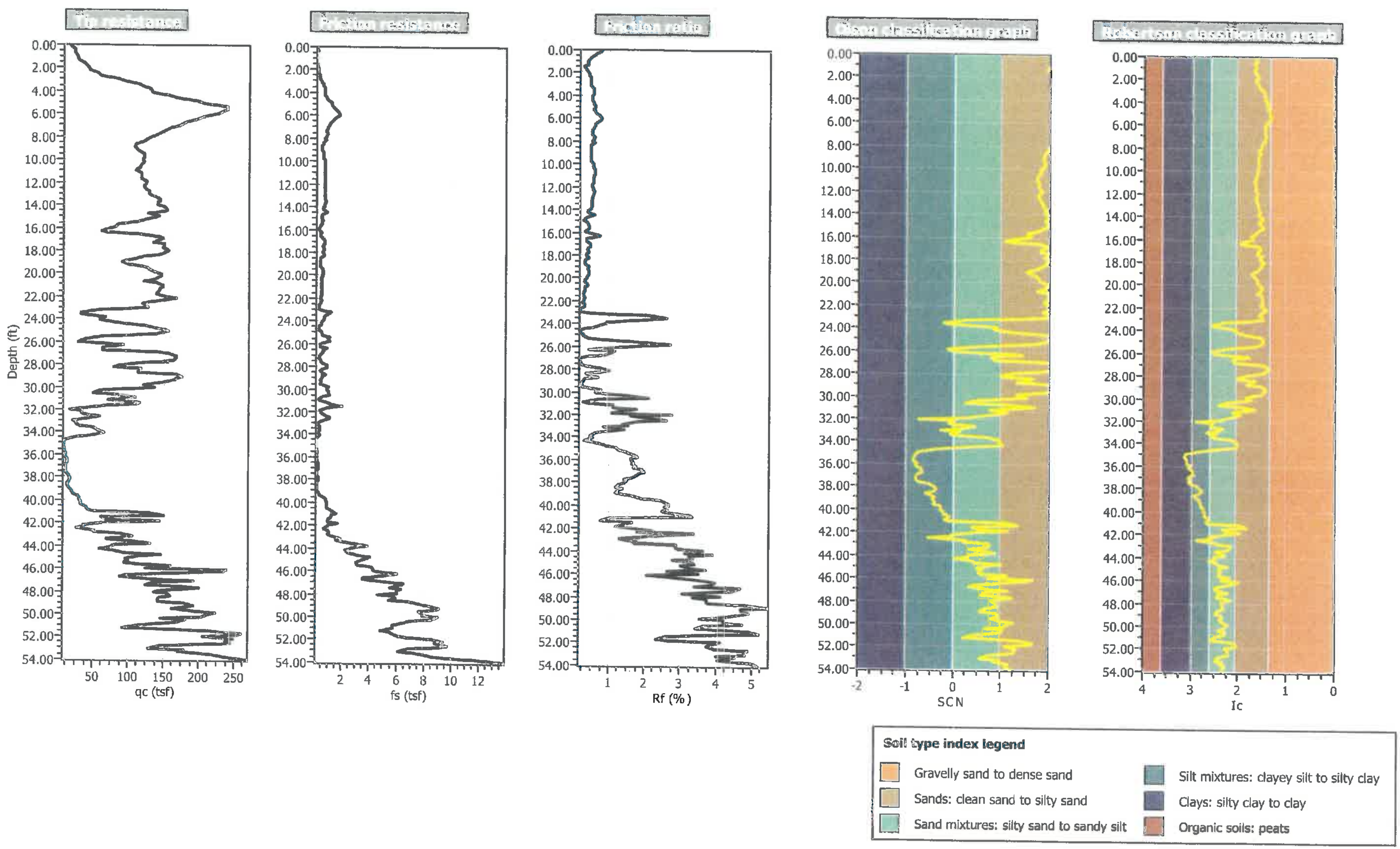











Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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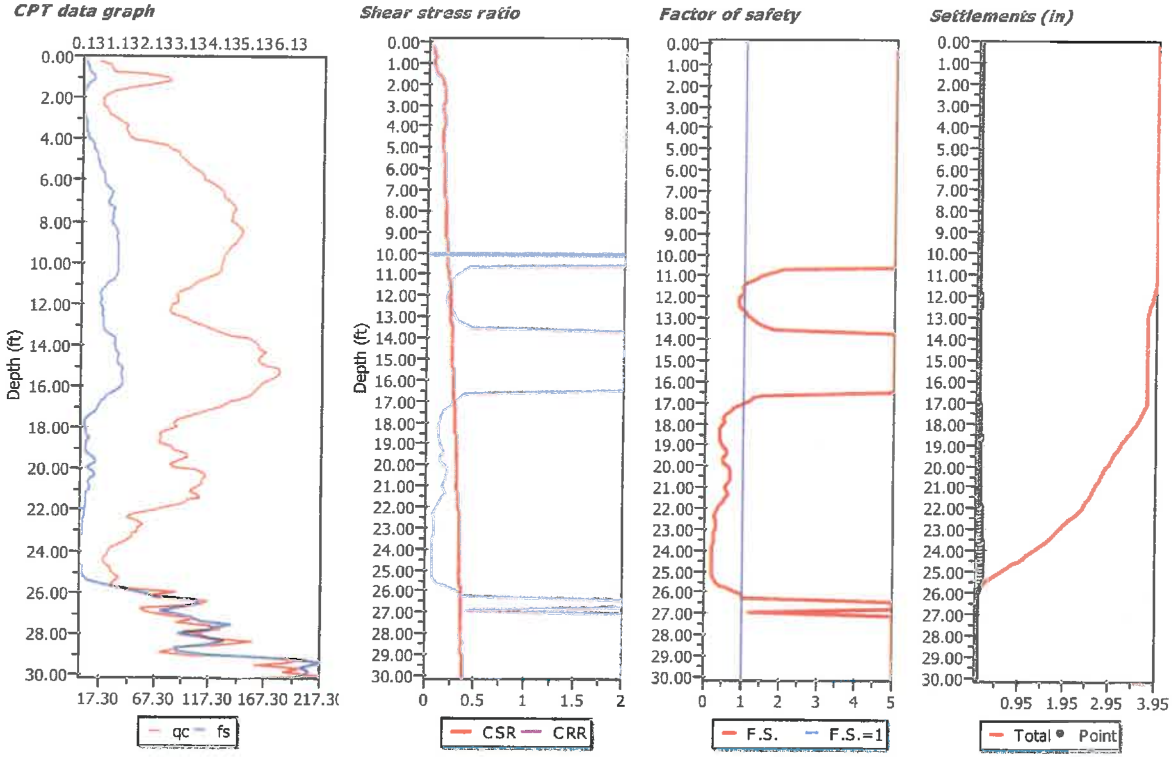
LIQUEFACTION ANALYSIS REPORT

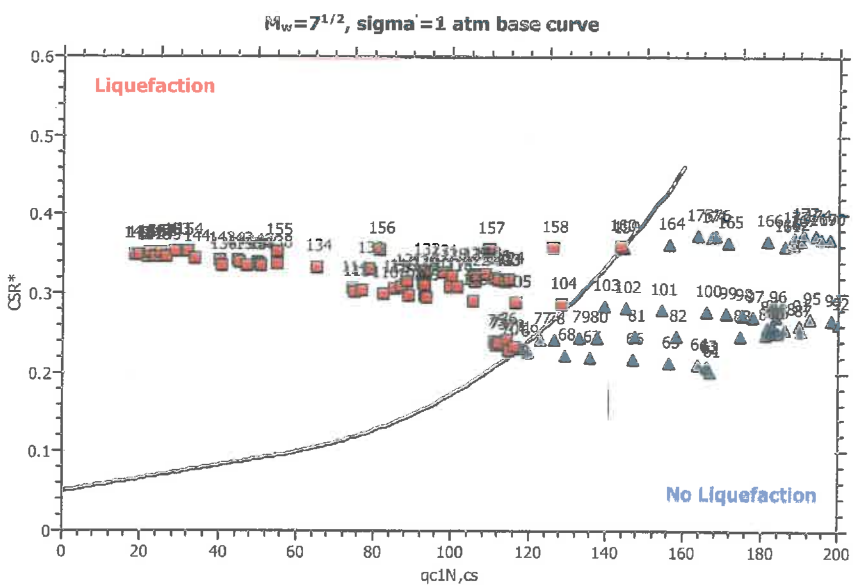
Project title : CPT-02

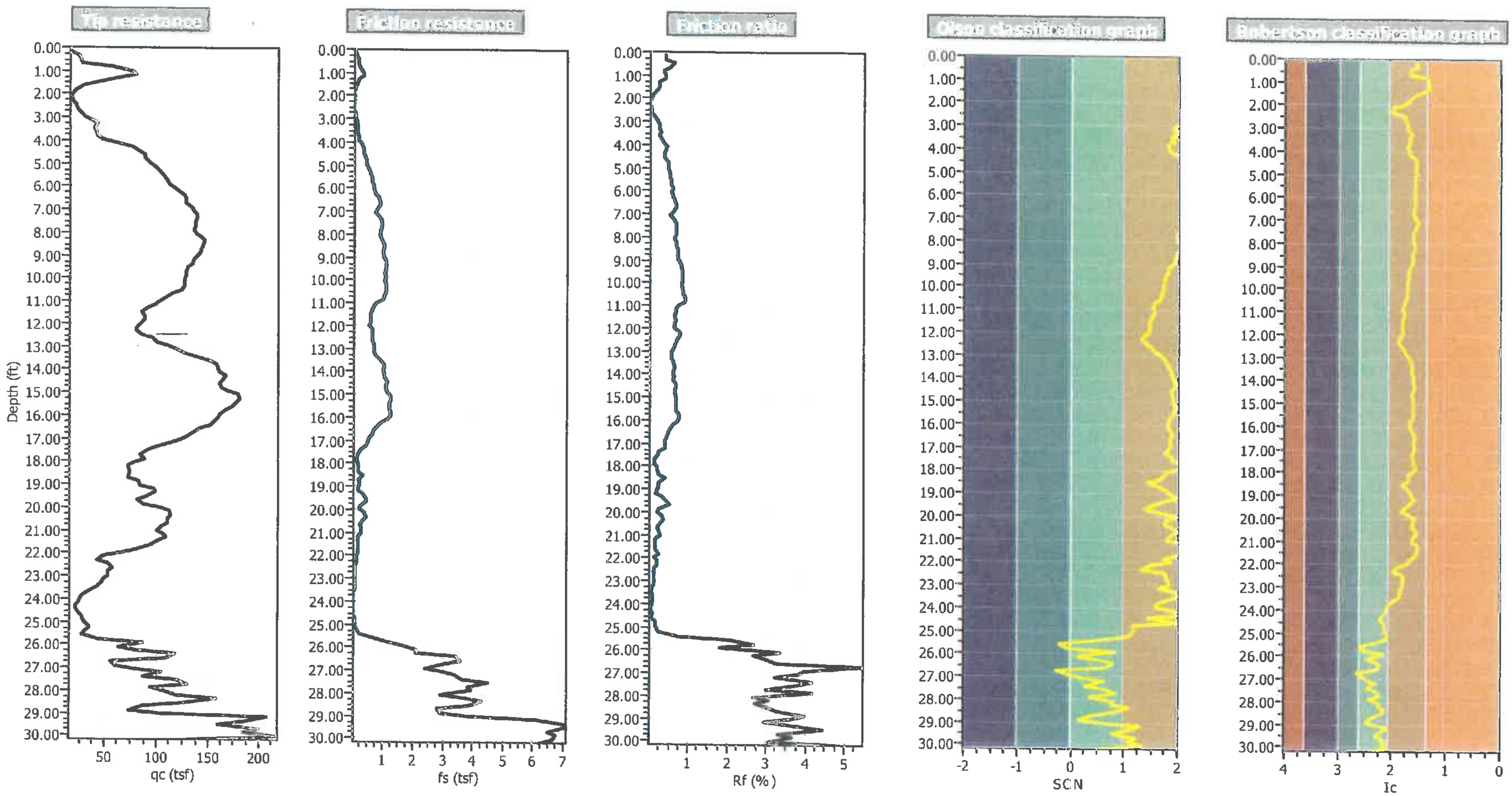
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00







Soil type index legend

- Gravelly sand to dense sand
- Sands: clean sand to silty sand
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt to silty clay
- Clays: silty clay to clay
- Organic soils: peats

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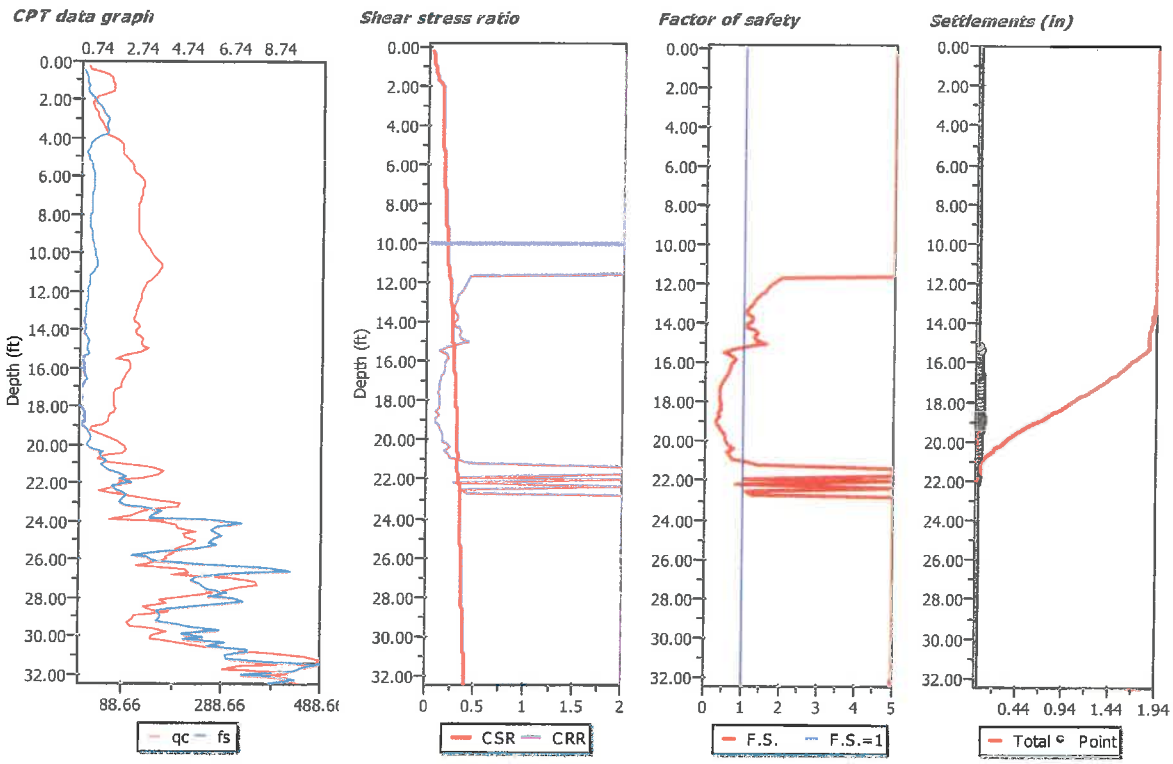
LIQUEFACTION ANALYSIS REPORT

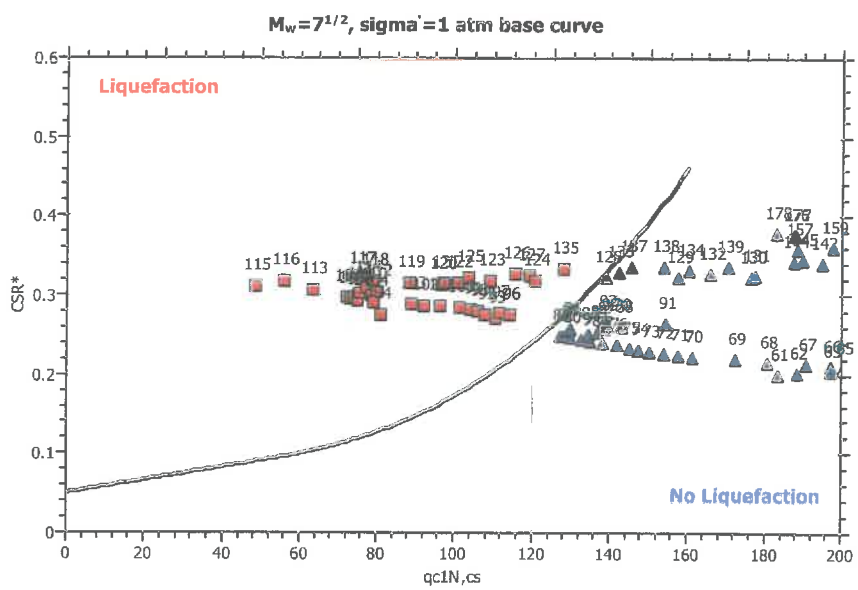
Project title : CPT-03

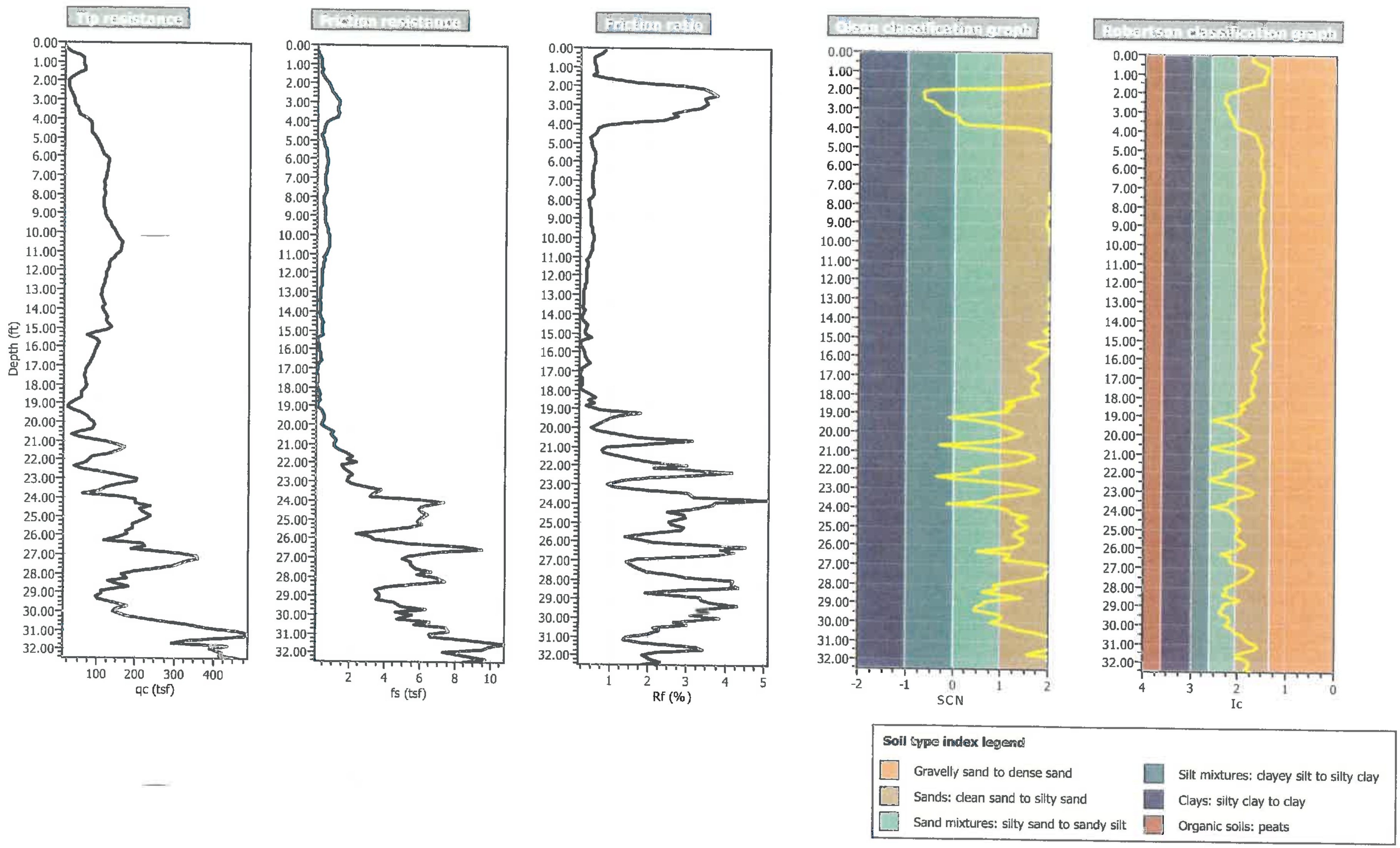
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Clean classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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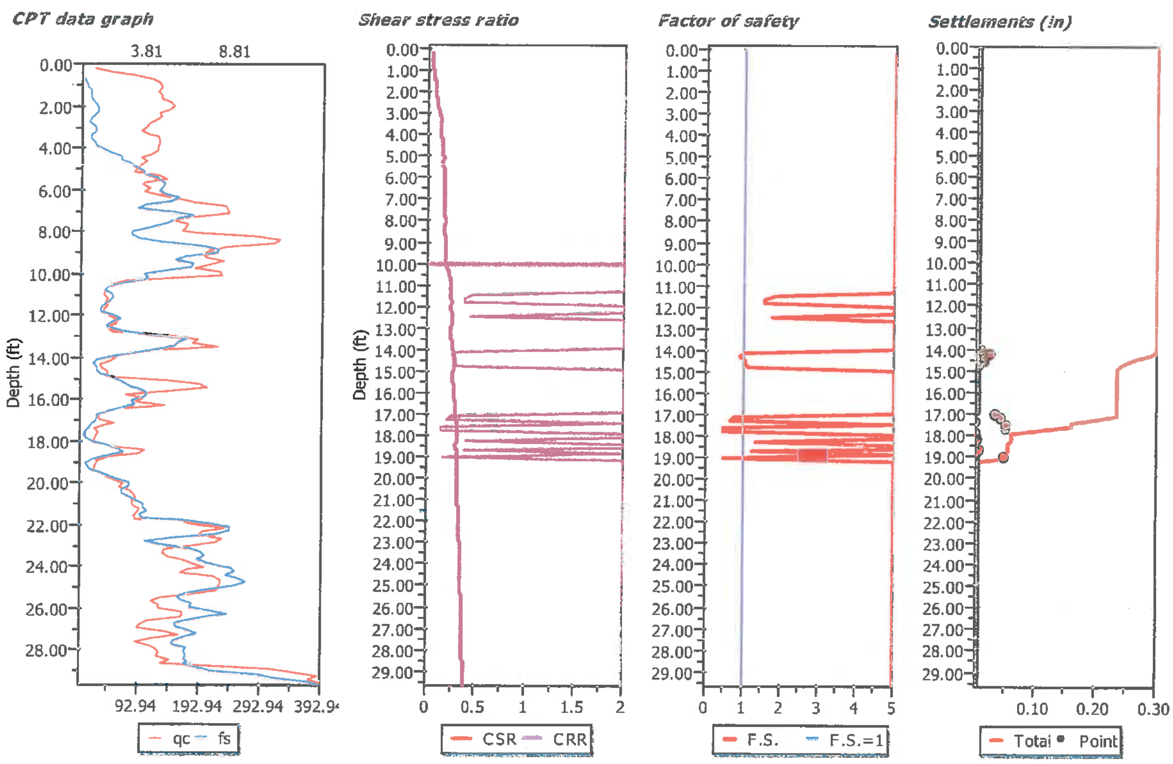
LIQUEFACTION ANALYSIS REPORT

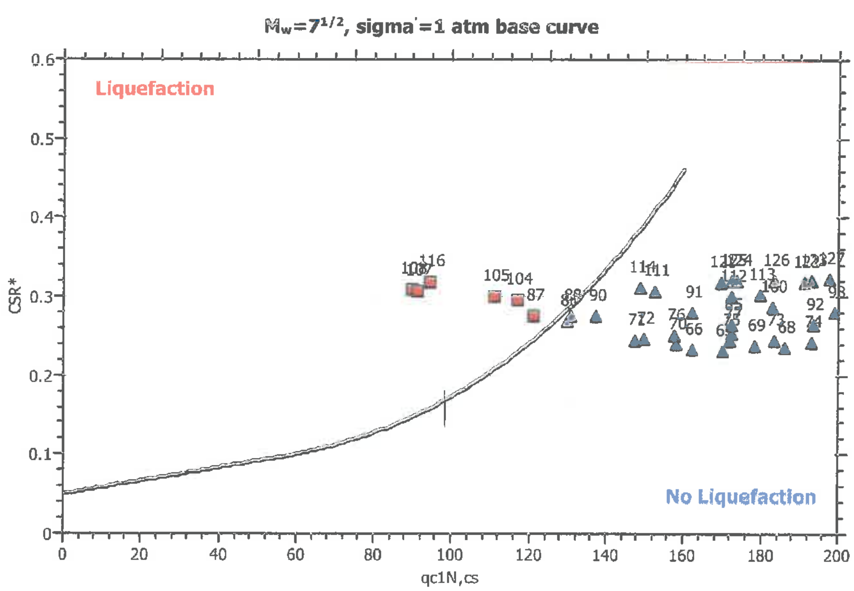
Project title : CPT-04

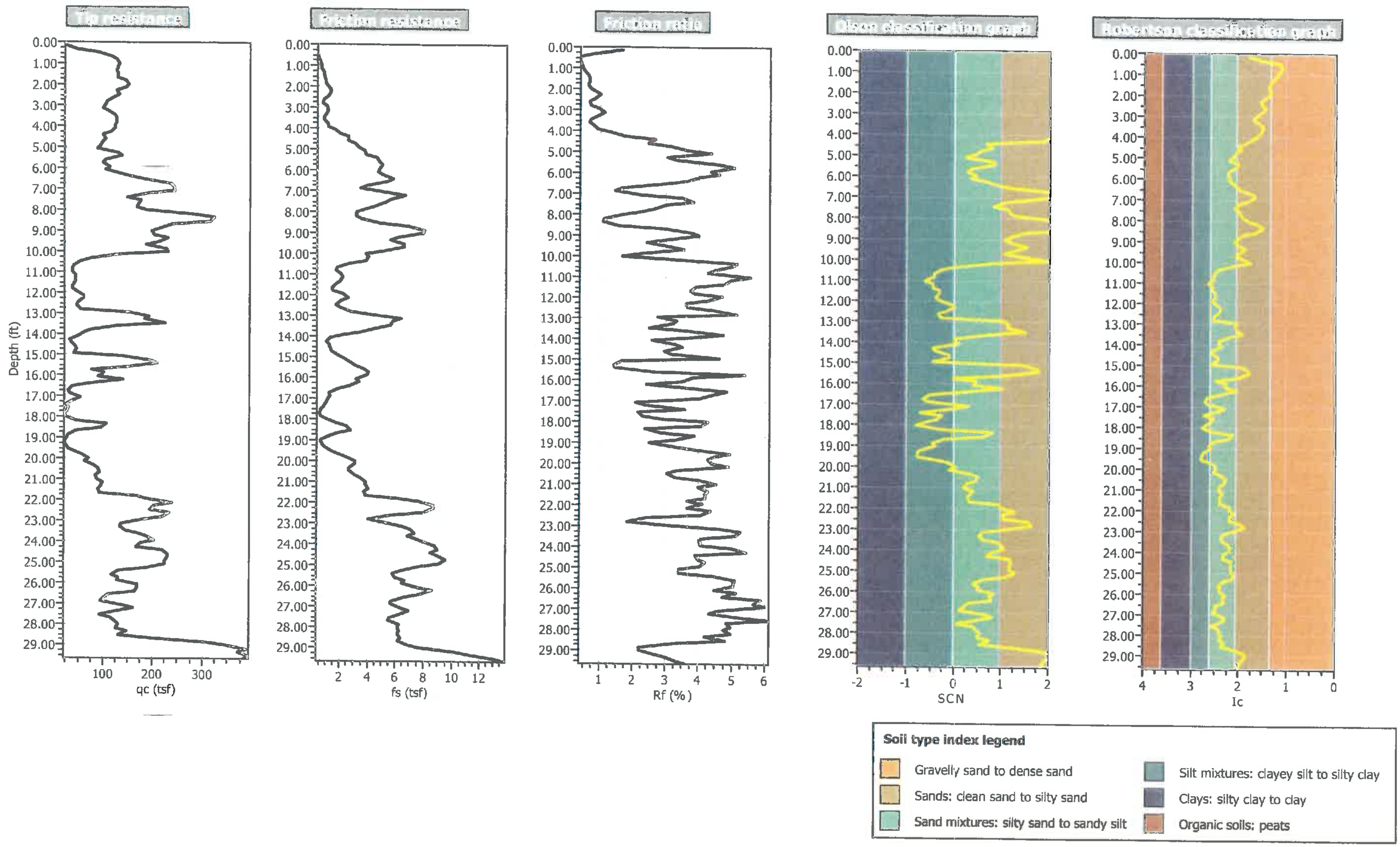
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Olsen classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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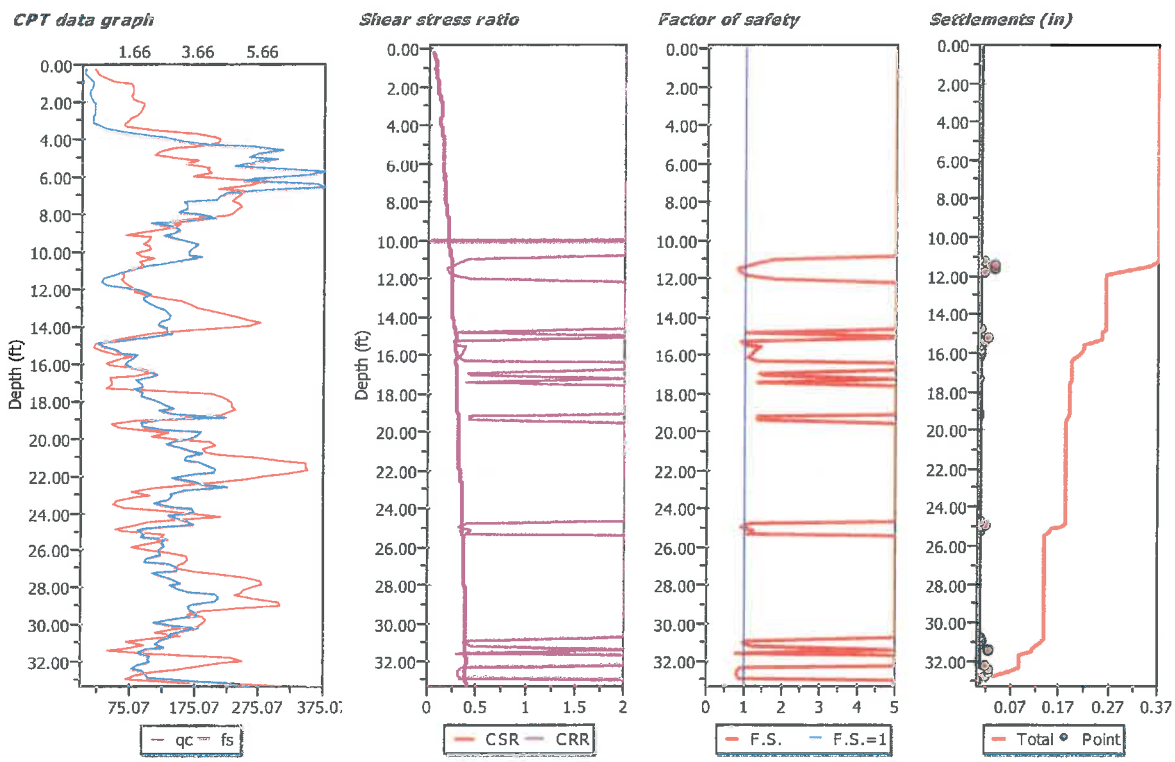
LIQUEFACTION ANALYSIS REPORT

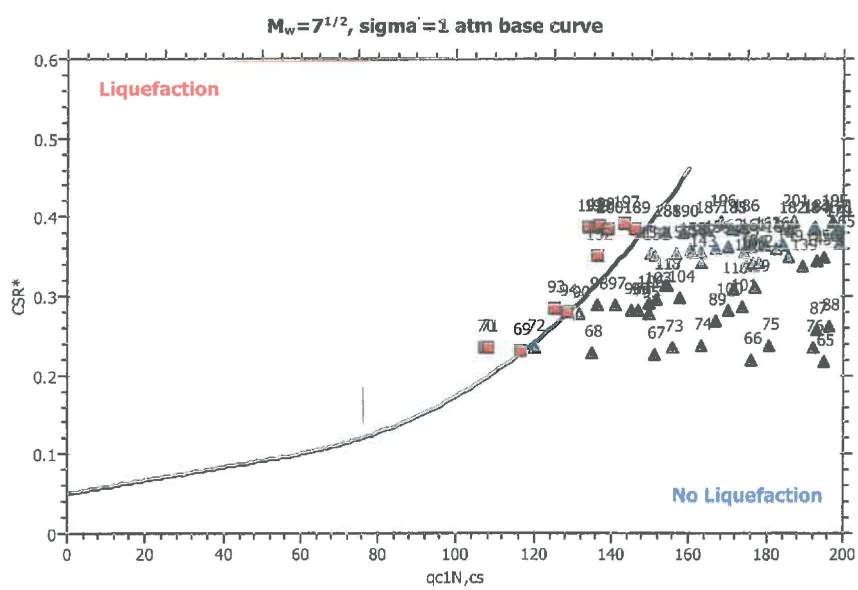
Project title : CPT-05

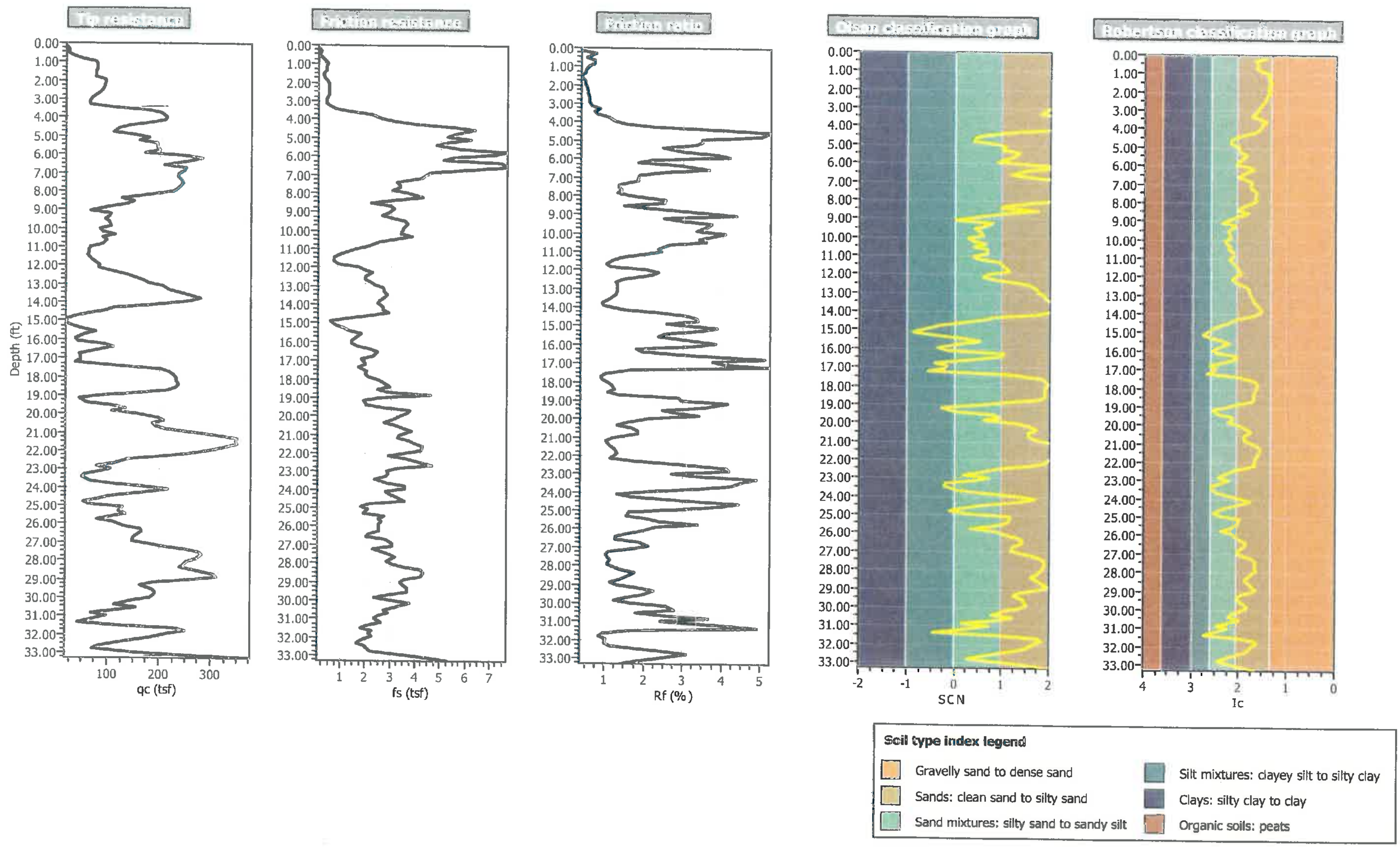
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Clean classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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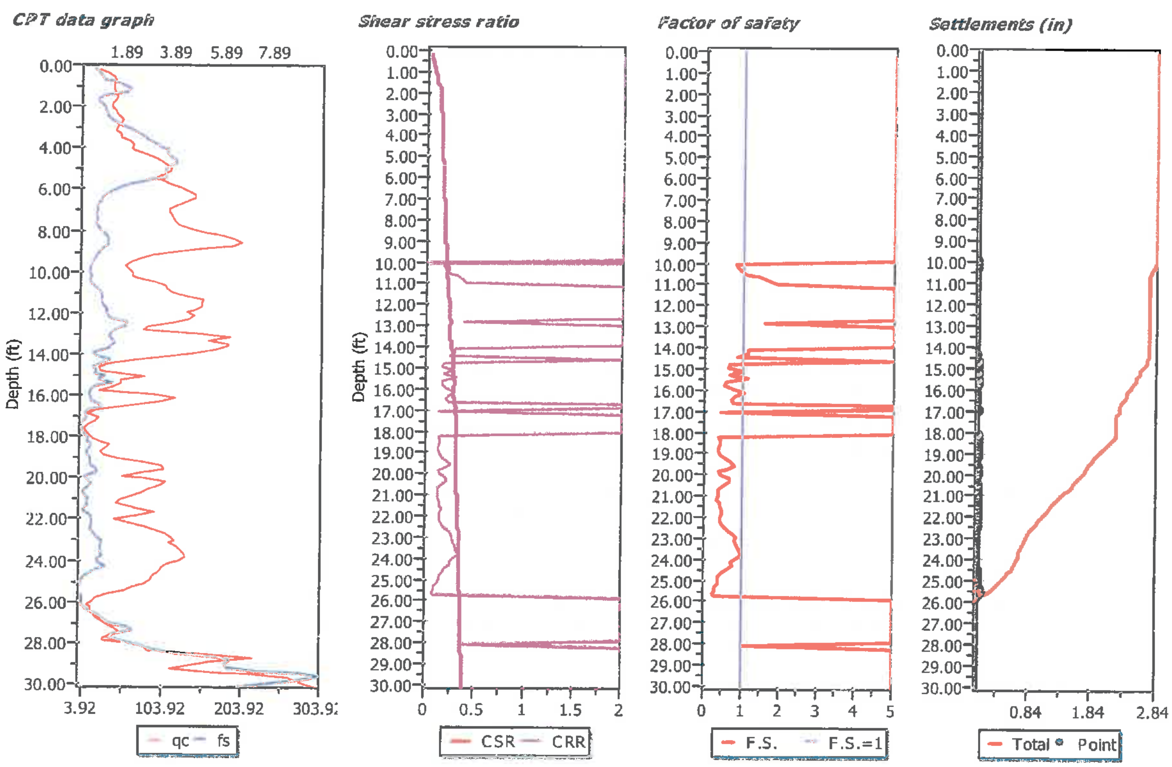
LIQUEFACTION ANALYSIS REPORT

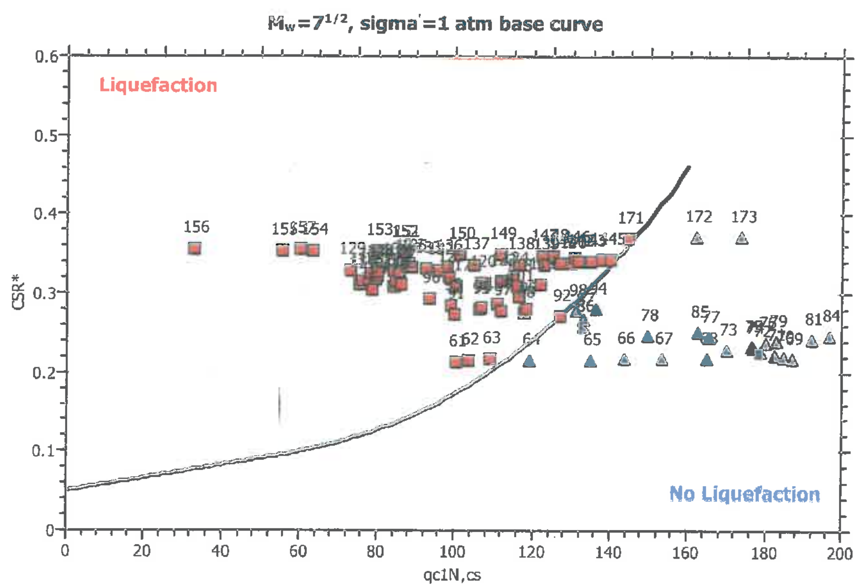
Project title : CPT-06

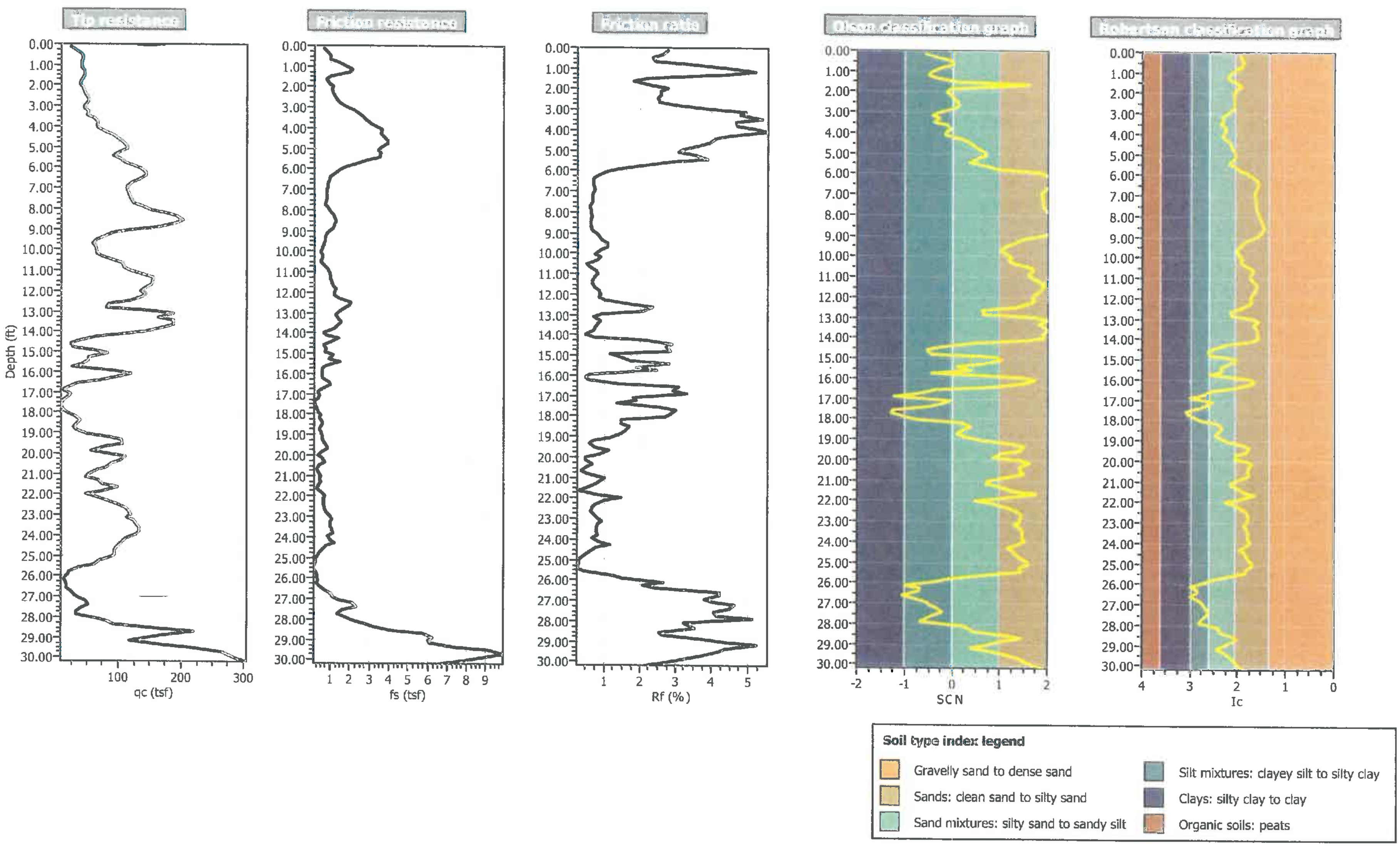
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Olson classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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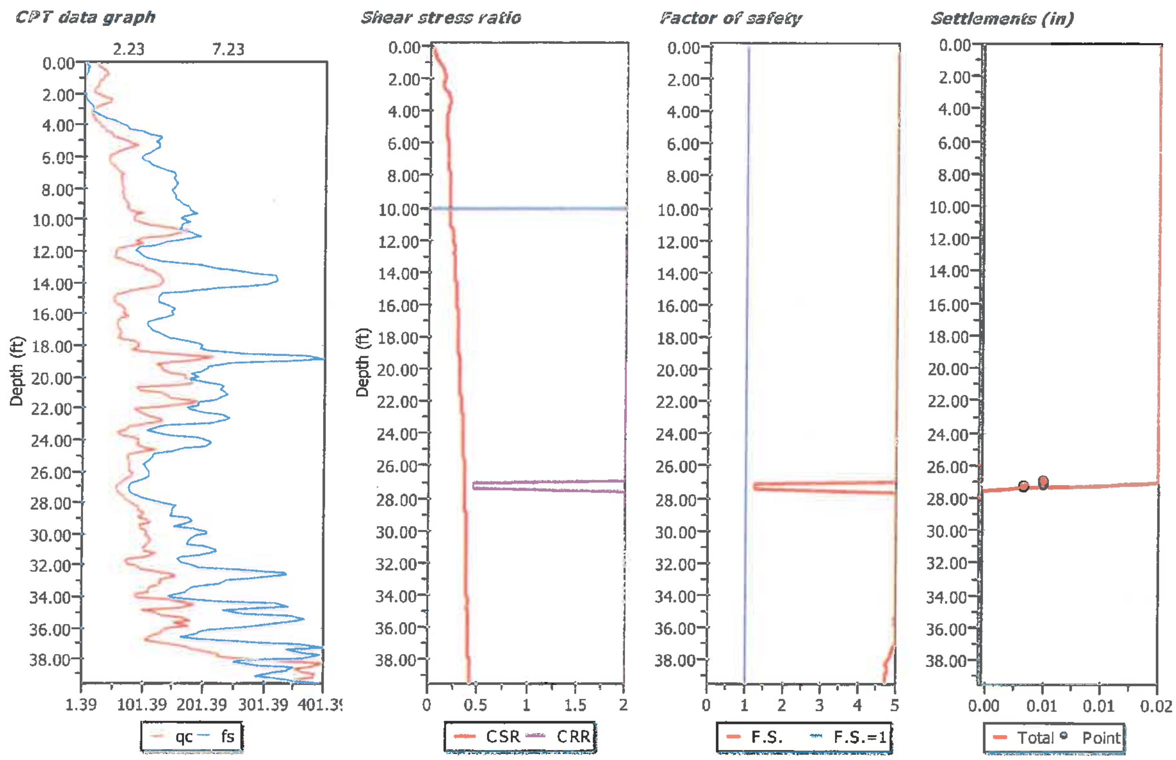
LIQUEFACTION ANALYSIS REPORT

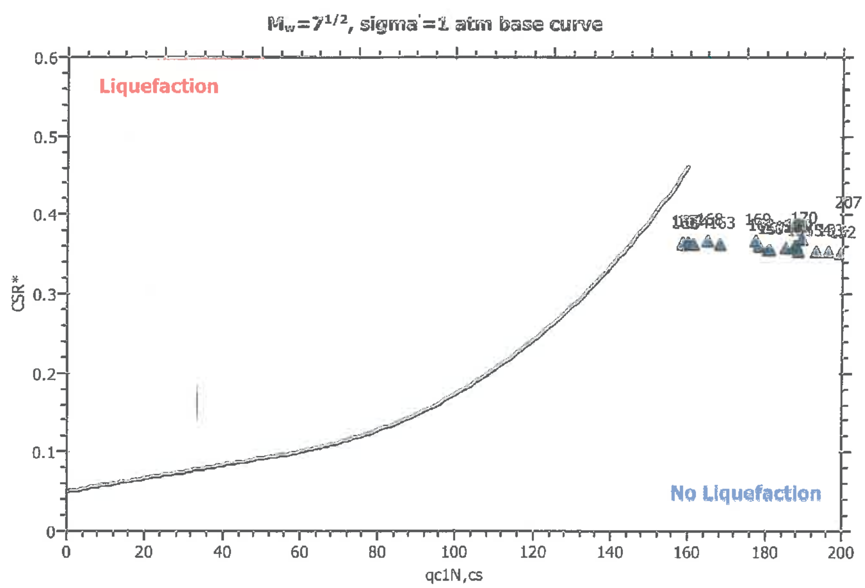
Project title : CPT-07

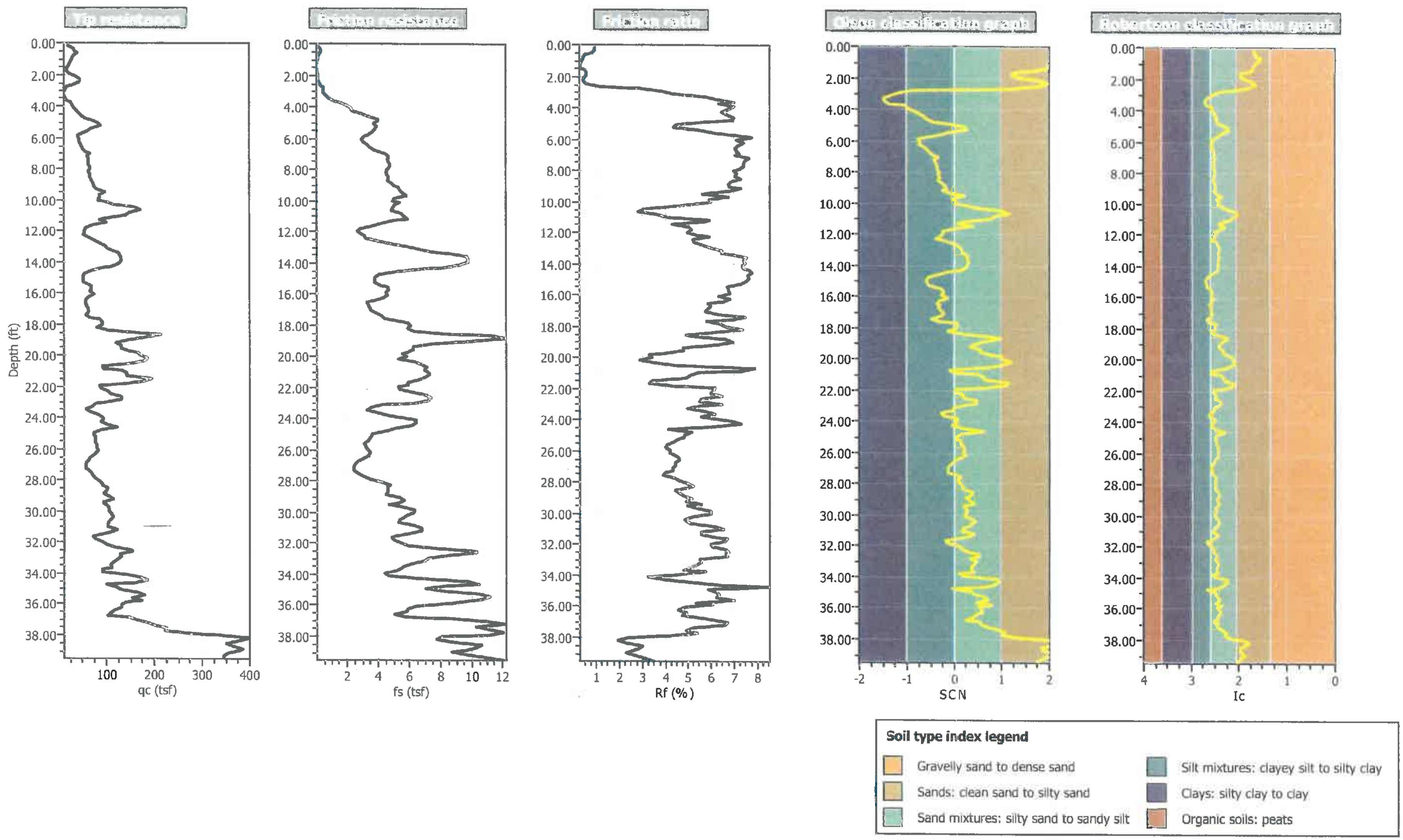
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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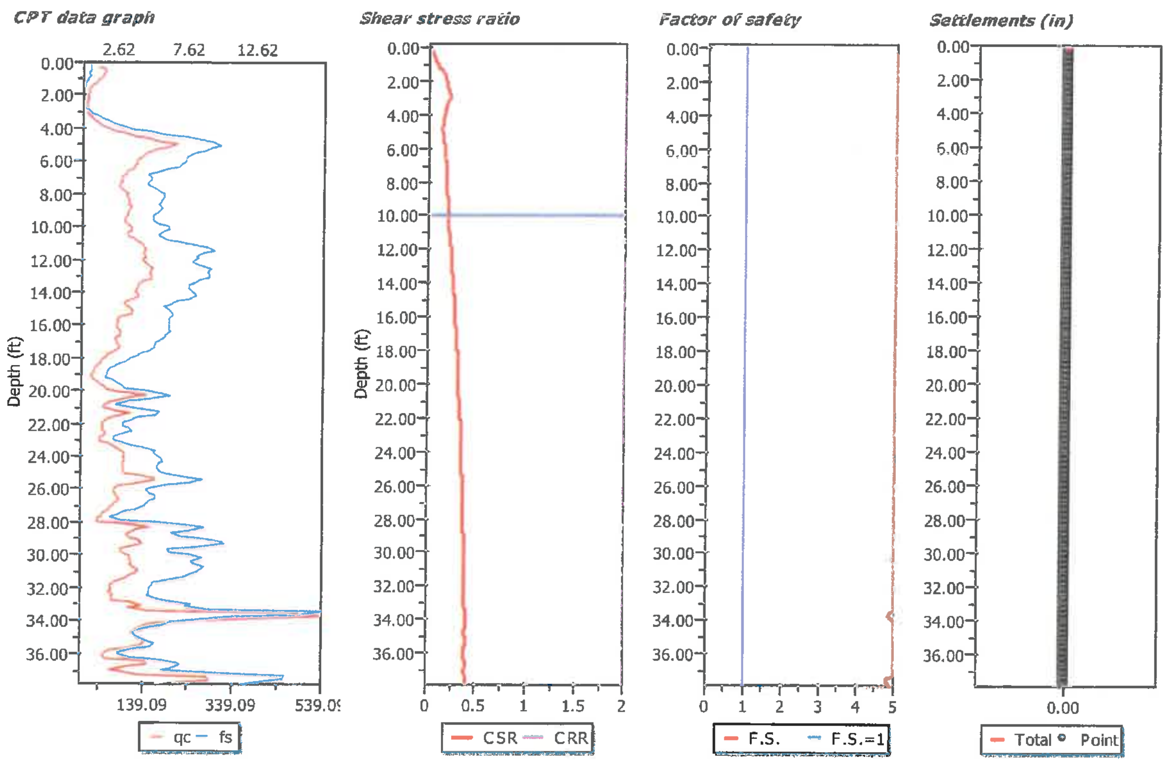
LIQUEFACTION ANALYSIS REPORT

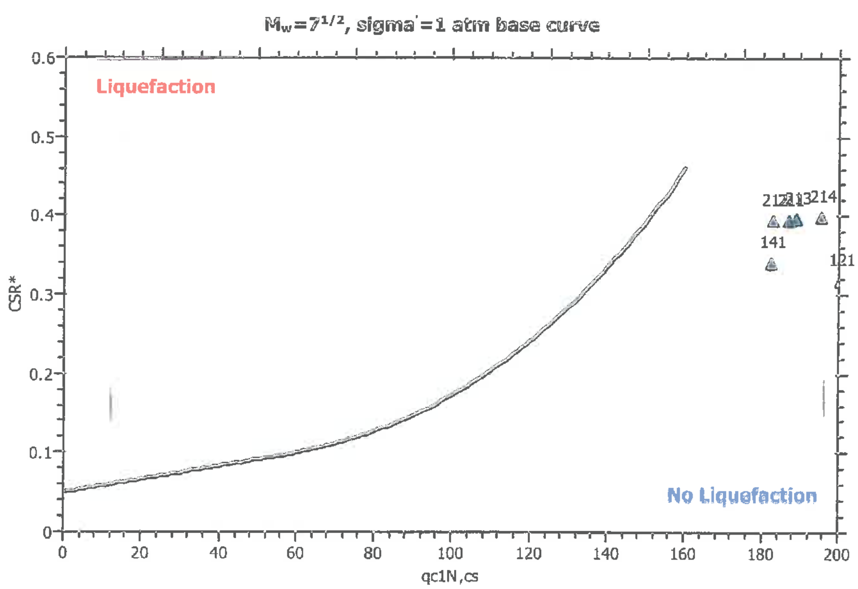
Project title : CPT-08

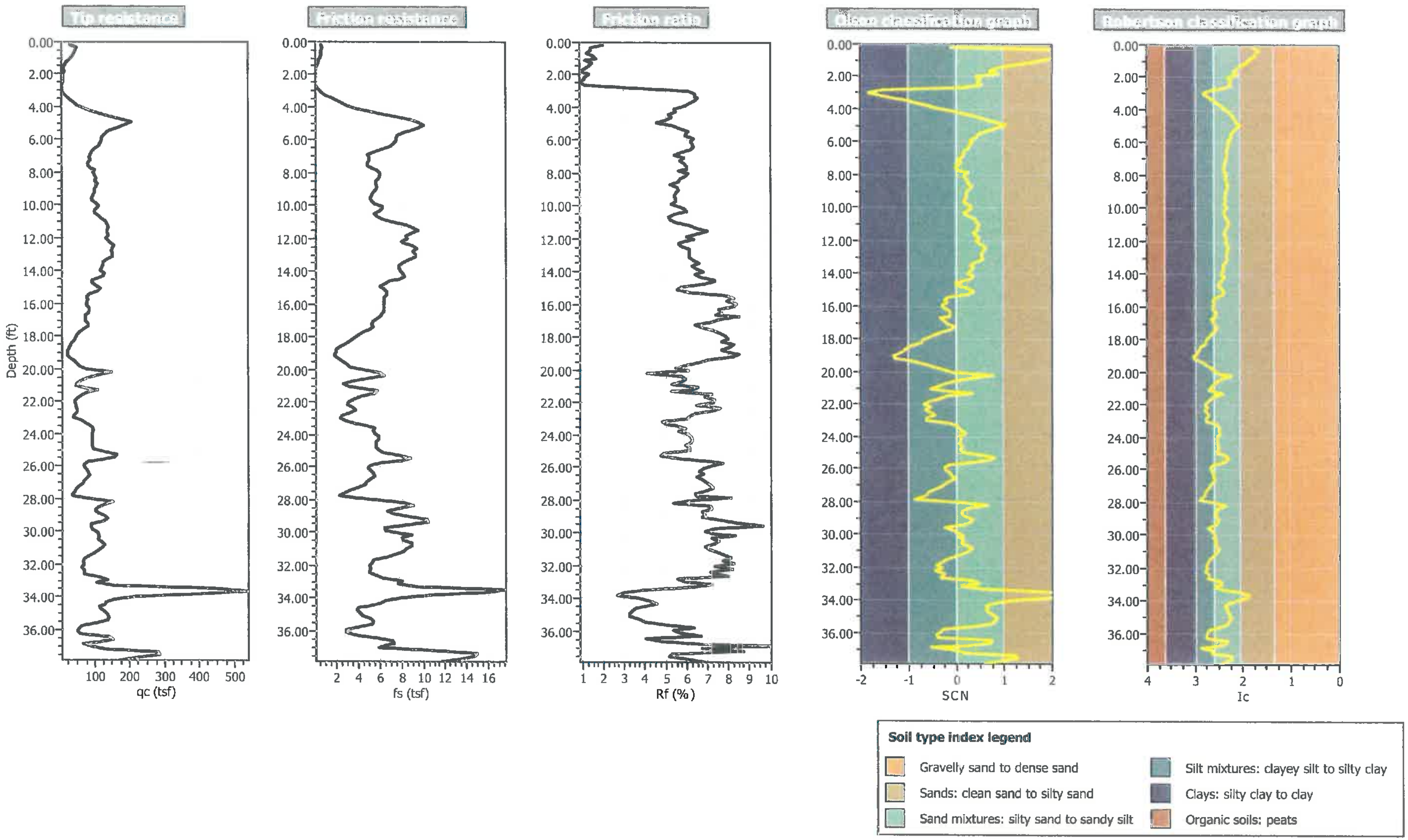
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Olsen classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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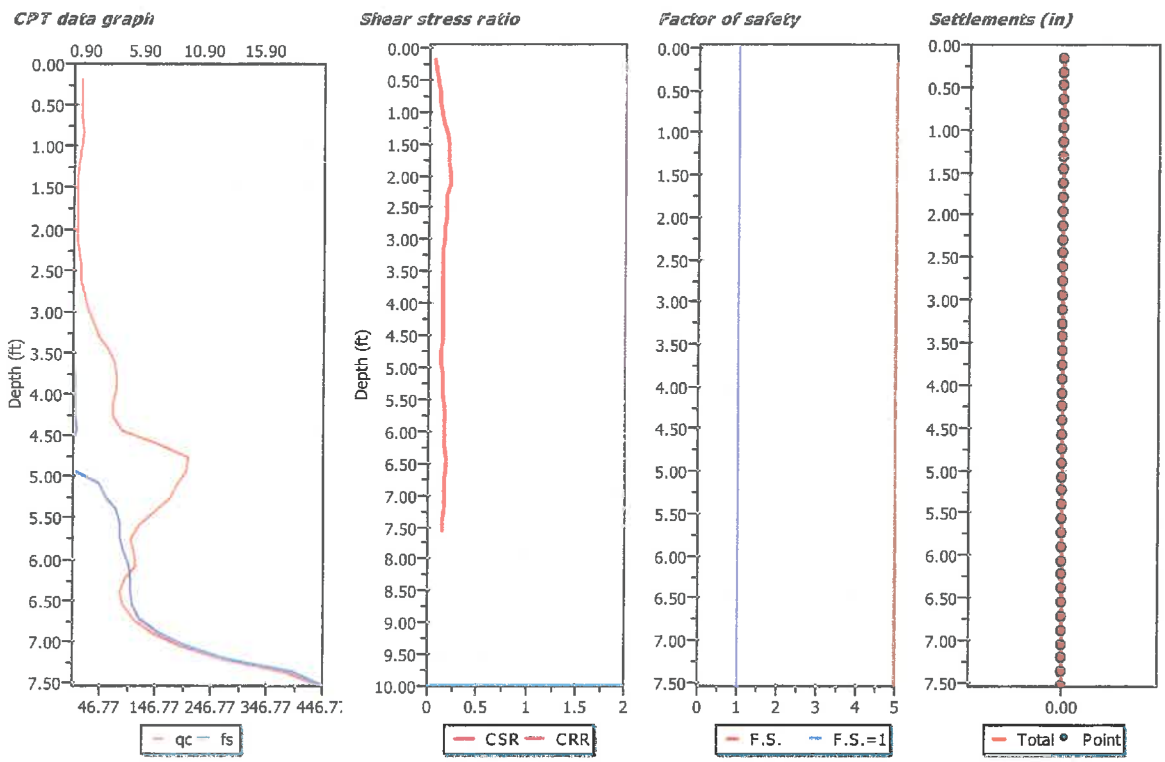
LIQUEFACTION ANALYSIS REPORT

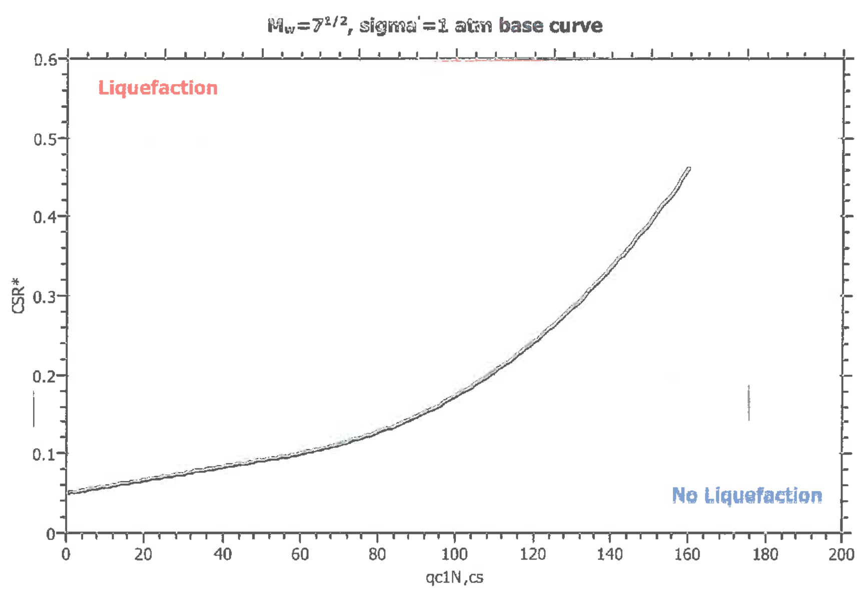
Project title : CPT-09

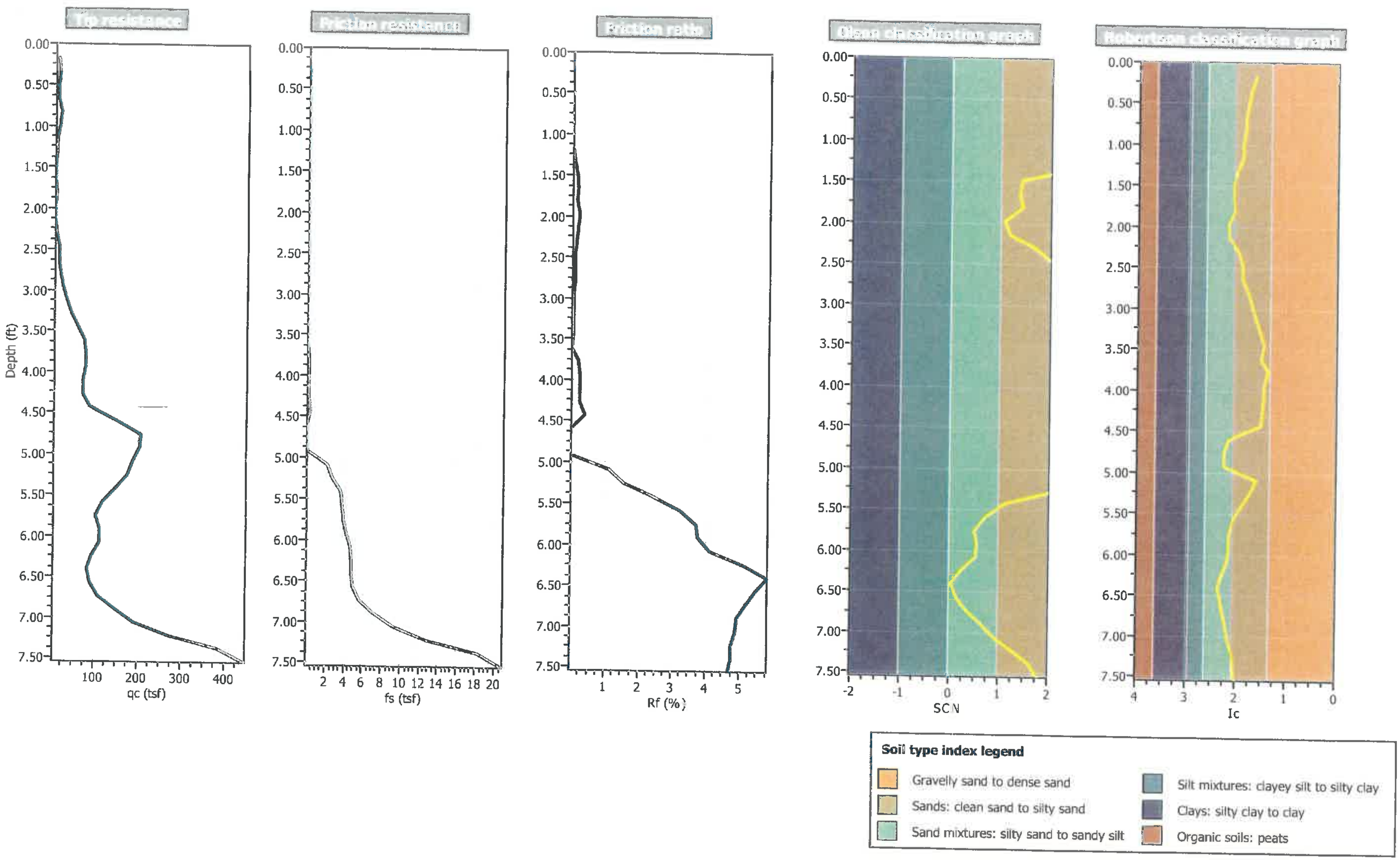
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Clean classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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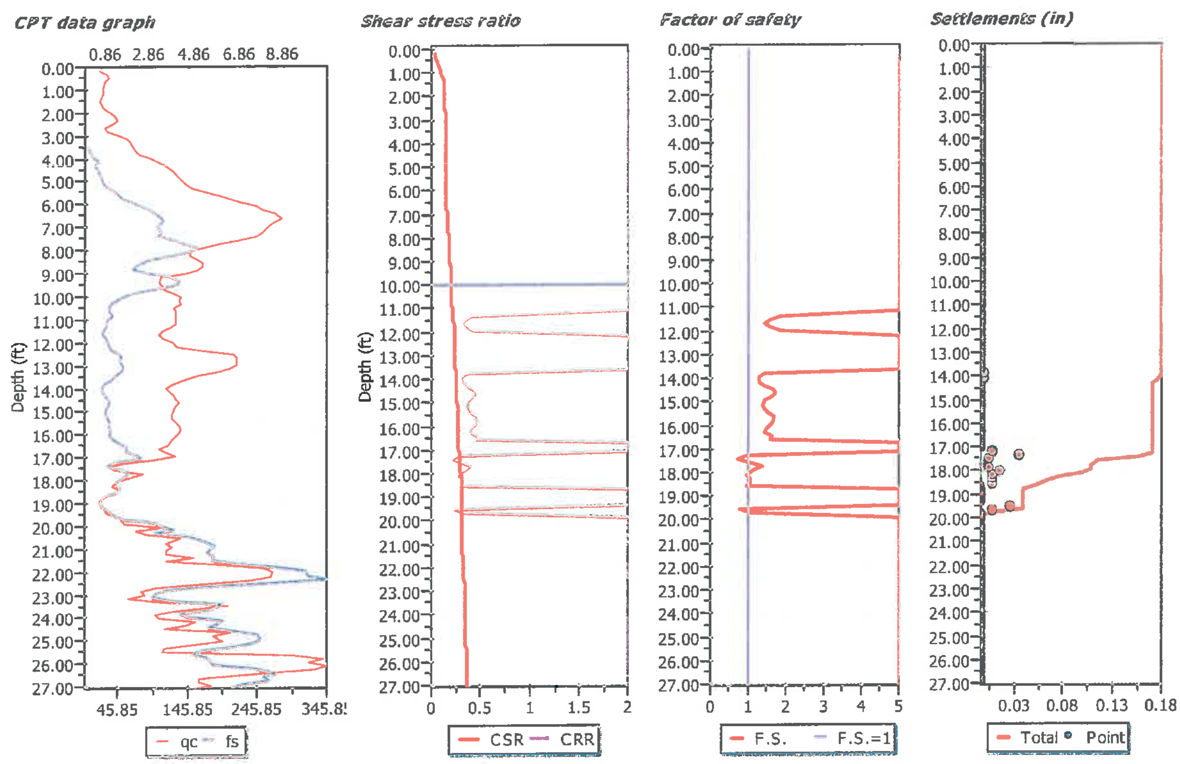
LIQUEFACTION ANALYSIS REPORT

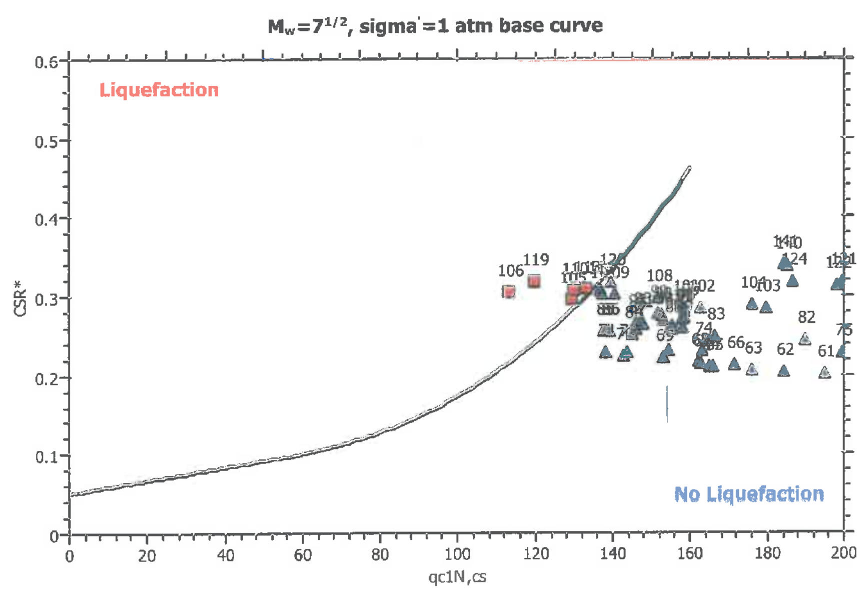
Project title : CPT-10

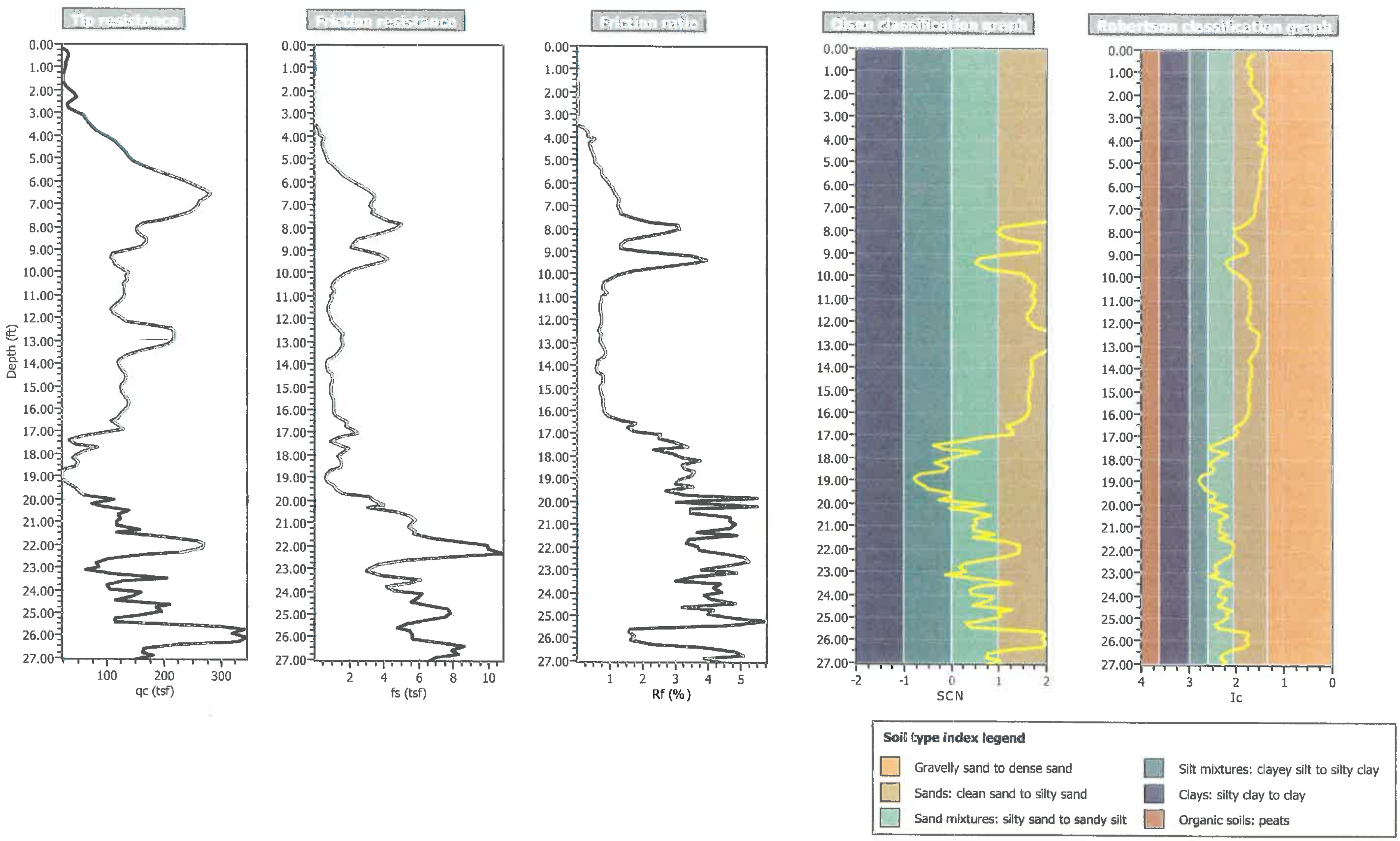
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Olsen classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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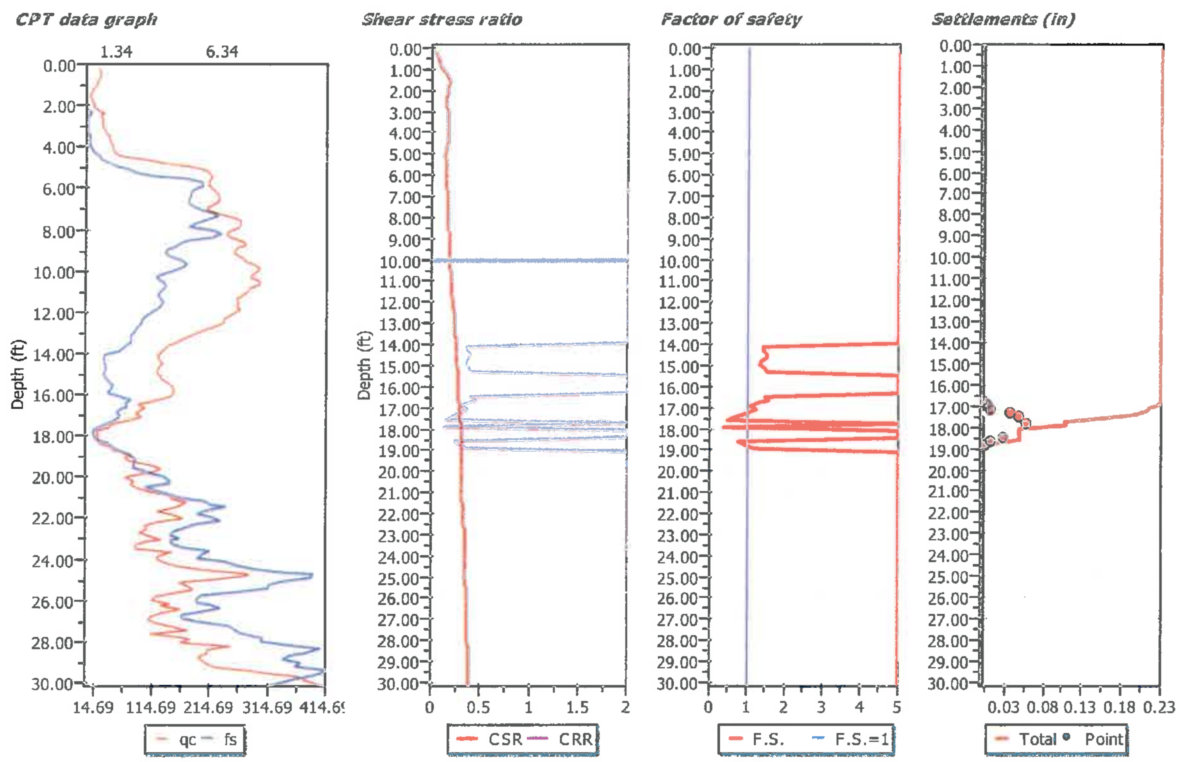
LIQUEFACTION ANALYSIS REPORT

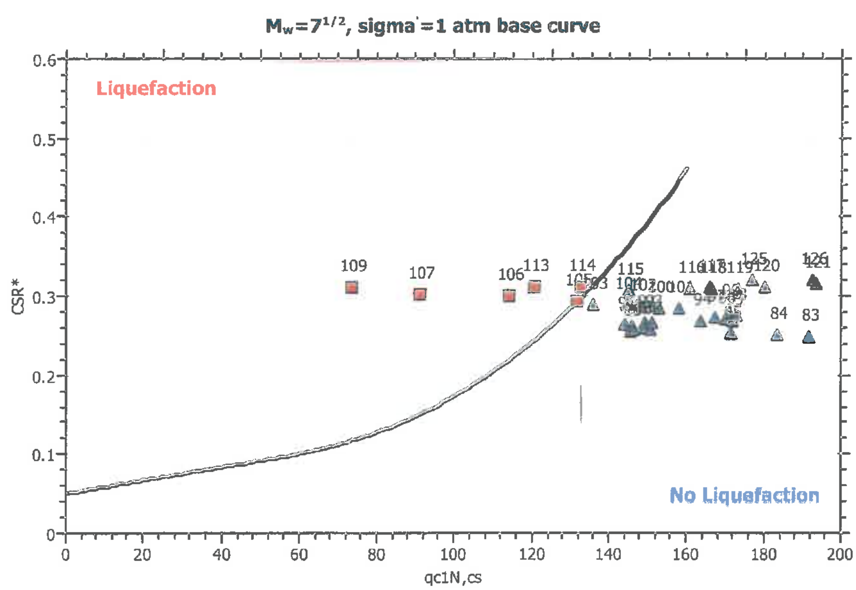
Project title : CPT-11

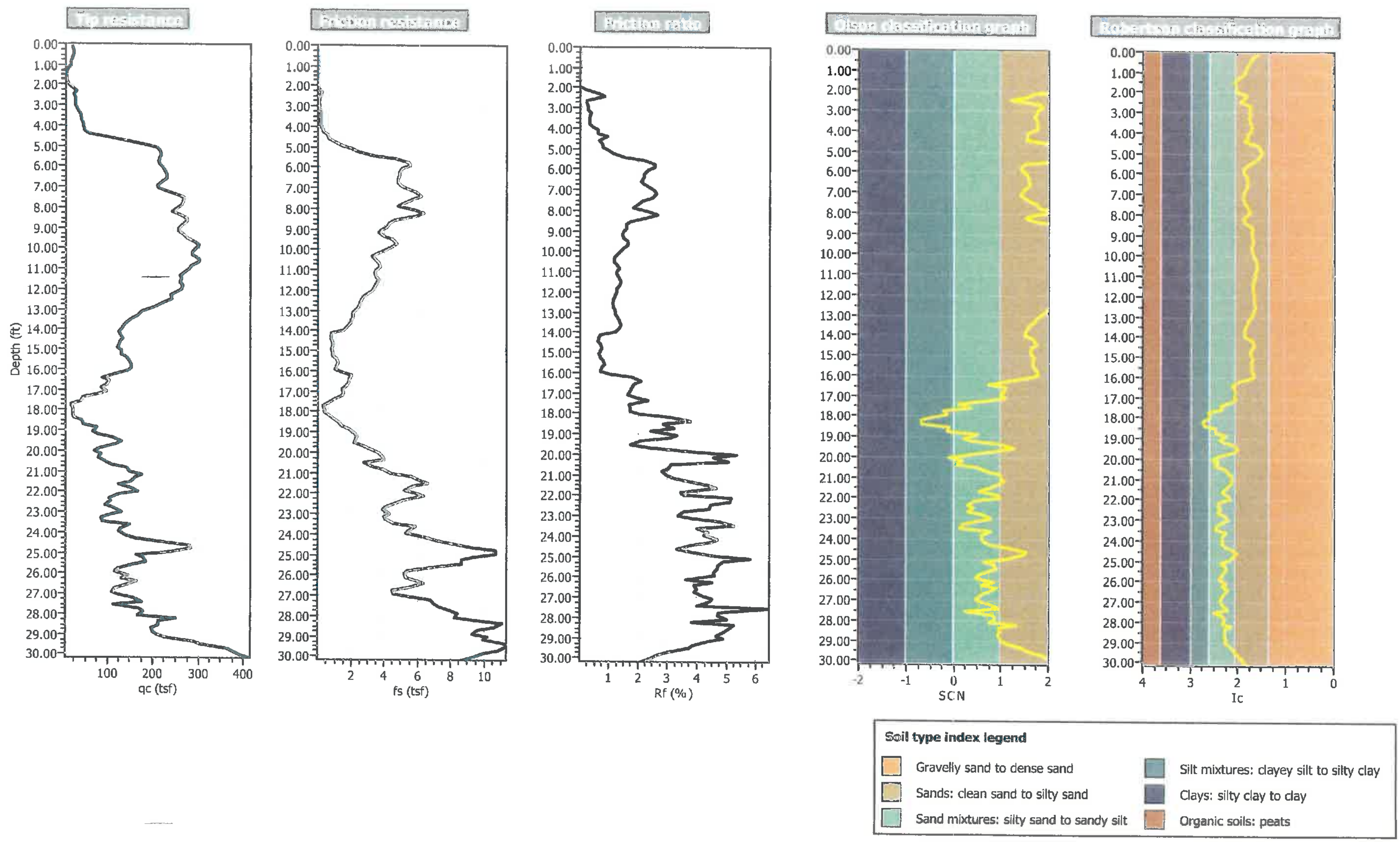
Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00






Tip resistance
Friction resistance
Friction ratio
Olsen classification graph
Robertson classification graph
Depth (ft)
qc (tsf)
fs (tsf)
Rf (%)
SCN
Ic
Soil type index legend
Gravelly sand to dense sand
Sands: clean sand to silty sand
Sand mixtures: silty sand to sandy silt
Silt mixtures: clayey silt to silty clay
Clays: silty clay to clay
Organic soils: peats

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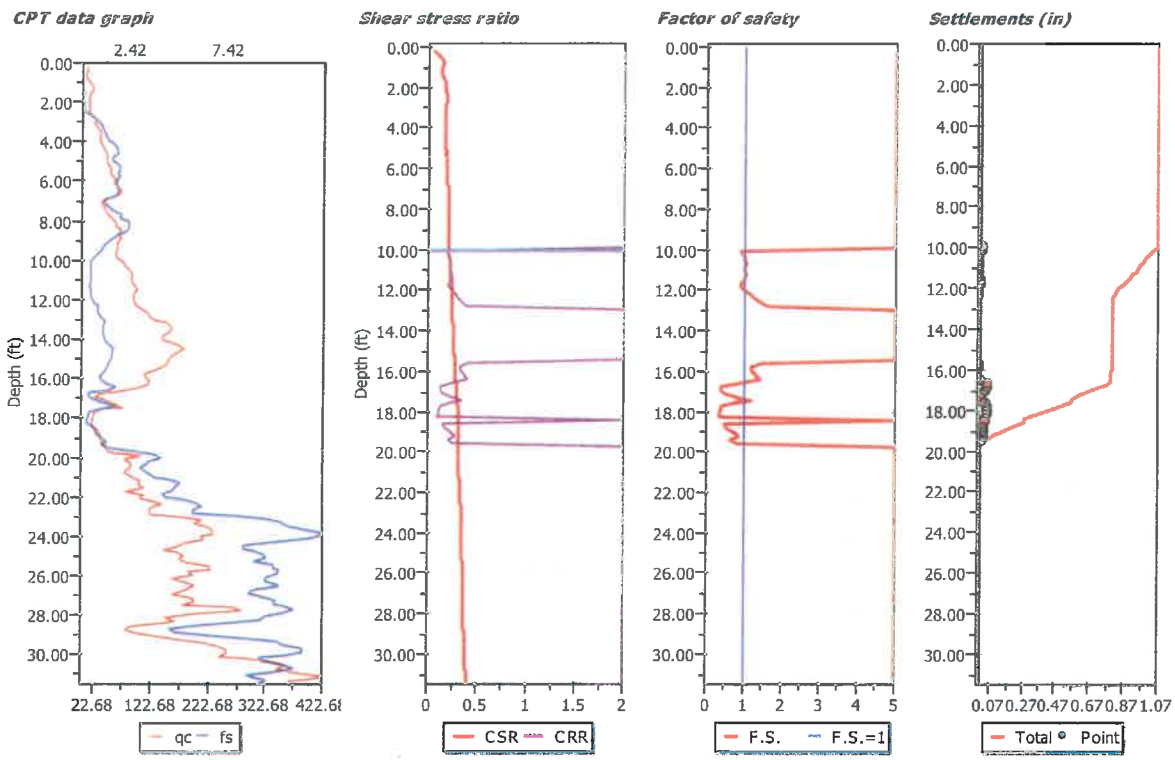
LIQUEFACTION ANALYSIS REPORT

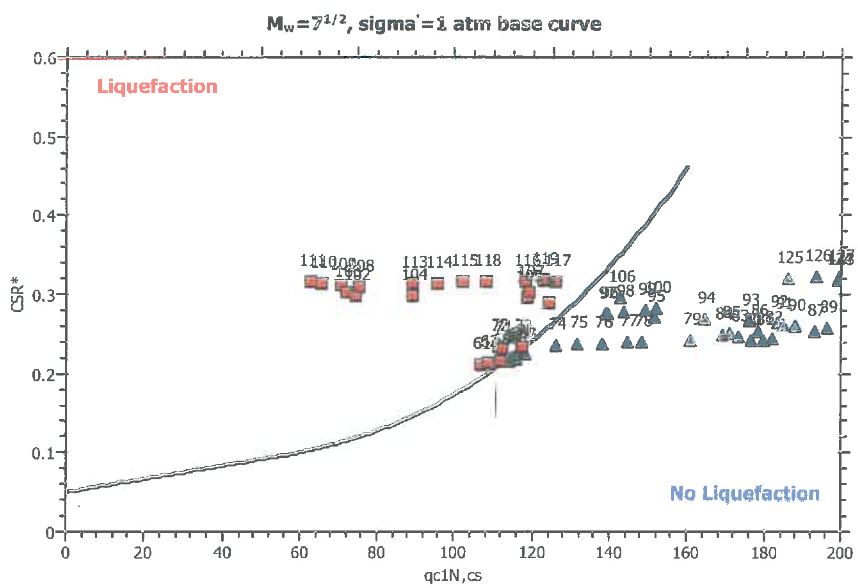
Project title : CPT-12

Project subtitle : Jack Ranch-San Luis Obispo, CA

Input parameters and analysis data

In-situ data type:	Cone Penetration Test	Depth to water table:	10.00 ft
Analysis type:	Deterministic	Earthquake magnitude M_w:	6.70
Analysis method:	Robertson (1998)	Peak ground accelaration:	0.53 g
Fines correction method:	Robertson (1998)	User defined F.S.:	1.00





:: Field input data ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	Fines content (%)	Unit weight (pcf)
1	0.16	8.70	0.00	5.82	120.94
2	0.33	9.50	0.00	7.35	120.94
3	0.49	6.81	0.00	9.94	120.94
4	0.66	6.78	0.00	11.12	120.94
5	0.82	8.92	0.00	10.78	120.94
6	0.98	14.87	0.00	7.47	120.94
7	1.15	20.07	0.00	6.00	120.94
8	1.31	18.92	0.00	6.09	120.94
9	1.48	14.42	0.12	13.79	120.94
10	1.64	12.71	0.11	15.64	120.94
11	1.80	11.98	0.01	9.41	120.94
12	1.97	12.24	0.09	16.09	120.94
13	2.13	13.08	0.13	17.54	120.94
14	2.30	11.47	0.09	18.28	120.94
15	2.46	11.24	0.14	21.72	120.94
16	2.62	14.87	0.33	24.17	120.94
17	2.79	21.75	0.61	23.02	120.94
18	2.95	23.48	0.85	25.35	120.94
19	3.12	26.19	1.00	25.26	120.94
20	3.28	28.01	1.04	24.71	120.94
21	3.44	32.64	1.10	22.48	120.94
22	3.61	32.78	1.23	23.89	120.94
23	3.77	31.42	1.31	25.85	120.94
24	3.94	30.77	1.44	27.81	120.94
25	4.10	34.78	1.55	26.32	120.94
26	4.27	37.35	1.74	26.38	120.94
27	4.43	42.13	1.82	24.56	120.94
28	4.59	44.62	1.87	23.89	120.94
29	4.76	43.71	1.53	22.27	120.94
30	4.92	44.82	1.59	22.40	120.94
31	5.09	45.42	1.78	23.62	120.94
32	5.25	51.94	1.91	21.87	120.94
33	5.41	49.26	1.93	23.28	120.94
34	5.58	50.23	1.86	22.65	120.94
35	5.74	57.30	1.96	20.70	120.94
36	5.91	59.69	1.88	19.67	120.94
37	6.07	56.17	1.80	20.52	120.94
38	6.23	63.92	1.81	18.30	120.94
39	6.40	68.84	1.87	17.39	120.94
40	6.56	65.79	1.89	18.46	120.94
41	6.73	56.20	1.63	20.14	120.94
42	6.89	37.68	1.34	26.73	120.94
43	7.05	34.07	1.14	27.39	120.94
44	7.22	36.28	1.28	27.43	120.94
45	7.38	42.17	1.53	26.26	120.94
46	7.55	45.69	1.81	26.62	120.94
47	7.71	48.19	2.04	27.06	120.94
48	7.87	52.13	1.96	24.90	120.94
49	8.04	59.90	2.41	24.44	120.94
50	8.20	61.41	2.41	24.03	120.94
51	8.37	70.87	2.43	21.20	120.94
52	8.53	67.20	2.23	21.45	120.94
53	8.69	65.54	1.96	20.65	120.94
54	8.86	69.82	1.67	17.87	120.94
55	9.02	64.48	1.43	17.95	120.94

:: Field input data (continued) ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	Fines content (%)	Unit weight (pcf)
56	9.19	63.09	1.22	17.04	120.94
57	9.35	63.27	1.06	15.82	120.94
58	9.51	59.26	1.04	16.94	120.94
59	9.68	59.00	0.86	15.51	120.94
60	9.84	64.44	0.65	12.07	120.94
61	10.01	73.04	0.50	8.85	120.94
62	10.17	77.03	0.48	8.03	120.94
63	10.33	81.78	0.49	7.39	120.94
64	10.50	84.62	0.50	7.13	120.94
65	10.66	88.65	0.48	6.44	120.94
66	10.83	88.76	0.46	6.29	120.94
67	10.99	88.89	0.48	6.49	120.94
68	11.15	91.84	0.50	6.35	120.94
69	11.32	95.90	0.41	5.15	120.94
70	11.48	97.24	0.44	5.22	120.94
71	11.65	92.79	0.45	5.82	120.94
72	11.81	92.26	0.44	5.83	120.94
73	11.98	92.36	0.52	6.58	120.94
74	12.14	95.86	0.69	7.53	120.94
75	12.30	97.02	0.83	8.47	120.94
76	12.47	106.25	0.85	7.44	120.94
77	12.63	117.97	0.81	6.03	120.94
78	12.80	119.30	0.90	6.44	120.94
79	12.96	127.94	1.11	6.77	120.94
80	13.12	148.19	1.19	5.53	120.94
81	13.29	154.68	1.13	4.85	120.94
82	13.45	157.20	1.08	4.47	120.94
83	13.62	150.28	1.10	5.08	120.94
84	13.78	142.54	1.13	5.76	120.94
85	13.94	143.04	1.19	6.02	120.94
86	14.11	153.06	1.24	5.53	120.94
87	14.27	168.82	1.42	5.19	120.94
88	14.44	180.60	1.63	5.23	120.94
89	14.60	167.01	1.60	5.99	120.94
90	14.76	156.11	1.56	6.65	120.94
91	14.93	153.15	1.55	6.83	120.94
92	15.09	152.87	1.51	6.73	120.94
93	15.26	147.16	1.41	6.81	120.94
94	15.42	134.99	1.31	7.42	120.94
95	15.58	119.63	1.23	8.64	120.94
96	15.75	108.82	1.08	9.09	120.94
97	15.91	113.85	0.96	7.82	120.94
98	16.08	120.34	0.98	7.28	120.94
99	16.24	116.52	1.29	9.38	120.94
100	16.40	98.49	1.74	14.31	120.94
101	16.57	63.83	1.28	19.69	120.94
102	16.73	34.73	0.41	22.17	120.94
103	16.90	25.66	0.37	28.49	120.94
104	17.06	43.53	0.63	21.23	120.94
105	17.22	61.25	1.19	20.03	120.94
106	17.39	71.01	1.74	20.84	120.94
107	17.55	38.02	1.12	31.05	120.94
108	17.72	23.30	0.40	32.34	120.94
109	17.88	20.94	0.34	33.67	120.94
110	18.04	20.43	0.29	32.63	120.94

:: Field input data (continued) ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	Fines content (%)	Unit weight (pcf)
111	18.21	19.90	0.26	32.46	120.94
112	18.37	21.76	0.52	38.04	120.94
113	18.54	28.94	0.61	31.58	120.94
114	18.70	30.00	0.71	32.50	120.94
115	18.86	33.50	0.83	31.40	120.94
116	19.03	35.71	1.12	33.53	120.94
117	19.19	39.03	1.29	32.95	120.94
118	19.36	44.42	1.01	26.34	120.94
119	19.52	44.80	1.29	29.15	120.94
120	19.69	51.51	2.64	35.39	120.94
121	19.85	104.32	3.76	21.90	120.94
122	20.01	74.54	4.05	31.38	120.94
123	20.18	88.68	3.46	24.72	120.94
124	20.34	89.33	3.46	24.56	120.94
125	20.51	85.18	3.08	24.25	120.94
126	20.67	74.90	3.23	28.15	120.94
127	20.83	86.25	3.49	25.66	120.94
128	21.00	98.66	3.79	23.58	120.94
129	21.16	102.53	4.54	25.04	120.94
130	21.33	101.25	5.09	26.99	120.94
131	21.49	110.55	4.84	24.18	120.94
132	21.65	79.88	4.75	32.41	120.94
133	21.82	110.88	4.20	22.36	120.94
134	21.98	102.81	4.37	24.67	120.94
135	22.15	120.08	5.19	23.34	120.94
136	22.31	141.40	5.86	21.26	120.94
137	22.47	122.02	6.17	25.37	120.94
138	22.64	120.07	5.75	24.82	120.94
139	22.80	121.51	5.77	24.60	120.94
140	22.97	163.16	7.39	21.21	120.94
141	23.13	210.18	9.45	19.06	120.94
142	23.29	197.69	10.27	21.43	120.94
143	23.46	224.77	10.58	19.17	120.94
144	23.62	229.49	11.41	19.73	120.94
145	23.79	231.27	12.40	20.67	120.94
146	23.95	211.24	12.42	22.68	120.94
147	24.11	213.10	11.75	21.75	120.94
148	24.28	183.97	10.12	22.98	120.94
149	24.44	166.57	8.35	22.63	120.94
150	24.61	146.24	8.30	25.63	120.94
151	24.77	165.79	8.81	23.54	120.94
152	24.93	179.20	9.34	22.59	120.94
153	25.10	173.93	9.59	23.67	120.94
154	25.26	186.64	8.94	21.17	120.94
155	25.43	225.35	9.90	18.58	120.94
156	25.59	227.93	9.96	18.45	120.94
157	25.75	190.66	10.16	22.50	120.94
158	25.92	196.10	10.08	21.80	120.94
159	26.08	161.10	9.55	25.61	120.94
160	26.25	182.39	9.47	22.61	120.94
161	26.41	199.28	10.13	21.59	120.94
162	26.57	192.22	10.23	22.55	120.94
163	26.74	180.00	8.88	22.13	120.94
164	26.90	162.07	8.60	24.12	120.94
165	27.07	196.82	9.39	20.96	120.94

:: Field input data (continued) ::

Point ID	Depth (ft)	q_c (tsf)	f_s (tsf)	Fines content (%)	Unit weight (pcf)
166	27.23	200.08	10.00	21.46	120.94
167	27.40	180.61	9.89	23.64	120.94
168	27.56	264.83	10.40	16.34	120.94
169	27.72	281.85	10.92	15.78	120.94
170	27.89	196.01	10.47	22.64	120.94
171	28.05	147.90	9.42	27.95	120.94
172	28.22	163.04	9.29	25.34	120.94
173	28.38	148.60	8.37	26.12	120.94
174	28.54	89.40	6.07	35.12	120.94
175	28.71	80.40	4.52	33.53	120.94
176	28.87	100.60	4.88	28.41	120.94
177	29.04	141.14	6.90	24.77	120.94
178	29.20	182.07	9.02	22.50	120.94
179	29.36	212.69	10.07	20.56	120.94
180	29.53	238.20	10.34	18.57	120.94
181	29.69	256.02	11.43	18.38	120.94
182	29.86	255.81	11.44	18.43	120.94
183	30.02	242.09	10.59	18.60	120.94
184	30.18	289.77	9.15	13.63	120.94
185	30.35	336.07	9.37	11.50	120.94
186	30.51	360.74	10.35	11.38	120.94
187	30.68	343.36	10.91	12.69	120.94
188	30.84	372.82	10.08	10.67	120.94
189	31.00	422.57	8.56	7.58	120.94
190	31.17	416.54	8.78	7.98	120.94
191	31.33	366.90	9.57	10.46	120.94
192	31.50	362.27	9.06	10.16	120.94

Depth : Depth from free surface, at which CPT was performed (ft)
q_c : Measured cone resistance
f_s : Sleeve friction resistance
Fines content : Percentage of fines in soil (%)
Unit weight : Bulk soil unit weight (tsf)

:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) ::

Point ID	Depth (ft)	Sigma (tsf)	u (tsf)	Sigma' (tsf)	r_d	CSR	MSF	$CSR_{eq,M=7.5}$	K_{sigma}	CSR^*
1	0.16	0.01	0.00	0.01	1.00	0.34	1.33	0.26	4.29	0.06
2	0.33	0.02	0.00	0.02	1.00	0.34	1.33	0.26	2.98	0.09
3	0.49	0.03	0.00	0.03	1.00	0.34	1.33	0.26	2.03	0.13
4	0.66	0.04	0.00	0.04	1.00	0.34	1.33	0.26	1.79	0.14
5	0.82	0.05	0.00	0.05	1.00	0.34	1.33	0.26	1.84	0.14
6	0.98	0.06	0.00	0.06	1.00	0.34	1.33	0.26	2.11	0.12
7	1.15	0.07	0.00	0.07	1.00	0.34	1.33	0.26	2.21	0.12
8	1.31	0.08	0.00	0.08	1.00	0.34	1.33	0.26	2.03	0.13
9	1.48	0.09	0.00	0.09	1.00	0.34	1.33	0.26	1.75	0.15
10	1.64	0.10	0.00	0.10	1.00	0.34	1.33	0.26	1.61	0.16
11	1.80	0.11	0.00	0.11	1.00	0.34	1.33	0.26	1.52	0.17
12	1.97	0.12	0.00	0.12	1.00	0.34	1.33	0.26	1.49	0.17
13	2.13	0.13	0.00	0.13	1.00	0.34	1.33	0.26	1.48	0.17
14	2.30	0.14	0.00	0.14	0.99	0.34	1.33	0.26	1.39	0.18
15	2.46	0.15	0.00	0.15	0.99	0.34	1.33	0.26	1.35	0.19
16	2.62	0.16	0.00	0.16	0.99	0.34	1.33	0.26	1.43	0.18
17	2.79	0.17	0.00	0.17	0.99	0.34	1.33	0.26	1.55	0.17
18	2.95	0.18	0.00	0.18	0.99	0.34	1.33	0.26	1.55	0.17
19	3.12	0.19	0.00	0.19	0.99	0.34	1.33	0.26	1.56	0.16

:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) (continued) ::

Point ID	Depth (ft)	Sigma (tsf)	u (tsf)	Sigma' (tsf)	r_d	CSR	MSF	$CSR_{eq,M=7.5}$	K_{sigma}	CSR^*
20	3.28	0.20	0.00	0.20	0.99	0.34	1.33	0.26	1.55	0.16
21	3.44	0.21	0.00	0.21	0.99	0.34	1.33	0.26	1.58	0.16
22	3.61	0.22	0.00	0.22	0.99	0.34	1.33	0.26	1.55	0.16
23	3.77	0.23	0.00	0.23	0.99	0.34	1.33	0.26	1.51	0.17
24	3.94	0.24	0.00	0.24	0.99	0.34	1.33	0.26	1.48	0.17
25	4.10	0.25	0.00	0.25	0.99	0.34	1.33	0.26	1.50	0.17
26	4.27	0.26	0.00	0.26	0.99	0.34	1.33	0.26	1.50	0.17
27	4.43	0.27	0.00	0.27	0.99	0.34	1.33	0.26	1.51	0.17
28	4.59	0.28	0.00	0.28	0.99	0.34	1.33	0.26	1.50	0.17
29	4.76	0.29	0.00	0.29	0.99	0.34	1.33	0.26	1.48	0.17
30	4.92	0.30	0.00	0.30	0.99	0.34	1.33	0.26	1.46	0.17
31	5.09	0.31	0.00	0.31	0.99	0.34	1.33	0.26	1.45	0.18
32	5.25	0.32	0.00	0.32	0.99	0.34	1.33	0.26	1.46	0.17
33	5.41	0.33	0.00	0.33	0.99	0.34	1.33	0.25	1.43	0.18
34	5.58	0.34	0.00	0.34	0.99	0.34	1.33	0.25	1.42	0.18
35	5.74	0.35	0.00	0.35	0.99	0.34	1.33	0.25	1.43	0.18
36	5.91	0.36	0.00	0.36	0.99	0.34	1.33	0.25	1.43	0.18
37	6.07	0.37	0.00	0.37	0.99	0.34	1.33	0.25	1.40	0.18
38	6.23	0.38	0.00	0.38	0.99	0.34	1.33	0.25	1.41	0.18
39	6.40	0.39	0.00	0.39	0.99	0.34	1.33	0.25	1.41	0.18
40	6.56	0.40	0.00	0.40	0.98	0.34	1.33	0.25	1.39	0.18
41	6.73	0.41	0.00	0.41	0.98	0.34	1.33	0.25	1.34	0.19
42	6.89	0.42	0.00	0.42	0.98	0.34	1.33	0.25	1.26	0.20
43	7.05	0.43	0.00	0.43	0.98	0.34	1.33	0.25	1.24	0.21
44	7.22	0.44	0.00	0.44	0.98	0.34	1.33	0.25	1.24	0.20
45	7.38	0.45	0.00	0.45	0.98	0.34	1.33	0.25	1.25	0.20
46	7.55	0.46	0.00	0.46	0.98	0.34	1.33	0.25	1.26	0.20
47	7.71	0.47	0.00	0.47	0.98	0.34	1.33	0.25	1.26	0.20
48	7.87	0.48	0.00	0.48	0.98	0.34	1.33	0.25	1.26	0.20
49	8.04	0.49	0.00	0.49	0.98	0.34	1.33	0.25	1.27	0.20
50	8.20	0.50	0.00	0.50	0.98	0.34	1.33	0.25	1.26	0.20
51	8.37	0.51	0.00	0.51	0.98	0.34	1.33	0.25	1.27	0.20
52	8.53	0.52	0.00	0.52	0.98	0.34	1.33	0.25	1.26	0.20
53	8.69	0.53	0.00	0.53	0.98	0.34	1.33	0.25	1.24	0.20
54	8.86	0.54	0.00	0.54	0.98	0.34	1.33	0.25	1.24	0.20
55	9.02	0.55	0.00	0.55	0.98	0.34	1.33	0.25	1.22	0.21
56	9.19	0.56	0.00	0.56	0.98	0.34	1.33	0.25	1.21	0.21
57	9.35	0.57	0.00	0.57	0.98	0.34	1.33	0.25	1.21	0.21
58	9.51	0.58	0.00	0.58	0.98	0.34	1.33	0.25	1.19	0.21
59	9.68	0.59	0.00	0.59	0.98	0.34	1.33	0.25	1.19	0.21
60	9.84	0.60	0.00	0.60	0.98	0.34	1.33	0.25	1.19	0.21
61	10.01	0.60	0.00	0.60	0.98	0.34	1.33	0.25	1.19	0.21
62	10.17	0.61	0.01	0.61	0.98	0.34	1.33	0.25	1.19	0.21
63	10.33	0.62	0.01	0.61	0.98	0.34	1.33	0.26	1.20	0.21
64	10.50	0.63	0.02	0.62	0.98	0.34	1.33	0.26	1.20	0.22
65	10.66	0.64	0.02	0.62	0.98	0.35	1.33	0.26	1.20	0.22
66	10.83	0.65	0.03	0.63	0.97	0.35	1.33	0.26	1.19	0.22
67	10.99	0.66	0.03	0.63	0.97	0.35	1.33	0.26	1.19	0.22
68	11.15	0.67	0.04	0.64	0.97	0.35	1.33	0.27	1.19	0.22
69	11.32	0.68	0.04	0.64	0.97	0.36	1.33	0.27	1.19	0.22
70	11.48	0.69	0.05	0.65	0.97	0.36	1.33	0.27	1.19	0.23
71	11.65	0.70	0.05	0.65	0.97	0.36	1.33	0.27	1.18	0.23
72	11.81	0.71	0.06	0.66	0.97	0.36	1.33	0.27	1.18	0.23
73	11.98	0.72	0.06	0.66	0.97	0.37	1.33	0.27	1.17	0.23
74	12.14	0.73	0.07	0.67	0.97	0.37	1.33	0.28	1.17	0.24

:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) (continued) ::

Point ID	Depth (ft)	Sigma (tsf)	u (tsf)	Sigma' (tsf)	r_d	CSR	MSF	$CSR_{eq,M=7.5}$	K_{sigma}	CSR^*
75	12.30	0.74	0.07	0.67	0.97	0.37	1.33	0.28	1.17	0.24
76	12.47	0.75	0.08	0.68	0.97	0.37	1.33	0.28	1.17	0.24
77	12.63	0.76	0.08	0.68	0.97	0.37	1.33	0.28	1.18	0.24
78	12.80	0.77	0.09	0.69	0.97	0.38	1.33	0.28	1.17	0.24
79	12.96	0.78	0.09	0.69	0.97	0.38	1.33	0.28	1.18	0.24
80	13.12	0.79	0.10	0.70	0.97	0.38	1.33	0.29	1.18	0.24
81	13.29	0.80	0.10	0.70	0.97	0.38	1.33	0.29	1.18	0.24
82	13.45	0.81	0.11	0.71	0.97	0.38	1.33	0.29	1.18	0.24
83	13.62	0.82	0.11	0.71	0.97	0.39	1.33	0.29	1.17	0.25
84	13.78	0.83	0.12	0.72	0.97	0.39	1.33	0.29	1.17	0.25
85	13.94	0.84	0.12	0.72	0.97	0.39	1.33	0.29	1.16	0.25
86	14.11	0.85	0.13	0.72	0.97	0.39	1.33	0.29	1.16	0.25
87	14.27	0.86	0.13	0.73	0.97	0.39	1.33	0.30	1.17	0.25
88	14.44	0.87	0.14	0.73	0.97	0.40	1.33	0.30	1.17	0.25
89	14.60	0.88	0.14	0.74	0.97	0.40	1.33	0.30	1.16	0.26
90	14.76	0.89	0.15	0.74	0.97	0.40	1.33	0.30	1.15	0.26
91	14.93	0.90	0.15	0.75	0.97	0.40	1.33	0.30	1.15	0.26
92	15.09	0.91	0.16	0.75	0.96	0.40	1.33	0.30	1.14	0.26
93	15.26	0.92	0.16	0.76	0.96	0.40	1.33	0.30	1.14	0.27
94	15.42	0.93	0.17	0.76	0.96	0.41	1.33	0.30	1.13	0.27
95	15.58	0.94	0.17	0.77	0.96	0.41	1.33	0.31	1.12	0.27
96	15.75	0.95	0.18	0.77	0.96	0.41	1.33	0.31	1.12	0.27
97	15.91	0.96	0.18	0.78	0.96	0.41	1.33	0.31	1.11	0.28
98	16.08	0.97	0.19	0.78	0.96	0.41	1.33	0.31	1.11	0.28
99	16.24	0.98	0.19	0.79	0.96	0.41	1.33	0.31	1.11	0.28
100	16.40	0.99	0.20	0.79	0.96	0.41	1.33	0.31	1.10	0.28
101	16.57	1.00	0.21	0.80	0.96	0.42	1.33	0.31	1.08	0.29
102	16.73	1.01	0.21	0.80	0.96	0.42	1.33	0.31	1.05	0.30
103	16.90	1.02	0.22	0.81	0.96	0.42	1.33	0.31	1.04	0.30
104	17.06	1.03	0.22	0.81	0.96	0.42	1.33	0.32	1.06	0.30
105	17.22	1.04	0.23	0.82	0.96	0.42	1.33	0.32	1.07	0.30
106	17.39	1.05	0.23	0.82	0.96	0.42	1.33	0.32	1.07	0.30
107	17.55	1.06	0.24	0.83	0.96	0.42	1.33	0.32	1.05	0.30
108	17.72	1.07	0.24	0.83	0.96	0.43	1.33	0.32	1.03	0.31
109	17.88	1.08	0.25	0.84	0.96	0.43	1.33	0.32	1.03	0.31
110	18.04	1.09	0.25	0.84	0.96	0.43	1.33	0.32	1.03	0.31
111	18.21	1.10	0.26	0.84	0.96	0.43	1.33	0.32	1.02	0.31
112	18.37	1.11	0.26	0.85	0.96	0.43	1.33	0.32	1.03	0.31
113	18.54	1.12	0.27	0.85	0.96	0.43	1.33	0.32	1.03	0.31
114	18.70	1.13	0.27	0.86	0.96	0.43	1.33	0.33	1.03	0.31
115	18.86	1.14	0.28	0.86	0.96	0.43	1.33	0.33	1.04	0.31
116	19.03	1.15	0.28	0.87	0.96	0.44	1.33	0.33	1.04	0.32
117	19.19	1.16	0.29	0.87	0.96	0.44	1.33	0.33	1.04	0.32
118	19.36	1.17	0.29	0.88	0.95	0.44	1.33	0.33	1.04	0.32
119	19.52	1.18	0.30	0.88	0.95	0.44	1.33	0.33	1.04	0.32
120	19.69	1.19	0.30	0.89	0.95	0.44	1.33	0.33	1.04	0.32
121	19.85	1.20	0.31	0.89	0.95	0.44	1.33	0.33	1.06	0.31
122	20.01	1.21	0.31	0.90	0.95	0.44	1.33	0.33	1.05	0.32
123	20.18	1.22	0.32	0.90	0.95	0.44	1.33	0.33	1.05	0.32
124	20.34	1.23	0.32	0.91	0.95	0.44	1.33	0.33	1.05	0.32
125	20.51	1.24	0.33	0.91	0.95	0.45	1.33	0.33	1.04	0.32
126	20.67	1.25	0.33	0.92	0.95	0.45	1.33	0.34	1.04	0.32
127	20.83	1.26	0.34	0.92	0.95	0.45	1.33	0.34	1.04	0.32
128	21.00	1.27	0.34	0.93	0.95	0.45	1.33	0.34	1.04	0.32
129	21.16	1.28	0.35	0.93	0.95	0.45	1.33	0.34	1.04	0.32

:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) (continued) ::

Point ID	Depth (ft)	Sigma (tsf)	u (tsf)	Sigma' (tsf)	r_d	CSR	MSF	$CSR_{eq,M=7.5}$	K_{sigma}	CSR*
130	21.33	1.29	0.35	0.94	0.95	0.45	1.33	0.34	1.04	0.33
131	21.49	1.30	0.36	0.94	0.95	0.45	1.33	0.34	1.04	0.33
132	21.65	1.31	0.36	0.95	0.95	0.45	1.33	0.34	1.03	0.33
133	21.82	1.32	0.37	0.95	0.95	0.45	1.33	0.34	1.03	0.33
134	21.98	1.33	0.37	0.95	0.95	0.45	1.33	0.34	1.03	0.33
135	22.15	1.34	0.38	0.96	0.95	0.46	1.33	0.34	1.03	0.33
136	22.31	1.35	0.38	0.96	0.95	0.46	1.33	0.34	1.03	0.33
137	22.47	1.36	0.39	0.97	0.95	0.46	1.33	0.34	1.03	0.33
138	22.64	1.37	0.39	0.97	0.95	0.46	1.33	0.34	1.03	0.34
139	22.80	1.38	0.40	0.98	0.95	0.46	1.33	0.34	1.02	0.34
140	22.97	1.39	0.40	0.98	0.95	0.46	1.33	0.34	1.02	0.34
141	23.13	1.40	0.41	0.99	0.95	0.46	1.33	0.35	1.02	0.34
142	23.29	1.41	0.41	0.99	0.95	0.46	1.33	0.35	1.02	0.34
143	23.46	1.42	0.42	1.00	0.95	0.46	1.33	0.35	1.02	0.34
144	23.62	1.43	0.43	1.00	0.94	0.46	1.33	0.35	1.02	0.34
145	23.79	1.44	0.43	1.01	0.94	0.46	1.33	0.35	1.02	0.34
146	23.95	1.45	0.44	1.01	0.94	0.47	1.33	0.35	1.01	0.34
147	24.11	1.46	0.44	1.02	0.94	0.47	1.33	0.35	1.01	0.35
148	24.28	1.47	0.45	1.02	0.94	0.47	1.33	0.35	1.01	0.35
149	24.44	1.48	0.45	1.03	0.94	0.47	1.33	0.35	1.01	0.35
150	24.61	1.49	0.46	1.03	0.94	0.47	1.33	0.35	1.00	0.35
151	24.77	1.50	0.46	1.04	0.94	0.47	1.33	0.35	1.00	0.35
152	24.93	1.51	0.47	1.04	0.94	0.47	1.33	0.35	1.00	0.35
153	25.10	1.52	0.47	1.05	0.94	0.47	1.33	0.35	1.00	0.35
154	25.26	1.53	0.48	1.05	0.94	0.47	1.33	0.35	1.00	0.35
155	25.43	1.54	0.48	1.06	0.94	0.47	1.33	0.35	1.00	0.36
156	25.59	1.55	0.49	1.06	0.94	0.47	1.33	0.35	0.99	0.36
157	25.75	1.56	0.49	1.07	0.94	0.47	1.33	0.35	0.99	0.36
158	25.92	1.57	0.50	1.07	0.94	0.47	1.33	0.36	0.99	0.36
159	26.08	1.58	0.50	1.07	0.94	0.47	1.33	0.36	0.99	0.36
160	26.25	1.59	0.51	1.08	0.94	0.48	1.33	0.36	0.99	0.36
161	26.41	1.60	0.51	1.08	0.94	0.48	1.33	0.36	0.98	0.36
162	26.57	1.61	0.52	1.09	0.94	0.48	1.33	0.36	0.98	0.36
163	26.74	1.62	0.52	1.09	0.94	0.48	1.33	0.36	0.98	0.36
164	26.90	1.63	0.53	1.10	0.94	0.48	1.33	0.36	0.98	0.37
165	27.07	1.64	0.53	1.10	0.94	0.48	1.33	0.36	0.98	0.37
166	27.23	1.65	0.54	1.11	0.94	0.48	1.33	0.36	0.97	0.37
167	27.40	1.66	0.54	1.11	0.94	0.48	1.33	0.36	0.97	0.37
168	27.56	1.67	0.55	1.12	0.94	0.48	1.33	0.36	0.97	0.37
169	27.72	1.68	0.55	1.12	0.94	0.48	1.33	0.36	0.97	0.37
170	27.89	1.69	0.56	1.13	0.93	0.48	1.33	0.36	0.97	0.37
171	28.05	1.70	0.56	1.13	0.93	0.48	1.33	0.36	0.97	0.37
172	28.22	1.71	0.57	1.14	0.93	0.48	1.33	0.36	0.97	0.37
173	28.38	1.72	0.57	1.14	0.93	0.48	1.33	0.36	0.97	0.37
174	28.54	1.73	0.58	1.15	0.93	0.48	1.33	0.36	0.97	0.37
175	28.71	1.74	0.58	1.15	0.93	0.48	1.33	0.36	0.97	0.37
176	28.87	1.75	0.59	1.16	0.93	0.48	1.33	0.36	0.97	0.38
177	29.04	1.76	0.59	1.16	0.93	0.49	1.33	0.36	0.96	0.38
178	29.20	1.77	0.60	1.17	0.93	0.49	1.33	0.36	0.96	0.38
179	29.36	1.78	0.60	1.17	0.93	0.49	1.33	0.36	0.95	0.38
180	29.53	1.79	0.61	1.18	0.93	0.49	1.33	0.37	0.95	0.38
181	29.69	1.80	0.61	1.18	0.93	0.49	1.33	0.37	0.95	0.39
182	29.86	1.81	0.62	1.19	0.93	0.49	1.33	0.37	0.94	0.39
183	30.02	1.81	0.62	1.19	0.93	0.49	1.33	0.37	0.94	0.39
184	30.18	1.82	0.63	1.19	0.93	0.49	1.33	0.37	0.94	0.39

:: Cyclic Stress Ratio calculation (CSR fully adjusted and normalized) (continued) ::

Point ID	Depth (ft)	Sigma (tsf)	u (tsf)	Sigma' (tsf)	r_d	CSR	MSF	$CSR_{eq,M=7.5}$	K_{sigma}	CSR*
185	30.35	1.83	0.64	1.20	0.93	0.49	1.33	0.37	0.93	0.39
186	30.51	1.84	0.64	1.20	0.93	0.49	1.33	0.37	0.93	0.39
187	30.68	1.85	0.65	1.21	0.93	0.49	1.33	0.37	0.93	0.39
188	30.84	1.86	0.65	1.21	0.92	0.49	1.33	0.37	0.93	0.40
189	31.00	1.87	0.66	1.22	0.92	0.49	1.33	0.37	0.92	0.40
190	31.17	1.88	0.66	1.22	0.92	0.49	1.33	0.37	0.92	0.40
191	31.33	1.89	0.67	1.23	0.92	0.49	1.33	0.37	0.92	0.40
192	31.50	1.90	0.67	1.23	0.92	0.49	1.33	0.37	0.92	0.40

Depth : Depth from free surface, at which CPT was performed (ft)
Sigma : Total overburden pressure at test point, during earthquake (tsf)
u : Water pressure at test point, during earthquake (tsf)
Sigma' : Effective overburden pressure, during earthquake (tsf)
r_d : Nonlinear shear mass factor
CSR : Cyclic Stress Ratio
MSF : Magnitude Scaling Factor
$CSR_{eq,M=7.5}$ CSR adjusted for M=7.5
K_{sigma} Effective overburden stress factor
CSR* CSR fully adjusted

:: Cyclic Resistance Ratio calculation $CRR_{7.5}$ ::

Point ID	q_c (tsf)	I_c	F (%)	n	q_{c1n}	K_c	q_{c1cs}	$CRR_{7.5}$
1	8.70	1.68	0.01	0.51	88.58	1.00	88.58	2.00
2	9.50	1.76	0.01	0.53	75.47	1.00	75.47	2.00
3	6.81	1.88	0.01	0.57	49.08	1.00	49.08	2.00
4	6.78	1.93	0.01	0.58	43.53	1.00	43.53	2.00
5	8.92	1.92	0.01	0.58	49.85	1.00	49.85	2.00
6	14.87	1.77	0.01	0.54	66.79	1.00	66.79	2.00
7	20.07	1.69	0.01	0.51	77.17	1.00	77.17	2.00
8	18.92	1.70	0.02	0.52	68.09	1.00	68.09	2.00
9	14.42	2.03	0.86	0.62	62.95	1.34	84.48	2.00
10	12.71	2.09	0.90	0.64	54.24	1.44	78.37	2.00
11	11.98	1.86	0.07	0.57	40.97	1.00	40.97	2.00
12	12.24	2.11	0.76	0.64	46.82	1.47	68.91	2.00
13	13.08	2.16	0.99	0.66	48.88	1.57	76.51	2.00
14	11.47	2.18	0.84	0.66	41.30	1.62	66.71	2.00
15	11.24	2.28	1.25	0.69	40.91	1.88	76.93	2.00
16	14.87	2.34	2.24	0.71	53.81	2.10	112.81	2.00
17	21.75	2.31	2.83	0.70	74.16	1.99	147.76	2.00
18	23.48	2.37	3.63	0.72	79.47	2.21	175.44	2.00
19	26.19	2.37	3.84	0.72	85.23	2.20	187.49	2.00
20	28.01	2.36	3.75	0.71	87.26	2.15	187.37	2.00
21	32.64	2.30	3.39	0.70	95.52	1.95	185.79	2.00
22	32.78	2.34	3.76	0.71	94.51	2.07	195.68	2.00
23	31.42	2.39	4.19	0.72	89.76	2.26	202.52	2.00
24	30.77	2.43	4.71	0.74	87.04	2.46	213.75	2.00
25	34.78	2.40	4.50	0.73	94.05	2.30	216.64	2.00
26	37.35	2.40	4.68	0.73	98.24	2.31	226.86	2.00
27	42.13	2.35	4.34	0.71	105.89	2.13	225.83	2.00
28	44.62	2.34	4.21	0.71	108.54	2.07	224.79	2.00
29	43.71	2.29	3.53	0.70	101.96	1.93	196.51	2.00
30	44.82	2.30	3.57	0.70	102.25	1.94	198.20	2.00
31	45.42	2.33	3.94	0.71	102.49	2.05	209.73	2.00
32	51.94	2.28	3.70	0.69	112.77	1.89	213.51	2.00
33	49.26	2.32	3.94	0.70	106.03	2.02	213.68	2.00
34	50.23	2.30	3.73	0.70	105.26	1.96	206.29	2.00
35	57.30	2.25	3.43	0.68	115.69	1.80	207.96	2.00

:: Cyclic Resistance Ratio calculation $CRR_{7.5}$ (continued) ::

Point ID	q_c (tsf)	I_c	F (%)	n	q_{c1n}	K_c	q_{c1cs}	$CRR_{7.5}$
36	59.69	2.22	3.18	0.67	117.11	1.72	201.12	2.00
37	56.17	2.24	3.22	0.68	108.94	1.78	194.21	2.00
38	63.92	2.18	2.86	0.66	119.42	1.62	193.09	2.00
39	68.84	2.15	2.74	0.65	125.41	1.56	195.03	2.00
40	65.79	2.18	2.89	0.66	118.97	1.63	193.69	2.00
41	56.20	2.23	2.93	0.68	101.26	1.75	177.56	2.00
42	37.68	2.41	3.60	0.73	69.81	2.34	163.66	2.00
43	34.07	2.42	3.40	0.74	62.23	2.41	150.12	2.00
44	36.28	2.42	3.56	0.74	65.20	2.42	157.52	2.00
45	42.17	2.40	3.66	0.73	74.11	2.30	170.29	2.00
46	45.69	2.41	3.99	0.73	79.25	2.33	184.92	2.00
47	48.19	2.42	4.27	0.73	82.52	2.38	196.19	2.00
48	52.13	2.36	3.79	0.72	86.85	2.17	188.03	2.00
49	59.90	2.35	4.05	0.71	98.18	2.12	208.27	2.00
50	61.41	2.34	3.95	0.71	98.98	2.08	206.19	2.00
51	70.87	2.26	3.46	0.69	110.89	1.84	203.77	2.00
52	67.20	2.27	3.34	0.69	103.85	1.86	192.94	2.00
53	65.54	2.25	3.01	0.68	99.47	1.79	178.34	2.00
54	69.82	2.17	2.41	0.66	102.94	1.59	163.39	2.00
55	64.48	2.17	2.23	0.66	93.90	1.59	149.54	2.00
56	63.09	2.14	1.96	0.65	90.28	1.53	138.28	2.00
57	63.27	2.10	1.69	0.64	88.84	1.46	129.27	2.00
58	59.26	2.14	1.77	0.65	82.76	1.53	126.22	2.00
59	59.00	2.09	1.47	0.63	80.81	1.44	116.10	2.00
60	64.44	1.97	1.01	0.60	85.59	1.26	107.75	2.00
61	73.04	1.83	0.69	0.56	94.09	1.13	106.48	0.19
62	77.03	1.80	0.63	0.55	98.22	1.10	108.37	0.20
63	81.78	1.76	0.60	0.54	103.36	1.08	111.82	0.21
64	84.62	1.75	0.59	0.53	106.30	1.07	114.06	0.22
65	88.65	1.72	0.54	0.52	110.34	1.05	115.79	0.22
66	88.76	1.71	0.52	0.52	109.89	1.04	114.73	0.22
67	88.89	1.72	0.54	0.52	109.77	1.05	115.37	0.22
68	91.84	1.71	0.55	0.52	112.86	1.05	118.08	0.23
69	95.90	1.65	0.44	0.50	116.32	1.00	116.32	0.23
70	97.24	1.65	0.45	0.50	117.57	1.00	117.57	0.23
71	92.79	1.68	0.48	0.51	112.23	1.00	112.23	0.21
72	92.26	1.68	0.48	0.51	111.17	1.00	111.17	0.21
73	92.36	1.72	0.57	0.53	111.46	1.05	117.50	0.23
74	95.86	1.77	0.72	0.54	116.02	1.09	126.05	0.27
75	97.02	1.82	0.87	0.55	117.66	1.12	131.64	0.29
76	106.25	1.77	0.80	0.54	127.61	1.08	138.28	0.33
77	117.97	1.70	0.69	0.52	139.93	1.03	144.80	0.36
78	119.30	1.72	0.76	0.52	141.38	1.05	148.34	0.38
79	127.94	1.73	0.87	0.53	151.44	1.06	160.66	2.00
80	148.19	1.67	0.81	0.51	173.54	1.02	176.30	2.00
81	154.68	1.63	0.73	0.50	179.90	1.00	179.90	2.00
82	157.20	1.61	0.69	0.50	182.22	1.00	182.22	2.00
83	150.28	1.64	0.74	0.50	173.61	1.00	173.28	2.00
84	142.54	1.68	0.80	0.51	164.77	1.02	168.87	2.00
85	143.04	1.69	0.84	0.52	165.03	1.03	170.69	2.00
86	153.06	1.67	0.82	0.51	175.54	1.02	178.36	2.00
87	168.82	1.65	0.84	0.50	192.64	1.00	193.14	2.00
88	180.60	1.65	0.91	0.50	205.51	1.00	206.33	2.00
89	167.01	1.69	0.96	0.52	190.16	1.03	196.50	2.00
90	156.11	1.73	1.01	0.53	177.71	1.06	187.79	2.00

:: Cyclic Resistance Ratio calculation $CRR_{7.5}$ (continued) ::

Point ID	q_c (tsf)	I_c	F (%)	n	q_{c1n}	K_c	q_{c1cs}	$CRR_{7.5}$
91	153.15	1.74	1.02	0.53	173.88	1.06	184.80	2.00
92	152.87	1.73	0.99	0.53	172.88	1.06	183.15	2.00
93	147.16	1.74	0.97	0.53	165.88	1.06	176.20	2.00
94	134.99	1.77	0.97	0.54	151.99	1.08	164.58	2.00
95	119.63	1.82	1.04	0.56	134.82	1.12	151.61	0.40
96	108.82	1.84	1.00	0.56	122.33	1.14	139.49	0.33
97	113.85	1.79	0.85	0.54	126.93	1.10	139.18	0.33
98	120.34	1.76	0.82	0.54	133.46	1.08	143.87	0.36
99	116.52	1.86	1.12	0.57	129.82	1.15	149.41	0.39
100	98.49	2.05	1.79	0.62	110.94	1.37	151.93	0.41
101	63.83	2.22	2.03	0.67	72.22	1.72	124.12	0.26
102	34.73	2.29	1.22	0.70	38.82	1.92	74.47	0.12
103	25.66	2.45	1.50	0.74	28.60	2.53	72.28	0.12
104	43.53	2.26	1.49	0.69	48.42	1.84	89.10	0.15
105	61.25	2.23	1.97	0.68	68.16	1.74	118.89	0.24
106	71.01	2.25	2.48	0.68	79.01	1.81	142.90	0.35
107	38.02	2.51	3.03	0.76	42.33	2.81	118.96	0.24
108	23.30	2.54	1.79	0.77	25.40	2.96	75.18	0.12
109	20.94	2.56	1.70	0.78	22.63	3.12	70.59	0.11
110	20.43	2.54	1.48	0.77	21.91	2.99	65.60	0.11
111	19.90	2.54	1.38	0.77	21.20	2.97	63.04	0.10
112	21.76	2.65	2.51	0.80	23.35	2.97	69.43	2.00
113	28.94	2.52	2.20	0.76	31.06	2.87	89.19	0.15
114	30.00	2.54	2.47	0.77	32.14	2.98	95.73	0.16
115	33.50	2.52	2.57	0.76	35.82	2.85	102.06	0.18
116	35.71	2.56	3.25	0.78	38.19	3.10	118.44	0.23
117	39.03	2.55	3.42	0.77	41.64	3.03	126.24	0.27
118	44.42	2.40	2.33	0.73	46.98	2.31	108.30	0.20
119	44.80	2.47	2.95	0.75	47.35	2.60	123.06	0.25
120	51.51	2.60	5.25	0.79	54.76	2.60	142.31	2.00
121	104.32	2.28	3.64	0.69	110.10	1.90	208.72	2.00
122	74.54	2.52	5.53	0.76	78.83	2.85	224.49	2.00
123	88.68	2.36	3.96	0.72	92.99	2.15	199.72	2.00
124	89.33	2.35	3.92	0.71	93.30	2.13	198.97	2.00
125	85.18	2.35	3.66	0.71	88.53	2.10	186.23	2.00
126	74.90	2.44	4.39	0.74	77.68	2.49	193.54	2.00
127	86.25	2.38	4.10	0.72	89.09	2.24	199.44	2.00
128	98.66	2.33	3.90	0.71	101.52	2.04	207.34	2.00
129	102.53	2.37	4.48	0.72	105.30	2.18	229.35	2.00
130	101.25	2.41	5.09	0.73	103.74	2.37	245.96	2.00
131	110.55	2.34	4.43	0.71	112.70	2.10	236.34	2.00
132	79.88	2.54	6.05	0.77	81.23	2.97	241.07	2.00
133	110.88	2.30	3.83	0.70	112.06	1.93	216.77	2.00
134	102.81	2.36	4.30	0.71	103.60	2.14	222.04	2.00
135	120.08	2.32	4.37	0.70	120.68	2.02	243.85	2.00
136	141.40	2.27	4.19	0.69	141.65	1.84	260.93	2.00
137	122.02	2.37	5.12	0.72	121.91	2.21	269.38	2.00
138	120.07	2.36	4.85	0.72	119.47	2.16	257.72	2.00
139	121.51	2.35	4.80	0.71	120.48	2.14	257.44	2.00
140	163.16	2.26	4.57	0.69	161.41	1.84	296.71	2.00
141	210.18	2.20	4.53	0.67	207.42	1.67	346.65	2.00
142	197.69	2.27	5.23	0.69	194.56	1.86	361.18	2.00
143	224.77	2.21	4.74	0.67	220.47	1.68	370.26	2.00
144	229.49	2.22	5.00	0.67	224.44	1.72	386.38	2.00
145	231.27	2.25	5.39	0.68	225.52	1.80	404.81	2.00

:: Cyclic Resistance Ratio calculation $CRR_{7.5}$ (continued) ::

Point ID	q_c (tsf)	I_c	F (%)	n	q_{c1n}	K_c	q_{c1cs}	$CRR_{7.5}$
146	211.24	2.30	5.92	0.70	205.30	1.96	402.82	2.00
147	213.10	2.28	5.55	0.69	206.38	1.88	388.61	2.00
148	183.97	2.31	5.54	0.70	177.43	1.99	352.90	2.00
149	166.57	2.30	5.06	0.70	159.96	1.96	313.26	2.00
150	146.24	2.38	5.73	0.72	139.84	2.24	312.59	2.00
151	165.79	2.33	5.36	0.71	158.16	2.04	322.45	2.00
152	179.20	2.30	5.25	0.70	170.51	1.95	333.31	2.00
153	173.93	2.33	5.56	0.71	164.91	2.05	338.22	2.00
154	186.64	2.26	4.83	0.69	176.51	1.84	323.97	2.00
155	225.35	2.19	4.42	0.66	212.80	1.64	348.36	2.00
156	227.93	2.18	4.40	0.66	214.59	1.63	349.30	2.00
157	190.66	2.30	5.38	0.70	178.59	1.95	347.76	2.00
158	196.10	2.28	5.18	0.69	183.17	1.89	345.66	2.00
159	161.10	2.38	5.99	0.72	149.61	2.23	334.14	2.00
160	182.39	2.30	5.24	0.70	169.16	1.96	331.01	2.00
161	199.28	2.27	5.13	0.69	184.44	1.87	344.86	2.00
162	192.22	2.30	5.37	0.70	177.24	1.95	345.90	2.00
163	180.00	2.29	4.98	0.69	165.39	1.92	316.74	2.00
164	162.07	2.34	5.36	0.71	148.18	2.09	309.99	2.00
165	196.82	2.26	4.81	0.69	179.97	1.82	327.20	2.00
166	200.08	2.27	5.04	0.69	182.37	1.86	339.00	2.00
167	180.61	2.33	5.53	0.71	163.80	2.05	335.44	2.00
168	264.83	2.12	3.95	0.64	241.20	1.49	358.72	2.00
169	281.85	2.10	3.90	0.64	256.18	1.45	372.22	2.00
170	196.01	2.30	5.39	0.70	176.37	1.96	345.49	2.00
171	147.90	2.44	6.45	0.74	131.87	2.47	325.81	2.00
172	163.04	2.37	5.76	0.72	145.30	2.21	320.63	2.00
173	148.60	2.39	5.70	0.73	131.82	2.28	300.97	2.00
174	89.40	2.60	6.92	0.79	77.99	3.30	257.17	2.00
175	80.40	2.56	5.75	0.78	69.82	3.10	216.53	2.00
176	100.60	2.45	4.94	0.74	87.77	2.52	221.04	2.00
177	141.14	2.36	4.95	0.72	123.72	2.15	266.29	2.00
178	182.07	2.30	5.00	0.70	159.88	1.95	311.22	2.00
179	212.69	2.25	4.78	0.68	186.84	1.79	333.68	2.00
180	238.20	2.19	4.38	0.66	209.27	1.64	342.40	2.00
181	256.02	2.18	4.49	0.66	224.48	1.62	364.23	2.00
182	255.81	2.18	4.50	0.66	223.67	1.63	363.68	2.00
183	242.09	2.19	4.41	0.66	210.97	1.64	345.57	2.00
184	289.77	2.02	3.18	0.62	253.83	1.33	338.58	2.00
185	336.07	1.94	2.80	0.59	294.89	1.23	363.88	2.00
186	360.74	1.94	2.88	0.59	315.97	1.23	388.33	2.00
187	343.36	1.99	3.19	0.61	299.28	1.29	385.31	2.00
188	372.82	1.91	2.72	0.58	325.48	1.20	390.47	2.00
189	422.57	1.77	2.04	0.54	370.62	1.09	403.40	2.00
190	416.54	1.79	2.12	0.55	364.20	1.10	401.23	2.00
191	366.90	1.90	2.62	0.58	318.20	1.19	379.11	2.00
192	362.27	1.89	2.51	0.58	313.65	1.18	370.08	2.00

q_c : Measured cone resistance
I_c : Soil behavior type index
F : Normalized friction ratio
n : Stress exponent
q_{c1N} : Normalized cone resistance
K_c : Cone resistance correction factor due to fines
$q_{c1N,cs}$: Normalized and adjusted cone resistance
$CRR_{7.5}$: Cyclic resistance ratio for M_w=7.5

:: Settlements calculation for saturated sands ::

Point ID	q_c (tsf)	$q_{c1N,cs}$	FS_L	e_v (%)	Settle. (in)
1	8.70	88.58	5.00	0.00	0.00
2	9.50	75.47	5.00	0.00	0.00
3	6.81	49.08	5.00	0.00	0.00
4	6.78	43.53	5.00	0.00	0.00
5	8.92	49.85	5.00	0.00	0.00
6	14.87	66.79	5.00	0.00	0.00
7	20.07	77.17	5.00	0.00	0.00
8	18.92	68.09	5.00	0.00	0.00
9	14.42	84.48	5.00	0.00	0.00
10	12.71	78.37	5.00	0.00	0.00
11	11.98	40.97	5.00	0.00	0.00
12	12.24	68.91	5.00	0.00	0.00
13	13.08	76.51	5.00	0.00	0.00
14	11.47	66.71	5.00	0.00	0.00
15	11.24	76.93	5.00	0.00	0.00
16	14.87	112.81	5.00	0.00	0.00
17	21.75	147.76	5.00	0.00	0.00
18	23.48	175.44	5.00	0.00	0.00
19	26.19	187.49	5.00	0.00	0.00
20	28.01	187.37	5.00	0.00	0.00
21	32.64	185.79	5.00	0.00	0.00
22	32.78	195.68	5.00	0.00	0.00
23	31.42	202.52	5.00	0.00	0.00
24	30.77	213.75	5.00	0.00	0.00
25	34.78	216.64	5.00	0.00	0.00
26	37.35	226.86	5.00	0.00	0.00
27	42.13	225.83	5.00	0.00	0.00
28	44.62	224.79	5.00	0.00	0.00
29	43.71	196.51	5.00	0.00	0.00
30	44.82	198.20	5.00	0.00	0.00
31	45.42	209.73	5.00	0.00	0.00
32	51.94	213.51	5.00	0.00	0.00
33	49.26	213.68	5.00	0.00	0.00
34	50.23	206.29	5.00	0.00	0.00
35	57.30	207.96	5.00	0.00	0.00
36	59.69	201.12	5.00	0.00	0.00
37	56.17	194.21	5.00	0.00	0.00
38	63.92	193.09	5.00	0.00	0.00
39	68.84	195.03	5.00	0.00	0.00
40	65.79	193.69	5.00	0.00	0.00
41	56.20	177.56	5.00	0.00	0.00
42	37.68	163.66	5.00	0.00	0.00
43	34.07	150.12	5.00	0.00	0.00
44	36.28	157.52	5.00	0.00	0.00
45	42.17	170.29	5.00	0.00	0.00
46	45.69	184.92	5.00	0.00	0.00
47	48.19	196.19	5.00	0.00	0.00
48	52.13	188.03	5.00	0.00	0.00
49	59.90	208.27	5.00	0.00	0.00
50	61.41	206.19	5.00	0.00	0.00
51	70.87	203.77	5.00	0.00	0.00
52	67.20	192.94	5.00	0.00	0.00
53	65.54	178.34	5.00	0.00	0.00
54	69.82	163.39	5.00	0.00	0.00
55	64.48	149.54	5.00	0.00	0.00

:: Settlements calculation for saturated sands (continued) ::

Point ID	q_c (tsf)	$q_{c1N,cs}$	FS_L	e_v (%)	Settle. (in)
56	63.09	138.28	5.00	0.00	0.00
57	63.27	129.27	5.00	0.00	0.00
58	59.26	126.22	5.00	0.00	0.00
59	59.00	116.10	5.00	0.00	0.00
60	64.44	107.75	5.00	0.00	0.00
61	73.04	106.48	0.91	1.43	0.03
62	77.03	108.37	0.93	1.39	0.03
63	81.78	111.82	0.98	0.80	0.02
64	84.62	114.06	1.01	0.78	0.02
65	88.65	115.79	1.03	0.77	0.02
66	88.76	114.73	1.00	0.78	0.02
67	88.89	115.37	1.00	0.77	0.02
68	91.84	118.08	1.04	0.76	0.01
69	95.90	116.32	1.01	0.77	0.02
70	97.24	117.57	1.02	0.76	0.01
71	92.79	112.23	0.92	1.32	0.03
72	92.26	111.17	0.90	1.34	0.03
73	92.36	117.50	0.99	0.76	0.01
74	95.86	126.05	1.13	0.47	0.01
75	97.02	131.64	1.23	0.33	0.01
76	106.25	138.28	1.37	0.00	0.00
77	117.97	144.80	1.52	0.00	0.00
78	119.30	148.34	1.60	0.00	0.00
79	127.94	160.66	5.00	0.00	0.00
80	148.19	176.30	5.00	0.00	0.00
81	154.68	179.90	5.00	0.00	0.00
82	157.20	182.22	5.00	0.00	0.00
83	150.28	173.28	5.00	0.00	0.00
84	142.54	168.87	5.00	0.00	0.00
85	143.04	170.69	5.00	0.00	0.00
86	153.06	178.36	5.00	0.00	0.00
87	168.82	193.14	5.00	0.00	0.00
88	180.60	206.33	5.00	0.00	0.00
89	167.01	196.50	5.00	0.00	0.00
90	156.11	187.79	5.00	0.00	0.00
91	153.15	184.80	5.00	0.00	0.00
92	152.87	183.15	5.00	0.00	0.00
93	147.16	176.20	5.00	0.00	0.00
94	134.99	164.58	5.00	0.00	0.00
95	119.63	151.61	1.49	0.00	0.00
96	108.82	139.49	1.21	0.32	0.01
97	113.85	139.18	1.20	0.32	0.01
98	120.34	143.87	1.29	0.22	0.00
99	116.52	149.41	1.40	0.00	0.00
100	98.49	151.93	1.44	0.00	0.00
101	63.83	124.12	0.89	1.14	0.02
102	34.73	74.47	0.40	2.98	0.06
103	25.66	72.28	0.38	3.05	0.06
104	43.53	89.10	0.49	2.57	0.05
105	61.25	118.89	0.80	1.58	0.03
106	71.01	142.90	1.19	0.32	0.01
107	38.02	118.96	0.78	1.58	0.03
108	23.30	75.18	0.39	2.95	0.06
109	20.94	70.59	0.36	3.11	0.06
110	20.43	65.60	0.34	3.30	0.06

:: Settlements calculation for saturated sands (continued) ::

Point ID	q_c (tsf)	$q_{c1N,cs}$	FS_L	e_v (%)	Settle. (in)
111	19.90	63.04	0.33	3.41	0.07
112	21.76	69.43	5.00	0.00	0.00
113	28.94	89.19	0.47	2.57	0.05
114	30.00	95.73	0.51	2.42	0.05
115	33.50	102.06	0.57	2.30	0.05
116	35.71	118.44	0.74	1.93	0.04
117	39.03	126.24	0.85	1.45	0.03
118	44.42	108.30	0.63	2.19	0.04
119	44.80	123.06	0.80	1.50	0.03
120	51.51	142.31	5.00	0.00	0.00
121	104.32	208.72	5.00	0.00	0.00
122	74.54	224.49	5.00	0.00	0.00
123	88.68	199.72	5.00	0.00	0.00
124	89.33	198.97	5.00	0.00	0.00
125	85.18	186.23	5.00	0.00	0.00
126	74.90	193.54	5.00	0.00	0.00
127	86.25	199.44	5.00	0.00	0.00
128	98.66	207.34	5.00	0.00	0.00
129	102.53	229.35	5.00	0.00	0.00
130	101.25	245.96	5.00	0.00	0.00
131	110.55	236.34	5.00	0.00	0.00
132	79.88	241.07	5.00	0.00	0.00
133	110.88	216.77	5.00	0.00	0.00
134	102.81	222.04	5.00	0.00	0.00
135	120.08	243.85	5.00	0.00	0.00
136	141.40	260.93	5.00	0.00	0.00
137	122.02	269.38	5.00	0.00	0.00
138	120.07	257.72	5.00	0.00	0.00
139	121.51	257.44	5.00	0.00	0.00
140	163.16	296.71	5.00	0.00	0.00
141	210.18	346.65	5.00	0.00	0.00
142	197.69	361.18	5.00	0.00	0.00
143	224.77	370.26	5.00	0.00	0.00
144	229.49	386.38	5.00	0.00	0.00
145	231.27	404.81	5.00	0.00	0.00
146	211.24	402.82	5.00	0.00	0.00
147	213.10	388.61	5.00	0.00	0.00
148	183.97	352.90	5.00	0.00	0.00
149	166.57	313.26	5.00	0.00	0.00
150	146.24	312.59	5.00	0.00	0.00
151	165.79	322.45	5.00	0.00	0.00
152	179.20	333.31	5.00	0.00	0.00
153	173.93	338.22	5.00	0.00	0.00
154	186.64	323.97	5.00	0.00	0.00
155	225.35	348.36	5.00	0.00	0.00
156	227.93	349.30	5.00	0.00	0.00
157	190.66	347.76	5.00	0.00	0.00
158	196.10	345.66	5.00	0.00	0.00
159	161.10	334.14	5.00	0.00	0.00
160	182.39	331.01	5.00	0.00	0.00
161	199.28	344.86	5.00	0.00	0.00
162	192.22	345.90	5.00	0.00	0.00
163	180.00	316.74	5.00	0.00	0.00
164	162.07	309.99	5.00	0.00	0.00
165	196.82	327.20	5.00	0.00	0.00

:: Settlements calculation for saturated sands (continued) ::

Point ID	q_c (tsf)	$q_{c1N,cs}$	FS_L	e_v (%)	Settle. (in)
166	200.08	339.00	5.00	0.00	0.00
167	180.61	335.44	5.00	0.00	0.00
168	264.83	358.72	5.00	0.00	0.00
169	281.85	372.22	5.00	0.00	0.00
170	196.01	345.49	5.00	0.00	0.00
171	147.90	325.81	5.00	0.00	0.00
172	163.04	320.63	5.00	0.00	0.00
173	148.60	300.97	5.00	0.00	0.00
174	89.40	257.17	5.00	0.00	0.00
175	80.40	216.53	5.00	0.00	0.00
176	100.60	221.04	5.00	0.00	0.00
177	141.14	266.29	5.00	0.00	0.00
178	182.07	311.22	5.00	0.00	0.00
179	212.69	333.68	5.00	0.00	0.00
180	238.20	342.40	5.00	0.00	0.00
181	256.02	364.23	5.00	0.00	0.00
182	255.81	363.68	5.00	0.00	0.00
183	242.09	345.57	5.00	0.00	0.00
184	289.77	338.58	5.00	0.00	0.00
185	336.07	363.88	5.00	0.00	0.00
186	360.74	388.33	5.00	0.00	0.00
187	343.36	385.31	5.00	0.00	0.00
188	372.82	390.47	5.00	0.00	0.00
189	422.57	403.40	5.00	0.00	0.00
190	416.54	401.23	5.00	0.00	0.00
191	366.90	379.11	5.00	0.00	0.00
192	362.27	370.08	5.00	0.00	0.00

Total settlement : 1.07

q_c :	Measured cone resistance
$q_{c1N,cs}$	Normalized and adjusted cone resistance
FS_L :	Factor of safety against liquefaction
e_v :	Post-liquefaction volumentric strain
Settle. :	Calculated settlement

:: Overall liquefaction potential according to Iwasaki ::

Point ID	F	w_z	I_L	Point ID	F	w_z	I_L
1	0.00	9.97	0.00	2	0.00	9.95	0.00
3	0.00	9.92	0.00	4	0.00	9.90	0.00
5	0.00	9.87	0.00	6	0.00	9.85	0.00
7	0.00	9.82	0.00	8	0.00	9.80	0.00
9	0.00	9.77	0.00	10	0.00	9.75	0.00
11	0.00	9.72	0.00	12	0.00	9.70	0.00
13	0.00	9.67	0.00	14	0.00	9.65	0.00
15	0.00	9.62	0.00	16	0.00	9.60	0.00
17	0.00	9.57	0.00	18	0.00	9.55	0.00
19	0.00	9.52	0.00	20	0.00	9.50	0.00
21	0.00	9.47	0.00	22	0.00	9.45	0.00
23	0.00	9.42	0.00	24	0.00	9.40	0.00
25	0.00	9.37	0.00	26	0.00	9.35	0.00
27	0.00	9.32	0.00	28	0.00	9.30	0.00
29	0.00	9.27	0.00	30	0.00	9.25	0.00
31	0.00	9.22	0.00	32	0.00	9.20	0.00
33	0.00	9.17	0.00	34	0.00	9.15	0.00
35	0.00	9.12	0.00	36	0.00	9.10	0.00

:: Overall liquefaction potential according to Iwasaki (continued) ::

Point ID	F	w_z	I_L	Point ID	F	w_z	I_L
37	0.00	9.07	0.00	38	0.00	9.05	0.00
39	0.00	9.02	0.00	40	0.00	9.00	0.00
41	0.00	8.97	0.00	42	0.00	8.95	0.00
43	0.00	8.92	0.00	44	0.00	8.90	0.00
45	0.00	8.87	0.00	46	0.00	8.85	0.00
47	0.00	8.82	0.00	48	0.00	8.80	0.00
49	0.00	8.77	0.00	50	0.00	8.75	0.00
51	0.00	8.72	0.00	52	0.00	8.70	0.00
53	0.00	8.67	0.00	54	0.00	8.65	0.00
55	0.00	8.62	0.00	56	0.00	8.60	0.00
57	0.00	8.57	0.00	58	0.00	8.55	0.00
59	0.00	8.52	0.00	60	0.00	8.50	0.00
61	0.09	8.47	0.04	62	0.07	8.45	0.03
63	0.02	8.42	0.01	64	0.00	8.40	0.00
65	0.00	8.37	0.00	66	0.00	8.35	0.00
67	0.00	8.32	0.00	68	0.00	8.30	0.00
69	0.00	8.27	0.00	70	0.00	8.25	0.00
71	0.08	8.22	0.03	72	0.10	8.20	0.04
73	0.01	8.17	0.01	74	0.00	8.15	0.00
75	0.00	8.12	0.00	76	0.00	8.10	0.00
77	0.00	8.07	0.00	78	0.00	8.05	0.00
79	0.00	8.02	0.00	80	0.00	8.00	0.00
81	0.00	7.97	0.00	82	0.00	7.95	0.00
83	0.00	7.92	0.00	84	0.00	7.90	0.00
85	0.00	7.87	0.00	86	0.00	7.85	0.00
87	0.00	7.82	0.00	88	0.00	7.80	0.00
89	0.00	7.77	0.00	90	0.00	7.75	0.00
91	0.00	7.72	0.00	92	0.00	7.70	0.00
93	0.00	7.67	0.00	94	0.00	7.65	0.00
95	0.00	7.62	0.00	96	0.00	7.60	0.00
97	0.00	7.57	0.00	98	0.00	7.55	0.00
99	0.00	7.52	0.00	100	0.00	7.50	0.00
101	0.11	7.47	0.04	102	0.60	7.45	0.22
103	0.62	7.42	0.23	104	0.51	7.40	0.19
105	0.20	7.37	0.07	106	0.00	7.35	0.00
107	0.22	7.32	0.08	108	0.61	7.30	0.22
109	0.64	7.27	0.23	110	0.66	7.25	0.24
111	0.67	7.22	0.24	112	0.00	7.20	0.00
113	0.53	7.17	0.19	114	0.49	7.15	0.17
115	0.43	7.12	0.15	116	0.26	7.10	0.09
117	0.15	7.07	0.05	118	0.37	7.05	0.13
119	0.20	7.02	0.07	120	0.00	7.00	0.00
121	0.00	6.97	0.00	122	0.00	6.95	0.00
123	0.00	6.92	0.00	124	0.00	6.90	0.00
125	0.00	6.87	0.00	126	0.00	6.85	0.00
127	0.00	6.82	0.00	128	0.00	6.80	0.00
129	0.00	6.77	0.00	130	0.00	6.75	0.00
131	0.00	6.72	0.00	132	0.00	6.70	0.00
133	0.00	6.67	0.00	134	0.00	6.65	0.00
135	0.00	6.62	0.00	136	0.00	6.60	0.00
137	0.00	6.57	0.00	138	0.00	6.55	0.00
139	0.00	6.52	0.00	140	0.00	6.50	0.00
141	0.00	6.47	0.00	142	0.00	6.45	0.00
143	0.00	6.42	0.00	144	0.00	6.40	0.00
145	0.00	6.37	0.00	146	0.00	6.35	0.00
147	0.00	6.32	0.00	148	0.00	6.30	0.00

:: Overall liquefaction potential according to Iwasaki (continued) ::

Point ID	F	w_z	I_L	Point ID	F	w_z	I_L
149	0.00	6.27	0.00	150	0.00	6.25	0.00
151	0.00	6.22	0.00	152	0.00	6.20	0.00
153	0.00	6.17	0.00	154	0.00	6.15	0.00
155	0.00	6.12	0.00	156	0.00	6.10	0.00
157	0.00	6.07	0.00	158	0.00	6.05	0.00
159	0.00	6.02	0.00	160	0.00	6.00	0.00
161	0.00	5.97	0.00	162	0.00	5.95	0.00
163	0.00	5.92	0.00	164	0.00	5.90	0.00
165	0.00	5.87	0.00	166	0.00	5.85	0.00
167	0.00	5.82	0.00	168	0.00	5.80	0.00
169	0.00	5.77	0.00	170	0.00	5.75	0.00
171	0.00	5.72	0.00	172	0.00	5.70	0.00
173	0.00	5.67	0.00	174	0.00	5.65	0.00
175	0.00	5.62	0.00	176	0.00	5.60	0.00
177	0.00	5.57	0.00	178	0.00	5.55	0.00
179	0.00	5.52	0.00	180	0.00	5.50	0.00
181	0.00	5.47	0.00	182	0.00	5.45	0.00
183	0.00	5.42	0.00	184	0.00	5.40	0.00
185	0.00	5.37	0.00	186	0.00	5.35	0.00
187	0.00	5.32	0.00	188	0.00	5.30	0.00
189	0.00	5.27	0.00	190	0.00	5.25	0.00
191	0.00	5.22	0.00	192	0.00	5.20	0.00

Overall potential I_L : 2.80

I_L = 0.00 - No liquefaction
I_L between 0.00 and 5.00 - Liquefaction not probable
I_L between 5.00 and 15.00 - Liquefaction probable
I_L > 15.00 - Liquefaction certain

NCEER (2001)

Borehole No	GB-1		Amax	0.28	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.8		Settlement FS <=	1.0	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement	User Input		
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth: -80.0

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation (ft)	SPT Depth (ft)	CPT Corrected Depth (ft)	Thickness (ft)	Design Depth (ft)	Design Depth (m)	Soil Parameters γ (pcf)	Soil Type	FC (%)	Soil Stress σv0 (psf)	u (psf)	σv0' (psf)	Demand σv0'design (psf)	rd	Bore Hole Diameter (in)	Diameter (mm)	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS	N60
-5.5	5.5	5.5	6.3	6	1.7	125	SM	17	688	0	688	688	0.99	6.0	152	MC	23	15	1.33	1.06	0.75	1.00	16
-7.0	7.0	7.0	2.5	7	2.1	125	SM	17	875	0	875	875	0.99	6.0	152	SPT	8	8	1.33	1.06	0.75	1.00	8
-10.5	10.5	10.5	2.5	11	3.2	125	SM	27	1,313	0	1,313	1,094	0.98	6.0	152	MC	13	9	1.33	1.06	0.80	1.00	10
-12.0	12.0	12.0	2.5	12	3.7	125	SM	27	1,500	0	1,500	1,188	0.97	6.0	152	SPT	6	6	1.33	1.06	0.80	1.00	7
-15.5	15.5	15.5	4.3	16	4.7	125	SP-SM	10	1,938	0	1,938	1,407	0.97	6.0	152	SPT	11	11	1.33	1.06	0.85	1.00	13
-20.5	20.5	20.5	5.0	21	6.2	125	SP-SM	9	2,563	0	2,563	1,720	0.96	6.0	152	SPT	16	16	1.33	1.06	0.95	1.00	22
-25.5	25.5	25.5	5.0	26	7.8	125	SM	16	3,188	0	3,188	2,033	0.94	6.0	152	SPT	13	13	1.33	1.06	0.95	1.00	17
-30.5	30.5	30.5	2.5	31	9.3	120	SSt	23	3,788	31	3,756	2,321	0.92	6.0	152	SPT	6	6	1.33	1.06	0.95	1.00	8

Elevation (ft)	Cyclic Resistance CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ' (degree)	σm' (psf)	Gmax (ksf)	γeff x (Geff/Gmax)	γeff (%)			γvol (%)	Saturated Sand CSRM7.5	γvol (%)	Settlement γvol (%)	Layer (in)	Cumulative (in)
-5.5	1.7	28	3.01	1.06	33	too dense	1.00	too dense	0.18	N.A.	32	445	1,276	9.7E-05	0.02	-3.86	-3.80	0.01	0.14	-	0.01	0.00	2.83
-7.0	1.6	13	3.01	1.06	17	0.18	1.00	0.23	0.18	N.A.	32	566	1,124	1.4E-04	0.03	-3.81	-3.22	0.03	0.14	-	0.03	0.01	2.82
-10.5	1.3	13	4.48	1.13	19	0.20	1.00	0.26	0.21	1.20	32	708	1,235	1.9E-04	-	-	-	-	0.17	-	-	0.00	2.81
-12.0	1.2	8	4.48	1.13	14	0.15	1.00	0.19	0.22	0.84	32	768	1,111	2.4E-04	-	-	-	-	0.17	1.88	1.88	0.56	2.81
-15.5	1.0	14	0.87	1.02	15	0.16	1.00	0.21	0.24	0.85	32	910	1,447	2.4E-04	-	-	-	-	0.19	1.50	1.50	0.77	2.25
-20.5	0.9	20	0.56	1.02	20	0.22	0.95	0.27	0.26	1.04	32	1,112	1,795	2.5E-04	-	-	-	-	0.20	-	-	0.00	1.48
-25.5	0.8	14	2.77	1.05	18	0.19	0.90	0.22	0.27	0.82	32	1,315	1,757	3.1E-04	-	-	-	-	0.21	1.25	1.25	0.75	1.48
-30.5	0.8	6	4.06	1.10	11	0.12	0.87	0.13	0.27	0.49	32	1,501	1,412	4.5E-04	-	-	-	-	0.21	2.44	2.44	0.73	0.73

NCEER (2001)

Borehole No	GB-2		Amax	0.30	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.80		Settlement FS <=	1.2	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement	User Input		
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth: -80.0

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation (ft)	SPT Depth (ft)	CPT Corrected Depth (ft)	Thickness (ft)	Design Depth (ft)	Design Depth (m)	Soil Parameters γ (pcf)	Soil Type	FC (%)	Soil Stress σv0 (psf)	u (psf)	σv0' (psf)	Demand σv0'design (psf)	rd	Bore Hole Diameter (in)	Diameter (mm)	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS	N60
-2.5	2.5	2.5	3.3	3	0.8	125	SM	15	313	0	313	313	1.00	6.0	152	MC	22	15	1.33	1.06	0.75	1.00	16
-4.0	4.0	4.0	1.5	4	1.2	125	SM	15	500	0	500	500	0.99	6.0	152	SPT	13	13	1.33	1.06	0.75	1.00	14
-5.5	5.5	5.5	1.5	6	1.7	125	SM	18	688	0	688	688	0.99	6.0	152	MC	29	19	1.33	1.06	0.75	1.00	21
-7.0	7.0	7.0	2.5	7	2.1	125	SC	18	875	0	875	875	0.99	6.0	152	SPT	13	13	1.33	1.06	0.75	1.00	14
-10.5	10.5	10.5	2.5	11	3.2	125	SM	15	1,313	0	1,313	1,094	0.98	6.0	152	MC	17	11	1.33	1.06	0.80	1.00	13
-12.0	12.0	12.0	2.5	12	3.7	125	SM	15	1,500	0	1,500	1,188	0.97	6.0	152	SPT	13	13	1.33	1.06	0.80	1.00	15
-15.5	15.5	15.5	2.5	16	4.7	125	SP-SM	7	1,938	0	1,938	1,407	0.97	6.0	152	MC	19	13	1.33	1.06	0.85	1.00	15
-17.0	17.0	17.0	2.5	17	5.2	120	SM	7	2,118	0	2,118	1,494	0.96	6.0	152	SPT	8	8	1.33	1.06	0.85	1.00	10
-20.5	20.5	20.5	4.3	21	6.2	120	SM	15	2,538	0	2,538	1,695	0.96	6.0	152	SPT	13	13	1.33	1.06	0.95	1.00	17
-25.5	25.5	25.5	5.0	26	7.8	120	SM	37	3,138	0	3,138	1,983	0.94	6.0	152	SPT	5	5	1.33	1.06	0.95	1.00	7
-30.5	30.5	30.5	5.0	31	9.3	120	SM	19	3,738	31	3,706	2,271	0.92	6.0	152	SPT	21	21	1.33	1.06	0.95	1.00	28
-35.5	35.5	35.5	5.0	36	10.8	120	SC	32	4,338	343	3,994	2,559	0.89	6.0	152	SPT	2	2	1.33	1.06	1.00	1.00	3
-40.5	40.5	40.5	5.0	41	12.3	120	SC	35	4,938	655	4,282	2,847	0.85	6.0	152	SPT	1	1	1.33	1.06	1.00	1.00	1
-45.5	45.5	45.5	5.0	46	13.9	120	SSt	30	5,538	967	4,570	3,135	0.80	6.0	152	SPT	34	34	1.33	1.06	1.00	1.00	48
-50.5	50.5	50.5	2.5	51	15.4	120	SSt	30	6,138	1,279	4,858	3,423	0.75	6.0	152	SPT	32	32	1.33	1.06	1.00	1.00	45

Elevation (ft)	Cyclic Resistance CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ' (degree)	σm' (psf)	Gmax (ksf)	γeff x (Geff/Gmax)	γeff (%)			γvol (%)	Saturated Sand CSRM7.5	γvol (%)	Settlement γvol (%)	Layer (in)	Cumulative (in)
-2.5	1.7	27	2.50	1.05	30	too dense	1.00	too dense	0.19	N.A.	32	202	848	7.2E-05	0.01	-3.96	-3.85	0.01	0.15	-	0.01	0.00	7.04
-4.0	1.7	23	2.50	1.05	27	0.34	1.00	0.44	0.19	N.A.	32	323	1,029	9.4E-05	0.02	-3.82	-3.76	0.01	0.15	-	0.01	0.00	7.04
-5.5	1.7	35	3.23	1.07	41	too dense	1.00	too dense	0.19	N.A.	32	445	1,379	9.6E-05	0.02	-3.86	-3.80	0.00	0.15	-	0.00	0.00	7.04
-7.0	1.6	21	3.23	1.07	26	0.32	1.00	0.41	0.19	N.A.	32	566	1,321	1.3E-04	0.02	-3.81	-3.22	0.02	0.15	-	0.02	0.00	7.04
-10.5	1.3	16	2.50	1.05	20	0.21	1.00	0.27	0.23	1.18	32	708	1,350	1.9E-04	-	-	-	-	0.18	0.17	0.17	0.05	7.03
-12.0	1.2	17	2.50	1.05	21	0.23	1.00	0.29	0.24	1.21	32	768	1,438	2.0E-04	-	-	-	-	0.19	-	-	0.00	6.98
-15.5	1.0	16	0.12	1.01	16	0.17	1.00	0.22	0.26	0.85	32	910	1,519	2.4E-04	-	-	-	-	0.20	1.34	1.34	0.40	6.98
-17.0	1.0	10	0.12	1.01	10	0.11	1.00	0.14	0.27	0.54	32	966	1,321	3.0E-04	-	-	-	-	0.21	2.60	2.60	0.78	6.58
-20.5	0.9	16	2.50	1.05	19	0.21	0.96	0.25	0.28	0.90	32	1,096	1,666	2.8E-04	-	-	-	-	0.22	1.02	1.02	0.52	5.80
-25.5	0.8	6	5.00	1.20	12	0.13	0.91	0.15	0.29	0.51	32	1,283	1,265	4.6E-04	-	-	-	-	0.23	2.34	2.34	1.40	5.28
-30.5	0.8	21	3.43	1.07	26	0.32	0.87	0.36	0.30	1.21	32	1,469	2,124	3.2E-04	-	-	-	-	0.23	-	-	0.00	3.88
-35.5	0.7	2	4.83	1.17	7	0.09	0.85	0.10	0.29	0.33	32	1,655	1,035	7.3E-04	-	-	-	-	0.23	3.08	3.08	1.85	3.88
-40.5	0.7	1	5.00	1.20	6	0.08	0.84	0.09	0.29	0.30	32	1,841	857	9.5E-04	-	-	-	-	0.22	3.38	3.38	2.03	2.03
-45.5	0.7	33	4.71	1.15	43	too dense	0.82	too dense	0.28	N.A.	32	2,028	2,878	3.0E-04	-	-	-	-	0.21	-	-	0.00	0.00
-50.5	0.7	30	4.71	1.15	39	too dense	0.81	too dense	0.26	N.A.	32	2,214	2,918	3.1E-04	-	-	-	-	0.20	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-3		Amax	0.28	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.80		Settlement FS <=	1.2	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement	User Input		
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth: -80.0

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation (ft)	SPT Depth (ft)	CPT Corrected Depth (ft)	Thickness (ft)	Design Depth (ft)	Design Depth (m)	Soil Parameters γ (pcf)	Soil Type	FC (%)	Soil Stress σv0 (psf)	u (psf)	σv0' (psf)	Demand σv0'design (psf)	rd	Bore Hole Diameter (in)	Diameter (mm)	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS	N60
-1.5	1.5	1.5	3.5	1.5	0.5	125	ML	60	188	0	188	188	1.00	6.0	152	MC	13	9	1.33	1.06	0.75	1.00	9
-5.5	5.5	5.5	2.8	5.5	1.7	125	SM	20	688	0	688	688	0.99	6.0	152	MC	41	27	1.33	1.06	0.75	1.00	29
-7.0	7.0	7.0	2.5	7.0	2.1	125	SM	20	875	0	875	875	0.99	6.0	152	SPT	25	25	1.33	1.06	0.75	1.00	27
-10.5	10.5	10.5	2.5	10.5	3.2	125	SC	13	1,313	0	1,313	1,094	0.98	6.0	152	MC	19	13	1.33	1.06	0.80	1.00	14
-12.0	12.0	12.0	2.5	12.0	3.7	125	SC	13	1,500	0	1,500	1,188	0.97	6.0	152	SPT	13	13	1.33	1.06	0.80	1.00	15
-15.5	15.5	15.5	2.5	15.5	4.7	125	SP-SM	10	1,938	0	1,938	1,407	0.97	6.0	152	MC	21	14	1.33	1.06	0.85	1.00	17
-17.0	17.0	17.0	2.5	17.0	5.2	125	SM	14	2,125	0	2,125	1,501	0.96	6.0	152	SPT	10	10	1.33	1.06	0.85	1.00	12
-20.5	20.5	20.5	2.5	20.5	6.2	125	SM	15	2,563	0	2,563	1,720	0.96	6.0	152	MC	15	10	1.33	1.06	0.95	1.00	14
-22.0	22.0	22.0	2.5	22.0	6.7	125	SM	15	2,750	0	2,750	1,814	0.95	6.0	152	SPT	4	4	1.33	1.06	0.95	1.00	5
-25.5	25.5	25.5	4.3	25.5	7.8	125	SM	23	3,188	0	3,188	2,033	0.94	6.0	152	SPT	11	11	1.33	1.06	0.95	1.00	15
-30.5	30.5	30.5	5.0	30.5	9.3	125	SSt	20	3,813	31	3,781	2,346	0.92	6.0	152	SPT	14	14	1.33	1.06	0.95	1.00	19
-35.5	35.5	35.5	2.5	35.5	10.8	125	SSt	20	4,438	343	4,094	2,316	0.89	6.0	152	SPT	45	45	1.33	1.06	1.00	1.00	64

Elevation (ft)	Cyclic Resistance CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ' (degree)	σm' (psf)	Gmax (ksf)	γeff x (Geff/Gmax)	γeff (%)			γvol (%)	Saturated Sand CSRM7.5	γvol (%)	Settlement γvol (%)	Layer (in)	Cumulative (in)
-1.5	1.7	16	5.00	1.20	24	0.27	1.00	0.35	0.18	N.A.	36	114	535	6.4E-05	-	-4.05	-3.96	-	0.14	-	-	0.00	3.51
-5.5	1.7	50	3.61	1.08	57	too dense	1.00	too dense	0.18	N.A.	32	445	1,547	8.0E-05	0.01	-4.00	-3.93	0.00	0.14	-	0.00	0.00	3.51
-7.0	1.6	41	3.61	1.08	48	too dense	1.00	too dense	0.18	N.A.	32	566	1,642	9.6E-05	0.01	-3.86	-3.81	0.00	0.14	-	0.00	0.00	3.51
-10.5	1.3	18	1.89	1.04	21	0.23	1.00	0.29	0.21	1.36	32	708	1,401	1.7E-04	-	-	-	-	0.17	-	-	0.00	3.51
-12.0	1.2	17	1.89	1.04	20	0.22	1.00	0.28	0.22	1.24	32	768	1,438	1.9E-04	-	-	-	-	0.17	-	-	0.00	3.51
-15.5	1.0	18	0.87	1.02	19	0.20	1.00	0.26	0.24	1.07	32	910	1,571	2.2E-04	-	-	-	-	0.19	0.70	0.70	0.21	3.51
-17.0	1.0	12	2.20	1.04	15	0.16	1.00	0.20	0.25	0.81	32	971	1,426	2.6E-04	-	-	-	-	0.19	1.82	1.82	0.55	3.30
-20.5	0.9	12	2.50	1.05	15	0.16	0.95	0.20	0.26	0.77	32	1,112	1,538	2.9E-04	-	-	-	-	0.20	1.62	1.62	0.49	2.75
-22.0	0.9	5	2.50	1.05	7	0.09	0.94	0.11	0.26	0.42	32	1,173	1,149	4.1E-04	-	-	-	-	0.20	3.08	3.08	0.92	2.27
-25.5	0.8	12	4.06	1.10	17	0.18	0.90	0.21	0.27	0.90	32	1,315	1,662	3.3E-04	-	-	-	-	0.21	1.25	1.25	0.64	1.34
-30.5	0.7	14	3.61	1.08	19	0.20	0.86	0.22	0.27	0.82	32	1,517	1,880	3.4E-04	-	-	-	-	0.21	1.17	1.17	0.70	0.70
-35.5	0.7	46	3.61	1.08	53	too dense	0.85	too dense	0.33	N.A.	32	1,498	2,766	2.8E-04	-	-	-	-	0.26	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-4		Amax	0.28	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.8		Settlement FS <=	1.2	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement	User Input		
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth: -80.0

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation (ft)	SPT Depth (ft)	CPT Corrected Depth (ft)	Thickness (ft)	Design Depth (ft)	Design Depth (m)	Soil Parameters γ (pcf)	Soil Type	FC (%)	Soil Stress σv0 (psf)	u (psf)	σv0' (psf)	Demand σv0'design (psf)	rd	Bore Hole Diameter (in)	Diameter (mm)	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS	N60
-5.5	5.5	5.5	6.3	6	1.7	125	SC	40	688	0	688	688	0.99	6.0	152	MC	58	39	1.33	1.06	0.75	1.00	41
-7.0	7.0	7.0	2.5	7	2.1	125	SC	43	875	0	875	875	0.99	6.0	152	SPT	16	16	1.33	1.06	0.75	1.00	17
-10.5	10.5	10.5	2.5	11	3.2	125	SC	45	1,313	0	1,313	1,094	0.98	6.0	152	MC	50	34	1.33	1.06	0.80	1.00	38
-12.0	12.0	12.0	2.5	12	3.7	125	SC	45	1,500	0	1,500	1,188	0.97	6.0	152	SPT	36	36	1.33	1.06	0.80	1.00	41
-15.5	15.5	15.5	4.3	16	4.7	125	SC	37	1,938	0	1,938	1,407	0.97	6.0	152	SPT	25	25	1.33	1.06	0.85	1.00	30
-20.5	20.5	20.5	5.0	21	6.2	125	SSt	35	2,563	0	2,563	1,720	0.96	6.0	152	SPT	47	47	1.33	1.06	0.95	1.00	63
-25.5	25.5	25.5	2.5	26	7.8	125	CLSt	60	3,188	0	3,188	2,033	0.94	6.0	152	SPT	39	39	1.33	1.06	0.95	1.00	52

Elevation (ft)	Cyclic Resistance CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ' (degree)	σm' (psf)	Gmax (ksf)	γeff x (Geff/Gmax)	γeff (%)			γvol (%)	Saturated Sand CSRM7.5	γvol (%)	Settlement γvol (%)	Layer (in)	Cumulative (in)
-5.5	1.7	70	5.00	1.20	89	too dense	1.00	too dense	0.18	N.A.	32	445	1,737	7.1E-05	0.01	-4.00	-3.93	0.00	0.14	-	0.00	0.00	0.00
-7.0	1.6	26	5.00	1.20	37	too dense	1.00	too dense	0.18	N.A.	32	566	1,416	1.1E-04	0.02	-3.81	-3.22	0.01	0.14	-	0.01	0.00	0.00
-10.5	1.3	48	5.00	1.20	63	too dense	1.00	too dense	0.21	N.A.	32	708	1,933	1.2E-04	-	-	-	-	0.17	-	-	0.00	0.00
-12.0	1.2	48	5.00	1.20	63	too dense	1.00	too dense	0.22	N.A.	32	768	2,018	1.3E-04	-	-	-	-	0.17	-	-	0.00	0.00
-15.5	1.0	31	5.00	1.20	43	too dense	1.00	too dense	0.24	N.A.	32	910	1,902	1.8E-04	-	-	-	-	0.19	-	-	0.00	0.00
-20.5	0.9	57	5.00	1.20	74	too dense	0.95	too dense	0.26	N.A.	32	1,112	2,571	1.7E-04	-	-	-	-	0.20	-	-	0.00	0.00
-25.5	0.8	43	5.00	1.20	56	too dense	0.90	too dense	0.27	N.A.	32	1,315	2,533	2.2E-04	-	-	-	-	0.21	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-5		Amax	0.28	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.8		Settlement FS <=	1.2	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement		User Input	
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth -80.00

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation	SPT Depth	CPT Corrected Depth	Thickness	Design Depth	Design Depth	Soil Parameters γ	Soil Type	FC	Soil Stress σv0	u	σv0'	Demand σv0'design	rd	Bore Hole Diameter	Diameter	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS
ft	ft	ft	ft	ft	m	pcf		%	psf	psf	psf	psf		in	mm							
-2.0	2.0	2.0	2.8	2	0.6	125	CH	78	250	0	250	250	1.00	8.0	203	MC	10	7	1.33	1.15	0.75	1.00
-3.5	3.5	3.5	1.5	4	1.1	125	CL	70	438	0	438	438	0.99	8.0	203	SPT	7	7	1.33	1.15	0.75	1.00
-5.0	5.0	5.0	1.5	5	1.5	125	ML	65	625	0	625	625	0.99	8.0	203	MC	38	25	1.33	1.15	0.75	1.00
-6.5	6.5	6.5	2.5	7	2.0	125	ML	65	813	0	813	813	0.99	8.0	203	SPT	31	31	1.33	1.15	0.75	1.00
-10.0	10.0	10.0	4.3	10	3.0	125	ML	65	1,250	0	1,250	1,250	0.98	8.0	203	MC	66	44	1.33	1.15	0.80	1.00
-15.0	15.0	15.0	5.0	15	4.6	125	CL	70	1,875	0	1,875	1,563	0.97	8.0	203	MC	41	27	1.33	1.15	0.85	1.00
-20.0	20.0	20.0	2.5	20	6.1	125	SM	15	2,500	0	2,500	1,876	0.96	8.0	203	SPT	54	54	1.33	1.15	0.95	1.00

Elevation	Cyclic Resistance N60	CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ'	σm'	Gmax	γeff x (Geff/Gmax)	γeff			γvol	Saturated Sand CSRM7.5	γvol	Settlement γvol	Layer	Cumulative
ft												degree	psf	ksf	(Geff/Gmax)	%			%		%	%	in	in
-2.0	8	1.7	13	5.00	1.20	21	0.22	1.00	0.29	0.18	N.A.	32	162	599	7.6E-05	-	-3.96	-3.85	-	0.14	-	-	0.00	0.00
-3.5	8	1.7	14	5.00	1.20	21	0.23	1.00	0.30	0.18	N.A.	32	283	805	9.8E-05	0.02	-3.80	-3.74	0.01	0.14	-	0.01	0.00	0.00
-5.0	29	1.7	50	5.00	1.20	65	too dense	1.00	too dense	0.18	N.A.	32	404	1,478	7.6E-05	0.01	-4.00	-3.92	0.00	0.14	-	0.00	0.00	0.00
-6.5	36	1.6	58	5.00	1.20	74	too dense	1.00	too dense	0.18	N.A.	32	525	1,769	8.3E-05	0.01	-3.93	-3.86	0.00	0.14	-	0.00	0.00	0.00
-10.0	54	1.3	71	5.00	1.20	90	too dense	1.00	too dense	0.18	N.A.	32	808	2,348	9.5E-05	-	-	-	-	0.14	-	-	0.00	0.00
-15.0	36	1.1	38	5.00	1.20	51	too dense	1.00	too dense	0.21	N.A.	32	1,011	2,137	1.5E-04	-	-	-	-	0.16	-	-	0.00	0.00
-20.0	79	0.9	73	2.50	1.05	79	too dense	0.96	too dense	0.23	N.A.	32	1,213	2,901	1.5E-04	-	-	-	-	0.18	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-6		Amax	0.28	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.8		Settlement FS <=	1.2	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement		User Input	
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth -80.00

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation	SPT Depth	CPT Corrected Depth	Thickness	Design Depth	Design Depth	Soil Parameters γ	Soil Type	FC	Soil Stress σv0	u	σv0'	Demand σv0'design	rd	Bore Hole Diameter	Diameter	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS
ft	ft	ft	ft	ft	m	pcf		%	psf	psf	psf	psf		in	mm							
-2.0	2.0	2.0	2.8	2	0.6	125	CH	63	250	0	250	250	1.00	8.0	203	MC	13	9	1.33	1.15	0.75	1.00
-3.5	3.5	3.5	1.5	4	1.1	125	CH	63	438	0	438	438	0.99	8.0	203	SPT	7	7	1.33	1.15	0.75	1.00
-5.0	5.0	5.0	1.5	5	1.5	125	CL	60	625	0	625	625	0.99	8.0	203	MC	32	21	1.33	1.15	0.75	1.00
-6.5	6.5	6.5	2.5	7	2.0	125	SM	20	813	0	813	813	0.99	8.0	203	SPT	17	17	1.33	1.15	0.75	1.00
-10.0	10.0	10.0	4.3	10	3.0	125	CL	65	1,250	0	1,250	1,250	0.98	8.0	203	MC	90	60	1.33	1.15	0.80	1.00
-15.0	15.0	15.0	5.0	15	4.6	125	CL	65	1,875	0	1,875	1,563	0.97	8.0	203	SPT	25	25	1.33	1.15	0.85	1.00
-20.0	20.0	20.0	5.0	20	6.1	125	CL	65	2,500	0	2,500	1,876	0.96	8.0	203	MC	40	27	1.33	1.15	0.95	1.00
-25.0	25.0	25.0	2.5	25	7.6	120	CL	65	3,100	0	3,100	2,164	0.94	8.0	203	SPT	21	21	1.33	1.15	0.95	1.00

Elevation	Cyclic Resistance N60	CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ'	σm'	Gmax	γeff x (Geff/Gmax)	γeff			γvol	Saturated Sand CSRM7.5	γvol	Settlement γvol	Layer	Cumulative
ft												degree	psf	ksf	(Geff/Gmax)	%			%		%	%	in	in
-2.0	10	1.7	17	5.00	1.20	25	0.30	1.00	0.39	0.18	N.A.	27	174	679	6.7E-05	-	-4.05	-3.96	-	0.14	-	-	0.00	0.00
-3.5	8	1.7	14	5.00	1.20	21	0.23	1.00	0.30	0.18	N.A.	27	305	835	9.5E-05	0.02	-3.81	-3.75	0.01	0.14	-	0.01	0.00	0.00
-5.0	25	1.7	42	5.00	1.20	55	too dense	1.00	too dense	0.18	N.A.	32	404	1,396	8.1E-05	0.01	-3.92	-3.85	0.00	0.14	-	0.00	0.00	0.00
-6.5	20	1.6	32	3.61	1.08	38	too dense	1.00	too dense	0.18	N.A.	32	525	1,448	1.0E-04	0.02	-3.81	-3.21	0.01	0.14	-	0.01	0.00	0.00
-10.0	74	1.3	96	5.00	1.20	121	too dense	1.00	too dense	0.18	N.A.	32	808	2,604	8.6E-05	-	-	-	-	0.14	-	-	0.00	0.00
-15.0	33	1.1	35	5.00	1.20	47	too dense	1.00	too dense	0.21	N.A.	32	1,011	2,071	1.6E-04	-	-	-	-	0.16	-	-	0.00	0.00
-20.0	39	0.9	36	5.00	1.20	48	too dense	0.96	too dense	0.23	N.A.	32	1,213	2,297	1.9E-04	-	-	-	-	0.18	-	-	0.00	0.00
-25.0	31	0.8	25	5.00	1.20	35	too dense	0.91	too dense	0.25	N.A.		2,164	2,729	1.9E-04	-	-	-	-	0.19	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-7		Amax	0.28	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.8		Settlement FS <=	1.2	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement		User Input	
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth -80.00

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation	SPT Depth	CPT Corrected Depth	Thickness	Design Depth	Design Depth	Soil Parameters γ	Soil Type	FC	Soil Stress σv0	u	σv0'	Demand σv0'design	rd	Bore Hole Diameter	Diameter	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS
ft	ft	ft	ft	ft	m	pcf		%	psf	psf	psf	psf		in	mm							
-2.0	2.0	2.0	2.8	2	0.6	125	CH	70	250	0	250	250	1.00	8.0	203	MC	5	3	1.33	1.15	0.75	1.00
-3.5	3.5	3.5	1.5	4	1.1	125	CH	70	438	0	438	438	0.99	8.0	203	SPT	4	4	1.33	1.15	0.75	1.00
-5.0	5.0	5.0	1.5	5	1.5	125	SC	46	625	0	625	625	0.99	8.0	203	MC	21	14	1.33	1.15	0.75	1.00
-6.5	6.5	6.5	2.5	7	2.0	125	SC	46	813	0	813	813	0.99	8.0	203	SPT	24	24	1.33	1.15	0.75	1.00
-10.0	10.0	10.0	4.3	10	3.0	125	CL	70	1,250	0	1,250	1,250	0.98	8.0	203	MC	64	43	1.33	1.15	0.80	1.00
-15.0	15.0	15.0	5.0	15	4.6	125	CL	70	1,875	0	1,875	1,563	0.97	8.0	203	MC	82	55	1.33	1.15	0.85	1.00
-20.0	20.0	20.0	5.0	20	6.1	125	CL	70	2,500	0	2,500	1,876	0.96	8.0	203	SPT	45	45	1.33	1.15	0.95	1.00
-25.0	25.0	25.0	2.5	25	7.6	120	SM	20	3,100	0	3,100	2,164	0.94	8.0	203	SPT	29	29	1.33	1.15	0.95	1.00

Elevation	Cyclic Resistance N60	CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ'	σm'	Gmax	γeff x (Geff/Gmax)	γeff			γvol	Saturated Sand CSRM7.5	γvol	Settlement γvol	Layer	Cumulative
ft												degree	psf	ksf	(Geff/Gmax)	%			%		%	%	in	in
-2.0	4	1.7	7	5.00	1.20	13	0.14	1.00	0.18	0.18	N.A.	27	174	494	9.2E-05	-	-3.77	-3.70	-	0.14	-	-	0.00	0.01
-3.5	5	1.7	8	5.00	1.20	14	0.15	1.00	0.20	0.18	N.A.	27	305	693	1.1E-04	0.03	-3.75	-2.85	0.04	0.14	-	0.04	0.01	0.01
-5.0	16	1.7	28	5.00	1.20	38	too dense	1.00	too dense	0.18	N.A.	30	417	1,232	9.1E-05	0.01	-3.85	-3.80	0.00	0.14	-	0.00	0.00	0.00
-6.5	28	1.6	45	5.00	1.20	59	too dense	1.00	too dense	0.18	N.A.	32	525	1,624	9.0E-05	0.01	-3.93	-3.86	0.00	0.14	-	0.00	0.00	0.00
-10.0	53	1.3	69	5.00	1.20	87	too dense	1.00	too dense	0.18	N.A.	32	808	2,324	9.6E-05	-	-	-	-	0.14	-	-	0.00	0.00
-15.0	72	1.1	76	5.00	1.20	96	too dense	1.00	too dense	0.21	N.A.	32	1,011	2,692	1.2E-04	-	-	-	-	0.16	-	-	0.00	0.00
-20.0	66	0.9	60	5.00	1.20	78	too dense	0.96	too dense	0.23	N.A.	32	1,213	2,730	1.6E-04	-	-	-	-	0.18	-	-	0.00	0.00
-25.0	42	0.8	35	3.61	1.08	41	too dense	0.91	too dense	0.25	N.A.	32	1,400	2,444	2.2E-04	-	-	-	-	0.19	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-8		Amax	0.28	g	Energy Ratio	80	%
Ground Elevation (NAVD 88)	0.00	ft	Mw	6.8		Settlement FS <=	1.2	
Water Depth (Exploration)	30.00	ft	MSF	1.28	Triggering	Finished Grade El.	0.00	ft
Water Depth (Design)	10.00	ft	MSFVol	0.86	Settlement		User Input	
Station		ft						

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth -80.00

Settlement Calculation per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)

Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation	SPT Depth	CPT Corrected Depth	Thickness	Design Depth	Design Depth	Soil Parameters γ	Soil Type	FC	Soil Stress σv0	u	σv0'	Demand σv0'design	rd	Bore Hole Diameter	Diameter	Sampler	Blow Counts (N) Uncorrected	Sampler Corrected	Blow Count Correction Factors CE	CB	CR	CS
ft	ft	ft	ft	ft	m	pcf		%	psf	psf	psf	psf		in	mm							
-2.0	2.0	2.0	2.8	2	0.6	125	SM	29	250	0	250	250	1.00	8.0	203	MC	12	8	1.33	1.15	0.75	1.00
-3.5	3.5	3.5	1.5	4	1.1	125	SM	25	438	0	438	438	0.99	8.0	203	SPT	8	8	1.33	1.15	0.75	1.00
-5.0	5.0	5.0	1.5	5	1.5	125	SM	25	625	0	625	625	0.99	8.0	203	MC	60	40	1.33	1.15	0.75	1.00
-6.5	6.5	6.5	2.5	7	2.0	125	SM	28	813	0	813	813	0.99	8.0	203	SPT	45	45	1.33	1.15	0.75	1.00
-10.0	10.0	10.0	4.3	10	3.0	125	Sndst	25	1,250	0	1,250	1,250	0.98	8.0	203	MC	81	54	1.33	1.15	0.80	1.00
-15.0	15.0	15.0	5.0	15	4.6	125	SW	25	1,875	0	1,875	1,563	0.97	8.0	203	SPT	39	39	1.33	1.15	0.85	1.00
-20.0	20.0	20.0	5.0	20	6.1	125	Sndst	15	2,500	0	2,500	1,876	0.96	8.0	203	SPT	21	21	1.33	1.15	0.95	1.00
-25.0	25.0	25.0	5.0	25	7.6	120	Sndst	15	3,100	0	3,100	2,164	0.94	8.0	203	MC	42	28	1.33	1.15	0.95	1.00
-30.0	30.0	30.0	2.5	30	9.1	120	Sndst	15	3,700	0	3,700	2,452	0.92	8.0	203	SPT	44	44	1.33	1.15	0.95	1.00

Elevation	Cyclic Resistance N60	CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	Demand CSR	Results FS	Dry Sand φ'	σm'	Gmax	γeff x (Geff/Gmax)	γeff			γvol	Saturated Sand CSRM7.5	γvol	Settlement γvol	Layer	Cumulative
ft												degree	psf	ksf	(Geff/Gmax)	%			%		%	%	in	in
-2.0	9	1.7	16	4.64	1.15	23	0.25	1.00	0.32	0.18	N.A.	32	162	637	7.1E-05	-	-3.96	-3.85	-	0.14	-	-	0.00	0.00
-3.5	9	1.7	16	4.29	1.12	22	0.24	1.00	0.31	0.18	N.A.	32	283	841	9.4E-05	0.02	-3.80	-3.74	0.01	0.14	-	0.01	0.00	0.00
-5.0	46	1.7	79	4.29	1.12	92	too dense	1.00	too dense	0.18	N.A.	32	404	1,721	6.5E-05	0.01	-4.10	-4.00	0.00	0.14	-	0.00	0.00	0.00
-6.5	52	1.6	84	4.56	1.14	100	too dense	1.00	too dense	0.18	N.A.	32	525	2,002	7.3E-05	0.01	-4.01	-3.93	0.00	0.14	-	0.00	0.00	0.00
-10.0	67	1.3	87	4.29	1.12	101	too dense	1.00	too dense	0.18	N.A.	32	808	2,514	8.9E-05	-	-	-	-	0.14	-	-	0.00	0.00
-15.0	51	1.1	54	4.29	1.12	65	too dense	1.00	too dense	0.21	N.A.	32	1,011	2,402	1.4E-04	-	-	-	-	0.16	-	-	0.00	0.00
-20.0	31	0.9	28	2.50	1.05	32	too dense	0.96	too dense	0.23	N.A.	32	1,213	2,118	2.1E-04	-	-	-	-	0.18	-	-	0.00	0.00
-25.0	41	0.8	34	2.50	1.05	38	too dense	0.91	too dense	0.25	N.A.	32	1,400	2,420	2.2E-04	-	-	-	-	0.19	-	-	0.00	0.00
-30.0	64	0.8	49	2.50	1.05	53	too dense	0.87	too dense	0.25	N.A.	32	1,586	2,902	2.1E-04	-	-	-	-	0.20	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-9	
Ground Elevation (NAVD 88)	0.00	ft
Water Depth (Exploration)	30.00	ft
Water Depth (Design)	10.00	ft
Station		ft

Amax	0.28	g
Mw	6.8	
MSF	1.28	Triggering
MSFVol	0.86	Settlement

Energy Ratio	80	%
Settlement FS <=	1.2	
Finished Grade El.	0.00	ft
	User Input	

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth
-80.00

Settlement Calculation
per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)		
Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

Elevation	SPT Depth	CPT Correcte	Thicknes s	Design Depth	Design Depth	Soil Parameters			Soil Stress			Demand	
						γ	Soil Type	FC	σv0	u	σv0'	σv0'design	rd
ft	ft	ft	ft	ft	m	pcf		%	psf	psf	psf	psf	
-2.0	2.0	2.0	2.8	2	0.6	125	SM	14	250	0	250	250	1.00
-3.5	3.5	3.5	1.5	4	1.1	125	SM	14	438	0	438	438	0.99
-5.0	5.0	5.0	1.5	5	1.5	125	SC	43	625	0	625	625	0.99
-6.5	6.5	6.5	2.5	7	2.0	125	SC	43	813	0	813	813	0.99
-10.0	10.0	10.0	4.3	10	3.0	125	Sndst	20	1,250	0	1,250	1,250	0.98
-15.0	15.0	15.0	5.0	15	4.6	125	Sndst	20	1,875	0	1,875	1,563	0.97
-20.0	20.0	20.0	5.0	20	6.1	125	Sndst	20	2,500	0	2,500	1,876	0.96
-25.0	25.0	25.0	5.0	25	7.6	120	Sndst	20	3,100	0	3,100	2,164	0.94
-30.0	30.0	30.0	2.5	30	9.1	120	Sndst	20	3,700	0	3,700	2,452	0.92

Elevation	Bore Hole			Blow Counts (N)		Blow Count Correction Factors				Cyclic Resistance									Demand	Results
	Diameter	Diameter	Sampler	Uncorrected	Sampler Correcte	CE	CB	CR	CS	N60	CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	CSR	FS
ft	in	mm																		
-2.0	8.0	203	MC	9	6	1.33	1.15	0.75	1.00	7	1.7	12	2.20	1.04	15	0.16	1.00	0.20	0.18	N.A.
-3.5	8.0	203	SPT	10	10	1.33	1.15	0.75	1.00	12	1.7	20	2.20	1.04	23	0.25	1.00	0.32	0.18	N.A.
-5.0	8.0	203	MC	32	21	1.33	1.15	0.75	1.00	25	1.7	42	5.00	1.20	55	too dense	1.00	too dense	0.18	N.A.
-6.5	8.0	203	SPT	21	21	1.33	1.15	0.75	1.00	24	1.6	39	5.00	1.20	52	too dense	1.00	too dense	0.18	N.A.
-10.0	8.0	203	MC	38	25	1.33	1.15	0.80	1.00	31	1.3	41	3.61	1.08	48	too dense	1.00	too dense	0.18	N.A.
-15.0	8.0	203	SPT	26	26	1.33	1.15	0.85	1.00	34	1.1	36	3.61	1.08	43	too dense	1.00	too dense	0.21	N.A.
-20.0	8.0	203	MC	81	54	1.33	1.15	0.95	1.00	79	0.9	73	3.61	1.08	82	too dense	0.96	too dense	0.23	N.A.
-25.0	8.0	203	SPT	49	49	1.33	1.15	0.95	1.00	72	0.8	59	3.61	1.08	67	too dense	0.91	too dense	0.25	N.A.
-30.0	8.0	203	SPT	36	36	1.33	1.15	0.95	1.00	53	0.8	40	3.61	1.08	47	too dense	0.87	too dense	0.25	N.A.

Elevation	Dry Sand								Saturated Sand		Settlement		
	φ'	σm'	Gmax	γeff x	γeff			γvol	CSRM7.5	γvol	γvol	Layer	Cumulative
ft	degree	psf	ksf	(Geff/Gmax)	%			%		%	%	in	in
-2.0	32	162	579	7.8E-05	-	-3.96	-3.85	-	0.14	-	-	0.00	0.00
-3.5	32	283	906	8.7E-05	0.01	-3.88	-3.80	0.01	0.14	-	0.01	0.00	0.00
-5.0	32	404	1,396	8.1E-05	0.01	-3.92	-3.85	0.00	0.14	-	0.00	0.00	0.00
-6.5	32	525	1,554	9.4E-05	0.01	-3.86	-3.81	0.00	0.14	-	0.00	0.00	0.00
-10.0	32	808	1,954	1.1E-04	-	-	-	-	0.14	-	-	0.00	0.00
-15.0	32	1,011	2,099	1.6E-04	-	-	-	-	0.16	-	-	0.00	0.00
-20.0	32	1,213	2,906	1.5E-04	-	-	-	-	0.18	-	-	0.00	0.00
-25.0	32	1,400	2,910	1.8E-04	-	-	-	-	0.19	-	-	0.00	0.00
-30.0	32	1,586	2,715	2.3E-04	-	-	-	-	0.20	-	-	0.00	0.00

NCEER (2001)

Borehole No	GB-10	
Ground Elevation (NAVD 88)	0.00	ft
Water Depth (Exploration)	30.00	ft
Water Depth (Design)	10.00	ft
Station		ft

Amax	0.28	g
Mw	6.8	
MSF	1.28	Triggering
MSFVol	0.86	Settlement

Energy Ratio	80	%
Settlement FS <=	1.2	
Finished Grade El.	0.00	ft
	User Input	

Borehole diameter (mm)	Correction CB
115	1
150	1.05
200	1.15

No liquefaction below this depth
-80.00

Settlement Calculation
per Tokimatsu & Seed (1987)

From Tokimastu & Seed (1987)		
Mw	Neq	Vol. Strain Ratio
8.50	26	1.25
7.50	15	1.00
6.75	10	0.85
6.00	5	0.60
5.25	2 - 3	0.40

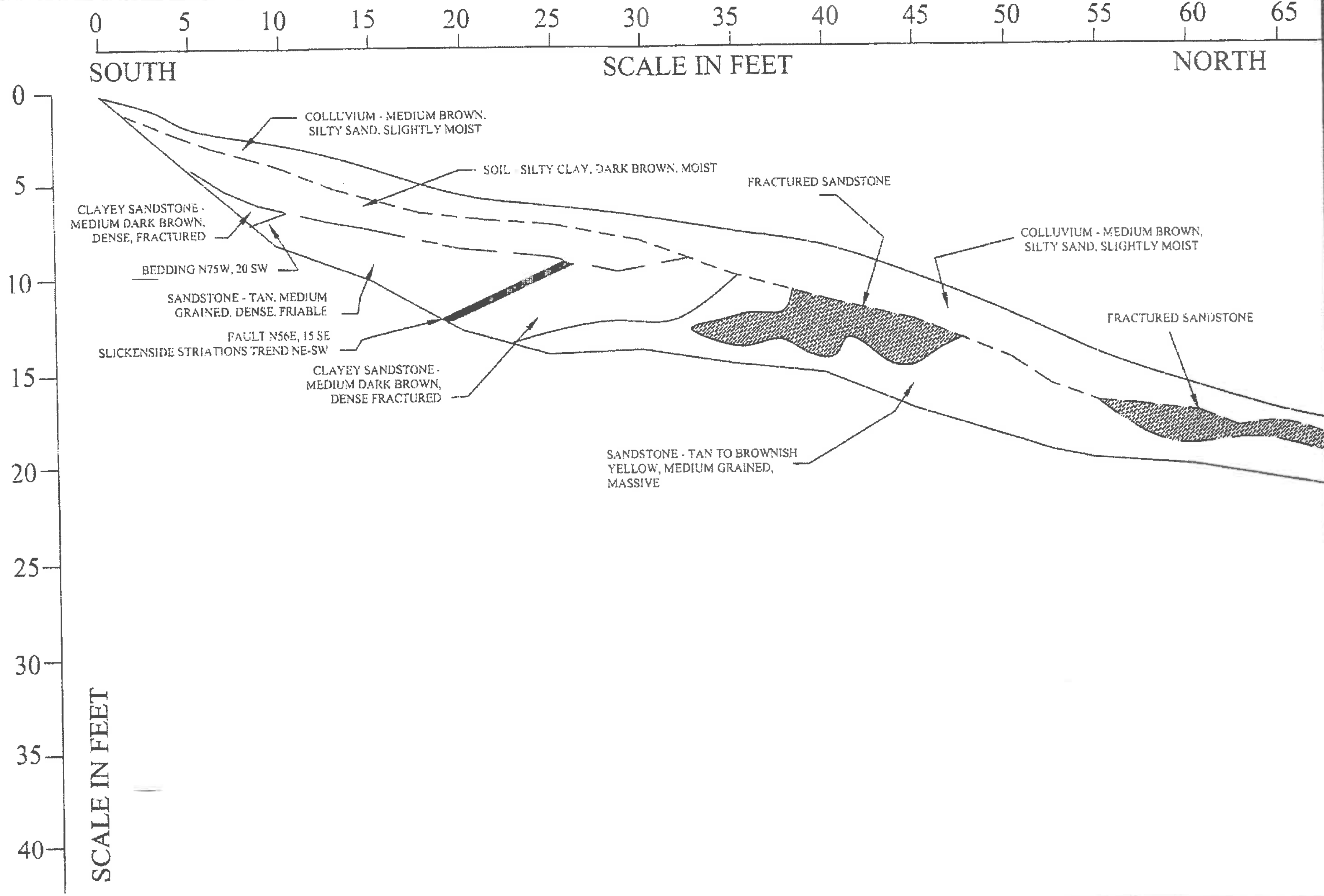
Elevation	SPT Depth	CPT Correcte	Thicknes s	Design Depth	Design Depth	Soil Parameters			Soil Stress			Demand	
						γ	Soil Type	FC	σv0	u	σv0'	σv0'design	rd
ft	ft	ft	ft	ft	m	pcf		%	psf	psf	psf	psf	
-2.0	2.0	2.0	2.8	2	0.6	125	SC	42	250	0	250	250	1.00
-3.5	3.5	3.5	1.5	4	1.1	125	CL	70	438	0	438	438	0.99
-5.0	5.0	5.0	1.5	5	1.5	125	CL	70	625	0	625	625	0.99
-6.5	6.5	6.5	2.5	7	2.0	125	CL	70	813	0	813	813	0.99
-10.0	10.0	10.0	4.3	10	3.0	125	CL	70	1,250	0	1,250	1,250	0.98
-15.0	15.0	15.0	5.0	15	4.6	125	CL	70	1,875	0	1,875	1,563	0.97
-20.0	20.0	20.0	2.5	20	6.1	125	CL	70	2,500	0	2,500	1,876	0.96

Elevation	Bore Hole			Blow Counts (N)		Blow Count Correction Factors				Cyclic Resistance									Demand	Results
	Diameter	Diameter	Sampler	Uncorrected	Sampler Correcte	CE	CB	CR	CS	N60	CN	(N1)60	α	β	(N1)60,CS	CRR7.5	Kσ	CRR	CSR	FS
ft	in	mm																		
-2.0	8.0	203	MC	3	2	1.33	1.15	0.75	1.00	2	1.7	4	5.00	1.20	10	0.11	1.00	0.14	0.18	N.A.
-3.5	8.0	203	SPT	5	5	1.33	1.15	0.75	1.00	6	1.7	10	5.00	1.20	17	0.18	1.00	0.23	0.18	N.A.
-5.0	8.0	203	MC	11	7	1.33	1.15	0.75	1.00	8	1.7	14	5.00	1.20	22	0.25	1.00	0.32	0.18	N.A.
-6.5	8.0	203	SPT	13	13	1.33	1.15	0.75	1.00	15	1.6	24	5.00	1.20	34	too dense	1.00	too dense	0.18	N.A.
-10.0	8.0	203	MC	33	22	1.33	1.15	0.80	1.00	27	1.3	35	5.00	1.20	47	too dense	1.00	too dense	0.18	N.A.
-15.0	8.0	203	MC	30	20	1.33	1.15	0.85	1.00	26	1.1	28	5.00	1.20	38	too dense	1.00	too dense	0.21	N.A.
-20.0	8.0	203	SPT	22	22	1.33	1.15	0.95	1.00	32	0.9	30	5.00	1.20	40	too dense	0.96	too dense	0.23	N.A.

Elevation	Dry Sand								Saturated Sand		Settlement		
	φ'	σm'	Gmax	γeff x	γeff			γvol	CSRM7.5	γvol	γvol	Layer	Cumulative
ft	degree	psf	ksf	(Geff/Gmax)	%			%		%	%	in	in
-2.0	32	162	401	1.1E-04	-	-3.70	-2.52	-	0.14	-	-	0.00	0.01
-3.5	32	283	719	1.1E-04	0.02	-3.74	-2.78	0.03	0.14	-	0.03	0.01	0.01
-5.0	32	404	978	1.2E-04	0.02	-3.80	-3.16	0.02	0.14	-	0.02	0.00	0.01
-6.5	32	525	1,324	1.1E-04	0.02	-3.81	-3.21	0.01	0.14	-	0.01	0.00	0.00
-10.0	32	808	1,864	1.2E-04	-	-	-	-	0.14	-	-	0.00	0.00
-15.0	32	1,011	1,926	1.7E-04	-	-	-	-	0.16	-	-	0.00	0.00
-20.0	32	1,213	2,151	2.0E-04	-	-	-	-	0.18	-	-	0.00	0.00

APPENDIX F

LOGS FROM PREVIOUS CONSULTANT REPORTS



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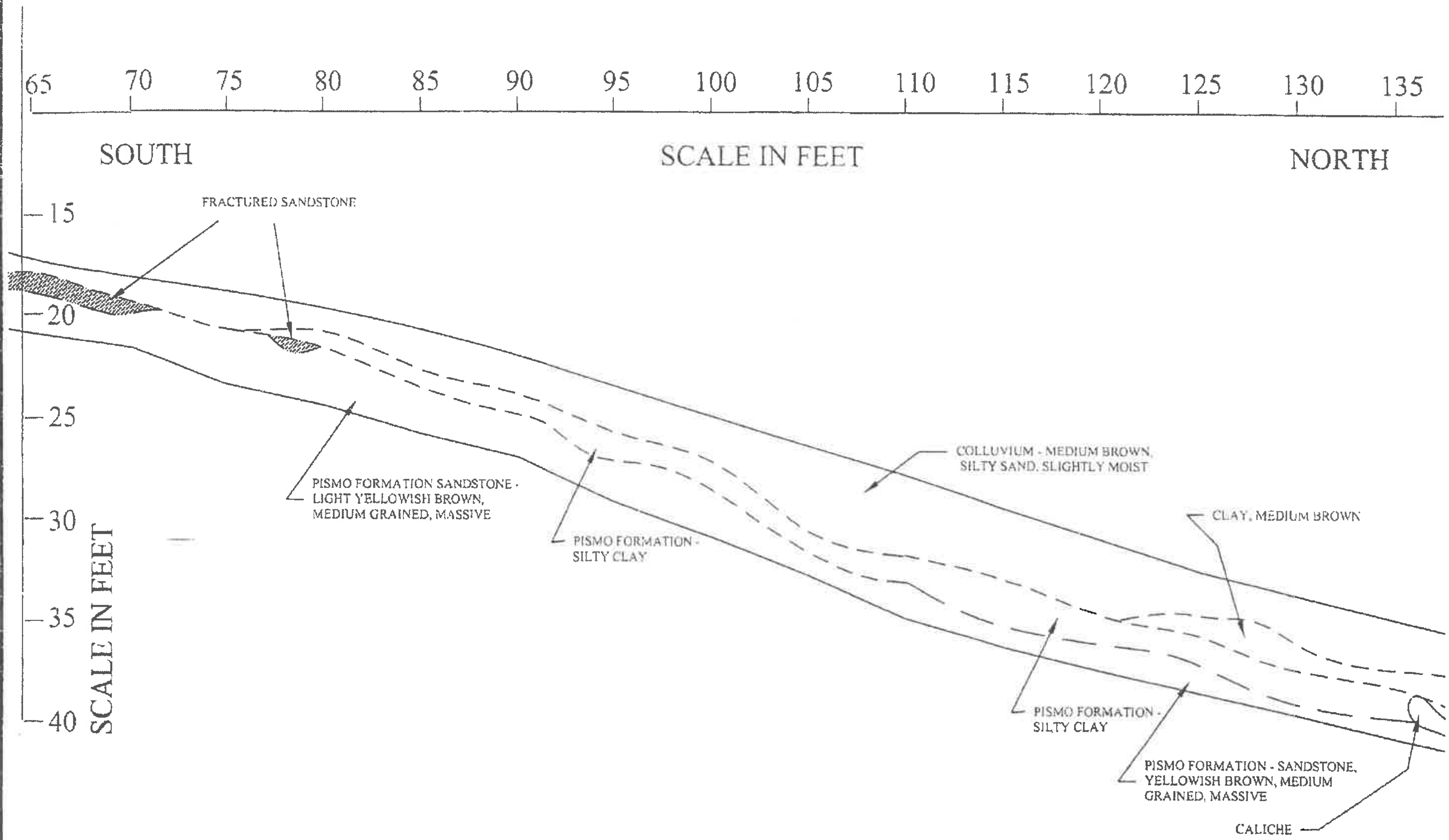
TRENCH T-1

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
6A

PROJECT
SL01493-2



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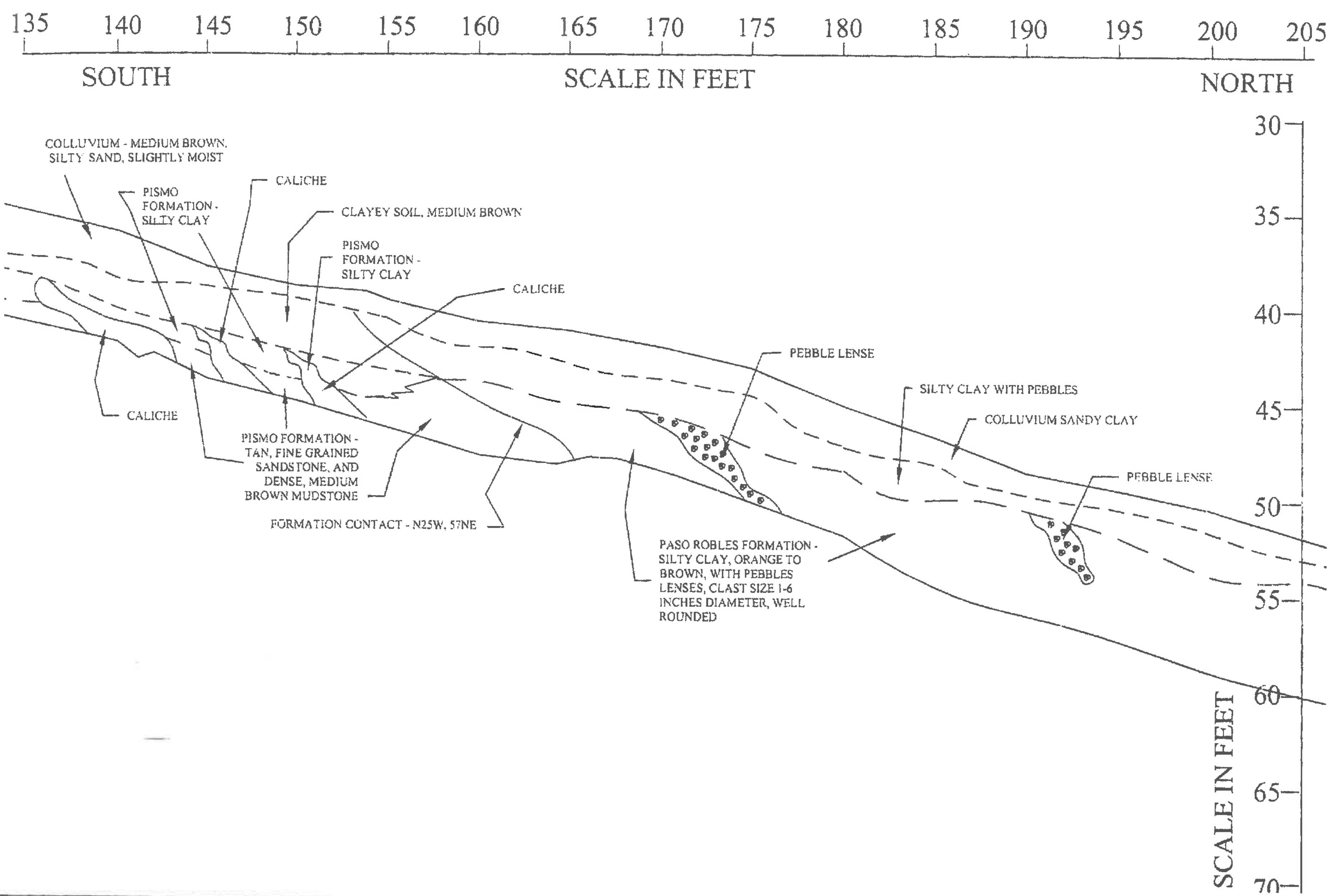
TRENCH T-1

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
6-B

PROJECT
SL01642-1



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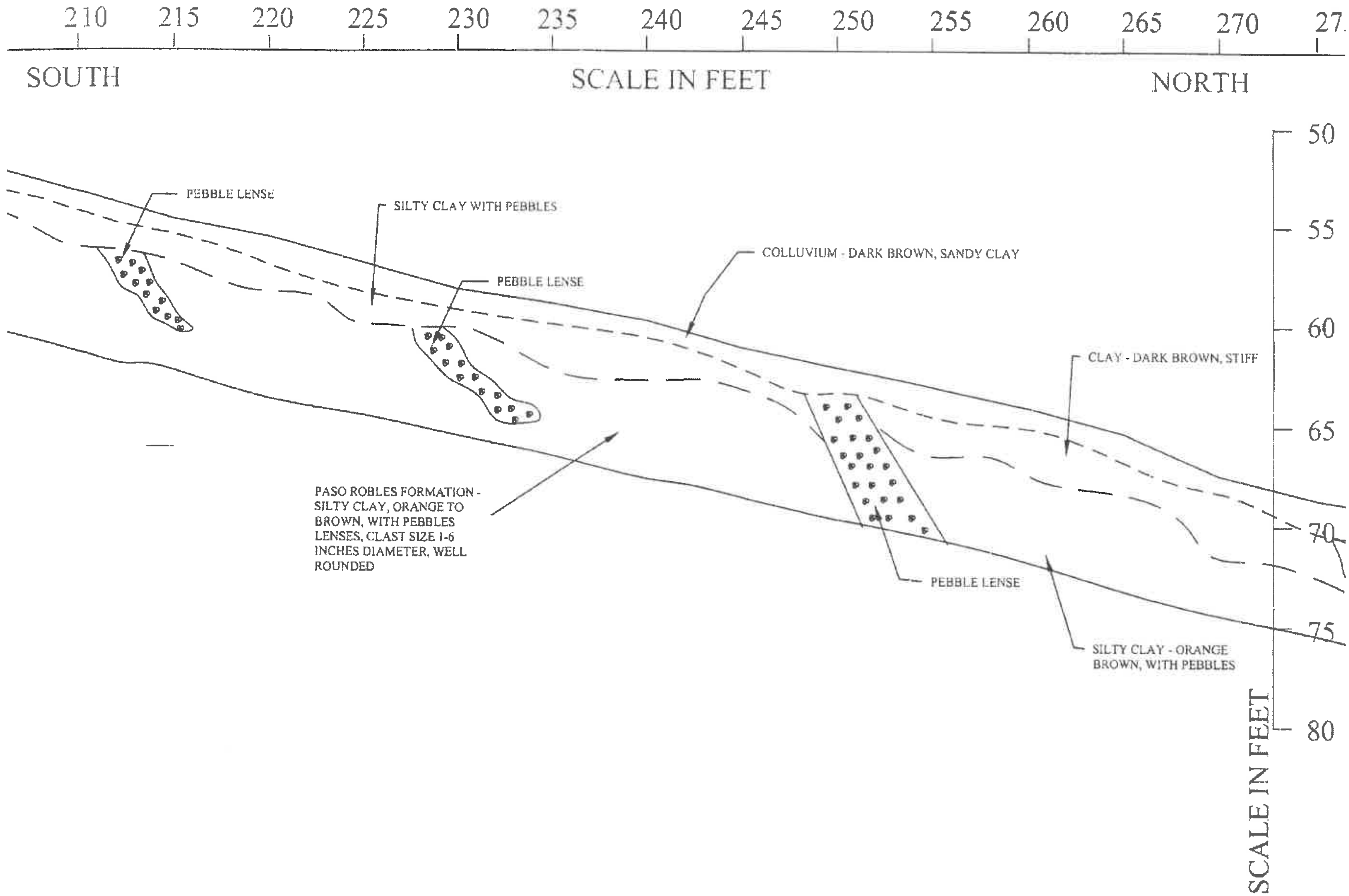
TRENCH T-1

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
6-C

PROJECT
SL01642-1



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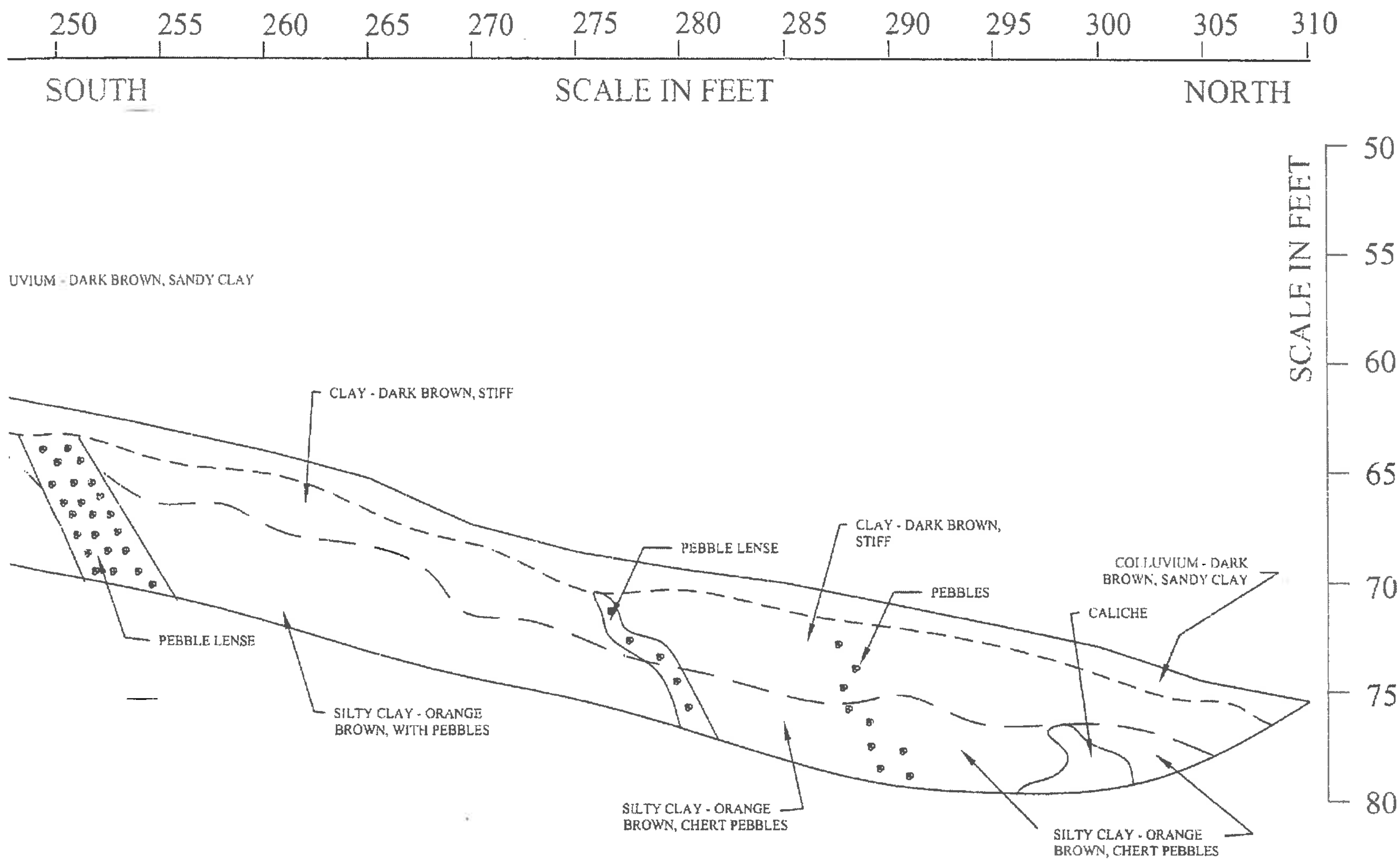
TRENCH T-1

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
6-D

PROJECT
SL01642-1



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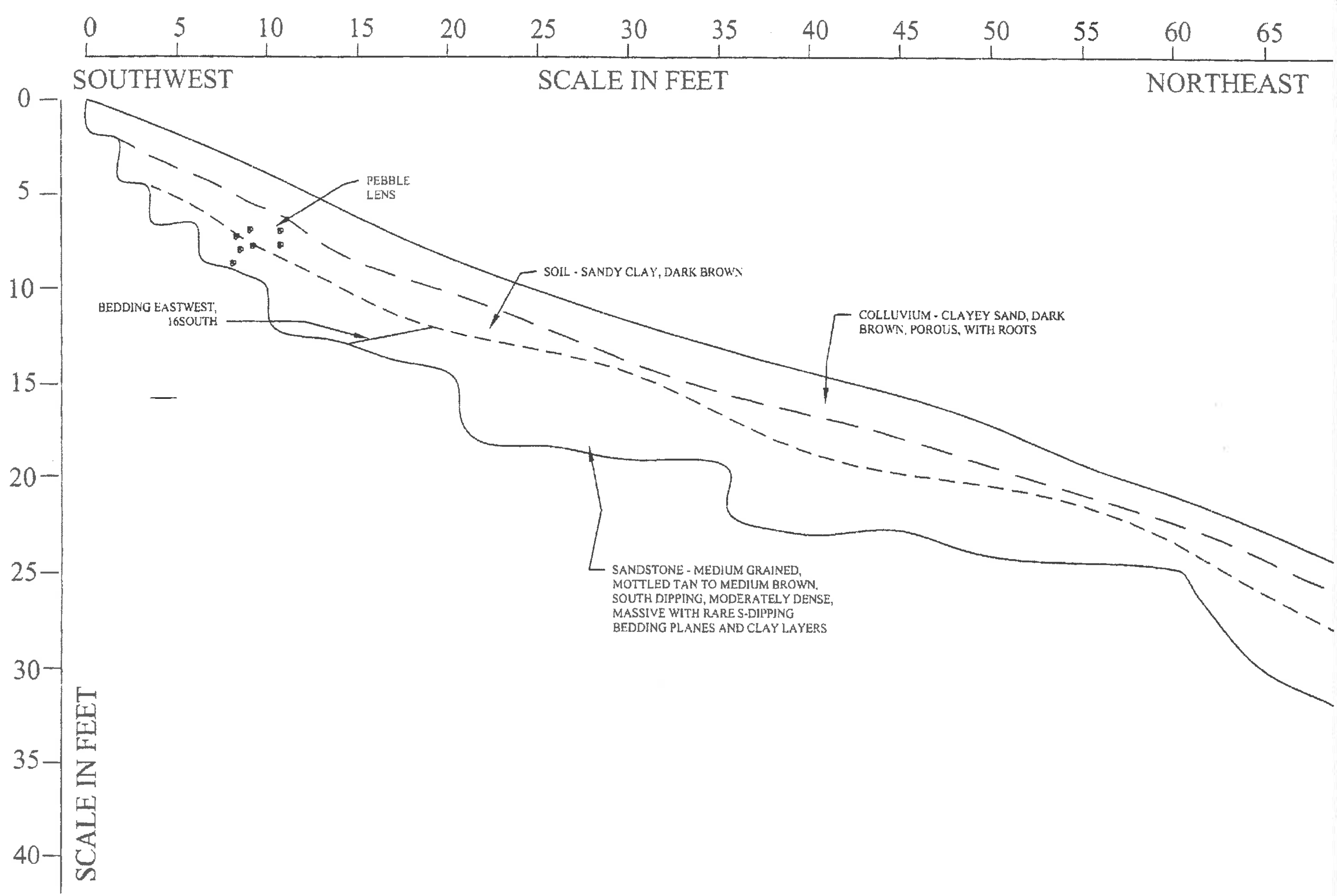
TRENCH T-1

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
6-E

PROJECT
SL01642-1



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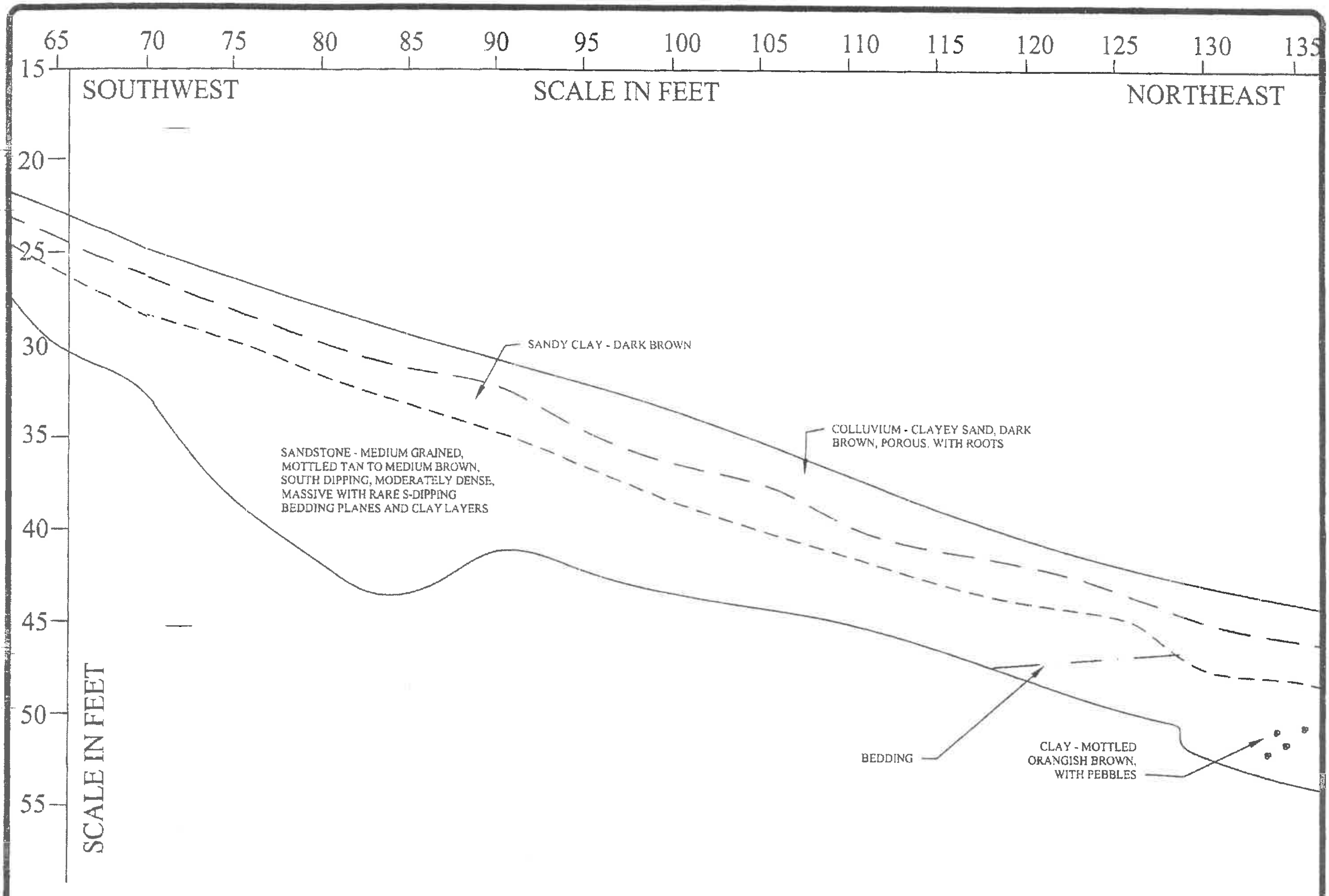
TRENCH T-2

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
7A

PROJECT
SL01493-2



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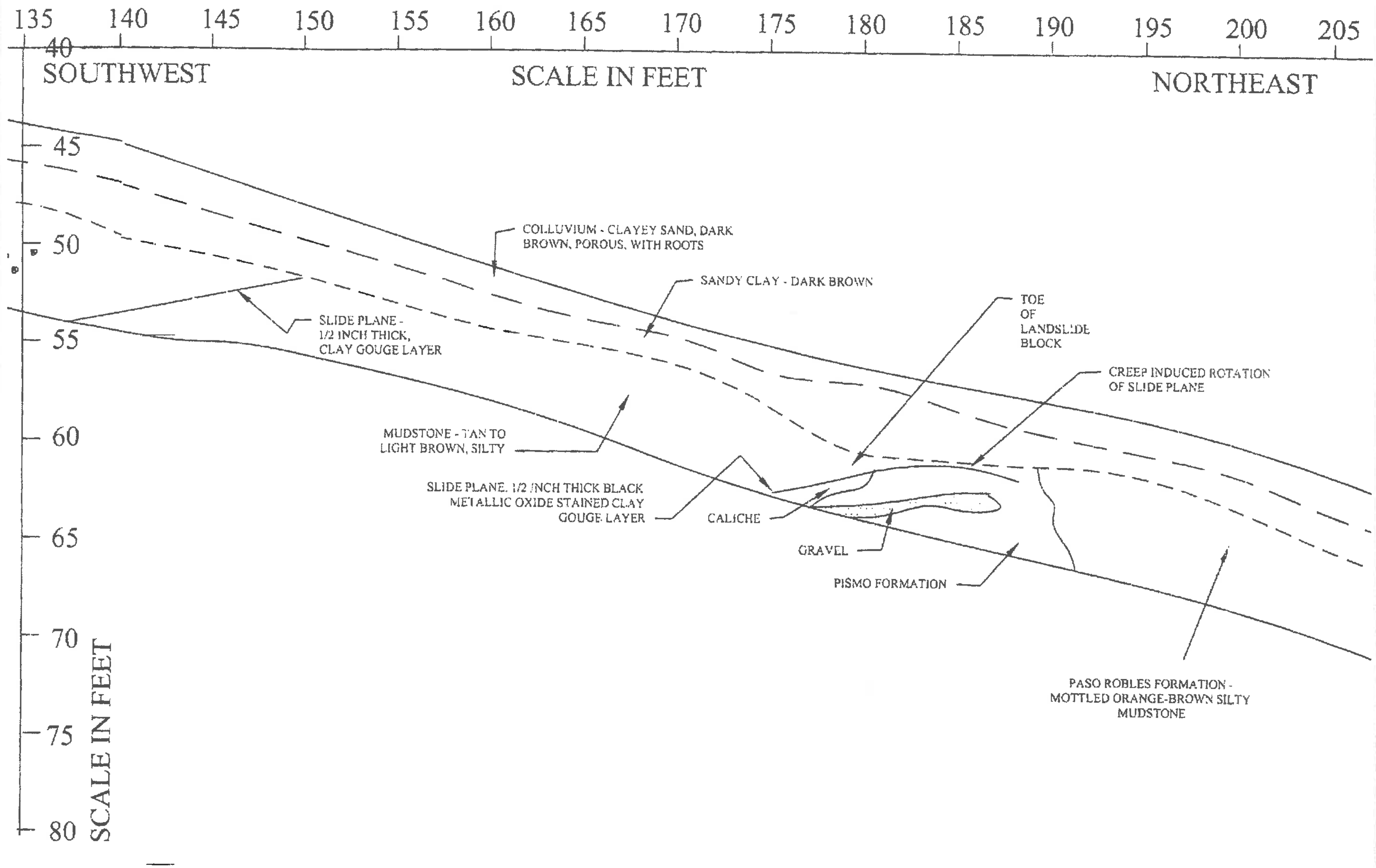
TRENCH T-2

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
7B

PROJECT
SL01493-2



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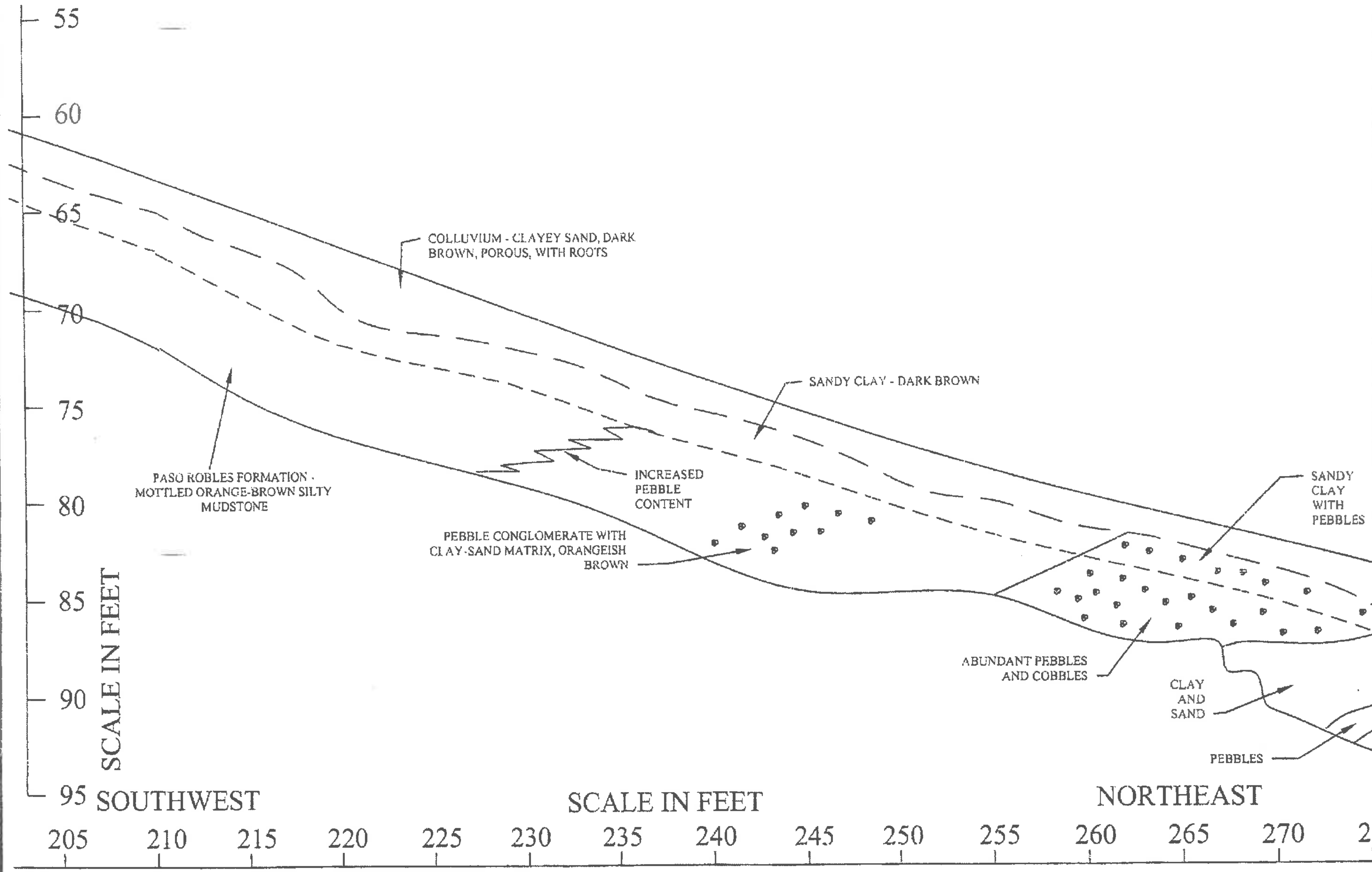
TRENCH T-2

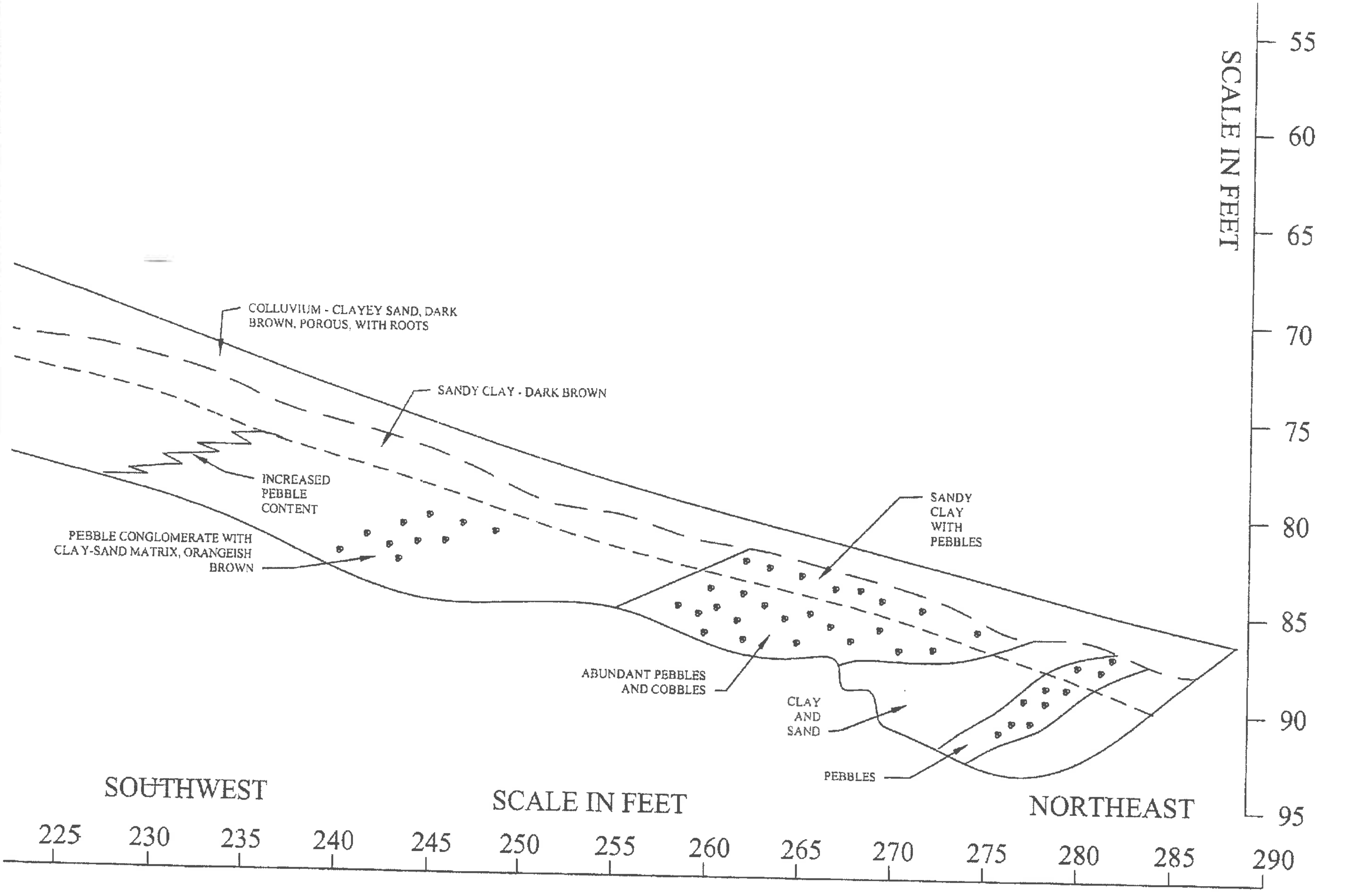
JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
7C

PROJECT
SL01493-2



GeoSolutions, Inc. 220 High Street San Luis Obispo, CA 93401 (805) 543-8539 Fax: (805) 543-2171	**TRENCH T-2** JACK RANCH, CRESTMONT ROAD, EDNA VALLEY SAN LUIS OBISPO COUNTY, CALIFORNIA	**FIGURE** 7D **PROJECT** SL01493-2



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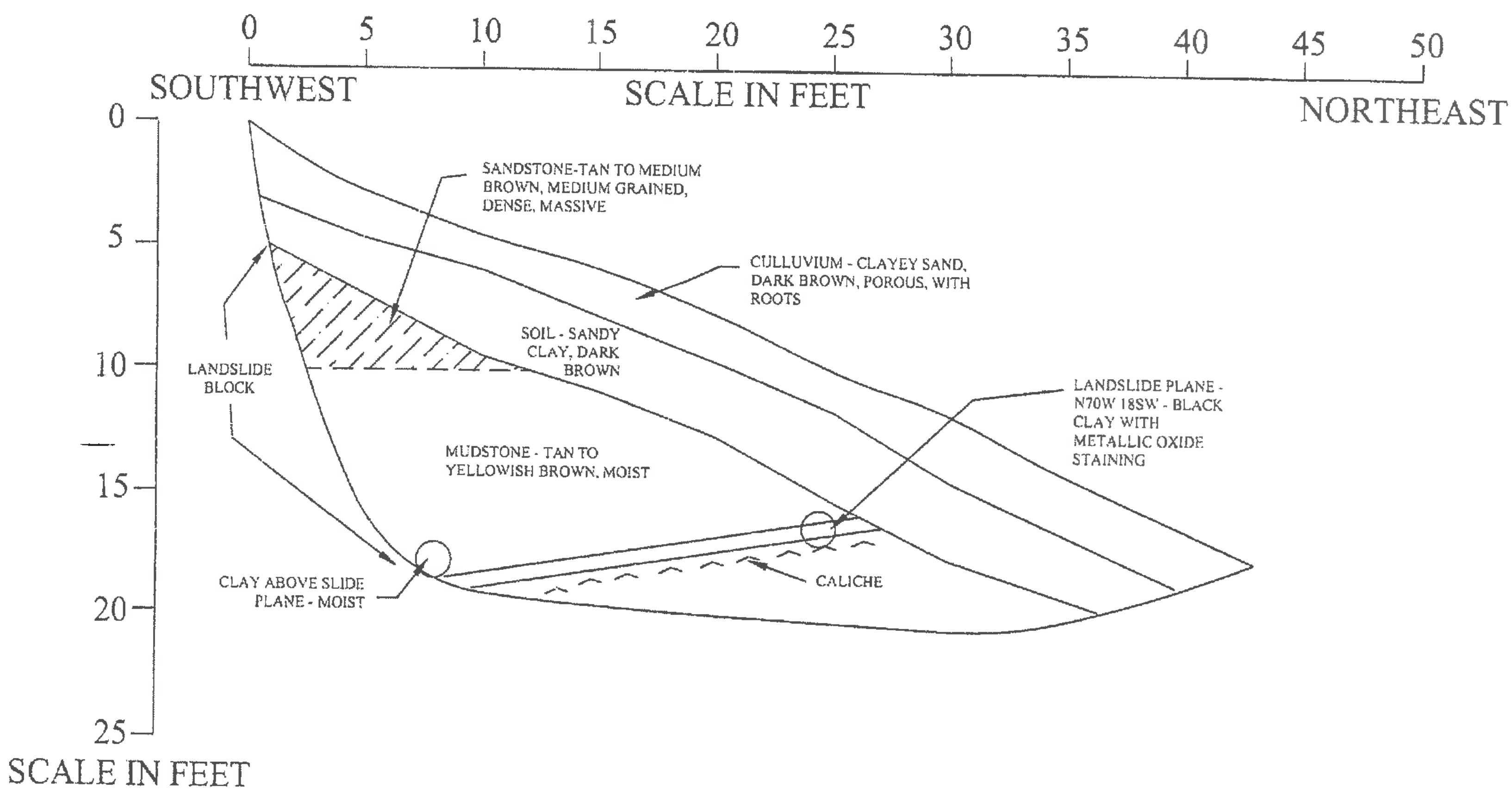
TRENCH T-2

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
7E

PROJECT
SL01493-2



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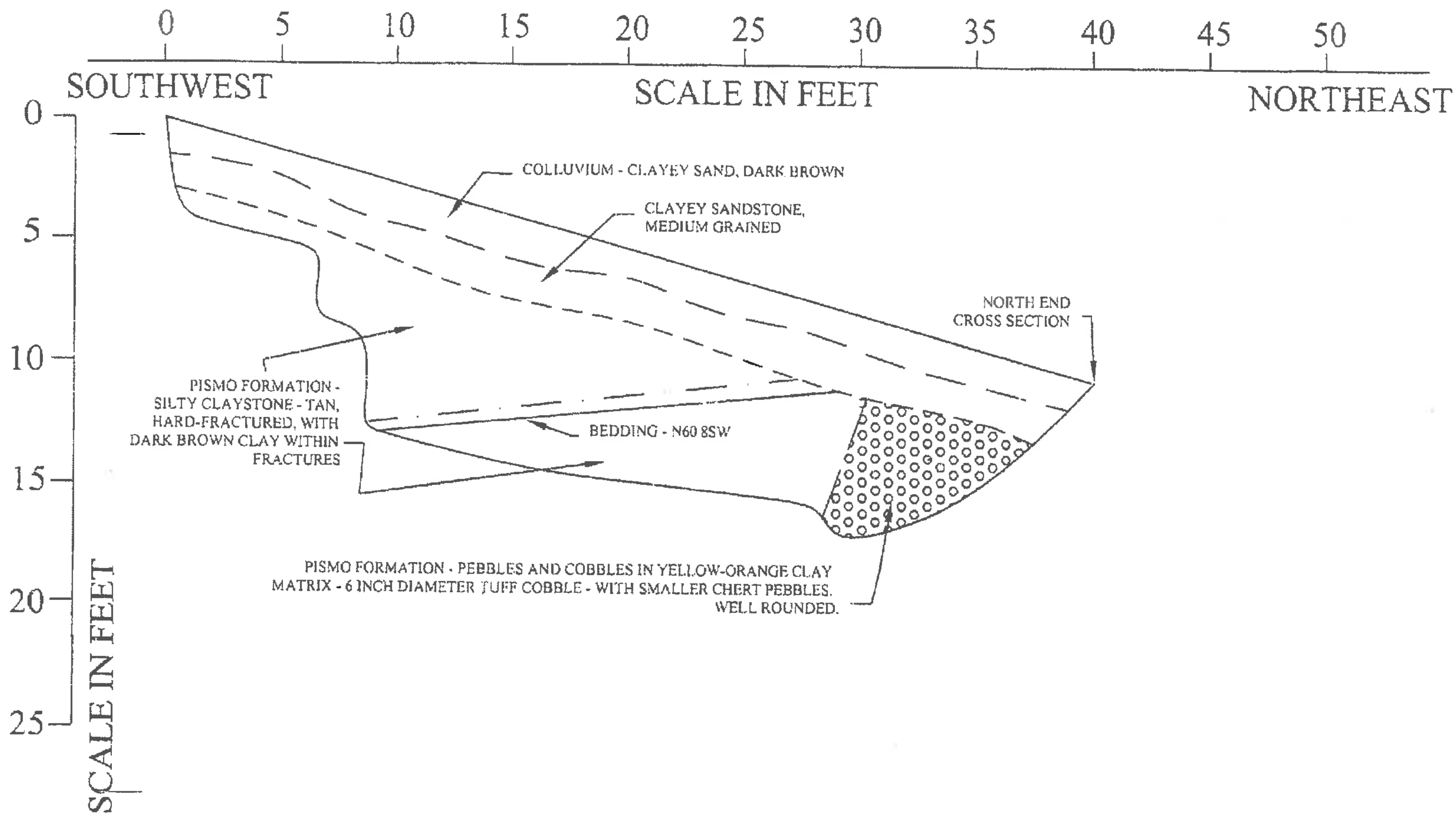
TRENCH T-3

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
8

PROJECT
SL01493-2



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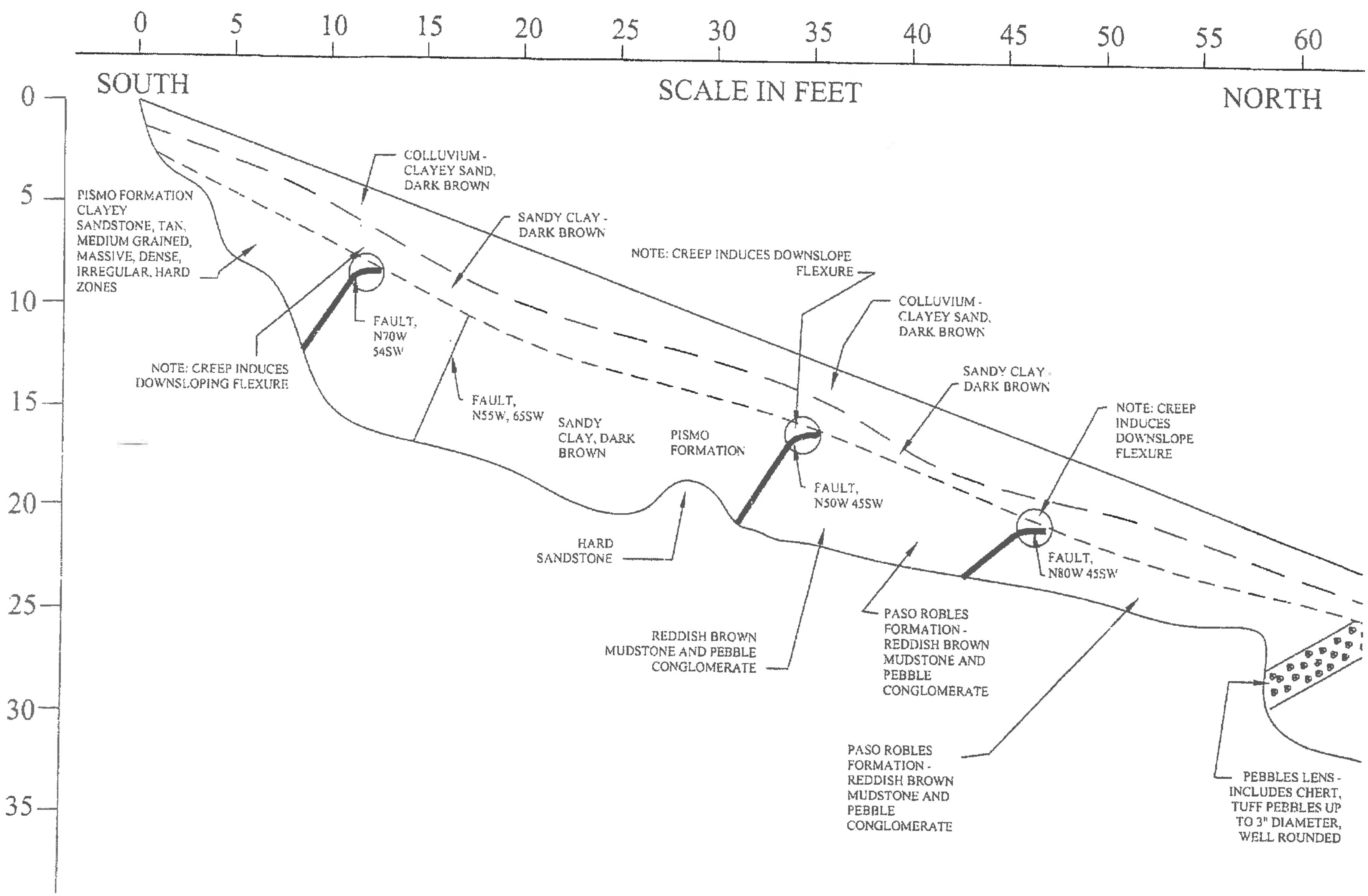
TRENCH T-4

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
9

PROJECT
SL01493-2



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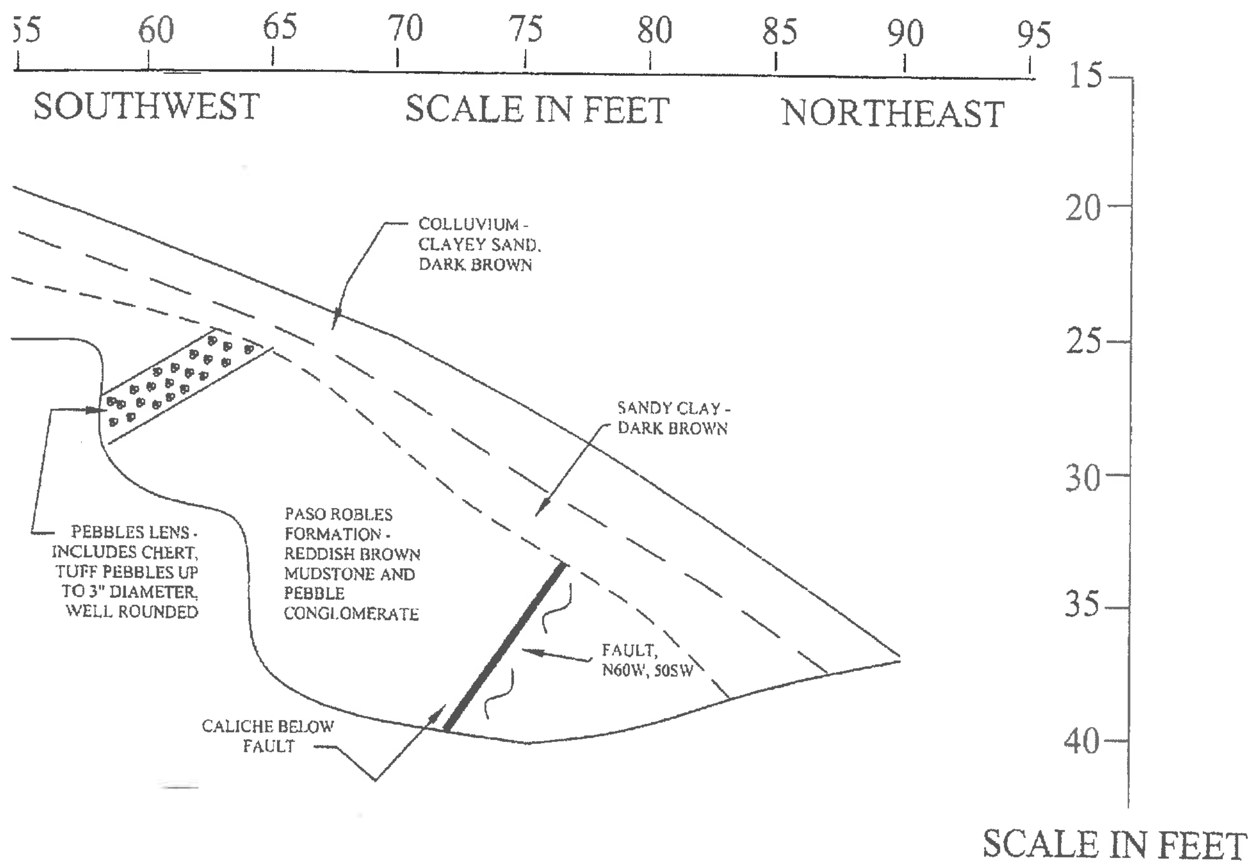
TRENCH T-5

JACK RANCH, CRESTMONT ROAD, EDNA VALLEY
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
10A

PROJECT
SL01493-2



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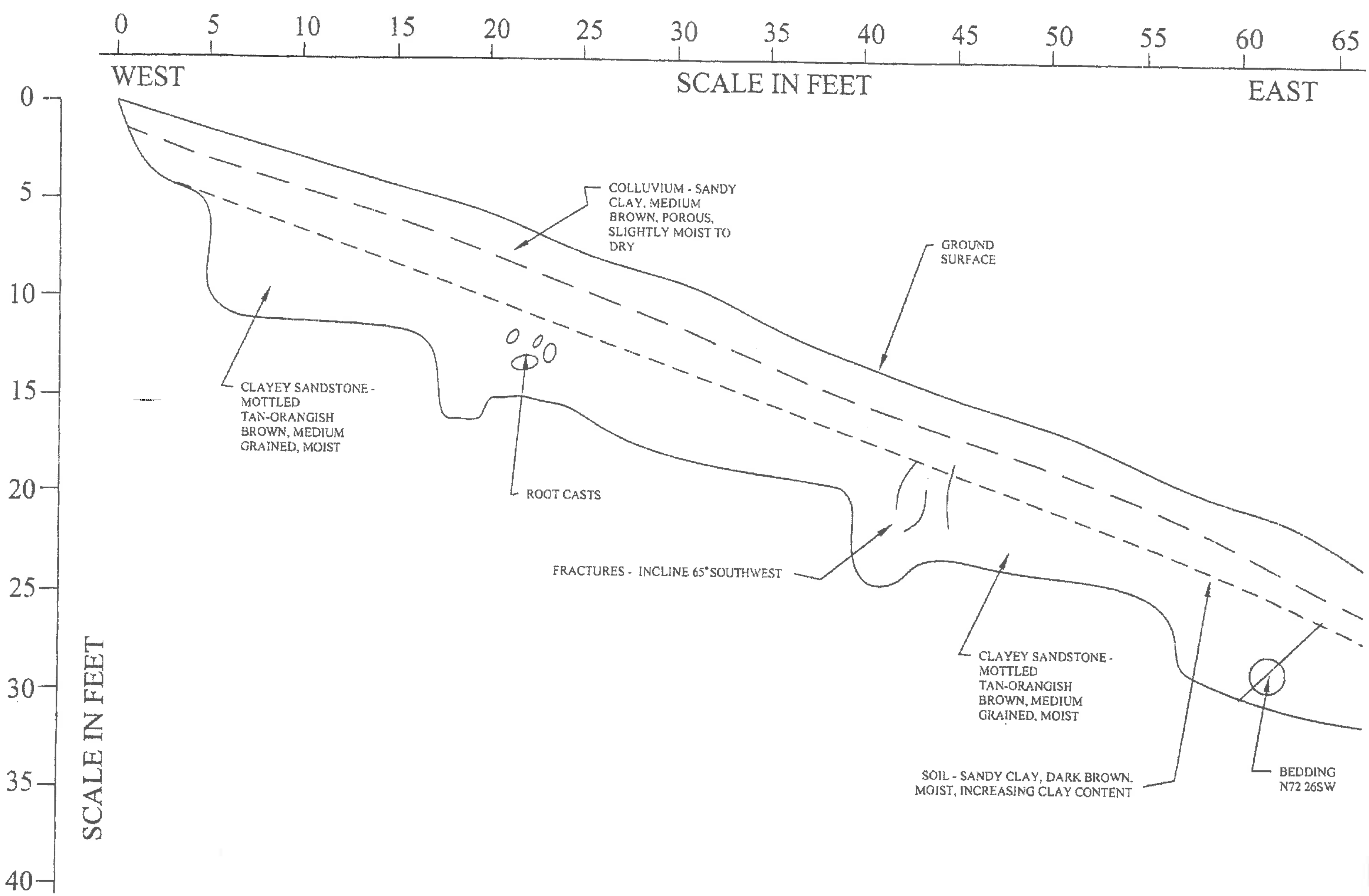
TRENCH T-5

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
10B

PROJECT
SL01493-2



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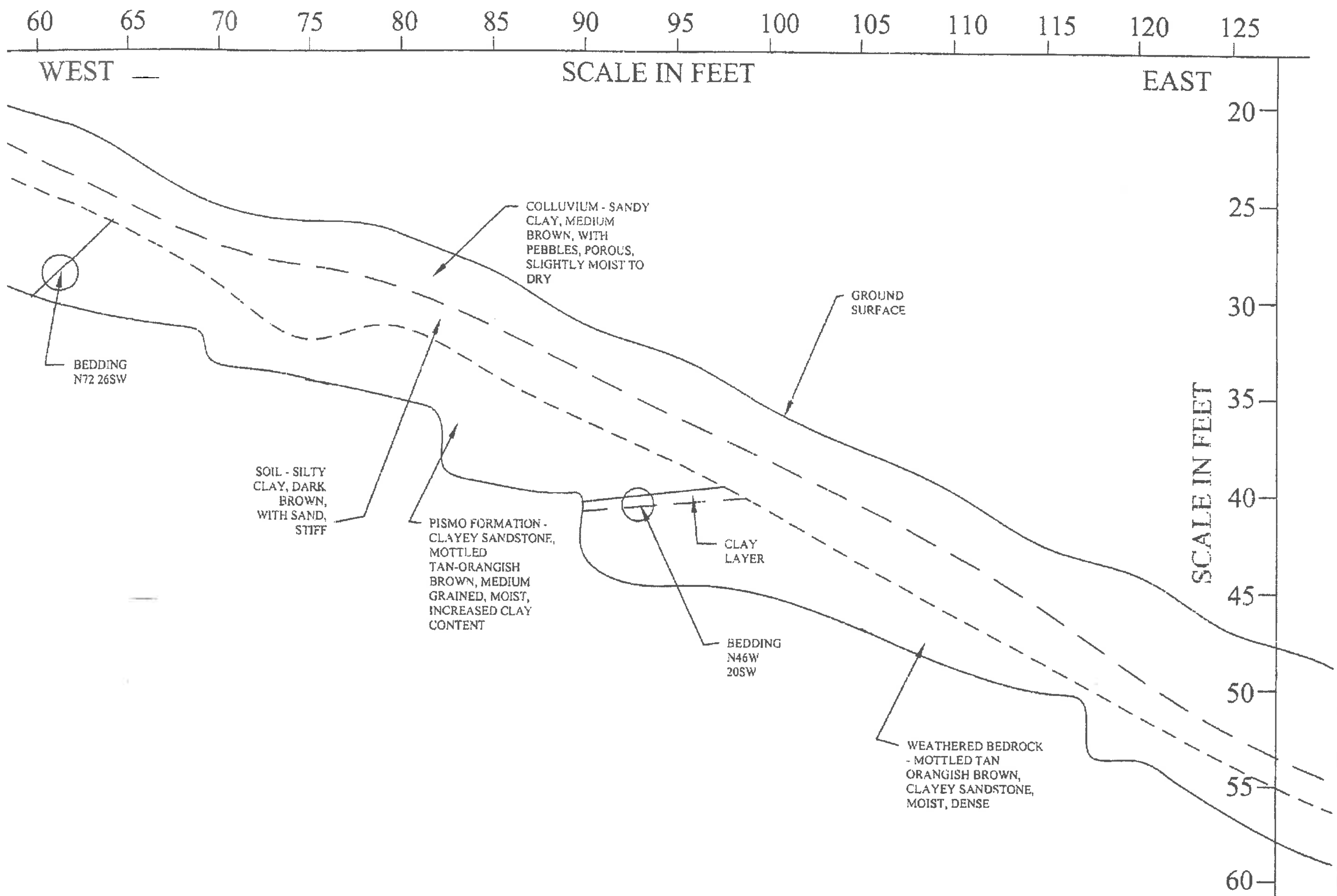
TRENCH T-6

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
11A

PROJECT
SL01493-2



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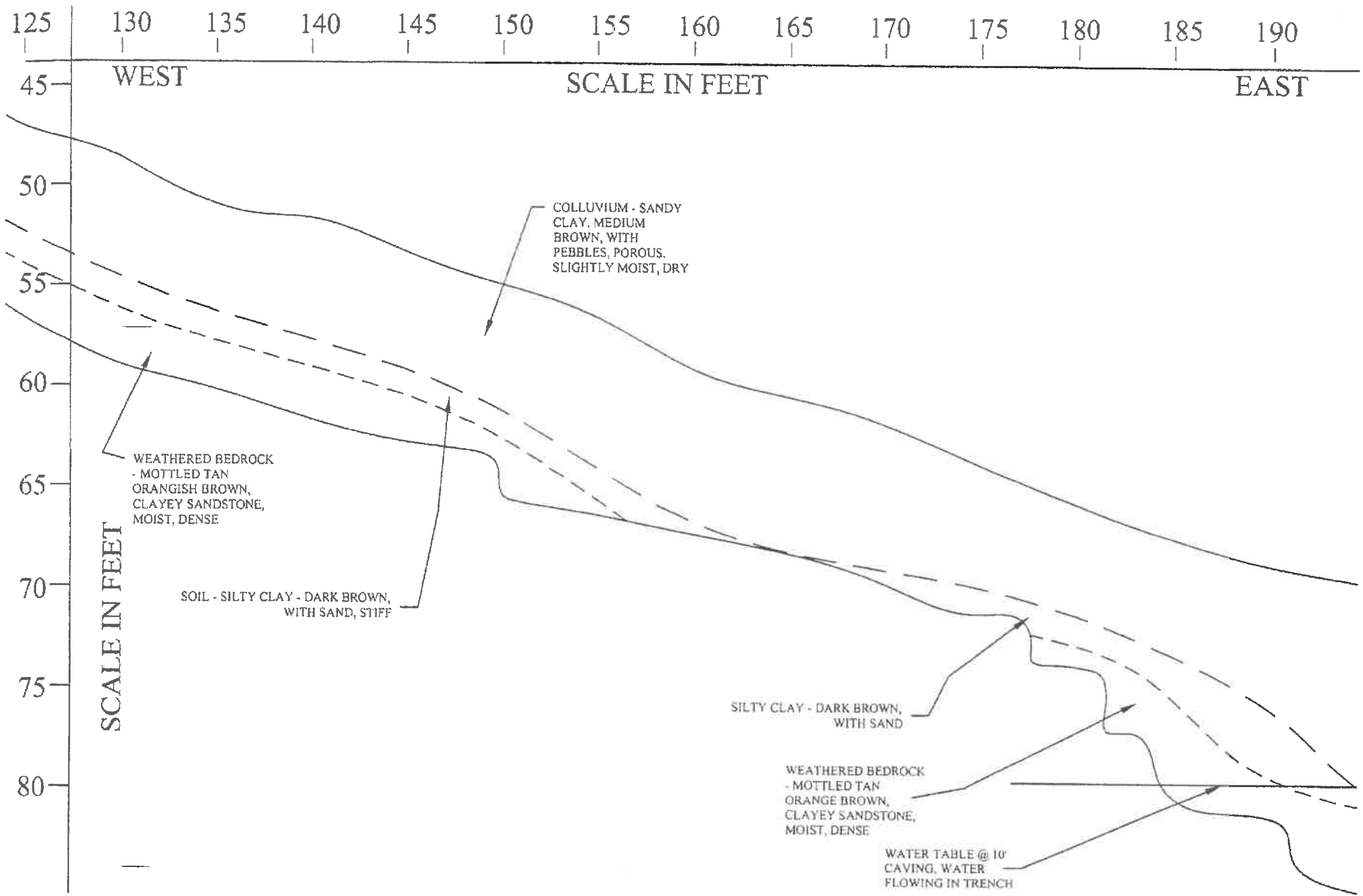
TRENCH T-6

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
11B

PROJECT
SL01493-2



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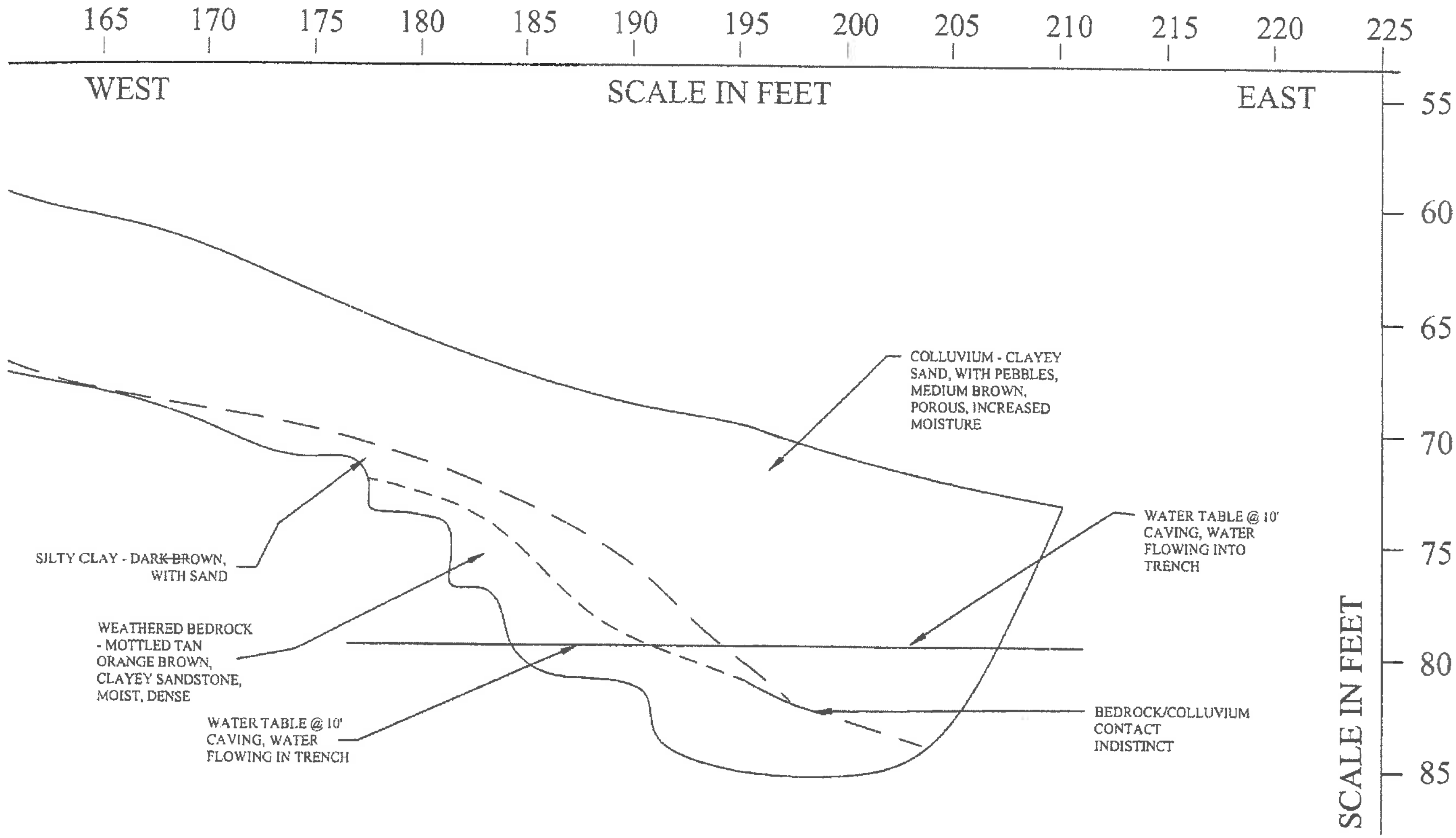
TRENCH T-6

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
11C

PROJECT
SL01493-2



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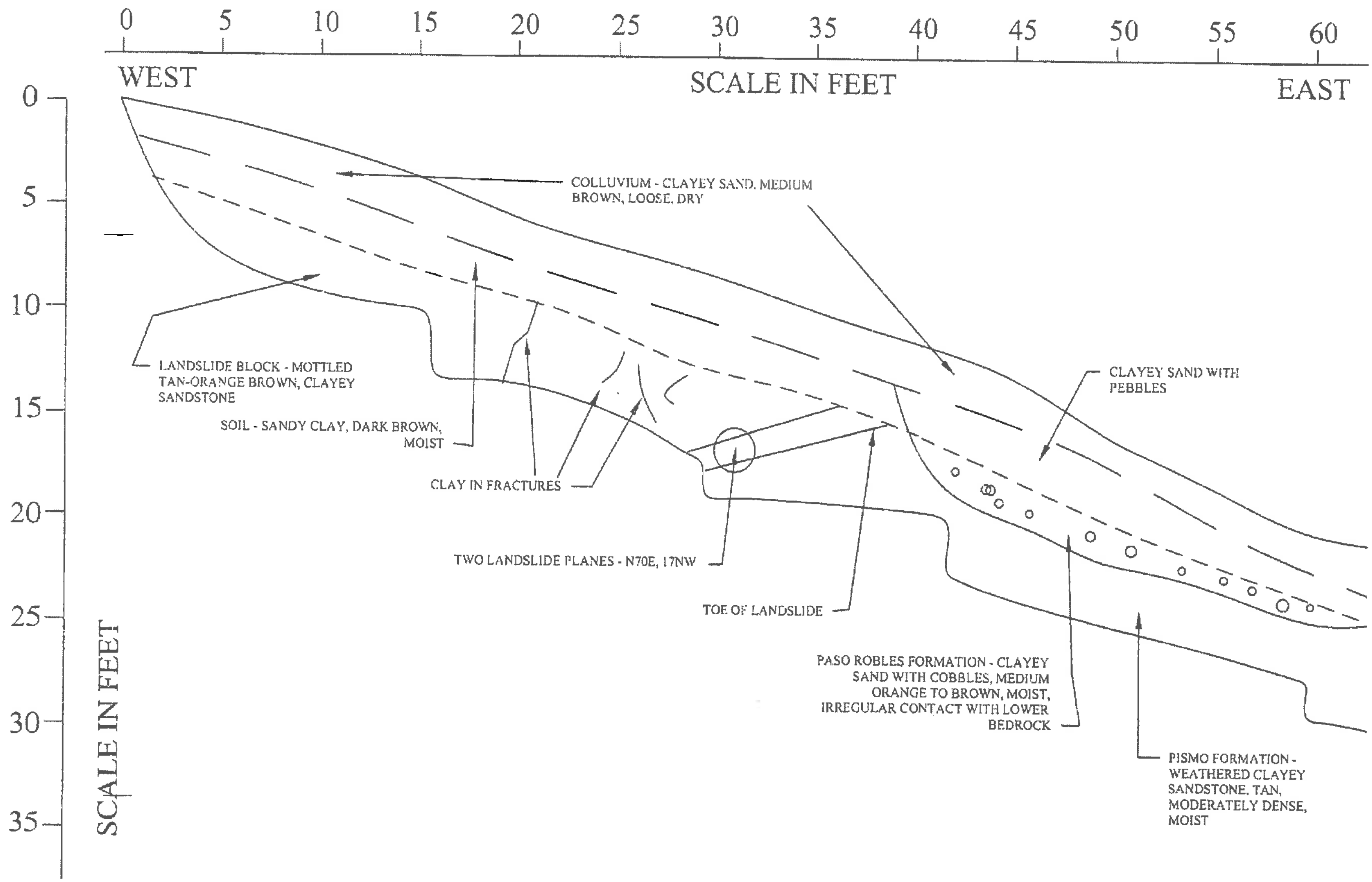
TRENCH T-6

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
11D

PROJECT
SL01493-2



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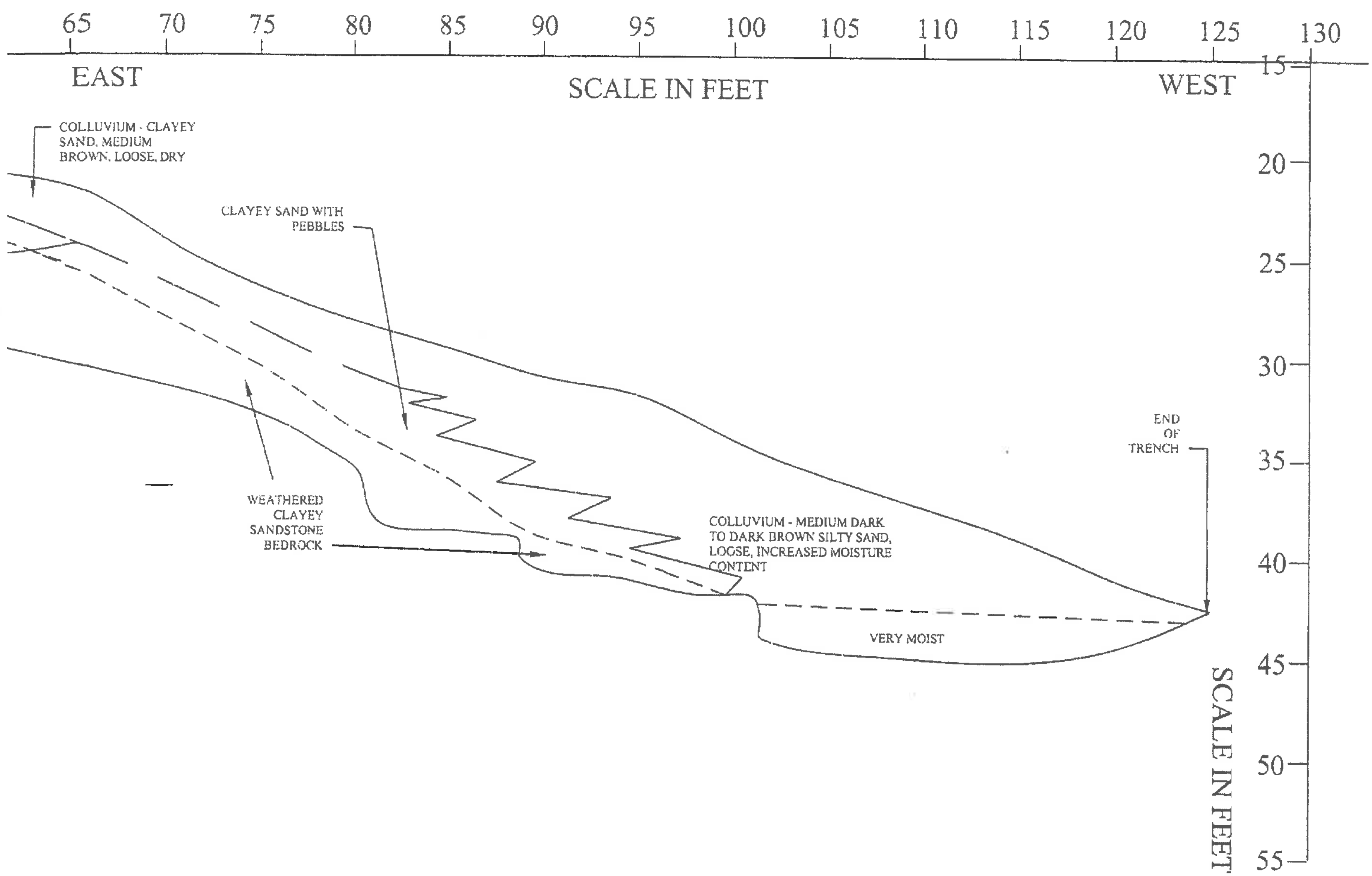
TRENCH T-7

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
12A

PROJECT
SL01493-2



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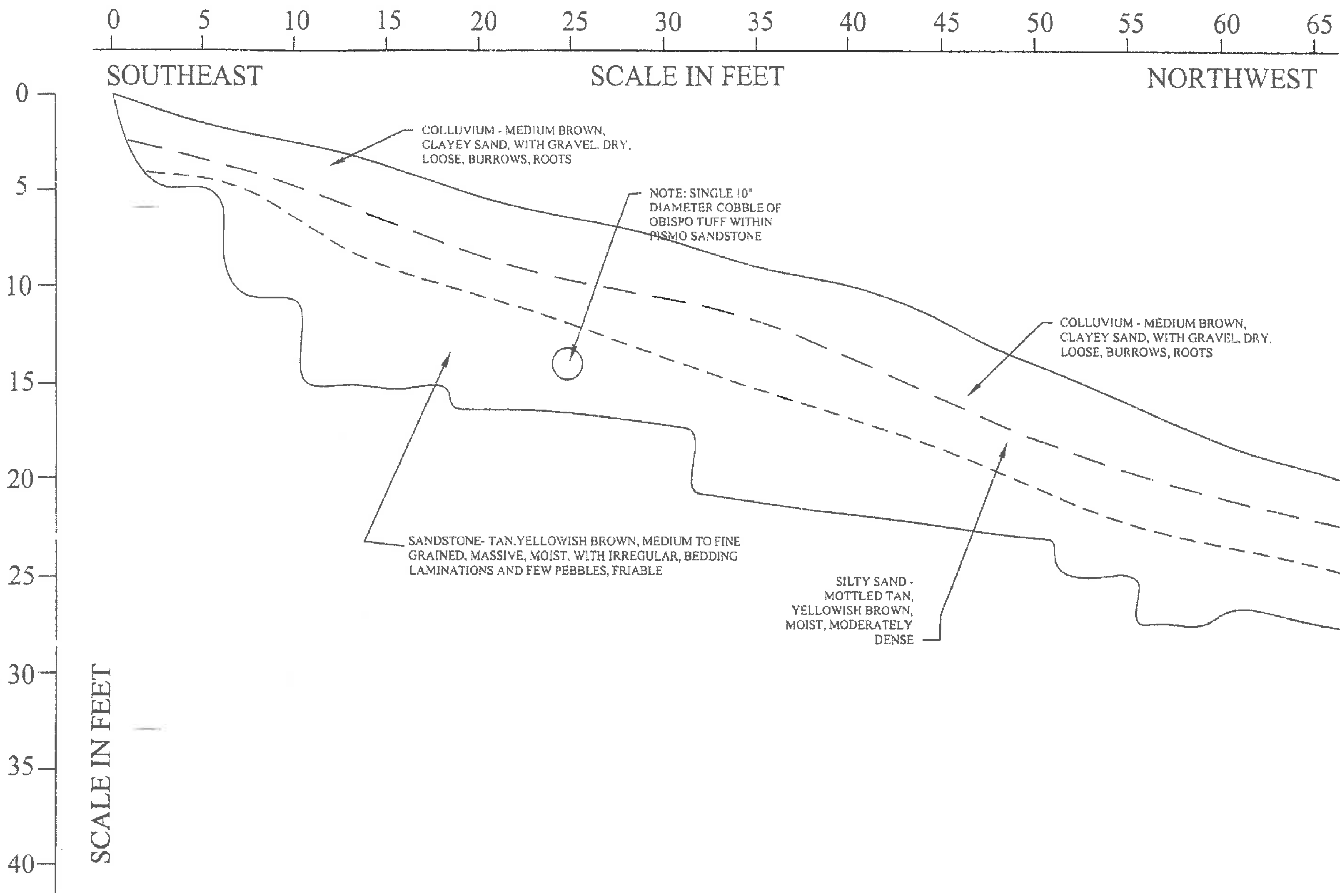
TRENCH T-7

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
12B

PROJECT
SL01493-2



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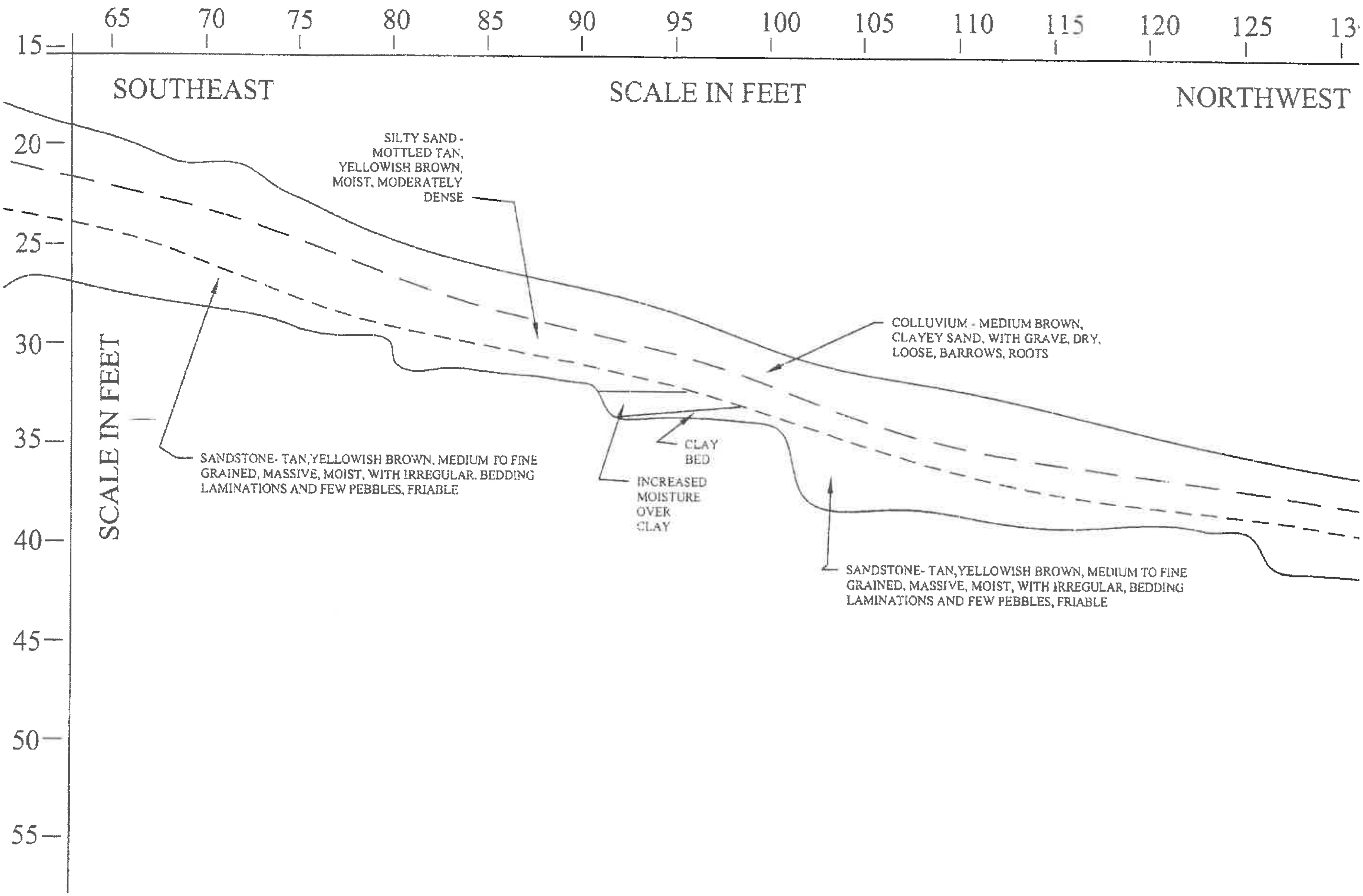
TRENCH T-8

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
13A

PROJECT
SL01493-2



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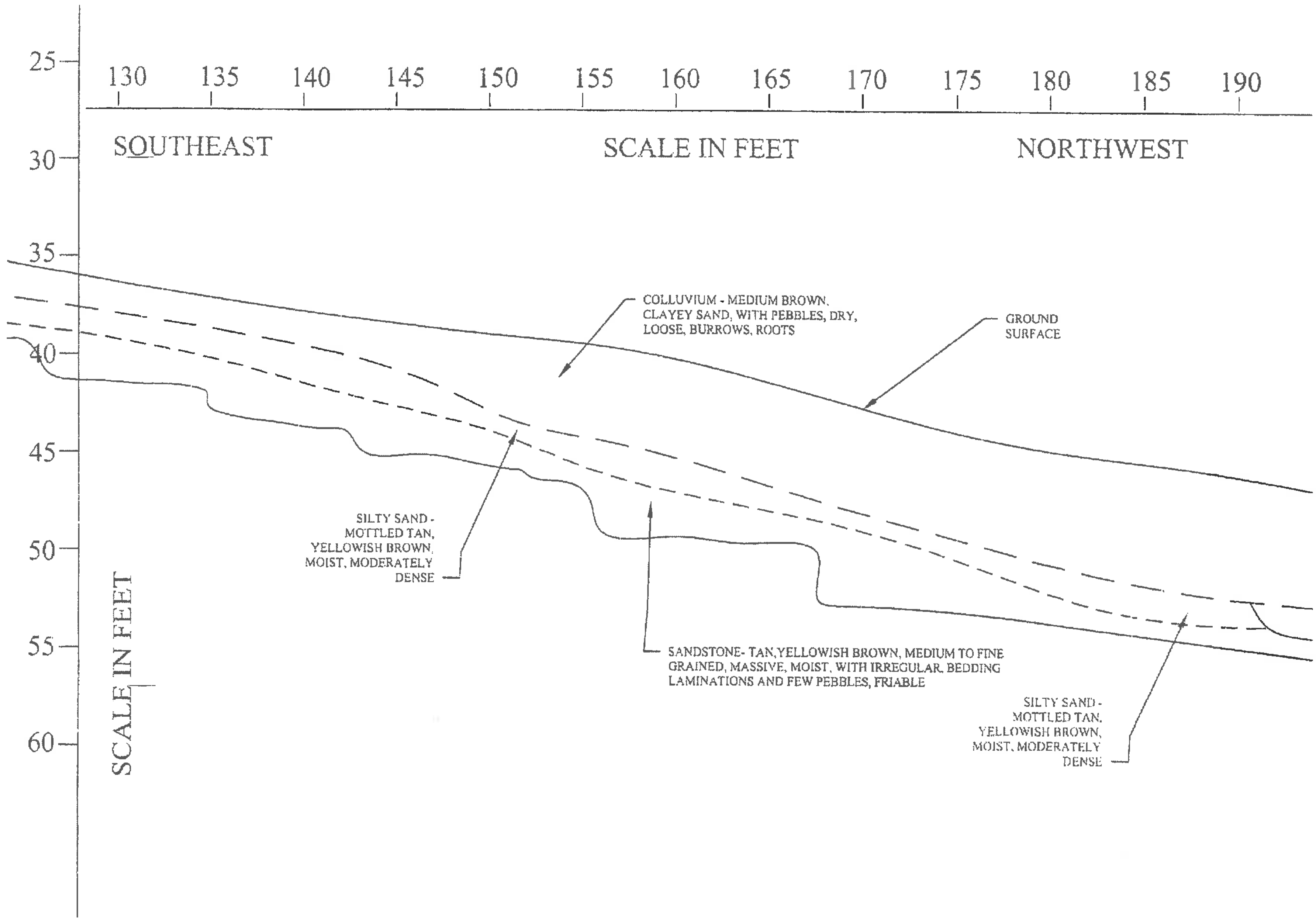
TRENCH T-8

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
13B

PROJECT
SL01493-2



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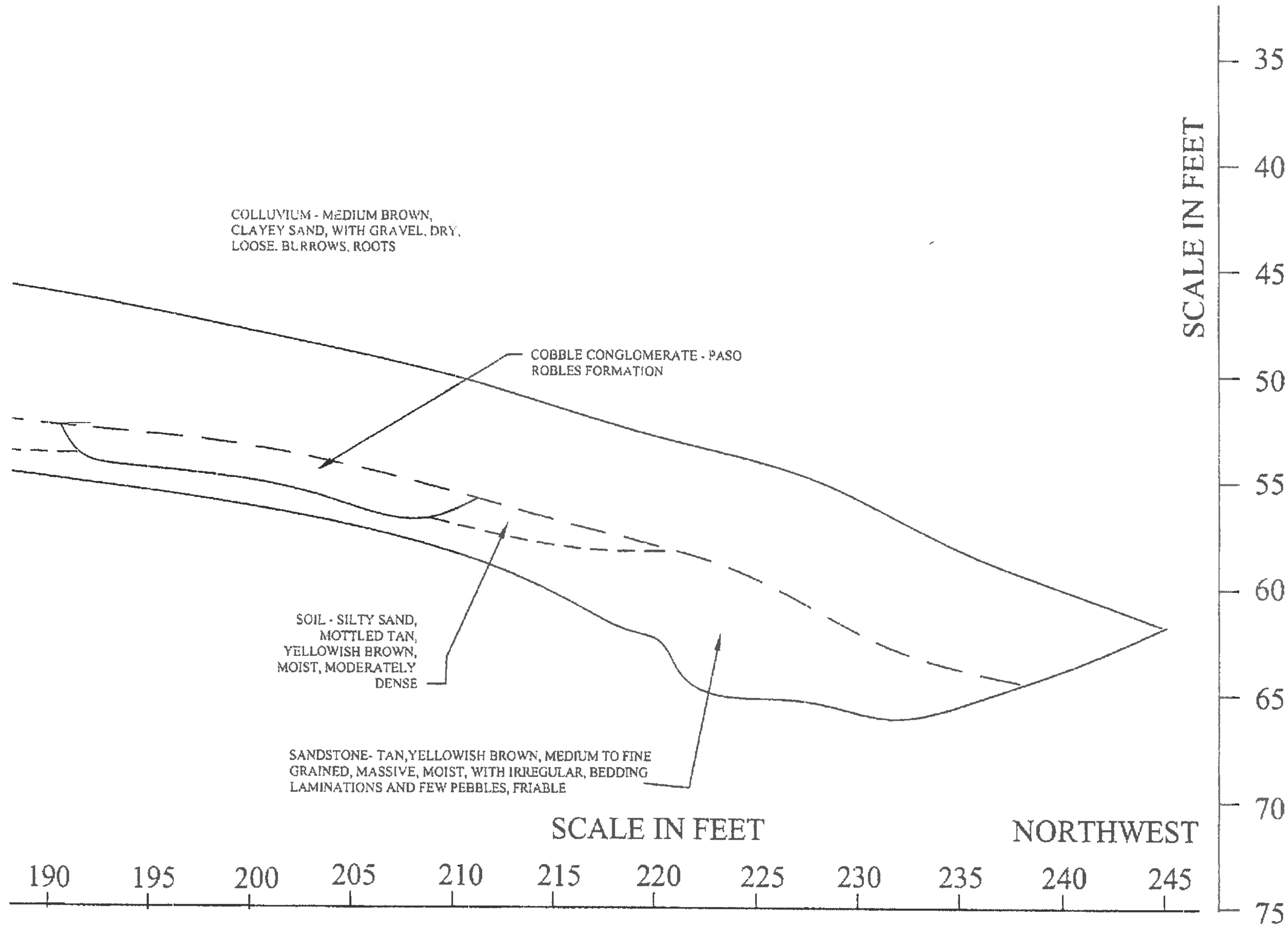
TRENCH T-8

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
13C

PROJECT
SL01493-2



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TRENCH T-8

JACK RANCH, CRESTMONT ROAD, EDNA RANCH
SAN LUIS OBISPO COUNTY, CALIFORNIA

FIGURE
13D

PROJECT
SL01493-2

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San Luis Obispo, CA 93401

PIEZOMETER LOG

BORING NO. **PZ-1**

JOB NO. **SL01493-5**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	Jack Ranch	DRILL RIG:	Mobile B61
DRILLING LOCATION:	See Figure 1	HOLE DIA.:	6 Inches
DATE DRILLED:	10/13/00	SAMPLING METHOD:	
LOGGED BY:	ND	HOLE ELEVATION:	

Depth of Groundwater: 31.5 feet — **BORING TERMINATED AT 38.5 FEET** —

DEPTH	SOIL DESCRIPTION	USCS	LITHOLOGY	TOP WATER	TOP WATER SYMBOL	WELL CROSS SECTION	WELL CASING MATERIAL DESCRIPTION
0 to -6	SANDY CLAY: Dark brown, slightly moist, stiff						PERFORATED PIPE: Perforated from 0-31.5 feet
-6 to -12	SAND: Dark brown, with clay, slightly moist, dense						
-12 to -19	SANDY CLAY: Dark brown, moist, very stiff to hard						

Depth scale: 0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19

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PIEZOMETER LOG

BORING NO. **PZ-1**
JOB NO. **SL01493-5**

Depth of Groundwater: 31.5 feet | **BORING TERMINATED AT 38.5 FEET** |

DEPTH	SOIL DESCRIPTION	USCS	LITHOLOGY	TOP WATER	TOP WATER SYMBOL		WELL CROSS SECTION	WELL CASING MATERIAL DESCRIPTION
-20	SANDY CLAY: Dark brown, moist, very stiff to hard, some rock chips at 20 feet							
-21								
-22								
-23								
-24								
-25								
-26	SANDY CLAY: Brown, with rock chips, slightly moist, hard							
-27								
-28								
-29								
-30								
-31								CAP: Bottom
-32								
-33								
-34	CLAY: Light brown, with silt, moist, hard							
-35								
-36								
-37								
-38								
-39								
-40								

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PIEZOMETER LOG

BORING NO. PZ-2

JOB NO. SL01493-5

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	Jack Ranch	DRILL RIG:	Mobile B61
DRILLING LOCATION:	See Figure 1	HOLE DIA.:	6 Inches
DATE DRILLED:	10/13/00	SAMPLING METHOD:	
LOGGED BY:	ND	HOLE ELEVATION:	

Depth of Groundwater: 34 feet — BORING TERMINATED AT 38.5 FEET —

DEPTH	SOIL DESCRIPTION	USCS	LITHOLOGY	TOP WATER	TOP WATER SYMBOL	WELL CROSS SECTION	WELL CASING MATERIAL DESCRIPTION
0 to -6.5	SAND: Dark brown, slightly moist						PERFORATED PIPE: Perforated casing from 0-38.5 feet
-6.5 to -21	SANDY CLAY: Light grayish brown, moist, firm						

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BORING LOG

BORING NO. **PZ-2**

JOB NO. **SL01493-5**

Depth of Groundwater: 34 feet | **BORING TERMINATED AT 38.5 FEET** |

DEPTH	SOIL DESCRIPTION	USCS	LITHOLOGY	TOP WATER	TOP WATER SYMBOL		WELL CROSS SECTION	WELL CASING MATERIAL DESCRIPTION
-20								
-21	SANDY CLAY: Light olive, moist							
-22								
-23								
-24								
-25								
-26								
-27								
-28								
-29								
-30								
-31								
-32								
-33								
-34								
-35								
-36								
-37								
-38								CAP: Bottom
-39								
-40								

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PERCOLATION LOG

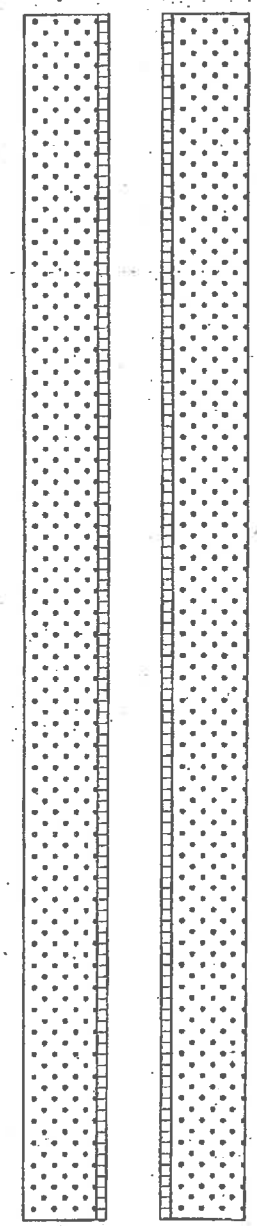
BORING NO. **PZ-1**
JOB NO. **SL01493-9**

PROJECT INFORMATION	DRILLING INFORMATION
PROJECT: **Jack Ranch**	DRILL RIG: **Mobile B61**
DRILLING LOCATION: **See Figure 2, Site Plan**	HOLE DIAMETER **6 Inches**
DATE DRILLED: **5/11/05**	SAMPLING METHOD:
LOGGED BY: **SL**	HOLE ELEVATION:

Depth of Groundwater: **Not Encountered** Boring Terminated At: **25 Feet**

DEPTH	SOIL DESCRIPTION	USCS	LITHOLOGY	ANNULAR MATERIAL DESCRIPTION	WELL CASING MATERIAL DESCRIPTION	WELL CROSS-SECTION
0 to -5	SILTY CLAY: black, slightly moist	CL		SAND	PVC SCREEN	
-5 to -13.5	SANDY SILTY CLAY: olive brown, slightly moist, with gravel at 10 feet	CL				
-13.5 to -19.5	SANDY SILTY CLAY: brown, with gravel, slightly moist	CL				
-19.5 to -21	SANDY SILTY CLAY: olive brown, slightly moist	CL				
-21 to -25	SANDY SILTY CLAY: light brown, slightly moist	CL				

Depth scale: 0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -20, -21, -22, -23, -24, -25



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PERCOLATION LOG

BORING NO. **PZ-2**
JOB NO. **SL01493-9**

PROJECT INFORMATION		DRILLING INFORMATION	
PROJECT:	Jack Ranch	DRILL RIG:	Mobile B61
DRILLING LOCATION:	See Figure 2, Site Plan	HOLE DIAMETER	6 Inches
DATE DRILLED:	5/11/05	SAMPLING METHOD:	
LOGGED BY:	SL	HOLE ELEVATION:	

Depth of Groundwater: Not Encountered   Boring Terminated At: 25 Feet   Page 6 of 6

DEPTH	SOIL DESCRIPTION	USCS	LITHOLOGY	ANNULAR MATERIAL DESCRIPTION	WELL CASING MATERIAL DESCRIPTION	WELL CROSS-SECTION
0 to -6	SILTY CLAY: black, slightly moist	CL		SAND	PVC SCREEN	
-6 to -12.5	SILTY SANDY CLAY: pale brown, moist	CL				
-12.5 to -17.5	SANDY SILTY CLAY: olive, with gravel	CL				
-17.5 to -21.5	SANDY SILTY CLAY: brown, with gravel, moist	CL				
-21.5 to -25	SILTY SANDY CLAY: reddish brown, moist	CL				

Depth scale: 0, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12, -13, -14, -15, -16, -17, -18, -19, -20, -21, -22, -23, -24, -25

Appendix F

San Luis Obispo County Airport Land Use Commission determination of consistency letter

STAFF REPORT
SAN LUIS OBISPO COUNTY AIRPORT LAND USE COMMISSION

DATE: FEBRUARY 15, 2017

TO: AIRPORT LAND USE COMMISSION (ALUC)

FROM: BRIAN PEDROTTI, COUNTY PLANNING AND BUILDING

REFERRING AGENCY: COUNTY OF SAN LUIS OBISPO
APPLICANT: ORCUTT BROAD LLC AND ERSKINE PROPERTY TRUST
COUNTY FILE NUMBER: S000323U/TR2429
PROJECT MANAGER: STEPHANIE FUHS

SUBJECT: A REFERRAL BY THE COUNTY OF SAN LUIS OBISPO (COUNTY) FOR A DETERMINATION OF CONSISTENCY OR INCONSISTENCY REGARDING A CONDITIONAL USE PERMIT (CUP) AND VESTING TENTATIVE TRACT MAP TO ALLOW THE JACK RANCH AGRICULTURAL CLUSTER SUBDIVISION FOR 13 LOTS, EACH ONE ACRE IN SIZE, ON A 299-ACRE PROPERTY.

LOCATION: THE 299-ACRE PROPERTY (APN: 044-081-040) IS LOCATED AT THE END OF HACIENDA AVENUE ON THE SOUTHEAST SIDE OF EDNA ROAD NEAR ITS INTERSECTION WITH LOS RANCHOS ROAD, AND IS IN WITHIN THE AGRICULTURE AND RURAL LANDS LAND USE CATEGORY. THE PROPOSED PROJECT IS LOCATED IN THE SAN LUIS OBISPO COUNTY AIRPORT LAND USE PLAN (ALUP) - AIRPORT SAFETY ZONE 2.

RECOMMENDATION:
Recommend a determination of consistency to the County of San Luis Obispo for the Conditional Use Permit and Vesting Tentative Tract Map to allow the Jack Ranch Agricultural Cluster Subdivision for 13 lots, each one acre in size, on a 299-acre property.

Finding(s):

a) The proposed project is consistent with General Land Use Policies, G-1 through G-3 because: all information required for review of the proposed local action was provided by the referring agency; the project (as conditioned) would not result in any incompatibilities to the continued economic vitality and efficient operation of the Airport with specific respect to safety, noise, overflight or obstacle clearance;

b) The proposed project is consistent with the Specific Land Use Policies for Noise because a portion of the area affected by the project or local action is located within the 50 dB CNEL airport noise contour and development of any extremely noise-sensitive uses such as residences are located outside of any airport noise contour;

c) The proposed project is consistent with the Specific Land Use Policies for Safety because the proposed development would not result in a density greater than specified in Table 7; the proposed development would not result in a greater building coverage than permitted by Table 7; and the proposed development would not result in high intensity land uses or special land use functions as conditioned;

d) The proposed project is consistent with the Specific Land Use Policies for Airspace Protection because the proposed development shall not include any structure, landscaping, glare, apparatus, or other feature, whether temporary or permanent in nature to constitute an obstruction to air navigation or a hazard to air navigation;

e) The proposed project is consistent with the Specific Land Use Policies for Overflight because the proposed development has been conditioned to record avigation easements for each property developed within the project area prior to the issuance of any building permit or minor use permit; and all owners, potential purchasers, occupants (whether as owners or renters), and potential occupants (whether as owners or renters) will receive full and accurate disclosure concerning the noise, safety, or overflight impacts associated with airport operations prior to entering any contractual obligation to purchase, lease, rent, or otherwise occupy any property or properties within the Airport Area; and

f) The proposed development within the project area will not exceed the maximum building coverage nor increase densities greater than what is allowed per Table 7 of the ALUP, because the square footage of the space and maximum number of people per acre do not surpass the requirements set by the ALUP.

PROJECT DESCRIPTION:
Proposal: 13-lot agricultural cluster subdivision
Setting: Rural, agricultural area
Existing Uses: Agriculture (planted vineyards)
Site Area: Approximately 299 acres

DISCUSSION:
Agricultural Cluster Subdivision Proposal
The applicant has submitted a proposal for a Conditional Use Permit and Vesting Tentative Tract Map to allow the Jack Ranch Agricultural Cluster Subdivision for 13 lots, each one acre in size, on a 299-acre property. Remaining land would be retained in vineyards (160 acres) and natural open space (approximately 122 acrs).

Setting/Existing Uses/Site Area
The project site consist of one parcel totaling 299 acres located at the end of Hacienda Avenue on the southeast side of Edna Road near its intersection with Los Ranchos Road, and is in within the Agriculture and Rural Lands land use categories. The majority of the site consists of planted vineyards, with scattered oaks and some riparian area. Surrounding land uses include: agricultural land to the south and west; single-family residences to the north and east; and a golf course and single-family residences to the east.

Airport Land Use Plan Applicability
The project site is located within Airport Land Use Plan Aviation Safety Area S-2, and is over one nautical mile from the San Luis Obispo County Regional Airport (SBP) active runway 11-29. A small portion of the project site is within the 50 dB Airport Land Use Plan Noise Contour, as shown on ALUP Figure 1 (Airport Noise Contours).

ALUP 4.3 Specific Land Use Policies: Noise
The proposed project is consistent with the objective of the ALUP noise policies to minimize the number of people exposed to frequent and/or high levels of airport noise or to frequent and/or high cumulative noise levels of which airport noise is one component. The proposed residential development is a compatible use, because it involves few people and is located outside of any airport noise contour.

ALUP 4.4 Specific Land Use Policies: Safety
The proposed project is located within Safety Area S-2 and is consistent with the objective of the ALUP safety policies to minimize the risk to the safety and property of persons on the ground associated with potential aircraft accidents and to enhance the chances for survival of the occupants involved in an accident which takes place beyond the immediate runway environment. The proposed residential use is a compatible use, because no aviation safety risk have been identified; the number of people on the ground will be

limited; potential severity of an aviation-related incident has been reduced because the use will have a limited number of people; the project does not include features that could substantially contribute to the severity of an aircraft accident.

ALUP 4.5 Specific Land Use Policies: Airspace Protection
The proposed project is consistent with the airspace protection policies of the ALUP to minimize the risk of potential aircraft accidents in the vicinity of the Airport by avoiding the development of land uses and land use conditions which pose hazards to aircraft in flight. The proposed project does not pose an obstruction to the air navigation because the height of future development is limited by County ordinance and will not exceed 35 feet above ground level (AGL), and the project site is located within the Horizontal Airport Imaginary surface.

ALUP 4.6 Specific Land Use Policies: Overflight
The proposed project is consistent with the overflight policies of the ALUP to ensure that potential and prospective airport area land users are provided with sufficient information on the presence and activity of the Airport and associated noise and safety impacts in order for them to make an informed decision as to whether or not they wish to live and/or work in the Airport area. The subject property is located within several established flight paths shown on Figure 10, but will have a very low density of residential use.

ALUP 5.3 Land Use Compatibility Table
Based on review of the ALUP Section 5.3 Land Use Compatibility Table: 1) "Single-family residential" is an Allowed land use in S-2; and 2) Single-family residential within Aviation Safety Area S-1b is designated R8 (land use is Allowed provided the maximum residential density of use is limited to the values presented in ALUP Table 7 Figure 6).

ALUP Table 7 – Density Adjustment
Based on review of the ALUP Table 7 (Planning Requirements and density adjustments for Land Uses within the Aviation Safety Areas for the San Luis Obispo County Regional Airport): 1) the maximum building coverage (% of gross area) is 20 percent for Airport Safety Area S-2; 2) the maximum density of residential development is 6 persons/acre for Airport Safety Area S-2; and 3) Special Function and High Intensity Land Uses are not allowed within the Airport Safety Area S-2.

Density and Building Coverage Calculations
The applicant's requested density for the proposed agricultural cluster subdivision is based on 299 gross acres. Based on ALUP Table 7, a maximum residential density of up to 6 persons per acre is allowed.

Maximum Residential density:

*299 gross acres x 6 person per acre = **1,794 persons total***

Maximum Building Coverage:

*299 gross acres x 20% = **59.8 acres***

Conditions of Approval to be incorporated into any use permit(s) for development:

1. All tall structures shall be reviewed by the Air Traffic Division of the FAA regional office having jurisdiction over San Luis Obispo County to determine compliance with the provisions of FAR Part 77. In addition, applicable construction activities must be reported via FAA Form 7460-1 at least 30 days before proposed construction or application for building permit.

2. No structure, landscaping, apparatus, or other feature, whether temporary or permanent in nature shall constitute an obstruction to air navigation or a hazard to air navigation, as defined by the ALUP.

3. Any use is prohibited that may entail characteristics which would potentially interfere with the takeoff, landing, or maneuvering of aircraft at the Airport, including:

    - creation of electrical interference with navigation signals or radio communication between the aircraft and airport;
    - lighting which is difficult to distinguish from airport lighting;
    - glare in the eyes of pilots using the airport;
    - uses which attract birds and create bird strike hazards;
    - uses which produce visually significant quantities of smoke; and
    - uses which entail a risk of physical injury to operators or passengers of aircraft (e.g., exterior laser light demonstrations or shows).

4. Avigation easements will be recorded for each property developed within the area included in the proposed local action prior to the issuance of any building permit or conditional use permit; and

5. All owners, potential purchasers, occupants (whether as owners or renters), and potential occupants (whether as owners or renters) will receive full and accurate disclosure concerning the noise, safety, or overflight impacts associated with airport operations prior to entering any contractual obligation to purchase, lease, rent, or otherwise occupy any property or properties within the airport area.

EXHIBITS:
Ex.1: Project Graphics

Appendix G

Noise measurement data and Federal Highway Administration (FHWA) Highway Traffic Noise Prediction Model (1978) assumptions and output

Noise Measurement #1 Data

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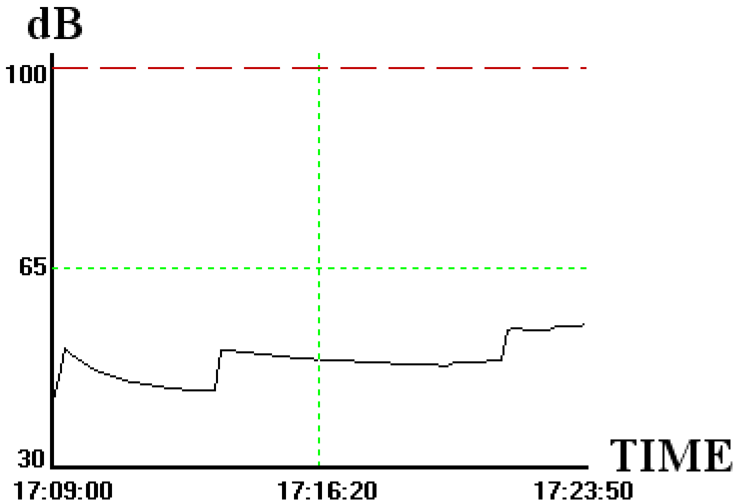
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L(50)	48.6	48.6	48.5	48.5	48.5	48.5	48.4	48.4	48.4
L(60)	48.3	48.2	48.2	48.1	48.1	48.1	48.1	48.1	48.0
L(70)	47.9	47.9	47.6	47.1	46.7	46.3	46.3	45.9	45.6
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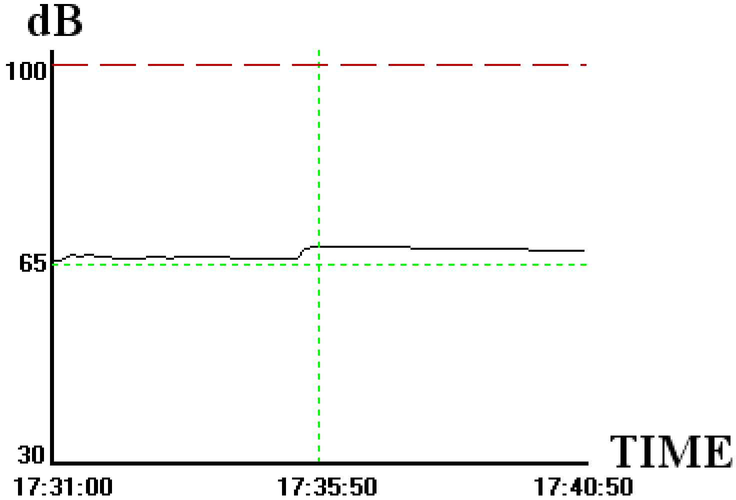
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L(30)	67.8	67.8	67.8	67.7	67.7	67.7	67.6	67.6	67.6
L(40)	67.5	67.5	67.5	67.5	67.4	67.4	67.4	67.4	67.4
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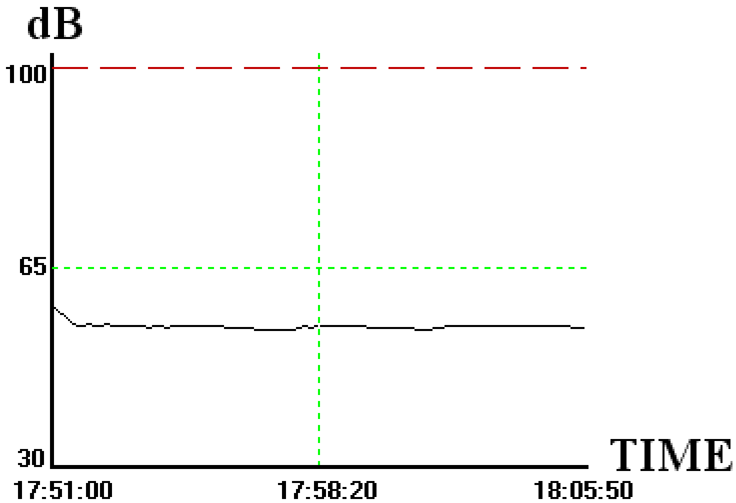
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L(20)	54.8	54.8	54.8	54.8	54.8	54.8	54.8	54.8	54.8
L(30)	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7
L(40)	54.7	54.7	54.7	54.7	54.7	54.6	54.6	54.6	54.6
L(50)	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6	54.6
L(60)	54.6	54.6	54.6	54.5	54.5	54.5	54.5	54.5	54.5
L(70)	54.5	54.5	54.4	54.4	54.4	54.4	54.4	54.4	54.4
L(80)	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.2
L(90)	54.2	54.2	54.2	54.2	54.1	54.1	54.1	54.0	54.0

TABLE G-1

Calculations and Assumptions for Noise Model Traffic Input data SR 227

Street Segment	ADT
SR 227	
NW of Crestmont Dr.	18900
bet. Crestmont Dr. and Los Ranchos Rd.	16900
bet. Los Ranchos Rd. and Biddle Ranch Rd.	13800
south of Biddle Ranch Rd.	13000
north of Price Cn Rd.	12300
Los Ranchos Rd., north of Greystone Pl.	3900
Project ADT (13 lots x 12 ADT/lot)	156

ADT = Average Daily Traffic

MT = Medium duty trucks (3 axle or less)	4%	for this location
HT = Heavy duty trucks (4 or more axles)	5%	for this location

References:

Caltrans 2015. Traffic Volumes: Annual Average Daily Traffic. Division of Traffic Operations, California Department of Transportation, Sacramento, CA. Obtained June 2017 at: http://www.dot.ca.gov/trafficops/census/

2015. Truck Traffic: Annual Average Daily Truck Traffic. Obtained June 2017 at same reference.

FHWA. December 1978. FHWA Highway Traffic Noise Prediction Model. Report No. FHWA-RD-77-108, Prepared by T.M. Barry and J.A. Reagan, Federal Highway Administration, Office of Research, Office of Environmental Policy, Washington, D.C. Note: This printed report is generally not available, since its replacement by the later TNM 2.5. Obtained July 2017 at: https://ntl.bts.gov/lib/57000/57600/57638/fhwahighwaytraff00barr.pdf

TABLE G-2

FHWA Noise Model Calculations and Results

Roadway	Location	ADT	Ldn (dBA) @ 50 Feet	Ldn (dBA) @ 100 Feet	From Roadway Centerline Distance (feet) to 70 Ldn Contour	Distance (feet) to 65 Ldn Contour	Distance (feet) to 60 Ldn Contour	Distance (feet) to 55 Ldn Contour	Assumptions for: % Autos	% MT	% HT	Daytime Auto/hr	MT/hr	HT/hr	Nighttime Auto/hr	MT/hr	HT/hr	Speed
SR 227	n/o Price Cn Rd. to Buckley Rd. (max. AADT)	19,000	73.5	70.5	85	184	396	854	91.0%	4.0%	5.0%	980	43	54	288	13	16	45
Los Rn.	Los Ranchos Rd., n/o Greystone Pl.	3,900	59.2	56.2		(within roadway)		96	97.9%	2.0%	0.1%	216	4	0	64	1	0	30
	With Project:	4,056	59.4	56.4		(within roadway)		98	97.9%	2.0%	0.1%	225	5	0	66	1	0	30
	Project alone	160	47.7	44.7		(within roadway)			98.0%	1.0%	1.0%	9	0	0	3	0	0	35

Notes:

1. AADT and truck % from input data.
   Actual ADT values range from a low of 12,300 up to 18,900. For worst case analysis, a single value of 19,000 is used here

2. Assumptions for Daytime-Nighttime Splits:

Daytime = 7:00 a.m. to 10:00 p.m. 15 hours and 85% of ADT
Nighttime = 10:00 p.m to 7:00 a.m. 9 hours and 15%

3. REMLS are Reference Energy Mean Levels for each vehicle class.
4. California Vehicle Noise Levels (Calveno) were used for REMLS.
5. For Heavy Trucks, if the speed is lower than 35 mph, then the REMLS equation must be adjusted
   Use 80 dBA for 31-35 mph,
   51.9+19.2*log(speed, mph) for 25 to 31 mph

speed	HTREML
30	80.3

6. Truck Traffic data (% for Medium Trucks and Heavy Trucks) is from Caltrans data (on input data sheet).

7. These calculations use the FHWA Highway Traffic Noise Prediction Model, FHWA-RD-77-108.
   The estimates of distances to Ldn contours are considered accurate out to about 200 m or 600 feet
8. A drop off rate of 4.5 dBA per doubling of distance is used in calculating distance to Ldn contours.

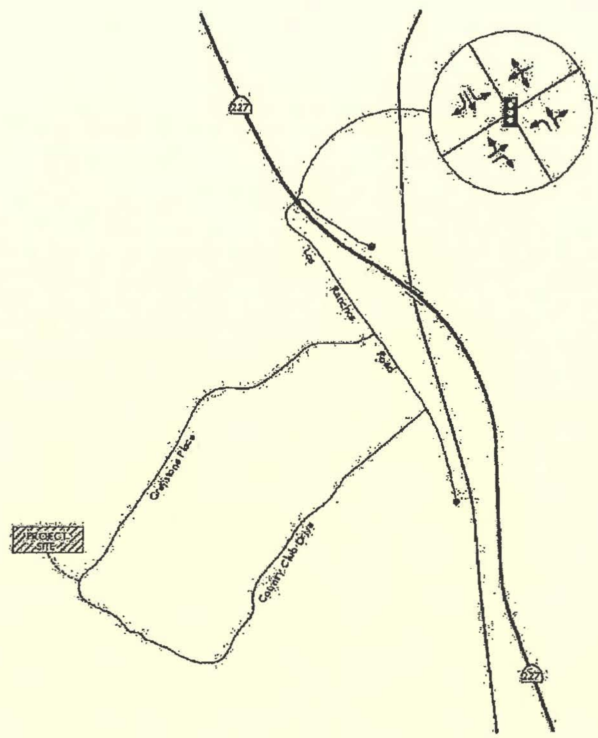
NOTE: The distance from the nearest lots in Jack Ranch (Lots 1 and 7) to SR 227 is over 5,000 feet.
The resulting noise levels and Ldn values from SR 227 would be approx. 53 dBA

Appendix H

Updated Traffic and Circulation Study

JACK RANCH SUBDIVISION (TENTATIVE TRACT MAP 2429)
SAN LUIS OBISPO COUNTY, CALIFORNIA

UPDATED TRAFFIC AND CIRCULATION STUDY



June 21, 2016 | **ATE Project #15053.01**

Prepared for:

John Wilson
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Since 1978

Richard L. Pool, P.E.
Scott A. Schell, AICP, PTP

June 21, 2016

John Wilson
P.O. Box 510
Paso Robles, CA 93447

UPDATED TRAFFIC AND CIRCULATION STUDY FOR THE JACK RANCH SUBDIVISION PROJECT, COUNTY OF SAN LUIS OBISPO, CALIFORNIA

Associated Transportation Engineers has prepared the following updated traffic and circulation study for the Jack Ranch Subdivision Project (Tentative Tract Map 2429), proposed in San Luis Obispo County. ATE previously prepared a traffic study for the project in July 2015, which assessed impacts related to 16 single family residences. The updated study assesses impacts related to 13 single family residences. It is our understanding that the traffic study will be submitted to the County for environmental review.

We appreciate the opportunity to assist you with the project.

Associated Transportation Engineers

Richard L. Pool, PE
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
RICHARD L. POOL
C 18030
CIVIL
STATE OF CALIFORNIA

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INTRODUCTION

The following report contains an analysis of the potential traffic and circulation impacts associated with the Jack Ranch Subdivision Project (the "Project"). ATE prepared a traffic study for the Project in July 2015, which assessed impacts related to 16 single family residences. The updated study assesses impacts related to 13 single family residences and includes updated traffic counts and updated cumulative forecasts. Potential impacts are assessed based on County thresholds. Mitigation measures are recommended where required.

PROJECT DESCRIPTION

The Project site is located on the northwest side of Greystone Place approximately one-half mile south of Los Ranchos Road, south of the City of San Luis Obispo. Figure 1 shows the Project site location. The Project is proposing to subdivide the property and construct 13 single-family residences. Figure 2 shows the Project site plan. Access to the Project site would be provided via a new roadway connection to Greystone Place. The on-site road for the new neighborhood would be built to County standards, but would be gated and privately maintained. Emergency access would be provided via two private roads that connect to the Rolling Hills neighborhood located northeast of the Project site.

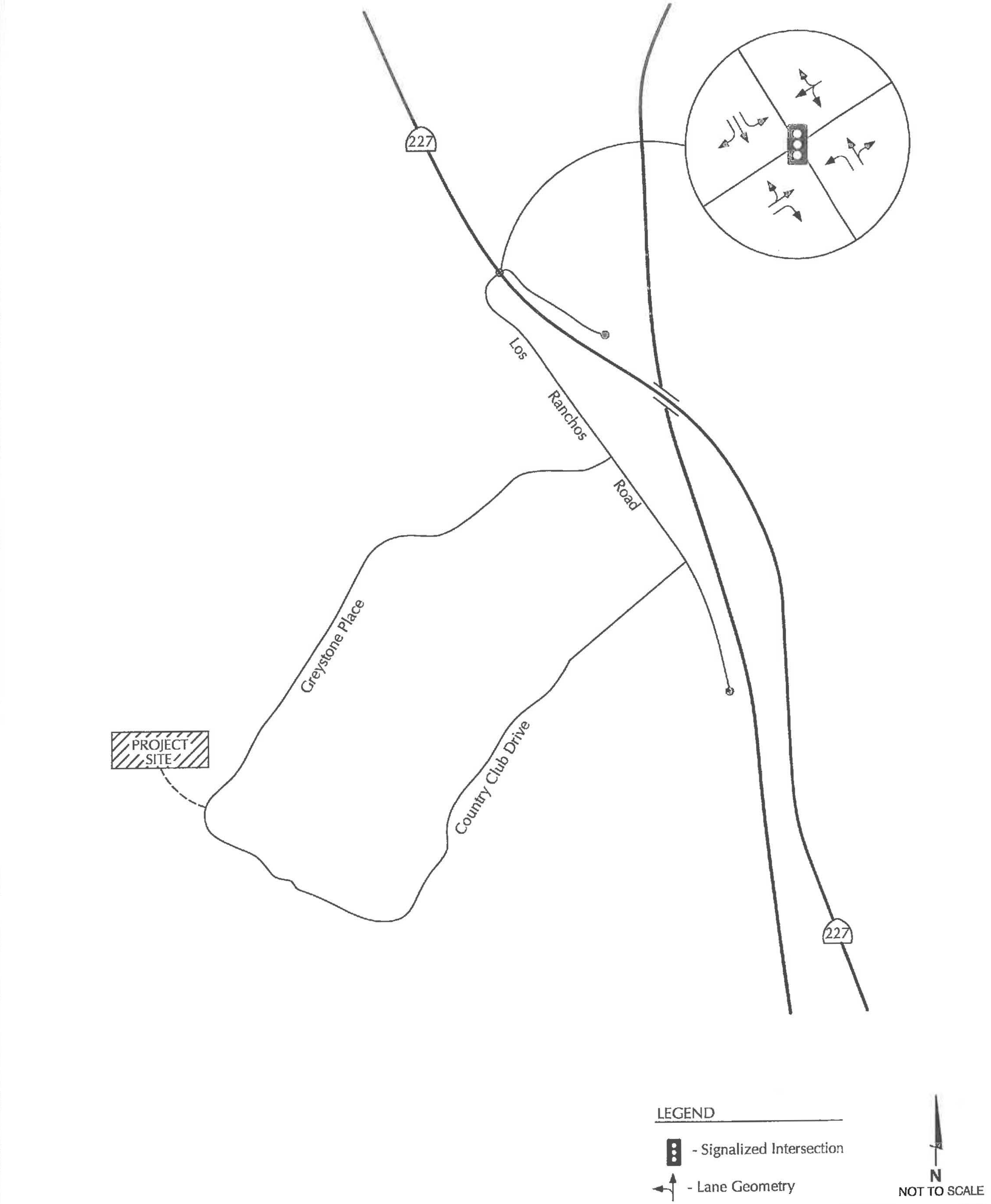
IMPACT THRESHOLDS

County of San Luis Obispo impact thresholds were used to assess the significance of the traffic generated by the Project. The County has adopted a minimum standard of LOS C for roadways and intersections in rural areas.

EXISTING CONDITION

Street Network

The Project site is served by a network of rural roadways, as illustrated on Figure 1. The following text provides a brief discussion of major components of the study-area roadway network.



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PROJECT SITE LOCATION/EXISTING STREET NETWORK

FIGURE 1

EKM - #15053.01

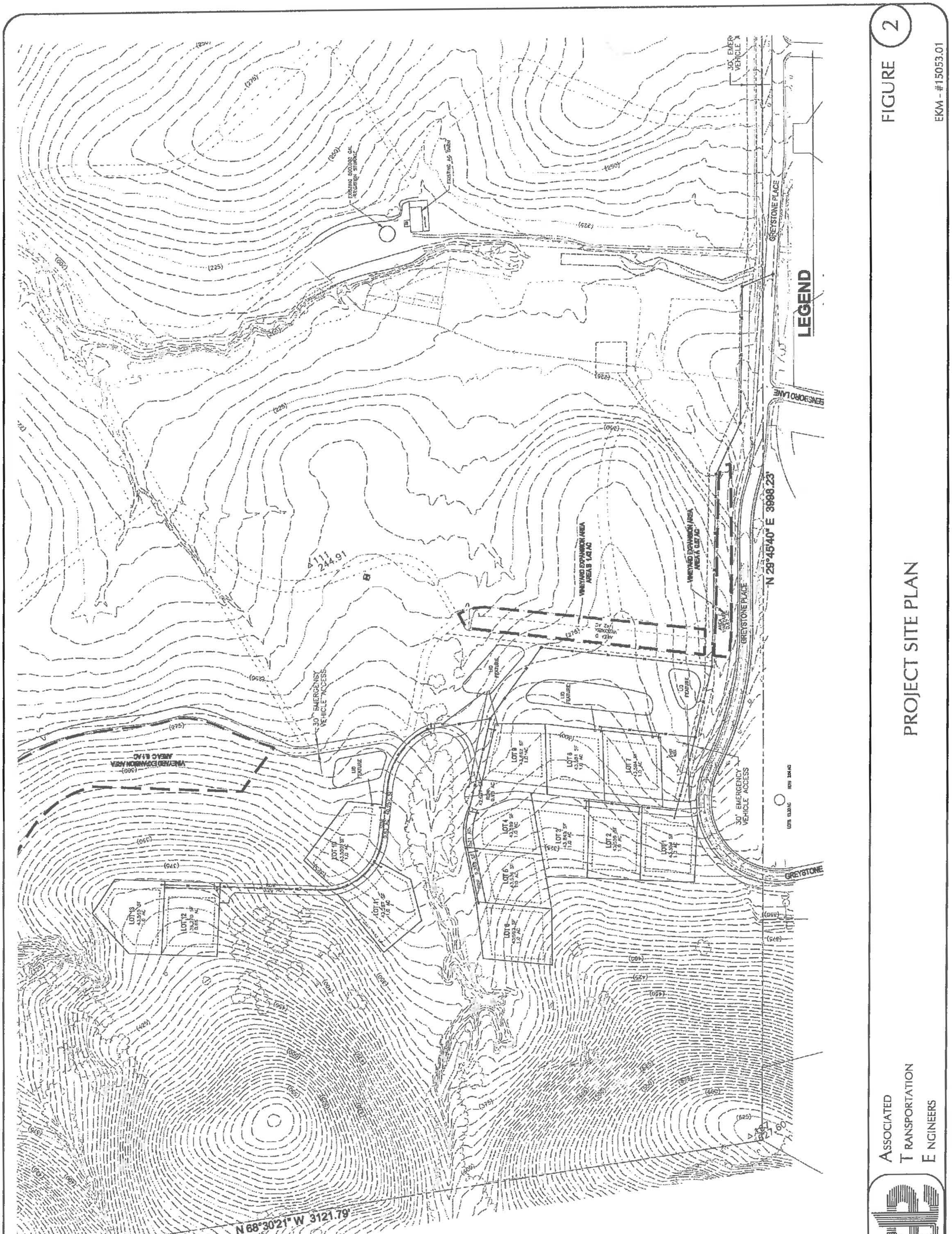


FIGURE 2
PROJECT SITE PLAN

State Route (SR) 227 is a fourteen-mile long rural arterial road that extends north from U.S. 101 in the City of Arroyo Grande to the U.S. 101 interchange at Madonna Road in the City of San Luis Obispo. This roadway primarily serves local and commuter traffic between the Five Cities area and San Luis Obispo. Within the study-area, SR 227 (also known as Edna Road) contains two 12-foot travel lanes and 8-foot shoulders. The SR 227 intersection at Los Ranchos Road is controlled by traffic signals.

Los Ranchos Road is a two-lane collector road with 6-foot shoulders and sidewalks between SR 227 and Country Club Drive. The road narrows and continues for about 1,200 feet south of Country Club Drive, where it serves residential and agricultural uses.

Greystone Place is a private two-lane local road that extends west from Los Ranchos Road and through the San Luis Obispo Golf & Country Club. Primary access to the Project site would be provided via a new roadway connection to Greystone Place.

Roadway Operations

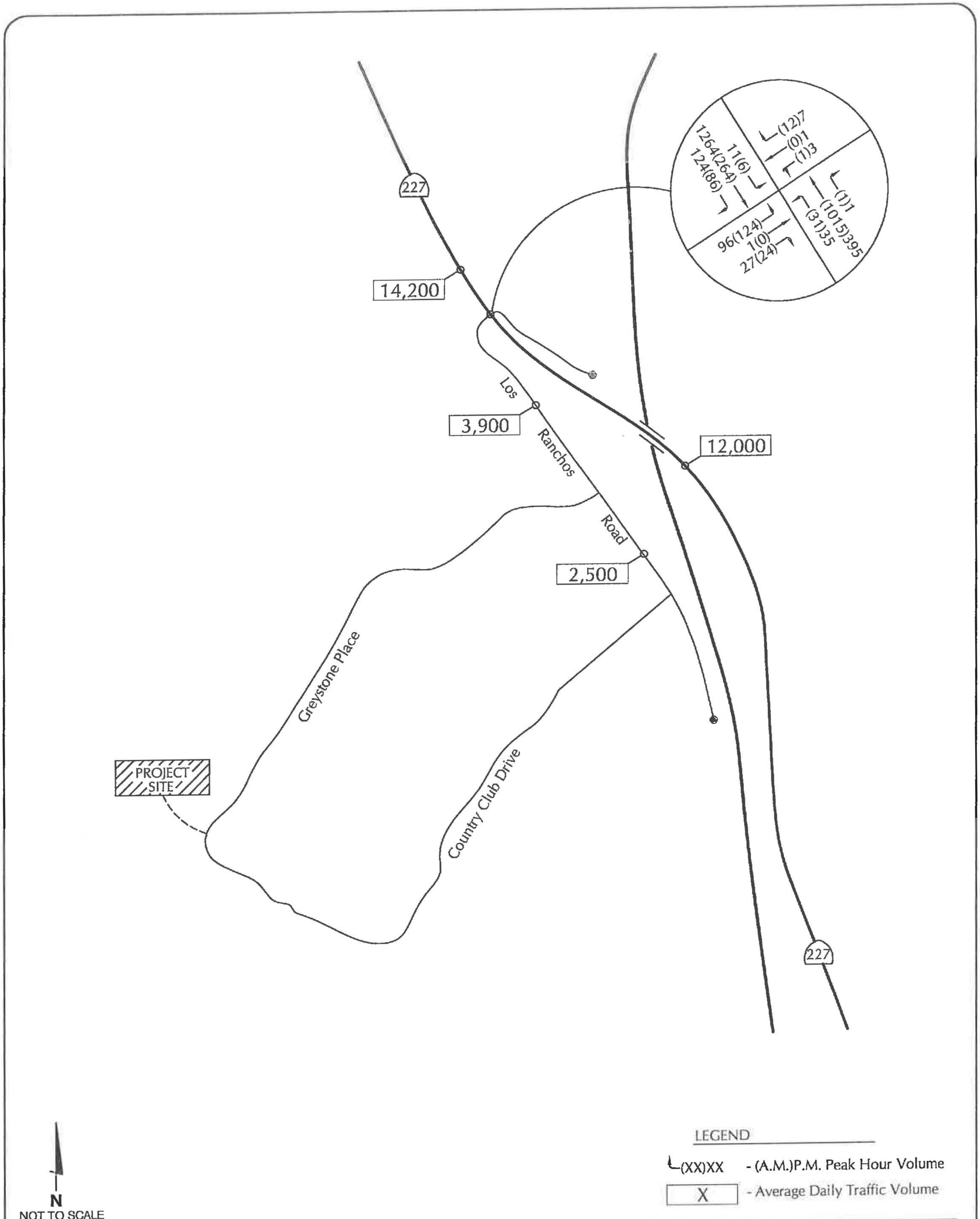
Existing average daily traffic (ADT) volumes for the study-area roadways are shown on Figure 3. The ADT volumes on SR 227 were obtained from Caltrans[1] and the ADT volumes on the local roads were collected in July 2015 for this study (traffic counts are contained in the Technical Appendix for reference). Existing levels of service were evaluated for the study-area roadway segment using standard engineering design capacities, which are summarized in the Technical Appendix. Table 1 summarizes the Existing operations for the study-area roadways.

Table 1
Existing Roadway Operations

Roadway Segment	Roadway Classification	Capacity	Existing ADT	LOS
SR 227 n/o Los Ranchos Road	2-Lane Arterial	20,000	14,200	LOS C
SR 227 s/o Los Ranchos Road	2-Lane Arterial	20,000	12,900	LOS B
Los Ranchos Road n/o Greystone Place	2-Lane Collector	11,800	3,900	LOS A
Los Ranchos Road s/o Greystone Place	2-Lane Collector	11,800	2,500	LOS A

Table 1 shows that the study-area roadway currently operate at LOS C or better, which meet the County's LOS C standard for rural areas.

1 Traffic Volumes on State Highways, State of California Department of Transportation, 2014.



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EXISTING TRAFFIC VOLUMES

FIGURE 3

EKM - #15053.01

Intersection Operations

Since traffic flow on roadway networks is most restricted at intersections, detailed traffic impact analyses examine operating conditions of critical intersections during peak travel periods. Figure 3 illustrates the Existing A.M. and P.M. peak hour traffic volumes at the SR 227/Los Ranchos Road intersection. The peak hour volumes were collected in 2015 for this study (traffic count data is included in the Technical Appendix). Pursuant to County criteria, levels of service were calculated for the intersection using the operations methodology outlined in the Highway Capacity Manual (HCM).[2] Existing levels of service are shown in Table 2.

Table 2
Existing Intersection Operations

Intersection	Delay / LOS	
	A.M. Peak Hour	P.M. Peak Hour
SR 227/Los Ranchos Road	19.3 Sec./LOS B	21.2 Sec./LOS C

Table 2 shows that the SR 227/Los Ranchos Road intersection currently operates at LOS B during the A.M. peak hour and LOS C during the P.M. peak hour, which meet the County's adopted LOS C standard for rural intersections.

PROJECT-SPECIFIC IMPACT ANALYSIS

Project Trip Generation

Trip generation estimates were calculated for the Project using the Single-Family Detached Housing rates (Land Use Code #210) published in the Institute of Transportation Engineers (ITE) Trip Generation Report.[3] The results of the trip generation calculations are presented in Table 3.

Table 3
Project Trip Generation

Land Use	Size	ADT		A.M. Trips		P.M. Trips	
		Rate	Trips	Rate	Trips	Rate	Trips
Single-Family Residential	13 DU	9.52	124	0.75	10	1.00	13

2 Highway Capacity Manual, Transportation Research Board, 2010.

3 Trip Generation, Institute of Transportation Engineers, 9th Edition, 2012.

The data presented in Table 3 show that the Project would generate 124 ADT, with 10 trips occurring during the A.M. peak hour and 13 trips occurring during the P.M. peak hour.

Project Trip Distribution and Assignment

Project-generated traffic was distributed onto the study-area roadway system based on the Existing traffic volume patterns observed at the SR 227/Los Ranchos Road intersection. The Project trip distribution pattern is shown in Table 4. The trip distribution percentages and assignment of Project traffic on the study-area street network are illustrated on Figure 4.

Table 4
Project Trip Distribution

Route	Origin/Destination	Percentage
SR 227	North South	80% 20%

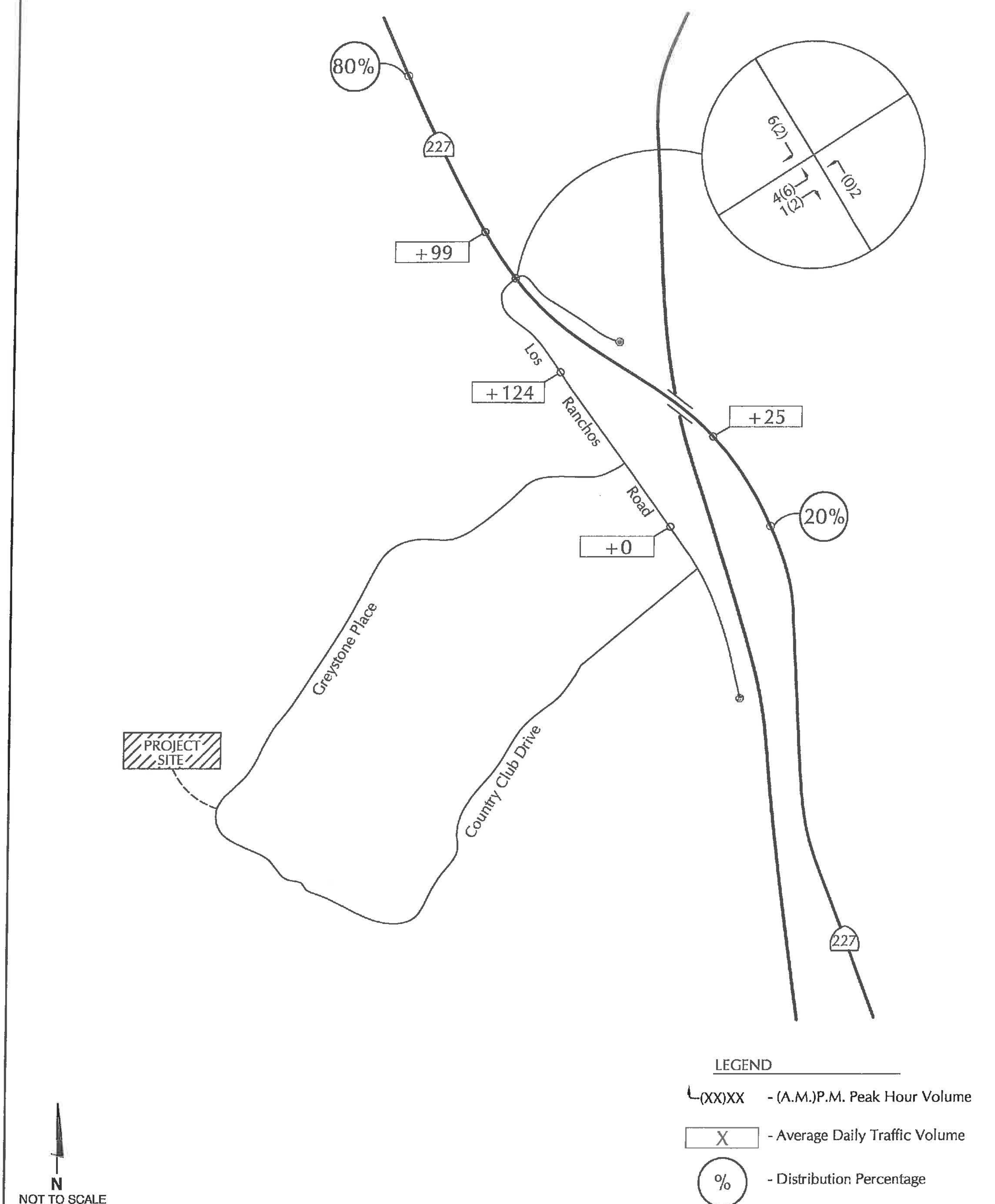
Existing + Project Roadway Operations

The operational characteristics of the key roadways were analyzed assuming the Existing + Project ADT volumes shown on Figure 5. Existing and Existing + Project roadway operations are compared in Table 5.

Table 5
Existing + Project Roadway Operations

	Existing		Existing + Project	
Roadway Segment	ADT	LOS	ADT	LOS
SR 227 n/o Los Ranchos Road	14,200	LOS C	14,299	LOS C
SR 227 s/o Los Ranchos Road	12,000	LOS B	12,025	LOS B
Los Ranchos Road n/o Greystone Place	3,900	LOS A	4,024	LOS A
Los Ranchos Road s/o Greystone Place	2,500	LOS A	2,500	LOS A

As shown in Table 5, the study-area roadways are forecast to continue to operate at LOS C or better with Existing + Project traffic, which meet the County's LOS C standard for rural roads. Thus, the Project would not generate significant roadway impacts based on County thresholds.



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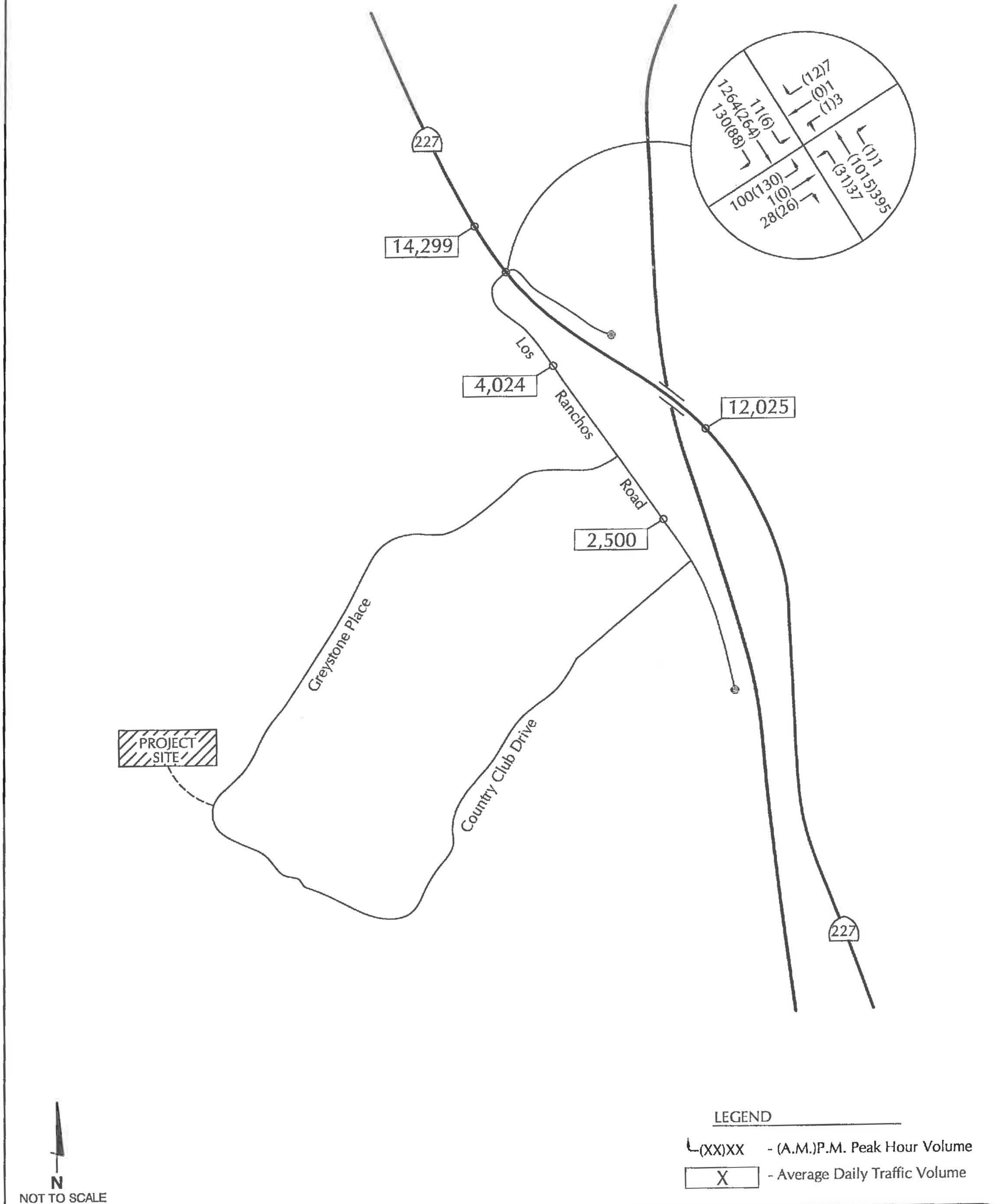
PROJECT TRIP DISTRIBUTION AND ASSIGNMENT

FIGURE 4

EKM - #15053.01



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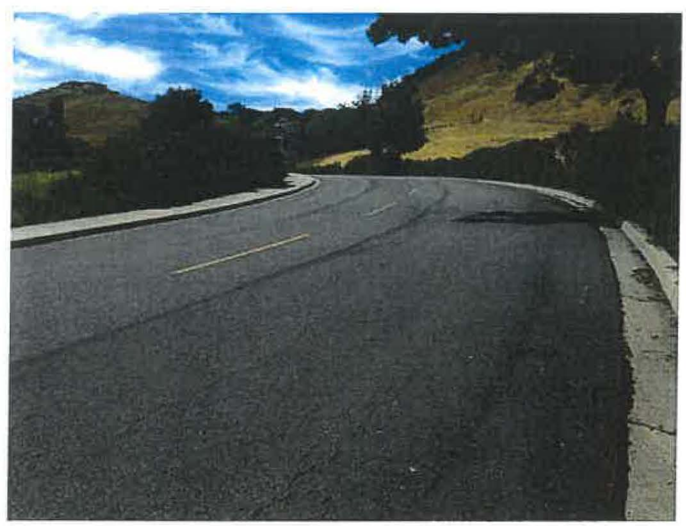
EXISTING + PROJECT TRAFFIC VOLUMES

FIGURE 5

EKM - #15053.01

DRIVEWAY SIGHT DISTANCE

SIGHT DISTANCE TO EAST



SIGHT DISTANCE TO WEST

ASSOCIATED TRANSPORTATION ENGINEERS

GREYSTONE DRIVE SIGHT DISTANCES

FIGURE 6

EKM - #15053.01

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ENGINEERS

EMERGENCY ACCESS ROUTES

FIGURE 7

EKM - #15053.01

Provision of the emergency access connections between the Jack Ranch site and the Rolling Hills neighborhood would enhance the emergency access routing for both neighborhoods. In the event of an emergency where the Crestmont Drive connection to SR 227 is blocked, the Rolling Hills residents would be able access the emergency routes through the Jack Ranch site and exit to SR 227 through the San Luis County Club subdivision. Conversely, in the event of an emergency where the Los Ranchos Road connection to SR 227 is blocked, the San Luis Country Club residents would be able access the emergency routes through the Jack Ranch site and exit to SR 227 through the Rolling Hills subdivision.

CUMULATIVE IMPACT ANALYSIS

Traffic Forecasts

Cumulative traffic volumes were forecasted assuming construction of approved and pending projects within the study-area. County staff provided a list of the cumulative projects for the traffic analysis. Traffic was estimated for the cumulative projects by applying the trip generation rates published in the ITE Trip Generation manual. The resulting traffic estimates were then assigned to the study-area street network. Those volumes were then added to the Existing traffic volumes to produce the Cumulative forecasts. Cumulative and Cumulative + Project traffic forecasts are shown on Figures 8 and 9.

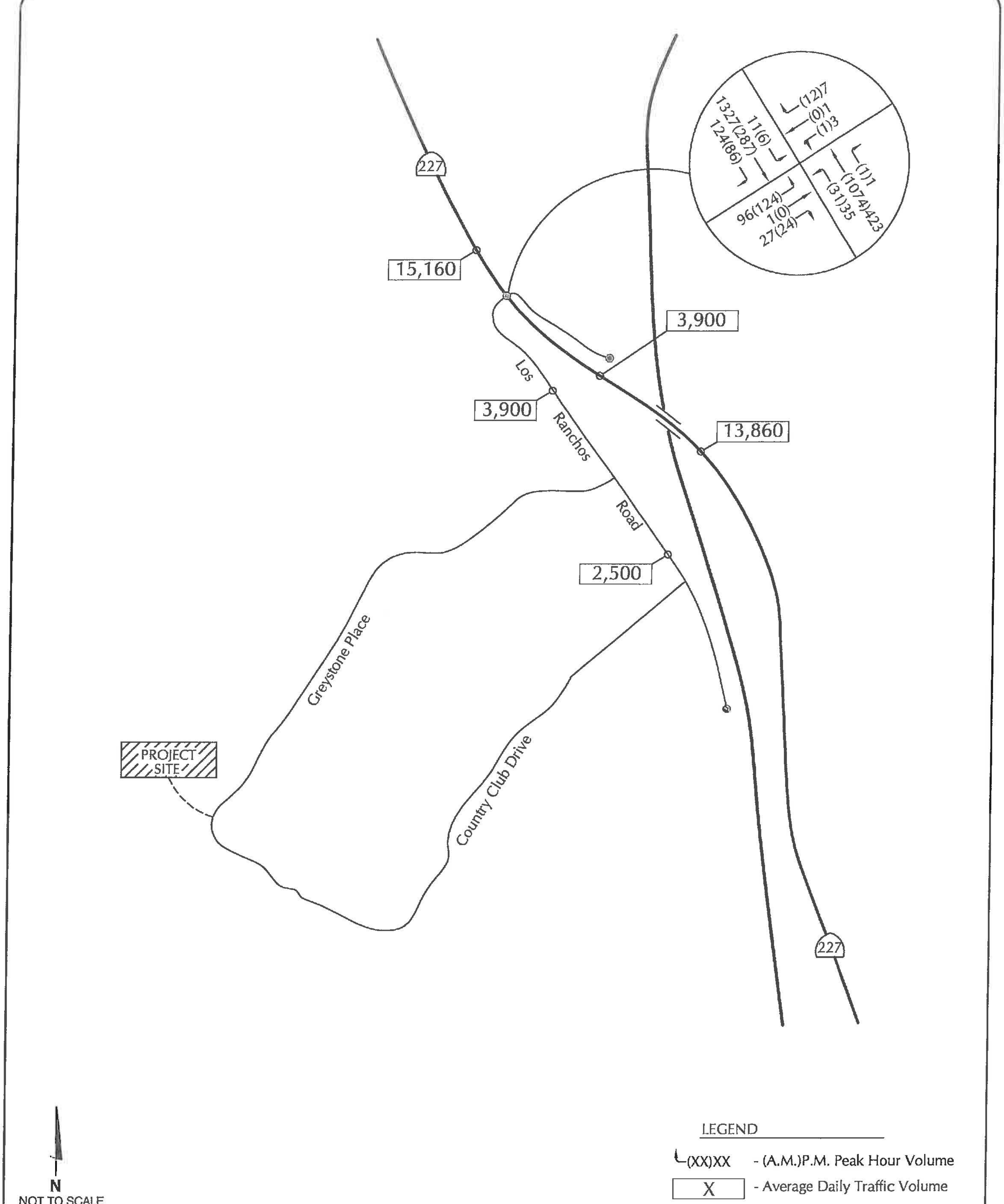
Roadway Operations

The operational characteristics of the study-area roadway segments were assessed assuming the Cumulative and Cumulative + Project traffic volumes shown on Figures 8 and 9. Cumulative and Cumulative + Project roadway operations are summarized in Table 7.

Table 7
Cumulative & Cumulative + Project Roadway Operations

	Cumulative		Cumulative + Project	
Roadway Segment	**ADT**	**LOS**	**ADT**	**LOS**
SR 227 n/o Los Ranchos Road	15,160	LOS C	15,259	LOS C
SR 227 s/o Los Ranchos Road	13,860	LOS B	13,885	LOS B
Los Ranchos Road n/o Greystone Place	3,900	LOS A	4,024	LOS A
Los Ranchos Road s/o Greystone Place	2,500	LOS A	2,500	LOS A

As shown in Table 7, the study-area roadways are forecast to operate at LOS C or better with Cumulative and Cumulative + Project traffic, which meet the County's LOS C standard for rural roads. Thus, the Project would not contribute to significant cumulative roadway impacts.



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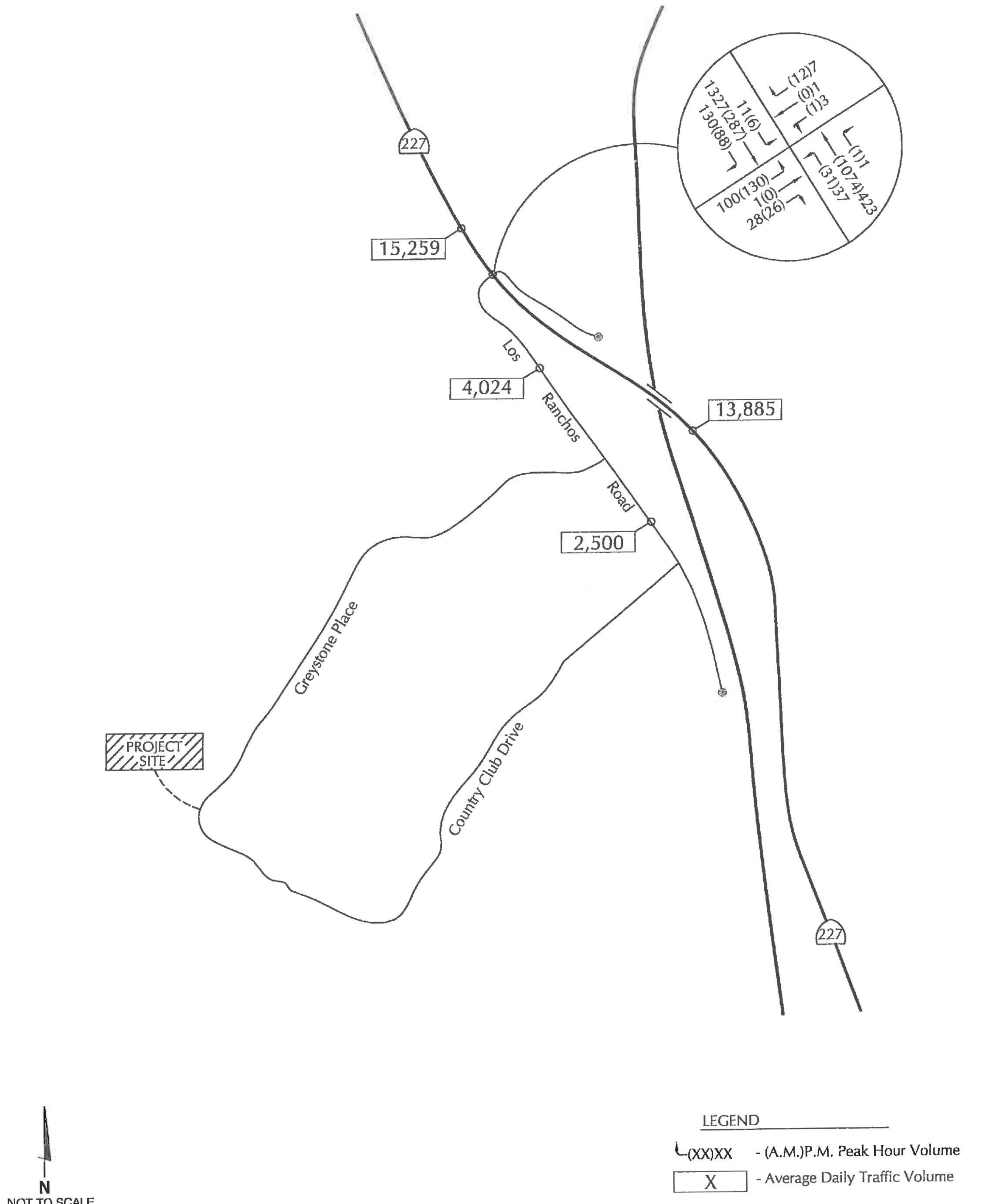
CUMULATIVE TRAFFIC VOLUMES

FIGURE 8

EKM - #15053.01



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CUMULATIVE + PROJECT TRAFFIC VOLUMES

FIGURE 9

EKM - #15053.01

Intersection Operations

Levels of service were calculated for the SR 227/Los Ranchos Road intersection assuming the Cumulative and Cumulative + Project traffic volumes shown on Figures 8 and 9. Table 8 compares the Cumulative and Cumulative + Project levels of service for the intersection.

Table 8
Cumulative & Cumulative + Project Intersection Operations

Intersection	Delay / LOS			
	A.M. Peak Hour		P.M. Peak Hour	
	Cumulative	Cumulative + Project	Cumulative	Cumulative + Project
SR 227/Los Ranchos Road	20.6 Sec./LOS C	20.8 Sec./LOS C	24.8 Sec./LOS C	25.6 Sec./LOS C

The results presented in Table 8 show that the SR 227/Los Ranchos Road intersection is forecast to at LOS C with Cumulative and Cumulative + Project traffic, which meets the County's LOS C standard for rural intersections. Thus, the Project would not contribute to significant cumulative intersection impacts based on County thresholds.

■ ■ ■

STUDY PARTICIPANTS AND REFERENCES

Associated Transportation Engineers

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Dan Dawson, Supervising Transportation Planner
Matthew Farrington, Transportation Planner
Erica Monson, Traffic Technician

References

Appendix to 2014 Public Improvement Standards, San Luis Obispo County Department of Public Works & Transportation, 2014.

Traffic Volumes on State Highways, State of California Department of Transportation, 2014.

Highway Capacity Manual, Transportation Research Board, 2010.

Trip Generation, Institute of Transportation Engineers, 9th Edition, 2012.

TECHNICAL APPENDIX

CONTENTS:

TRAFFIC COUNT DATA

LEVEL OF SERVICE DEFINITIONS AND ROADWAY DESIGN CAPACITIES

LEVEL OF SERVICE WORKSHEETS

CUMULATIVE PROJECTS

SAN LUIS OBISPO COUNTY SIGHT DISTANCE STANDARDS

TRAFFIC COUNT DATA

ITM Peak Hour Summary

Prepared by:

NDS

National Data & Surveying Services

SR-227 and Los Ranchos Rd , San Luis Obispo

Date: 7/2/2015

Day: Thursday

Project #: 15-8078-001

City: San Luis Obispo

AM Peak Hour	745 AM
NOON Peak Hour	
PM Peak Hour	430 PM

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON		
PM	4:00 PM	6:00 PM

Peak Hour Summary

N

SR-227

Los Ranchos Rd

CONTROL

Southbound Approach

Lanes

	Left	Through	Right	Out
AM	86	264	6	1151
NOON	0	0	0	0
PM	124	1264	11	498

Eastbound Approach

	AM	NOON	PM
Out	117	0	160
Left	124	0	96
Through	0	0	1
Right	24	0	27

Lanes

Westbound Approach

	AM	NOON	PM
Right	12	0	7
Through	0	0	1
Left	1	0	3
Out	7	0	13

Lanes

Northbound Approach

	Out	Left	Through	Right
AM	289	31	1015	1
NOON	0	0	0	0
PM	1294	35	395	1

Lanes

Total Ins & Outs

North Leg

AM	356	1151
NOON	0	0
PM	1399	498

West Leg

AM	NOON	PM
117	0	160
148	0	124

East Leg

AM	NOON	PM
13	0	11
7	0	13

South Leg

AM	289	1047
NOON	0	0
PM	1294	431

Total Volume Per Leg

North Leg

AM	1507
NOON	0
PM	1897

West Leg

AM	NOON	PM
265	0	284

East Leg

AM	NOON	PM
20	0	24

South Leg

AM	1336
NOON	0
PM	1725

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-8078-001 **Day:** Thursday

City: San Luis Obispo **Date:** 7/2/2015

AM

NS/EW Streets:	SR-227			SR-227			Los Ranchos Rd			Los Ranchos Rd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	0	0	0	0	0	0	0	0	0	0	0	
7:00 AM	0	136	0	0	67	9	17	0	1	0	2	0	232
7:15 AM	1	200	1	3	65	12	19	0	6	0	0	1	308
7:30 AM	6	213	1	5	71	11	26	0	8	0	0	1	342
7:45 AM	11	318	0	3	61	12	27	0	7	1	0	1	441
8:00 AM	7	277	0	2	59	22	35	0	5	0	0	2	409
8:15 AM	8	203	0	0	64	27	31	0	5	0	0	5	343
8:30 AM	5	217	1	1	80	25	31	0	7	0	0	4	371
8:45 AM	13	198	0	0	69	25	44	0	5	0	0	2	356

	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	51	1762	3	14	536	143	230	0	44	1	2	16	2802
APPROACH %'s :	2.81%	97.03%	0.17%	2.02%	77.34%	20.63%	83.94%	0.00%	16.06%	5.26%	10.53%	84.21%	
PEAK HR START TIME :	745 AM												TOTAL
PEAK HR VOL :	31	1015	1	6	264	86	124	0	24	1	0	12	1564
PEAK HR FACTOR :		0.796			0.840			0.925			0.650		0.887

UTURNS			
NB	SB	EB	WB
0	0	0	0

CONTROL : 0

Intersection Turning Movement

Prepared by:

National Data & Surveying Services

Project ID: 15-8078-001 **Day:** Thursday

City: San Luis Obispo **Date:** 7/2/2015

PM

NS/EW Streets:	SR-227			SR-227			Los Ranchos Rd			Los Ranchos Rd			
	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
LANES:	0	0	0	0	0	0	0	0	0	0	0	0	
4:00 PM	9	79	1	0	302	27	32	0	10	1	0	3	464
4:15 PM	2	90	1	1	311	38	23	0	8	0	0	2	476
4:30 PM	11	103	0	0	330	30	22	0	6	0	0	1	503
4:45 PM	6	95	1	7	301	38	26	1	6	0	1	2	484
5:00 PM	9	94	0	2	308	29	28	0	5	3	0	1	479
5:15 PM	9	103	0	2	325	27	20	0	10	0	0	3	499
5:30 PM	7	97	0	0	304	37	24	0	9	1	0	1	480
5:45 PM	11	93	0	1	269	29	22	0	9	0	0	1	435

	UTURNS			
	NB	SB	EB	WB

	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
TOTAL VOLUMES :	64	754	3	13	2450	255	197	1	63	5	1	14	3820
APPROACH %'s :	7.80%	91.84%	0.37%	0.48%	90.14%	9.38%	75.48%	0.38%	24.14%	25.00%	5.00%	70.00%	

NB	SB	EB	WB
0	0	0	0

PEAK HR START TIME :	430 PM												TOTAL
PEAK HR VOL :	35	395	1	11	1264	124	96	1	27	3	1	7	1965
PEAK HR FACTOR :		0.945			0.972			0.939			0.688		0.977

CONTROL : 0

Prepared by NDS/ATD

VOLUME

Los Ranchos Rd N/O Greystone Pl

Day: Tuesday
Date: 7/7/2015

City: San Luis Obispo
Project #: CA15_8081_001

DAILY TOTALS	NB	SB	EB	WB	Total
	1,936	1,939	0	0	3,875

AM Period	NB		SB		EB	WB	TOTAL	
00:00	0		1				1	
00:15	0		1				1	
00:30	2		1				3	
00:45	1	3	0	3			1	6
01:00	1		0				1	
01:15	0		0				0	
01:30	0		1				1	
01:45	0	1	2	3			2	4
02:00	0		0				0	
02:15	0		1				1	
02:30	0		0				0	
02:45	2	2	0	1			2	3
03:00	0		0				0	
03:15	0		0				0	
03:30	0		0				0	
03:45	0		1	1			1	1
04:00	0		2				2	
04:15	1		1				2	
04:30	3		2				5	
04:45	1	5	1	6			2	11
05:00	3		10				13	
05:15	1		9				10	
05:30	7		3				10	
05:45	4	15	2	24			6	39
06:00	11		4				15	
06:15	13		6				19	
06:30	16		4				20	
06:45	15	55	15	29			30	84
07:00	23		14				37	
07:15	23		10				33	
07:30	32		15				47	
07:45	46	124	23	62			69	186
08:00	43		26				69	
08:15	40		25				65	
08:30	43		42				85	
08:45	43	169	37	130			80	299
09:00	42		26				68	
09:15	23		25				48	
09:30	46		26				72	
09:45	28	139	37	114			65	253
10:00	36		33				69	
10:15	32		32				64	
10:30	34		27				61	
10:45	31	133	43	135			74	268
11:00	37		43				80	
11:15	36		29				65	
11:30	38		41				79	
11:45	41	152	49	162			90	314
TOTALS		798		670				1468
SPLIT %		54.4%		45.6%				37.9%

PM Period	NB		SB		EB	WB	TOTAL	
12:00	31		40				71	
12:15	41		47				88	
12:30	29		38				67	
12:45	40	141	37	162			77	303
13:00	38		36				74	
13:15	29		23				52	
13:30	37		29				66	
13:45	39	143	22	110			61	253
14:00	49		31				80	
14:15	24		38				62	
14:30	51		37				88	
14:45	51	175	37	143			88	318
15:00	42		32				74	
15:15	36		35				71	
15:30	45		36				81	
15:45	24	147	39	142			63	289
16:00	34		45				79	
16:15	29		39				68	
16:30	34		31				65	
16:45	32	129	48	163			80	292
17:00	32		43				75	
17:15	27		46				73	
17:30	30		53				83	
17:45	24	113	47	189			71	302
18:00	27		42				69	
18:15	27		29				56	
18:30	20		28				48	
18:45	26	100	29	128			55	228
19:00	27		17				44	
19:15	20		26				46	
19:30	33		16				49	
19:45	17	97	19	78			36	175
20:00	12		18				30	
20:15	11		19				30	
20:30	10		23				33	
20:45	9	42	8	68			17	110
21:00	8		13				21	
21:15	9		15				24	
21:30	6		11				17	
21:45	5	28	6	45			11	73
22:00	1		11				12	
22:15	6		10				16	
22:30	5		7				12	
22:45	4	16	4	32			8	48
23:00	1		4				5	
23:15	5		3				8	
23:30	1		1				2	
23:45	0	7	1	9			1	16
TOTALS		1138		1269				2407
SPLIT %		47.3%		52.7%				62.1%

DAILY TOTALS	NB	SB	EB	WB	Total
	1,936	1,939	0	0	3,875

	NB	SB	EB	WB	TOTAL
AM Peak Hour	07:45	11:30			11:30
AM Pk Volume	172	177			328
Pk Hr Factor	0.935	0.903			0.911
7 - 9 Volume	293	192	0	0	485
7 - 9 Peak Hour	07:45	08:00			08:00
7 - 9 Pk Volume	172	130	0	0	299
Pk Hr Factor	0.935	0.774	0.000	0.000	0.879

	NB	SB	EB	WB	TOTAL
PM Peak Hour	14:30	16:45			14:30
PM Pk Volume	180	190			321
Pk Hr Factor	0.882	0.896			0.912
4 - 6 Volume	242	352	0	0	594
4 - 6 Peak Hour	16:00	16:45			16:45
4 - 6 Pk Volume	129	190	0	0	311
Pk Hr Factor	0.949	0.896	0.000	0.000	0.937

Prepared by NDS/ATD

VOLUME

Los Ranchos Rd S/O Greystone Pl

Day: Tuesday
Date: 7/7/2015

City: San Luis Obispo
Project #: CA15_8081_002

DAILY TOTALS	NB	SB	EB	WB	Total
	1,265	1,265	0	0	2,530

AM Period	NB		SB		EB	WB	TOTAL		PM Period	NB		SB		EB	WB	TOTAL	
00:00	0		1				1		12:00	18		30				48	
00:15	1		1				2		12:15	24		42				66	
00:30	1		1				2		12:30	25		16				41	
00:45	1	3	0	3			1	6	12:45	29	96	24	112			53	208
01:00	1		0				1		13:00	23		19				42	
01:15	0		0				0		13:15	18		17				35	
01:30	0		0				0		13:30	16		17				33	
01:45	0	1	1	1			1	2	13:45	26	83	11	64			37	147
02:00	0		0				0		14:00	29		17				46	
02:15	0		1				1		14:15	18		23				41	
02:30	0		0				0		14:30	40		17				57	
02:45	2	2	0	1			2	3	14:45	34	121	24	81			58	202
03:00	0		0				0		15:00	32		22				54	
03:15	0		0				0		15:15	26		22				48	
03:30	0		0				0		15:30	31		20				51	
03:45	0		1	1			1	1	15:45	21	110	26	90			47	200
04:00	0		2				2		16:00	19		30				49	
04:15	1		1				2		16:15	17		21				38	
04:30	1		3				4		16:30	21		23				44	
04:45	1	3	1	7			2	10	16:45	23	80	32	106			55	186
05:00	3		10				13		17:00	19		26				45	
05:15	1		8				9		17:15	22		25				47	
05:30	4		4				8		17:30	19		34				53	
05:45	3	11	3	25			6	36	17:45	17	77	32	117			49	194
06:00	8		3				11		18:00	14		25				39	
06:15	8		6				14		18:15	17		14				31	
06:30	8		2				10		18:30	16		16				32	
06:45	8	32	13	24			21	56	18:45	16	63	17	72			33	135
07:00	20		8				28		19:00	29		14				43	
07:15	10		8				18		19:15	15		13				28	
07:30	18		10				28		19:30	29		9				38	
07:45	30	78	14	40			44	118	19:45	12	85	11	47			23	132
08:00	29		20				49		20:00	9		10				19	
08:15	22		20				42		20:15	11		11				22	
08:30	22		26				48		20:30	8		17				25	
08:45	24	97	33	99			57	196	20:45	10	38	5	43			15	81
09:00	27		16				43		21:00	5		7				12	
09:15	14		17				31		21:15	5		10				15	
09:30	22		9				31		21:30	4		5				9	
09:45	15	78	25	67			40	145	21:45	3	17	2	24			5	41
10:00	23		21				44		22:00	1		3				4	
10:15	16		26				42		22:15	3		6				9	
10:30	20		23				43		22:30	3		3				6	
10:45	23	82	29	99			52	181	22:45	2	9	2	14			4	23
11:00	24		32				56		23:00	2		2				4	
11:15	21		23				44		23:15	3		3				6	
11:30	23		28				51		23:30	1		1				2	
11:45	25	93	38	121			63	214	23:45	0	6	1	7			1	13
TOTALS		480		488				968	TOTALS		785		777				1562
SPLIT %		49.6%		50.4%				38.3%	SPLIT %		50.3%		49.7%				61.7%

DAILY TOTALS	NB	SB	EB	WB	Total
	1,265	1,265	0	0	2,530

	NB	SB	EB	WB	Total		NB	SB	EB	WB	Total
AM Peak Hour	07:45	11:30			11:30	PM Peak Hour	14:30	16:45			14:30
AM Pk Volume	103	138			228	PM Pk Volume	132	117			217
Pk Hr Factor	0.858	0.821			0.864	Pk Hr Factor	0.825	0.860			0.935
7 - 9 Volume	175	139	0	0	314	4 - 6 Volume	157	223	0	0	380
7 - 9 Peak Hour	07:45	08:00			08:00	4 - 6 Peak Hour	16:30	16:45			16:45
7 - 9 Pk Volume	103	99	0	0	196	4 - 6 Pk Volume	85	117	0	0	200
Pk Hr Factor	0.858	0.750	0.000	0.000	0.860	Pk Hr Factor	0.924	0.860	0.000	0.000	0.909

LEVEL OF SERVICE DEFINITIONS AND ROADWAY DESIGN CAPACITIES

Signalized Intersection Level of Service Definitions

LOS	Delay[a]	V/C Ratio	Definition
A	< 10.0	< 0.60	Progression is extremely favorable. Most vehicles arrive during the green phase. Many vehicles do not stop at all.
B	10.1 - 20.0	0.61 - 0.70	Good progression, short cycle lengths, or both. More vehicles stop than with LOS A, causing higher levels of delay.
C	20.1 - 35.0	0.71 - 0.80	Only fair progression, longer cycle lengths, or both, result in higher cycle lengths. Cycle lengths may fail to serve queued vehicles, and overflow occurs. Number of vehicles stopped is significant, though many still pass through intersection without stopping.
D	35.1 - 55.0	0.81 - 0.90	Congestion becomes more noticeable. Unfavorable progression, long cycle lengths and high v/c ratios result in longer delays. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
E	55.1 - 80.0	0.91 - 1.00	High delay values indicate poor progression, long cycle lengths and high v/c ratios. Individual cycle failures are frequent
F	> 80.0	> 1.00	Considered unacceptable for most drivers, this level occurs when arrival flow rates exceed the capacity of lane groups, resulting in many individual cycle failures. Poor progression and long cycle lengths may also contribute to high delay levels.

[a] Average control delay per vehicle in seconds.

Unsignalized Intersection Level of Service Definitions

The HCM[1] uses *control delay* to determine the level of service at unsignalized intersections. Control delay is the difference between the travel time actually experienced at the control device and the travel time that would occur in the absence of the traffic control device. Control delay includes deceleration from free flow speed, queue move-up time, stopped delay and acceleration back to free flow speed.

LOS	Control Delay Seconds per Vehicle
A	< 10.0
B	10.1 - 15.0
C	15.1 - 25.0
D	25.1 - 35.0
E	35.1 - 50.0
F	> 50.0

[1] Highway Capacity Manual, National Research Board, 2000

Associated Transportation Engineers
100 N. Hope Avenue, Suite 4, Santa Barbara (805) 687-4418

ENGINEERING ROADWAY DESIGN CAPACITIES

TYPE OF ROADWAY	# OF LANES	LOS A		LOS B		LOS C		LOS D		LOS E	
		Low	High	Low	High	Low	High	Low	High	Low	High
Arterial	2 Lanes	8,100	12,000	9,400	14,000	10,800	16,000	12,100	18,000	13,500	20,000
Arterial	4 Lanes	16,100	23,900	18,900	27,900	21,600	31,900	24,300	35,900	27,000	39,900
Major	2 Lanes	6,500	9,600	7,500	11,200	8,600	12,800	9,700	14,400	10,800	16,000
Major	4 Lanes	12,900	19,200	15,100	22,300	17,200	25,500	19,400	28,700	21,600	31,900
Collector	- -	4,600	7,100	5,400	8,200	6,200	9,400	6,900	10,600	7,700	11,800

The roadway capacities listed above are "rule of thumb" figures only. Some factors which affect these capacities are intersections (numbers and configuration), degrees of access control, roadway grades, design geometrics (horizontal and vertical alignment standards), sight distance, level of truck and bus traffic and level of pedestrian and bicycle traffic.

ASSOCIATED TRANSPORTATION ENGINEERS
100 N. Hope Avenue, Suite 4, Santa Barbara, CA 93110 • (805) 687-4418

LEVEL OF SERVICE WORKSHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		✣		↰	↑↱		↰	↑	↱
Volume (vph)	124	0	24	1	0	12	31	1015	1	6	264	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.87		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1623		1770	1863		1770	1863	1583
Flt Permitted		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1770	1583		1623		1770	1863		1770	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	139	0	27	1	0	13	35	1140	1	7	297	97
RTOR Reduction (vph)	0	0	24	0	13	0	0	0	0	0	0	23
Lane Group Flow (vph)	0	139	3	0	1	0	35	1141	0	7	297	74
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		6.9	6.9		0.5		1.6	42.7		0.6	41.7	48.6
Effective Green, g (s)		6.9	6.9		0.5		1.6	42.7		0.6	41.7	48.6
Actuated g/C Ratio		0.11	0.11		0.01		0.03	0.67		0.01	0.65	0.76
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		192	171		13		44	1249		17	1220	1208
v/s Ratio Prot		c0.08			c0.00		c0.02	c0.61		0.00	0.16	0.01
v/s Ratio Perm			0.00									0.04
v/c Ratio		0.72	0.02		0.08		0.80	0.91		0.41	0.24	0.06
Uniform Delay, d1		27.5	25.4		31.4		30.9	8.9		31.4	4.5	1.9
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		12.7	0.0		2.8		62.9	10.3		15.4	0.1	0.0
Delay (s)		40.2	25.4		34.2		93.8	19.2		46.8	4.6	1.9
Level of Service		D	C		C		F	B		D	A	A
Approach Delay (s)		37.8			34.2			21.5			4.7	
Approach LOS		D			C			C			A	

Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	63.7	Sum of lost time (s)	9.0
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰	↱		✥		↰	↱		↰	↑	↱
Volume (vph)	96	1	27	3	1	7	35	395	1	11	1264	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1775	1583		1680		1770	1862		1770	1863	1583
Flt Permitted		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1775	1583		1680		1770	1862		1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	98	1	28	3	1	7	36	403	1	11	1290	127
RTOR Reduction (vph)	0	0	26	0	7	0	0	0	0	0	0	24
Lane Group Flow (vph)	0	99	2	0	4	0	36	404	0	11	1290	103
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		5.7	5.7		0.6		2.1	61.6		0.7	60.2	65.9
Effective Green, g (s)		5.7	5.7		0.6		2.1	61.6		0.7	60.2	65.9
Actuated g/C Ratio		0.07	0.07		0.01		0.03	0.75		0.01	0.74	0.81
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		124	111		12		46	1406		15	1374	1278
v/s Ratio Prot		c0.06			c0.00		c0.02	0.22		0.01	c0.69	0.01
v/s Ratio Perm			0.00									0.06
v/c Ratio		0.80	0.02		0.34		0.78	0.29		0.73	0.94	0.08
Uniform Delay, d1		37.4	35.3		40.3		39.5	3.1		40.4	9.1	1.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		29.0	0.1		16.0		57.8	0.1		103.2	12.3	0.0
Delay (s)		66.4	35.4		56.3		97.3	3.2		143.6	21.5	1.6
Level of Service		E	D		E		F	A		F	C	A
Approach Delay (s)		59.6			56.3			10.9			20.6	
Approach LOS		E			E			B			C	

Intersection Summary			
HCM Average Control Delay	21.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	81.6	Sum of lost time (s)	13.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↰↑	↱		↰↑↱		↰	↑↱		↰	↑	↱
Volume (vph)	130	0	26	1	0	12	31	1015	1	6	264	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.87		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1623		1770	1863		1770	1863	1583
Flt Permitted		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1770	1583		1623		1770	1863		1770	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	146	0	29	1	0	13	35	1140	1	7	297	99
RTOR Reduction (vph)	0	0	25	0	13	0	0	0	0	0	0	22
Lane Group Flow (vph)	0	146	4	0	1	0	35	1141	0	7	297	77
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		9.1	9.1		0.5		1.9	45.1		0.6	43.8	52.9
Effective Green, g (s)		9.1	9.1		0.5		1.9	45.1		0.6	43.8	52.9
Actuated g/C Ratio		0.13	0.13		0.01		0.03	0.66		0.01	0.64	0.77
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		236	211		12		49	1230		16	1195	1226
v/s Ratio Prot		c0.08			c0.00		c0.02	c0.61		0.00	0.16	0.01
v/s Ratio Perm			0.00									0.04
v/c Ratio		0.62	0.02		0.09		0.71	0.93		0.44	0.25	0.06
Uniform Delay, d1		28.0	25.7		33.7		32.9	10.2		33.7	5.2	1.8
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		4.8	0.0		3.3		39.0	12.0		18.0	0.1	0.0
Delay (s)		32.7	25.8		37.0		72.0	22.1		51.7	5.3	1.8
Level of Service		C	C		D		E	C		D	A	A
Approach Delay (s)		31.6			37.0			23.6			5.3	
Approach LOS		C			D			C			A	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	68.3	Sum of lost time (s)	9.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1	28	3	1	7	37	395	1	11	1264	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1775	1583		1680		1770	1862		1770	1863	1583
Flt Permitted		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1775	1583		1680		1770	1862		1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	102	1	29	3	1	7	38	403	1	11	1290	133
RTOR Reduction (vph)	0	0	27	0	7	0	0	0	0	0	0	26
Lane Group Flow (vph)	0	103	2	0	4	0	38	404	0	11	1290	107
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		5.7	5.7		0.6		2.1	61.6		0.7	60.2	65.9
Effective Green, g (s)		5.7	5.7		0.6		2.1	61.6		0.7	60.2	65.9
Actuated g/C Ratio		0.07	0.07		0.01		0.03	0.75		0.01	0.74	0.81
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		124	111		12		46	1406		15	1374	1278
v/s Ratio Prot		c0.06			c0.00		c0.02	0.22		0.01	c0.69	0.01
v/s Ratio Perm			0.00									0.06
v/c Ratio		0.83	0.02		0.34		0.83	0.29		0.73	0.94	0.08
Uniform Delay, d1		37.5	35.3		40.3		39.6	3.1		40.4	9.1	1.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		35.4	0.1		16.0		69.9	0.1		103.2	12.3	0.0
Delay (s)		72.9	35.4		56.3		109.5	3.2		143.6	21.5	1.6
Level of Service		E	D		E		F	A		F	C	A
Approach Delay (s)		64.6			56.3			12.4			20.6	
Approach LOS		E			E			B			C	

Intersection Summary			
HCM Average Control Delay	21.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	81.6	Sum of lost time (s)	13.0
Intersection Capacity Utilization	85.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	124	0	24	1	0	12	31	1074	1	6	287	86
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.87		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1623		1770	1863		1770	1863	1583
Flt Permitted		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1770	1583		1623		1770	1863		1770	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	139	0	27	1	0	13	35	1207	1	7	322	97
RTOR Reduction (vph)	0	0	24	0	13	0	0	0	0	0	0	21
Lane Group Flow (vph)	0	139	3	0	1	0	35	1208	0	7	322	76
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		6.6	6.6		0.6		1.8	50.2		0.7	49.1	55.7
Effective Green, g (s)		6.6	6.6		0.6		1.8	50.2		0.7	49.1	55.7
Actuated g/C Ratio		0.09	0.09		0.01		0.03	0.71		0.01	0.69	0.78
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		164	147		14		45	1315		17	1287	1240
v/s Ratio Prot		c0.08			c0.00		c0.02	c0.65		0.00	0.17	0.01
v/s Ratio Perm			0.00									0.04
v/c Ratio		0.85	0.02		0.08		0.78	0.92		0.41	0.25	0.06
Uniform Delay, d1		31.8	29.3		35.0		34.5	8.7		35.0	4.1	1.8
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		31.2	0.0		2.4		56.9	10.3		15.4	0.1	0.0
Delay (s)		63.0	29.3		37.4		91.4	19.1		50.4	4.2	1.8
Level of Service		E	C		D		F	B		D	A	A
Approach Delay (s)		57.5			37.4			21.1			4.4	
Approach LOS		E			D			C			A	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	71.1	Sum of lost time (s)	9.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	96	1	27	3	1	7	35	423	1	11	1327	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1775	1583		1680		1770	1862		1770	1863	1583
Flt Permitted		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1775	1583		1680		1770	1862		1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	98	1	28	3	1	7	36	432	1	11	1354	127
RTOR Reduction (vph)	0	0	26	0	7	0	0	0	0	0	0	23
Lane Group Flow (vph)	0	99	2	0	4	0	36	433	0	11	1354	104
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		5.5	5.5		0.6		2.3	67.4		0.7	65.8	71.3
Effective Green, g (s)		5.5	5.5		0.6		2.3	67.4		0.7	65.8	71.3
Actuated g/C Ratio		0.06	0.06		0.01		0.03	0.77		0.01	0.75	0.82
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		112	100		12		47	1439		14	1406	1294
v/s Ratio Prot		c0.06			c0.00		c0.02	0.23		0.01	c0.73	0.01
v/s Ratio Perm			0.00									0.06
v/c Ratio		0.88	0.02		0.34		0.77	0.30		0.79	0.96	0.08
Uniform Delay, d1		40.5	38.3		43.1		42.2	2.9		43.2	9.6	1.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		50.4	0.1		15.9		52.3	0.1		130.6	15.9	0.0
Delay (s)		90.9	38.4		59.0		94.5	3.0		173.7	25.5	1.6
Level of Service		F	D		E		F	A		F	C	A
Approach Delay (s)		79.3			59.0			10.1			24.6	
Approach LOS		E			E			B			C	

Intersection Summary			
HCM Average Control Delay	24.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	87.2	Sum of lost time (s)	13.0
Intersection Capacity Utilization	88.5%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Cumulative + Project A.M. Peak Hour
1: Los Ranchos Road & SR 227

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	130	0	26	1	0	12	31	1074	1	6	287	88
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.87		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1770	1583		1623		1770	1863		1770	1863	1583
Flt Permitted		0.95	1.00		1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1770	1583		1623		1770	1863		1770	1863	1583
Peak-hour factor, PHF	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Adj. Flow (vph)	146	0	29	1	0	13	35	1207	1	7	322	99
RTOR Reduction (vph)	0	0	26	0	13	0	0	0	0	0	0	21
Lane Group Flow (vph)	0	146	3	0	1	0	35	1208	0	7	322	78
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		7.6	7.6		0.6		1.9	51.8		0.7	50.6	58.2
Effective Green, g (s)		7.6	7.6		0.6		1.9	51.8		0.7	50.6	58.2
Actuated g/C Ratio		0.10	0.10		0.01		0.03	0.70		0.01	0.69	0.79
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		183	163		13		46	1309		17	1279	1250
v/s Ratio Prot		c0.08			c0.00		c0.02	c0.65		0.00	0.17	0.01
v/s Ratio Perm			0.00									0.04
v/c Ratio		0.80	0.02		0.09		0.76	0.92		0.41	0.25	0.06
Uniform Delay, d1		32.3	29.7		36.3		35.7	9.3		36.3	4.4	1.7
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		21.0	0.0		2.8		52.3	10.9		15.4	0.1	0.0
Delay (s)		53.3	29.7		39.1		88.0	20.2		51.7	4.5	1.7
Level of Service		D	C		D		F	C		D	A	A
Approach Delay (s)		49.4			39.1			22.1			4.6	
Approach LOS		D			D			C			A	

Intersection Summary			
HCM Average Control Delay	20.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	73.7	Sum of lost time (s)	9.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	1	28	3	1	7	37	423	1	11	1327	130
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frt		1.00	0.85		0.91		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1775	1583		1680		1770	1862		1770	1863	1583
Flt Permitted		0.95	1.00		0.99		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1775	1583		1680		1770	1862		1770	1863	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	102	1	29	3	1	7	38	432	1	11	1354	133
RTOR Reduction (vph)	0	0	27	0	7	0	0	0	0	0	0	24
Lane Group Flow (vph)	0	103	2	0	4	0	38	433	0	11	1354	109
Turn Type	Split		Perm	Split			Prot			Prot		pm+ov
Protected Phases	4	4		8	8		5	2		1	6	4
Permitted Phases			4									6
Actuated Green, G (s)		5.5	5.5		0.6		2.3	67.4		0.7	65.8	71.3
Effective Green, g (s)		5.5	5.5		0.6		2.3	67.4		0.7	65.8	71.3
Actuated g/C Ratio		0.06	0.06		0.01		0.03	0.77		0.01	0.75	0.82
Clearance Time (s)		2.5	2.5		2.5		4.0	4.0		4.0	4.0	2.5
Vehicle Extension (s)		3.0	3.0		3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)		112	100		12		47	1439		14	1406	1294
v/s Ratio Prot		c0.06			c0.00		c0.02	0.23		0.01	c0.73	0.01
v/s Ratio Perm			0.00									0.06
v/c Ratio		0.92	0.02		0.34		0.81	0.30		0.79	0.96	0.08
Uniform Delay, d1		40.6	38.3		43.1		42.2	2.9		43.2	9.6	1.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		59.5	0.1		15.9		63.4	0.1		130.6	15.9	0.0
Delay (s)		100.1	38.4		59.0		105.6	3.0		173.7	25.5	1.6
Level of Service		F	D		E		F	A		F	C	A
Approach Delay (s)		86.6			59.0			11.3			24.5	
Approach LOS		F			E			B			C	

Intersection Summary			
HCM Average Control Delay	25.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	87.2	Sum of lost time (s)	13.0
Intersection Capacity Utilization	88.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

CUMULATIVE PROJECTS

CUMULATIVE DEVELOPMENT PROJECTS - SLO COUNTY PLANNING AND BUILDING DEPARTMENT

	Permit	Parcel	Permit Type	Permit Status	Status Date	Description
1	SUB2015-00002	076-512-010	Parcel Map	Approved	11/13/2015	SPLIT A 2.29 AC PARCEL INTO (1) 1 AC PARCEL AND (1) 1.29 AC PARCEL
2	SUB2015-00058	076-512-008	Parcel Map	Hearing Scheduled	6/10/2016	PARCEL MAP TO CREATE 3 PARCELS OF 1.3 AC, 1.2 AC, AND 1.3 AC
3	SUB2015-00059	044-082-052	Parcel Map	Information Hold	4/5/2016	TENTATIVE PARCEL MAP TO DIVIDE ONE PARCEL OF 7.9 AC INTO THREE PARCELS OF APPROXIMATELY 1.4 AC, 1.4 AC, AND 5.0 AC
4	DRC2015-00054	076-512-001	Minor Use Permit	Approved	3/23/2016	12,400 square foot administrative building
5	DRC2015-00142	076-512-024	Site Plan	Initial 30 days		3,916 square foot restaurant with drive thru
6	DRC2015-00141	076-511-015	Conditional Use Permit	Initial 30 days		116,000 square foot mini storage facility
7	DRC2015-00093	076-512-003	Minor Use Permit	Hearing scheduled	8/1/2016	11,350 square foot office/warehouse building
8	DRC2015-00013	076-512-037	Conditional Use Permit	Approved	9/30/2015	19,664 square foot warehouse (Food Bank)
9	DRC2015-00056	076-512-038	Minor Use Permit	Approved		14,389 square foot warehouse

Associated Transportation Engineers
Trip Generation Worksheet - Approved Projects

TRACT 2429 (JACK RANCH) - CUMULATIVE PROJECTS

Project # / Land Use	Size	ADT		A.M.						P.M.					
		Rate	Trips	Rate	Trips	In %	Trips	Out %	Trips	Rate	Trips	In %	Trips	Out %	Trips
SUB2015-00002 / SFDU	2	9.52	19	0.75	2	25%	1	75%	1	1.00	2	63%	1	37%	1
SUB2015-00058 / SFDU	3	9.52	29	0.75	2	25%	1	75%	1	1.00	3	63%	2	37%	1
SUB2015-00058 / SFDU	3	9.52	29	0.75	2	25%	1	75%	1	1.00	3	63%	2	37%	1
DRC2015-00054 / Office	24,000	11.03	265	1.56	37	88%	33	12%	4	1.49	36	17%	6	83%	30
DRC2015-00142 / Fast Food w/ Drive Thru	3,916	496.12	1,943	45.42	178	51%	91	49%	87	32.65	128	52%	67	48%	61
DRC2015-00141 / Mini Storage	116,000	2.50	290	0.14	16	55%	9	45%	7	0.26	30	50%	15	50%	15
DRC2015-00093 / Warehouse & Office	11,350	11.03	125	1.56	18	88%	16	12%	2	1.49	17	17%	3	83%	14
DRC2015-00013 / Warehouse	19,664	3.56	70	0.30	6	79%	5	21%	1	0.32	6	25%	2	75%	4
DRC2015-00056 / Warehouse	14,389	3.56	51	0.30	4	79%	3	21%	1	0.32	5	25%	1	75%	4

San Luis Obispo County

Department of Public Works & Transportation

COUNTY OF
ALCALDES
1850
NOT FOR OURSELVES ALONE
SAN LUIS OBISPO, CALIFORNIA

2014 Standard Construction Drawings

Available Online at:

http://www.slocounty.ca.gov/PW/DevServ/PublicImprovementStandards.htm

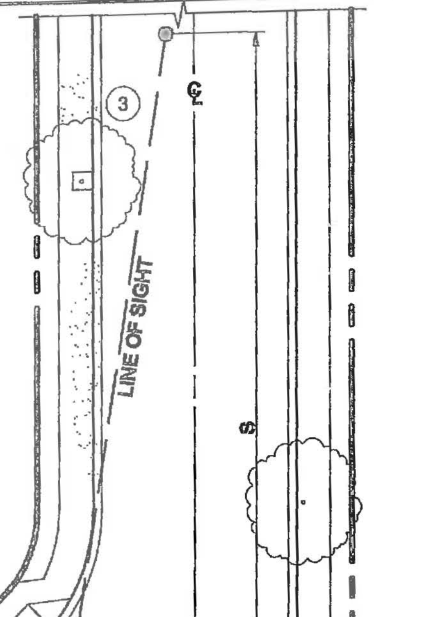
Revisions

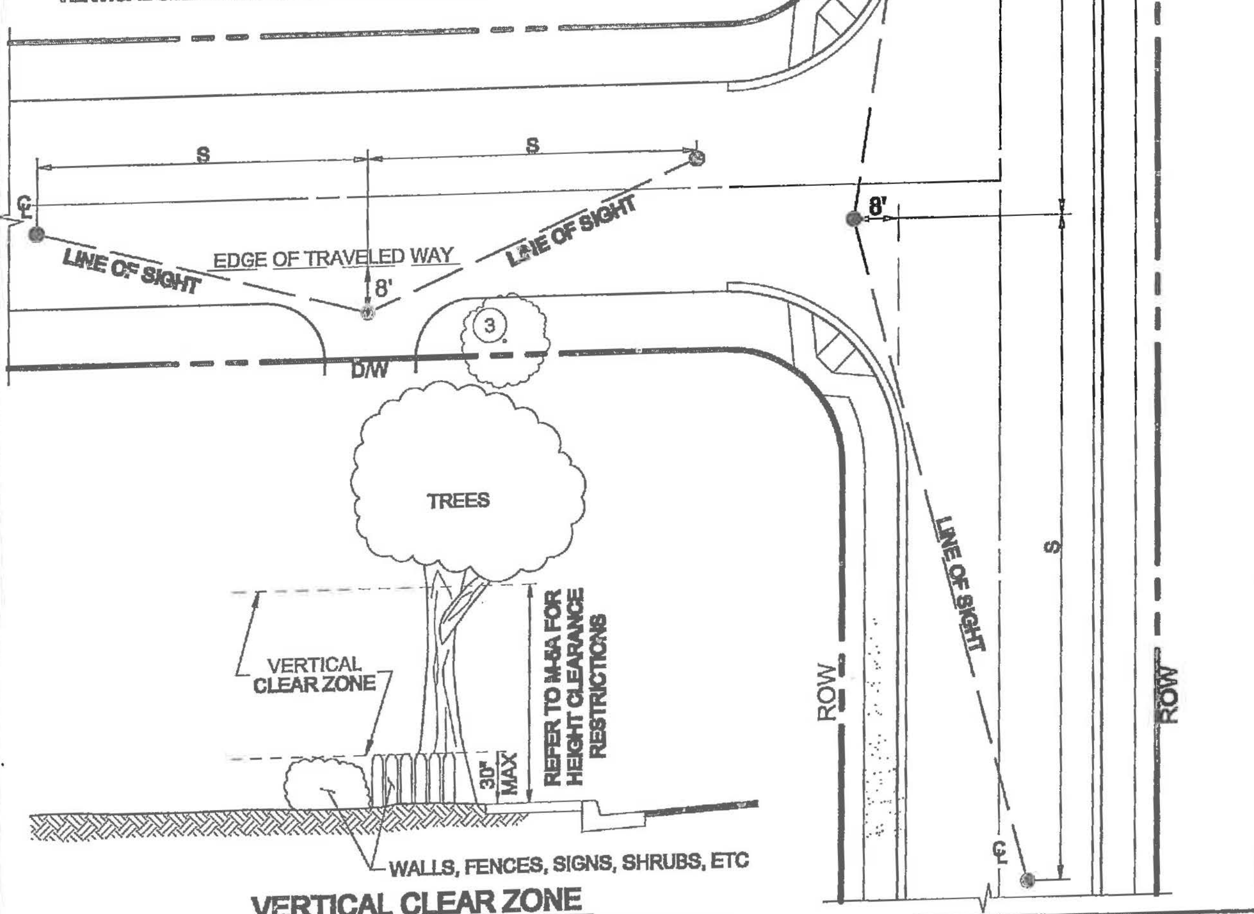
Description	Approved	Date	Description	Approved	Date
SIGHT DISTANCE LINES	REM	NOV 07	D/W SIGHT DIST. SAME AS INTERSECTION	GDM	JAN 11
SIGHT DISTANCE CHANGED TO CALTRANS STD	GDM	NOV 08	REVISED NOTE 2	FH	AUG 14

DESIGN SPEED (MPH)	"S" SIGHT DISTANCE (FEET)	DESIGN SPEED (MPH)	"S" SIGHT DISTANCE (FEET)
20	125'	40	300
25	150'	45	360'
30	200'	50	430'
35	250'	55	500'

NOTES:

1. INTERSECTION AND DRIVEWAY SIGHT DISTANCE REQUIREMENTS ON COUNTY MAINTAINED ROADS. REFERENCES STATE STANDARD 201.1, STOPPING SIGHT DISTANCE.
2. LINE OF SIGHT IS FROM A POINT AT THE INTERSECTION (OR DRIVEWAY) WHICH IS 3.5-FEET HIGH AND 8-FEET BEHIND THE CURB FACE (URBAN) OR EDGE OF TRAVELED WAY (RURAL) TO A POINT THAT IS 0.5 FEET HIGH AND LOCATED AT MIDPOINT OF THE TRAVELED WAY.
3. NO OBSTRUCTION OF THE LINE OF SIGHT SHALL BE ALLOWED WITHIN THE VERTICAL CLEAR ZONE BETWEEN 2.5-FEET AND 8-FEET.





VERTICAL CLEAR ZONE

DEPARTMENT OF PUBLIC WORKS & TRANSPORTATION

INTERSECTION & DRIVEWAY SIGHT DISTANCE

Scale:	Adopted:
1"=60'	2014
Drawing No: A-5a	
Sheet No: 1 OF 1	

Appendix I

County Service Area No. 18 Conditional Intent to Provide Waste Water Service Letter

SAN LUIS OBISPO COUNTY
DEPARTMENT OF PUBLIC WORKS
Wade Horton, Director

County Government Center, Room 206 • San Luis Obispo CA 93408 • (805) 781-5252
Fax (805) 781-1229 email address: pwd@co.slo.ca.us

February 1, 2017

John Wilson
1326 Chorro Street
San Luis Obispo, CA 93401

Subject: County Service Area No. 18; Conditional Intent to Provide Waste Water Service Letter to Tract 2429, Jack Ranch

Dear Mr. Wilson,

The following is a Conditional Intent to Provide a Waste Water Service Letter for the above described property located adjacent to the San Luis Obispo Golf and Country Club, San Luis Obispo, California. The County Service Area No. 18 (District) is ready and willing to provide waste water service to the subject project provided the following conditions are met.

1. All work performed by the County Department of Public Works Utilities Division staff for the subject project shall be billed to and reimbursed by the Applicant through and in accordance with the Engineering Reimbursement Agreement (ERA) for this project, executed on April 30, 2015.

2. Per the terms of the ERA, the Applicant shall design, construct, and install a gravity wastewater collector line extension (including all necessary system improvements) and manholes from the nearest existing point of connection adequate to provide wastewater service to the proposed project.

3. The Applicant shall employ a Registered Civil Engineer (RCE) of work to design the gravity wastewater collector line, manholes and associated appurtenances, and provide inspection during the course of construction to certify to the Public Works Director that the improvements were installed in accordance with the improvement plans, and to submit as-built plans to the Public Works Director. If the engineer of work is other than the designing engineer, or is replaced during the course of construction, the Public Works Director shall be notified in writing; and each such engineer of work shall certify as to their respective involvement. The Public Works Director, or his designated representative, may make such additional inspection as is deemed necessary and shall be available to review field conditions and/or proposed changes with the engineer of work.

4. As recommended in the Brown and Caldwell "Country Club Wastewater Treatment Plant Audit" dated February 25, 2004 and Wallace Group "CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429" dated April 27, 2016, the Applicant shall provide funding suitable to:

   - furnish and install a floating baffle and,
   - furnish and install two (2) 10 hp aerators to Pond 2

   Additionally, the Applicant shall provide complete services to:

   - remove the sludge from Pond 2 and,
   - furnish and install the inlet extension to the center of the first half of Pond 2

5. As indicated in the above referenced Wallace Group letter, the Applicant shall provide (within their development area) 120 days of wet weather flow storage, based on an estimated rate of 300 gallons per day/Dwelling Unit Equivalent (DUE) (approximately 470,000 total gallons for 13 units).

6. As indicated in the above referenced Wallace Group letter, the applicant shall provide their increment of funding suitable for an influent grinder upgrade to accommodate peak flows and dewatering equipment (including sludge transfer) at the CSA 18 Country Club Wastewater Plant. The Applicant shall pay prorate share of upgrade costs.

7. Upon District's approval of the proposed construction project, the Applicant shall submit plans and specifications to the Regional Water Quality Control Board for review, comment and determinations with regard to the project and its impacts to the Waste Discharge Permits for both the District and the San Luis Country Club Estates.

8. The proposed project will require connection to the existing County Service Area 18 (CSA 18) wastewater collection system. Construction of the proposed project will be at the Applicant's responsibility and expense. Construction of all facilities shall be in accordance with the County Standards and Specifications, CSA 18 regulations and the San Luis Country Club Estates Home Owner's Association Rules and Regulations. The Applicant shall employ a licensed contractor, and must submit evidence that the contractor is licensed prior to issuance of a final will-serve letter.

9. All work within the public right-of-way will require an Encroachment Permit from the County Director of Public Works, as described in the attached "General Conditions for Additions to District Facilities." Any work in areas maintained by the San Luis Country Club Estates must be approved by the Estates Home Owners Association.

10. The Applicant shall comply with all processing and approvals in accordance with the California Environmental Quality Act (CEQA).

11. As the subject lots have been determined to be outside of the CSA 18 District boundaries, said lots must be annexed to CSA 18. Accordingly, the Applicant shall complete and return to District the attached document entitled "Application for Annexation." In addition, the Applicant must also apply to the Local Agency Formation Commission (LAFCo) for annexation to the District. The District shall generate and submit a "Resolution of Application" to the Board of Supervisors on behalf of the Applicant.

12. Prior to provision of wastewater service to the project described above, Applicant shall pay to District all remaining applicable CSA 18 connections fees, meter charges, or other new service related fees established by ordinance and/or as described in the attached ERA prior to the completion date of the service connections for the proposed lots. Connection fees (system buy-in) are anticipated to cost approximately $2,200 per DUE.

13. The Applicant must provide District with written correspondence from the San Luis Country Club Estates indicating the Club's willingness to accept any additional treated wastewater effluent generated by the proposed project.

14. In accordance with the terms and conditions of County Ordinance No. 2317, executed by the San Luis Obispo County Board of Supervisors on July 28, 1987, the Applicant and/or all future owners of the proposed project and/or residences constructed as part of the proposed project are prohibited from installing self-regenerating water softeners.

15. The above CSA 18 conditions shall be effective until November 1, 2026, or until some unforeseen event might occur making this presently, intended service unusually difficult, or impossible, to provide.

If you have any questions regarding this letter, please feel free to call John Austin at (805) 781-5935 or Dean Benedix at or (805) 781-5267.

Sincerely,

MARK HUTCHINSON
Deputy Director of Public Works

Attachments: Attachment No. 1 - Engineering Reimbursement Agreement (Minus Sample Exhibits previously provided)
Attachment No. 2 - General Conditions for Additions to District Facilities
Attachment No. 3 - Application for Annexation
Attachment No. 4 – Final Report County of SLO Country Club Audit
Attachment No. 5 – CSA 18 – Wallace Report, April 27, 2016

file: Districts/CSA 18 (Country Club) - Correspondence

c: Dean Benedix, Utilities Division Manager
Andrea Montes, Utilities Program Manager
John Austin, Utilities Project Manager
Tim Tomlinson, Development Services Division
County Planning and Building Department
County Environmental Health Department
Tom Erskine, P.O. 510, Paso Robles, CA 93447

L:\Utilities\2017\February\Tract 2429 Cond Intent to Serve JA.docx JA:jb

Exhibit 2C

ANNEXATION AGREEMENT

WHEREAS, the parties to this Annexation Agreement ("Agreement") are the County of San Luis Obispo ("County") on behalf of County Service Area No. 18, and ("Owner"); and

WHEREAS, Owner hereby requests annexation of certain real property ("Owner's Property") described and portrayed in Exhibits "1A" and "1B" to this Agreement, which Exhibits "1A" and "1B" are attached hereto and by this reference incorporated herein, to San Luis Obispo County Service Area No. 18 of the County of San Luis Obispo a political subdivision of the State of California, and

WHEREAS, the County of San Luis Obispo is willing to consent to said annexation on the terms and conditions specified in this Agreement.

NOW, THEREFORE, THIS AGREEMENT made and entered into this ________ day of ______________, 20____, by and between the Owner and the County;

WITNESSETH:

1. In consideration for the annexation of Owner's Property to County Service Area No. 18, the Owner shall:

(a). Comply with all requirements set forth in the Letter of Conditional Intent to Serve Wastewater dated , 2016, including completion of the annexation process by the Local Agency Formation Commission. Said requirements and conditions shall be completed by Owner prior to connection to and provision of wastewater service by County Service Area No. 18.

(b). Comply with all terms, conditions and requirements set forth in the Engineering Reimbursement Agreement (ERA) for the subject project and dated May 8, 2015.

(c). Pay to County a cash "buy-in" fee for County Service Area No. 18 existing facilities and reserves of $ within 15 (or 30??) days after approval of the annexation at public hearing by the San Luis Obispo County Local Agency Formation Commission.

(d). Submit to County, for approval by the County Director of Public Works, Improvement Plans for all wastewater system improvements internal to Owner's Property ("Owners Onsite Improvements"), including but not necessarily limited to sewer laterals, sewer mains, manholes, lift stations and appurtenant equipment.

(e). Submit to County, for approval by the County Director of Public Works, Off Site Improvements (which are necessary to provide service to Owner's property, but which are not constructed on Owner's property) for all wastewater system improvements necessary to connect Owner's Onsite Improvements to the County Service Area No. 18 systems, including but not limited to any improvements or additions to CSA No. 18's equipment and/or treatment facilities which are determined by the County Director of Public Works to be reasonably necessary to receive Owner's Onsite Improvements, including but not limited to any sewer and/or force mains, manholes, lift stations and appurtenant equipment.

(f). Comply with all requirements for Owner's Property under the California Environmental Quality Act and other applicable law.

(g). Such Improvement Plans shall be prepared in accordance with County Standards. Construct all of Owner's Improvements (On Site, Off Site and facility upgrades) in accordance with the approved Improvement Plans (such Improvement Plans shall be prepared in accordance with County standards) and shall comply with all requirements under the California Environmental Quality Act and other applicable law.

(h). Employ a California licensed professional civil engineer as an Engineer of Work to provide inspection during the course of construction, to certify to the Director of Public Works that the Owner's Improvements (On Site, Off Site and facility upgrades) were installed in accordance with approved plans, and to submit as-built plans to the Director of Public Works. If the Engineer of Work is other than the designing engineer or is replaced during the course of construction, the County Director of Public Works shall be notified in writing; and each such Engineer of Work shall certify as to their respective involvement. The County Director of Public Works, or his designated representative, may make such additional inspection(s) as is deemed necessary, but no such inspection shall relieve the Engineer of Work's responsibility to inspect and certify the work and the as-built plans.

(i). Reimburse the County for the cost of checking the Improvement Plans, for the cost of inspection of Owner's Improvements (On Site, Off Site and facility upgrades) by the San Luis Obispo County Director of Public Works or his designated representative, and for the cost of processing the annexation of the subject property to County Service Area No. 18, including but not limited to costs associated with processing the request for consideration by the Local Agency Formation Commission, the San Luis Obispo County Board of Supervisors, the Regional Water Quality Control Board and filings with the State of California Board of Equalization. For all services rendered by County personnel, the Owner shall be charged and pay to the County the actual cost, as computed in the County's cost accounting system and as described and detailed in the ERA.

(j). Provide such easements for Owner's Improvements (On Site, Off Site and facility upgrades) as deemed necessary by the County.

(k). Provide a will-serve letter from the San Luis Obispo Golf and Country Club that there is sufficient capacity for disposal of the additional effluent on the Golf Course and that the Golf Course is willing to extend that service to the subject Tract.

2. Permission is hereby granted to the County, or its authorized agent, to enter upon the land which is the subject of the Owner's Improvements (On Site, Off Site and facility upgrades) for the purpose of inspection of any and/or all work to be done under the agreement.

3. It is understood and agreed by and between County and Owner that this agreement shall bind the heirs, executors, administrators, successors and assigns of the Owner to the Owner's Property.

4. The Owner shall defend, indemnify and save harmless the County, its officers, agents and employees, from any and all claims, demands, damages, costs, expenses, judgments, attorney fees or any liability arising out of this agreement or attempted performance of the provisions hereof, including but not limited to those predicated upon theories of violation of statue, ordinance, or regulation, professional malpractice, negligence, or recklessness including negligent or reckless operation of motor vehicles or other equipment, furnishing of defective or dangerous products or completed operations, premises liability, inverse condemnation, violation of civil rights, or any act or omission to act, whether or not it be willful, intentional or actively or passively negligent on the part of the Owner or its agents, employees or other independent Consultants directly responsible to Owner; providing further that the foregoing shall apply to any wrongful acts or any active or passively negligent acts or permissions to employees or other independent contractors and County, its agents, employees or independent professional contractors involved in this project. Nothing contained in the foregoing indemnity provision shall be construed to require indemnification for claims, demands, damages, cost, expenses, judgements, attorney fees resulting solely from the negligence or willful misconduct of the County.

5. Owner hereby recognizes that Owner's Property shall be subject to all the benefits of County Service Area No. 18, and also shall be subject to all the burdens, liabilities, and costs of County Service Area No. 18, including but not limited to County Service Area No. 18 rules and regulations, resolutions and ordinances and Federal, California State and San Luis Obispo County laws, regulations, compliance orders, and cease and desist orders that may either exist at the time of the annexation or that may come into existence subsequent to the annexation. Owner further recognizes that while annexation to County Service Area No. 18 provides Owner's Property with the right of access to the public wastewater system, the annexation requirements do not exempt Owner's Property from connection requirements or from charges or assessments for new facilities or resources acquired after the date of this Agreement.

IN WITNESS WHEREOF the Owner has hereunto set his hand and the County has caused these presents to be signed and its corporate seal hereto affixed by it's duly sworn and authorized officers the day and year first hereinabove written.

OWNER:

By:______________________________

SAN LUIS OBISPO COUNTY
SERVICE AREA NO. 18

By: ______________________________
Chairperson, Board of Supervisors
Acting on behalf of County Service
Area No. 18

ATTEST:

____
County Clerk and Ex-officio Clerk
of the Board of Supervisors of the
County of San Luis Obispo

APPROVED AS TO FORM AND LEGAL EFFECT:

RITA L. NEAL
County Counsel

By:______________________________
Deputy County Counsel

Dated:___________________________

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Attachment No. 2

General Conditions for Additions to District Facilities
County Water Works and County Service Areas
Department of Public Works - County of San Luis Obispo

The General Conditions below describe the requirements of the Applicant, the Applicant's engineer, and the construction of the improvements.

Submitted Drawings and Agreement to Provide Service - Your submittal of engineering drawings (and specifications, if applicable), and our review is required as the basis to provide water or wastewater service, and any Agreement to accept your facilities. Any changes to our accepted plans must be re-submitted to the Department of Public Works for consideration; as-constructed plans shall reflect any such changes.

Construction - Any and all construction is subject to the approval of the Director of Public Works. All plans and specifications shall be reviewed and signed as approved by District staff prior to any construction. Construction shall be performed in accordance with the Approved Plans, and within the guidelines of all applicable County Specifications (County Department of Public Works Standard Improvement Specifications and Drawings). No connection to the existing system shall be permitted unless all work performed is acceptable to the County Director of Public Works.

Submitted Drawings and Signature Block - A signature block shall be provided for the Utilities Division Manager and the County Director of Public Works. The title blocks shall be provided on each original mylar (or vellum) sheet which shows the pipeline connection or related details. The title blocks shall read as follows:

RECOMMENDED FOR APPROVAL BY:
_____________________________, DATE:_________
UTILITIES DIVISION MANAGER, RCE 42090

APPROVED BY:
____, DATE:_____________
S.L.O. COUNTY DEPUTY DIRECTOR OF PUBLIC WORKS, RCE

A note (smaller font) shall be provided below the signature blocks which reads as follows: "DISTRICT REVIEW AND APPROVAL OF PLANS COVERS ONLY THOSE FACILITIES WITHIN THE PUBLIC RIGHT OF WAY".

An as-built revision block shall be provided for each original drawing.

Submittal of the contractor's proposed method of connection to the existing system is required. Submit these details to Doug Bird, Program Manager, Department of Public Works, Room 207, County Government Center, San Luis Obispo, CA, 93408; (Phone: 788-2768).

Permits and Notification - A County Encroachment Permit is required for all work done within the County right-of-way. All utility companies shall be notified prior to the start of construction. The County Director of Public Works shall be notified at least 48-hours prior to starting of construction. Contact Scott Wetmore, Permits Engineer (phone 781-5288) to arrange for submitting information, fees, and for arranging inspections required by the County Road Department. Any construction done without approved plans or prior notification to the County Director of Public Works will be rejected, and will be at the contractor's own risk.

Pipeline Pressure Test Results - The Applicant's Engineer shall submit a brief report describing the pressures and observations noted during the timed pressure testing of the pipeline.

Soils Inspection Report and Compaction Test Results - A Final Soils Report and Compaction Test Summary discussing the compaction results for the backfill (and the test locations) shall be submitted to the District for approval.

Field Changes - An Inspector (acting on behalf of the District) may identify unforeseen problems arising in the field, requiring revisions in the plans and Specifications. Upon discovery, the Applicant's engineer shall promptly evaluate the problems and submit plans to the District indicating the proposed action.

Project Design and Final Inspection – improvements to be offered/accepted by the District for maintenance shall be designed by a California Registered Civil Engineer (RCE), in accordance with the District's Conditional Intent to Provide Water Service Letter. A final inspection and certification of the project will be required. The RCE certifying the improvements and preparing the as-constructed plans shall be present when the final inspection is made.

Certification of Conformance - An Engineer's Improvement Certification shall be submitted to the District, attesting to the fact that "improvements were constructed at the horizontal and vertical alignment, and in substantial conformance with those approved plans and the Standard Specifications and Drawings, or with those approved changes shown on the as-constructed drawings".

As-Constructed Drawings - As-constructed drawings shall be submitted to the District prior to final acceptance; field verified alignments of all utilities in the vicinity of the District's point of connection shall be clearly indicated on the plans.

Ownership of Facilities - If completed as per the Agreement, after final inspection and District approval of the constructed facilities, the District will accept them for maintenance (those within the County right-of-way). Title to facilities shall vest in County in accordance with the Agreement. Any domestic water service meter(s) (and bypass meters, on the backflow preventers) shall also be owned and maintained by the District. The Applicant shall own and maintain all other facilities located on their property.

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Attachment No. 3

Application for Annexation

_______________________________ hereby requests that
(Owner)

Tract 2429 _______________________________, totaling ________ acres,
(General Description of Owners Property; for example, Tract No. XXXX, or Assessor's Parcel Number YYY-YYY-YYY)

which is more specifically described in the attached metes and bounds legal description (Exhibit 2A), and which is shown on the attached vicinity map and the attached map or plat of the property (Exhibit 2B), (attachments to be provided by owner upon submitting this application)

be annexed to:

County Service Area No. 18 (Country Club),
(Name of Special District, zone or improvement area thereof)

for the purpose of:

Obtaining wastewater service ___________________________.
(For example, obtaining water service)

Owner hereby acknowledges that the County's consideration of the Annexation request may include, but not be limited to, the following items:

A) Processing and approval by the San Luis Obispo County Local Agency Formation Commission (LAFCO) and/or the San Luis Obispo County Board of Supervisors.

B) Processing and approval in accordance with the California Environmental Quality Act (CEQA).

C) Review of an engineering analysis to be prepared by a California licensed registered civil engineer employed by the Owner which identifies the impact that the development of the Owner's Property will have on the existing system of the Special District.

D) Review of Improvement Plans for Onsite Improvements (Owners Improvements), which are to be constructed on owner's property.

E) Review of Improvement Plans for Offsite Improvements, which are necessary to provide service to Owner's property, but which are not constructed on owner's property.

F) Review of other items relating, but not limited to, the Special District's operating permits from agencies of the State of California and other agreements and requirements associated with operation of the existing system of the Special District.

G) Development of an Annexation Agreement which will include terms and conditions of the annexation if the County is willing to consent to said annexation. Exhibit "2C" attached to this application, is an example annexation agreement provided by the County to the Owner.

Owner agrees to reimburse the County for costs incurred by County in response to this annexation application, and has submitted an initial deposit of $2,000 per the terms of the attached Engineering Reimbursement Agreement. The Owner shall reimburse the San Luis Obispo County Department of Public Works in accordance with the terms and conditions of said Engineering Reimbursement Agreement.

Owner hereby designates the following person(s) to be the Owner's designated representative on matters of this Application.

Owner's Designated Representative: ______________________________

Address: ______________________________

City & Zip: ______________________________

Phone & FAX: ______________________________

IN WITNESS WHEREOF the Owner has hereunto set his hand.

OWNER:

By: ______________________ Address: ____________________

Date: ______________________ City & Zip: ____

Phone & FAX: ____________________

Attachments Exhibit 2A – Legal Description
Exhibit 2B – Tract Map
Exhibit 2C – Example Annexation Agreement

February 25, 2004

Ms. Carmen Fojo
County of San Luis Obispo
Department of Public Works
County Government Center, Room 207
San Luis Obispo, CA 93408 018-24865

Subject: Country Club Wastewater Treatment Plant Audit

Dear Ms. Fojo;

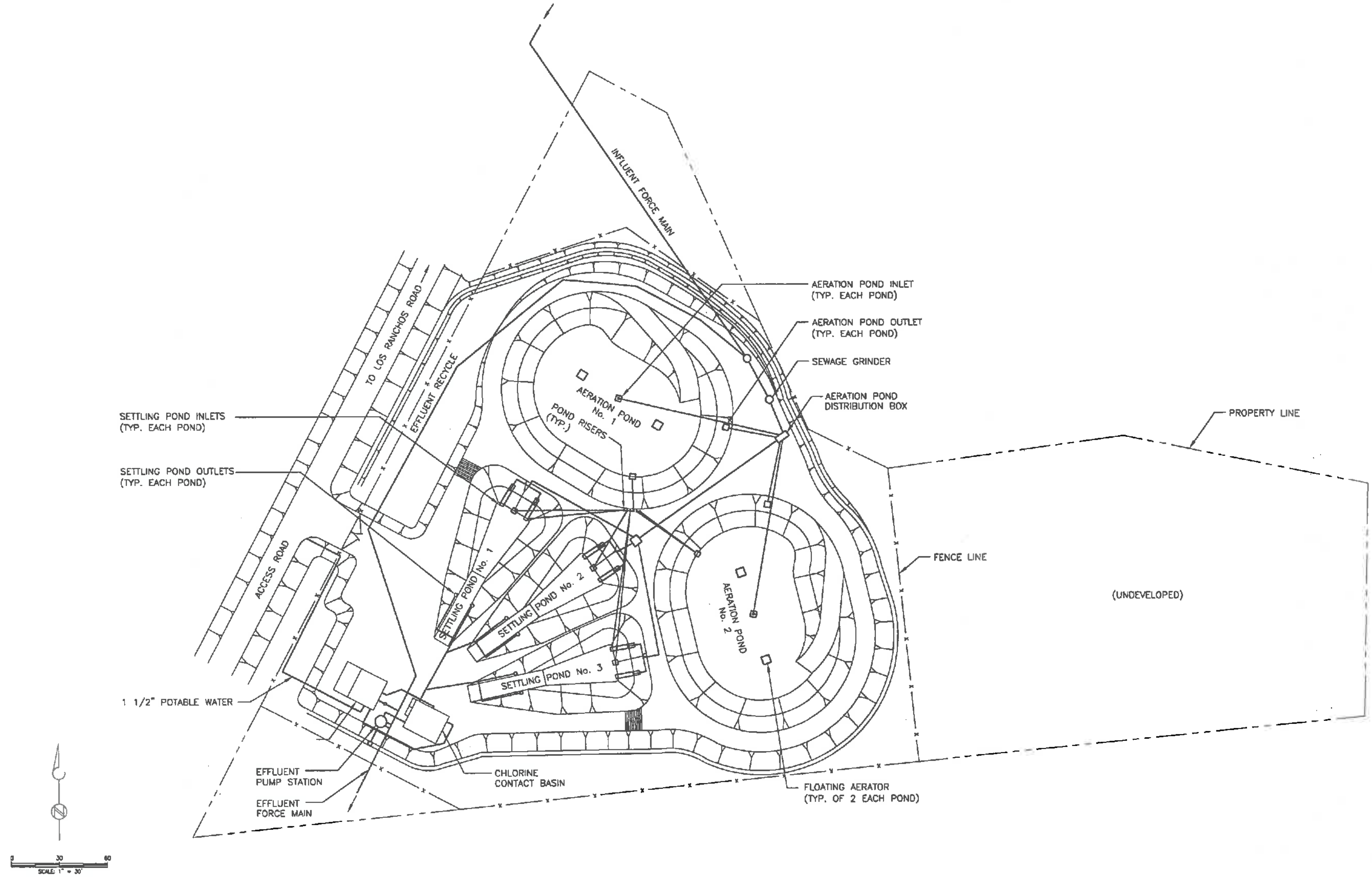
Brown and Caldwell is pleased to submit this letter report summarizing our audit of the County Service Area 18 (CSA 18) Country Club Wastewater Treatment Plant WWTP). This report addresses the operations and maintenance concerns raised by County staff during our kickoff meeting, site visit, brainstorming meeting, and draft report review meeting. These concerns include aeration pond sludge accumulation, aeration pond short-circuiting, settling pond operation, pond liner condition, settling pond water level control, and utility water pressure.

This report also addresses the specific concerns regarding sludge disposal options should liquid sludge disposal at the Santa Maria WWTP be discontinued. Sludge dewatering and disposal options were identified and estimates of annual costs were developed for four alternatives.

INTRODUCTION

The Country Club Wastewater Treatment Plant was constructed in 1987 to treat domestic wastewater from a golf course and associated housing development located south of the City of San Luis Obispo. The design capacity of the plant is 120,000 gallons per day (gpd). The current influent flow averages approximately 85,000 gpd, or approximately 2/3 of the design capacity. The layout of the principal Country Club WWTP facilities are shown on Figure 1.

Treatment facilities at the Country Club WWTP include a raw sewage grinder, two aeration ponds, three settling ponds, effluent flow measurement (using a Parshall flume), chlorine contact tank, and final effluent pumping station. The two aeration



BROWN AND CALDWELL
OXNARD, CALIFORNIA

SUBMITTED: ____ PROJECT MANAGER DATE: ____
APPROVED: ____ BROWN AND CALDWELL DATE: ____
APPROVED: ____ DATE: ____

LINE IS 2 INCHES AT FULL SIZE (IF NOT 50mm-SCALE ACCORDINGLY)
FILE 24865
DRAWN ____
DESIGNED ____
CHECKED ____
CHECKED ____

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

COUNTY OF SAN LUIS OBISPO

WASTEWATER TREATMENT PLANT AUDIT
CSA 18 WASTEWATER TREATMENT PLANT

FIGURE 1
EXISTING COUNTRY CLUB
WASTEWATER TREATMENT PLANT

DRAWING NUMBER

SHEET NUMBER

Path: P:\CAD\24865 - County of SLO WWTF\ Filename: Figure 1 - Existing Country Club Plot date: Feb 17, 2004-02:20:44pm CAD User: amorad
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ponds are typically operated in series. The influent flow distribution box is configured so that either of the ponds can be taken out of service or both ponds can be operated in parallel. Pond 1 has two 5 horsepower (hp) floating aerators and pond 2 has two 3 hp aerators. Disinfected final effluent is pumped to a blending pond, located offsite, where it is blended with well water and used for golf course irrigation. If final effluent flows exceed irrigation demands, disinfected final effluent is pumped to an emergency overflow pond, also located offsite. The emergency overflow pond is at a significantly lower elevation than the blending pond. The final effluent pump discharge pressure is significantly lower when the emergency overflow pond is used because of the emergency overflow pond's lower water surface elevation. Golf course staff control the operation of the blending pond and emergency overflow pond.

Existing Conditions

County staff provided historical operations data from February 1997 through August 2003 for analysis. These data were analyzed to determine representative influent concentrations and evaluate plant performance. Influent characteristics have been relatively constant over this 5-½year period as illustrated by time series plots of biochemical oxygen demand (BOD), total suspended solids (TSS), ammonia nitrogen, and alkalinity provided in Attachment A (Figures A-1 through A-4). Influent concentrations for these four constituents averaged 243 mg/L for BOD, 208 mg/L for TSS, 26.4 mg/L as N for ammonia nitrogen, and 538 mg/L as $CaCO_3$ for alkalinity. These influent concentrations are consistent with those observed in "typical" municipal wastewater.

Staff Concerns

A project kickoff meeting and site visit were held on September 29, 2003. Following the site visit, a brainstorming session was held with County staff and Brown and Caldwell project staff to review staff concerns and discuss potential solutions. These activities are summarized in a memorandum submitted to the County on October 23, 2003.

RECOMMENDED TREATMENT SYSTEM IMPROVEMENTS

Several modifications are recommended to optimize performance of the aeration pond/settling pond treatment system. A biological treatment process simulator, BioWin32 (EnviroSim Associates), was configured to simulate aeration pond performance at the Country Club WWTP. The physical characteristics (e.g., volume, surface area) of the aeration ponds and settling ponds were used to configure the plant simulator. The average plant influent data summarized above and an average influent flow of 85,000 gpd were used as input to the plant simulator. Relationships between particulate and soluble BOD, volatile suspended solids (VSS) and TSS, and ammonia and organic nitrogen for typical domestic wastewater were used.

The relative locations of the aeration pond inlet, outlet, and aerators results in "short-circuiting" so that the full aeration pond volume is not used. To simulate this short-circuiting, only half the actual pond volume (0.5*1,200,000 gal = 600,000 gal) was used. The corresponding hydraulic residence time is 7.1 days at current average flows. Simulation results, in parentheses, are compared to average plant data in Table 1.

Table 1. Measured and Simulated Treatment Plant Performance

Location	BOD, mg/L	TSS, mg/L	Ammonia nitrogen, mg/L as N	Alkalinity, mg/L as $CaCO_3$
Influent	243 (243)	208 (208)	26.4 (26.3)	538 (540)
Pond 1 effluent	139 (151)	209 (183)	16.5 (13.4)	483 (470)
Pond 2 effluent	94 (96)	192 (162)	3.5 (6.9)	382 (430)
Settling pond effluent	50 (43)	36 (29)	3.6 (6.9)	382 (430)

This table shows that the simulation results for BOD and TSS are comparable to measured performance data throughout the treatment system, with only semi-quantitative model calibration. Although the settling pond effluent simulation results for ammonia nitrogen and alkalinity are higher than measured performance data, the differences are not critical for this study. Therefore, we believe that the biological treatment process simulator, as configured, is acceptable for evaluating BOD removal and TSS production under alternative treatment system and operating conditions.

Aeration Ponds

Simulation results indicate that aeration pond performance could be improved by using the full volume of the ponds. Treatment efficiency improves and solids production is reduced, as more volatile solids are digested through endogenous decay at longer retention times. Therefore, modifications are recommended to each of the aeration ponds to reduce short-circuiting. The existing flow distribution box will be retained to maintain the flexibility to operate both ponds in series, both ponds in parallel, or either pond by itself.

A floating baffle is recommended for each aeration pond to minimize short-circuiting and operate closer to the design hydraulic residence time of 14.2 days at an average influent flow of 85,000 gpd. The longer hydraulic residence time will not necessarily reduce effluent BOD concentrations, but will allow for more sludge digestion through endogenous decay. A brochure from Environetics, included as Attachment B, shows the features of a typical floating baffle. Additional information can be found at http://www.environeticsinc.com/pages/02.html. The proposed baffle layout for each of the aeration ponds at the Country Club WWTP is shown in Figure 2. Each baffle would span the width of each pond, roughly splitting the pond in half. It is also recommended that each floating aerator be relocated to the approximate center point of its respective section. Additionally, it is also recommended that the inlet pipe into each pond would be extended to discharge more towards the center of the inlet section. Submerged openings at each end of the baffle will hydraulically connect the inlet and outlet halves of the pond.

County staff expressed a concern regarding the solids accumulation on the bottom of each of the aeration ponds and asked if the accumulated sludge affected plant performance. Current conditions were documented with sludge depth measurements provided by County staff in late January 2004. Figures 3 and 4 below summarize the measured sludge depths at 15 locations in each aeration pond.

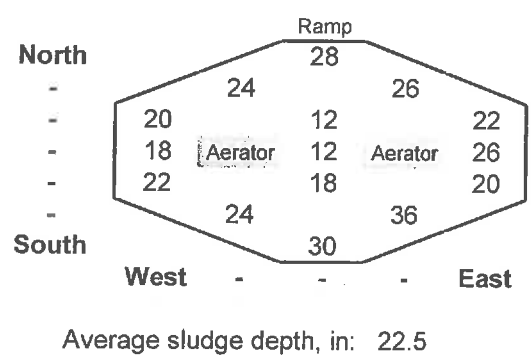
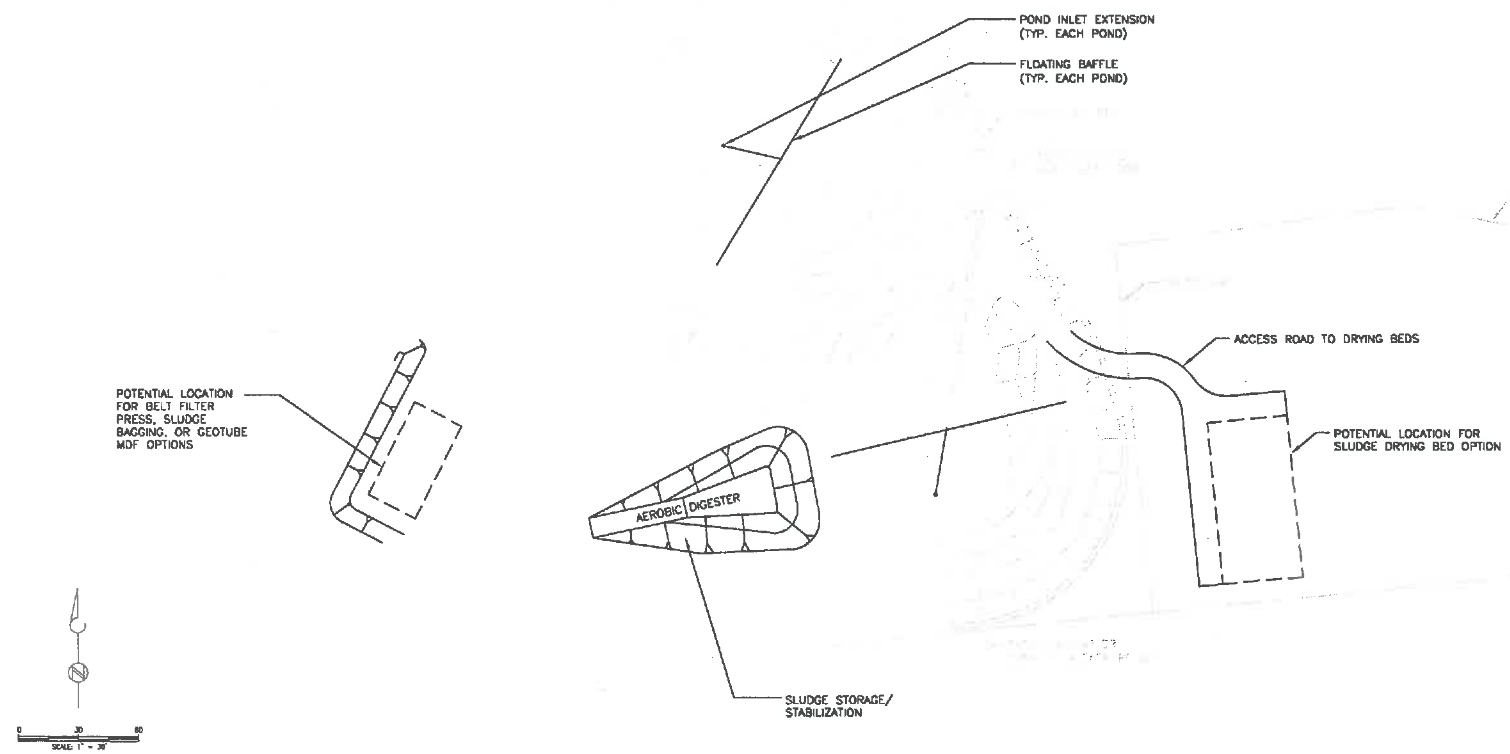


Figure 3. Aeration Pond 1 Sludge Depth



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OXNARD, CALIFORNIA

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LINE IS 2 INCHES AT FULL SIZE (IF NOT 50mm–SCALE ACCORDINGLY)
FILE 24865
DRAWN
DESIGNED
CHECKED
CHECKED

REVISIONS

ZONE	REV.	DESCRIPTION	BY	DATE	APP.

COUNTY OF SAN LUIS OBISPO

WASTEWATER TREATMENT PLANT AUDIT
CSA 18 WASTEWATER TREATMENT PLANT

FIGURE 2
PROPOSED COUNTRY CLUB
WASTEWATER TREATMENT PLANT
IMPROVEMENTS/MODIFICATIONS

DRAWING NUMBER
SHEET NUMBER

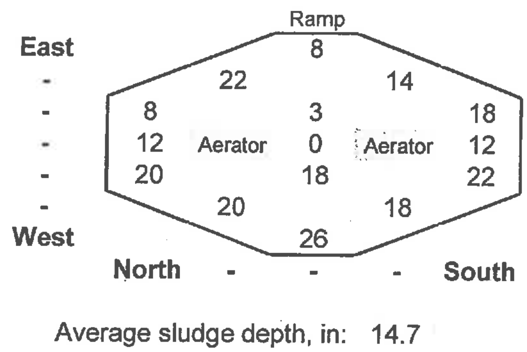


Figure 4. Aeration Pond 2 Sludge Depth

The average sludge depth is 22.5 inches in aeration pond 1 and 14.7 inches in aeration pond 2. This is equivalent to an accumulation rate of 1.5 inches/year in aeration pond 1 and 1.0 inches/year in aeration pond 2. Note that the two aeration ponds were not designed to keep all solids suspended; some solids will settle on the bottom where they undergo additional stabilization that reduces overall sludge production. The floating aerators in each pond appear to have been sized for process oxygen requirements and not necessarily for mixing requirements. The measured sludge depths are consistent with the existing aerator power input. (If the aerators were sized based on mixing considerations, two 7.5 hp mixers would be needed in each aeration pond.)

The planning level construction costs for the recommended aeration pond modifications are $33,800, including a 50 percent planning-level contingency. A 50 percent contingency allowance provided for this project (and other projects that follow) reflects a planning-level estimate and is provided to budget for unforeseen construction costs. The construction cost includes $22,500 for the floating baffles and $11,300 for the inlet pipes extension. The total project cost for the recommended modifications is $47,320. This amount includes an allowance of 40 percent of the construction cost for project engineering, legal, administration, and related project costs.

Removal of the accumulated sludge in each aeration pond was estimated using the measured sludge depths shown above. The volume of accumulated sludge in the two ponds is approximately 471 cu yd and 308 cu yd, respectively. Sludge removal from each aeration pond will need to be sequenced to meet effluent limits. We recommend that the floating baffle be installed in aeration pond 2, while the pond is still in service, so that aeration pond 1 can be taken out of service. Before aeration pond 1 is taken out of service and all the flow is directed to aeration pond 2, the aerators in each pond will be exchanged so the larger aerators are in aeration pond 2. The sludge removed from the bottom of aeration pond 1 will likely need to be air dried so that it can pass a paint filter test and ultimately be disposed of in a sanitary landfill. The contractor will need to secure an off-site location for the air-drying. Following sludge removal from aeration pond 1, the inlet pipe will be extended and the floating baffle anchors installed. Aeration pond 1 will be placed into service in series operation downstream of aeration pond 2 to reestablish treatment performance. The floating baffle will be installed and the aerators centered in aeration pond 2 once aeration pond 1 is in service.

In preparation for taking aeration pond 2 out of service, the aerators will be exchanged again so the larger aerators are back in aeration pond 1. Following sludge removal from aeration pond 2, the inlet pipe will be extended. The floating baffle will be reinstalled once aeration pond 2 is back in service. The estimated project cost for accumulated sludge removal is $38,700. The sanitary landfill disposal cost is an additional $17,400, for a total of $56,100, assuming that the accumulated sludge is air dried to approximately 15 percent total solids and the tipping fee is $88/wet ton.

We recommend installation of the floating baffles and extension of the influent lines in the two aeration ponds at this time, as these modifications will have the greatest impact on aeration pond performance. Removal of accumulated sludge can be done concurrently at the County's option. If the accumulated sludge is not removed at this time, aeration pond sludge depths should be measured periodically and compared against the depths measured in January 2004. Changes in aeration pond and settling pond suspended solids should be tracked as well. Figure A-5, in Attachment A, shows aeration pond 2 suspended solids concentrations. The blue linear trend line shows that aeration pond 2 suspended solids concentrations were not affected by sludge accumulation over the past 5-½ years. Figure A-6, in Attachment A, shows a similar plot for settling pond suspended solids concentrations. Again, the blue linear trend line shows that settling pond suspended solids concentrations were not affected by sludge accumulation over the past 5-½ years. In both cases, the data show a decreasing trend. Significant increases in aeration pond 2 and settling pond suspended solids concentrations in the future are an indicator that the accumulated sludge should be removed.

Settling Ponds

Aeration pond solids are effectively removed in the existing settling ponds, with an average effluent TSS concentration of 36 mg/L. Duckweed accumulation on the pond surface does not appear excessive, and helps reduce algae production that could affect effluent suspended solids concentrations and chlorine demand. Operator concerns about long settled sludge residence time and water surface elevation control are addressed below.

SOLIDS HANDLING ALTERNATIVES

A major emphasis of this study was an evaluation of existing solids handling practices and developing alternative solids handling approaches based on a range of potential sludge disposal options. Waste solids from the County Club WWTP are currently trucked as liquid sludge to the Santa Maria WWTP. County staff are concerned that the Santa Maria WWTP could stop receiving liquid sludge and asked for an evaluation of solids handling alternatives that consider landfill disposal, composting, and alternative daily cover disposal options.

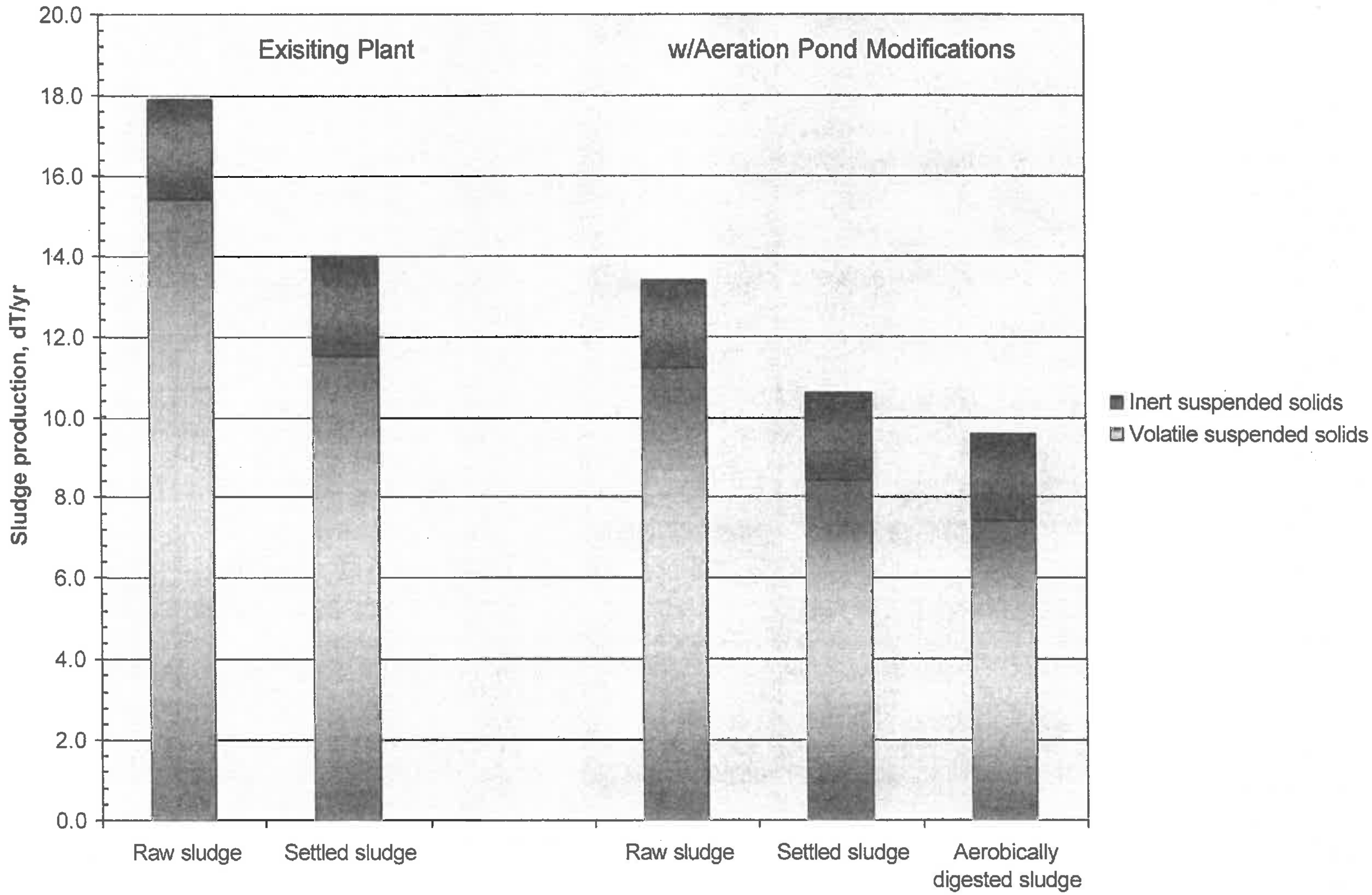
Existing Practice

Approximately three years ago, County staff started removing accumulated sludge from the settling ponds. (No sludge was removed from the Country Club WWTP for the first 12 years of operation.) The sludge is loaded into a septic truck at approximately 3 percent solids and trucked to the Santa Maria WWTP, where it is disposed of at a current rate of $0.194/gal. County staff provided recent sludge handling and disposal costs between March 2002 and August 2003. During this 18-month period, a total of 171,300 gal of sludge was pumped from the settling ponds. This corresponds to an annual sludge removal/disposal rate of 114,200 gal/yr. At 3 percent solids concentration, this corresponds to 14.3 dry tons per year (dT/yr).

Solids Production

The process simulator described above was used to calculate existing sludge production and to evaluate changes in sludge production with the proposed aeration pond improvements. Simulated sludge production is 84 lb/d volatile suspended solids (VSS) and 98 lb/d total suspended solids (TSS), corresponding to 15.4 dT/yr VSS and 17.9 dT/yr TSS. Note that this is "raw" sludge production, representing suspended solids from aeration pond 2 that are collected in the settling ponds. The volatile portion of the raw sludge will be reduced through stabilization while the sludge sits in the bottom of the settling ponds. Assuming 25 percent volatile solids destruction in the settling ponds, the simulated sludge production for ultimate disposal is estimated to be 14.1 dT/yr. A graphical comparison of the calculated raw sludge and settled sludge production for the existing plant is shown on Figure 5. The calculated settled sludge production is comparable to the actual annual sludge production of 14.3 dT/yr calculated from plant records.

Sludge production will be reduced through increased endogenous decay if aeration pond short-circuiting is eliminated, as discussed above. The longer hydraulic and solids residence time when the full aeration pond volume is used will reduce the



SludgeCalc SludgeChart

Figure 5. Annual Sludge Production

quantity of volatile solids produced. The simulator was run using the full pond volume, and simulated sludge production decreased to 61 lb/d (11.2 dT/yr) VSS and 74 lb/d (13.4 dT/yr) TSS – a 25 percent reduction relative to current raw sludge production. This increased treatment efficiency will reduce the rate of sludge collection in the settling ponds and may also improve final effluent quality, due to the lower solids loading and accumulation rate. Assuming 25 percent volatile solids destruction in the settling ponds, the simulated settled sludge production is 10.6 dT/yr. The estimated sludge production with the recommended aeration pond modifications is also shown on Figure 5. It should be noted that all of the sludge handling alternatives considered in this study and related costs assume that the above recommended aeration pond improvements are implemented.

Solids Storage/Stabilization

Sludge stabilization provides additional volatile solids destruction that reduces the total quantity of sludge for ultimate disposal. Stabilization also provides pathogen destruction. Minimum requirements for vector attraction reduction and pathogen destruction for various beneficial uses, such as land application, have been set by USEPA in regulations found at 40CFR503. A summary of the regulations, including vector attraction reduction requirements, is provided in Attachment C.

For small treatment facilities such as the Country Club WWTP, sludge stabilization also provides for sludge storage between periodic sludge removal and disposal. Two alternatives are commonly used for sludge stabilization at small treatment facilities: anaerobic or aerobic stabilization.

The existing settling ponds provide anaerobic stabilization while the sludge sits in the bottom of the ponds. The settling ponds act as facultative ponds where natural oxygen transfer maintains aerobic conditions in the top layer of the pond, where final effluent is removed for subsequent disinfection, while anaerobic conditions occur at the bottom of the pond. The levels of sludge stabilization and pathogen destruction that are achieved depend on the length of sludge storage. For example, other facilities have found that one to two years of storage produces a sludge that meets Class A criteria, suitable for beneficial reuse as regulated by 40CFR503. The pathogen reduction requirements for Class A biosolids are summarized in Attachment C.

Aerobic stabilization uses mechanical or diffused air aeration to provide oxygen transfer and mixing energy. The aerobic stabilization rate is higher than anaerobic stabilization, so the typical detention time for sludge from plants without primary sedimentation is 16 to 18 days. Conversion of settling pond 3 to an aerobic digester would provide storage so sludge in the two settling ponds could be pumped from each settling pond on a routine basis. Routine sludge removal would reduce settling pond residence time and potentially improve effluent quality. An aerobic digester would provide some additional sludge stabilization and would minimize potential dewatering system odor potential. Assuming an additional 10 percent volatile solids destruction in an aerobic digester, annual sludge production would be reduced to 9.6 dT/yr as shown on Figure 5. The estimated construction cost for an aerobic digester conversion is $25,500, including a 50 percent contingency allowance. The corresponding project cost is $35,700. This amount includes a 40 percent allowance for project engineering, legal, administration and related project costs.

Solids Dewatering

Sludge dewatering is needed to increase the solids content (decrease the moisture content) before disposal as sanitary waste at a landfill, feed material for composting, or as alternative daily cover at a landfill. Several dewatering alternatives suitable for small plants such as the Country Club WWTP are summarized below.

Mechanical/Passive Dewatering

These dewatering alternatives are capable of a dewatered sludge concentration of approximately 15 to 18 percent dry solids with aerobically digested sludge. A belt filter press is one example of a mechanical dewatering system. Figure 6 shows a schematic of how a belt filter press could be incorporated into the Country Club WWTP. Feed sludge is mixed with a polymer solution to flocculate the solids and is then distributed on a moving belt. The free water drains through the belt and then the sludge is "squeezed" through a series of rollers to force additional water from the sludge. The belt then drops the dewatered sludge into a bin. The filtrate, along with spray water used to clean the belt, is collected and routed back to the plant headworks.

The Aero-Mod Monobelt is a specific belt filter press that is available for this application. The pre-assembled unit includes a sludge feed pump and polymer feed system. The Monobelt also incorporates a rotary thickener to thicken the flocculated sludge before it is distributed on the moving belt. Additional information about the Monobelt can be found at http://www.aeromod.net/monobelt.cfm.

The Aero-Mod Draimad and Geotube Municipal Dewatering System (MDS) are specific examples of a "passive" dewatering system. Figure 7 shows a schematic of how these systems could be incorporated into the Country Club WWTP.

For the Aero-Mod Draimad system, feed sludge is mixed with a polymer solution to flocculate the solids, similar to the belt filter press. The flocculated sludge is discharged into a porous bag where the free water drains through the bag. The Aero-Mod Draimad unit includes a sludge feed pump and a polymer feed system. Multiple

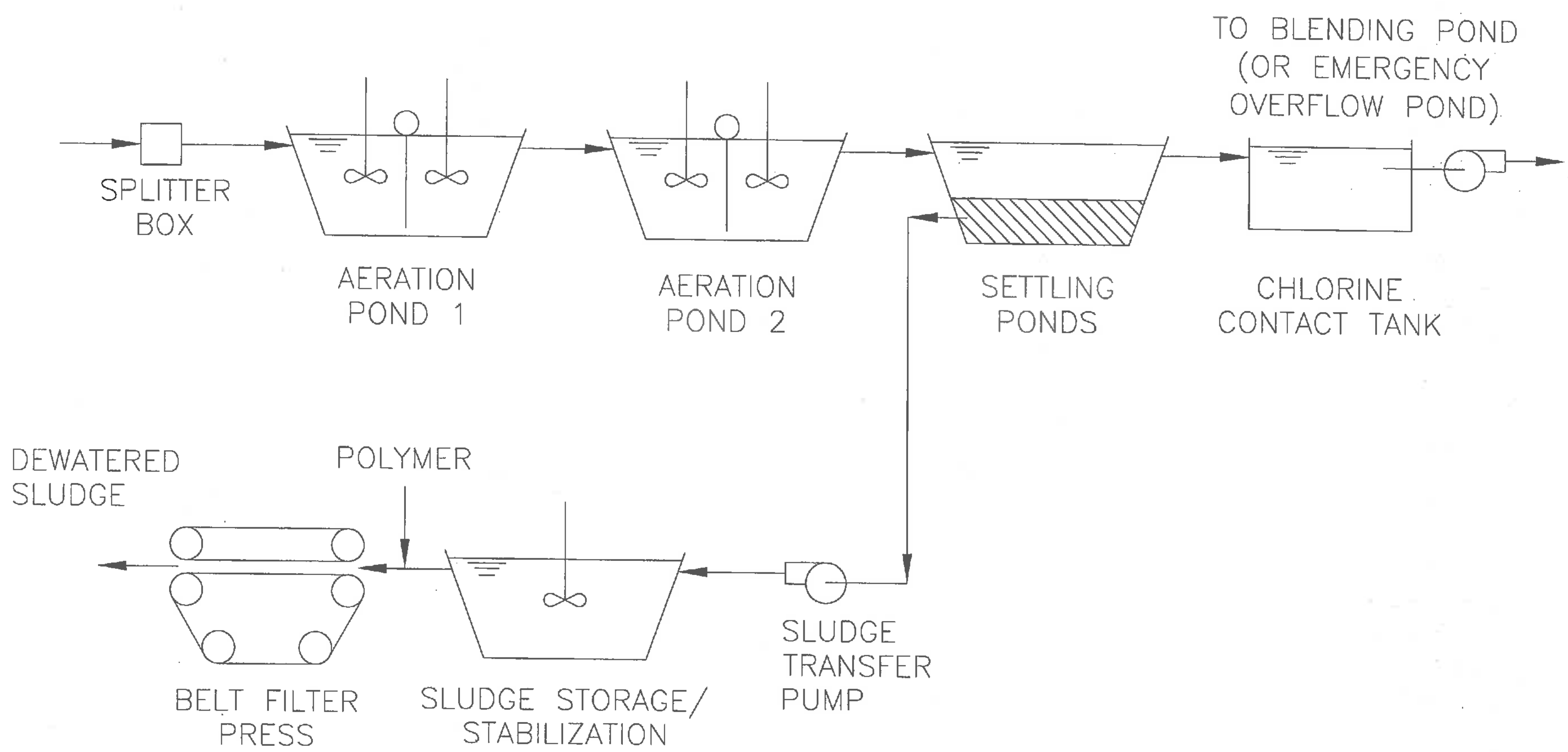


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FIGURE 6 – BELT FILTER PRESS DEWATERING OPTION

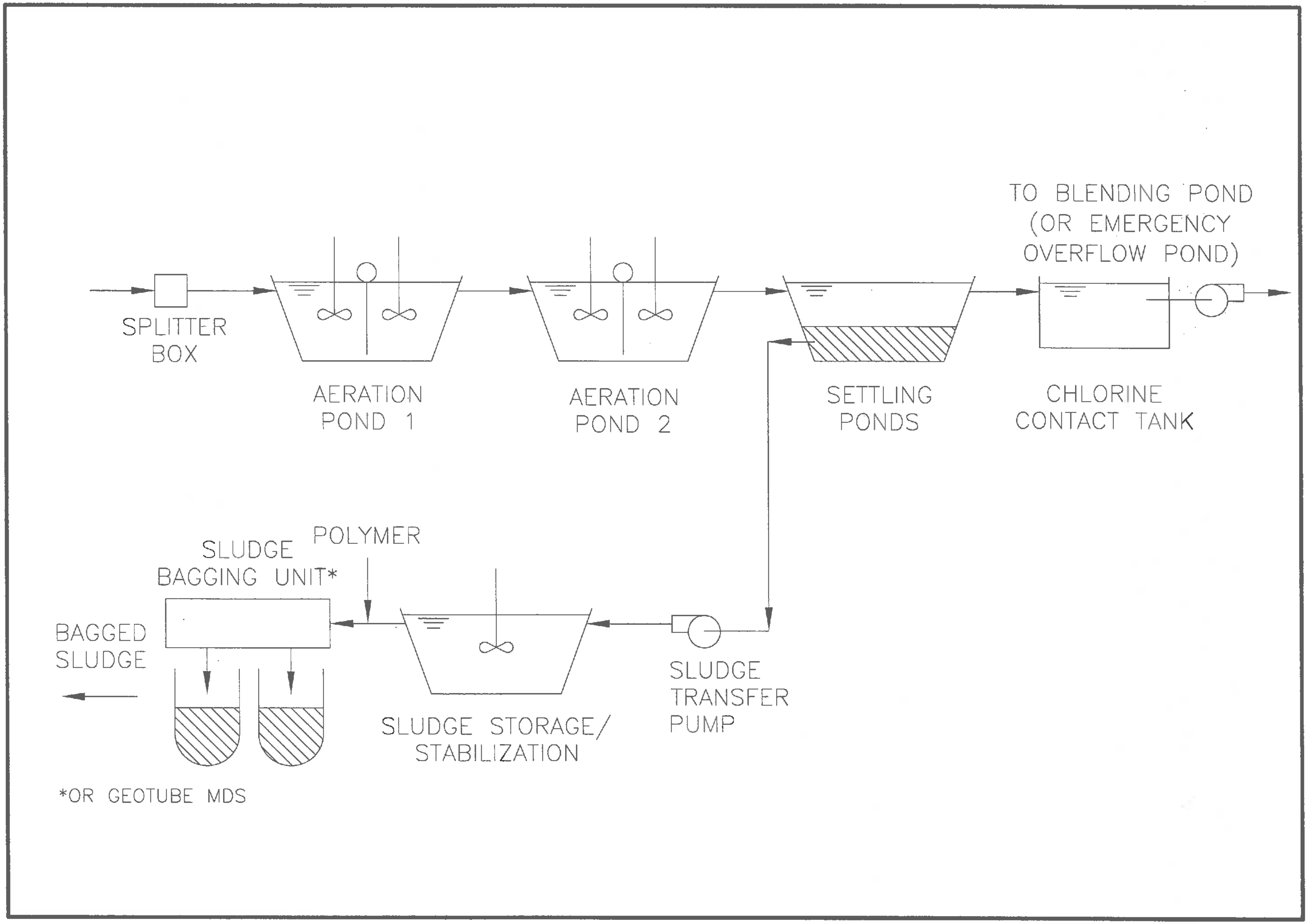

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FIGURE 7 – SLUDGE BAGGING OPTION

bags are installed on the unit. When the bags become full, they are removed and new bags are installed. The filtrate is collected and routed back to the plant headworks. The filled bags can be laid out for additional drying to achieve higher solids content. For example, the filled bags could be laid out around the perimeter of the aeration ponds so that any additional filtrate would drain directly into the pond. Additional information about the Aero-Mod Draimad system can be found at http://www.aeromod.net/draimad.cfm.

The Geotube MDS system consists of a single large porous bag that fits within a 30 cu yd roll off bin. Feed sludge is mixed with a polymer solution and the flocculated sludge is discharged into the bag. The bag can accommodate multiple feed cycles, with additional drying occurring between feed cycles. The roll off bin is collected for disposal when the bag is full. The filtrate is collected and routed back to the plant headworks. Additional information about the Geotube can be found at http://www.geotube.com/enviro/envir_index.html or by contacting Ms. Vickie Ginter (Geotube, 678 227 9944).

Sludge drying beds are another type of "passive" dewatering system. Figure 8 shows a schematic of how a sludge drying bed could be incorporated into the Country Club WWTP. The County's Lopez Lake WWTP uses drying beds for sludge dewatering. Compared to the Aero-Mod Draimad or Geotube MDS systems, a higher dewatered sludge concentration can be achieved as there is more sludge surface area exposed to the atmosphere. However, the dewatered sludge must be manually removed from the drying bed for disposal.

A relatively small space is required for either of the Aero-Mod Monobelt, Aero-Mod Draimad, or Geotube MDS systems, so they can be located within the existing developed area of the plant as shown on Figure 2. However, a sludge drying bed requires more space and may need to be located in the undeveloped area of the plant as shown on Figure 2.

Supplemental Drying

Sludge concentrations greater than 15 to 18 percent can be achieved with mechanically or passively dewatered sludge with supplemental air-drying. However, to achieve this, the dewatered sludge from a Monobelt, Draimad, or Geotube MDS system will need to be spread out on drying beds for supplemental drying. While sludge concentrations of 25 percent solids, or more, can be achieved, the labor requirements are relatively high. The mechanically dewatered sludge must be loaded into a truck, transported to the drying bed, and unloaded. Then the air-dried sludge must be loaded into a truck and transported to a sanitary landfill for ultimate disposal. The sludge is essentially handled twice. Additionally, a drying bed must be located in the undeveloped area of the plant as shown on Figure 2.

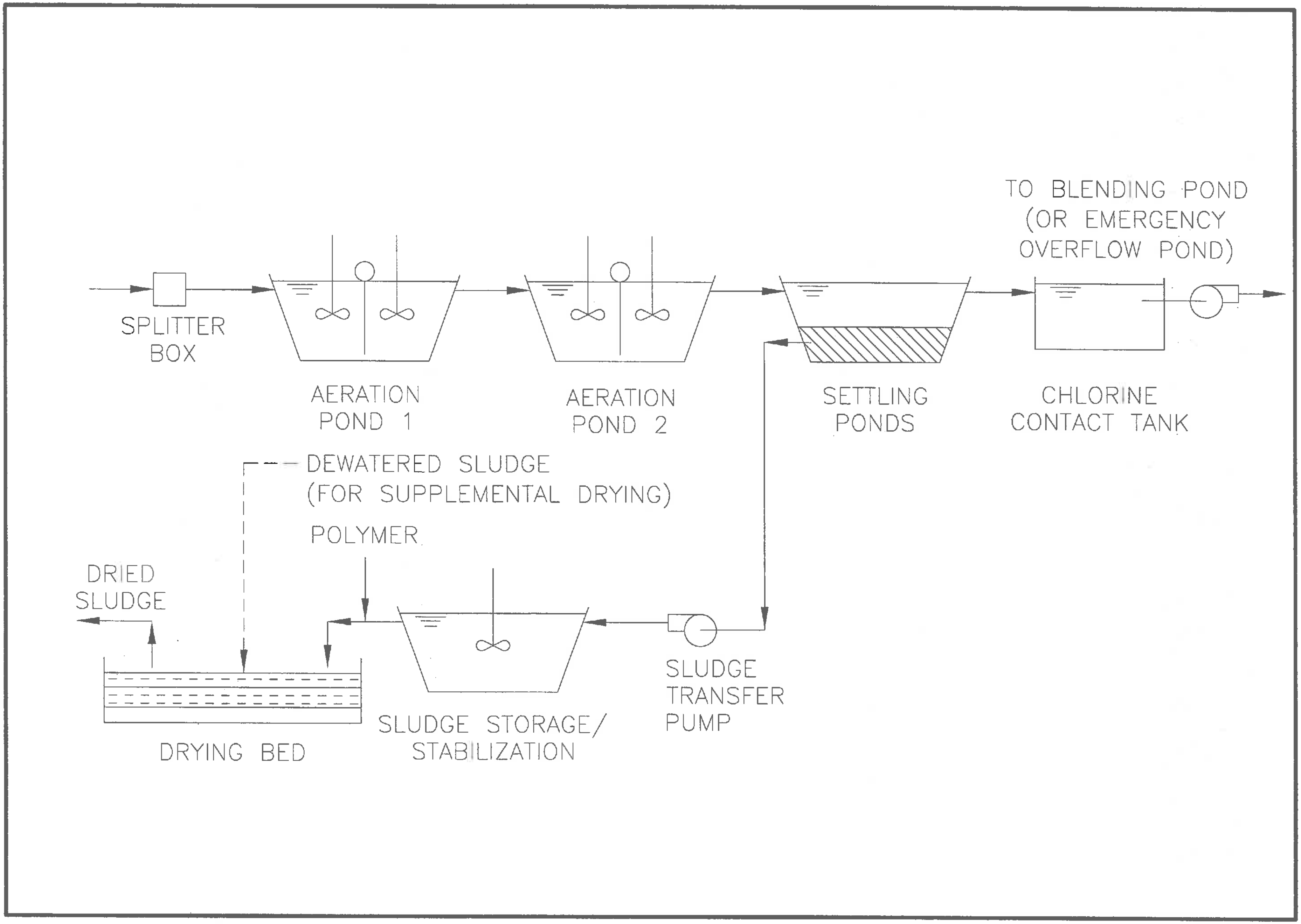

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FIGURE 8 – DRYING BED OPTION

Solids Disposal

Several sludge disposal options were evaluated in this study as alternatives to disposal of the sludge at the Santa Maria WWTP. The focus was on alternatives within a relatively short distance from the Country Club WWTP to minimize hauling costs.

Sanitary Landfill

Dewatered sludge can be disposed of simply as a sanitary waste, as long as the sludge passes a paint filter test, which checks for the presence of free water. County staff identified two nearby landfills that would accept dewatered sludge: Cold Canyon Landfill (5 miles from the plant) and Paso Robles Landfill (35 miles from the plant). Disposal costs are $88/wet ton at Cold Canyon Landfill and $47/wet ton at Paso Robles Landfill.

Another option for landfill disposal is to use the sludge as alternative daily cover at a landfill. The sludge must meet pathogen and vector attraction reduction requirements for Class B biosolids, but the disposal cost is significantly lower. The pathogen reduction requirements for Class B biosolids are summarized in Attachment C. County staff cited a cost of $7/wet ton for alternative daily cover.

Composting

Another disposal option is to use the dewatered sludge as raw material for composting. Composting stabilizes the dewatered sludge through microbiological activity. The dewatered sludge is typically mixed with a bulking agent (e.g., wood chips) and spread out in "static piles" where microbiological activity raises the temperature significantly in the interior of the pile. The bulking agent allows aeration throughout the pile to promote aerobic activity and minimize odors. The piles are turned several times during the composting cycle to achieve a target value of time multiplied by temperature. The bulking agent is screened from the finished compost and reused for the next composting cycle. The finished compost is typically used as a soil amendment.

Composting is typically only economically feasible for smaller plants where there is a regional facility that composts sludge from a number of facilities. Fortunately, Engle & Gray operates a regional composting facility adjacent to the Santa Maria WWTP. This composting facility currently receives sludge from the Cities of Santa Maria, San Luis Obispo, Solvang, and Guadalupe. The finished product is marketed as "Harvest Blend Compost".

Engle & Gray was contacted to inquire on the feasibility of receiving dewatered sludge from the Country Club WWTP as additional raw material for their composting operation. The company maintains their own trucks to pick up dewatered sludge. For larger plants, such as the City of San Luis Obispo, stockpiled dewatered sludge is loaded into transfer trailers. For smaller plants, such as the City of Solvang, the company leaves a roll off bin and picks up dewatered sludge periodically. The preliminary discussions with a representative of Engle & Gray indicate that they may be willing and able to take the projected sludge production from the plant. Their requirements include annual analysis of trace metals; however, given the strictly domestic wastewater source at the plant this should not present a problem. Additional information can be obtained by contacting Mr. Jim Gill (Engle & Gray, 805 925 2771).

Other

Land application within San Luis Obispo County is a potential future disposal option. Typically, more stringent sludge quality requirements are set for land application than for landfill alternative daily cover. The sludge will likely meet "exceptional quality" criteria for trace metals concentration given the strictly domestic wastewater source at the Country Club WWTP. (The criteria for "exceptional quality" biosolids are summarized in Attachment C.) Additional sludge treatment will be required for pathogen inactivation needed to meet Class A biosolids requirements for beneficial reuse. This additional pathogen inactivation can be achieved by constructing additional settling ponds that are sequentially rotated through a loading/stabilization/air drying cycle. A given pond would receive sludge for a year while it is used for solids settling. It would then sit idle for approximately two years for additional pathogen inactivation and stabilization. The pond would be decanted and the sludge air-dried during the fourth year. While this approach is not specifically listed in the Federal regulations, pathogen levels are tested in the dried sludge to demonstrate compliance with the Class A pathogen reduction criteria. This approach is being used to produce Class A biosolids by both small and large plants, such as the San Jose/Santa Clara WPCP.

Based on the estimated settled sludge production at the Country Club WWTP, the three existing settling ponds are adequate for one years' sludge loading. Three additional settling/stabilization ponds, 0.351 million gallons each, would need to be constructed on the undeveloped parcel east of the existing facilities. The new settling/stabilization ponds would need to have a steeper side slope than the existing ponds (1:1 rather than 1:2) in order to obtain the required volume within the available area. The estimated planning-level construction cost for the settling/stabilization ponds is $576,000, including a 50 percent construction contingency. The corresponding project cost is $806,000. This amount includes a 40 percent allowance for engineering, legal, administration and related project costs.

Costs

Construction and operations and maintenance costs were developed for four combinations of dewatering and disposal options. These four alternatives are based on liquid sludge disposal, disposal as sanitary waste, composting disposal, and disposal as alternative daily cover. All four alternatives assume that the recommended aeration pond improvements are implemented. As such, the sludge production and removal/disposal rates considered under each of the four alternatives reflects the anticipated overall reduction of approximately 25 percent relative to current production levels with the aeration pond improvements. The three latter alternatives also assume implementation of the recommended settling pond 3 modifications for sludge storage/stabilization discussed above, to further reduce sludge quantities and stabilize the sludge to minimize odors during dewatering.

Alternative A

Alternative A is based on existing practice, with liquid sludge disposal at the Santa Maria WWTP. No additional sludge treatment is needed and a liquid sludge concentration of approximately 3 percent dry solids is assumed, consistent with current operational results. Table 2 summarizes the estimated construction, project, and operations and maintenance costs for this alternative. Disposal costs are based on $0.194/gal and labor costs are based on $375/dT. Total annual costs are $20,400 at a projected sludge production of 10.6 dT/yr. It should be noted that these costs reflect only those costs associated with dewatering and disposal. These costs would be in addition to the costs associated with the aeration pond improvements and/or other plant improvements discussed herein. The same applies to the other alternatives discussed below.

Alternative B

Alternative B is based on sludge storage/stabilization, dewatering to approximately 15 percent dry solids, and disposal as sanitary waste. Three sub alternatives, B.1 through B.3, are included to cover the three mechanical/passive dewatering options discussed above. The respective equipment costs include a 30 percent allowance for installation, a 25 percent allowance for electrical/instrumentation, and a 50 percent allowance for planning-level construction contingency. Construction costs range from $45,400 for Alternative B.3 (Geotube MDS) to $271,000 for Alternative B.1 (Aero-Mod Rollpress). Corresponding project costs range from $63,600 for Alternative B.3 to $380,000 for Alternative B.1, including a 40 percent allowance for engineering, legal, and administration. Equivalent uniform annual costs are calculated using the project cost, a 6 percent interest rate, and a 20-year amortization period.

Table 2. Solids Handling Alternatives Costs

	Alternative A Santa Maria WWTP	Alternative B.1 Rollpress Landfill	Alternative B.2 Draimad Landfill	Alternative B.3 MDS Landfill	Alternative C MDS Co-composting	Alternative D Rollpress/Drying bed Alternative daily cover
Capital Cost						
Aerobic digester						
Aerator	$ -	$ 17,100	$ 17,100	$ 17,100	$ 17,100	$ 17,100
Misc. modifications	$ -	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Dewatering equipment						
AeroMod Monobelt, 0.8 m	$ -	$ 244,000	$ -	$ -	$ -	$ 244,000
Drying bed, 2,200 sq ft	$ -	$ -	$ -	$ -	$ -	$ 50,000
Sludge bagging						
Geotube MDF	$ -	$ -	$ -	$ -	$ -	$ -
AeroMod Draimad, 12 bag unit	$ -	$ -	$ 147,000	$ -	$ -	$ -
Sludge feed pump	$ -	$ -	$ -	$ 6,100	$ 6,100	$ -
Polymer system	$ -	$ -	$ -	$ 12,200	$ 12,200	$ -
Subtotal (Construction Cost)	$ -	$ **271,100**	$ **174,100**	$ **45,400**	$ **45,400**	$ **321,100**
Engineering, legal, administration [h]	$ -	$ 108,440	$ 69,640	$ 18,160	$ 18,160	$ 128,440
Subtotal (Project Cost)	$ -	$ **379,540**	$ **243,740**	$ **63,560**	$ **63,560**	$ **449,540**
Equivalent Uniform Annual Cost [a]	$ -	$ **33,088**	$ **21,249**	$ **5,541**	$ **5,541**	$ **39,191**
Operations and Maintenance Cost						
Assumed Sludge Production/Removal Rate (	**10.6**	**9.6**	**9.6**	**9.6**	**9.6**	**9.6**
Polymer [b]	$ -	$ 360	$ 360	$ 360	$ 360	$ 360
Sludge bags [c]	$ -	$ -	$ 1,904	$ 3,042	$ 3,042	$ -
Electrical power [d]	$ -	$ 4,079	$ 4,079	$ 4,079	$ 4,079	$ 4,079
Disposal [e]	$ 16,438	$ 5,614	$ 5,614	$ 5,614	$ 3,190	$ 268
Labor [f]	$ 3,975	$ 9,216	$ 19,043	$ 8,399	$ 8,399	$ 18,432
Maintenance [g]	$ -	$ 2,711	$ 1,741	$ 454	$ 454	$ 3,211
Subtotal	$ **20,413**	$ **21,980**	$ **32,742**	$ **21,948**	$ **19,523**	$ **26,350**
Total Annual Cost	$ **20,413**	$ **55,069**	$ **53,991**	$ **27,489**	$ **25,065**	$ **65,541**

a - Project cost amortized at 6% interest over 20 years
b - Polymer dose = 15 lb/dT, polymer cost = $2.50/lb
c - Draimad bag = $2 each, MDS bag = $1,000 each
d - Electrical power = $0.125/kWh
e - Liquid sludge disposal = $0.194/gal, sanitary waste disposal = $88/wet ton, composting disposal = $50/wet ton, alternative daily cover = $7/wet ton
f - Labor = $60/hr
g - Annual maintenance cost = 1% of construction cost
h - Engineering, legal, administration = 40% of construction cost

Annual polymer costs are based on a polymer dose of 15 lb/dT and a polymer cost of \$2.50/lb. Disposables costs for the Aero-Mod Draimad and Geotube MDS dewatering options are based on \$2/bag for Aero-Mod Draimad and \$1,000/bag for Geotube MDS. Electrical costs for the aerobic digester mixer are based on a California average power cost of \$0.125/kWh.

Annual disposal costs are based on a sludge concentration of 15 percent dry solids and a tipping fee of \$88/wet ton.

Annual labor costs vary for each of the three dewatering options. The Aero-Mod Rollpress estimate (Alternative B.1) assumes the unit is operated for 6 hours every 2 1/2 months, with 32 labor hours assumed for set-up, operation, and cleanup. The run interval is based on having sufficient stored sludge for a 6-hour run. The Aero-Mod Draimad estimate (Alternative B.2) is based on continuous operation with a 4.6-day capacity for a 12-bag unit, and 4 labor hours assumed for bag change out and handling. The Geotube MDS estimate (Alternative B.3) assumes a single bag has a 4-month capacity based on projected sludge production, with 12 labor hours for roll off bin change out plus two labor hours per week. Labor costs are based on \$60/labor hour.

Annual maintenance costs are estimated as 1 percent of the construction cost.

The estimated annual operations and maintenance costs range from \$22,000 (Alternative B.3) to \$32,700 (Alternative B.2). The estimated total annual costs, the sum of the equivalent uniform annual cost and operations and maintenance cost, are \$27,500 for Alternative B.3, \$54,000 for Alternative B.2, and \$55,100 for Alternative B.3.

Alternative C

Alternative C is based on sludge storage/stabilization, dewatering to approximately 15 percent dry solids, and use of the dewatered sludge as a raw material for composting. Sludge dewatering is based on the use of a Geotube MDS system. This system provides a low construction cost and assumes the roll off bin can be hauled to the Engle & Gray composting facility with a minimum of additional labor. The construction costs are identical to Alternative B.3.

Similarly, the annual operations and maintenance costs are the same as in Alternative B.3, except that the sludge disposal is \$50/wet ton. The estimated total annual cost for this alternative are \$25,100.

Alternative D

Alternative D is based on sludge storage/stabilization, mechanical dewatering to approximately 15 percent dry solids, supplemental drying to 25 percent dry solids, and landfill disposal as alternative daily cover. Sludge dewatering is based on Monobelt. Dewatered sludge will be spread on new drying beds for supplemental air-drying. The construction costs are similar to Alternative B.1, with the additional sludge drying bed costs added.

Annual operations and maintenance costs are also similar to Alternative B.1, except that disposal costs are lower and labor costs are higher. The significantly lower disposal cost reflects the $7/wet ton tipping fee for alternative daily cover. The higher labor costs reflect the additional labor required to transport the mechanically dewatered sludge across the plant site from the belt filter press to the drying beds, remove the previously air-dried sludge, and spread the mechanically dewatered sludge. The level of effort is estimated as 32 labor hours at a frequency of every 2-½ months to correspond to belt filter press operation as described above. The 2-½ month interval between belt filter press runs is adequate to achieve at least 25 percent dry solids in the final product.

Annual maintenance costs are estimated as 1 percent of the construction cost.

The estimated construction cost for Alternative D is $321,000 with a corresponding project cost of $450,000. The estimated annual operations and maintenance cost is $26,400. The estimated total annual cost is $65,500.

Recommendations

We recommend that the aeration pond improvements discussed hereinbefore be implemented. With respect to sludge handling and disposal, continued liquid sludge disposal at Santa Maria WWTP (Alternative A) represents the lowest cost alternative for solids handling at the County Club WWTP. Use of dewatered sludge as raw material for composting at the Engle & Gray Santa Maria regional composting facility (Alternative C) is the next lowest cost alternative and has an annual cost approximately 23 percent higher than Alternative A. We recommend that the County contact Engle & Gray to discuss use of dewatered sludge as a compost raw material and to develop a firm cost estimate. Once more detailed costs for sludge storage/stabilization, dewatering, and composting are known for Alternative C, County staff can compare these costs against continued liquid sludge disposal and select between these two lowest cost alternatives.

Either of these two alternatives has some risk that the Santa Maria WWTP will stop receiving liquid sludge, or that Engle & Gray will stop receiving dewatered sludge from the Country Club WWTP or go out of business entirely. As a contingency, we recommend that County staff plan for alternative dewatered sludge disposal at Cold Canyon or Paso Robles landfill. Landfill disposal requires conversion of settling pond 3 for sludge storage/stabilization and installation of one of the dewatering options. If this cannot be accomplished before the Santa Maria WWTP or Engle & Gray stop receiving sludge, Baker tanks and aerators can be rented on an interim basis for sludge storage/stabilization while settling pond 3 is modified and a dewatering system is installed.

The four dewatering options discussed above are based on construction at the Country Club WWTP site, as shown on Figure 2. Alternatively, dewatering facilities could be located remotely from the plant site if there is significant opposition to modification of the Country Club WWTP. In this alternative, stabilized sludge would be trucked from the storage/stabilization pond (former settling pond 3) to the remote dewatering facilities, much as liquid sludge is trucked to the Santa Maria WWTP now.

MISCELLANEOUS IMPROVEMENTS

County staff also expressed concerns regarding operations and/or maintenance of several other areas at the Country Club WWTP during our kickoff meeting and subsequent site visit. The following sections summarize our recommendations for the pond erosion control/weed control liners, settling pond water surface elevation control, and utility water system pressure. The existing instrumentation and control system appears to be suitable for plant operation for compliance with effluent discharge permit limits.

Pond Erosion Control/Weed Control Liners

The pond erosion control/weed control liners in the two aeration ponds and three settling ponds have been in service for the approximately 15 years since plant startup. The pond liners do not cover the entire bottom and sidewalls of each pond, but extend only about 1 ft below the water surface to protect the exposed pond walls against erosion and prevent weed growth. We observed that exposed portion of the liners is relatively pliable and that the surface does not have a "chalky" appearance. County staff do not know the specific liner material (e.g., Hypalon, high-density polyethylene, reinforced polypropylene) or thickness. There are significant differences in UV resistance among these typical liner materials. While the existing liners appear suitable for their current service, we cannot comment on projected additional service life without knowing the material type and discussing this issue with the material manufacturer.

Settling Ponds

Operations staff partially close the valve on the pipeline between the settling ponds and the chlorine contact tank to increase the settling pond water surface elevation. They feel the higher water surface elevation improves effluent quality by increasing settling pond depth. At high flows, however, the valve must be fully opened manually to avoid overflows upstream of the settling ponds. A weir box could be fabricated that clamps to each settling pond effluent riser to increase the water surface elevation without manual valve adjustment. The weir box would provide sufficient weir length to routinely maintain a higher water surface elevation in the settling ponds and allow high flows to pass without upstream overflows. The estimated project cost of six fabricated weir boxes is approximately $10,800. However, we recommend that the settling ponds be operated at their design water surface elevation (i.e., with the valve fully open) after the recommended aeration pond improvements are constructed. The settling pond effluent suspended solids should be monitored to measure performance changes. We expect that the reduced solids concentration from the aeration ponds will improve settling pond performance by reducing the solids loading and that modification of the settling pond water surface elevation will not be necessary.

Utility Water System

Chlorinated effluent from the effluent pump discharge line is used for the chlorine injector and for other minor uses at the plant. The vacuum generated at the chlorine injector is critical for chlorination system operation and is affected by supply water flow and pressure. There is adequate pressure in the effluent pump discharge line for injector operation when the final effluent is pumped to the blending pond for golf course irrigation. However, when the blending pond is full (or the final effluent cannot otherwise be used for golf course irrigation), final effluent is pumped to the overflow pond. The overflow pond water surface elevation is significantly lower that the blending pond water surface elevation, so the discharge line pressure drops to the point where the injector cannot develop the necessary vacuum and the chlorination system fails.

We recommend that an in-line booster pump be installed to be used when the effluent discharge line pressure drops below a minimum acceptable value. The booster pump would take suction from the effluent discharge line and would run continuously while the overflow pond is in use. When effluent flow is directed back to the blending pond, the booster pump will be shut off manually. The pump would be sized to provide a minimum acceptable pressure at the maximum anticipated utility water flow.

A pressure relief valve would be installed on the booster pump discharge line, with the valve discharge routed back to the effluent pump wet well. The pressure relief valve setting would correspond to the minimum acceptable flow on the booster pump discharge-head curve to ensure booster pump operation within an acceptable portion of the curve. When the utility water demand drops below the minimum acceptable booster pump flow, the pressure relief valve would open to discharge the excess flow to the effluent pump wet well. Although the booster pump is running continuously, this is a simple arrangement to maintain utility water pressure for those periods when the blending pond is not used. The estimated project cost of two booster pumps (duty and standby) and associated piping modifications is $9,240.

Thank you for the opportunity to assist the County with this project. This letter report presents an assessment of the existing facilities at the Country Club WWTP, and recommends specific modifications to improve aeration pond performance and maintain adequate utility water pressure for final effluent chlorination.

We have evaluated several sludge handling and disposal alternatives should the Santa Maria WWTP stop taking liquid sludge from the Country Club WWTP. We recommend that the County implement the aeration pond improvements and continue with liquid sludge disposal at the Santa Maria WWTP, which is the lowest cost alternative. Additionally, we recommend that the County further evaluate the next lowest cost alternative, composting of dewatered sludge, to develop a more definitive cost estimate for comparison against liquid sludge disposal. We have also developed several other alternatives based on landfill disposal and landfill alternative daily cover. Should you have any questions about the evaluation and recommendations discussed above, please call me at (805) 604-7890 or Ron Appleton at (925) 210-2294.

Very truly yours,

BROWN AND CALDWELL

A. Ron Appleton Jr.

Ruben Zubia, P.E.
Managing Engineer

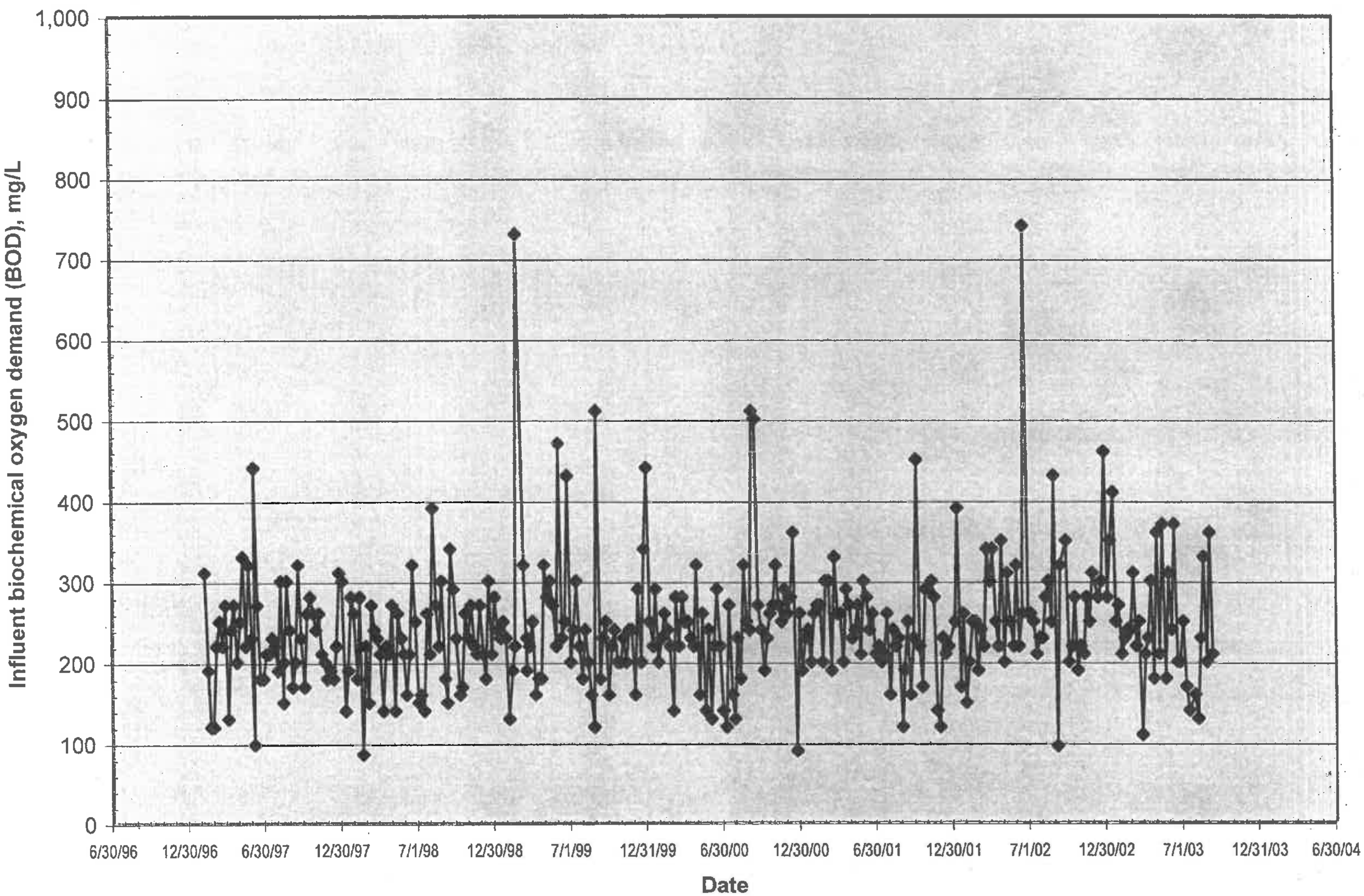
Alan R. Appleton, P.E.
Regional Processing Engineer

ARA:RZ:clk
Attachments

cc: Mr. Ron Appleton, P.E. (Brown and Caldwell)
Mr. Jim Chitty (Brown and Caldwell)

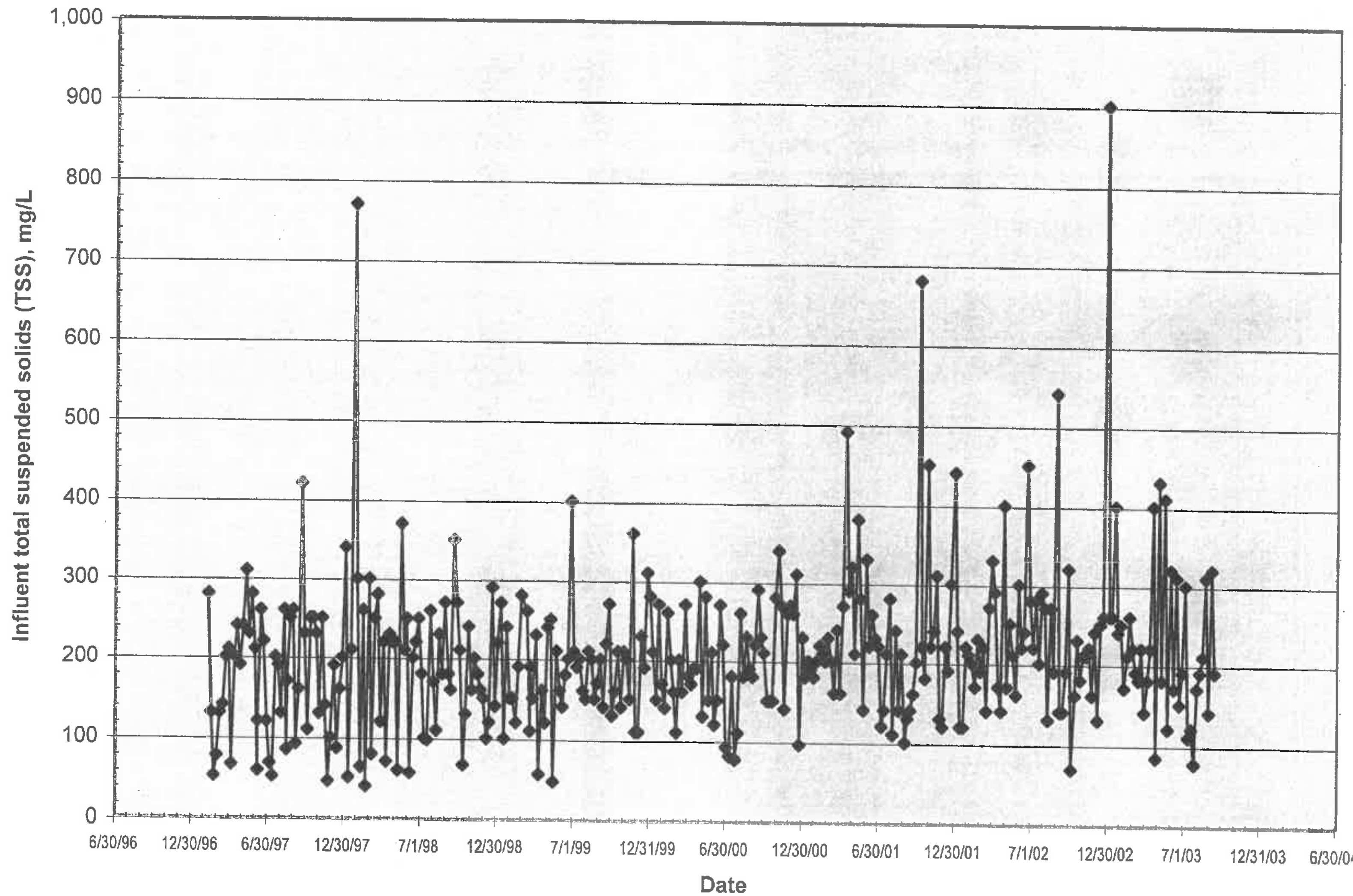
ATTACHMENT A
COUNTRY CLUB WWTP HISTORICAL PERFORMANCE DATA

Figure A-1 – Influent Biochemical Oxygen Demand
Figure A-2 – Influent Total Suspended Solids
Figure A-3 – Influent Ammonia Nitrogen
Figure A-4 – Influent Alkalinity
Figure A-5 – Aeration Pond 2 Total Suspended Solids
Figure A-6 – Settling Pond Total Suspended Solids



Audit data(ARA) RS BOD

Figure A-1. Influent Biochemical Oxygen Demand



Audit data(ARA) RS TSS

Figure A-2. Influent Total Suspended Solids

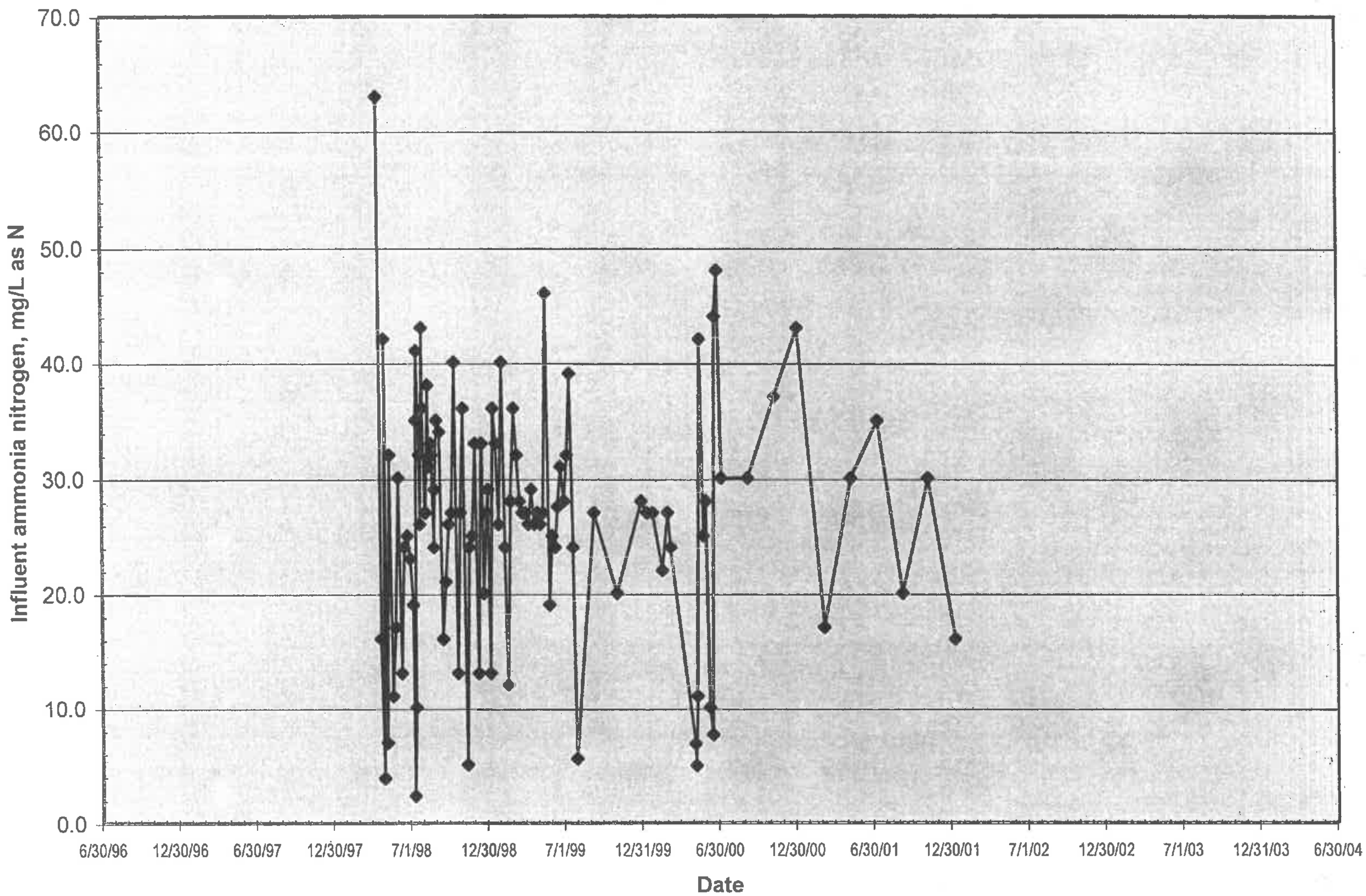
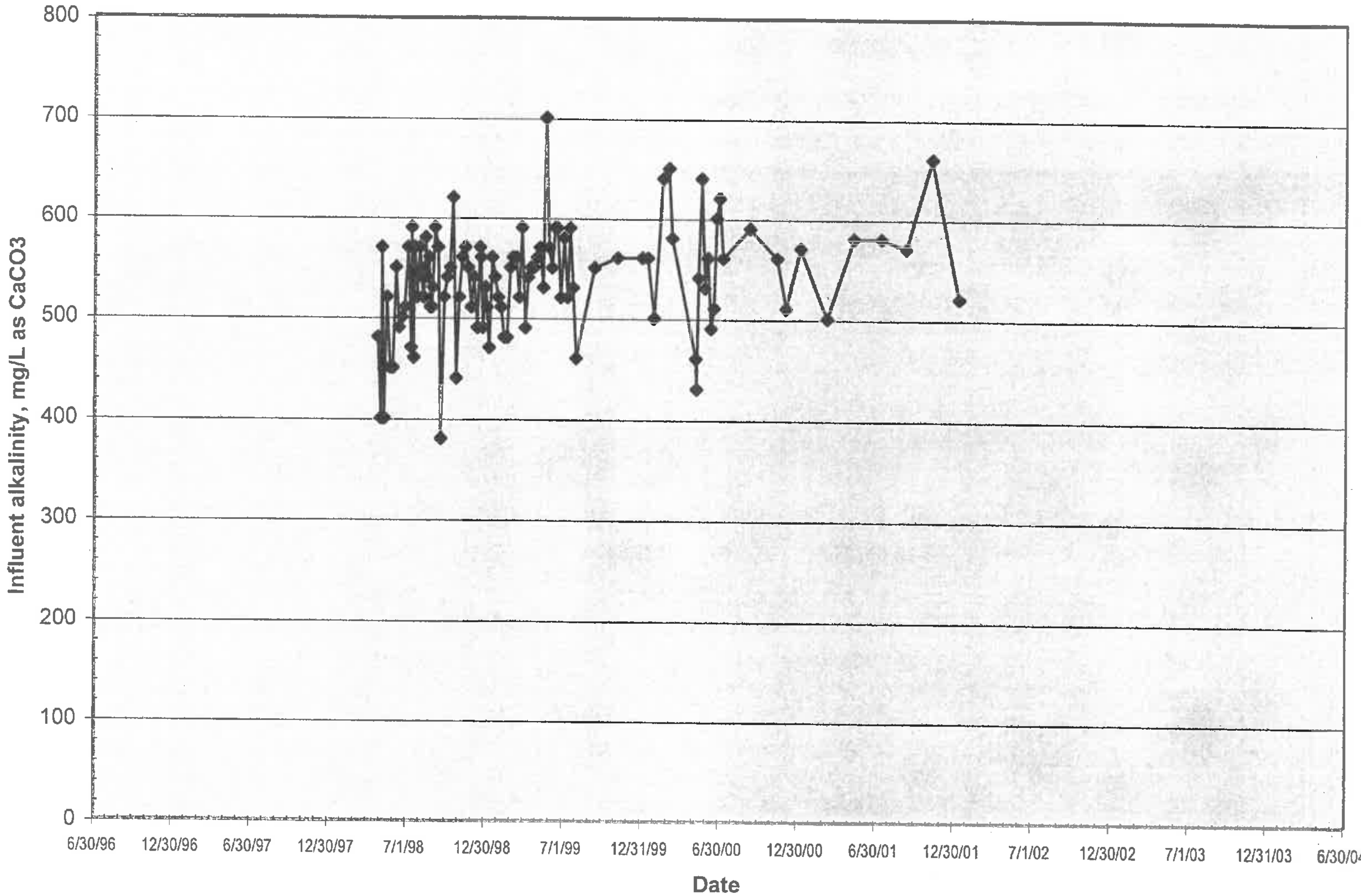


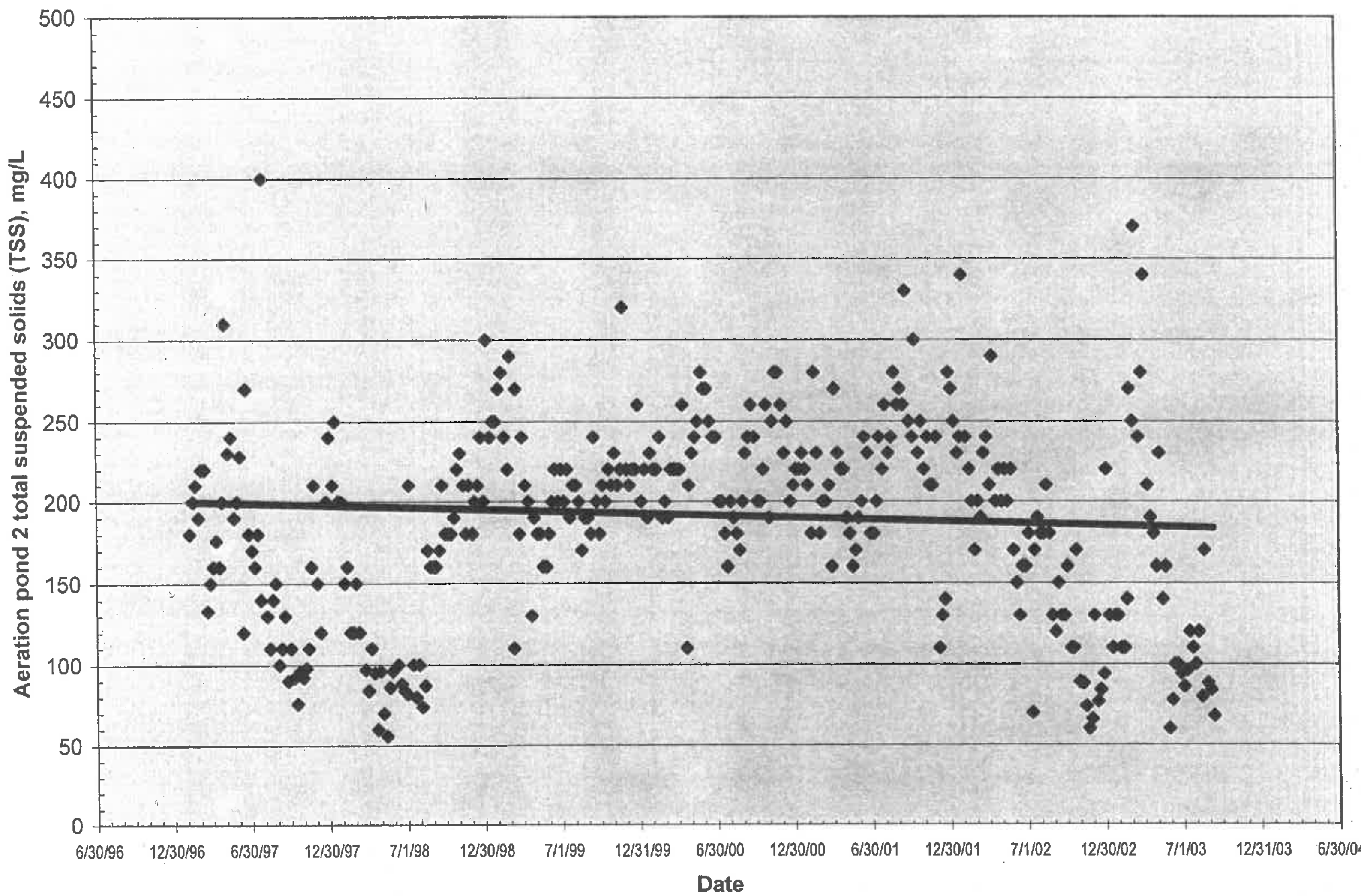
Figure A-3. Influent Ammonia Nitrogen

Audit data(ARA) RS NH3



Audit data(ARA) RS Alk

Figure A-4. Influent Alkalinity



Audit data(ARA).xls AerationPond TSS

Figure A-5. Aeration Pond 2 Total Suspended Solids

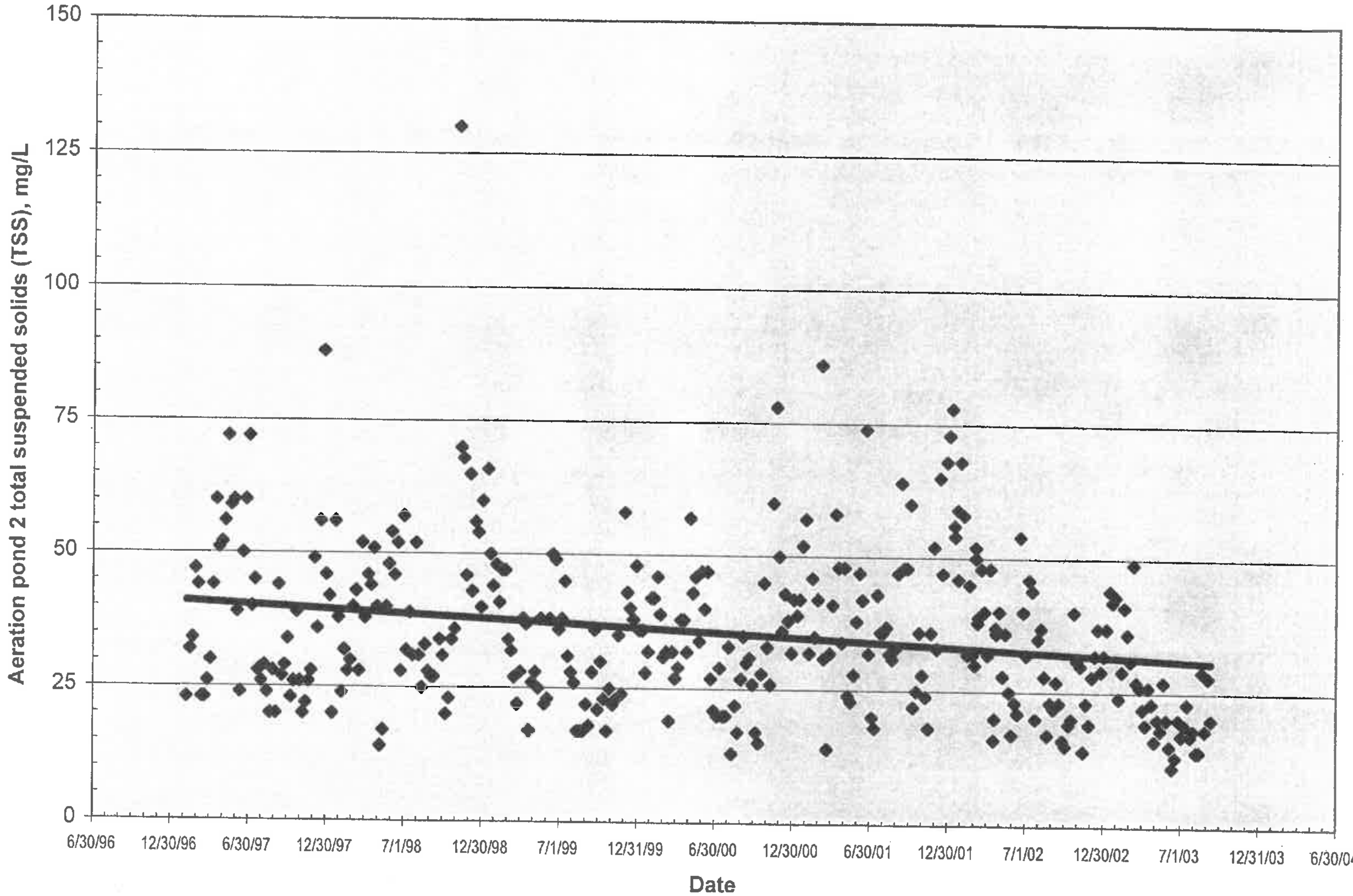
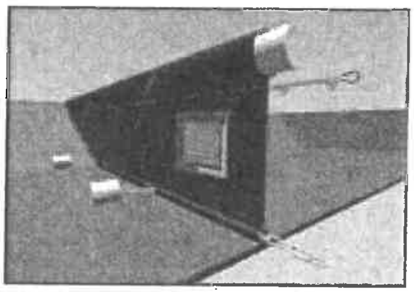


Figure A-6. Settling Pond Total Suspended Solids

Audit data(ARA).xls SettlingPond TSS

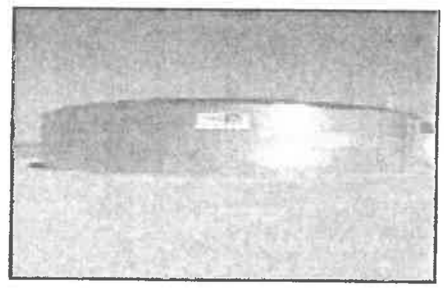
ATTACHMENT B
ENVIRONETICS FLOATING BAFFLE BROCHURE

Environmental Control Products



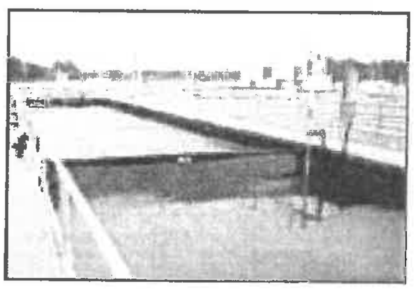
- Increase lagoon efficiency
- Prevent short circuiting
- Improve retention time
- Create treatment cells
- Bottom anchored design
- Quality construction
- Stainless steel hardware

DIRECTOR I™
Floating Baffles



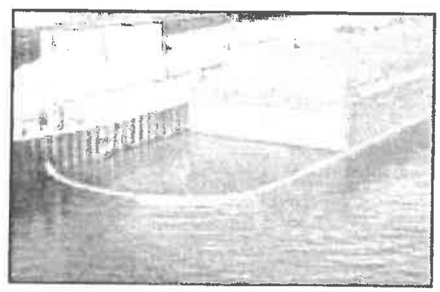
- Rapid Deployment
- Economical storage
- Permanent or temporary
- Foundation not required
- Bolted steel walls
- Chemical resistant liners
- 6,500 to 5 million gallons

Porta Tank™
Liqiud Storage Tanks



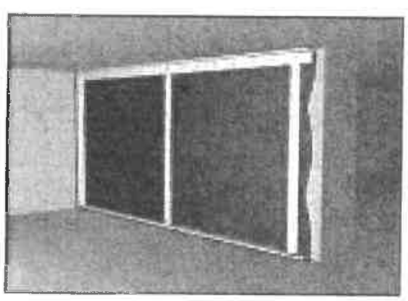
- Increase efficiency
- Save energy costs
- Create a multi-stage treatment process
- Available for circular or rectangular tanks
- Cost effective upgrade for activated sludge systems

DIRECTOR II™
Tank Baffles



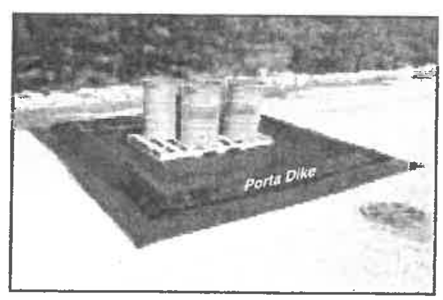
- Contain oil spills
- Open ocean spills
- Harbors and marina docks
- Rivers and streams
- Trap debris and sediment
- Universal end connectors
- Permanent or temporary

Boa Boom™
Oil Spill Containment Booms



- Increase Contact Time
- Meet Stage 1 DBP regs
- For new or existing steel or concrete clearwell tanks
- NSF 61 certified materials
- Quality construction
- Custom fit stainless steel mounting hardware

DIRECTOR III™
Clearwell baffles



- Secure spill containment
- Meets federal regulations
- Drive in - drive out design
- Durable materials
- Quality construction
- Custom sizes available
- Permanent or temporary

Porta Dike™
Spill Containment Berms

ENVIRONETICS, INC.
Established in 1970

1201 Commerce Street, Lockport, IL 60441, Phone: 815-838-8331, Fax: 815-838-8336
Web site: www.environeticsinc.com E-mail: info@environeticsinc.com

CASE STUDY

DIRECTOR I™

FLOATING BAFFLE SYSTEM

DIRECTOR I™ Features

- Increases Lagoon Efficiency
- Prevents Short Circuiting
- Cost Effective Upgrade
- Increases Retention Time
- Creates Treatment Cells
- Increases Treatment Area
- Available for Lined and Unlined Lagoons
- Industrial Thermoplastics
- Marine Grade Hardware
- Bottom Anchored Design
- Easy Installation
- Proven Reliability

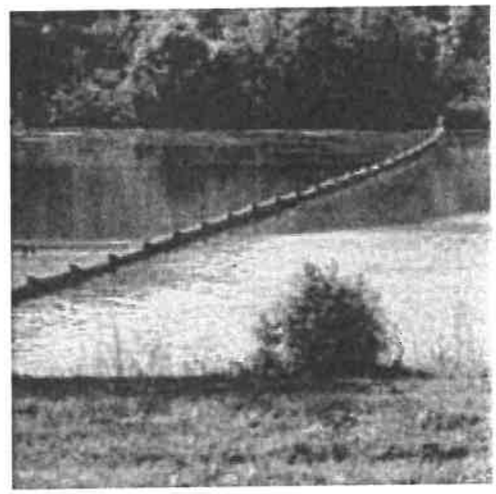
Floating Baffle System Improves Lagoon Efficiency by 90%

Industries and municipalities that deal with wastewater treatment are concerned with improving the efficiency of their wastewater treatment facilities. Lagoon efficiency, cost effective treatment, and low maintenance are important factors when purchasing treatment upgrades. Environetics, Inc. of Lockport, IL took these factors into consideration when they designed the Director™ floating baffle system.

Recently, Environetics discussed wastewater treatment improvements with Citizens Utilities Company, a private utility involved in supplying water and treating wastewater for various municipal and private clients in six states. At their Morris, Illinois facility, Citizens Utilities operates a series of wastewater treatment lagoons.

With lower than normal limits (10 mg/1 BOD and 12mg/1 SS) they had been experiencing times when they were close to their discharge limitations for biochemical oxygen demand (BOD) and suspended solids (SS). This was occurring approximately nine to ten times per year.

An investigation by company personnel, headed by Dave English, operations supervisor, revealed that short circuiting was taking place in the final polishing lagoon. Not only were they experiencing short circuiting in the lagoon, but the levels of BOD and SS were higher at the discharge than at the inlet. In the winter they noticed that ice formed around the edges of the lagoon and they could see a straight path of flowing water from the inlet to the outlet. The ice was able to form because of slower or stagnant flow velocities in the greater part of the lagoon. The majority of the wastewater was traveling



quickly straight from the inlet to the outlet, without allowing enough retention time needed for the biological process necessary for the reduction of BOD and SS work.

Environetics has dealt with many industries and municipalities struggling with the same problem. Citizens Utilities Company and Environetics, Inc. agreed that installation of this floating baffle system would improve the efficiency of the lagoon.

After installation in the lagoon, the Director™ floating baffle system guided the wastewater to take a serpentine pattern through the lagoon thus utilizing the entire lagoon area. This increased the retention time and allowed enough time for the biological process to take place. Since the installation of the baffle system, Citizens Utilities have reduced their BOD and SS excursions by 90%.

An added (and unexpected) benefit of installing this system was the elimination of a beaver problem. Prior to installation, beavers had been building dams in the area and causing debris to get trapped in the outfall.

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DIRECTOR I™

FLOATING BAFFLE SYSTEM

DIRECTOR I™ Features

- Increases Lagoon Efficiency
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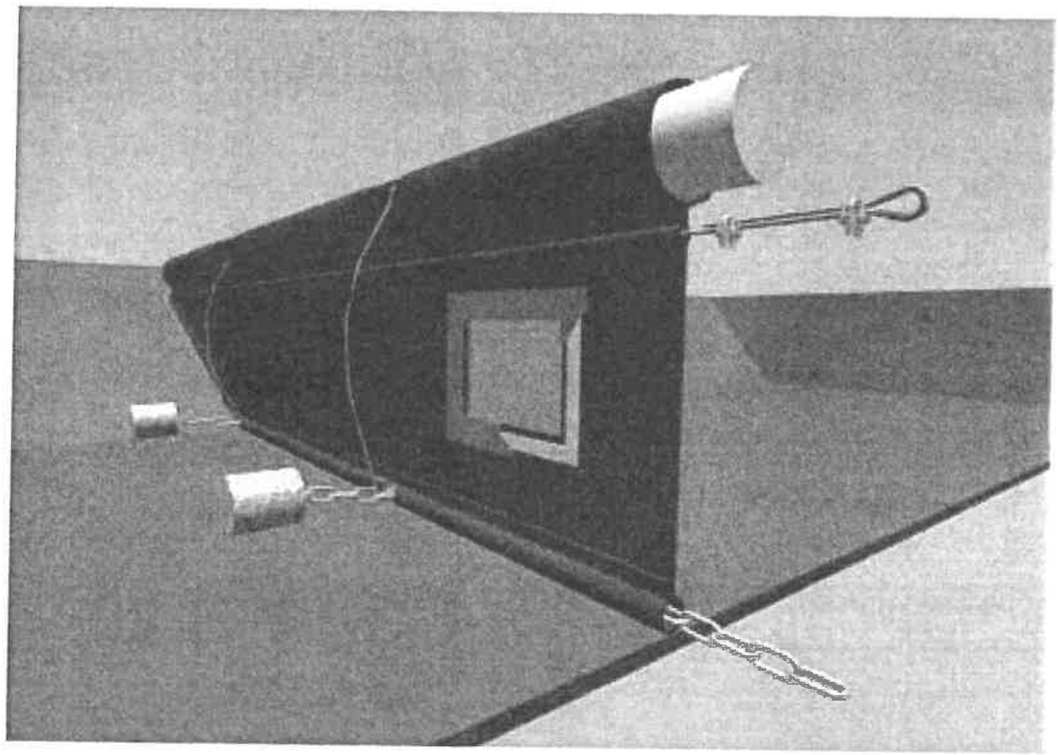
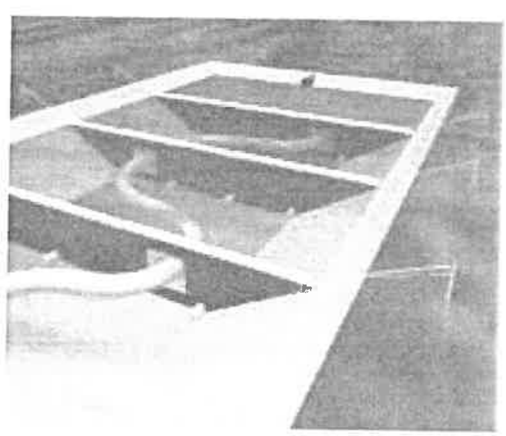
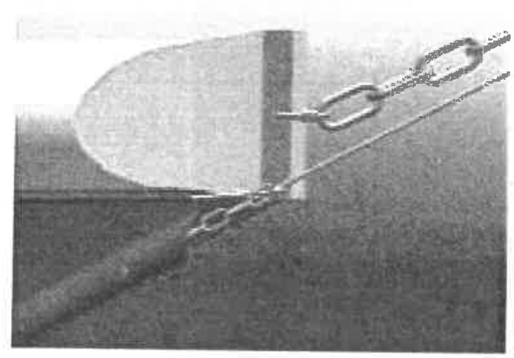


Director I™ Floating Baffle Systems are custom manufactured from industrial grade materials to fit the profile and increase the performance of your specific lagoon.





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ATTACHMENT C
SUMMARY OF BIOSOLIDS BENFICIAL REUSE AND DISPOSAL REGULATIONS

Regulations for sludge beneficial use and disposal are mainly the province of the state and federal governments. In California individual counties have traditionally been involved as local enforcement agencies (LEAs) for enforcement of state solid waste regulations. More recently, California counties have also become more involved in land application of biosolids through development of local restrictions more stringent that those associated with state and federal regulations. These restrictions have generally been developed by rural Central Valley and southern California counties to restrict or eliminate the land application of biosolids from urban areas.

In simplified terms, federal regulations have the most influence over sludge beneficial use and disposal methods other than co-disposal with solid waste in landfills (including use of biosolids as alternative landfill cover). State regulations have the most influence over sludge co-disposal in solid waste landfills and in use of biosolids for landfill cover. There are, of course, exceptions to this general statement. For example, there are federal solid waste landfill regulations (40 CFR Part 258) with which state regulations must be compatible.

This section presents overviews of biosolids beneficial use and disposal regulations. The interrelationships between the state and federal government's roles in each will be included in the discussions. This section is divided into several subsections covering two broad topics:

Beneficial Use. This discussion focuses on the federal regulations published in the early 1990s under 40 CFR Part 503. Those components of 40 CFR Part 503 that will most likely impact future biosolids disposal will be emphasized, with briefer descriptions of alternative beneficial use methods, such as distribution of composted or heat-dried materials. The roles of the state government and local (county) governments in biosolids beneficial use will also be presented.

Landfill /Landfill Cover. This discussion will focus on the State regulations for landfill co-disposal of biosolids with municipal solid waste and for the use of biosolids as alternative daily cover at landfills. The necessity of the state's approach being compatible with federal regulations will be covered as will the role of county governments acting as LEAs.

Federal 40 CFR Part 503 Regulations

Biosolids land application is regulated at the federal level by the U. S. Environmental Protection Agency (USEPA) through the 40 Code of Federal Regulations (CFR) Part 503 (503 regulations). The 503 regulations establish standards to protect public health and the environment from adverse effects that may result from use/disposal practices of biosolids.

The 503 regulations establish standards for pollutant limits; operational standards; management practices; and monitoring, record keeping, and reporting requirements. The 503 regulations impose requirements on the generators and entities that further treat, distribute, or use the biosolids. Persons not complying with the requirements are in violation of the 503 regulations and can be subject to enforcement action from the EPA.

To land apply biosolids, the 503 regulations require that the biosolids be nonhazardous and that they meet minimum standards for pollutant concentrations, pathogen reduction, vector attraction reduction, and nutrient loadings, as described in the following paragraphs. If the biosolids achieve higher standards (as defined below), they are considered "exceptional quality biosolids" and may be used for more applications with fewer restrictions.

Pollutant Limits. The 503 regulations have established pollution concentration limits for ten metals as listed in Tables C-1 and C-2. Table C-1 shows pollutant concentration limits in mg/kg. Table C-2 shows annual and cumulative loading limits in kg/hectare. Since the information in Tables C-1 and C-2 is often cited by the appropriate table number from the 503 regulations, those table numbers are shown in the column headings.

Biosolids with pollutant levels greater than the ceiling concentrations (Table C-1, column 1) cannot be applied to land. Biosolids with pollutant levels below the ceiling concentration, but above the concentrations shown in column 2 (of Table C-1) can be land-applied but are subject to the annual and cumulative pollutant loadings in Table C-2. Biosolids with pollutant levels below the concentrations in Table C-1, column 2 can be applied to land without regard to the cumulative loading restrictions. (The current Biosolids Land Application EIR for California suggests that cumulative loadings be tracked regardless of how the limits in Table C-1 might apply in any specific land application program.)

Pathogen Reduction. In addition to pollutant concentrations, biosolids must not pose a public health risk from pathogens. The 503 regulations stipulate that biosolids applied to land must be treated to reduce pathogens. The 503 regulations permit the use of either performance-based or technology-based approaches to ensuring that pathogen reduction requirements are met.

Table C-1. EPA 40 CFR 503 Pollutant Concentration Limits

Pollutant	503.13 Table 1 Ceiling Concentrations (mg/kg[a])	503.13 Table 3 Pollutant Concentrations (mg/kg[a])
Arsenic	75	41
Cadmium	85	39
Chromium	3,000	1,200
Copper	4,300	1,500
Lead	840	300
Mercury	57	17
Molybdenum	75	NA[b]
Nickel	420	420
Selenium	100	100
Zinc	7,500	2,800

[a] Dry weight basis.
[b] Temporarily suspended by EPA pending further consideration. Value was 18 mg/kg.

Table C-2. EPA 40 CFR 503 Annual and Cumulative Land Application Rates

Pollutant	503.13 Table 2 Cumulative Pollutant Loading Rate (kg/hectare)[a]	503.13 Table 4 Annual Pollutant Loading Rate (kg/hectare/yr)[a]
Arsenic	41	2.0
Cadmium	39	1.9
Chromium	3000	150
Copper	1500	75
Lead	300	15
Mercury	17	0.85
Molybdenum	NA[b]	NA[c]
Nickel	420	21
Selenium	100	5.0
Zinc	2800	140

[a] Dry-weight basis
[b] Temporarily suspended by EPA pending further review. Value was 18 kg/hectare.
[c] Temporarily suspended by EPA pending further review. Value was 0.90 kg/hectare/yr.

The 503 regulations identify two levels of pathogen reduction requirements, Class A and Class B, which may be satisfied by use of specific treatment methods and/or by meeting pathogen concentration standards. The goal of Class A requirements is to reduce pathogens to below detectable limits. Class B biosolids meet adequate pathogen reduction requirements by relying upon environmental factors at the beneficial use site to further reduce pathogens. Therefore, sites, which use Class B biosolids, must follow additional restrictions concerning public access, animal grazing, and crop harvesting.

Class A Requirements—Meeting Class A pathogen reduction requirements necessitates sludge treatment processes that provide a higher treatment level than conventional anaerobic digestion processes. Thermal treatment, high-temperature/high pH treatment, composting, and heat drying (all with specific design and/or operational requirements) are among the processes that can be used to meet Class A requirements. Performance-based approaches for determining attainment of Class A standards focus on enteric virus and helminth ova concentrations in the biosolids.

High-temperature (thermophilic) anaerobic digestion is one technology-based approach to meeting Class A requirements that may be suitable for those plants with conventional anaerobic digestion if production of Class A biosolids becomes appropriate at some future time.

Performance-based standards can be used for the Country Club WWTP to determine whether the biosolids stored in settling ponds meet Class A requirements. Long-term storage of biosolids (over several years) has been shown to significantly decrease pathogen concentrations.

Class B Requirements—Treatment processes that can be used to meet Class B requirements include conventional anaerobic digestion, aerobic digestion, composting, and lime stabilization. The operational requirements for the last two processes are less stringent than those that apply to Class A treatment. For anaerobic digestion, treatment must take place at a specific solids retention time for a specific temperature. Values for solids retention time and temperature range from 15 days at 35 to 55 degrees C to 60 days at 20 degrees C.

Attainment of Class B status can also be determined by monitoring the biosolids for fecal coliforms. The limit is two million colony-forming units or most probable number per gram of biosolids (dry weight basis).

Vector Attraction Reduction. Vector attraction is any characteristic that attracts disease vectors. Disease vectors are insects or animals, which are capable of transporting and transmitting infectious agents to humans. Common vectors include flies, mosquitoes, and rodents. The 503 regulations specify twelve alternatives for meeting the vector attraction reduction requirement. They focus on attaining a specified level of biosolids stabilization (such as through anaerobic digestion) or rapid incorporation of the biosolids into the soil.

Exceptional Quality Biosolids. Biosolids that meet (1) the pollutant concentrations listed in column 2 of Table C-1; (2) one of the Class A pathogen reduction requirements; and (3) one of the treatment-based vector attraction reduction alternatives may be classified as "exceptional quality biosolids." Exceptional quality biosolids may be used and distributed in bulk or bags without being subject to general requirements and management practices other than monitoring, record keeping, and reporting, which substantiate that the quality criteria have been met.

Nutrients. Because excessive nitrogen added to soil can result in leaching of nitrate to groundwater, the 503 regulations require that biosolids application be limited to the agronomic needs of the crop being grown. Therefore, the nitrogen content of the biosolids must be known to the applier to determine appropriate biosolids loading rates. Nitrogen loading limits apply regardless of the limits resulting from the metals concentrations in Table C-1.

Distribution and Marketing of Biosolids Products. The distribution and marketing of biosolids-derived fertilizers and soil conditioners are regulated under the 503 regulations. Biosolids applied to farmland, forest, and reclamation sites must meet (1) the pollutant ceiling concentrations from Table C-1; (2) Class B pathogen requirements; and (3) vector attraction reduction requirements. The biosolids can be applied using the Cumulative Pollutant Loading Rates under Table C-2, if the biosolids do not meet the pollutant concentrations listed in Table C-1, column 2.

Biosolids applied on lawns and home gardens must meet (1) Class A pathogen requirements; (2) vector attraction reduction requirements; and (3) the pollutant concentrations listed in Table C-1, column 2. There is an exception for biosolids whose pollutant concentrations are below the ceiling concentrations in Table C-1, column 1, but above the column 2 pollutant concentrations. Such biosolids can be sold for use at product application rates, prescribed on a label, that are based on meeting annual pollutant loading rates.

April 27, 2016

Doug Bird
Program Manager, Utilities Division
San Luis Obispo County Department of Public Works
1055 Monterey Street
San Luis Obispo, CA 93408

Subject: **REVISED**: CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429

Mr. Bird,

Enclosed is our response to the comments and questions presented to Wallace Group in the following documents that were provided:

- Technical Memorandum – Peer Review of the CSA No. 18 (San Luis Country Club) Wastewater Treatment Facility Capacity Assessment Report 15-533 by Garing Taylor and Associates dated October 13, 2015
- REVISED – Technical Memorandum – Peer Review of the CSA No. 18 (San Luis Country Club) Wastewater Treatment Facility Capacity Assessment Report 15-533 by Garing Taylor and Associates dated November 25, 2015
- Marked up version of "CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429" by Wallace Group, dated September 1, 2015

In response to the comments and questions outlined in the documents listed above, we have provided the following, which are attached herein:

- Updated report titled "REVISED – CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429" by Wallace Group dated April 12, 2016
- Marked up/redline version of the report titled "CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429" dated September 1, 2015
- Summary of Comments – A list of responses to the comments provided in the GTA marked up version of the Wallace Group September 1, 2015 report.

In general, the comments and questions presented by Garing Taylor and Associates focused around four main issues, which were discussed in a peer review between the County, GTA, and Wallace Group on March 24, 2016. These four main issues are as follows:

1. <u>Calculation of the system reaction rate:</u> The flow rate used to calculate the standard reaction rate is 80,000 gpd, the design flow of the treatment system. Wallace Group considered using the maximum month flow rate of 95,000 gpd,

WALLACE GROUP

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which would be a typical value to use in this situation. However, this would give a higher reaction rate. In order to be conservative, 80,000 gpd was used.

One comment suggested varying the reaction rate to account for winter vs. summer temperature. However, analysis of the actual treatment system data for 5 years did not show a difference in treatment efficiency relating to temperature.

2. Disposal Capacity: The disposal capacity of the CSA 18 WWTP will not be impacted by the Jack Ranch Development. Following treatment, flows generated by the Development will be conveyed back to Tract 2429 for storage, reuse, and disposal. A value of 300 gpd/DUE is suggested in the report as a conservative flow factor is estimating the amount of disposal capacity that will be designed for the Tract 2429 property.

3. Wet Weather and I/I: During wet weather periods, inflow and infiltration cause an increase in influent flows to the wastewater plant, thereby diluting the influent concentration. As flows increase, the dilution factor increases, and the theoretical required detention time decreases. A sensitivity analysis that considers theoretical levels of infiltration and inflow was included.

4. Calculation of Peak Dry Weather Flow and BOD concentration: The report was amended to emphasize the conservative assumptions that were made. These include modeling the historical data for theoretical performance with build-out flows, and also a 20% safety factor is allowable effluent quality.

Other comments have been addressed in the attached response to comments. Please let us know if you have any other questions.

Sincerely,

Shannon Jessica, PE

April 27, 2016
Wallace Group
Summary of GTA Comments on "CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429", dated September 1, 2015:

1. If GTA needs to review these documents, our review budget will need to be increased.
   Response: Noted.

2. This item was not provided to GTA.
   Response: Noted. Item was subsequently provided per Revised Technical Memorandum by GTA dated November 25, 2015.

3. This item was not provided to GTA.
   Response: Noted. Item was subsequently provided, per Revised Technical Memorandum by GTA dated November 25, 2015.

4. We recommend that the report include a site plan, with piping and flow direction shown.
   Response: Noted. A site plan has been provided in the revised report.

5. We recommend evaluating the disposal capacity of the system during wet weather, taking into account irrigation, percolation, evaporation, and direct precipitation into this blending pond. We recommend using a worst case 2 month period such as January-February 1969.
   Response: Per the conversation during peer review meeting on March 24, 2016, the disposal capacity of the WWTP system should not be impacted by the Jack Ranch Development. The development will provide a means for disposal of all wastewater generated by the development at a rate of 300 gal/DUE, which is substantially more than the expected flow.

6. Are there discharge requirements for chlorine contact?
   Response: Total chlorine residual in recycled water shall equal or exceed 1 mg/L, as measured immediately after the chlorine contact zone. This requirement has been added to the report text.

7. Are these all 5-day average peak wet weather flow rates? Daily? Hourly?
   Response: Flows in Table 2 are actual Peak Wet Weather Daily Flows for each year. Dates have been added as footnotes in the table.

8. See page 9. Are future flows based on existing plus Jack Ranch, or build out plus Jack Ranch?
   Response: Future flows were calculated using existing plus Jack Ranch. However, theoretical build-out capacity of the WWTP was also calculated, to determine how the additional Jack Ranch development flows would impact available capacity.

9. Low wastewater rates may also be temporary, due to drought awareness and resource conservation efforts that may lapse when rains return.
   Response: It is noted that water conservation may lapse if and when the drought subsides, however low flow fixtures in homes are more permanent. Landscape and outdoor water use are expected to increase, but we do not expect the same increase from indoor fixtures. In fact, we expect the downward trend to continue as fixture replacement occurs, given that recent code requirements are more stringent for toilets and showerheads.

10. Plant?
    Response: Spelling error corrected.

11. Without?
    Response: Spelling error corrected.

12. Please show claculations.
    Response: Calculations have been added to the report. Actual HRT was calculated as 6.67 days.

13. I calculate average BOD load (using average flow rates from Table 2) to be 196, 190, 173, 168 lb/day.
    Response: The values in this table are actual averages, taken from weekly effluent BOD data provided by the County.

14. I calculate average TSS load (using average flow rates from Table 2) to be 200, 186, 205, 189, and 174 lbs/day.
    Response: The values in this table are actual averages, taken from weekly effluent TSS data provided by the County.

15. I believe the author meant that BOD and TSS concentrations are higher than design values. I find actual BOD loading to be lower than the design value of 250 lbs/day and actual TSS loading to be both above and below design value of 200 lbs/day. See notes above. Adding additional units could increase TSS loading above design values.
    Response: Correct on concentration versus loading; the text has been updated in the report. Noted, TSS influent loading may increase above design values, however the plant has not historically had difficulty meeting the TSS permit limit.

16. At this retention time, average flow rate = 1.2 MG/14 days = 85,714 gpd. Where is average flow rate shown?
    Response: The flow used in this calculation was the average design flow of the plant, 80,000 gpd. 1.2 MG/80,000 gpd = 15 days. The original statement of 14 days HRT was incorrect and has been corrected in the report.

17. +
    Response: Noted. This has been corrected in the text.

18. These don't match Table 4. Avg BODin = 312.6 mg/L; Ave BOD out=12 mg/L
    Response: Noted and corrected. Average influent BOD is 312.7 mg/L, as stated in Table 5. Average effluent BOD is still 14 mg/L.

19. I get 0.54 Please see attached worksheet.
    Response: Noted. This calculation has been revised per discussion in the March 24, 2016 conference call; the report has been updated to reflect the correct calculation. The actual reaction rate calculated is 0.50.

20. The selection of peak wet weather conditions should be reconsidered. See discussion in GTA Technical Memorandum.

Response: Per the peer review discussion, a sensitivity analysis was added to the text of the report that considered higher levels of infiltration and inflow, along with the impact on influent BOD concentration and treatment capacity.

21. These flows do not include build-out of existing development (475 DUE at build-out vs. 463.5 DUE current, see page 4).
    Response: Correct. Being that part of this report's evaluation was to calculate potential build-out of the WWTP, proposed build-out values (assuming 475 DUES) were not considered in this section of the report. Total theoretical build-out of the WWTP would accommodate more DUEs than the proposed build-out of 475 DUES, therefore this value was not used for the combined flow calculation.

22. The selection of peak wet weather conditions should be reconsidered. See discussion in GTA Technical Memorandum.
    Response: See item 20.

23. A more thorough analysis of this problem appears to be indicated. Are there ways to coordinate the two lift stations so that peaks do not coincide? Could more storage capacity be provided at the front end of the Muffin Monster?
    Response: The Jack Ranch development will not be conveyed through the lift stations, but the development is prepared to pay a pro-rata share of grinder improvements as listed in Table 11. We do not believe that further analysis is warranted at this level of review.

24. Where will this provision be located? How will it be enforced? Who will enforce this provision?
    Response: The development CC&R's will enforce this provision.

25. Does the current set-up meet current discharge requirements? How does it perform in high flows? Low flows? How will it perform with the new flows?
    Response: The combined flows with the Jack Ranch Development are less than the design values for the system, therefore the chlorine contact system should not be affected. It is our understanding that the system performs acceptably at high and low flows.

26. Conflicts with text following page 'the current method of effluent disposal has sufficient capacity to dispose of the existing CSA WWTP flows..."
    Response: The Jack Ranch Development will not contribute to the current effluent disposal system, as all flows generated will be pumped back to the Development to be disposed of on-site.

27. 195 gpd/DUE
    Response: Noted. Text has been corrected.

28. We recommend a detailed analysis to show that this volume be sufficient in really wet years, and should include the effect of direct precipitation, peak wet weather wastewater flow rates, evaporation, limited irrigation potential, etc.
    Response: Additional analysis of the existing disposal system is outside the scope of this study. Wastewater flows generated by the Development will be pumped back to the Development property for disposal, and therefore will not impact the existing system.

29. It appears this area of concern could use greater analysis. Possibilities to explore include managing/coordinating existing lift station operation, possibilities for enhancing local storage capacity just upstream of the muffin monster.
Response: Additional analysis of the influent lift station is outside the scope of this study. The Jack Ranch Development will not impact the lift stations, and will contribute a proportional amount to proposed grinder upgrades.

30. At what price is it cheaper to switch to another method?
Response: Additional analysis of the solids handling system is outside the scope of this study. The Jack Ranch Development will contribute a proportional amount to proposed improvements.

31. Could you provide an annualized cost for this operation, including capital and operations?
Response: Additional analysis of the solids handling system is outside the scope of this study. The Jack Ranch Development will contribute their proportional amount to proposed improvements.

32. Conflicts with previous page "the management of wet weather flows has been a subject of concern for operations staff"
Response: See previous responses regarding disposal capacity for the Jack Ranch.

33. This is a reasonable requirement because disposal appears to be the limiting factor at this time.
Response: Noted.

34. I recommend that the CSA look at I&I to reduce wet weather flows.
Response: Noted.

35. I'm not sure dewatering process improvements will be triggered by the new development. Inclusion here may not be appropriate.
Response: Understood. However, in order to show a benefit to existing rate payers, a proportional contribution toward solids dewatering is included in the estimates.

36. I can't match your numbers when I run the calculation. I get Q=148,895 gpd; Working backward I get Cn=32 mg/L.
Response: Calculations have been updated to reflect the conversation that was held on March 24, 2016. Target effluent BOD was reduced to 32 mg/L to be conservative. The reaction rate was updated to be 0.50, to reflect actual data.

37. These calcs check.
Response: Noted, although the calculation values changed per the conversation that was held on March 24, 2016 (see #36 above).

April 27, 2016

Doug Bird
Program Manager, Utilities Division
San Luis Obispo County Department of Public Works
1055 Monterey Street
San Luis Obispo, CA 93408

Subject: **REVISED**: CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429

INTRODUCTION AND SCOPE OF SERVICES

Wallace Group has been retained to prepare an evaluation of the County Service Area Number 18 (CSA 18) Wastewater Treatment Plant (WWTP). The focus of this analysis is on the proposed annexation of a 13 lot residential development designated as vesting tentative tract map 2429 just outside of the CSA 18 boundary, commonly known as the Jack Ranch Development. This evaluation includes the following tasks:

1. Estimate the capacity of the existing treatment plant in terms of system flow and treatment facilities;
2. Estimate the capacity of the existing disposal facilities;
3. Estimate build-out demand of the existing service area;
4. Estimate the post build-out of the Jack Ranch Development;
5. Outline likely amendments to the Waste Discharge Requirements;
6. Estimate the cost for improvements needed to provide adequate sewer treatment and disposal for the Facility to accommodate the proposed development at build-out.

Three previous reports have been used as reference in this evaluation:

1. "Country Club Wastewater Treatment Plant Audit" by Brown and Caldwell, dated February 25, 2004 (B&C Audit)
2. "Dwelling Unit Equivalent (DUE) Analysis for CSA 18 – Country Club and Los Ranchos School" a memorandum by San Luis Obispo County Public Works, dated May 13, 2005 (County Memo)
3. "San Luis Obispo Country Club CSA 18 Evaluation of Country Club Wastewater Treatment Plant to Serve Weyrick AG Cluster, Tentative Tract 2469" a memorandum by Wallace Group, dated September 18, 2006 (Wallace Memo).

In addition to the reports listed above, daily flow and monthly average flow summary data was obtained from the County in June, 2015 and used to prepare the following evaluation of the CSA 18 WWTP.

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CSA 18 EXISTING DEMOGRAPHICS OVERVIEW

The CSA 18 service area includes single family residences, a country club, and an elementary school. A breakdown of the current sewer connections, as provided by the County, is summarized as follows:

Table 1. CSA 18 Service Area Dwelling Unit Equivalent (DUE)	
Existing Single Family Units	431
Country Club[1]	21.5
School[1]	11
Vacant Parcels (Future single family units)	8
Total Service Area Existing DUEs	**471.5**

[1]Values in Table 2 from Memo from Courtney Howard to Will Clemens May 13, 2005, County of San Luis Obispo Public Works Department.

The most recent evaluation on wastewater flow rates as they correspond to service area dwelling unit equivalent (DUE) was prepared by the County and dated May 13, 2005. This memo set the standard flow rate per DUE at 195 gpd and defined the country club and school DUE values as represented in Table 1.

WWTP GENERAL PROCESS DESCRIPTION

The treatment process is generally described as follows:

Raw wastewater enters the plant through a raw sewage grinder. Flow then discharges to two aeration ponds, operated in series. Flow from the aeration ponds then discharges to three settling ponds. Effluent is disinfected with chlorine and pumped to a blending pond, located offsite, where it is used for golf course irrigation. If final effluent exceeds irrigation demand, effluent is pumped to an emergency overflow pond, also located offsite. A summary of the plant design criteria is outlined below.

Process Unit	Design Value	Criteria
Average Dry Weather Flow	0.12 mgd	Daily Flow, dry conditions
PHWWF Factor	4.0	
Peak Hour Wet Weather	0.48 mgd	PHWWF
Sewage Grinder		
No. of Units	1	
ADWF Capacity	0.12 mgd	
PHWWF Capacity	0.48 mgd	3” headloss max.
Aerated Lagoon System		
No. of Lagoons	2	

Operation	Series
Detention Time	5 days
Lagoon Operation	Partial Mix
Pond Volume, each	600,000 gal
Pond Depth	8 feet
Pond Surface Area, each	0.3 AC
Pond Loading, each	450 lb O_2/day
Pond #1 Aerators	2@10 HP each
Pond #2 Aerators	2@10 HP each
Settling Ponds	
No. of Ponds	3
Volume, each	80,000 gal
Sludge Volume, each	20,000 gal
Pond Depth	5 to 7 feet
Surface area, each	2,600 SF
Surface Overflow Rate	23 gpd/SF
Parshall Flume (Not Used)	
Size	2-inch
Minimum Capacity	0.24 mgd
Maximum Capacity	0.30 mgd
Chlorinator	
Maximum feed rate	50 lb/day 50 mg/L@0.12 mgd 25.0 mg/L@0.24 mgd 12.5 mg/L@0.48 mgd
Chlorine Contactor Chamber	
Volume	5,000 gal
Depth	2.5 feet
L/W Ratio	40
Detention Time	60 minutes@0.12 mgd 30 minutes@0.24 mgd 15 minutes@0.48 mgd
Effluent Pump Station	
No. of Pumps	2
Design Point	125 gpm@92 ft TDH
Maximum Capacity	0.18 mgd
Standby Power	
Standby Generator	80 kW

WASTE DISCHARGE REQUIREMENTS AND SUPPORTING DOCUMENTS

The CSA 18 WWTP is currently regulated by the RWQCB under permit No. R3-2003-0004 and -0005. The WDRs were adopted October 24, 2003. A summary of the key permit requirements are:

- Daily flow averaged over each month shall not exceed 120,000 gpd.
- Effluent BOD5 shall not exceed 40 mg/L (30 day average) or 100 mg/L max .
- Effluent TSS shall not exceed 40 mg/L (30 day average or 100 mg/L max.
- Effluent bacteriological quality of recycled water shall not exceed 23 MPN per 100ml (7 day median) and shall not exceed 240 MPN per 100 ml in any single sample.
- Total chlorine residual in recycled water shall equal or exceed 1 mg/l, as measured immediately after the chlorine contact zone.

EXISTING WASTEWATER FLOWS AND CHARACTERISTICS
The following sections describe the existing and wastewater flows, characteristics, and loading.

Existing Wastewater Demands In Planned Service Area
The existing WWTP was designed for an average dry weather flow (ADWF) of 80,000 gpd, with maximum month flows up to 120,000 gpd. Data for the past five years was obtained from the County and average daily, peak daily, and maximum month flow for each year is identified in Table 2. It should be noted that the peak wet weather flow event referenced in Table 2 is also the largest for the 10-year period of 2005 through 2014.

Table 2. Historical Annual Flows for CSA 18 WWTP

	Average Daily Flow, gpd	Peak Wet Weather Daily Flow, gpd	Maximum Month Flow, gpd
2010	75,996	179,900[1]	95,096
2011	71,988	160,000[2]	81,554
2012	67,350	130,036[3]	77,099
2013	65,396	104,000[4]	70,304
2014	60,290	104,533[5]	69,496

[1]5-day average daily flow during storm event in December 2010; see discussion below.
[2]March 20, 2011
[3]January 17, 2012
[4]February 12, 2013
[5]February 26, 2014

According to the discharge permit, the flow limit of 120,000 gpd is for maximum month flow. While peak daily flow has historically exceeded the 120,000 gpd mark, the maximum month flow has consistently remained within acceptable limits, including during the wettest year (2010) when maximum month flow was 95,096 gpd.

In 2005, the County prepared a flow analysis and determined the average flow per residential unit was approximately 195 gpd, which was based on a total service area equivalent dwelling unit (DUE) of 475 at build-out. As of the time of this report, the total DUE count is 463.5 (471.5 minus 8).

Wastewater flows have been trending downward over the past five years. This trend is consistent with the replacement of plumbing fixtures over time, given that new fixtures are subject to current low flow requirements. Of the past five years, 2010 had the highest maximum monthly flow at 95,096 gpd. Using this data, and the compiled data from the past five years, the corresponding CSA 18 WWTP flows have been calculated and are outlined in Table 3.

Table 3. Existing Wastewater Flow Summary for CSA 18 WWTP	
Average Daily Flow per residential unit[1]	164 gpd
Average Daily Flow (ADF)[2]	75,996 gpd
Maximum Month Flow (MMF)[3]	95,096 gpd
Peak Day Dry Weather Flow[4]	110,770 gpd
Peak Wet Weather Flow[5]	179,900 gpd

1 - Average daily flow per unit = 75,996/463.5
2 - Using 2010 average daily flow
3 - Using 2010 maximum month flow
4 - Occurred June 5, 2010
5 – 5-day average during storm in December 2010

In the past 5 years, peak wet weather flow for the CSA 18 WWTP occurred during a large storm in December, 2010. The storm produced 8.68 inches of rain over the course of 7 consecutive days of rainfall. The maximum daily flow that was recorded at the plant during this storm was 325,647 gpd. In the case of treatment plants with a short hydraulic residence time (HRT) of 1 to 2 days, the maximum wet weather peak day flow must be used for the purpose of determining plant capacity. In the case of CSA 18, the ponds contain multiple days of residence time, thereby absorbing a one day peak without compromising the total time available for biological treatment. For this reason, the available storage volume in the ponds was considered, along with the cumulative influent volume through the event. The flow during this 5-day period was averaged and resulted in the 5-day average peak wet weather flow of 179,000 gpd. Using this peak wet weather flow, the system HRT totaled 6.67 days.

Table 4. Peak Wet Weather Flow Calculation

Date	Flow, gallons
12/19/2010	104,239
12/20/2010	325,647
12/21/2010	233,000
12/22/2010	134,618

12/23/2010	102,000
Total Flow	899,504

Total Pond Volume: 1,200,000 gallons

Cumulative Flow During Peak Wet Weather Storm Event: 899,504 gallons

5-Day Average Peak Wet Weather Flow (899,504/5 days): 179,000 gpd

1,200,000 gal / 899,504 gal = 6.67 days HRT

Wastewater Treatment Plant Loading
Design organic loading of the wastewater treatment plant was based on the following average values:

- Influent BOD5: 250 mg/L, average (250 lbs/day @ 120,000 gpd)
- Influent TSS: 200 mg/L, average (200 lbs/day @ 120,000 gpd)

Actual annual average influent and effluent BOD (based on monthly average totals) values are listed in Tables 5 and 6. Currently the plant has had two instances of exceeding the monthly 30-day average BOD (>40 mg/L) in the past 5 years. Both instances occurred in January of 2012 and were likely due to nitrogenous oxygen demand according to operations staff.

Table 5. Annual Influent and Effluent BOD

YEAR	Average Influent BOD5, mg/L	Peak Influent BOD5, mg/L	Average Effluent BOD5, mg/L	Peak Effluent BOD5, mg/L
2010	310	413	13	17
2011	318	406	15	26
2012	311	420	17	45
2013	289	365	14	22
2014	335	358	11	14
Average	312.7	392.4	14	24.8

Table 6. Annual Influent and Effluent TSS				
YEAR	Average Influent TSS, mg/L	Peak Influent TSS, mg/L	Average Effluent TSS, mg/L	Peak Effluent TSS, mg/L
2010	316	478	10.5	17
2011	310	408	15	20
2012	367	766	13	17
2013	346	585	15	22
2014	346	568	11	19
Average	337	561	12.9	19

While actual BOD and TSS concentrations are higher than original design criteria, treatment efficiency of the plant is about 95 – 96% and the treatment plant consistently meets the effluent discharge limits of 40 mg/L BOD and TSS.

PROPOSED BUILDOUT CAPACITY OF CSA 18 WWTP

In order to determine the estimated potential build-out capacity of the treatment plant, the existing biological reaction rate was estimated from existing data. The reaction rate was calculated using the total volume of the two ponds (1,200,000 gallons), the hydraulic retention time (15 days @ average design flow of 80,000 gpd), and the actual average influent and effluent BOD values. To be conservative, the average permitted design flow of 80,000 gpd was used in the HRT calculation rather than the historic peak flows, which would yield a higher historical reaction rate. The BOD values used for this specific calculation were compiled by taking the total average influent BOD from the 5 years-worth of data and the total average effluent BOD for the same time period. In response to feedback from the peer review team, additional analysis of historical data has also been added in a subsequent section of this report.

Average reaction rate in existing system:

$C_n/C_o = 1/[1+(kt/n)]^n$ where:

C_n = Effluent BOD = 14 mg/L
C_o = Influent BOD = 312.7 mg/L
k = First order reaction rate (BOD reaction rate)
t = detention time = 15 days
n = number of ponds in series = 2

The resulting BOD reaction rate is 0.50 for the combined 2-pond system. This value is consistent with similar aerated lagoon-style treatment systems, with an average range of 0.5 – 1.5 called out in Table 8-29 of Metcalf & Eddy Fourth Edition.

Table 7 outlines the flow scenarios that were considered in determining the build-out service area flow for the CSA 18 WWTP. Three separate flow scenarios were considered. The first scenario considers the permitted maximum month flow rate of 120,000 gpd and compares that value to the actual existing flow conditions for the past 5 years. The second scenario was at the Peak Day Dry Weather Flow (PDDWF), in which the actual existing flow condition was pulled from the 5-year data set. The WWTP capacity at PDDWF was back calculated using the flow per DUE at the existing PDDWF. During the initial County peer review of this analysis, the use of an effluent BOD target of 40 mg/L was discussed, and a 20% safety factor was subsequently added. The resulting effluent target of 32 mg/L was used to determine the recommended max number of DUEs. This approach is highly conservative when applied to peak conditions, given that the waste discharge requirements allow for short term effluent BOD levels of over 40 mg/L (daily max of 100 mg/L).

The third condition analyzed was the WWTP Peak Wet Weather Flow (PWWF). The PWWF was calculated by taking a 5-day average flow during the largest storm on record in the past 5 years. This analysis was also supplemented by a sensitivity study that considered higher levels of infiltration and inflow (See Supplemental Wet Weather Analysis below). Similar to condition number 2, the wastewater capacity PWWF was back calculated using the recorded PWWF from the past 5 years and a wet weather diluted BOD value of 206 mg/L. The recommended DUE count was also adjusted using the 20% effluent safety factor as before. Calculations supporting the three flow conditions are provided in Appendix A.

Table 7. CSA 18 WWTP Maximum Flow Conditions

No.[1]	Flow & Loading Condition Reviewed	WWTP Capacity[1] (gpd)	Existing Flow Conditions[2] (gpd)	Flow per DUE[3] (gpd)	Max No. DUEs[6]	Recommended No. of DUEs[7]
(1)	Max. Month Flow	120,000	95,096	205.2	584	584
(2)	Peak Day Dry Weather Flow	158,398	110,770	239.0	662	561
(3)	Peak Wet Weather Flow[5]	194,923	179,900	388.1	608	502

[1]Calculations associated with condition number are provided in Appendix A.
[2]From Table 3
[3](Existing Flow Condition) / (463.5 DUEs in current service area)
[4](WWTP Capacity) / (Flow per DUE)
[5]Calculated diluted BOD = 206 mg/L
[6]Maximum number of DUEs calculated using effluent BOD limit of 40 mg/L
[7]Recommended number of DUEs calculated using effluent BOD limit of 32 mg/L (20% safety factor)

As shown in Table 7, the limiting factor for maximum DUEs is during the Peak Wet Weather Flow condition. The maximum DUE's that could be accommodated by the

WWTP is 608. Including the conservative effluent safety factor described above, this amount decreases to 502 DUE's. Compared to the existing 463.5, the County has conservative capacity for 38.5 additional DUEs. Taking the Jack Ranch Development into account (13 DUEs), the build-out of the CSA 18 WWTP would accommodate an additional 22.5 DUEs. As indicated previously, 8 DUEs remain to be served within the CSA 18 service area, and therefore adequate capacity exists to serve the Jack Ranch Development.

The oxygen requirement of the system was calculated to determine theoretical horsepower needed for treatment at the Peak Wet Weather Flow condition. At the PWWF of 194,923 gallons per day, the total required horsepower is 14 Hp. The current system consists of two (2) 10 Hp units, therefore the current aerators are sufficient to meet the oxygen demand at the proposed "build-out" flow of 194,923 gpd.

<u>Peak Day Dry Weather Flow Oxygen Requirement</u>

Assume:

Design Flow	194,923 gpd
Influent BOD	335 mg/L
Number of Lagoons	2
Temperature	22°C
K factor	0.50
O2 Demand/BOD	1.5 lbs O2/lb BOD
Vertical aerator efficiency*	1.5 O2/hp-hr

*Clean water vertical aerator efficiency = 3.0 from aerator manufacturer; de-rated to 1.5 O2/hp-hr for wastewater application.

Peak Day BOD: (0.19 MGD) x (335 mg/L) x (8.34) = 530.84 lbs BOD/d

Oxygen Demand: (530.84 lbs/d) x 1.5 = 796.26 lbs O2/day

Surface Aeration energy requirement:

(796.26 lbs O2/day) / [(1.5 O2/hp-hr) x (24 hr/day)] = **<u>15 Hp</u>**

Supplemental Wet Weather Analysis

As stated above, data from the most recent 10 year period was analyzed, and the worst case wet weather condition during that period was utilized. During the County's initial peer review of this analysis, the potential for larger storm events was raised. As a result, a sensitivity analysis was performed assuming successively higher volumes of theoretical infiltration and inflow. It should be noted that such levels represent a theoretical analysis and have not necessarily been observed in practice. Increasing theoretical storm flows were applied to the model, and the corresponding diluted influent BOD was used to back-calculate the maximum treatment capacity flow through the plant (assuming the average reaction rate of 0.5). As shown in Table 8, as flows increase, influent BOD decreases, and overall treatment capacity of the plant increases. Therefore, peak wet weather events are not expected to have a limiting factor on the biological capacity of the treatment system.

Table 8. Wet Weather Flows and Associated Buildout Capacity			
Theoretical Wet Weather Flow (gpd)	Influent BOD (Diluted Peak WW Conditions)	Max Theoretical Flow (gpd)	Max DUEs (388gpd/DUE)
179,900	206	194,939	502
197,890	188	211,147	544
217,679	170	229,334	591
239,447	155	249,852	643
263,392	141	273,152	704

Notes:

1) Effluent target BOD assumed to be 32 mg/L
2) Diluted loading during storm event based on 110,770 gpd flow = 309.5 lbs/day BOD
3) Reaction rate = 0.50

FUTURE WASTEWATER DEMANDS FOR DEVELOPMENT

The new development of the Jack Ranch will include 13 residential units. Using existing data from the past 5 years, the average flow calculates to 164 gpd/residential unit. However to be conservative, and consistent with the prior May 13, 2005 memo from the County, a value of 195 gpd/residential unit was used to estimate the following wastewater flows for the Jack Ranch development:

Table 9. Jack Ranch Flow Estimate	
Flow per residential unit[1]	195 gpd
Average Daily Flow (ADF)	2,535 gpd
Maximum Month Flow (MMF)[2]	3,169 gpd

[1]From County Memo, May 13, 2005
[2]MMF is 1.25 times ADF (95,096/75,996)

Adding the new development demands to the existing treatment plant results in the following estimated wastewater flow for CSA 18 WWTP.

Table 10. Estimated Combined Wastewater Flow CSA 18 with Jack Ranch	
Average Daily Flow (ADF)[1]	78,531 gpd
Maximum Month Flow (MMF)[2]	98,265 gpd

[1]Maximum CSA 18 average daily flow from past 5 years (year 2010) plus Jack Ranch average daily flow (75,996 + 2,535)
[2]Maximum CSA 18 max month flow from past 5 years (year 2010) plus Jack Ranch average daily flow (95,096+3,169)

As indicated above, the maximum month flow at build-out is expected to be 65% of the 120,000 gpd permit limit. The Jack Ranch will increase the existing maximum month flow by 3.3%.

REGULATORY IMPLICATIONS

As outlined in Table 10, even with the additional 13 units, daily flow averaged over the month is not estimated to exceed 120,000 gpd. However, the following provisions are outlined in the Waste Discharge Requirements (WDR) portion of the existing permit:

- The County will need to submit a report of waste discharge or secure a waiver from the RWQCB at least 120 days before making any change to the character, location, or volume of the discharge.
- The County will need to notify the RWQCB if the monthly average daily flow will or may reach the design capacity within four years. Notification shall be in the form of a letter or report that includes the following information:
    - The best estimate of when the monthly average daily dry weather flow rate will equal or exceed design capacity.
    - A schedule for studies, design, and other steps needed to provide additional capacity for waste treatment and/or disposal facilities before the waste flow rate equals the capacity of present units.
    - The required technical report shall be prepared with public participation and reviewed, approved, and jointly submitted by all planning and building departments having jurisdiction in the area served by the waste collection, treatment, or disposal facilities.
- The County must notify the RWQCB whenever there is a substantial change in the volume or character of pollutants being introduced into the wastewater stream. Notice shall include information on the quality and quantity of waste being introduced to the system and the anticipated impact of the waste upon the quantity and quality of the aggregate discharge.

If the County decides to increase the number of service connections to include the Jack Ranch Development, an update letter or Report of Waste Discharge conforming to the above requirements will be necessary.

EVALUATION OF INDIVIDUAL TREATMENT PLANT COMPONENTS

<u>Influent Grinder</u>
The influent grinder unit is a Muffin Monster Model 30000-12. The unit is designed to handle an average daily flow of 120,000 gpd with a peak hour factor of 4.0. The grinder has historically been inundated due to the fact that two of the system lift stations may cycle on at the same time and induce peak pumping flows to a common gravity sewer leading to the grinder. Operational staff has addressed this concern by providing containment around the unit. The Jack Ranch development may be required to provide a pro-rata contribution to the upgrade of the unit.

Influent Lift Station and Force Main
It is anticipated that the Jack Ranch development would be served by an existing 8" gravity sewer, therefore the upstream lift station/forcemain would not be impacted by the additional flow.

Aeration Ponds 1 and 2
The two aerated ponds are designed to operate in series. All wastewater enters Pond 1 and then flows to Pond 2. Pond 1 and Pond 2 have been evaluated in both the B&C Audit and the previous Wallace Memo. It was determined in the earlier B&C Audit that the ponds were experiencing some short circuiting that was resulting in a loss of treatment capacity. As a result, it was recommended that both ponds be improved by adding a floating baffle, modifying the inlet piping geometry, and repositioning the aerators. The County has implemented the recommended improvements to Pond 1. However, it does not appear that any of B&C's recommendations have been implemented in Pond 2. In order to maximize the treatment potential of the WWTP, it is recommended that the B&C pond improvements are implemented in Pond 2. A summary of those modifications is as follows:

- Install a floating baffle in Pond 2 to split the pond in half,
- Install (2) 10Hp aerators, positioned in the center of each half of the pond,
- Relocate the inlet to the center of the first half of Pond 2.

As outlined in the previous reports, once these improvements are implemented, the aeration ponds should operate at their designed rating of 120,000 gpd. Given that Jack Ranch will increase the influent flows to the WWTP, the developer proposes to pay the full cost of the proposed Pond 2 upgrade.

Wastewater constituents, such as BOD, TSS, total dissolved solids (TDS), sodium (NA), and chloride (Cl) are expected to remain as they currently are and treatment efficiencies should not be affected by the additional Jack Ranch units. That being said, the Jack Ranch Development plans on implementing a provision that limits self-generating water softeners so as not to increase the percentage of salts in the wastewater effluent.

Settling Ponds 1, 2 and 3
Settling Ponds 1, 2 and 3 are situated south/southwest of Aeration Ponds 1 and 2. These ponds are used for settling effluent from Pond 2. It is recommended that these ponds remain unchanged.

Chlorine Contact Chamber.
The chlorine contact chamber was sized based on meeting the 23 MPN median (240 MPN maximum) criteria set in the waste discharge requirements. Currently, based on design criteria for this WWTP, the contact chamber provides for 30 minutes (at 2x design flow) of contact time, at a concentration of 25 mg/L. This meets a CT value of 750, which exceeds that required in Title 22 CCR for tertiary 2.2 MPN recycled wastewater. It should be noted that a defined CT value is not required for secondary, 23 MPN recycled water.

Effluent Clearwell and Pumping Station.
Given the incremental flow increase being added by the development, it is not anticipated that additional modifications to the clearwell and effluent pumping station should be required. Further discussion on the effluent disposal system is provided in the section below. In the event effluent disposal for the additional units is required to be addressed by the Jack Ranch development, a small submersible pump could be added to the existing clearwell. The submersible pump would be used to lift the development's proportion of effluent flow to the Jack Ranch development for reuse. The pump should include flow metering and controls.

Standby Power/Generator. The standby power generator is designed to power the influent grinder, existing four pond aerators, chlorine injection system, lighting and controls. It is not anticipated that any changes are necessary to the standby generator.

Solids Handling
A major emphasis of the B&C Audit was an evaluation of the solids handling practices, including the development of alternative approaches based on potential sludge disposal options. The Audit looked at mechanical and passive dewatering, hauling to landfill and/or compost facilities, and potential land application opportunities. The recommendations from the Audit concluded that continuing to haul wet sludge from the WWTP was the most cost effective alternative. It was also recommended, however, that in the event sludge hauling rates rise significantly or if the designated facility ceases to receive liquid sludge, that mechanical dewatering should be considered.

In March 2015, a volute dewatering press was piloted at the CSA 18 WWTP. While the dewatering press equipment worked well on the solids that were pumped out of the settling basin, it became apparent that the plant would need to construct a means of transferring sludge to the equipment. The pilot used a small sump pump that was placed in the bottom of one of the settling ponds and operated for only a few minutes before it was unable to draw additional sludge into the suction side without physical relocation of the pump. Because there is no slope to the bottom of the settling ponds, a sludge transfer pump station would need to be designed and constructed to withdraw sludge from each of the settling ponds.

It is still assumed that hauling liquid sludge to Santa Paula or equivalent is more cost effective than implementing a solids dewatering system. In the event the County decides to move forward with improving the solids handling system, it is anticipated that the Jack Ranch development would fund their pro-rata portion of the costs associated with construction of the new facility.

Effluent Disposal System
The CSA 18 WWTP disposal system is rated at the same capacity as the plant, 120,000 gpd, and consists of recycled water for irrigation of the County Club Golf Course. Wet weather storage facilities are maintained by the County Club and include a 5 million gallon holding pond. Irrigation demand has historically been sufficient to meet the rated disposal capacity of the plant.

As outlined in Table 10, the maximum monthly flow is not anticipated to exceed 120,000 gpd, even with the incremental increase due to new development. Therefore, it is not anticipated that any modifications to the existing effluent disposal system would be needed to accommodate the additional 13 units. However, the management of wet weather flows has been a subject of concern for operations staff.

Principal concerns include:

- Influent flows increase during wet weather, and prolonged periods of rainfall could result in extended periods without golf course irrigation.
- Irrigation of the golf course during a wet winter can impact the play of the course. While this is an obligation of the County Club currently, the addition of 13 additional units could be a cause for concern.

In order to mitigate the above concerns, the addition of a supplemental wet weather storage pond on the Jack Ranch property is proposed. The pond would store a minimum of 120 days of flow at a conservative rate of 300 gpd/DUE, resulting in a minimum storage requirement of 1.4 acre-ft. Alternatively, improvements could be made to improve the existing 5 million gallon reservoir to add the additional capacity. Given the conservative estimate applied in this calculation, this improvement is expected to improve the effluent storage situation for the current CSA 18 rate payers.

Historical Data Modeling

During the course of the County's initial peer review, additional historical data analysis was requested to validate the assumptions made in the body of this report. The past 5 years of data from the wastewater treatment facility was analyzed with respect to the average actual reaction rate for the system. A plot of the results from this analysis is provided in Appendix B. The plot shows that the existing system has historically performed at a higher apparent reaction rate during periods of peak flow. However, the average reaction rate of 0.50 was used during the peak flow analysis, which adds a level of conservatism to the treatment calculations.

Using the same 5 years of data, the actual pond performance was used to calculate the theoretical pond performance with the additional planned build-out units from Tract 2429 and the remaining 8 vacant units in the original service area. A flow per DUE of 195 gpd was assumed, to be consistent with County planning data. A plot of this information is provided in Appendix B. As shown in the plot, the projected effluent BOD is 70% below the effluent limit.

With respect to wet weather, the most current 10 year period of precipitation and flow data was reviewed and it was determined that the 2010 event used during the calculation of the 5-day average Peak Wet Weather Flow is the worst case wet weather flow experienced at the plant.

Conclusion and Recommendations

The WWTP design capacity is sufficient to accommodate build-out of the existing service area and the increase flow from 13 units. The recommended pond improvements from the original B&C plant audit have not yet been fully implemented, therefore it is recommended that those improvements be constructed to comfortably accommodate build out flow.

While it is not anticipated that further modifications will be necessary as a result of the additional 13 units, the following facilities were noted as possible plant improvements.

- Influent grinder: Due to cycling of collection system pumps, the influent grinder sees peak flow conditions regularly. The influent grinder should be evaluated in further detail to determine existing condition and remaining useful life. If the unit needs to be replaced, it is estimated that the installed cost of a new grinder would be approximately $150,000, including improvements to the containment system.

- Solids handling system: Based on previous reports and hauling rates, the current method of hauling liquid sludge is still the most cost effective means of solids removal from the WWTP. If disposal rates increase significantly in the near future, the County may consider installing dewatering equipment. In order to accurately utilize a dewatering press, a sludge transfer pump station with associated piping from Settling Ponds 1, 2, and 3, would also need to be installed. It is estimated that costs associated with this improvement would be as follows:

    - Dewatering equipment: in the range of $150,000 to $200,000
    - Sludge transfer piping/pump: $150,000
    - Total project cost with contingencies: $400,000

- Effluent disposal system: The current method of effluent disposal has sufficient capacity to dispose of the existing CSA WWTP flows as well as the additional flow from the new units. However, the Jack Ranch Development will plan to accommodate a minimum of 120 days of effluent storage/disposal. If necessary, this would occur on the Jack Ranch property.

Cost Implications

In the event that the County elects to advance a grinder project or dewatering system the Jack Ranch would be responsible for covering their proportion of the cost. Given that the portion of EDUs being added by the development is 2.8% (13 EDU/471.5 EDU), Jack Ranch would be responsible for that percentage. In the case of the Pond 2 improvements contemplated by the B&C Audit and the effluent disposal system, it is assumed that the Development would cover 100% of the cost. During the Pond 2 improvement project, the disposal of accumulated sludge would be the responsibility of the County. Table 11 outlines the possible Development costs associated with WWTP improvements.

Table 11. Estimated Improvement Costs

	Facility	Total Cost	Development Cost[1]
1	Influent Grinder	$150,000	$5,100
2	Pond 2 Improvements	$170,000	$170,000
3	Dewatering Equipment, including sludge transfer	$400,000	$13,600
	Total Cost (not including effluent disposal)		$188,700

[1]Calculated at 3.4% for Items 1 & 3, 100% for Item 2

Please let me know if you have any questions, or if you need more information.

Sincerely,

Shannon Jessica, PE
Wallace Group

Rob Miller, PE
Wallace Group

Appendix A – Calculations

<u>Flow Condition #1 – Maximum Month Flow</u>

Permitted MMF:	120,000 gpd
Existing/Historical MMF:	95,096 gpd
Flow Per DUE: 95,096/463.5 =	205.2 gpd/DUEs
Max DUEs: 120,000/205.2 =	584 DUEs

<u>Flow Condition #2 – Peak Day Dry Weather Flow</u>
Existing/Historical PDDWF: 110,770 gpd
Highest Annual Average Influent BOD: 335 mg/L

$Cn = Co/[1+ (kV/nQ)]^n$

Cn = Effluent BOD = 40 mg/L
Co = Influent BOD = 335 mg/L
k = 0.50
V= 1,200,000 gallons (4542 m^3)
n = number of ponds in series = 2

Q = 158,398gpd

Existing/Historical Flow per DUE: 110,770 gpd / 463.5 DUE = 239 gpd/DUE

Max DUEs @ PDDWF (40 mg/L): 158,398gpd / 239 gpd/DUE = 662 DUEs

Recommended DUEs @ PDDWF (32 mg/L): 134,195 gpd/239 gpd/DUE = 561 DUEs

<u>Flow Condition #3 – Peak Wet Weather Flow</u>
Calculate Diluted Loading during Storm:

(110,770 gpd/1,000,000) x (335 mg/L) x (8.34) = 309.5 lbs/day BOD

Corresponding influent loading under PWWF conditions:

309.5 lbs/day = (<u> C </u> mg/L) x (8.34) x (179,900 gpd/1,000,000)

C = 206.3 mg/L

Maximum flow at diluted loading and permitted max effluent BOD:

$Cn = Co/[1+ (kV/nQ)]^n$

Cn = Effluent BOD = 40 mg/L
Co = Influent BOD = 206.3 mg/L
k = 0.50
V= 1,200,000 gallons (4542 m^3)

n = number of ponds in series = 2

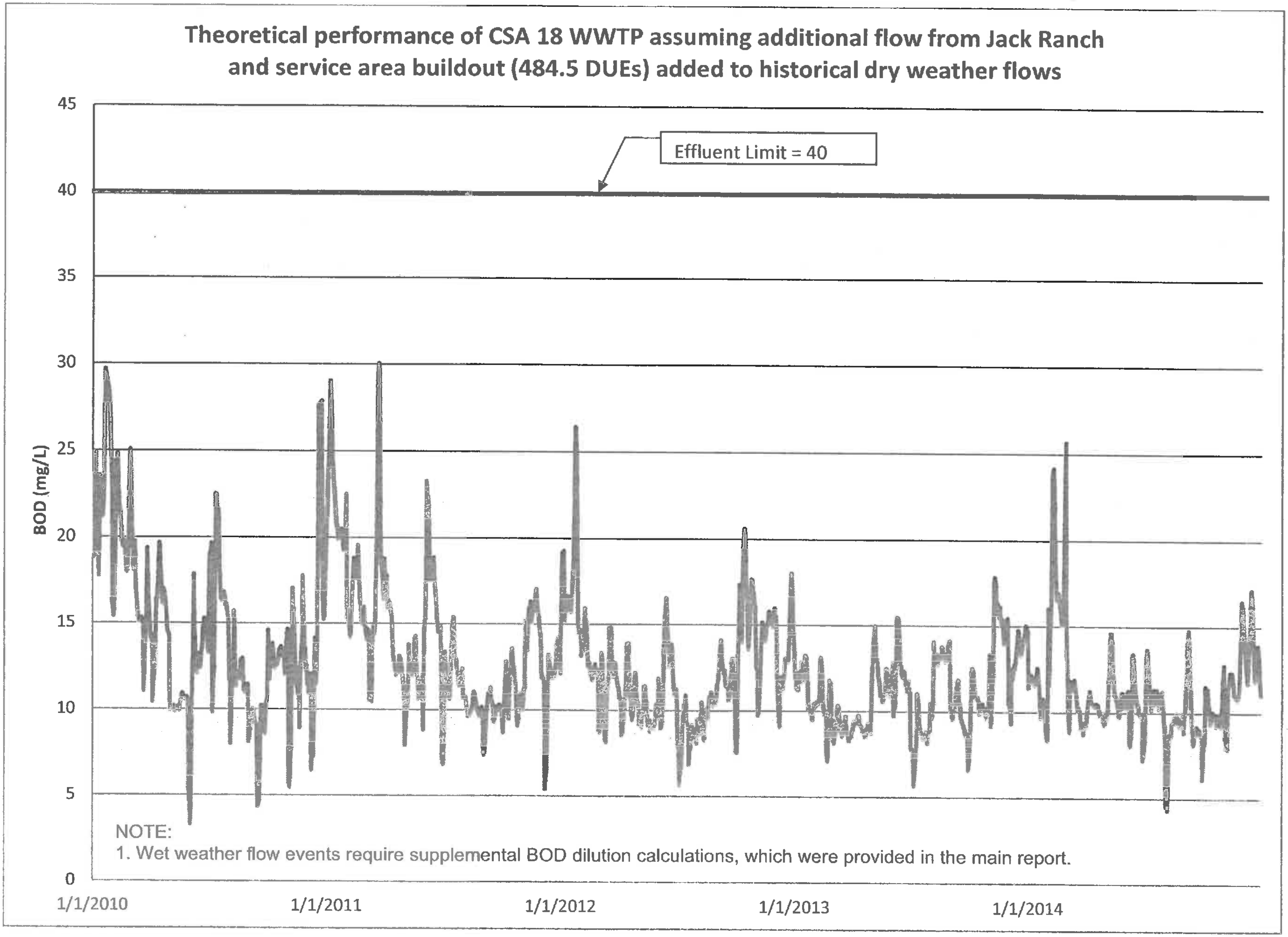
Q = 236,032gpd

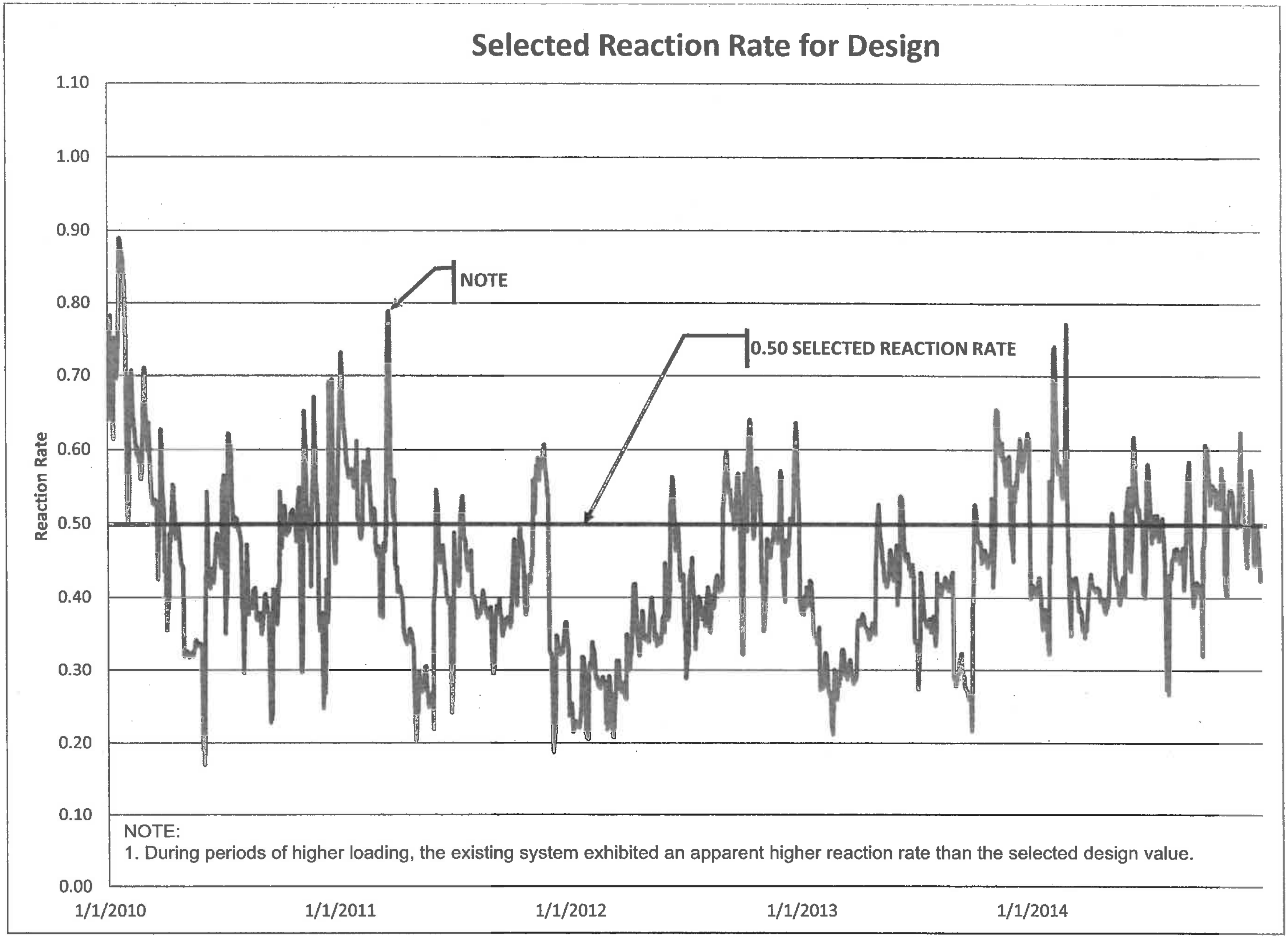
Existing/Historical Flow per DUE: 179,900 gpd / 463.5 DUE = 388 gpd/DUE

Max DUEs @ PDDWF (40mg/L): 236,032 / 388 gpd = 608 DUEs

Recommended DUEs @ PDDWF (32 mg/L): 194,923 gpd / 388 gpd/DUE = 502 DUEs

APPENDIX B – HISTORICAL DATA ANALYSIS PLOTS


Theoretical performance of CSA 18 WWTP assuming additional flow from Jack Ranch and service area buildout (484.5 DUEs) added to historical dry weather flows
Effluent Limit = 40
BOD (mg/L)
45
40
35
30
25
20
15
10
5
0
1/1/2010
1/1/2011
1/1/2012
1/1/2013
1/1/2014
NOTE:
1. Wet weather flow events require supplemental BOD dilution calculations, which were provided in the main report.



Selected Reaction Rate for Design
Reaction Rate
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1/1/2010
1/1/2011
1/1/2012
1/1/2013
1/1/2014
NOTE
0.50 SELECTED REACTION RATE
NOTE:
1. During periods of higher loading, the existing system exhibited an apparent higher reaction rate than the selected design value.

~~March 11~~April 26, 2016

Doug Bird
Program Manager, Utilities Division
San Luis Obispo County Department of Public Works
1055 Monterey Street
San Luis Obispo, CA 93408

Subject: **REVISED**: CSA 18 WWTP Evaluation Update to Serve Tentative Tract 2429

INTRODUCTION AND SCOPE OF SERVICES

Wallace Group has been retained to prepare an evaluation of the County Service Area Number 18 (CSA 18) Wastewater Treatment Plant (WWTP). The focus of this analysis is on the proposed annexation of a ~~16~~13 lot residential development designated as vesting tentative tract map 2429 just outside of the CSA 18 boundary, commonly known as the Jack Ranch Development. This evaluation includes the following tasks:

1. Estimate the capacity of the existing treatment plant in terms of system flow and treatment facilities;

2. Estimate the capacity of the existing disposal facilities;

3. Estimate ~~buildout~~build-out demand of the existing service area;

4. Estimate the post ~~buildout~~build-out of the Jack Ranch Development;

5. Outline likely amendments to the Waste Discharge Requirements;

6. Estimate the cost ~~estimate~~ for improvements needed to provide adequate sewer treatment and disposal for the Facility to accommodate the proposed development ~~and~~ at build-out.

Three previous reports have been used as reference in this evaluation:

1. "Country Club Wastewater Treatment Plant Audit" by Brown and Caldwell, dated February 25, 2004 (B&C Audit)
2. "Dwelling Unit Equivalent (DUE) Analysis for CSA 18 – Country Club and Los Ranchos School" a memorandum by San Luis Obispo County Public Works, dated May 13, 2005 (County Memo)
3. "San Luis Obispo Country Club CSA 18 Evaluation of Country Club Wastewater Treatment Plant to Serve Weyrick AG Cluster, Tentative Tract 2469" a memorandum by Wallace Group, dated September 18, 2006 (Wallace Memo).

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In addition to the reports listed above, daily flow and monthly average flow summary data was obtained ~~by~~from the County in June, 2015 and used to prepare the following evaluation of the CSA 18 WWTP.

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CSA 18 EXISTING DEMOGRAPHICS OVERVIEW
The CSA 18 service area includes single family residences, a country club, and an elementary school. A breakdown of the current sewer connections, as provided by the County, is summarized as follows:

Table 1. CSA 18 Service Area Dwelling Unit Equivalent (DUE)	
Existing Single Family Units	431
Country Club[1]	21.5
School[1]	11
Vacant Parcels (Future single family units)	8
Total Service Area Existing DUEs	**471.5**

[1]Values in Table 2 from Memo from Courtney Howard to Will Clemens May 13, 2005, County of San Luis Obispo Public Works Department.

The most recent evaluation on wastewater flow rates as they correspond to service area dwelling unit equivalent (DUE) was prepared by the County and dated May 13, 2005. This memo set the standard flow rate per DUE at 195 gpd and defined the country club and school DUE values as represented in Table 1.

WWTP GENERAL PROCESS DESCRIPTION

The treatment process is generally described as follows:

Raw wastewater enters the plant through a raw sewage grinder ~~pump~~. Flow then discharges to two aeration ponds, operated in series. Flow from the aeration ponds then discharges to three settling ponds. Effluent is disinfected with chlorine and pumped to a blending pond, located offsite, where it is used for golf course irrigation. If final effluent exceeds irrigation demand, effluent is pumped to an emergency overflow pond, also located offsite. A summary of the plant design criteria is outlined below.

Process Unit	Design Value	Criteria
Average Dry Weather Flow	0.12 mgd	Daily Flow, dry conditions
PHWWF Factor	4.0	
Peak Hour Wet Weather	0.48 mgd	PHWWF
Sewage Grinder		
No. of Units	1	
ADWF Capacity	0.12 mgd	

PHWWF Capacity	0.48 mgd	3" headloss max.

Aerated Lagoon System

No. of Lagoons	2
Operation	Series
Detention Time	5 days
Lagoon Operation	Partial Mix
Pond Volume, each	600,000 gal
Pond Depth	8 feet
Pond Surface Area, each	0.3 AC
Pond Loading, each	450 lb O_2/day
Pond #1 Aerators	2@10 HP each
Pond #2 Aerators	2@10 HP each

Settling Ponds

No. of Ponds	3
Volume, each	80,000 gal
Sludge Volume, each	20,000 gal
Pond Depth	5 to 7 feet
Surface area, each	2,600 SF
Surface Overflow Rate	23 gpd/SF

Parshall Flume (Not Used)

Size	2-inch
Minimum Capacity	0.24 mgd
Maximum Capacity	0.30 mgd

Chlorinator

Maximum feed rate	50 lb/day 50 mg/L@0.12 mgd 25.0 mg/L@0.24 mgd 12.5 mg/L@0.48 mgd

Chlorine Contactor Chamber

Volume	5,000 gal
Depth	2.5 feet
L/W Ratio	40
Detention Time	60 minutes@0.12 mgd 30 minutes@0.24 mgd 15 minutes@0.48 mgd

Effluent Pump Station

No. of Pumps	2
Design Point	125 gpm@92 ft TDH
Maximum Capacity	0.18 mgd

Standby Power

Standby Generator	80 kW

WASTE DISCHARGE REQUIREMENTS AND SUPPORTING DOCUMENTS

The CSA 18 WWTP is currently regulated by the RWQCB under permit No. R3-2003-0004 and -0005. The WDRs were adopted October 24, 2003. A summary of the key permit requirements are:

- Daily flow averaged over each month shall not exceed 120,000 gpd.
- Effluent BOD5 shall not exceed 40 mg/L (30 day average) or 100 mg/L max .
- Effluent TSS shall not exceed 40 mg/L (30 day average or 100 mg/L max.
- Effluent bacteriological quality of recycled water shall not exceed 23 MPN per 100ml (7 day median) and shall not exceed 240 MPN per 100 ml in any single sample.
- Total chlorine residual in recycled water shall equal or exceed 1 mg/l, as measured immediately after the chlorine contact zone.

EXISTING WASTEWATER FLOWS AND CHARACTERISTICS

The following sections describe the existing and wastewater flows, characteristics, and loading.

Existing Wastewater Demands In Planned Service Area

The existing WWTP was designed for an average dry weather flow (ADWF) of 80,000 gpd, with maximum month flows up to 120,000 gpd. Data for the past five years was obtained from the County and average daily, peak daily, and maximum month flow for each year is identified in Table 2. It should be noted that the peak wet weather flow event referenced in Table 2 is also the largest for the 10-year period of 2005 through 2014.

Table 2. Historical Annual Flows for CSA 18 WWTP

	Average Daily Flow, gpd	Peak Wet Weather Daily Flow, gpd	Maximum Month Flow, gpd
2010	75,996	179,900[1]	95,096
2011	71,988	160,~~000~~000[2]	81,554
2012	67,350	130,~~036~~036[3]	77,099
2013	65,396	104,~~000~~000[4]	70,304
2014	60,290	104,~~533~~533[5]	69,496

[1] 5-day average daily flow during storm event in December 2010; see discussion below.
[2] March 20, 2011
[3] January 17, 2012
[4] February 12, 2013

[5]February 26, 2014

According to the NPDESdischarge permit, the flow limit of 120,000 gpd is for maximum month flow. While peak daily flow has historically exceeded the 120,000 gpd mark, the maximum month flow has consistently remained within acceptable limits, including during the wettest year, (2010) when maximum month flow was 95,096 gpd.

In 2005, the County prepared a flow analysis and determined the average flow per residential unit was approximately 195 gpd, which was based on a total service area equivalent dwelling unit (DUE) of 475 at buildoutbuild-out. As of the time of this report, the total DUE count is 463.5 (471.5- minus 8).

Wastewater flow hasflows have been trending downward over the past five years. This trend is consistent with the replacement of plumbing fixtures over time, given that new fixtures are subject to current low flow requirements. Of the past five years, 2010 had the highest maximum monthly flow at 95,096 gpd. Using this data, and the compiled data from the past five years, the corresponding CSA 18 WWTP flows have been calculated and are outlined in Table 3.

Table 3. Existing Wastewater Flow Summary for CSA 18 WWTP	
Average Daily Flow per residential unit[1]	164 gpd
Average Daily Flow (ADF)[2]	75,996 gpd
Maximum Month Flow (MMF)[3]	95,096 gpd
Peak Day Dry Weather Flow[4]	110,770 gpd
Peak Wet Weather Flow[5]	179,900 gpd

1 - Average daily flow per unit = 75,996/463.5
2 - Using 2010 average daily flow
3 - Using 2010 maximum month flow
4 - Occurred June 5, 2010
5 – 5-day average during storm in December 2010

In the past 5 years, peak wet weather flow for the CSA 18 WWTP occurred during a large storm in December, 2010. The storm produced 8.68 inches of rain over the course of 7 consecutive days of rainfall. The maximum daily flow that was recorded at the plant during this storm was 325,647 gpd. In the case of treatment plants with a short hydraulic residence time (HRT) of 1 to 2 days, the maximum wet weather peak day flow must be used for the purpose of determining planplant capacity. In the case of CSA 18, the ponds contain multiple days of residence time, thereby absorbing a one day peak withwithout compromising the total time available for biological treatment. For this reason, the available storage volume in the ponds was considered, along with the cumulative influent volume through the event, and it was determined that the HRT available over the course of the storm totaled a minimum of 5 days.. The flow during this 5-day period was averaged and resulted in the 5-day average peak wet weather flow of 179,000 gpd.— Using this peak wet weather flow, the system HRT totaled 6.67 days.

Table 4. Peak Wet Weather Flow Calculation

Date	Flow, gallons
12/19/2010	104,239
12/20/2010	325,647
12/21/2010	233,000
12/22/2010	134,618
12/23/2010	102,000
Total Flow	899,504

Total Pond Volume: 1,200,000 gallons

Cumulative Flow During Peak Wet Weather Storm Event: 899,504 gallons

5-Day Average Peak Wet Weather Flow (899,504/5 days): 179,000 gpd

1,200,000 gal / 899,504 gal = 6.67 days HRT

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Wastewater Treatment Plant Loading

Design organic loading of the wastewater treatment plant was based on the following average values:

- Influent BOD5: 250 mg/L, average (250 lbs/day @ 120,000 gpd)
- Influent TSS: 200 mg/L, average (200 lbs/day @ 120,000 gpd)

Actual annual average influent and effluent BOD (based on monthly average totals) values are listed in Table 4Tables 5 and 56. Currently the plant has had two instances of exceeding the monthly 30-day average BOD (>40 mg/L) in the past 5 years. Both instances occurred in January of 2012 and were likely due to nitrogenous oxygen demand according to operations staff.

Table 45. Annual Influent and Effluent BOD

YEAR	Average Influent BOD5, mg/L	Peak Influent BOD5, mg/L	Average Effluent BOD5, mg/L	Peak Effluent BOD5, mg/L
2010	310	413	13	17
2011	318	406	15	26
2012	311	420	17	45
2013	289	365	14	22
2014	335	358	11	14
~~Table 5. Annual Influent and Effluent TSS~~Average	312.7	392.4	14	24.8

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Table 6. Annual Influent and Effluent TSS

YEAR	Average Influent TSS, mg/L	Peak Influent TSS, mg/L	Average Effluent TSS, mg/L	Peak Effluent TSS, mg/L
2010	316	478	10.5	17
2011	310	408	15	20
2012	367	766	13	17
2013	346	585	15	22
2014	346	568	11	19

Average	337	561	12.9	19

While actual BOD and TSS ~~loading is~~concentrations are higher than original design criteria, treatment efficiency of the plant is about 95 – 96% and the treatment plant consistently meets the effluent discharge limits of 40 mg/L BOD and TSS.

PROPOSED BUILDOUT CAPACITY OF CSA 18 WWTP

In order to determine the estimated potential ~~buildout~~build-out capacity of the treatment plant, the existing biological reaction rate was estimated from existing data. The reaction rate was calculated using the total volume of the two ponds (1,200,000 gallons), the hydraulic retention time (~~14~~15 days @ average design flow of 80,000 gpd), and the actual average influent and effluent BOD values. To be conservative, the average permitted design flow of 80,000 gpd was used in the HRT calculation rather than the historic peak flows, which would yield a higher historical reaction rate. The BOD values used for this specific calculation were compiled by taking the total average influent BOD from the 5 years-worth of data and the total average effluent BOD for the same time period. In response to feedback from the peer review team, additional analysis of historical data has also been added in a subsequent section of this report.

Average reaction rate in existing system:

Cn/Co = 1/[1=~~(~~+(kt/n)]n where:

Cn = Effluent BOD = 14 mg/L
Co = Influent BOD = ~~320~~312.7 mg/L
k = First order reaction rate (BOD reaction rate)
t = detention time = ~~14~~15 days
n = number of ponds in series = 2

The resulting BOD reaction rate is 0.~~47~~50 for the combined 2-pond system. This value is consistent with similar aerated lagoon-style treatment systems, with an average range of 0.5 – 1.5 called out in Table 8-29 of Metcalf & Eddy Fourth Edition.

Table ~~6~~7 outlines the flow scenarios that were considered in determining the ~~buildout~~build-out service area flow for the CSA 18 WWTP. Three separate flow scenarios were considered. The first scenario considers the permitted maximum month flow rate of 120,000 gpd and compares that value to the actual existing flow conditions for the past 5 years. The second scenario was at the Peak Day Dry Weather Flow (PDDWF), in which the actual existing flow condition was pulled from the 5-year data set. The WWTP capacity at PDDWF was back calculated using the flow per DUE at the existing PDDWF. During the initial County peer review of this analysis, the use of an effluent BOD target of 40 mg/L was discussed, and a 20% safety factor was subsequently added. The resulting effluent target of 32 mg/L was used to determine the recommended max number of DUEs. This approach is highly conservative when applied to peak conditions, given that the waste discharge requirements allow for short term effluent BOD levels of over 40 mg/L (daily max of 100 mg/L).

The third condition analyzed was ~~looking at~~ the WWTP Peak Wet Weather Flow (PWWF). The PWWF was calculated by taking a 5-day average flow during the largest storm on record in the past 5 years. ~~This storm occurred in December of 2010 with precipitation over that 5-day period totaling 7.42 inches.~~This analysis was also supplemented by a sensitivity study that considered higher levels of infiltration and inflow (See Supplemental Wet Weather Analysis below). Similar to condition number 2, the wastewater capacity PWWF was back calculated using the recorded PWWF from the past 5 years and a wet weather diluted BOD value of 206 mg/L. The recommended DUE count was also adjusted using the 20% effluent safety factor as before. Calculations supporting the three flow conditions are provided in Appendix A.

Table 7. CSA 18 WWTP Maximum Flow Conditions

~~Table 6. CSA 18 WWTP Maximum Flow ConditionsNo.~~ No.[1]	Flow & Loading Condition Reviewed	WWTP Capacity[1] (gpd)	Existing Flow Conditions[2] (gpd)	Flow per DUE[3] (gpd)	Max No. ~~DUEs~~ DUEs[6]	Recommended No. of DUEs[7]
(1)	Max. Month Flow	120,000	95,096	205.2	584	584
(~~1~~2)	Peak Day Dry Weather Flow	~~125,857~~ 158,398	110,770	239.0	~~526~~662	561

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(23)	Peak Wet Weather Flow[6]Flow[5]	221,9051 94,923	179,900	388:1	57160 8	502

[1]Calculations associated with condition number are provided in Appendix A.
[2]From Table 3
[3](Existing Flow Condition) / (463.5 DUEs in current service area)
[4] (WWTP Capacity) / (Flow per DUE)
[6]Calculated[5]Calculated diluted BOD = 206 mg/L
[6]Maximum number of DUEs calculated using effluent BOD limit of 40 mg/L
[7]Recommended number of DUEs calculated using effluent BOD limit of 32 mg/L (20% safety factor)

As shown in Table 67, the limiting factor for maximum DUEs is during the Peak Day DryWet Weather Flow condition. The maximum DUE's that could be accommodated by the WWTP is 526 608. Including the conservative effluent safety factor described above, this amount decreases to 502 DUE's. Compared to the existing 463.5, the County has conservative capacity for 38.5 additional DUEs. Taking the Jack Ranch Development into account (13 DUEs), the build-out of the CSA 18 WWTP would accommodate an additional 62.5 DUEs. 22.5 DUEs. As indicated previously, 8 DUEs remain to be served within the CSA 18 service area, and therefore adequate capacity exists to serve the Jack Ranch Development.

The oxygen requirement of the system was calculated to determine theoretical horsepower needed for treatment at the Peak Day DryWet Weather Flow condition. At the PDDWF flowPWWF of 125,857194,923 gallons per day, the total required horsepower is 14 Hp. The current system consists of two (2) 10 Hp units, therefore the current aerators are sufficient to meet the oxygen demand at the proposed "buildoutbuild-out" flow of 125,857194,923 gpd.

Peak Day Dry Weather Flow Oxygen Requirement
Assume:

Design Flow	125,857194,923 gpd
Influent BOD	335 mg/L
Number of Lagoons	2
Temperature	22°C
K factor	0.4750
O2 Demand/BOD	1.5 lbs O2/lb BOD
Vertical aerator efficiency*	1.5 O2/hp-hr

*Clean water vertical aerator efficiency = 3.0 from aerator manufacturer; deratedde-rated to 1.5 O2/hp-hr for wastewater application.

Peak Day BOD: (0.1219 MGD) x (335 mg/L) x (8.34) = 335.3530.84 lbs BOD/d

Oxygen Demand: (335.3530.84 lbs/d) x 1.5 = 502.9796.26 lbs O2/day

Surface Aeration energy requirement:

(502.9796.26 lbs O2/day) / [(1.5 O2/hp-hr) x (24 hr/day)] = **1415 Hp**

Supplemental Wet Weather Analysis

As stated above, data from the most recent 10 year period was analyzed, and the worst case wet weather condition during that period was utilized. During the County's initial peer review of this analysis, the potential for larger storm events was raised. As a result, a sensitivity analysis was performed assuming successively higher volumes of theoretical infiltration and inflow. It should be noted that such levels represent a theoretical analysis and have not necessarily been observed in practice. Increasing theoretical storm flows were applied to the model, and the corresponding diluted influent BOD was used to back-calculate the maximum treatment capacity flow through the plant (assuming the average reaction rate of 0.5). As shown in Table 8, as flows increase, influent BOD decreases, and overall treatment capacity of the plant increases. Therefore, peak wet weather events are not expected to have a limiting factor on the biological capacity of the treatment system.

Table 8. Wet Weather Flows and Associated Buildout Capacity

Theoretical Wet Weather Flow (gpd)	Influent BOD (Diluted Peak WW Conditions)	Max Theoretical Flow (gpd)	Max DUEs (388gpd/DUE)
179,900	206	194,939	502
197,890	188	211,147	544
217,679	170	229,334	591
239,447	155	249,852	643
263,392	141	273,152	704

Notes:

1) Effluent target BOD assumed to be 32 mg/L
2) Diluted loading during storm event based on 110,770 gpd flow = 309.5 lbs/day BOD
3) Reaction rate = 0.50

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FUTURE WASTEWATER DEMANDS FOR DEVELOPMENT

The new development of the Jack Ranch will include ~~16~~13 residential units. Using existing data from the past 5 years, the average flow ~~per residential unit~~ calculates to 164 gpd/residential unit. However to be conservative, and consistent with the prior May 13, 2005 memo from the County, a value of 195 gpd/residential unit was used to estimate the following wastewater flows for the Jack Ranch development ~~(rounded to nearest 100 gal/day):~~:

Table ~~7~~9. Jack Ranch Flow Estimate	
Flow per residential unit[1]	195 gpd
Average Daily Flow (ADF)	~~3,120~~2,535 gpd

Maximum Month Flow (MMF)[2]	3,~~900~~169 gpd

[1]From County Memo, May 13, 2005
[2]MMF is 1.25 times ADF (95,096/75,996)

Adding the new development demands to the existing treatment plant results in the following estimated wastewater flow ~~demands~~ for CSA 18 WWTP.

Table ~~8~~10. Estimated Combined Wastewater Flow CSA 18 with Jack Ranch	
Average Daily Flow (ADF)[1]	~~79,116~~78,531 gpd
Maximum Month Flow (MMF)[2]	98,~~996~~265 gpd

~~[1](75,996 + 3,120)~~
~~[2](95,096+3,900)~~

[1]Maximum CSA 18 average daily flow from past 5 years (year 2010) plus Jack Ranch average daily flow (75,996 + 2,535)
[2]Maximum CSA 18 max month flow from past 5 years (year 2010) plus Jack Ranch average daily flow (95,096+3,169)

As indicated above, the maximum month flow at build-out is expected to be ~~82.5~~65% of the 120,000 gpd permit limit. The Jack Ranch will increase the existing maximum month flow by ~~4.0~~3.3%.

REGULATORY IMPLICATIONS

As outlined in Table ~~8~~10, even with the additional ~~16~~13 units, daily flow averaged over the month is not estimated to exceed 120,000 gpd. However, the following provisions are outlined in the Waste Discharge Requirements (WDR) portion of the existing permit:

- The County will need to submit a report of waste discharge or secure a waiver from the RWQCB at least 120 days before making any change to the character, location, or volume of the discharge.
- The County will need to notify the RWQCB if the monthly average daily flow will or may reach the design capacity within four years. Notification shall be in the form of a letter or report that includes the following information:
  - The best estimate of when the monthly average daily dry weather flow rate will equal or exceed design capacity.
  - A schedule for studies, design, and other steps needed to provide additional capacity for waste treatment and/or disposal facilities before the waste flow rate equals the capacity of present units.
  - The required technical report shall be prepared with public participation and reviewed, approved, and jointly submitted by all planning and building departments having jurisdiction in the area served by the waste collection, treatment, or disposal facilities.
- The County must notify the RWQCB whenever there is a substantial change in the volume or character of pollutants being introduced into the wastewater stream. Notice shall include information on the quality and quantity of waste

being introduced to the system and the anticipated impact of the waste upon the quantity and quality of the aggregate discharge.

If the County decides to increase the number of service connections to include the Jack Ranch Development, an update letter or Report of Waste Discharge conforming to the above requirements will be necessary.

EVALUATION OF INDIVIDUAL TREATMENT PLANT COMPONENTS

Influent Grinder

The influent grinder unit is a Muffin Monster Model 30000-12. The unit is designed to handle an average daily flow of 120,000 gpd with a peak hour factor of 4.0. The grinder has historically been inundated due to the fact that two of the system lift stations may cycle on at the same time and induce peak pumping flows to a common gravity sewer leading to the grinder. Operational staff has addressed this concern by providing containment around the unit. The Jack Ranch development may be required to provide a pro-rata contribution to the upgrade of the unit.

Influent Lift Station and Force Main

It is anticipated that the Jack Ranch development would be served by an existing 8" gravity sewer, therefore the ~~influent~~upstream lift station/forcemain would not be impacted by the additional flow.

Aeration Ponds 1 and 2

The two aerated ponds are designed to operate in series. All wastewater enters Pond 1 and then flows to Pond 2. Pond 1 and Pond 2 have been evaluated in both the B&C Audit and the previous Wallace Memo. It was determined in the earlier B&C Audit that the ponds were experiencing some short circuiting that was resulting in a loss of treatment capacity. As a result, it was recommended that both ponds be improved by adding a floating baffle, modifying the inlet piping geometry, and repositioning the aerators. The County has implemented the recommended improvements to Pond 1~~, however~~. However, it does not appear that any of B&C's recommendations have been implemented in Pond 2. In order to maximize the treatment potential of the WWTP, it is recommended that the B&C pond improvements are implemented in Pond 2. A summary of those modifications is as follows:

- Install a floating baffle in Pond 2 to split the pond in half,
- Install (2) 10Hp aerators, positioned in the center of each half of the pond,
- Relocate the inlet to the center of the first half of Pond 2.

As outlined in the previous reports, once these improvements are implemented, the aeration ponds should operate at their designed rating of 120,000 gpd. Given that Jack Ranch will increase the influent flows to the WWTP, the developer proposes to pay the full cost of the proposed Pond 2 upgrade.

Wastewater constituents, such as BOD, TSS, total dissolved solids (TDS), sodium (NA), and chloride (Cl) are expected to remain as they currently are and treatment efficiencies should not be affected by the additional Jack Ranch units. That being said, the Jack Ranch Development plans on implementing a provision that limits self-generating water softeners so as not to increase the percentage of salts in the wastewater effluent.

Settling Ponds 1, 2 and 3

Settling Ponds 1, 2 and 3 are situated south/southwest of Aeration Ponds 1 and 2. These ponds are used for settling effluent from Pond 2. It is recommended that these ponds remain unchanged.

Chlorine Contact Chamber.

The chlorine contact chamber was sized based on meeting the 23 MPN median (240 MPN maximum) criteria set in the waste discharge requirements. Currently, based on design criteria for this WWTP, the contact chamber provides for 30 minutes (at 2x design flow) of contact time, at a concentration of 25 mg/L. This meets a CT value of 750, which exceeds that required in Title 22 CCR for tertiary 2.2 MPN recycled wastewater. However, recognizing that the treated effluent is not filtered, direct comparison of these two values is not possible.It should be noted that a defined CT value is not required for secondary, 23 MPN recycled water.

Effluent Clearwell and Pumping Station.

Given the incremental flow increase being added by the development, it is not anticipated that additional modifications to the clearwell and effluent pumping station should be required. Further discussion on the effluent disposal system is provided in the section below. In the event effluent disposal for the additional units is required to be addressed by the Jack Ranch development, a small submersible pump could be added to the existing clearwell. The submersible pump would be used to lift the development's proportion of effluent flow to the Jack Ranch development for reuse. The pump should include flow metering and controls.

Standby Power/Generator. The standby power generator is designed to power the influent grinder, existing four pond aerators, chlorine injection system, lighting and controls. It is not anticipated that any changes are necessary to the standby generator.

Solids Handling

A major emphasis of the B&C Audit was an evaluation of the solids handling practices, including the development of alternative approaches based on potential sludge disposal options. The Audit looked at mechanical and passive dewatering, hauling to landfill and/or compost facilities, and potential land application opportunities. The recommendations from the Audit concluded that continuing to haul wet sludge from the WWTP was the most cost effective alternative. It was also recommended, however, that in the event sludge hauling rates rise significantly or if the designated facility ceases to receive liquid sludge, that mechanical dewatering should be considered.

In March 2015, a volute dewatering press was piloted at the CSA 18 WWTP. While the dewatering press equipment worked well on the solids that were pumped out of the settling basin, it became apparent that the plant would need to construct a means of transferring sludge to the equipment. The pilot used a small sump pump that was placed in the bottom of one of the settling ponds and operated for only a few minutes before it was unable to draw additional sludge into the suction side without physical relocation of the pump. Because there is no slope to the bottom of the settling ponds, a sludge transfer pump station would need to be designed and constructed to withdraw sludge from each of the settling ponds.

It is still assumed that hauling liquid sludge to Santa Paula or equivalent is more cost effective than implementing a solids dewatering system. In the event the County decides to move forward with improving the solids handling system, it is anticipated that the Jack Ranch development would fund their pro-rata portion of the costs associated with construction of the new facility.

Effluent Disposal System

The CSA 18 WWTP disposal system is rated at the same capacity as the plant, 120,000 gpd, and consists of recycled water for irrigation of the County Club Golf Course. Wet weather storage facilities are maintained by the County Club and include a 5 million gallon holding pond. Irrigation demand has historically been sufficient to meet the rated disposal capacity of the plant.

As outlined in Table ~~8~~10, the maximum monthly flow is not anticipated to exceed 120,000 gpd, even with the incremental increase due to new development. Therefore, it is not anticipated that any modifications to the existing effluent disposal system would be needed to accommodate the additional ~~16~~13 units. However, the management of wet weather flows has been a subject of concern for operations staff.

Principal concerns include:

- Influent flows increase during wet weather, and prolonged periods of rainfall could result in extended periods without golf course irrigation.
- Irrigation of the golf course during a wet winter can impact the play of the course. While this is an obligation of the County Club currently, the addition of ~~16~~13 additional units could be a cause for concern.

In order to mitigate the above concerns, the addition of a supplemental wet weather storage pond on the Jack Ranch property is proposed. The pond would store a minimum of 120 days of flow at a conservative rate of ~~195 gal/day~~300 gpd/DUE, resulting in a minimum storage requirement of 1.4 acre-ft. Alternatively, improvements could be made to improve the existing 5 million gallon reservoir to add the additional capacity. Given the conservative estimate applied in this calculation, this improvement is expected to improve the effluent storage situation for the current CSA 18 rate payers.

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~~SUMMARY AND COST ESTIMATE~~

Historical Data Modeling
During the course of the County's initial peer review, additional historical data analysis was requested to validate the assumptions made in the body of this report. The past 5 years of data from the wastewater treatment facility was analyzed with respect to the average actual reaction rate for the system. A plot of the results from this analysis is provided in Appendix B. The plot shows that the existing system has historically performed at a higher apparent reaction rate during periods of peak flow. However, the average reaction rate of 0.50 was used during the peak flow analysis, which adds a level of conservatism to the treatment calculations.

Using the same 5 years of data, the actual pond performance was used to calculate the theoretical pond performance with the additional planned build-out units from Tract 2429 and the remaining 8 vacant units in the original service area. A flow per DUE of 195 gpd was assumed, to be consistent with County planning data. A plot of this information is provided in Appendix B. As shown in the plot, the projected effluent BOD is 70% below the effluent limit.

With respect to wet weather, the most current 10 year period of precipitation and flow data was reviewed and it was determined that the 2010 event used during the calculation of the 5-day average Peak Wet Weather Flow is the worst case wet weather flow experienced at the plant.

Conclusion and Recommendations
The WWTP design capacity is sufficient to accommodate ~~buildout~~build-out of the existing service area and the increase flow from ~~16~~13 units. The recommended pond improvements from the original B&C plant audit have not yet been fully implemented, therefore it is recommended that those improvements be constructed to comfortably accommodate build out flow.

While it is not anticipated that further modifications will be necessary as a result of the additional ~~16~~13 units, the following facilities were noted as possible plant improvements.

- Influent grinder: Due to cycling of collection system pumps, the influent grinder sees peak flow conditions regularly. The influent grinder should be evaluated in further detail to determine existing condition and remaining useful life. If the unit needs to be replaced, it is estimated that the installed cost of a new grinder would be approximately $150,000, including improvements to the containment system.

- Solids handling system: Based on previous reports and hauling rates, the current method of hauling liquid sludge is still the most cost effective means of solids removal from the WWTP. If disposal rates increase significantly in the near future, the County may consider installing dewatering equipment. In order to accurately utilize a dewatering press, a sludge transfer pump station with associated piping from Settling Ponds 1, 2, and 3, would also need to be installed. It is estimated that costs associated with this improvement would be as follows:
  - Dewatering equipment: in the range of $150,000 to $200,000
  - Sludge transfer piping/pump: $150,000
  - Total project cost with contingencies: $400,000
- Effluent disposal system: The current method of effluent disposal has sufficient capacity to dispose of the existing CSA WWTP flows as well as the additional flow from the new units. However, the Jack Ranch Development will plan to accommodate a minimum of 120 days of effluent storage/disposal. If necessary, this would occur on the Jack Ranch property.

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Cost Implications

In the event that the County elects to advance a grinder project or dewatering system the Jack Ranch would be responsible for covering their proportion of the cost. Given that the portion of EDUs being added by the development is ~~3.4% (16~~2.8% (13 EDU/471.5 EDU), Jack Ranch would be responsible for that percentage. In the case of the Pond 2 improvements contemplated by the B&C Audit and the effluent disposal system, it is assumed that the Development would cover 100% of the cost. During the Pond 2 improvement project, the disposal of accumulated sludge would be the responsibility of the County. Table ~~9~~11 outlines the possible Development costs associated with WWTP improvements.

Table ~~9~~11. Estimated Improvement Costs

	Facility	Total Cost	Development Cost[1]
1	Influent Grinder	$150,000	$5,100
2	Pond 2 Improvements	$170,000	$170,000
3	Dewatering Equipment, including sludge transfer	$400,000	$13,600
	Total Cost (not including effluent disposal)		$188,700

[1]Calculated at 3.4% for Items 1 & 3, 100% for Item 2

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Please let me know if you have any questions, or if you need more information.

Sincerely,

Shannon Jessica, PE
Wallace Group

Rob Miller, PE
Wallace Group

Appendix A – Calculations

Flow Condition #1 – Maximum Month Flow

Permitted MMF:	120,000 gpd
Existing/Historical MMF:	95,096 gpd
Flow Per DUE: 95,096/463.5 =	205.2 gpd/DUEs
Max DUEs: 120,000/205.2 =	584 DUEs

Flow Condition #2 – Peak Day Dry Weather Flow
Existing/Historical PDDWF: 110,770 gpd
Highest Annual Average Influent BOD: 335 mg/L

$$Cn = Co/[1+ (kV/nQ)]^n$$

Cn = Effluent BOD = 40 mg/L
Co = Influent BOD = 335 mg/L
k = 0.~~47~~50
V= 1,200,000 gallons (4542 m^3)
n = number of ponds in series = 2

Q = ~~125,857 gpd~~158,398gpd

Existing/Historical Flow per DUE: 110,770 gpd / 463.5 DUE = 239 gpd/DUE

Max DUEs @ PDDWF~~: 125,857 gpd~~ (40 mg/L): 158,398gpd / 239 gpd/DUE = ~~526~~662 DUEs

Recommended DUEs @ PDDWF (32 mg/L): 134,195 gpd/239 gpd/DUE = 561 DUEs

Flow Condition #3 – Peak Wet Weather Flow
Calculate Diluted Loading during Storm:

(110,770 gpd/1,000,000) x (335 mg/L) x (8.34) = 309.5 lbs/day BOD

Corresponding influent loading under PWWF conditions:

309.5 lbs/day = (C mg/L) x (8.34) x (179,900 gpd/1,000,000)

C = 206.3 mg/L

Maximum flow at diluted loading and permitted max effluent BOD:

$$Cn = Co/[1+ (kV/nQ)]^n$$

Cn = Effluent BOD = 40 mg/L
Co = Influent BOD = 206.3 mg/L
k = 0.~~47~~50

V= 1,200,000 gallons (4542 m^3)
n = number of ponds in series = 2

Q = ~~221,905 gpd~~236,032gpd

Existing/Historical Flow per DUE: 179,900 gpd / 463.5 DUE = 388 gpd/DUE

Max DUEs @ PDDWF~~: 221,905~~ (40mg/L): 236,032 / 388 gpd = ~~571~~608 DUEs

Recommended DUEs @ PDDWF (32 mg/L): 194,923 gpd / 388 gpd/DUE = 502 DUEs

APPENDIX B – HISTORICAL DATA ANALYSIS PLOTS