Appendix F: Geology

F-1: Expanded Geology Analysis

Expanded Geology Analysis
Prepared for the
Draft EIR
County of San Luis Obispo
Los Osos Wastewater Project

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PREFACE

This Expanded Geology Analysis corresponds to Section 5.4, Geology, of the Los Osos Wastewater Project Draft EIR. For readability and reference, the numbering system for headings and page numbers in the following environmental analysis uses the same section number as that used in the Draft EIR.

This Expanded Geology Analysis of the Los Osos Wastewater Proposed Project Draft EIR is a summary of a compendium of knowledge regarding geological issues statewide, as well as those issues applicable to San Luis Obispo County and specifically Los Osos. Since the body of knowledge is considerable and contained in numerous appendices, it would be difficult to present it entirely in this document and in a manner that is easily understood by the reader. In order to aid the reader in locating background information, this section is formatted to facilitate the retrieval of appended information by presenting the reader with references that address the issue at hand.

5.4 - GEOLOGY AND SOILS

5.4.1 - Introduction

This section analyzes the potential geology and soils impacts associated with the construction and operation of the Los Osos Wastewater Project. The following is a list of information used in preparation of this section.

1. Preliminary Geotechnical Report, Los Osos Wastewater Project EIR, San Luis Obispo County, California. Fugro West, Inc. May 21, 2008. This information is located in Appendix F-2 of the Draft EIR.

2. Viable Project Alternatives Fine Screening Analysis, Final, Carollo Engineers, August 2007. This document is not contained in the EIR appendices, but is instead available for review at the San Luis Obispo County Department of Planning and Building. Pursuant to CEQA Guidelines Section 15150, this document is hereby incorporated by reference.

The Preliminary Geotechnical Report was prepared based on a review of site-specific historical photographs, readily available published geologic data in Fugro's files, previous geotechnical reports and a technical memorandum prepared by Fugro in 2004 and 2007, and a reconnaissance by Fugro on May 6, 2008 of the sites proposed to include facilities.

5.4.2 - Environmental Setting

Geologic Setting

The project is located in the Los Osos Valley and within the Coast Ranges geologic and geomorphic province. The province consists of north-northwest-trending sedimentary, volcanic, and igneous rocks extending from the Transverse ranges to the south into northern California. Rocks of the Coast Ranges province are predominantly of Jurassic and Cretaceous age; however, some pre-Jurassic, along with Paleocene-age to Recent rocks are present.

The Los Osos Valley and adjacent Irish Hills are the dominant geomorphic features within the project vicinity. The Los Osos Valley has formed in response to several tectonic processes that began earlier to Pliocene time (more than 5 million years ago). Prior to the Pliocene, the bedrock strata in the Los Osos areas was folded into an east-west trending syncline (U-shaped fold) that has subsequently been filled with up to 1,000 feet of sediment during the Pliocene and Pleistocene periods. Concurrent with that deposition was uplift along the east-west striking Los Osos fault that forms the boundary between the Los Osos Basin and the adjacent Irish Hills.

The predominant geologic units exposed in the study area are surficial sediments comprised of dune sand deposits (Qs) and alluvium (Qal), and outcrops of Paso Robles Formation (Qpr) and Franciscan Formation. The Franciscan Formation materials are composed of greywacke (KJfg), metavolcanics (KJfmv), and mélange (KJfm). The dune sand (Qs) is referred to as eolian deposits (Qe). The

alluvial sediments are associates with the Los Osos Creek, the floor of the Los Osos Valley, and Warden Lake. Surficial sediments are primarily by weakly consolidated units of the age-equivalent of Paso Robles Formation and Careaga Sandstone (Tca). Relatively impermeable basement rocks composed of Franciscan greywacke and metavolcanics; Pismo Formation (Tp) shale, and Cretaceous-age dacitic (Td) intrusives underlie the Paso Robles Formation and Careaga Formation. Units of the Pismo Formation (Tpm) and Franciscan Formation (KJfm, KJfmv, KJfg) are exposed on the Irish Hills south of Los Osos.

Faulting

The majority of the faults within the Coast Ranges province and the Sierra de Salinas belt generally trend north-northwest. The California Geological Survey (CGS), formerly the California Division of Mines and Geology, considers major faulting within the project vicinity to include the Los Osos fault, San Simeon fault, and the San Andreas fault. The CGS fault database consists of active and potentially active faults that are considered by the CGS to be capable of affecting regional seismicity in California. A summary of faulting in the Central Coast area is shown on Plate 3 - Regional Fault Map in Appendix F-2.

A fault search routine was used to identify active and potentially active mapped faults and fault segments within a 62-mile radius of the project vicinity. Summarized below are nine faults and fault segments that are considered the most capable of producing high ground motion within the project vicinity. Additional information is presented in the California Geological Survey (CGS) (2002) fault database.

Table 5.4-1: Characteristics of Faults in Project Vicinity

Fault	Distance From Site (Mile)	Maximum Moment Magnitude (Mw)	Fault or Fault Segment Length (km)	Slip Rate (mm/yr)
Los Osos	0.6	7.0	44 ± 4	0.5 ± 0.4
Hosgri	7	7.5	169 ± 17	2.5 ± 1.0
San Luis Range (S. Margin)	9	7.2	64 ± 6	0.2 ± 0.1
Rinconada	16	7.5	190 ± 19	1.0 ± 1.0
Casmalia (Orcut Frontal Fault)	28	6.5	29 ± 3	0.3 ± 0.2
Lions Head	33	6.6	41 ± 4	0.02 ± 0.02
San Juan	37	7.1	68 ± 7	1.0 ± 1.0
San Andreas (Cholame)	43	7.3	63 ± 6	34 ± 5
Los Alamos - Baseline	48	6.9	28 ± 3	0.7 ± 0.7
Source: Fugro West, Inc. 2008.				

Los Osos Fault

The closest mapped active fault to the project vicinity is the Los Osos fault zone. The fault zone and associates structural features are shown in Exhibit 5.4-1. The Los Osos fault zone is described as a series of discontinuous, sub parallel and en echelon fault traces that extend from the offshore Hosgri fault zone to Lopez Reservoir, a distance of about 35 miles. The fault zone is subdivided into the following four segments: Estero Bay, Irish Hills, Lopez Reservoir, and Newsom Ridge. The Irish Hills segment of the Los Osos fault is about 10 to 12 miles long and extends from the Pacific Ocean near Los Osos eastward to San Luis Creek. This segment of the fault forms the boundary between the Los Osos Valley and the Irish Hills, has documented Holocene offset, is considered potentially active in the area near Los Osos, and considered active near the City of San Luis Obispo. As shown in Exhibit 5.4-1, the Los Osos fault zone is located south of the most southerly site that includes a proposed facility (i.e., Broderson). Portions of the fault east of Los Osos (east of the study area) near the City of San Luis Obispo have been zoned active and designated as an Alquist-Priolo earthquake fault hazard zone by the CGS. The entire length of the Los Osos fault is a potential source of high ground motion.

A northwest-trending strand (locally referred to as "Strand B") of the Los Osos fault is located through the Community of Los Osos and was also designated as potentially active because the presence of the Strand B fault was previously interpreted by an inferred offset in relatively deep bedrock units and groundwater aquifers in the Los Osos area. Based on subsequent evaluations, shallow groundwater was found perched on various shallow clay layers that pinch out near the presumed fault trace. The clay layers terminate near or east of Palisades Avenue. The inferred Strand B traces is an arcuate-shaped feature and not linear as inferred by previous investigations. Based on information from Cleath & Associates, as described in Appendix F-2, Strand B was determined not to be a fault or a source of high ground motion.

Nacimiento Fault

The Nacimiento fault zone is associated with relatively recent, significant seismic events; however, it is not included as a seismic source within the CGS database (i.e., located on Table 5.4-1). The fault does not have surficial features suggestive of Quaternary movement, and is considered inactive. However, the Bryson earthquake of 1952 and the Magnitude (M) 6.5 2003 San Simeon earthquake may have occurred within the fault zone; and therefore an inactive classification would be incorrect and would make the fault seismically active. The Bryson earthquake, which occurred in a rural area of northern San Luis Obispo County, is poorly understood and may be attributed to movement on other faults such as the active San Simeon or potentially active Rinconada fault zones.

The Nacimiento fault zone is as an ill-defined, complex array of northwest trending faults of diverse types and ages. The Nacimiento fault zone separates the soft rocks of the Coastal Franciscan domain on the west from the primarily granitic rocks of the Salinian domain on the east. The Nacimiento fault zone is not a single fault line of specific age, but rather a complex zone of branching and

discontinuous faults of diverse orientations, movements, and ages. The fault zone is more or less defined by a narrow sinuous outcrop band of Franciscan mélange.

Geologic Units

The following characterization of general subsurface conditions mapped within the sites proposed to include facilities is based on review of published geologic maps and soils encountered during previous exploration programs by Fugro.

Dune Sand Deposits (Qs)

Dune sand deposits comprise the predominant geologic unit exposed at the ground surface over the collection system area. The area extent of the dune sand deposits is generally consistent with units encountered in explorations. The dune sands are characterized as unconsolidated to moderately consolidated, undifferentiated late Pleistocene and Holocene wind blown deposits.

The dune sand encountered in previous exploration programs was typically weathered with a moderately developed topsoil horizon. The topsoil was generally classified as very loose to medium dense sand (SP), silty sand (SM) and sand with silt (SP-SM). The underlying dune sand typically consists of loose to very loose fine sand (SP) to depths of approximately five to ten feet below the ground surface. The sand dune deposits below the five to tenfoot depth were typically medium dense to dense sand (SP) and are locally interbedded with zones and lenses of silty sand (SM), clayey sand (SC), sand with silt (SP-SM), and silt (ML).

Alluvium (Qal)

Alluvium is generally present along the eastern edge of the Morro Bay estuary, along the floodplains associated with Los Osos Creek, within wetland areas including Warden Lake, and on generally flat topography within the Los Osos Valley drainage basin. Within the collection system area, the alluvium is similar in composition to the dune sand deposits, and is therefore difficult to distinguish from those deposits based on soil classification. Undifferentiated units of alluvium may be present in areas mapped or logged as dune sand deposits, particularly in low lying interdunal depressions within the project vicinity. The alluvium is characterized as Holocene-age unconsolidated cobbles, pebbles, sand, and silt stream deposits.

The alluvium encountered in previous exploration programs generally consisted of very loose to dense fine sand (SP, SP-SM) with varying amounts of silt. The deposits are locally interbedded with layers and lenses of gravel, clay, clayey sand, and organics. Dense sand units were encountered below the dune sand deposits near the intersection of Mitchell Drive and Pine Street, which is in the west-central portion of the Community of Los Osos.

Source: AirPhoto USA, San Luis Obispo County GIS Data, and MBA GIS Data.

NORTH

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Exhibit 5.4-1
Faults and Surface Features

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GEOLOGY EXPANDED ANALYSIS SECTION

Paso Robles Formation (Qpr)

The presence of the Paso Robles Formation within the project vicinity is unrecognized and undifferentiated from dune sands due to the surficial deposits comprising the plateau east of the Los Osos Creek flood plain. While not exposed within the collection system area, Paso Robles Formation is mapped along areas of Los Osos Creek, and overlies Franciscan rocks near the Los Osos Mortuary (i.e., Cemetery, Giacomazzi, and Branin sites), and along portions of the southern and southwesterly areas of the Tonini site. The Paso Robles Formation consists of weakly consolidated sandstone, siltstone, claystone, and conglomerate in the Los Osos Valley area. Although described in terms of rock designation because of the formational name, the sediments of the Paso Robles Formation are generally equivalent to stiff to hard cohesive soils and medium dense to very dense granular soils.

The age-equivalent of the Paso Robles Formation was encountered below dune sand deposits during previous exploration programs, and likely underlies most of the dune sand within the project area. The material locally referred to as Paso Robles Formation may include older wind blown sediment and is commonly of a similar grain size as the overlying dune sand, only denser. The relative density of the material encountered was used to differentiate between Paso Robles Formation and the surficial dune sand and alluvial deposits, in addition to the presence of clay layers that would not be expected to be encountered within wind blown deposits. The contact between the Paso Robles Formation and dune sands appears to be relatively uniform and dip to the northwest toward Morro Bay.

The Paso Robles Formation encountered in previous explorations generally consisted of dense to very dense sand (SP), silty sand (SM), and clayey sand (SC). The sand is locally interbedded with one to five-foot thick layers of very hard lean clay (CL). Where encountered in the explorations, the Paso Robles Formation was overlain by approximately 10 to 40 feet of dune sand and/or alluvium. Approximately 100 feet or more of dune sand overlies the Paso Robles Formation near Santa Maria Avenue located in the northern portion of the Community of Los Osos.

Franciscan Formation metavolcanics (KJfmv) and mélange (KJfm)

The Los Osos Valley is bounded to the north and south by the San Lucia and San Luis ranges, respectively. Within the project vicinity, the bases of these ranges are composed of Cretaceous or Jurassic-age Franciscan greywacke and metavolcanics. Along the easterly side of the collection area, Franciscan rocks are below the Paso Robles Formation. Metavolcanic rocks are below Paso Robles Formation at the east end of Santa Ysabel and along the South Bay Boulevard. Franciscan rocks are exposed on the hillsides above the Tonini site. The Franciscan metavolcanics primarily consists of metamorphosed basalt and diabase with localized, extensively sheared zones. The mélange is a pervasively sheared greywacke largely composed of sheared claystone, with exotic clast inclusions. The mélange typically weathers to a highly expansive soil at the ground surface, and is prone to soil creep, slope instability, and landsliding.

Groundwater Conditions

Groundwater depths range from approximately near or at the ground surface to greater than 80 feet below the existing ground surface west of Los Osos Creek. Based on a boring drilled on Doris Avenue in the west-central portion of the Community of Los Osos, groundwater conditions in areas near Morro Bay appear to be influenced by tidal changes. Groundwater ranging in depths from 30 to 48 feet below the existing ground surface was recorded within the limits of the Cemetery, Giacomazzi and Branin properties. During an exploration by Fugro in 2004 east of the Cemetery, Giacomazzi, and Branin properties, groundwater was not recorded in any of the explorations advanced to depths ranging from 20 to 60 feet. However, vegetation suggestive of groundwater seeps near surface groundwater was observed on the northeast-facing slope above the Warden Lake area, although active seeping was not observed during Fugro's 2008 reconnaissance. Based on published mapping, the Warden Lake area can be a marshy environment and has contained surface water in the past.

The potential exists for groundwater to be encountered at different depths at other locations and times, above impermeable layers, and within fractures or discontinuities within the bedrock (if encountered). Groundwater and soil moisture conditions fluctuate seasonally, and because of changes in precipitation, storm runoff, irrigation schedules, and other factors.

Seismic Conditions

Historical Seismicity

The project is located in a seismically active region of central California. Historical records indicate that the area has been subject to various seismic events over the last 183 years. A summary of Magnitude 2 and greater seismic events recorded from 1933 through March 2008 are presented on Plate 6 - Historical Seismicity Map in Appendix F-2. From these references, examples of relatively strong ground motion has reportedly been experienced near the project area during the seismic events of 1830, 1857, 1913, 1916, 1917, 1966, 1980, and 2003.

The 1830 event is estimated to be an approximately M5 earthquake that occurred from a poorly located source near San Luis Obispo. The effects of the 1830 event were generally observed between the Los Osos and Rinconada faults. The 1857 event (the Fort Tejon earthquake) occurred on the Mojave segment of the San Andreas fault, and reportedly resulted in damage in central and southern California. The 1913 event is estimated to be an approximately M5 earthquake that occurred along the southwestern margin of the San Luis/Pismo block near Arroyo Grande. The 1916 event is estimated to be an approximately M5 earthquake that occurred near Avila, possibly along the Los Osos fault or faults along the southwestern margin of the San Luis/Pismo block. The 1917 event is estimated to be an approximately M5 earthquake that occurred near Lopez Canyon between the Rinconada and West Huasna faults. The 1966 event (the Parkfield earthquake) is estimated to be an approximately M6 earthquake that occurred on the San Andreas fault. The 1980 event is estimated to be an approximately M5 earthquake that occurred offshore near Point Sal along the Casmalia fault zone, and near its intersection with the Hosgri fault. The 2003 event (the San Simeon earthquake) is

estimated to have been a M6.5 earthquake resulting in a ground acceleration of about 0.18g in the project vicinity. The epicenter of the 2003 earthquake was located approximately 25 miles north of Los Osos, near the Nacimiento fault zone.

Seismic Hazard Analysis

A preliminary probabilistic seismic hazard evaluation for the project vicinity was performed using the web-based interactive 2008 U.S. Geologic Survey (USGS) National Seismic Hazard Map program. The intent of the evaluation was to estimate the range of strong ground motions that could result from earthquakes occurring on active and potentially active faults. Crustal source and subduction source ground motions are calculated within a 200-kilometer (km) and 1,000-km radius of the project vicinity, respectively. Maps depicting the estimated peak horizontal ground motion and estimated spectral accelerations for 0.2 second(s) and 1.0s periods were used to estimate ranges within the project vicinity. Ground motions are calculated for a suite of attenuation relationships and combined using a weighted logic tree analysis. The ground motions are approximated for a reference site corresponding to the boundary between National Earthquake Hazard Reduction Program (NEHRP) Site Classes "B" and "C" (average shear wave velocity of 760 meters per second in the upper 30 meters of the crust). Estimated ground motions corresponding to a 2 percent probability of being exceeded in 50 years (statistical return period ≈ 2,475 Years) are tabulated below.

Table 5.4-2: Estimated Ground Motions in Vicinity of Los Osos Community

Hazard Level	Peak Horizontal Acceleration	0.2 Second Period Horizontal Acceleration	1.0 Second Period Horizontal Acceleration
2% Probability of Exceedance in 50 years	0.4 -0.6	1.01 - 1.6	0.31 - 0.5
Notes: All acceleration values in units of gravity(g) which is 32 ft/sec^2 or 9.81 m/s^2 Source: Fugro West, Inc. 2008.			

Based on the geology of the project vicinity and subsurface conditions encountered in previous exploration programs, the majority of sites proposed to include facilities are expected to be classified as site class "D". This soil profile type corresponds to a stiff soil profile according to the California Building Code (CBC). A site class "D" assumes that the material in the upper 100 feet of the site has an average shear wave velocity ranging between 600 and 1,200 feet per second (180 and 360 meters per second). However, based on review of geologic maps (see Exhibit 5.4-2) portions of the collection area are underlain by sediments that have been identified as having a potential for liquefaction. Exploration has not been performed for the Tonini site; however, the site is mapped as being underlain by alluvium that can be vulnerable to liquefaction. According to the American Society of Civil Engineers (ASCE) design code and the CBC , "soils vulnerable to potential failure or collapse under seismic loading, such as liquefiable soils…and collapsible weakly cemented soils" shall be classified as site class "F" and require a site-specific response analysis. It should be noted that a site-specific response analysis is not required for structures having fundamental periods of vibration equal to or less than 0.5 second, according to section 20.3.1 of the 2005 ASCE design code.

Liquefaction Conditions

Liquefaction is a sudden loss of soil strength due to rapid increases in pore water pressures caused by seismic shaking. Liquefaction typically occurs during an earthquake in unconsolidated loose to medium dense sandy soils that are below the groundwater table. The potential and severity of liquefaction will depend on the intensity and duration of the strong ground motion, the depth to groundwater, the soil type, and terrain in the area where liquefaction occurs. Seismically induced settlement, collapse, or lateral spreads can occur in soils that are loose, soft, or that are moderately dense and weakly cemented, or in association with liquefaction.

San Simeon Earthquake

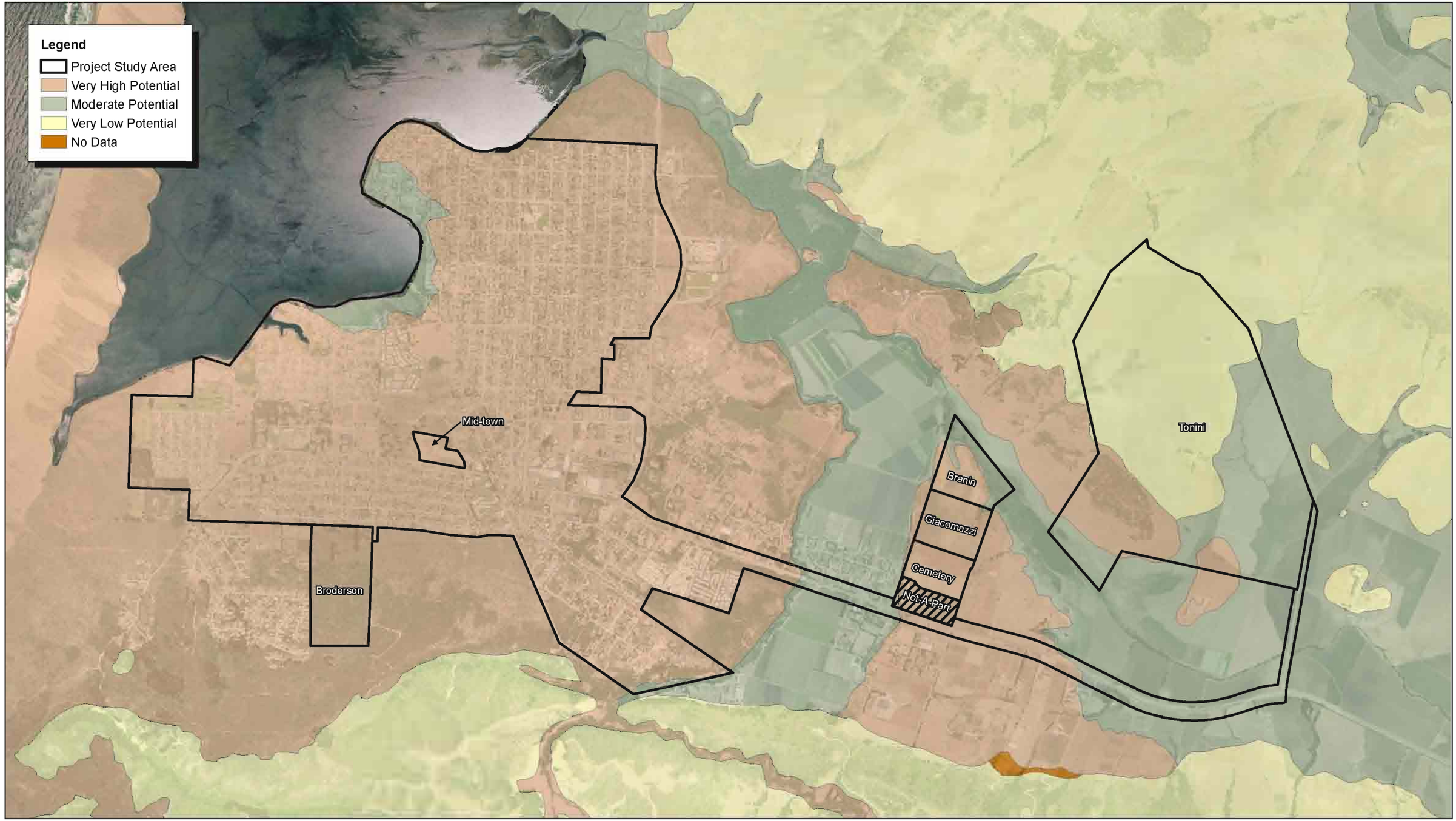
Selected areas within the Community of Los Osos were reviewed by Fugro on the afternoon following the December 22, 2003 M6.5 San Simeon earthquake to observe whether or not there was evidence of liquefaction or other earthquake damage. The epicenter of the earthquake was located approximately 25 miles north of Los Osos, and is estimated to have resulted in a ground acceleration of 0.18g in the project vicinity. Fugro visited the low-lying areas within Los Osos in 2003. Evidence of liquefaction was observed along the shorelines of Morro Bay and Cuesta Inlet. Liquefaction was manifested as sand that had ejected around the pilings that support the Baywood T-pier, numerous sand boils and mud volcanoes on the shore of Morro Bay mainly below the high-tide line, and lateral spreads, pipes, and fissures along the shoreline of Cuesta Inlet. The liquefaction appeared to be constrained to near the shoreline, and did not visually appear to have seriously impacted the adjacent roadways or infrastructure such as may have been evidenced by cracks, fissures, or differential settlement.

The liquefaction appears to have occurred within a relatively shallow layer of loose sand that was encountered in previous exploration programs. Evidence of liquefaction or differential seismic settlement at the higher elevations within Los Osos was not observed, as these areas were located away from the shoreline.

The manifestation and damage that can be associated with liquefaction is strongly dependent on the duration of the ground motion. Larger magnitude earthquakes typically result in longer periods of shaking. Earthquakes that occur closer to a site generally result in higher ground motions than a similar magnitude earthquake that could occur away from a site. The design earthquake ground motion is likely to be higher than the San Simeon earthquake ground motion (0.4g to 0.6g vs. 0.18g).

Liquefaction

The Safety Element of the San Luis Obispo County General Plan (1999) identifies areas where the potential for liquefaction should be evaluated based on mapping of geologic formations that may contain soil types susceptible to liquefaction. Within the Los Osos area, the Safety Element identifies geologic units such as beach sand, dune sand, and younger alluvial deposits as having a high potential



Source: AirPhoto USA, San Luis Obispo County GIS Data, and MBA GIS Data.

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Exhibit 5.4-2
Liquefaction Zones

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to contain sediments that may be prone to liquefaction. Based on review of geologic maps, all the sites proposed to include facilities are underlain completely or partially by geologic units that may contain sediments susceptible to liquefaction. The previous geotechnical data available for the sites was used to further characterize the potential for liquefaction to impact the project considering the soil types encountered within the various geologic units, the relative density of the soil, and the depth to groundwater. A summary of the liquefaction hazard for the project is presented in Exhibit 5.4-2. The varying potential for liquefaction shown in Exhibit 5.4-2 is presented below:

- Very High. Groundwater has been encountered within about 10 feet of the ground surface, soil units previously encountered are loose and vulnerable to liquefaction, and/or manifestation of liquefaction was observed following the 2003 San Simeon earthquake.
- High. Groundwater is present within about 50 feet of ground surface and previous explorations suggest sediments are loose and prone to liquefaction. The depth of potentially liquefiable material may be limited or near the groundwater table.
- Moderate. Groundwater is present within about 50 feet of ground surface, and previous explorations suggest sediments are medium dense and prone to liquefaction, or geologic units may contain sediments susceptible to liquefaction, but the area was not evaluated by the previous studies.
- Low. Groundwater likely not present within 50 feet of ground surface or sediments in this vicinity were previously evaluated and found to be dense and have a low potential for liquefaction.
- Not indicated. Bedrock or formation units that are not considered vulnerable to liquefaction.

5.4.3 - Regulatory Setting

California Building Code

The latest version of the California Building Code (CBC) is the 2007 edition. The CBC contains general building design and construction requirements relating to fire and life safety, structural safety, and access compliance. CBC provisions provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling design, construction, quality of materials, use and occupancy, location and maintenance of all buildings and structures and certain equipment.

Alquist-Priolo Earthquake Fault Zoning Act

In 1975 and amended in 1993, the Alquist-Priolo Earthquake Fault Zoning Act was enacted. Its intent is to provide policies and criteria to assist cities, counties, and state agencies in the exercise of their responsibility to prohibit the location of development and structures for human occupancy across the trace of active faults. Further, it is the intent of this Act to provide the citizens of the state with increased safety and to minimize the loss of life during and immediately following earthquakes.

5.4.4 - Thresholds of Significance

In accordance with the California Environmental Quality Act (CEQA), the effects of a project are evaluated to determine if they will result in significant adverse impact on the environment. The criteria used to determine the significance of an impact to geology and soils are based on the initial study checklist in Appendix G of the CEQA Guidelines. Accordingly, geology and soils impacts resulting from the proposed project are considered significant through application of the following thresholds of significance:

Would the project:

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
    - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault?
    - Strong seismic ground shaking?
    - Seismic-related ground failure, including liquefaction?
    - Landslides?
- Result in substantial soil erosion or the loss of topsoil?
- Be located on a geologic unit or soil that is unstable, or that would become unstable because of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?
- Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?
- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

5.4.5 - Analysis

This section analyzes Proposed Projects 1 through 4. The analysis includes a discussion of project-specific and cumulative impacts, provides mitigation measures where required, and concludes with a determination of level of significance after mitigation.

Faulting

5.4-A:	**The project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving a rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault.**

Project-Specific Impact Analysis

Proposed Project 1

A fault rupture hazard can exist when structures or facilities are located directly on an active fault, and rupture of that fault could displace the ground surface upon which the building or facility is located. The State of California precludes building on active faults under the Alquist-Priolo Earthquake Fault Zoning Act. The Alquist-Priolo Earthquake Fault Zoning Act's main purpose is to prevent the construction of buildings used for human occupancy on the surface trace of active faults.

The majority of the faults within the Coast Ranges province and the Sierra de Salinas belt generally trend north-northwest. The California Geological Survey considers major faulting within the project vicinity to include the Los Osos fault, San Simeon fault, and the San Andreas fault. The sites of the proposed facilities in Proposed Project 1 are not located within a designated Alquist-Priolo Earthquake Fault Hazard Zone. The closest mapped active fault to the project vicinity is the Irish Hills segment (Strand A) of the Los Osos fault mapped approximately 0.5 mile or more south of the most southerly site that includes a proposed facility (i.e., Broderson). This portion of the Los Osos fault closest to the proposed Broderson facility is not designated as an Alquist-Priolo Earthquake Fault Hazard Zone. The nearest fault that is designated as an Alquist-Priolo Earthquake Fault Hazard Zone is located approximately three miles east of the proposed facilities. Therefore, the potential for fault rupture to impact the sites of the proposed facilities for Proposed Project 1 are considered nil. Thus, there is no potential impact from fault rupture impact.

Proposed Project 2

The determination of no potential for fault rupture to impact the sites of the proposed facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Proposed Project 3

The determination of no potential for fault rupture to impact the sites of the proposed facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Proposed Project 4

The determination of no potential for fault rupture to impact the sites of the proposed facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Cumulative Impact Analysis

Proposed Projects 1 through 4

Geologic influences are site specific and there is little, if any, cumulative relationship between the development of the proposed project and development within the greater cumulative project area (as detailed in Exhibit 4.2-1 in Section 4.2 in the Draft EIR). As an example, development of the proposed project will not result in an alteration of geologic events or soil features/characteristics, such as groundshaking, seismic intensity, or soil expansion; therefore, development of the proposed project will not affect the level of intensity at which a seismic event on an adjacent property is experienced. The proposed project in conjunction with other projects or conditions will not result in cumulative impacts related to earthquake faults.

Mitigation Measures

Project-Specific

Proposed Projects 1 through 4

No mitigation measures are required.

Cumulative

Proposed Projects 1 through 4

No mitigation measures are required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

No impact.

Cumulative

Proposed Projects 1 through 4

No impact.

Seismic Ground Shaking

5.4-B:	**The project could expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving a strong seismic ground-shaking.**

Project-Specific Analysis

Proposed Project 1

Strong seismic ground shaking can occur in response to local or regional earthquakes. The sites under Proposed Project 1 are located within a seismically active area, and the potential exists for strong ground motion to affect the proposed facilities at the sites under Proposed Project 1 during the design lifetime. In general, the primary effects will be those phenomena associated with shaking and/or ground acceleration. Given that it is likely for the proposed facilities to be impacted by strong ground motion, potential seismic ground shaking impacts are considered significant.

Proposed Project 2

The potential for strong seismic ground shaking to impact the proposed facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Proposed Project 3

The potential for strong seismic ground shaking to impact the proposed facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Proposed Project 4

The potential for strong seismic ground shaking to impact the proposed facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Cumulative Impact Analysis

Proposed Projects 1 through 4

Geologic influences are site specific and there is little, if any, cumulative relationship between the development of the proposed project and development within the greater cumulative project area (as detailed in Exhibit 4.2-1 in Section 4.2 in the Draft EIR). As an example, development of the proposed project will not result in an alteration of geologic events or soil features/characteristics, such as groundshaking, seismic intensity, or soil expansion; therefore, development of the proposed project will not affect the level of intensity at which a seismic event on an adjacent property is experienced. The proposed project in conjunction with other projects or conditions will not result in cumulative impacts related to seismic ground shaking.

Mitigation Measures

Project-Specific

Proposed Projects 1 through 4

5.4-B1 Prior to the approval of building plans for each proposed facility, the design of each facility shall be based on a facility-specific geotechnical report prepared by a California registered geotechnical engineer and professional geologist. The geotechnical report shall provide seismic data for use with at least the minimum requirements of the California Building Code (2007), as adopted by the County of San Luis Obispo.

Cumulative

Proposed Projects 1 through 4

Implementation of Mitigation Measures 5.4-B1 is required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

Less than significant.

Cumulative

Proposed Projects 1 through 4

Less than significant.

Seismic-Related Ground Failure

5.4-C:	**The project may expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving seismic-related ground failure, including liquefaction.**

Project-Specific Analysis

Proposed Project 1

Collection System

Liquefaction can result in ground mobility that impacts pipeline grades, or results in pipelines floating out of the ground in areas of liquefaction. The collection system under Proposed Project 1 would consist of approximately 45 miles of pipeline that will essentially be constructed through the Los Osos Community. Loose sand blankets are found at the upper five to ten feet of the ground surface over most of the collection system area. Portions of the collection system network traverse areas having a relatively high potential for liquefaction. The potential for liquefaction and seismic settlement to impact pipelines may be governed by the depth of the pipeline relative to the depth of liquefiable soils. The proposed collection system for Proposed Project 1 may experience significant liquefaction impacts. Furthermore, this potential significant impact could result in pipeline breaks and release of untreated and/or treated effluent along the proposed collection/conveyance system, including within Los Osos Creek and Warden Creek.

Treatment Plant Site

Based on an investigation of the treatment plant site that encompasses Cemetery, Giacomazzi and Branin properties, materials of undifferentiated Paso Robles Formation and/or alluvium were encountered in each of the explorations. The upper 3 to 4 feet of materials appeared to be relatively loose/soft and likely represent topsoil/colluvial materials disturbed during previous agricultural/plowing activities. There appears to be a low potential for liquefaction to impact these sites based on currently available information. Although the potential is low, the proposed facilities at the treatment plant site may experience significant liquefaction impacts.

Disposal Sites

The spray field irrigation at Tonini would have little impact on the potential for liquefaction. Should liquefaction occur at the site, it is unlikely that the occurrence of liquefaction would impact the suitability of the site for spray irrigation.

The proposed effluent system at Broderson would be located on a relatively gently sloping hillside approximately 1,200 feet south of Highland Avenue. Based on previous investigations, the depth to groundwater is greater than 100 feet below the existing ground surface, and except for the near-surface loose dune sand deposits, the deeper soils encountered beneath the site is generally dense and not susceptible to liquefaction or seismic settlement. The near-surface loose dune sand would not be

considered potentially liquefiable. The proposed disposal at the Broderson site would include up to 448-ac ft per year of treated wastewater effluent. Based on the *Viable Project Alternatives Fine Screening Analysis* prepared by Corollo Engineers in August 2007, the capacity of Broderson site without the need to use harvest wells is a maximum flow of 896-acre feet per year. This annual volume would not result in rising groundwater levels to the surface of the Broderson site. The proposed project includes the use of Broderson at half of its capacity, which further support that the groundwater would not rise to liquefy the near surface loose dune sand. Thus even in the event the near surface loose dune sand were saturated due to precipitation or effluent disposal at the time of an earthquake, the groundwater depths would not rise near the ground surface at the site. Therefore, the proposed facilities at Broderson would not change the potential for liquefaction or seismic settlement to occur within the soils because of the effluent disposal system and estimated mounding at the Broderson site.

Combined Effects

As discussed above, there are facilities that are part of Proposed Project 1 that may experience significant liquefaction impacts. Therefore, the combined liquefaction impacts are considered significant.

Proposed Project 2

Collection System

The potential for liquefaction to impact the proposed collection system facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Treatment Plant Site

The potential for liquefaction to impact the proposed facilities at the treatment plant site for Proposed Project 2 would be the same as described above for Proposed Project 1.

Disposal System

The determination of no potential for liquefaction to impact the proposed disposal facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Combined Effects

As discussed above, there are facilities that are part of Proposed Project 2 that may experience significant liquefaction impacts. Therefore, the combined liquefaction impacts are considered significant.

Proposed Project 3

Collection System

The potential for liquefaction to impact the proposed collection system facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Treatment Plant Site

The potential for liquefaction to impact the proposed facilities at the treatment plant site for Proposed Project 3 would be the same as described above for Proposed Project 1.

Disposal System

The determination of no potential for liquefaction to impact the proposed disposal facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Combined Effects

As discussed above, there are facilities that are part of Proposed Project 3 that may experience significant liquefaction impacts. Therefore, the combined liquefaction impacts are considered significant.

Proposed Project 4

Collection System

The potential for liquefaction to impact the proposed collection system facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Treatment Plant Site

The lower, generally flat topography of the Tonini site is characterized primarily by alluvium, with queried deposits of dune sand and Paso Robles formation. The slopes along the western and northern portions of the site have been mapped as Franciscan mélange and metavolcanics. During a site visit on May 6, 2008, the presence of alluvial, surficial clayey soils on the generally flat portions of the site, and Franciscan units on the adjacent slopes were noted. As shown on Exhibit 5.4-2, the recent alluvial sediments are considered to have moderate to high potential for liquefaction if groundwater elevations are high. However, the presence of fine-grained cohesive materials within the soil profile suggests a lesser potential for liquefaction and seismic settlement than that typically associated with cohesionless soils. The majority of the Tonini site appears to have relatively shallow soil cover overlying Paso Robles Formation or Franciscan rocks. Due to the potential for liquefaction to occur, the proposed facilities at the treatment plant site may experience significant liquefaction impacts.

Disposal System

The determination of no potential for liquefaction to impact the proposed disposal facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Combined Effects

As discussed above, there are facilities that are part of Proposed Project 4 that may experience significant liquefaction impacts. Therefore, the combined liquefaction impacts are considered significant.

Cumulative Impact Analysis

Proposed Projects 1 through 4

The proposed facilities that are part of the collection system and at the treatment plant site for Proposed Projects 1 through 4 may expose structures to liquefaction impacts. Therefore, implementation of Proposed Projects 1through 4 may contribute to cumulative liquefaction impacts within the vicinity of Los Osos. This contribution is considered cumulatively considerable and, therefore, significant for Proposed Projects 1 through 4.

Mitigation Measures

Project-Specific

In addition to the implementation of Mitigation Measure 5.7-B.1 to reduce impacts from accidental spills due to seismic conditions, the following mitigation measures shall be implemented.

Proposed Projects 1 through 4

5.4-C1 Prior to approval of the improvement plans for the proposed facilities that are part of the collection system and at the treatment plant site, a geotechnical report that addresses liquefaction hazards shall be prepared and approved by the County of San Luis Obispo. The geotechnical report shall state the recommended actions for the collection system and treatment plant site so that potential impacts from seismically-induced liquefaction would be reduced to less than significant.

5.4-C2 Prior to approval of improvement plans, an Emergency Response Plan (ERP) shall be prepared as part of the operation and maintenance plan for the proposed collection system. The ERP shall recognize the potential for liquefaction, seismic hazards and ground lurching, to impact the pipeline or other proposed facilities, and specific high hazard areas shall be inspected for damage following an earthquake. "Soft Fixes" shall be incorporated in the ERP. Soft fixes typically consist of having a plan in-place to address the hazards, such as can be achieved by storing supplies and equipment for repair.

Cumulative

Proposed Projects 1 through 4

Implementation of Mitigation Measures 5.7-B.1, 5.4-C1 and 5.4-C2 are required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

Less than significant.

Cumulative

Proposed Projects 1 through 4

Less than significant.

Landslides

5.4-D: The project would not expose people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving landslides.

Project-Specific Analysis

Proposed Project 1

The proposed facilities within Proposed Project 1 are generally located on relative flat terrain and not in areas that would be subject to landslides. Therefore, no landslide impacts would occur with the implementation of Proposed Project 1.

Proposed Project 2

The potential for landslides to impact the sites of the proposed facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Proposed Project 3

The potential for landslides to impact the sites of the proposed facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Proposed Project 4

The potential for landslides to impact the sites of the proposed facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Cumulative Impact Analysis

Proposed Projects 1 through 4

The proposed facilities that are part of Proposed Projects 1 through 4 would not be exposed to landslide impacts; therefore, these facilities would not contribute to cumulative landslide impacts in the project vicinity. Proposed Projects 1 through 4 would result in no cumulative impacts related to landslides.

Mitigation Measures

Project-Specific

Proposed Projects 1 through 4

No mitigation measures are required.

Cumulative

Proposed Projects 1 through 4

No mitigation measures are required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

No impact.

Cumulative

Proposed Projects 1 through 4

No impact.

Soil Erosion or Loss of Topsoil

5.4-E: The project could result in substantial soil erosion or the loss of topsoil.

Project-Specific Impact Analysis

Proposed Project 1

The sites of the proposed facilities are located within a relatively flat topography. Construction activities associated with the proposed facilities will result in grading and excavation at the sites and these sites would be prone to erosion. Graded cut and fill slopes associated with the site development will be subject to sheet and rill erosion. Erosion of soils can be accelerated where soils are exposed directly to runoff and/or areas of concentrated storm runoff, such as at culvert outlets. Therefore, construction activities associated with the proposed facilities could result in substantial soil erosion or the loss of topsoil; thus, a significant impact would occur.

Periodic maintenance of the collection system, treatment plant facilities and disposal system could result in temporary increases in the potential for erosion. The periodic maintenance could range from minor maintenance of the pipelines and landscaping to major excavations every five to ten years of the leachfield at the Broderson site associated with the need to reconstruct the leachfield to maintain an effective flowrate. The potential for erosion during periodic maintenance could be significant.

Proposed Project 2

The potential for soil erosion or loss of topsoil to occur from construction and maintenance activities associated with the proposed facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Proposed Project 3

The potential for soil erosion or loss of topsoil to occur from construction and maintenance activities associated with the proposed facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Proposed Project 4

The potential for soil erosion or loss of topsoil to occur from construction and maintenance activities associated with the proposed facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Cumulative Impact Analysis

Proposed Project s 1 through 4

Construction and maintenance activities associated with the facilities that are part of Proposed Projects 1through 4 could result in substantial soil erosion or the loss of topsoil. Therefore,

implementation of Proposed Projects 1 through 4 may contribute to cumulative impacts associated with soil erosion or loss of topsoil within the vicinity of Los Osos. This contribution is considered cumulatively considerable and, therefore, significant for Proposed Projects 1 through 4.

Mitigation Measures

Project-Specific

Proposed Projects 1 through 4

5.4-E1 Prior to the approval of grading plans for each facility, erosion control measures shall be incorporated into the grading plans to minimize the potential for erosion or loss of top soil during grading to the satisfaction of the County of San Luis Obispo.

5.4-E2 Prior to the approval of grading plans for each facility, vegetation/landscaping shall be provided on the graded cut and fill slopes to reduce the long-term potential for soil erosion or loss of topsoil to the satisfaction of the County of San Luis Obispo.

5.4-E3 Prior to the approval of grading plans for each facility, the plans shall provide for the control of surface water away from slopes to the satisfaction of the County of San Luis Obispo.

Cumulative

Proposed Projects 1 through 4

Implementation of Mitigation Measures 5.4-E1 through 5.4-E3 is required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

Less than significant.

Cumulative

Proposed Projects 1 through 4

Less than significant.

Unstable Geologic Location

5.4-F: The project could be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse.

Project-Specific Impact Analysis

Proposed Project 1

The proposed facilities in Proposed Project 1 may be exposed to unstable soils or a geologic unit. Lateral spreading is slope instability that can occur in response to liquefaction. Lateral spreading typically develops on ground that is underlain by liquefiable soils or where free-face conditions can develop into liquefiable soil, such as along a riverbank or drainage area. The stream bank areas along Los Osos Creek are likely vulnerable to lateral spreading and could result in a significant impact on

the collection system that crosses the creek. No additional lateral spreading impacts have been identified for the other areas of the collection system or the treatment plant site or disposal sites in Proposed Project 1.

The sites of the proposed facilities are not in an area where the withdrawal of subsurface fluids is known to have caused ground subsidence. The greatest potential for subsidence would be if potentially compressible soils were impacted by lowering of the groundwater table during construction dewatering. The buoyancy of the soil above a specific depth decreases as groundwater levels are lowered. Lowering of the groundwater level, therefore, increases the effective weight of the soil above that depth, which can cause the soil to subside (settle) under the increased weight of the ground above it. Although the proposed facilities are not in an area known to cause ground subsidence, there could be some areas where potentially compressible soils could be impacted by lowering of the groundwater table during construction dewatering. Therefore, this potential for ground subsidence is considered significant.

Ground lurching is another potential hazard to be considered. As evidenced by the Loma Prieta, Landers, Northridge, and San Simeon earthquakes, the effects of ground lurching can damage facilities and buried pipelines. Ground lurching occurs due to detachment of underlying stratigraphic units, allowing near-surface soil to move differentially from underlying soil. The site is within a seismically active region of central California that is prone to moderate to large earthquakes. Therefore, there is a potential for significant impacts to occur on the proposed facilities from ground lurching.

Proposed Project 2

The potential for lateral spreading, ground subsidence and ground lurching to impact the proposed facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Proposed Project 3

The potential for lateral spreading, ground subsidence and ground lurching to impact the proposed facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Proposed Project 4

The potential for lateral spreading, ground subsidence and ground lurching to impact the proposed facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Cumulative Impact Analysis

Proposed Projects 1 through 4

The proposed facilities for Proposed Projects 1 through 4 may be exposed to unstable soils or geologic unit due to the potential for lateral spreading, ground subsidence and ground lurching. Therefore, implementation of Proposed Projects 1 through 4 may contribute to cumulative impacts associated with lateral spreading, ground subsidence and ground lurching within the vicinity of Los

Osos. This contribution is considered cumulatively considerable and, therefore, significant for Proposed Projects 1 through 4.

Mitigation Measures

Project-Specific

Proposed Projects 1 through 4

5.4-F1 Prior to approval of the improvement plans for the proposed facilities, a geotechnical report that addresses the potential for lateral spreading, ground subsidence, and ground lurching and provides measures to reduce potential impacts to less than significant shall be prepared and approved by the County of San Luis Obispo.

Cumulative

Proposed Projects 1 through 4

Implementation of Mitigation Measure 5.4-F1 is required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

Less than significant.

Cumulative

Proposed Projects 1 through 4

Less than significant.

Expansive Soil

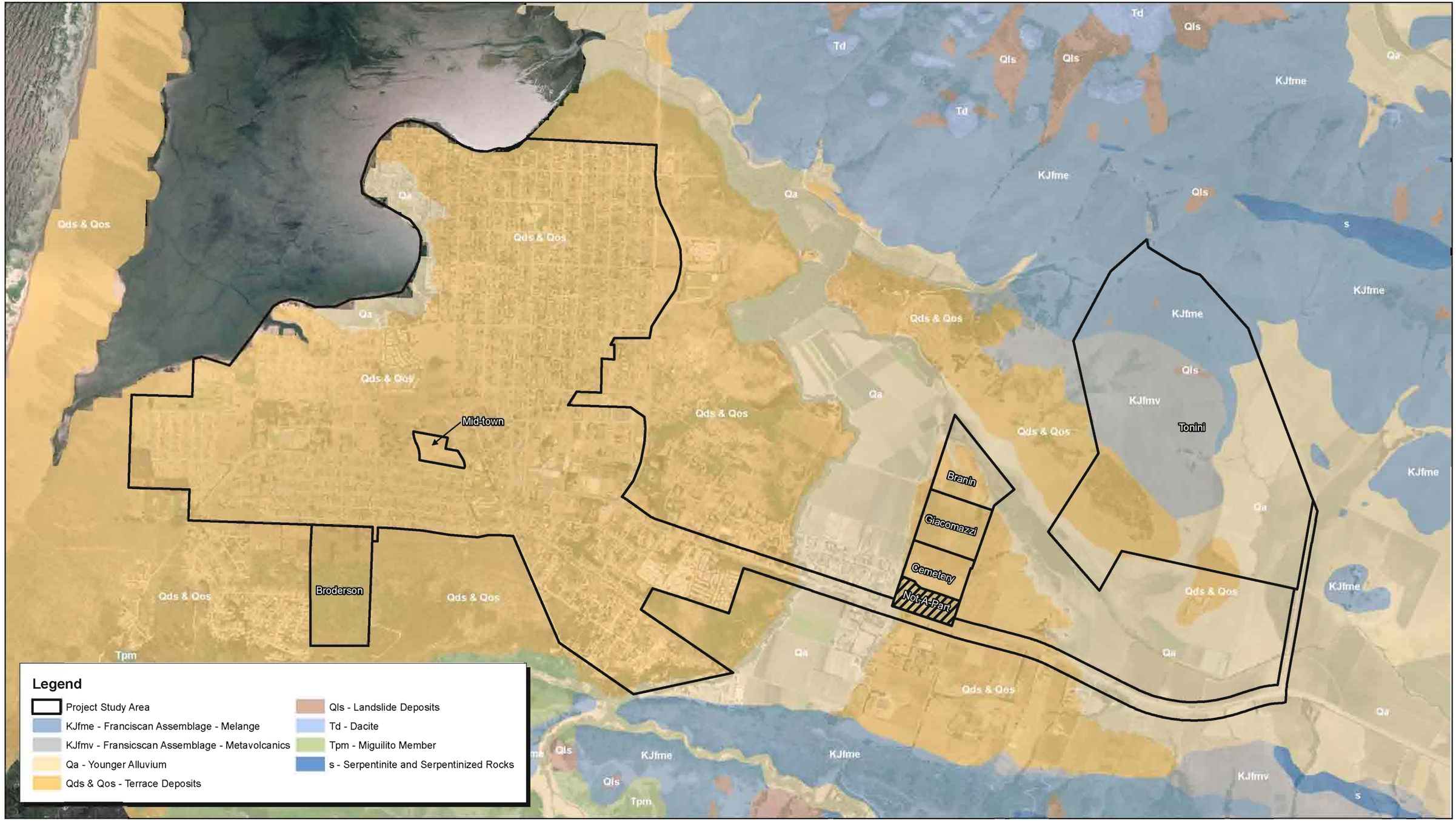
5.4-G: The projects would be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property.

Project-Specific Impact Analysis

Proposed Project 1

Expansive soils generally consists of fine-grained soil of high plasticity (clay) that can damage near surface improvements in response to shrinking and swelling associated with changes in soil moisture content. Expansion potential of soils within the project vicinity is depicted in Exhibit 5.4-3. Near surface soils at the prospective sites predominantly consists of dune sands having a generally low potential for expansion, and alluvial sediments having a low to high potential for expansion.

Soils mapped at the Cemetery, Giacomazzi, Branin, and Tonini sites have moderate to high potential for expansion. These soils are characterized as having slow to very slow permeability and high shrink-swell (expansion) potential. After swelling, water infiltration is typically low and surface water is more likely to runoff or pond. The facilities proposed at these sites could be significantly affected by the potential for expansive soil. The soils at the Broderson site have a low potential for expansive soil. Therefore, the potential impact from expansive soils on the proposed facilities at the Broderson site is considered significant.



Source: AirPhoto USA, San Luis Obispo County GIS Data, and MBA GIS Data.

NORTH

2,000 1,000 0 2,000 Feet

Michael Brandman Associates

02240002 • 11/2008 | 5.4-3_expansive_soils.mxd

Exhibit 5.4-3
Expansive Soils

COUNTY OF SAN LUIS OBISPO • LOS OSOS WASTEWATER PROJECT
GEOLOGY EXPANDED ANALYSIS SECTION

Proposed Project 2

The potential for expansive soil to impact the proposed facilities for Proposed Project 2 would be the same as described above for Proposed Project 1.

Proposed Project 3

The potential for expansive soil to impact the proposed facilities for Proposed Project 3 would be the same as described above for Proposed Project 1.

Proposed Project 4

The potential for expansive soil to impact the proposed facilities for Proposed Project 4 would be the same as described above for Proposed Project 1.

Cumulative Impact Analysis

Proposed Projects 1 through 4

The facilities proposed as part of the collection system and at the treatment plant site for Proposed Projects 1 through 4 may be affected by expansive soils. Therefore, implementation of Proposed Projects 1through 4 may contribute to cumulative impacts associated with expansive soils within the vicinity of Los Osos. This contribution is considered cumulatively considerable and, therefore, significant for Proposed Projects 1through 4.

Mitigation Measures

Project-Specific

Proposed Projects 1 through 4

5.4-G1 Prior to approval of improvement and building plans for the proposed collection system facilities and facilities at the treatment plant site, a design-level geotechnical report shall be prepared that addresses and reduces potential expansive soil impacts to less than significant. The expansive soil data shall be used with the requirements of the California Building Code (2007), as adopted by the County of San Luis Obispo.

Cumulative

Proposed Projects 1 through 4

Implementation of Mitigation Measure 5.4-G1 is required.

Level of Significance After Mitigation

Project-Specific

Proposed Projects 1 through 4

Less than significant.

Cumulative

Proposed Projects 1 through 4

Less than significant.

Wastewater Disposal Systems

5.4-H: The project would not have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater.

Project-Specific Impact Analysis

Proposed Project 1

Proposed Project 1 includes the use of septic tanks as part of the proposed facilities. The new septic tanks would replace the existing septic tanks that currently provide service to the residents. The existing septic tanks are located in areas that are mapped as low, moderate, and high liquefaction potential. The proposed septic tanks would be generally located in the same area as the existing septic tanks. As identified in Impact 5.4-C, there is a potential for liquefaction to impact the collection system including the septic tanks. Therefore, the potential impact from soils incapable of adequately supporting the use of septic tanks is significant.

Proposed Project 2

The capability of soils adequately supporting the use of septic tanks does not apply to Proposed Project 2 because no septic tanks are proposed as part of the collection system for Proposed Project 2. Therefore, Proposed Project 2 would result in no impacts related to soils incapable of adequately supporting septic tanks.

Proposed Project 3

The capability of soils adequately supporting the use of septic tanks does not apply to Proposed Project 2 because no septic tanks are proposed as part of the collection system for Proposed Project 3. Therefore, Proposed Project 3 would result in no impacts related to soils incapable of adequately supporting septic tanks.

Proposed Project 4

The capability of soils adequately supporting the use of septic tanks does not apply to Proposed Project 2 because no septic tanks are proposed as part of the collection system for Proposed Project 4. Therefore, Proposed Project 4 would result in no impacts related to soils incapable of adequately supporting septic tanks.

Cumulative Impact Analysis

Proposed Project 1

Based on the list of related project detailed in Section 4.2 and Exhibit 4.2-1 in the Draft EIR, there are no cumulative projects that would contribute to potential stability impacts for the use of septic tanks under Proposed Project 1. Therefore, since there are no related projects that would contribute to cumulative soil stability impacts for the use of septic tanks, implementation of Proposed Project 1 would not contribute to cumulative impacts related to soil stability impacts for the use of septic tanks.

Proposed Projects 2 through 4

The capability of soils adequately supporting the use of septic tanks does not apply to Proposed Projects 2 through 4 because no septic tanks are proposed as part of the collection system for Proposed Projects 2 through 4. Therefore, Proposed Projects 2 through 4 would not contribute to cumulative impacts related to soils incapable of adequately supporting septic tanks.

Mitigation Measures

Project-Specific

Proposed Project 1

Implementation of Mitigation Measure 5.4-C1 is required.

Proposed Project 2 through 4

No mitigation measures are required.

Cumulative

Proposed Projects 1

Implementation of Mitigation Measure 5.4-C1 is required.

Proposed Project 2 through 4

No mitigation measures are required.

Level of Significance After Mitigation

Project-Specific

Proposed Project 1

Less than significant.

Proposed Project 2 through 4

No impact.

Cumulative

Proposed Project 1

Less than significant.

Proposed Project 2 through 4

No impact.

F-2: Preliminary Geotechnical Report

FUGRO WEST, INC.

PRELIMINARY GEOTECHNICAL REPORT
LOS OSOS WASTEWATER PROJECT
LOS OSOS MORTUARY, GIACOMAZZI, AND BRANIN PROPERTIES
SAN LUIS OBISPO COUNTY, CALIFORNIA

Prepared for:
COUNTY OF SAN LUIS OBISPO

July 17, 2007

FUGRO WEST, INC.

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July 17, 2007
Project No. 3014.026

County of San Luis Obispo
Department of Public Works, Room 207
County Government Center
San Luis Obispo, CA 93408

Attention: Mr. John Waddell

Subject: Preliminary Geotechnical Report, Los Osos Mortuary, Giacomazzi, and Branin Properties, Los Osos Wastewater Project, San Luis Obispo County, California

Dear Mr. Waddell:

Fugro is pleased to submit this Preliminary Geotechnical Report for the Los Osos Wastewater Project on in San Luis Obispo County, California. This report was prepared in accordance with the scope of services presented in our proposal dated April 3, 2007, and authorized under the County's Purchase Order No. 25003474, dated April 24, 2007.

The purpose of this report is to provide preliminary geotechnical considerations for the three combined properties that are being considered as a possible site for the new wastewater treatment plant. This report provides preliminary geotechnical considerations and opinions regarding site geology, soil and groundwater conditions encountered, potential for the sites to be impacted by geologic hazards, and anticipated grading and foundation support for the proposed structures.

Please contact the undersigned if you have questions regarding this report, or require additional information.

Sincerely,

FUGRO WEST, INC.

REGISTERED PROFESSIONAL ENGINEER
CHRISTOPHER L. LOVATO
No. 60316
Exp. 6-30-08
CIVIL
STATE OF CALIFORNIA

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Project Engineer

Lori E. Prentice, C.E.G. 2312
Associate Engineering Geologist

Copies: 4 – Addressee, 1 PDF

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LIST OF PLATES

APPENDIX A – CONE PENETRATION TEST LOGS

APPENDIX B – FIELD EXPLORATION LOGS

1. SITE DESCRIPTION

The proposed site consists of three neighboring properties that are being considered as the possible location for the new wastewater treatment plant. The three properties are identified as the Los Osos Mortuary and Memorial Park, the Giacomazzi, and the Branin properties. The site is located behind the Los Osos Valley Memorial Park on the north side of Los Osos Valley Road, approximately 1 mile east of the community of Los Osos. The location of the site relative to nearby streets and geographic landmarks is shown on Plate 1, Vicinity Map. The layout of the site, showing each of the three properties is shown on Plate 2, Field Exploration Plan.

The site is within an agricultural property (grass-lands and crops) and is bound by the Los Osos Mortuary to the south, agricultural fields and northerly-draining canyon drainage to the west, the Los Osos Valley drainage (Warden/Eto Lake) to the north, and grasslands to the east. The Los Osos Mortuary property is currently undeveloped and covered with grass and weeds. The Giacomazzi and portions of the Branin properties are currently active agricultural fields. Other portions of the Branin property are being used as grazing/grass-lands.

The topography over the majority of the site and vicinity is characterized by gently rolling hills. Elevations range from about 30 feet near the Los Osos Valley drainage in the northern portion of the site to about 110 feet near the mortuary and Los Osos Valley Road. Slope inclinations in the vicinity of the Los Osos Valley drainage near the northern portion of the property and along the northerly-draining drainage along the western edge of the site range from about 3h:1v to 5h:1v.

Two northeast trending drainages cross the Giacomazzi property diagonally near the eastern edge of the property that appear to be subject to erosion in an easterly direction. A north-draining swale crosses the Branin Property along the western portion of the property. A second north-draining drainage is located west of the Branin property that appears to be subject to surficial instability and erosion along the western portion of the Branin Property.

2. WORK PERFORMED

2.1 PURPOSE

The purpose of this report is to provide preliminary geotechnical considerations and opinions for the proposed wastewater treatment plant site. The primary geotechnical considerations evaluated for the project are characterization of the subsurface materials, geologic hazards, anticipated site preparation and grading for support of the improvements, and foundation considerations. The information provided herein is preliminary and is not intended for design of the project. A design-level geotechnical study will be required if the project proceeds to design.

2.2 SCOPE

To evaluate the geotechnical considerations for the project, we performed the following scope of work:

- Site visits to observe the general site conditions, meet with the Los Osos Mortuary and Giacomazzi property representatives, and notifying Underground Service Alert of the field exploration program;
- Data review of selected published geologic maps, and geotechnical data available from our in-house files;
- Field exploration consisting of drilling four hand auger borings to depths of approximately 10 to 12.5 feet below the existing ground surface and advancing seven cone penetration test (CPT) soundings to depths of approximately 34 to 100 feet below the existing ground surface; and
- Preparation of this report summarizing the data obtained for the site, and our preliminary conclusions and recommendations regarding;
  - Geologic setting;
  - Soil and groundwater conditions encountered;
  - Potential for the site to be impacted by geologic hazards such as seismic shaking, fault rupture, liquefaction, landsliding, or slope instability;
  - Anticipated site grading and foundation support for the improvements, and
  - Construction considerations.

2.3 FIELD EXPLORATION

The field exploration program was modified from our proposed scope of work because of site access and accessibility considerations. Cone Penetration Test (CPT) soundings were limited to areas accessible to the truck-mounted equipment. At the time of our exploration, the Giacomazzi property was recently plowed and planted, and the CPT rig could only be operated on graded roads along the perimeter of the properties. Also, Mr. Waddell of the County of San Luis Obispo informed us that entry to the Branin property would not be permitted, therefore, CPT exploration was not performed on that property. Based on the CPT access constraints, hand auger explorations were used to supplement CPT data as agreed to with the County.

2.3.1 Cone Penetration Testing

Seven CPT soundings were advanced at the project site by Fugro Geosciences of Santa Fe Springs, California near the locations shown on Plate 2. CPT soundings C-1 and C-2 were advanced to refusal depths of approximately 34.5 and 42 feet below the existing ground surface, respectively. CPT C-3 through C-6 were advanced to depths of 50 feet, and CPT C-7 was advanced to 100 feet below the existing ground surface.

The CPT soundings were performed using electric cone penetrometers and piezocone penetrometers. The penetrometers were advanced into the ground using a hydraulic ram mounted in a truck having a weight of approximately 20 tons. The cone and piezocone penetrometers have a diameter of approximately 1.4 inches. Cone tip resistance (q_c) and

sleeve friction (f_s) were recorded on the penetrometer during all CPT soundings. The porewater pressure during penetration was measured behind the tip (u_2) in piezocone soundings. Data was recorded at approximately 2 cm intervals using an on-board computer to provide a near-continuous profile of the soil conditions encountered during penetration. The friction ratio (FR) was computed for each value of q_c and f_s recorded. The data was retrieved electronically for use in subsequent geotechnical analyses. CPT data and soil behavior type classifications were used to evaluate the subsurface conditions encountered at the site. Plots of CPT sounding data are presented in Appendix A.

2.3.2 Hand Auger Borings

The hand auger borings were performed by a field engineer using a 3-inch, outside diameter, hand auger. The hand auger borings were drilled to depths ranging from approximately 10 to 12.5 feet below the existing ground surface. Hand auger borings were performed to supplement soil data obtained from the CPT soundings and at areas that could not be accessed by the CPT rig. The logs of the borings are presented in Appendix B.

2.4 GENERAL CONDITIONS

Fugro prepared the conclusions, recommendations, and professional opinions of this report in accordance with the generally accepted geotechnical principles and practices at this time and location. This warranty is in lieu of all other warranties, either expressed or implied. This report was prepared for the exclusive use of The County of San Luis Obispo and their authorized agents only. It is not intended to address issues or conditions pertinent to other parties, projects or for other uses. The report and the drawings contained herein are not intended to act as construction drawings or specifications.

The scope of services did not include any environmental assessments for the presence or absence of hazardous/toxic materials in the soil, surface water, groundwater, or atmosphere. Any statements, or absence of statements, in this report or data presented herein regarding odors, unusual or suspicious items, or conditions observed are strictly for descriptive purposes and are not intended to convey engineering judgment regarding potential hazardous/toxic assessment.

Soil and rock deposits can vary in type, strength, and other geotechnical properties between points of observations and exploration. Additionally, groundwater and soil moisture conditions also can vary seasonally or for other reasons. Therefore, we do not and cannot have a complete knowledge of the subsurface conditions underlying the site. The conclusions and recommendations presented in this report are based upon the findings at the points of exploration, and interpolation and extrapolation of information between and beyond the points of observation, and are subject to confirmation based on the conditions revealed by construction.

3. SITE CONDITIONS

3.1 GEOLOGIC SETTING

The project is located in the Los Osos Valley that is part of the Coast Ranges geologic and geomorphic province. That province consists of north-northwest-trending sedimentary, volcanic, and igneous rocks extending from the Transverse ranges to the south, into northern California. Rocks of the Coast Ranges province are predominately of Jurassic and Cretaceous age; however, some pre-Jurassic, along with Paleocene-age to Recent rocks are present. The surficial geology in the project vicinity, as mapped by Hall (1979), is shown on Plate 3.

The site is located on a terrace that is dissected by Los Osos Creek to the west. As shown on Plate 3, the Paso Robles Formation underlies the plateau and gently rolling hill area of the majority of the project site as mapped by Hall (1979). Alluvium is located in the low-lying areas near the base of the gently rolling hills along the western project boundary and at the northern end of the Branin property. The alluvial sediments are associated with the Los Osos Valley drainage and Warden Lake. Other authors have mapped the plateau area as being underlain by eolian dune sand (Qe) as indicated on Plate 4. Based on our site reconnaissance and the results of the CPT soundings advanced for this study, it appears that the plateau area is underlain by the Paso Robles Formation as suggested by Hall (1979).

The Paso Robles Formation is described as consisting of weakly consolidated sandstone, siltstone, claystone, and conglomerate in the Los Osos Valley area. Although described in terms of rock designation because of the formational name, the sediments of the Paso Robles Formation are generally equivalent to stiff to hard cohesive soils and medium dense to very dense granular soils.

3.2 FAULTING

The closest active fault (as defined by the California Geologic Survey [CGS]) in the site vicinity is the Los Osos fault zone (PG&E 1988, Lettis & Hall, 1990; Asquith, 1997). A segment of the fault is designated as an Alquist-Priolo earthquake fault zone near the City of San Luis Obispo. Lettis & Hall (1990) describe the Los Osos fault zone as a series of discontinuous, subparallel and en echelon fault traces that extend from Hosgri fault offshore to Lopez Reservoir, a distance of about 35 miles. Lettis and Hall (1990) subdivided the fault zone into four segments: Estero Bay, Irish Hills, Lopez Reservoir, and Newsom Ridge. The Irish Hills segment of the Los Osos fault is about 10 to 12 miles long and extends from Morro Bay eastward to San Luis Creek. This segment of the fault forms the boundary between the Los Osos Valley and the Irish Hills and has documented Holocene offset (PG&E 1988). Portions of the fault east of Los Osos (east of study area) have been zoned active by the CGS.

3.3 SUBSURFACE CONDITIONS

The soil and groundwater conditions were characterized for the preliminary study based on the results of the field exploration program. The locations of the explorations are shown on Plate 2. Logs of the CPT soundings and hand auger borings are presented in Appendices A and

B, respectively. Correlations developed by Robertson and Campanella (1984) were use to classify soils encountered in the CPT soundings.

Paso Robles Formation and alluvium are mapped at the site. The alluvium is mapped along the northern portion of the site along Warden Lake and the low lying agricultural field to the west of the site. Materials of undifferentiated Paso Robles Formation and/or alluvium were encountered in each of the explorations at the ground surface to the maximum depth explored, approximately 100 feet below the existing ground surface in CPT C-7. The upper 3 to 4 feet of materials appear to be relatively loose/soft and likely represent topsoil/colluvial materials disturbed during previous agricultural/plowing activities.

Stiff clay and hard clay and silt with interbedded layers of dense sand were encountered in C-1 through C-5 from the ground surface to depths of approximately 20 to 30 feet below the existing ground surface. Below depths of about 20 to 30 feet, dense to very dense clayey sand with interbeds of hard silt and clay were encountered to the maximum depth explored, approximately 35 to 50 feet below the existing ground surface. Refusal was encountered in CPT's C-1 and C-2 at approximately 35 and 42.5 feet, respectively. Along the western portion of the site the stiff to very stiff silty clay to clayey silt with interbedded firm to stiff clay were encountered in CPT's C-6 and C-7 to 100 feet below the existing ground surface.

3.4 GROUNDWATER

The CPT holes were checked with a water-level sounder after completion of the CPT sounding at each location. Groundwater was recorded in the CPT holes or interpreted from porewater pressure measurements in CPT C-2 through C-7 at depths ranging from 30 to 48 feet below the existing ground surface. Water was not recorded in CPT C-1 to the maximum depth explored, approximately 34.5 feet below the existing ground surface. Based on published mapping, the Warden Lake area at the northern end of the property can be a marshy environment and has contained surface water in the past. Variations in surface and groundwater conditions will likely occur as a result of changes in precipitation, irrigation, runoff, and other factors.

4. GEOLOGIC HAZARDS

The following geologic hazard assessment is based on review of published information regarding regional and local geologic conditions and observations made during our site visits. The site is not within a San Luis Obispo County designated Geologic Study Area (San Luis Obispo 2006). Our assessment of geologic hazards was performed for input to the environmental impact report being prepared for the project, and to assist the County is considering potential sites for a new wastewater treatment plant.

4.1 SEISMICITY AND STRONG GROUND MOTION

4.1.1 Recent Seismicity

The site is located within a seismically active region of Central California that is prone to moderate to large earthquakes. The Los Osos area was impacted by the December 22, 2003 magnitude 6.5 earthquake that occurred near the town of San Simeon. The earthquake, now known as the San Simeon Earthquake, may have occurred on the Oceanic or Nacimiento fault zones located in the Santa Lucia Mountains, north of Cambria and west of the City of Paso Robles. Fault rupture likely occurred following a reverse or oblique-reverse type fault mechanism.

The epicenter of the San Simeon earthquake was located approximately 15 to 20 miles north of the project site. A ShakeMap for the site developed by the California Integrated Seismic Network (CISN 2003) shows that the project site likely experienced moderate ground motion during the earthquake. Peak horizontal ground accelerations at the project site, as estimated from the ShakeMap, were likely about approximately 0.12g.

4.1.2 Ground Motion Study

A probabilistic seismic hazard evaluation for the site was performed using the computer program FRISKSP (Blake, 2000) and the CGS (1996) California fault database. The program FRISKSP is based on FRISK (McGuire, 1978) and has been modified for the probabilistic estimations of seismic hazards using three-dimensional earthquake sources. The intent of our evaluation was to estimate strong ground motion corresponding to the Design Basis Earthquake (DBE) and Upper-Bound Earthquake (UBE). The DBE is defined by the building code as an earthquake having a 10 percent chance of being exceeded in 50 years (Statistical Return Period ≈ 475 years). The UBE is defined as an earthquake having a 10 percent chance of being exceeded in 100 years (Statistical Return Period ≈ 949 Years). FRISKSP was used to perform a search of potential earthquakes occurring on active or potentially faults mapped within a 62-mile radius of the site. The site location was estimated as –120.8017 degrees longitude and 35.3097 degrees latitude. Summarized below are 11 faults and fault segments that were considered the most capable of causing strong ground motion at the site. Additional information is provided in the CDMG (1996) fault database.

Summary of Predominant Faults

Fault	Approximate Distance From the Site (miles)	Maximum Moment Magnitude (M_w)	Fault or Fault Segment Length (miles)	Slip Rate (mm/yr)
Los Osos	0.7	6.8	27	0.5 ± 0.4
Hosgri	8.6	7.3	107	2.5 ± 1.0
San Luis Range (S. Margin)	8.8	7.0	40	0.2 ± 0.1

Fault	Approximate Distance From the Site (miles)	Maximum Moment Magnitude (M_w)	Fault or Fault Segment Length (miles)	Slip Rate (mm/yr)
Rinconada	14.5	7.3	117	1.0 ± 1.0
Casmalia (Orcutt Frontal Fault)	27.3	6.5	18	0.25 ± 0.2
Lions Head	32	6.6	25	0.02 ± 0.02
San Juan	35	7.0	42	1.0 ± 1.0
San Andreas (Cholame)	41	6.9	38	34 ± 5
San Andreas (Parkfield Segment)	41	6.7	23	34 ± 5
San Andreas (1857 Rupture)	41	7.8	214	34 ± 5
Los Alamos(W. Baseline)	47	6.8	17	0.7 ± 0.7

Based on subsurface conditions encountered at the site, the Soil Profile Type selected for our evaluations was Site Class D, "S_D". FRISKSP was then used to estimate strong ground motion for the DBE and UBE using the attenuation relationship proposed by Boore et al. (1997) and assuming an average shear wave velocity of 250 meters per second in the upper 100 feet.

The DBE and UBE were estimated to have a peak ground accelerations of 0.36g and 0.5g with a corresponding earthquake magnitude 6.7. As a result of statistical variations in the methods used to estimate strong ground motion, we expect that peak ground accelerations exceeding the DBE or UBE could potentially occur if a near-field earthquake were to occur on either of these faults.

4.2 SURFACE FAULT RUPTURE

Fault rupture is the displacement of the ground surface created by movement along a fault plane during an earthquake. Mapping by Lettis and Hall (1994) indicate tonal lineaments from aerial photographic review that trend northwestward south of the project site. Tonal lineaments can be related to different soil/bedrock materials resulting from fault offset. According to Lettis and Hall, the tonal lineaments may be related to faulting within the Los Osos fault zone (LOFZ). A portion of the Lettis and Hall map is reproduced on Plate 4.

No indication of scarps or other fault-related features was observed during our site visits for this project or for Fugro (2004). Tonal lineaments mapped by Lettis and Hall are subtle features that may have been disturbed by farming activities over time and/or may not be readily visible at the surface.

The LOFZ is an en-echelon-style reverse fault that extends east-southeast from the Hosgri fault zone offshore of Morro Bay to the Huasna fault zone east of San Luis Obispo. The LOFZ is considered active and a portion of the LOFZ (near the intersection of Los Osos Valley Road and Foothill Boulevard, about 7 miles southeast of the project site) is zoned by the State

of California Alquist-Priolo Special Studies Zones Act In our opinion, the potential exists for fault rupture to affect the project site and proposed improvements.

4.3 LIQUEFACTION, SEISMIC SETTLEMENT, AND LATERAL SPREADS

Liquefaction is a loss of soil strength due to a rapid increase in soil pore water pressures due to cyclic loading during a seismic event. Liquefaction commonly occurs in loose to medium dense sandy soil that is below the groundwater table at the time of an earthquake. The potential and severity of liquefaction will depend on the intensity and duration of the strong ground motion. Seismically induced settlement, collapse, or lateral spreads can occur in soils that are loose, soft, or that are moderately dense and weakly cemented, or in association with liquefaction.

The Paso Robles Formation is typically equivalent to stiff to hard and dense to very dense soil, thus, the majority of the site that is underlain by the Paso Robles Formation, has a low potential for liquefaction. Areas within the Warden Lake area were not evaluated as part of this preliminary study, but are likely to have a moderate to high liquefaction potential based on anticipated high groundwater elevations and recent alluvial sediments.

4.4 SUBSIDENCE AND COLLAPSE

The site is not in an area where the withdrawal of subsurface fluids is known to have caused ground subsidence. The formational materials that underlie the majority of the site generally have low compressibility, and should not be susceptible to significant compression due to lowering of local water levels. The fine-grained alluvial materials contain layers of relatively soft compressible clay. However the potentially compressible soft clay is of limited thickness (less than about 2 to 3 feet). It is therefore our opinion that there is a low potential for subsidence to impact the potential project site.

4.5 LANDSLIDING/SLOPE INSTABILITY

During our site reconnaissance, we observed evidence of landsliding/erosion along the western edge of the Branin Property and erosion along the eastern portion of the Giacomazzi Property. Access to the Branin property was unavailable at the time of our site visits. The erosion on the Giacomazzi property appears to be associated with concentrated runoff and has formed gullies approximately 2 to 6 feet deep along the eastern edge of the farmed field.

During our previous work for the Andre site (Fugro 2004), we observed evidence of landsliding on the northeast-facing hillside adjacent to the Warden Lake area east of the Giacomazzi property. The landslide has a well-defined, sharp headscarp, and was approximately 100 feet wide by about 200 feet long. The landslide appears to be relatively shallow, possibly about 10 feet deep. The cause of the instability is not known, but it may be related to excess moisture/groundwater seepage.

4.6 GROUND LURCHING

Ground lurching occurs as the ground is accelerated during a seismic event. As evidenced by the Loma Prieta, Landers, Northridge, and San Simeon earthquakes, the effects of ground lurching can damage facilities and buried pipelines. Ground lurching occurs due to detachment of underlying stratigraphic units, allowing near-surface soil to move differentially from underlying soil. The site is within a seismically active region of Central California that is prone to moderate to large earthquakes. It is therefore our opinion that there is a potential for ground lurching to impact the site. Ground lurching is generally not a geologic hazard that can be prevented, and therefore is mitigated by implementing preparedness measures.

4.7 EROSION

As described above, erosion was observed near the eastern edge of the Giacomazzi Property. Graded cut and fill slopes associated with the site development will be subject to sheet and rill erosion. Erosion of soils can be accelerated where soils are exposed directly to runoff and/or areas of concentrated storm runoff, such as at culvert outlets. Site drainage and landscape improvements can be designed to reduce the potential for soil erosion.

4.8 EXPANSIVE SOILS

The topsoil encountered at the site consists of sandy fat clay (CH) and lean clay (CL). These types of soils can be expansive. Based on our site observations, we expect that the near surface soils will have a moderate to high potential for expansion.

4.9 NATURALLY OCCURRING ASBESTOS

Naturally occurring asbestos (NOA) is common in serpentine rock throughout San Luis Obispo County. The California Air Resources Board has identified serpentine rock as having the potential to contain asbestos. The Paso Robles Formation and clayey alluvium were encountered at the site. Franciscan Formation/Serpentine was not encountered within the depth of anticipated site grading at the locations explored, and is not mapped in the site vicinity. Therefore, it is our opinion that there is a low potential for NOA to impact the project.

4.10 FLOODING, TSUNAMIS AND INUNDATION

The northern portion of the Branin Property is located within or near a County of San Luis Obispo mapped flood zone. The Giocamazzi and Los Osos Mortuary Properties are not located within the mapped flood zone. The elevation of the site is approximately 30 feet near the northern drainage to about 110 feet near the Los Osos Mortuary. Therefore, it is our opinion that there is a potential for flood, tsunami and inundation hazards to impact the project the northern portion of the site.

4.11 HYDROCOLLAPSE POTENTIAL

The central and southern portions of the site are underlain by relatively firm fine grained materials and relatively dense sandy materials. These materials are not considered susceptible

to hydrocollapse. Exploration was not performed in the Warden Lake alluvial area at the northern end of the site as part of this study. If project components are planned for that area, exploration should be performed to assess the material characteristics and to evaluate the potential hydrocollapse of the alluvial soils.

5. CONCLUSIONS AND RECOMMENDATIONS

We prepared the conclusions and recommendations for this report based on our preliminary geotechnical evaluation of the site conditions and a review of available geotechnical information for other projects located near the project site.

5.1 SUMMARY OF FINDINGS

- The south and eastern portions of the site are underlain by relatively firm fine grained soil and relatively dense sandy soil. The soils in the western portion of the site (CPT C-6 and C-7) contain layers of relatively soft fine-grained soils. Alluvium is mapped along the eastern and northern boundaries of the site. Groundwater was encountered at depths ranging from approximately 30 to 48 feet to below the existing ground surface. Surface and shallow groundwater likely are present along the northern drainage/Warden Lake areas.
- Access to Branin property to conduct subsurface exploration was not permitted for this work. Since subsurface exploration could not be performed on that property, this report and data presented are limited relative to characterizing the subsurface conditions and related geologic hazard for the Branin property. We recommend that additional field exploration be performed to further evaluate the Branin site, if the site is selected for design and construction of the facility.
- The sites are within Seismic Zone 4 and have been subjected to strong ground motions in response to historical earthquakes that have occurred in relatively close proximity to the site. The design of the facility should consider the potential for the site to be subject to strong ground motion in response to nearby or regional earthquakes. The soil encountered by our explorations is generally fine-grained or dense material that would not be considered susceptible to liquefaction. Based on the conditions encountered, there is a low potential for liquefaction or seismic settlement to impact the design of a facility located on the plateau area underlain by Paso Robles formational materials. However, due to the anticipated high groundwater levels and alluvial sediments, the potential for liquefaction to affect project elements located within the low-lying alluvial areas may be moderate to high.
- Development of the site will need to consider the proximity to the low-lying areas that underlie portions of the site, and building set backs from the top of slopes.
- We expect that typical 1 to 2 story structures, below grade structures, and moderately loaded structures can be supported on shallow foundations supported on compacted fill. Relatively heavy structures or large tanks will need to consider the potential for total and differential settlement of the underlying soft soil layers encountered along the western portion of the site.

- Site grading will need to consider the upper potentially expansive soils. Based on the hand auger borings and site observations, we expect that grading for structures would consist of removing the upper 3 to 5 feet of potentially expansive soils and replacing with non-expansive compacted fill.

5.2 PRELIMINARY SEISMIC DATA

The project site is located within Seismic Zone 4 based on the Uniform Building Code and the California Building Code, Title 24. The DBE and UBE for the site is estimated to be an approximately M6.7 earthquake with a corresponding peak ground acceleration of about 0.36g and 0.5g, respectively. The Los Osos fault is the controlling fault for the site, and is mapped approximately 0.7 miles east of the site, and is classified as a type "B" seismic source based on the building code. We recommend that the following values be used for zone-based seismic hazard analyses.

Seismic Data for Use with Building Code

Building Code Ch. 16A Table No.	Parameter	Value
--	Latitude	35.3097
--	Longitude	120.8017
16A-I	Seismic Zone Factor (Z)	0.40
16A-J	Soil Profile Type	(S_D), Stiff Soil Profile
16A-U	Controlling Seismic Source Type	B
16A-S	Near Source Factor (N_a)	1.3
16A-T	Near Source Factor (N_v)	1.6
16A-Q	Seismic Coefficient (C_a)	$0.44N_a = 0.57$
16A-R	Seismic Coefficient (C_v)	$0.64N_v = 1.02$
Figure 16A-3	Control Period (T_s)	0.72
Figure 16A-3	Control Period (T_o)	0.14

5.3 FOUNDATION DESIGN CONSIDERATIONS

Typical 1 to 2 story and moderately loaded structures can likely be supported on shallow foundations bearing in compacted fill. Relatively large or heavy structures located along the western edge of the site will need to consider total and differential settlement of the underlying fine grained materials (See CPT C-6 and C-7).

Allowable bearing pressures of 2,000 to 3,000 pounds per square foot (psf) can be used for preliminary foundation design. Additional exploration testing and analysis will be required as part of the design phase of the project.

5.4 EXPANSIVE SOILS

The clayey soils encountered at the site likely have a medium to high potential for expansion per the UBC. Removal or treatment of potentially expansive soils will need to be considered in foundation design.

5.5 GRADED SLOPES

Graded cut and fill slopes likely can be designed to a slope inclination of 2h:1v or flatter. Retaining structures or reinforced slopes can be provided to allow for steeper slopes, if needed.

5.6 DRAINAGE AND EROSION CONSIDERATIONS

Drainage should be provided such that surface water does not run over slopes or pond on pavements, slabs, or adjacent to foundations. Downspouts should be provided to collect roof drainage and direct the water to drainage pipes or areas away from the building. The sandy soils at the site are particularly vulnerable to erosion as evidenced from the walls of the onsite canyon drainages. Landscaping and maintenance of slopes should be provided to assist vegetation to be established on slopes, and reduce the potential for erosion. The top of slopes should be graded to direct drainage away from the slopes, or be provided with dikes and ditches that will direct surface water to controlled drainage structures. Concentrated flows and runoff should not be permitted to discharge onto slopes. Down drains, solid pipes, or lined ditches should be provided to carry water to the base of slopes. Energy dissipation and erosion control devises should be provided at the outlet of drainage pipes and in areas of concentrated flow and runoff to reduce the potential for erosion.

5.7 CONSTRUCTION CONSIDERATIONS

5.7.1 Excavation

The Paso Robles Formation encountered beneath the project site consists of loose to dense sand and soft to very stiff fine-grained materials. These types of soils likely can be excavated with typical heavy-duty construction equipment in good working order.

5.7.2 Use of On-site Soil

On-site soil consisting of sandy-type material that is free of organics, oversized rocks, pavements, and other deleterious materials should be suitable for use as compacted fill in building and pavement areas. The clayey on-site soils may not be suitable for fill in building and pavement areas due to potentially expansive soils but may be suitable for use as general fill. The on-site soils likely are not suitable for select material such as backfill for pipelines and base for roadways. On-site soil excavated from below the groundwater table (if encountered) will likely not be suitable for compacted fill as excavated. Drying or treating the soils may be needed to reduce the water content of the excavated material and make the material suitable for compaction.

5.7.3 Dewatering

We expect that excavations along the upper central and southern portions of the site will not require dewatering. If the northern portion of the site (near Warden Lake) is developed, excavations extending a few feet or more below existing site grades could encounter groundwater, depending on the groundwater level at the time of construction.

6. CONTINUATION OF SERVICES

The geotechnical considerations in this report are intended for preliminary planning and estimating costs associated with developing the site. The recommendations are preliminary based on our limited geotechnical study. A more comprehensive design-level geotechnical investigation should be completed in support of the final design of the proposed improvements.

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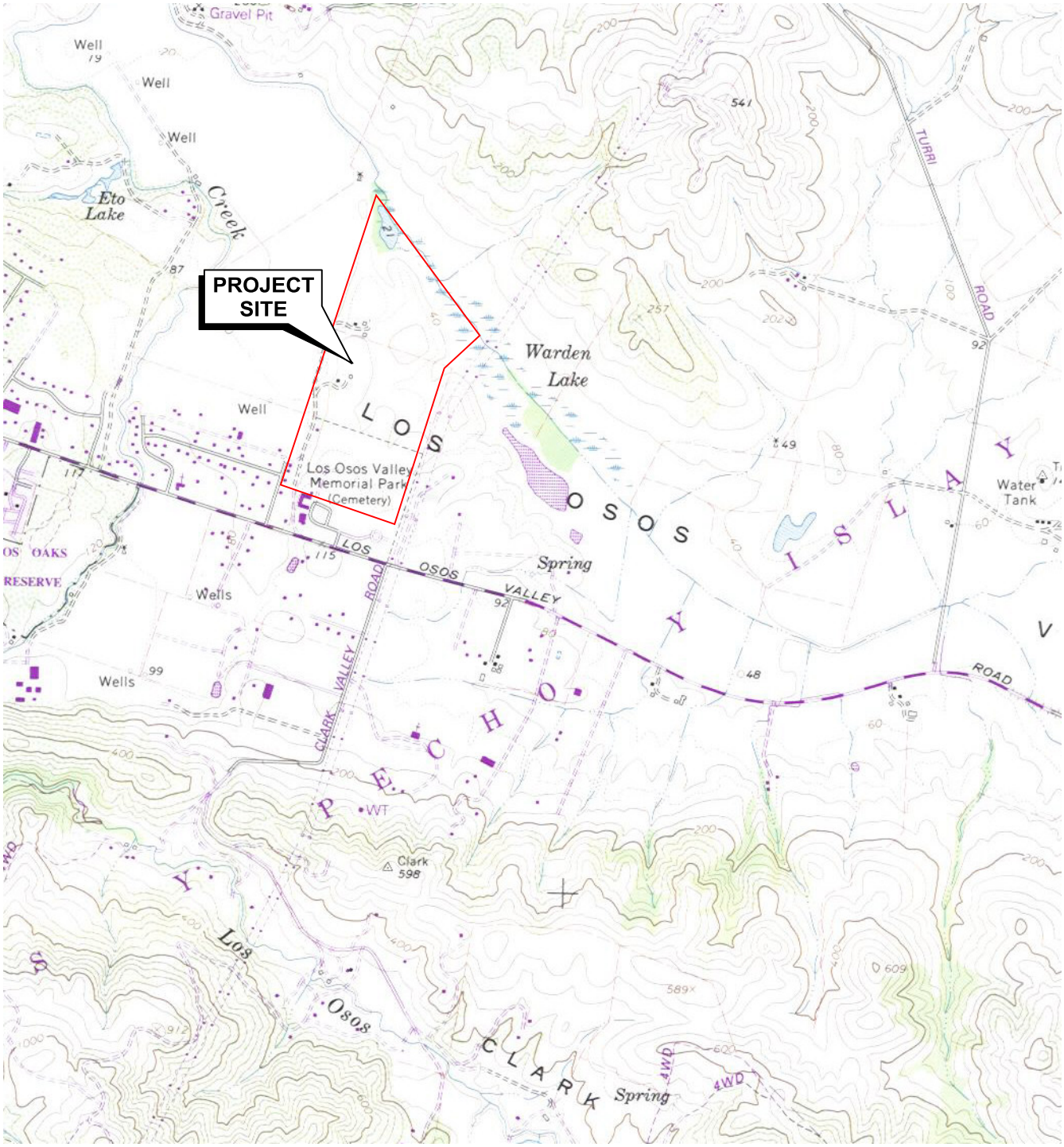
PLATES



BASE MAP SOURCE: USGS Morro Bay South 7.5' Quadrangle, revised 1994.

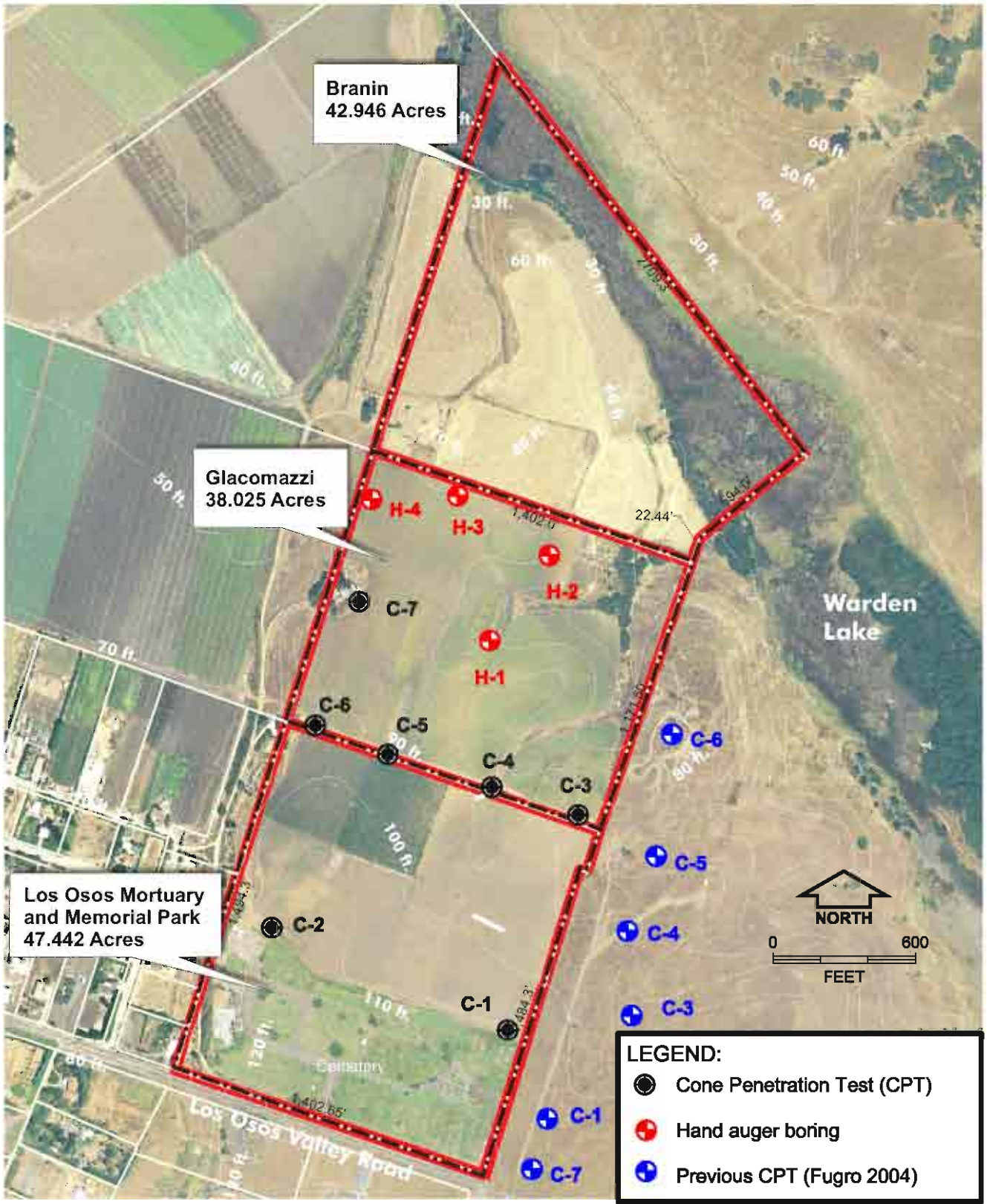
NORTH

0 1000 2000

FEET

VICINITY MAP
Los Osos Wastewater Project
San Luis Obispo County, California

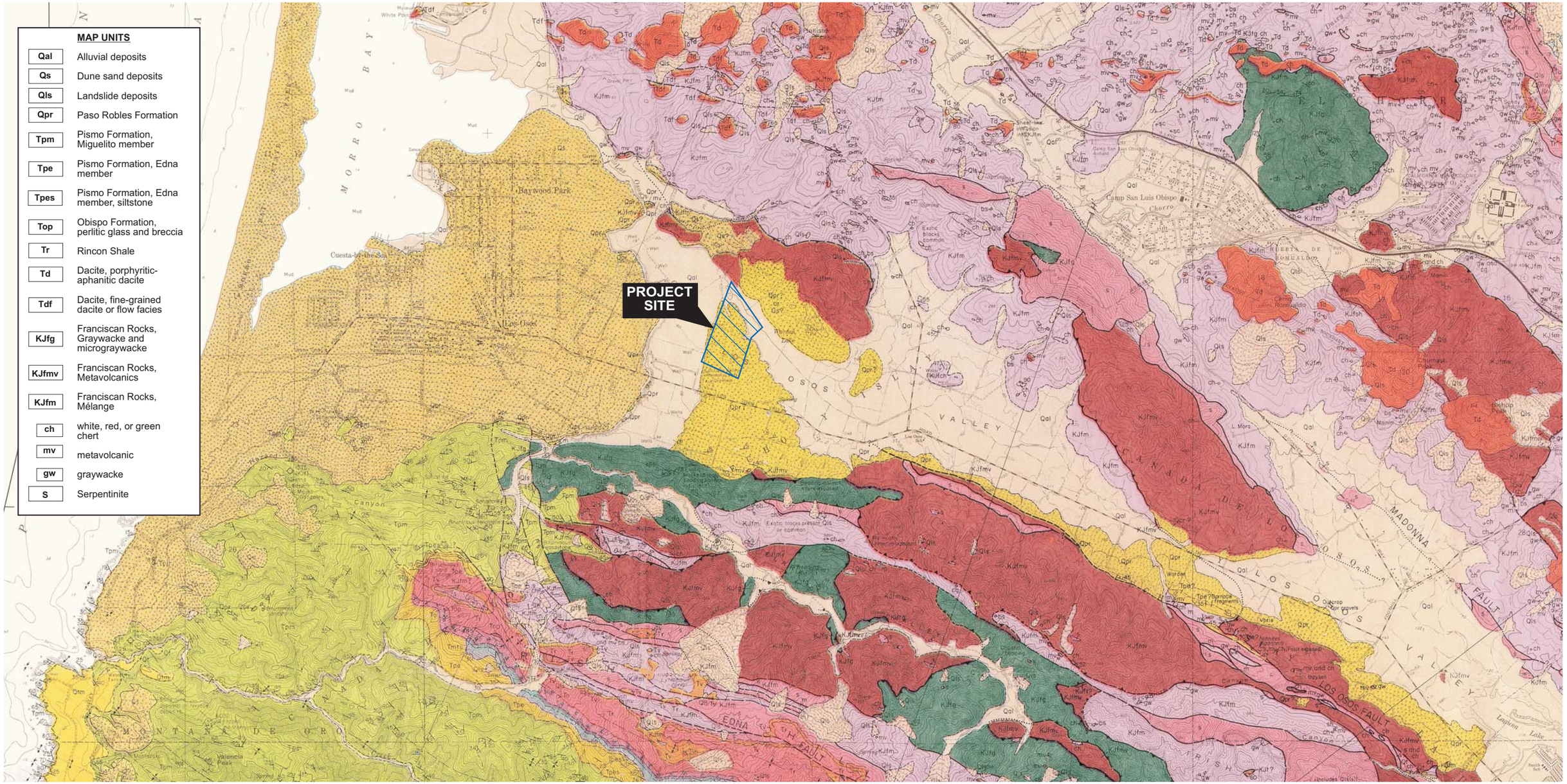
PLATE 1



BASE MAP SOURCE: Crawford Multari Clark Associates (2007). Areas Potentially Suitable for Wastewater Facilities.

FIELD EXPLORATION PLAN
Los Osos Wastewater Project
San Luis Obispo County, California

PLATE 2



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BASE MAP SOURCE: Geologic Map of the the San Luis Obispo-San Simeon Region, USGS Misc. Investigations Series Map I-1097, Sheet 3 of 3 (Hall, et al., 1979).

LEGEND

- Contact - Dashed where approximately located or inferred; queried where doubtful; dotted where concealed
- High-angle fault - Dashed where approximately located or inferred; dotted where concealed and inferred; queried where uncertain. Arrows show relative direction of movement on cross sections when known; queried where uncertain.
- Thrust or reverse fault - Dashed where approximately located or inferred, dotted where concealed and inferred; queried where concealed or doubtful. Sawteeth on upper plate. Dip of fault plane between 30° and 80°
- Photo lineament - Queried where uncertain
- Synform - Trace of axis at surface. Dashed where approximately located. Flanks coverate downward in folds and in rocks whose stratigraphic sequence is unknown.
- Antiform - Trace of axis at surface. Dashed where approximately located. Flanks diverge downward in folds and in rocks whose stratigraphic sequence is unknown.
- Strike and dip of beds uncertain

Marker beds

- Conglomerate or gravel bed
- Sandstone
- Siltstone or diatomaceous
- siltstone
- Tuff

- 30 — Strike and dip of flow banding
- x6193 — Megafossil locality - U.C.L.A. locality number
- Vollmer — Ranch name/property owner

NORTH

0 2000 4000

FEET

REGIONAL GEOLOGIC MAP

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE 3

MAP UNITS

Qal	Stream deposit
Qe	Eolian deposit
Qf	Fluvial and alluvial deposits
Qc	Colluvial deposit
Qm	Marine terrace deposit
Qoa	Older alluvial deposit
Tca	Cereaga sandstone
Tmpm	Miguelito member of Pismo Formation
KJf	Franciscan Complex
KJfmv	Metavolcanics
KJfch	Red, white or green cherts
KJfg	Graywacke
S	Serpentinite

PROJECT SITE

LOS OSOS FAULT ZONE

GS-1 -188? Tca
GS-2 -153 Tca
GS-3 -2, Tca -74, KJf
GS-4 -185 Tca
GS-5 8, Tca -72, KJf
GS-6 -85 Tca
MBO-2 -169.5
W.H. Provost Spooner 1 T.D. 533

Fluvial gravels buried by Qe

NORTH
0 1000 2000
FEET

M:\Drafting\JOBFILES\2007\3014.026\3014.026fault.cdr

BASE MAP SOURCE: Quaternary Geologic Map of Los Osos Fault Zone, Los Osos Fault Zone, San Luis Obispo County, CA, Plate 5 (Lettis and

LEGEND

Fault - Dashed where approximately located; dotted where concealed; U = up/D = down indicates relative sense of displacement; small arrow and number indicate strike and dip of fault exposed in outcrop

Aerial photo lineament - Or fault-related feature; dashed where less distinct; queried where uncertain; hachures indicate topographic scarp and show direction; ld = linear drainage, tc = tonal contrast, v = vegetation lineament, dd = deflected drainage, bis = break in slope, s = saddle, shb = side hill bench

Los Osos fault of Hall (1973) - Dashed where approximately located; dotted where concealed

Edna fault

Indian Knob fault

Other faults

Shoreline angle - Solid where well constrained; double dot dash where concealed; dotted where eroded; altitude shown in meters

Contact - Dashed where approximately located or inferred; queried

Strike and dip of bedding

Syncline - Showing trace of axial surfaces and direction of plunge

Anticline - Showing trace of axial surface and direction of plunge

Borehole - GS-1 - U.S. Geological Survey (unpublished data, G. Yates, Water Resource Division); MBO-2 - California Department of Water Resources (1972); altitude of subsurface of formations shown in meters

Borehole - Completed during this study

Exploratory oil well - Producer, name of well, and depth (meters) are indicated

Closed depression

Spring

Trench location

Bedrock exposure

Limit of mapping

LOS OSOS FAULT ZONE AND LINEAMENTS

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE 4

PROJECT SITE

San Andreas

NORTH
0 5
Miles
1:250,000

EXPLANATION

OFFSHORE REGION*

- Active or potentially active high angle fault (sea-floor projection of fault tip where blind or buried)—Deforms early/late Pliocene (2.8–3.4 Ma) unconformity or younger deposits or surfaces; U/D (Up/Down) indicates relative sense of displacement, bar indicates dip direction; dashed where approximately located
- Active or potentially active low angle fault (sea-floor projection of fault tip or leading edge of ramp where blind or buried)—Deforms early/late Pliocene (2.8–3.4 Ma) unconformity or younger deposits or surfaces; teeth indicate dip direction; dashed where approximately locate
- Active or potentially active anticline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located
- Active or potentially active syncline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located
- Active or potentially active monocline axial trace (sea-floor projection where buried)—Arrow indicates direction of plunge; dashed where approximately located
- Inactive fault (bold) or fold (light)—Does not deform early/late Pliocene (2.8–3.4 Ma) unconformity; where this unconformity and (or) younger sediments are absent as a result of erosion, structures are mapped as potentially active

ONSHORE REGION*

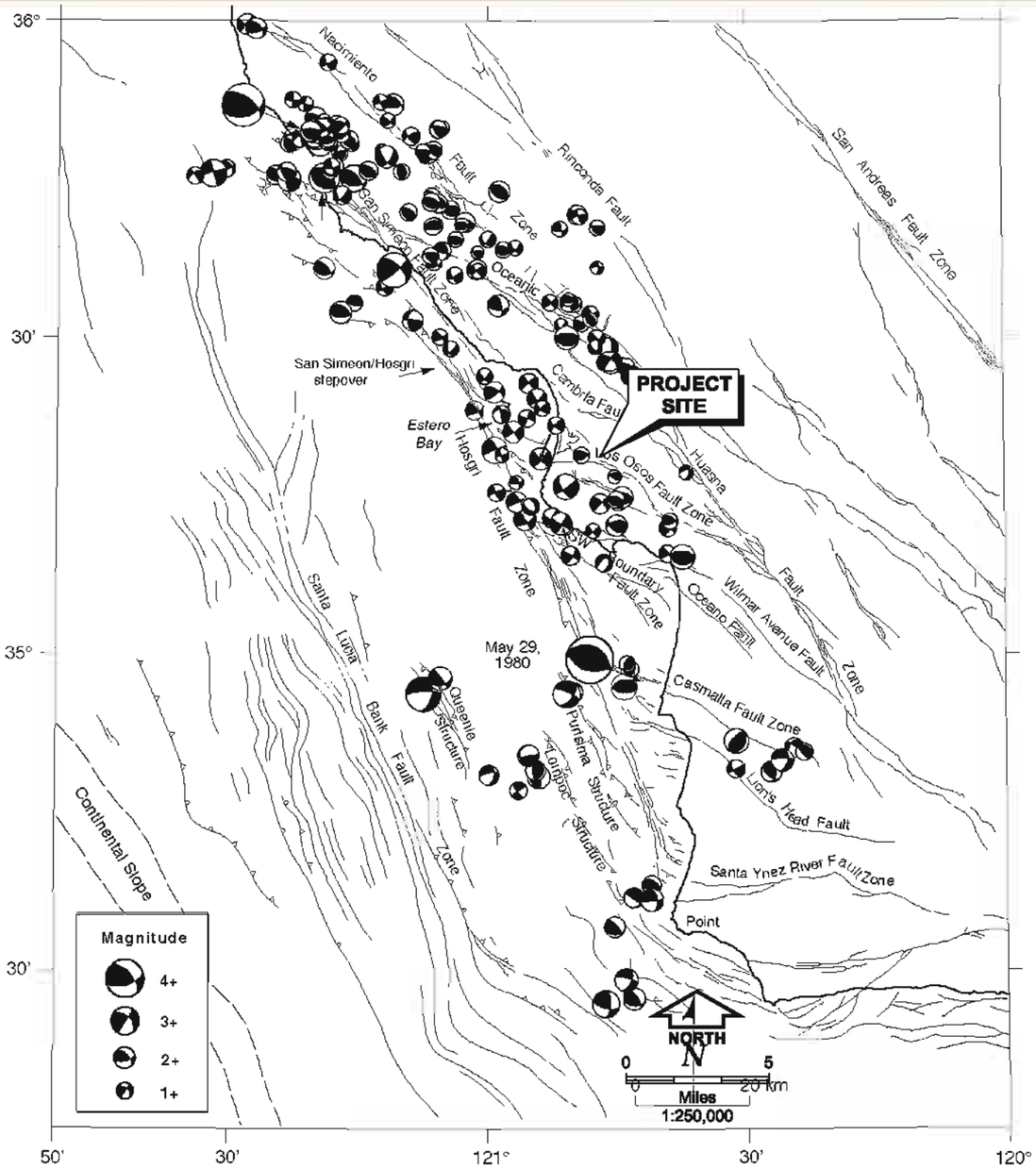
- Active fault trace—Deforms deposits or surfaces ≤500,000 ka; dashed where approximately located
- Potentially active fault trace—May deform deposits or surfaces ≤500,000 ka; dashed where approximately located
- Inactive active fault trace—Does not deform deposits or surfaces ≤500,000 ka; dashed where approximately located
- Anticline axial trace—Arrow indicates direction of plunge; solid where active or potentially active; dotted where inactive
- Syncline axial trace—Arrow indicates direction of plunge; solid where active or potentially active; dotted where inactive
- Monocline axial trace—Solid where active or potentially active; dotted where inactive

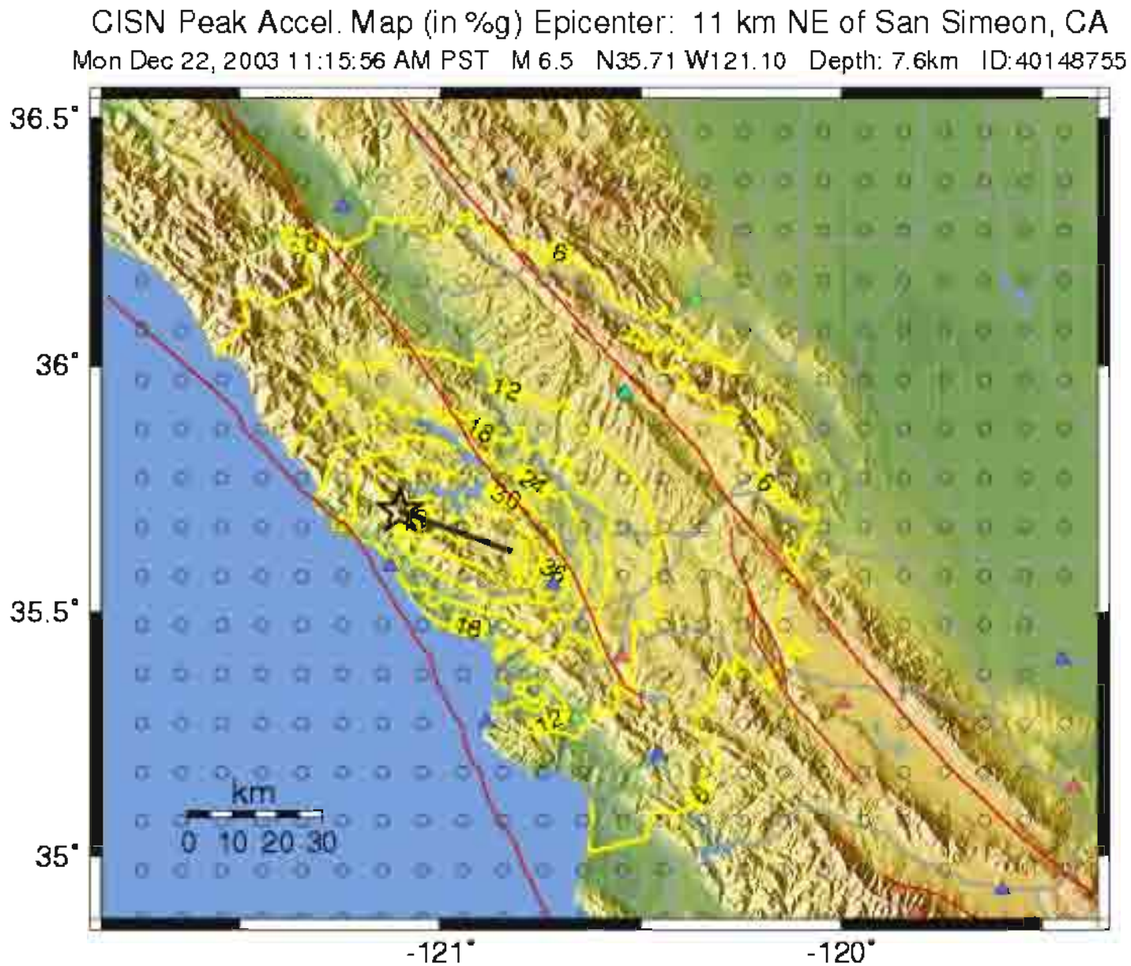
*Note: See text for discussion of mapping techniques and age criteria used to identify fault activity.

BASE MAP: Lettis et al. (2004), Faults and Folds in Onshore and Offsore Regions of South-Central California.

REGIONAL FAULT MAP
Los Osos Wastewater Project
San Luis Obispo County, California

PLATE 5



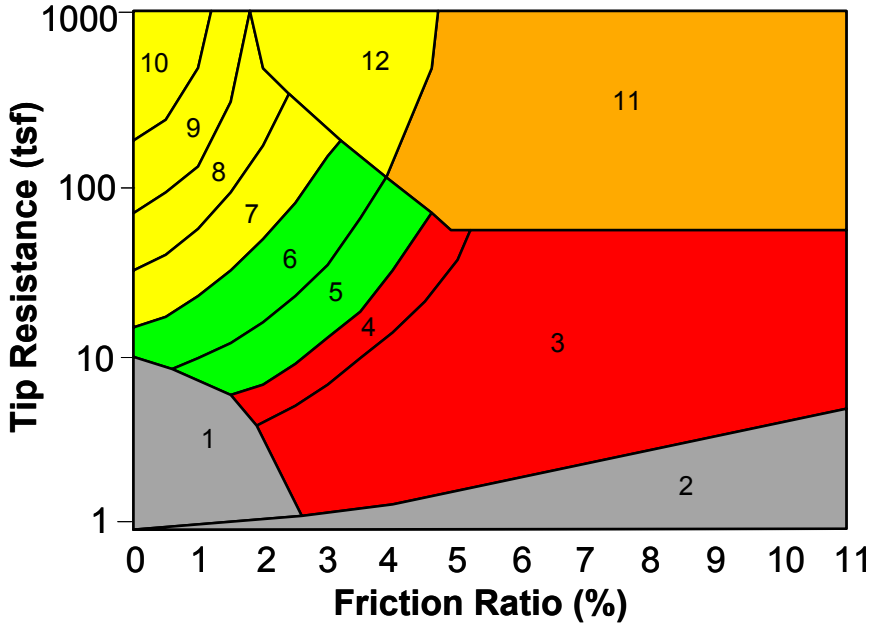


Map showing Quaternary faults and P-wave first-motion focal mechanisms from McLaren and Savage, 2001, (minimum, 20 first motions) from earthquakes along the south central coastal region from Point Piedras Blancas to Point Arguello. Focal mechanisms show (1) predominantly reverse and oblique-reverse motion between the Nacimiento and the San Simeon Fault Zones, (2) a mixture of strike slip, reverse, and oblique motion between the West Huasna-Oceanic and Hosgri Fault Zones, (3) strike slip motion along the northern Hosgri Fault Zone, and (4) reverse motion near the Casmalia Fault Zone and southwest of the Hosgri Fault Zone in the offshore Santa Maria Basin region.

BASE MAP: Lettis et al. (2004), Quaternary Tectonic Setting of South-Central California.

HISTORICAL SEISMICITY MAP
Los Osos Wastwater Project
San Luis Obispo County, California

APPENDIX A



Zone	Soil Behavior Type	U.S.C.S.
1	Sensitive Fine-grained	OL-CH
2	Organic Material	OL-OH
3	Clay	CH
4	Silty Clay to Clay	CL-CH
5	Clayey Silt to Silty Clay	MH-CL
6	Sandy Silt to Clayey Silt	ML-MH
7	Silty Sand to Sandy Silt	SM-ML
8	Sand to Silty Sand	SM-SP
9	Sand	SW-SP
10	Gravelly Sand to Sand	SW-GW
11	Very Stiff Fine-grained *	CH-CL
12	Sand to Clayey Sand *	SC-SM

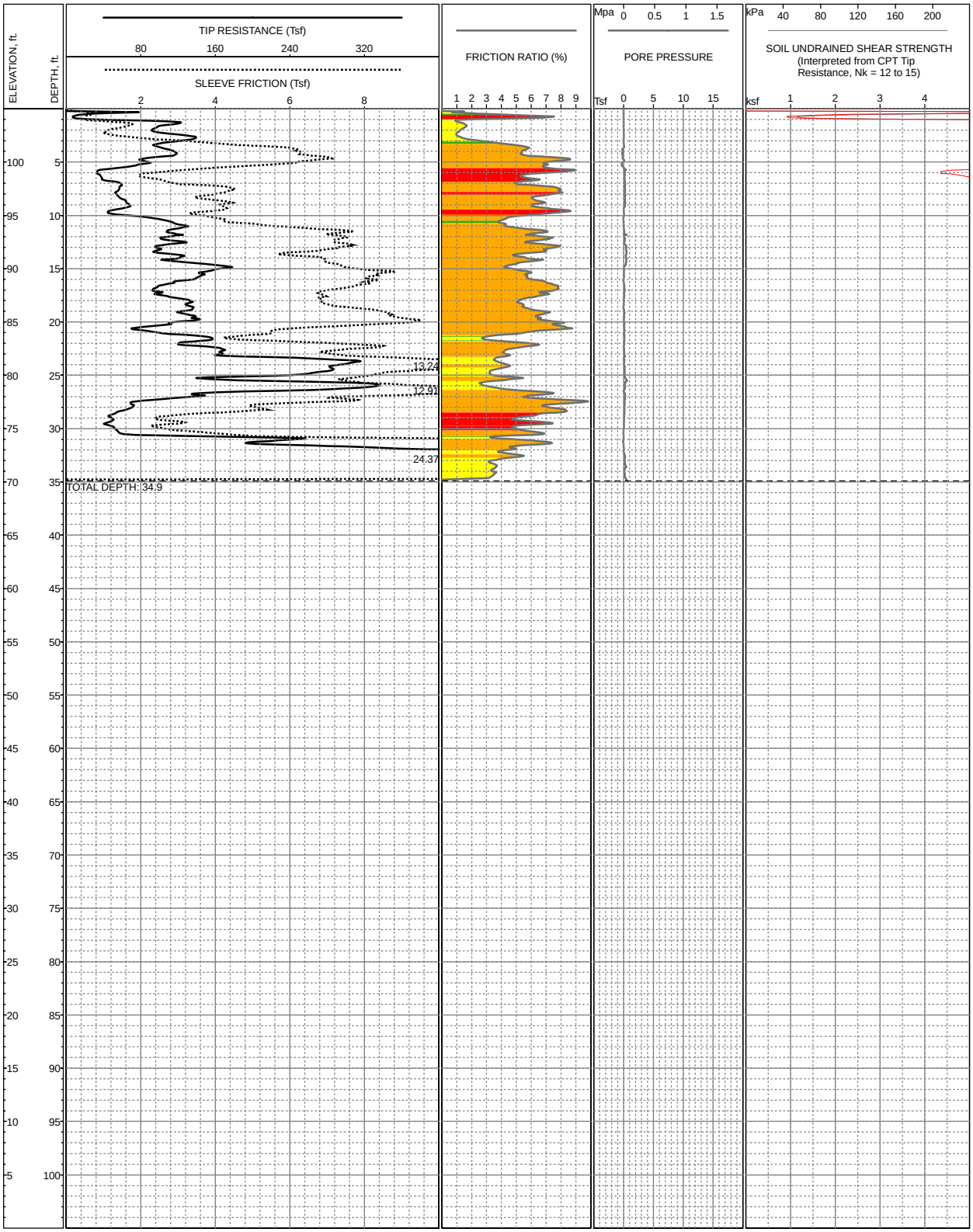
*overconsolidated or cemented

CPT CORRELATION CHART
(Robertson and Campanella, 1984)

KEY TO CPT LOGS

Los Osos Wasterwater Project
San Luis Obispo County, California

PLATE A-1



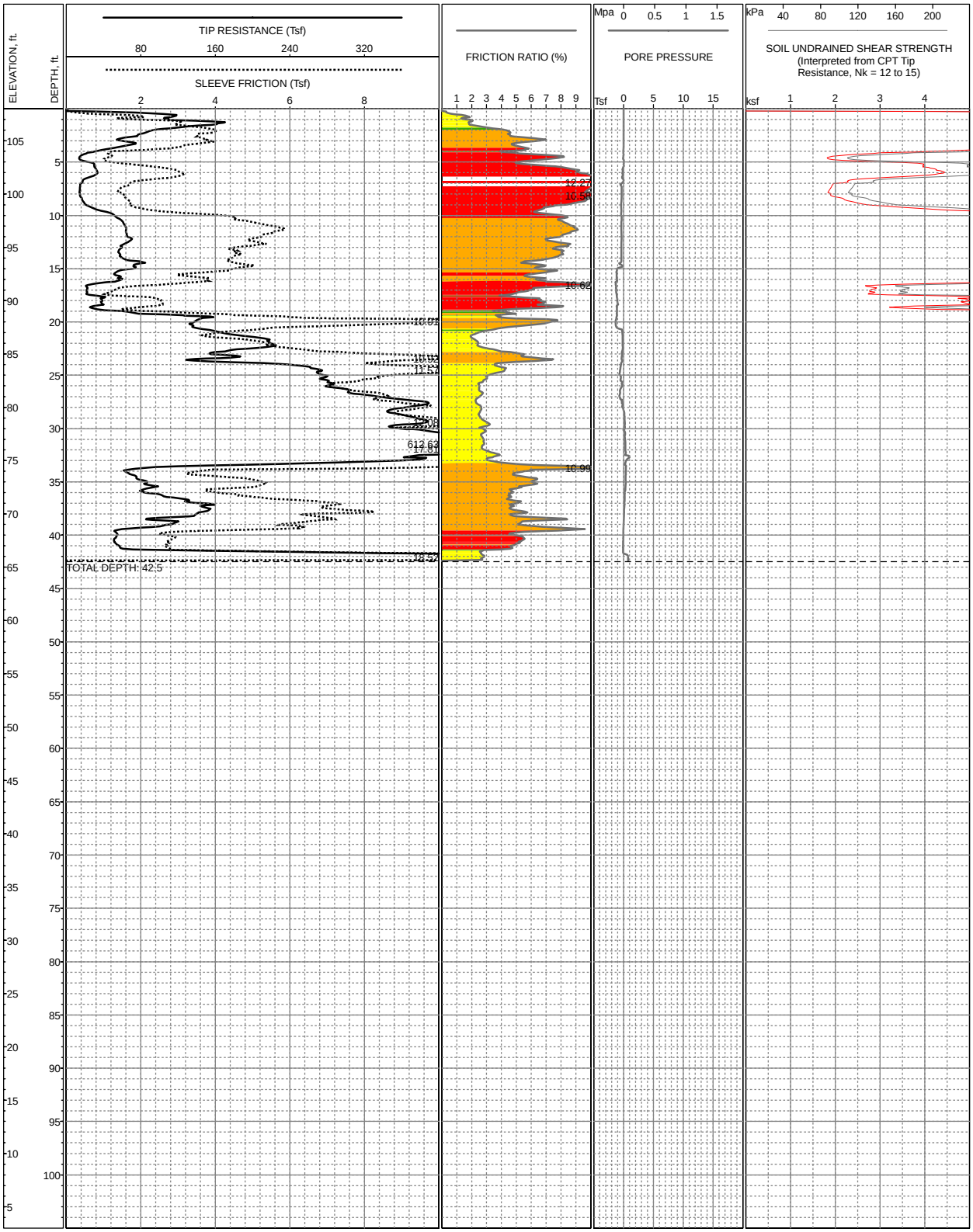
LOCATION: Southeast corner of Los Osos Mortuary property.
SURFACE EL: 105ft +/- (MSL)
COMPLETION DEPTH: 34.9ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-1

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-2



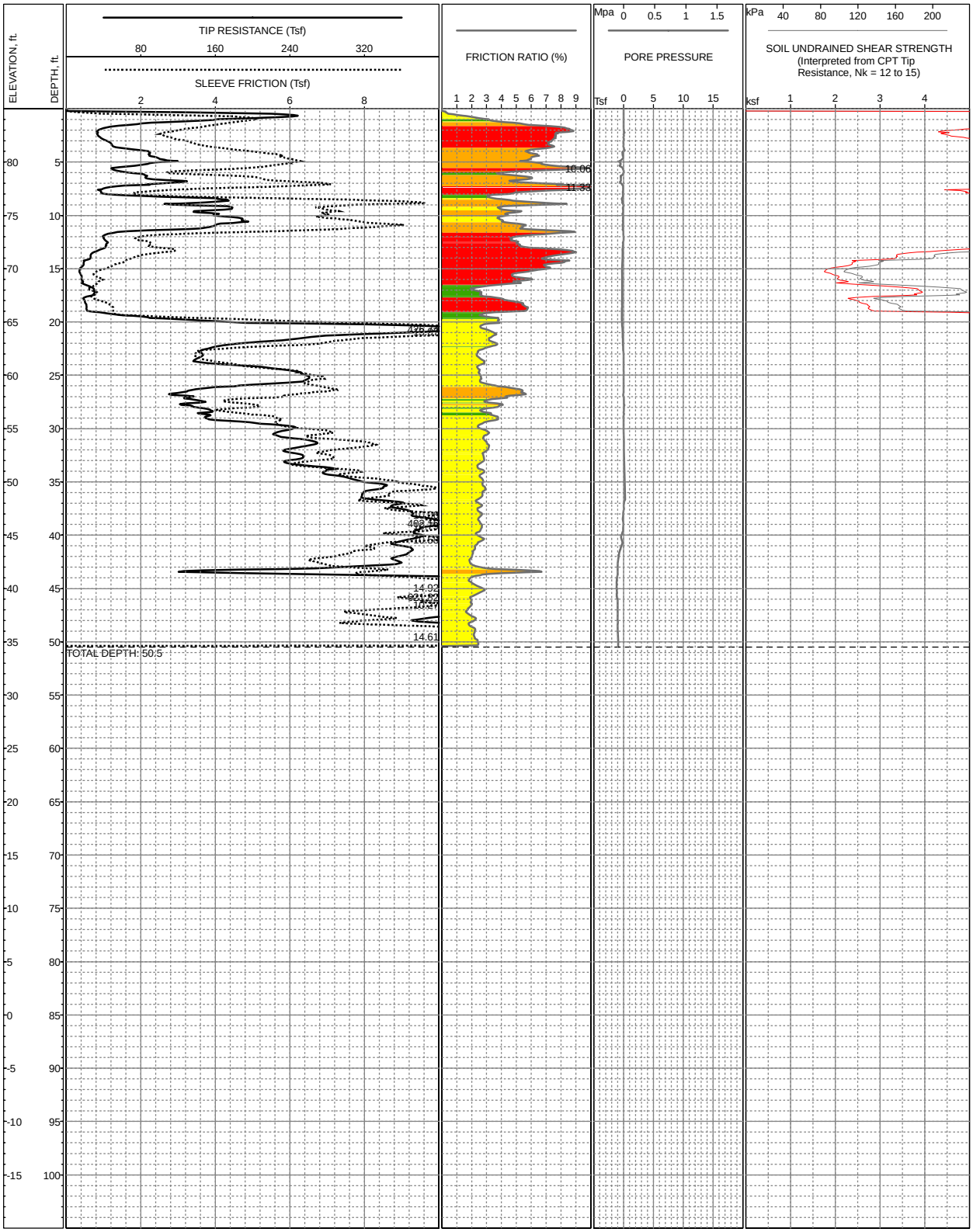
LOCATION: Southwest corner of Los Osos Mortuary property.
SURFACE EL: 108ft +/- (MSL)
COMPLETION DEPTH: 42.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-2

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-3



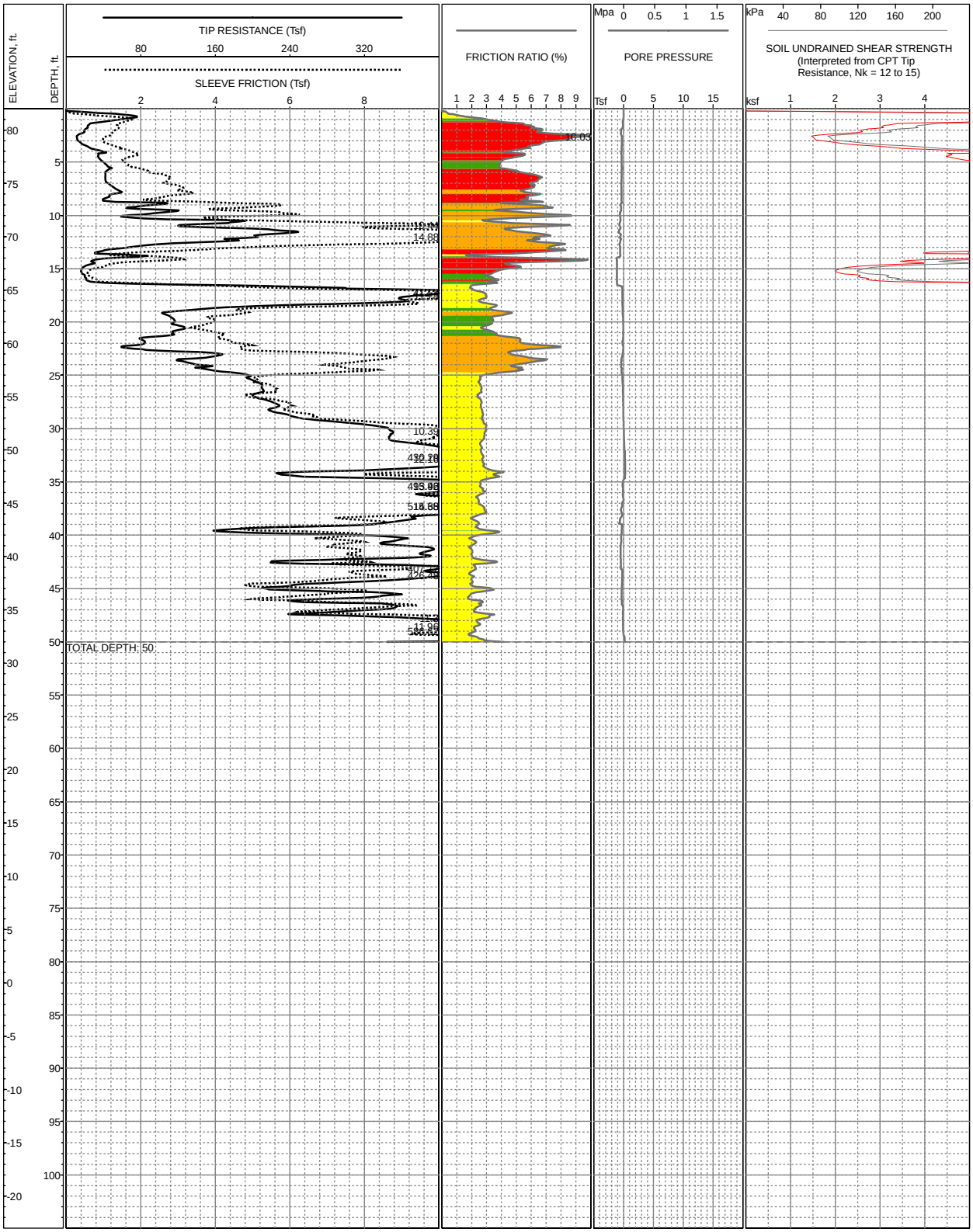
LOCATION: Southeast corner of Giacomazzi property.
SURFACE EL: 85ft +/- (MSL)
COMPLETION DEPTH: 50.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-3

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-4



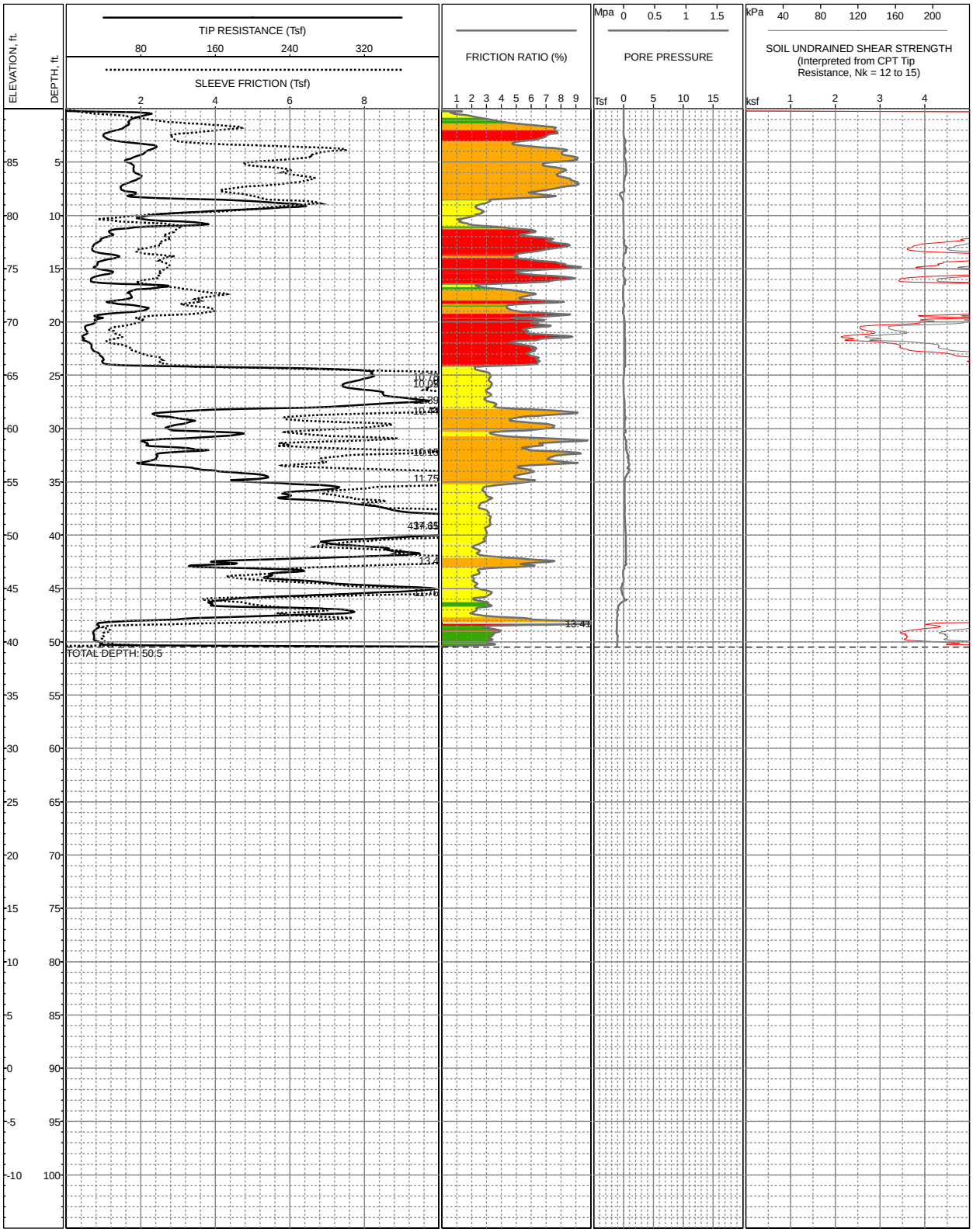
LOCATION: Southern access road of Giacomazzi property, 500 feet west of southeast corner.
SURFACE EL: 82ft +/- (MSL)
COMPLETION DEPTH: 50ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-4

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-5



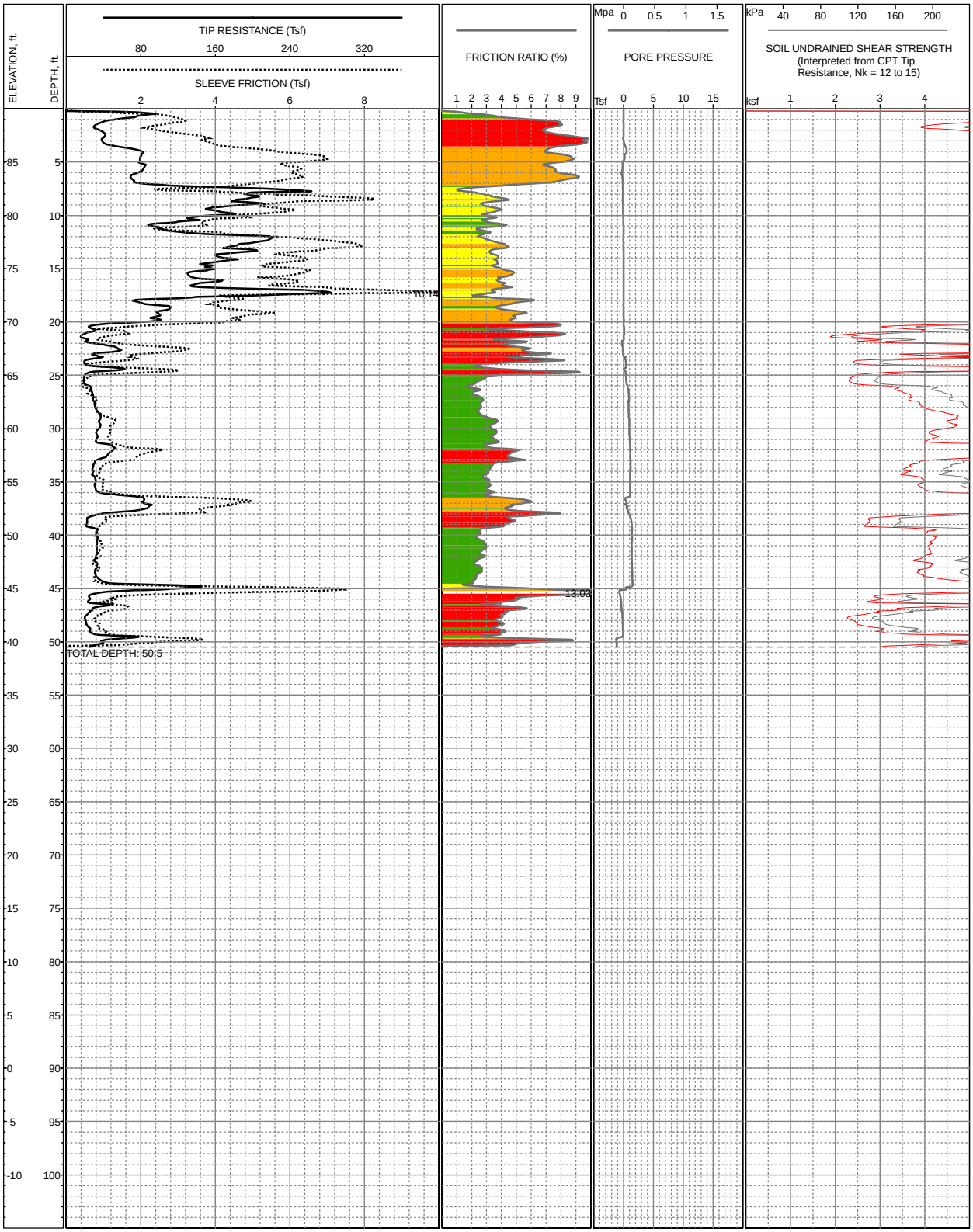
LOCATION: Southern access road of Giacomazzi property, 900 feet west of southeast corner.
SURFACE EL: 90ft +/- (MSL)
COMPLETION DEPTH: 50.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-5

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-6



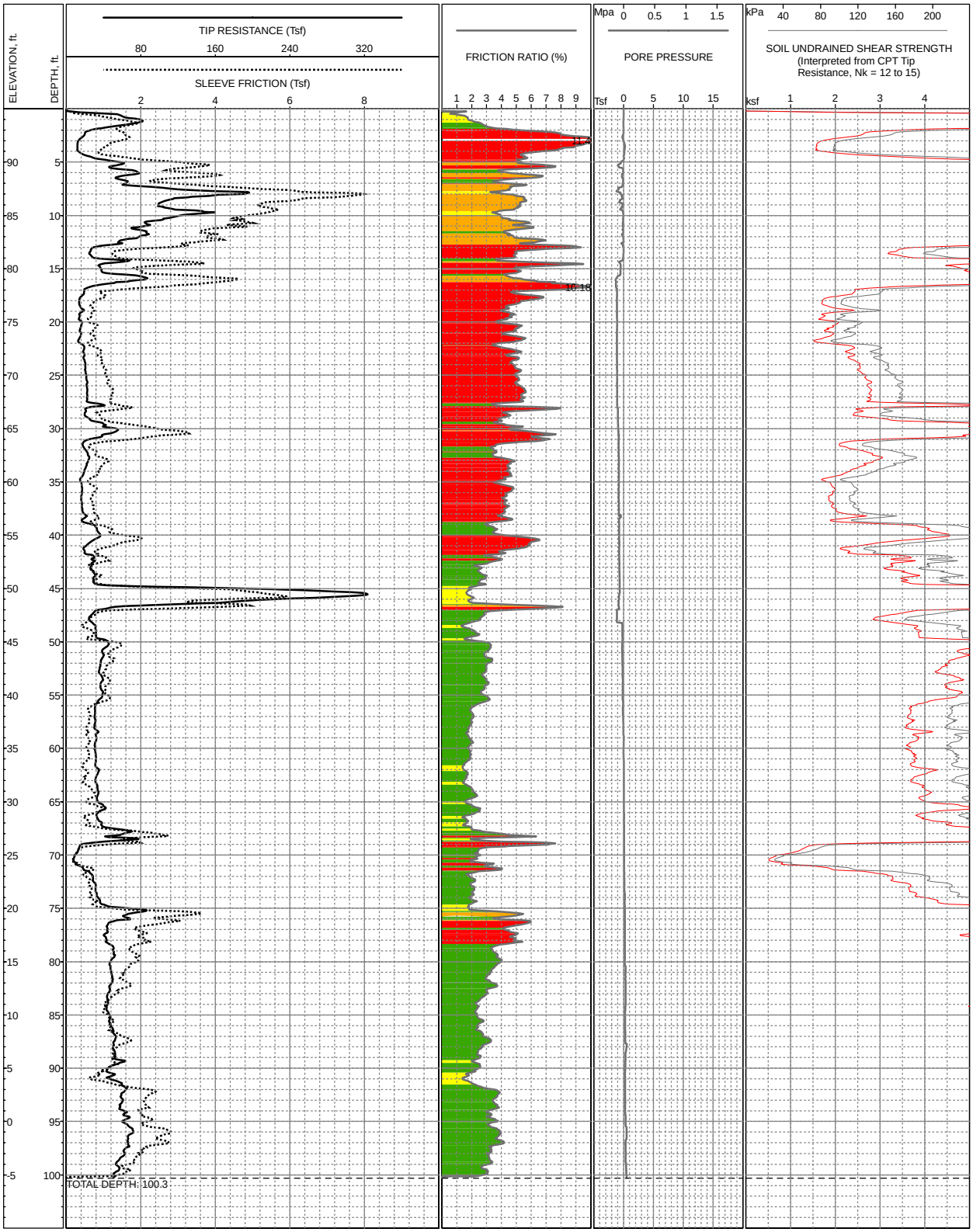
LOCATION: Southwest corner of Giacomazzi property.
SURFACE EL: 90ft +/- (MSL)
COMPLETION DEPTH: 50.5ft
TESTDATE: 5/8/2007

EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-6

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-7



LOCATION: Eastern edge of Giacomazzi property, adjacent to existing garage.
SURFACE EL: 95ft +/- (MSL)
COMPLETION DEPTH: 100.3ft
TESTDATE: 5/8/2007

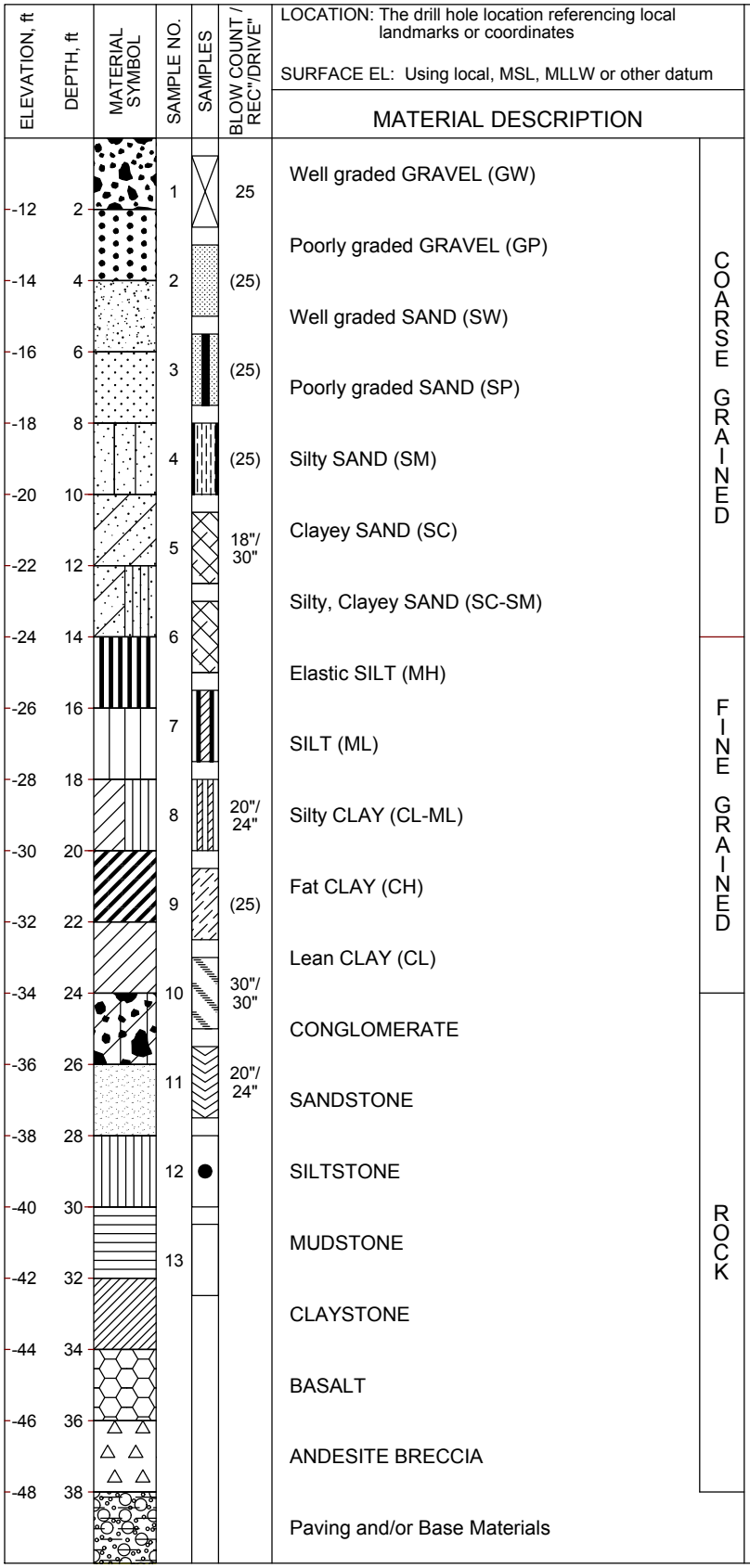
EXPLORATION METHOD: Cone Penetrometer
PERFORMED BY: Fugro Geosciences
REVIEWED BY: J Blanchard

LOG OF C-7

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE A-8

APPENDIX B



General Notes

Soil Texture Symbol

Sloped line in symbol column indicates transitional boundary

Samplers and sampler dimensions (unless otherwise noted in report text) are as follows:

Symbol for:

1	SPT Sampler, driven 1-3/8" ID, 2" OD
2	CA Liner Sampler, driven 2-3/8" ID, 3" OD
3	CA Liner Sampler, disturbed 2-3/8" ID, 3" OD
4	Thin-walled Tube, pushed 2-7/8" ID, 3" OD
5	Bulk Bag Sample (from cuttings)
6	CA Liner Sampler, Bagged
7	Hand Auger Sample
8	CME Core Sample
9	Pitcher Sample
10	Lexan Sample
11	Vibracore Sample
12	No Sample Recovered
13	Sonic Soil Core Sample

Sampler Driving Resistance

Number of blows with 140 lb. hammer, falling 30" to drive sampler 1 ft. after seating sampler 6"; for example,

Blows/ft	Description
25	25 blows drove sampler 12" after initial 6" of seating
86/11"	After driving sampler the initial 6" of seating, 36 blows drove sampler through the second 6" interval, and 50 blows drove the sampler 5" into the third interval
50/6"	50 blows drove sampler 6" after initial 6" of seating
Ref/3"	50 blows drove sampler 3" during initial 6" seating interval

Blow counts for California Liner Sampler shown in ( )

Length of sample symbol approximates recovery length

Classification of Soils per ASTM D2487 or D2488

Geologic Formation noted in bold font at the top of interpreted interval

Strength Legend

Q = Unconfined Compression
u = Unconsolidated Undrained Triaxial
t = Torvane
p = Pocket Penetrometer
m = Miniature Vane

Water Level Symbols

- Initial or perched water level
- Final ground water level
- Seepages encountered

Rock Quality Designation (RQD) is the sum of recovered core pieces greater than 4 inches divided by the length of the cored interval.

KEY TO TERMS & SYMBOLS USED ON LOGS

PLATE B-1

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	LOCATION: Giacomazzi property, near center of property. SURFACE EL: 70 ft +/- (rel. MSL datum) MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
						PASO ROBLES FORMATION (Qtp) Topsoil: Sandy Fat CLAY (CH): firm, brown, dry							
						- moist							
68	2					- grades to Clayey SAND (SC): medium dense, brown, moist							
						Lean CLAY (CL): stiff, red-brown, moist							
66	4					Lean CLAY with sand (CL): stiff, red-brown, moist							
						Lean CLAY (CL): stiff to very stiff, red-brown, moist							
64	6					Clayey SAND (SC): medium dense, brown, moist							
						Lean CLAY with sand (CL): very stiff, red-brown, moist, iron oxide staining							
62	8												
60	10												
58	12												
56	14												

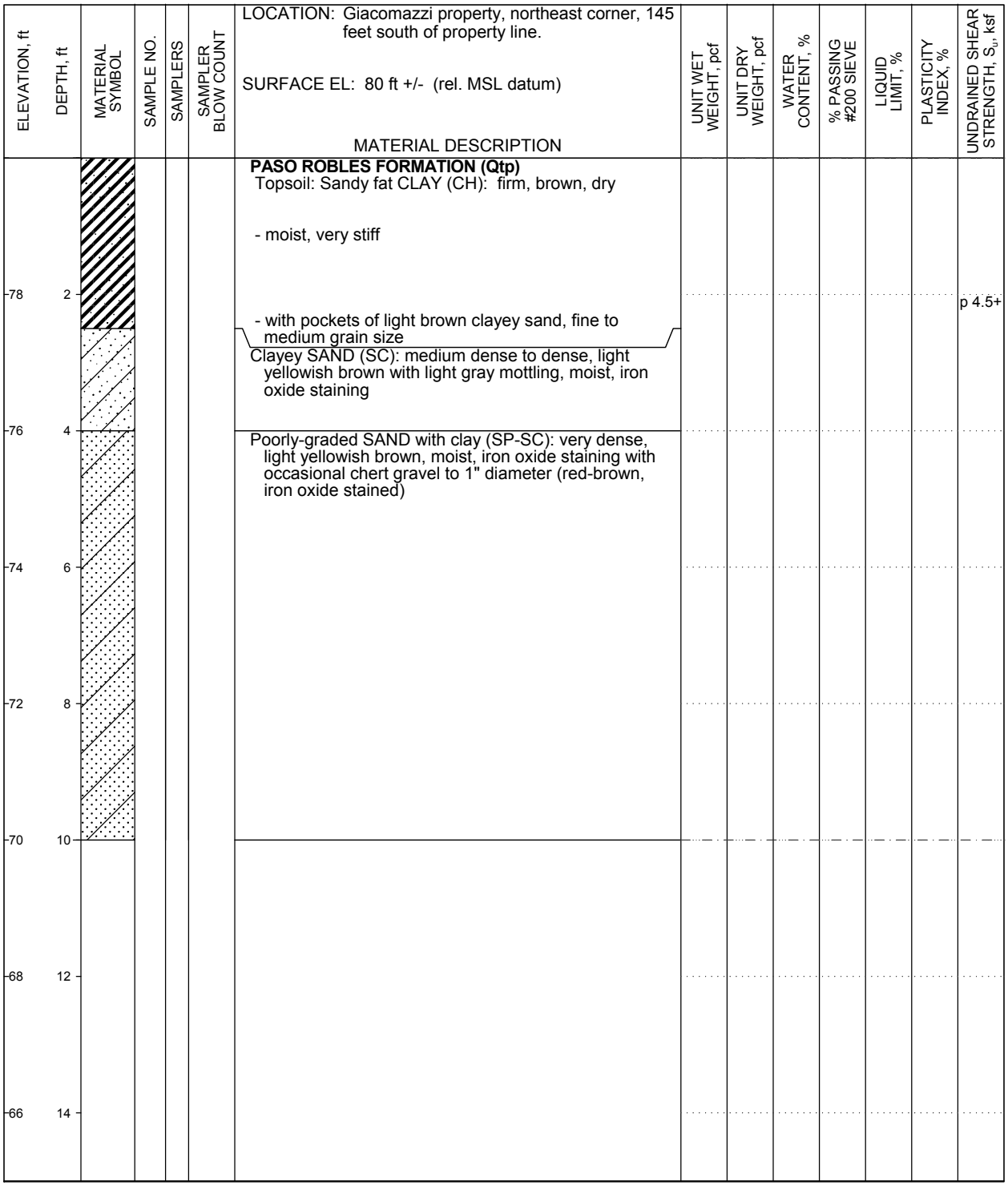
The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 12.5 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: CLovato
CHECKED BY: C Lovato

LOG OF NO. H-1
Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-2



The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 10.0 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: CLovato
CHECKED BY: C Lovato

LOG OF NO. H-2

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-3

LOCATION: Giacomazzi property, northern property line.

SURFACE EL: 80 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
						PASO ROBLES FORMATION (Qtp) Topsoil: Clayey SAND (SC): medium dense, brown, moist							
78	2					Sandy lean CLAY (CL): firm, light brown with gray and red-brown mottling, moist							
76	4					- stiff, gray							p 3.0
74	6					- very stiff, red-brown							
72	8												
70	10												
68	12												
66	14												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 10.0 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: CLovato
CHECKED BY: C Lovato

LOG OF NO. H-3

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-4

LOCATION: Giacomazzi property, western property line.

SURFACE EL: 82 ft +/- (rel. MSL datum)

ELEVATION, ft	DEPTH, ft	MATERIAL SYMBOL	SAMPLE NO.	SAMPLERS	SAMPLER BLOW COUNT	MATERIAL DESCRIPTION	UNIT WET WEIGHT, pcf	UNIT DRY WEIGHT, pcf	WATER CONTENT, %	% PASSING #200 SIEVE	LIQUID LIMIT, %	PLASTICITY INDEX, %	UNDRAINED SHEAR STRENGTH, S_u, ksf
						PASO ROBLES FORMATION (Qtp) Topsoil: Sandy lean CLAY (CL): firm, dark brown, moist							
80	2					Lean CLAY with sand (CL): stiff, brown, with dark brown mottling, moist							
						- dark brown, with gypsum							
78	4					- brown							
						- very stiff							
76	6												
74	8												
						Clayey SAND with gravel (SC): dense, red-brown, moist							
72	10					- grades to sandy CLAY (CL)/Clayey SAND (SC)							
70	12												
68	14												

The log and data presented are a simplification of actual conditions encountered at the time of drilling at the drilled location. Subsurface conditions may differ at other locations and with the passage of time.

COMPLETION DEPTH: 12.0 ft
DEPTH TO WATER: Not Encountered
BACKFILLED WITH: Cuttings
DRILLING DATE: May 8, 2007

DRILLING METHOD: 3-inch-dia. Hand Auger
HAMMER TYPE:
DRILLED BY: Fugro West, Inc.
LOGGED BY: JHollenback
CHECKED BY: C Lovato

LOG OF NO. H-4

Los Osos Wastewater Project
San Luis Obispo County, California

PLATE B-5