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FINNEY
ARCHITECTS

Addendum No. 01

File No. 40-39 **Date:** 8/7/2026
DSA Appl. No. 03-125585

Project: **Dana Elementary New Classrooms**
920 W. Tefft Street
Nipomo, CA, 93444
Lucia Mar Unified School District

LMUSD Project #: 0606
LMUSD Bid No. 27-01

1. This Addendum shall supersede all previously issued Contract Documents wherein it modifies same. All other conditions of the Contract remain unchanged. The following changes, additions, or deletions as set forth herein shall apply to the Contract Documents and shall be made a part thereof and shall be subject to all the requirements thereof as though originally shown and/or specified.

2. Bidders shall acknowledge receipt of this Addendum on Bid Form.

3. SPECIFICATION REVISIONS

    1. Division 00 – Notice Inviting Bids – Bidding Schedule

       The schedule shall be revised as follows:

       Prequalification due: August 11, 2026
       Last day for pre-bid questions: August 17, 2026
       Last day for Addenda to be issued: August 24, 2026
       Bid Opening: September 3, 2026, 2:00 p.m., at 222 Stanley Avenue, Arroyo Grande, CA
       Board Approval date: September 15, 2026
       Contract Start Date: September 21, 2026
       Contract End Date: December 3, 2027

    2. Geotechnical Report. The attached report shall be added as an appendix to the project manual.

4. DRAWING REVISIONS

   (None)

5. CLARIFICATIONS

   (None)

6. ATTACHMENTS

   Geotechnical Report:
   Updated Geotechnical Engineering and Geologic Hazards Report, Dana Elementary School, Two New Classroom Buildings (125 pages).

END OF ADDENDUM No. 01

UPDATED GEOTECHNICAL ENGINEERING AND GEOLOGIC HAZARDS REPORT
DANA ELEMENTARY SCHOOL
TWO NEW CLASSROOM BUILDINGS
920 WEST TEFFT STREET
NIPOMO, CALIFORNIA

May 6, 2025

Prepared for

Mr. Andy Stenson
Lucia Mar Unified School District

Prepared by

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401

EARTH SYSTEMS
4378 Santa Fe Road | San Luis Obispo, CA 93401 | (805) 544-3276 | www.earthsystems.com

May 6, 2025

File No.: 301260-005

Mr. Andy Stenson
Lucia Mar Unified School District
222 Stanley Avenue
Arroyo Grande, CA 93420

PROJECT: DANA ELEMENTARY SCHOOL
TWO NEW CLASSROOM BUILDINGS
920 WEST TEFFT STREET
NIPOMO, CALIFORNIA

SUBJECT: Updated Geotechnical Engineering and Geologic Hazards Report

CONTRACT REF: Purchase Order No. 251858 by Lucia Mar Unified School District (LMUSD), dated February 13, 2025, Referencing Earth Systems Pacific Proposal to Provide an Updated Geotechnical Engineering and Geologic Hazards Report, Dana Elementary School, Two New Classroom Buildings, 920 West Tefft Street, Nipomo, California, Doc. No. SLO-2412-052.PRP, dated December 19, 2025

Dear Mr. Stenson:

In accordance with the referenced Purchase Order, this updated geotechnical engineering and geologic hazards report has been prepared for use in the development of plans and specifications for the two new classroom buildings planned at Dana Elementary School in Nipomo, California. Updated geotechnical recommendations are presented herein for site preparation, grading, utility trenches, foundations, slabs-on-grade, drainage and maintenance, and observation and testing. This report also provides updated information regarding general geologic characteristics, existing and potential geologic hazards, and the impacts that the geologic conditions may have upon the project. An electronic copy of this report has been furnished for your use.

We appreciate the opportunity to have provided services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

Earth Systems Pacific

Nicholas B. Zoetewey
GE 3137

Nick Zoetewey, GE
Senior Engineer

Darrin G. Hasham
No. 2423

Darrin Hasham, CEG
Engineering Geologist

Doc. No.: 2505-010.SGR/cr

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APPENDICES

1.0 INTRODUCTION

The two proposed classroom buildings within Dana Elementary School at 920 West Tefft Street in Nipomo, California, (see Figure 1 – Site Vicinity Map in Appendix A) will be constructed on the south side of the campus, on the south side of the existing hardcourt play areas (Finney 2024). The buildings will be constructed with their long axes in an east-west alignment, essentially the same as the two existing classrooms to the east. For the purposes of this report, all directional references are with respect to Project North, as indicted on Figure 2 – Exploration Location Map in Appendix A.

The single-story structures will each have footprints of approximately 3,800 square feet and 4,300 square feet in plan; they will be site-built, and of conventional stud and/or steel frame construction. The buildings will be supported by conventional spread (pad) and continuous shallow foundations, with concrete slabs-on-grade. Maximum wall and column loads on the order of 2 kips per linear foot and 25 kips, respectively, have been assumed. Additional improvements will include exterior pedestrian flatwork, asphalt concrete (AC) paths and utilities, which will be extended underground to the existing campus utility systems. Cuts and fills on the order of 1 foot or less from the existing topography have been assumed. No other structures, retaining walls, or drainage basins or low impact development/best management practices (LID/BMP) features requiring infiltration testing, will be constructed.

It is our understanding that this project will be designed and constructed under the jurisdiction of the Division of the State Architect (DSA).

2.0 SCOPE OF SERVICES

The scope of work for this report included review of a previous Geotechnical and Geologic Hazards Report at the school prepared by this firm for the Modular Classrooms project (ESP 2017; a copy of this report is included in Appendix B); a field reconnaissance by a registered geotechnical engineer; subsurface exploration; geotechnical laboratory testing of samples obtained during the subsurface exploration; geotechnical and geologic analyses of the data; and preparation of this report. The analysis and subsequent recommendations were based on project information provided by Mr. John Tischler of Finney Architects (Finney 2024).

This report and updated recommendations are intended to comply with the considerations of Sections 1803A.1 through 1803A.7, J104.3 and J104.4, as applicable, of the California Building Code (CBC) (CBSC 2022); California Geological Survey (CGS) Note 48 (2022); Interpretation of Regulations (IR) Document A-4 (DSA 2021); and common geotechnical engineering and engineering geology practice in this area under similar conditions at this time. The geotechnical test procedures were accomplished in general conformance with the standards noted, as modified by common geotechnical engineering practice in this area under similar conditions at this time.

Updated geotechnical recommendations for site preparation, grading, utility trenches, foundations, slabs-on-grade, drainage and maintenance, and observation and testing are provided in this report. This report, either within or by reference, also describes the general geologic characteristics, identifies existing and potential geologic hazards, and discusses the impacts the geologic conditions may have upon the project. The results of previously completed corrosivity testing, which was subcontracted to CERCO Analytical, are also included by reference. These items are presented to guide the development of project plans and specifications. It is our intent that this geotechnical/geologic report be used exclusively by the client to form the geotechnical/geologic basis of the design, and in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk.

This report does not address dewatering and other issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, shoring, temporary slope angles, construction means and methods, etc. Analyses of the soil for mold potential, asbestos in man-made products, lead, radioisotopes, hydrocarbons, or chemical properties (other than geotechnical corrosivity) are beyond the scope of this report. Ancillary features such as temporary access roads, and non-structural fills are not within our scope and are also not addressed.

As there may be unresolved geotechnical and/or geologic issues with respect to this project, the geotechnical engineer and engineering geologist should be retained to provide consultation as the design progresses, to review project plans as they near completion, to assist in verifying that pertinent geotechnical and geologic issues have been addressed, and to aid in conformance with the intent of this report. In the event that there are any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed, and the conclusions of this report are verified or are modified in writing. The criteria presented in this report may be modified following a peer review or review by any jurisdiction or following a review by the geotechnical engineer and/or engineering geologist of conditions in the field during construction; modification of the recommendations must be completed in writing.

3.0 SITE SETTING

The planned building location on the south side of the existing campus has approximate coordinates and an elevation, as obtained from the Google Earth website (Google Earth 2025), of latitude 35.0276N, longitude 120.4987W, and 368 feet above mean sea level (MSL), respectively.

The east portion of the building area is partially paved with AC (asphalt concrete) at the surface and is used as a hardcourt play area. The west portion is a sandbox play area with a swing set and other play apparatus. The campus buildings are to the east and northeast, and the hardcourt play area extends to the north. Turf playfields are to the northwest and west. Across the school property lines to the southwest, south and southeast are doctor offices and a pharmacy. The existing topography has been graded to achieve a relatively flat and level gradient, with a slight slope to the southwest that is coincident with the property boundary (Google Earth 2025).

Based on the plan provided for our use (CLAD 2024), an abandoned conventional on-site effluent disposal system is in the west half of the planned building area. The plan indicates a septic tank filled with concrete is on the west end of the planned southern building's footprint, and a leachfield is present off that building's southwest corner; the leachfield apparently extends into the Nipomo Community Service District's easement along the southern boundary of the school. Also, according to the plan (CLAD 2024), another leachfield is present off the northwest corner of the planned northern building's footprint. The plan (CLAD 2024) does not indicate the disposition of the two former leachfields.

4.0 FIELD INVESTIGATION

The subsurface exploration for the current field investigation consisted of drilling four borings in the project area on February 25, 2025, to a maximum depth of approximately 24.5 feet below the existing ground surface (bgs). The borings were drilled with a GTech GT-8 truck mounted drill rig, equipped with 6-inch outside diameter hollow stem auger and an automatic trip hammer for sampling. The approximate locations of the borings are shown on Figure 2 – Exploration Location Map in Appendix A. As the borings were drilled, soil samples were obtained at selected depths using a ring-lined barrel sampler (ASTM D 3550-17 with shoe similar to D 2937-17); bulk samples were obtained from the auger cuttings. The borings were backfilled per the requirements of the governing jurisdiction. The two borings in the hardcourt area were capped at the surface with cold-mix AC.

Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-17. Copies of the boring logs and a Boring Log Legend are also included in Appendix A. In reviewing the boring logs and legend, the reader should recognize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, the presence of cobbles or boulders, cementation, variations in soil moisture, presence of groundwater, and other factors.

Previous explorations performed by this firm for the Modular Classroom Wings project (ESP 2017) consisted of eight borings, which were drilled to a maximum depth of 51.5 feet bgs (one boring), 21.5 feet bgs (three borings), and 16.5 feet bgs (four borings). The logs of these borings and an Exploration Location Map are included in the full copy of the report in Appendix B.

5.0 LABORATORY ANALYSIS

Selected ring samples obtained from the current borings were tested for unit weight and moisture (ASTM D 2937-17, modified for ring liners). One bulk sample was also tested for maximum density and optimum moisture (ASTM D 1557-12/21) and for cohesion and angle of shearing resistance under direct shear (ASTM D 3080-11). These current geotechnical laboratory test results are presented in Appendix C.

Laboratory test results for the Modular Classroom Wings project (ESP 2017) are also included in the full copy of the report in Appendix B.

Two soil samples were submitted to CERCO Analytical for geotechnical corrosivity testing for the Modular Classroom Wings project (ESP 2017). The Soil Corrosivity Study by CERCO Analytical is included in the previous report in Appendix B.

6.0 GENERAL SUBSURFACE AND GEOLOGIC PROFILE

Fill consisting of poorly graded sand with silt, in a loose to medium dense condition, was found in Borings 1 and 2, on the west side of the two planned building areas. Traces of debris (pvc tubing and wires) were found in the fill in Boring 1 below 2 feet. The existing pavement section at the surface in Borings 3 and 4 was 4.5 inches of AC over 4.5 inches of Aggregate base (AB). Below the fill and pavement sections in the borings was Older Dune Sand, composed of medium dense to dense poorly graded sand. During drilling, the soils were described as being slightly moist, with very moist conditions noted in Boring 2 between 3 feet and 8.5 feet bgs.

The subsurface conditions encountered in the borings performed for the Modular Classroom Wings project (ESP 2017) had thinner pavement sections, and only one boring encountered fill, which was approximately 6 inches thick. The underlying soils were all Older Dune Sands, similar to those found in the current investigation, to the maximum boring depth of 51.5 feet bgs.

Groundwater was not encountered in any of the borings during either investigation. Please refer to the boring logs in Appendix A of this report, and in the Modular Classroom Wings report (ESP 2017) in Appendix B, for a more complete description of the subsurface conditions.

7.0 GEOLOGY

Geologic Setting

The site lies upon the Nipomo Mesa, in the Coast Ranges geomorphic province of California (CGS 2002). The northern and southern coast ranges are separated by a depression containing the San Francisco Bay. The Nipomo Mesa, in the vicinity of the site, is bounded between the Pacific Ocean to the west, Arroyo Grande Valley to the north, Santa Maria Valley to the south, and Nipomo Valley to the east (USGS 2025a). This portion of coastal central California has been described in the context of *seismotectonic domains* by Clark and others (1994). Each domain is separated by predominantly northwest-southeast trending quaternary boundary faults. The Nipomo Mesa is within the triangular shaped Santa Maria basin-San Luis Range domain, which is bounded by the offshore Hosgri fault zone to the west, the Los Osos fault system to the northeast, and the Santa Ynez fault to the south (Clark et al 1994). Tectonically, the region is dominated by the Los Osos and San Luis Range faults (Lettis and Hall 1994).

According to the Geologic Map of the Nipomo Quadrangle by Delattre and Wiegers (2014), the project site is underlain by late Pleistocene eolian deposits (Qoe) which are old sand dunes (older dune sand) comprised of well sorted/poorly graded sand with weak soil development in places (see Figure 3 – Geologic Map in Appendix D). Our subsurface explorations performed for this site encountered unconsolidated deposits of poorly graded sand (SP), locally with silt, which are consistent with the geologic units mapped by Delattre and Wiegers.

Faulting

Faults are classified by the State of California based on the likelihood of generating ground motions and surface rupture. The classification system applies to known faults that have been compiled by numerous researchers through various methods of investigation. The State evaluates faults with documented ground rupture during the last 11,700 years and considers them for inclusion in Earthquake Fault Zones requiring investigation (A-P Zones) which encompass traces of *Holocene-active* faults, as defined by the State's Alquist-Priolo Earthquake Fault Zoning Act (State of California 1972). The State's guidance is intended to prohibit developments and structures for human occupancy across the trace of active faults (CGS 2018). Other active faults capable of generating strong ground motion are present in the region but are not included in A-P Zones because they do not meet the criteria of "sufficiently active and well-defined."

Significant Faults

The site is within a seismically active region and the project will experience seismic shaking during its design life. Known faults and fault systems within the region that could potentially generate earthquakes affecting the site include the San Luis Range, Los Osos, Oceanic-West Huasna, Hosgri-San Simeon, Rinconada, and San Andreas faults (USGS 2013). These are several of the known faults within a 65-mile radius of the site; other faults exist in the region and movement on any of these known or unknown faults could affect the proposed development during its design life.

The site is approximately equidistant between the inferred traces of the Pre-Holocene Oceano and Wilmar Avenue faults, both faults of the San Luis Range fault system. These faults, along with the San Luis Bay fault, are considered bounding faults of the San Luis Range, which has been tectonically uplifted on the northeast side of the faults. Each of these faults are depicted on the regional geologic map (Delattre and Wiegers 2014, Holland 2013) as a little over a mile from the site, but the locations are poorly constrained. The closest *Holocene-active* fault to the site included in an A-P Zone is the Irish Hills segment of the Los Osos fault, located approximately 6.8 miles northeast of the site. The zoned portion of the Los Osos fault is located approximately 20 miles from the site (Treiman 1989, SLOCO 2025). The Regional faults and locations of historic earthquake events are depicted on Figure 4 – Historical Seismicity Map in Appendix D.

San Luis Range Fault System

The San Luis Range fault system consists of a series of west-northwest trending faults that include the Santa Maria River, Wilmar Avenue, Oceano, San Luis Bay, and San Miguelito faults. The Wilmar Avenue fault extends from northern Nipomo to Pismo Beach, where it is exposed in the ocean bluff at the end of Wilmar Avenue. At this location, Pleistocene terrace deposits are displaced in the face of the bluff. The Oceano fault is a 12-mile-long northwest-trending fault extending from the town of Nipomo to the offshore area of San Luis Bay (Lettis and Hall 1994). The San Luis Range fault (south margin) is considered capable of a magnitude 7.49 earthquake (USGS 2014).

Los Osos Fault

The Los Osos fault zone is comprised of four distinct segments. From northwest to southeast the segments are Estero Bay, Irish Hills, Lopez Reservoir, and Newsom Ridge (Lettis and Hall 1994). The Los Osos fault is approximately 6.8 miles from the site. The Irish Hills segment of the Los Osos fault, located approximately 20 miles to the north, is the closest *Holocene-active* fault to the site included in a State Earthquake Fault Zone under the Alquist-Priolo Act (Hart and Bryant 2007). The Los Osos fault is considered capable of a magnitude 7.15 earthquake (USGS 2014).

Oceanic-West Huasna Fault

The Oceanic-West Huasna fault zone separates the Santa Lucia and San Rafael mountains from a series of distinct tectonic domains stretching from Cambria to the western Transverse Ranges (Lettis et al 2004). This fault system trends northwest-southeast for approximately 75 miles and is located about 6.4 miles northeast of the site. The Oceanic-West Huasna fault is considered capable of a magnitude 7.21 earthquake (USGS 2014).

Hosgri-San Simeon Fault System

The Hosgri-San Simeon fault system lies offshore approximately 18 miles west of the site. A northwest-trending strike-slip fault, the San Simeon fault extends from offshore of Ragged Point to just offshore of San Simeon Point, where it joins the northern end of the Hosgri fault; from this point the Hosgri fault extends to an ocean shelf 2 miles west of Point Buchon and then trends toward the Point Sal area. The fault system is considered *Holocene-active* and is included in an A-P Zone between San Simeon Point and Arroyo de le Cruz (CDMG 1986b, 1986c). The Hosgri-San Simeon fault is considered capable of a magnitude 7.54 earthquake (USGS 2014).

Rinconada Fault Zone

The Rinconada fault zone lacks obvious Holocene offset and therefore does not meet the State’s criteria for inclusion in an A-P zone; nonetheless, it is considered an active fault and is included as a seismic source in regional models. The Rinconada fault is a northwest trending high angle fault that forms the boundary between two dissimilar geologic terranes. Northeast of the Rinconada fault is the Salinian Block, composed of crystalline plutonic and metamorphic rock overlain by a thick sequence of marine sedimentary rocks. Southwest of the Rinconada fault is the Coastal Block, composed of Franciscan mélange overlain by marine sedimentary rocks (Dibblee 1976). The Rinconada fault is mapped as several anastomosing strands with the seismogenic plane modeled approximately 19 miles northeast of the site. The Rinconada fault is estimated to be capable of a magnitude 7.5 earthquake (Cao et al 2003).

San Andreas Fault

The San Andreas fault is considered the potential source of the largest regional earthquake. The San Andreas fault has a total length of approximately 671 miles and is divided into segments based on geometry and known historic behavior with some segments capable of earthquakes up to magnitude 7.5 (Cao et. al. 2003). Simultaneous rupture of more than one segment can cause an earthquake of magnitude 8 or more (USGS 2014). The Cholame-Carrizo segment is located approximately 40 miles east of the site, is approximately 201 km long and is in an A-P Zone (CDMG 1986a). This fault ruptured during the magnitude 7.9 earthquake in 1857 (USGS 2019).

Groundwater

Groundwater was not encountered in the borings completed for the current field investigation, and for the previous investigation (ESP 2017) to a maximum depth of 51.5 feet bgs. No recent groundwater well data was available in the immediate site area to evaluate long term trends. Data within approximately ¼-mile of the site indicated historical groundwater levels to be approximately 250 feet or more bgs within the vicinity of the site (CDWR 2025).

8.0 SEISMICITY

Earthquake History

The historic seismicity in the site's region was researched using a catalog of historical California earthquakes (ANSS 2025). We compiled the epicentral distance for earthquakes within the search parameters: magnitudes greater than 5.0, within a 65-mile radius from the site, from 1800 to December 2024. The epicentral distances should be considered estimates, particularly for earthquake data prior to 1932, when modern instruments were first used to record earthquake data. The site coordinates used in this search were latitude 35.0276°N and longitude 120.4987°W. Figure 4 – Historical Seismicity Map presented in Appendix D graphically depicts historical earthquake epicenters, their corresponding magnitudes, and the faults within the general region of the project.

Results of the search indicated that within the search parameters, 24 earthquakes with magnitude greater than or equal to 5.0 have occurred within 65 miles of the site (see Figure 4 – Historical Seismicity Map in Appendix D). The largest magnitude earthquake that occurred during the 224-year time period was the November 4, 1927 Lompoc earthquake with a calculated magnitude of 7.1. The closest earthquake to the site occurred approximately 16.7 miles from the site on July 28, 1902, and had an estimated magnitude of 5.8. The historical earthquakes are presented in Table F-2, Historical Earthquakes in Vicinity of Project Site, M≥5.0, in Appendix F.

Historical earthquakes that resulted in damage within the region include the Lompoc earthquake of 1927. This event is believed to have occurred on the offshore Hosgri fault (Helmberger et. al. 1992). The event triggered a tsunami that was measured by tidal gauges at San Francisco and San Diego and liquefaction phenomenon, including sand boils, at several locations within and around Lompoc. Reportedly, structures were damaged in Arroyo Grande and Guadalupe (SCEDC 2020).

The San Simeon earthquake that occurred on December 22, 2003, is an example of a significant regional earthquake during recent times, the results of which are well documented. Significant reports of damage were reported from Paso Robles to Oceano. The highest recorded PGA from the San Simeon earthquake was at the hospital in Templeton and liquefaction effects were concentrated at Oceano, approximately 50 miles south of the earthquake epicenter suggesting a PGA of 0.4g or greater (EERI 2005).

Ground Motion Analyses

In accordance with CGS Note 48 (2022), the CBC (CBSC 2022) and ASCE 7-16 (2017, 2018, 2021), an assessment was made to determine the need for employing “Site-Specific Ground Motion Procedures” to calculate the seismic design parameters for the project. Based on our site evaluation and Standard Penetration Tests (SPT), the subsurface characteristics are those of Site Class D (Stiff Soil) as defined by ASCE 7-16 (2017) Table 20.3-1, Site Classification. The mapped S_1 ground motion value obtained from the Structural Engineers Association of California website (SEAOC 2025), using ASCE 7-16 (2017), was 0.376 g, which is greater than 0.2; therefore, per Section 11.4.8 of ASCE 7-16, the project requires site-specific ground motion analyses unless certain procedures are used during the structural design that comply with the exceptions allowed. To provide flexibility for the structural design professionals, we have provided “General Procedure” seismic design parameters, which are only valid if structural calculations are performed in accordance with the exception permitted by Supplement 3 of ASCE 7-16 (ASCE 2021), and “Site-Specific” seismic design parameters developed through a site-specific ground motion hazard analysis in accordance with Chapter 21 of ASCE 7-16 (2017, 2018, 2021).

The site may be subject to strong ground shaking due to potential fault movements along regional faults including the San Luis Range fault system. Engineered design and earthquake-resistant construction increase safety and allow development of seismic areas. The minimum seismic design should comply with the CBC (CBSC 2022) and ASCE 7-16 (2017, 2018, 2021) using the seismic design coefficients given in the following sections.

Seismic Design Category

Section 1613A.2.5 of the CBC (CBSC 2022) states that structures classified as Risk Category I, II, or III that are located where the mapped spectral response acceleration parameter at 1-second period, S_1, is greater than or equal to 0.75 shall be assigned to Seismic Design Category E…others shall be assigned to Seismic Design Category D. The S_1 for the site is 0.376, which is less than 0.75; therefore, the site should be assigned to Seismic Design Category D. We understand that the site falls under Risk Category II, per Table 1604A.5 of the CBC (CBSC 2022).

General Procedure Seismic Design Parameters

The General Procedure seismic parameters presented in Table 1 below consider Site Class D, and an earthquake probability of 2-percent in 50 years, equivalent to a 2,475-year return period. The general procedure seismic design parameters presented below are only valid if structural calculations are performed in accordance with the exception permitted by Supplement 3 of ASCE 7-16 (ASCE 2021).

Table 1 - General Procedure Seismic Parameters (2022 CBC)

Site Class (ASCE 7-16)	D
Occupancy (Risk) Category	II
Seismic Design Category	D
Maximum Considered Earthquake (MCE) Ground Motion	
Spectral Response Acceleration, Short Period – S_s	1.022 g
Spectral Response Acceleration at 1 sec. – S_1	0.376 g
General Procedure Site Coefficient – F_a	1.09
General Procedure Site Coefficient – F_v	1.92
Site-Modified Spectral Response Acceleration, Short Period – S_{MS}	1.115 g
Site-Modified Spectral Response Acceleration at 1 sec. – S_{M1}	0.723 g
Design Earthquake Ground Motion	
Short Period Spectral Response – S_{DS}	0.743 g
One Second Spectral Response – S_{D1}	0.482 g
Site Modified Peak Ground Acceleration - PGA_M	0.52 g
Design Response Spectrum Transition Periods (Seconds)	
T_0 = 20% of S_{D1}/S_{DS}	0.13
$T_S = S_{D1}/S_{DS}$	0.65
T_L = Mapped Long Period Transition	8

Site Specific Seismic Design Parameters

As an alternative, we have also developed Site-Specific seismic design parameters for the site. The site-specific seismic design parameters are summarized in Table 2 below, and the results of our analysis are presented in Appendix F, Tables F-3 and F-4.

A risk-targeted maximum considered earthquake (MCE_R) modeling procedure was performed in accordance with ASCE 7-16 (2017, 2018, 2021), including a Probabilistic Seismic Hazard Analysis (PSHA) using ground motion data from the United States Geologic Survey Earthquake Hazard Toolbox (USGS 2025b), based on the National Seismic Hazard Model (NSHM) Conterminous U.S. 2023, and a Deterministic Seismic Hazard Analysis (DSHA) using the Third Uniform California Earthquake Rupture Forecast (UCERF3) fault model (USGS 2013) and NGA-West2 ground motion prediction equations (PEER 2015). These analyses are based on knowledge of the regional tectonic setting, geology, and seismicity. These analyses were performed as described in ASCE 7-16 (2017) Section 21.2.1.1 (Method 1) to estimate the peak ground motion corresponding to the uniform hazards earthquake and MCE_R which has a 2 percent probability of being exceeded in 50 years. Our site-specific ground motion hazard analysis considered the ground response anticipated resulting from a magnitude 7.49 earthquake on the San Luis Range fault (south margin, community fault model 3.2). Fault parameters used in our analyses are summarized in Table F-1, Fault Parameters, presented in Appendix F, modified in accordance with the USGS Earthquake Scenario web page (USGS 2014).

Table 2 - Site Specific Seismic Parameters (2022 CBC/ASCE 7-16)

Seismic Design Category	D
Occupancy (Risk) Category	II
Site Class	D
Mapped and Code Based Ground Motion	
Short Period Spectral Response, S_s	1.022 g
1 second mapped Spectral Response, S_1	0.376 g
Design Earthquake Ground Motion	
Short Period Spectral Response, S_{DS}	0.832 g
1 second Spectral Response, S_{D1}	0.747 g
Peak Ground Acceleration (PGA_M)	0.496 g
MCE Spectral Response Acceleration	
Short Period Spectral Response, S_{MS}	1.249 g
1 Second Period Spectral Response, S_{M1}	1.120 g
Site Amplification Factors	
Short Period Site Coefficient, F_a	1.09
1 Second Period Site Coefficient, F_v	2.50
Vertical Site Coefficient, C_v	1.30
Risk Coefficient (Short Period), C_{Rs}	0.900
Risk Coefficient (1 Second Period), C_{R1}	0.905
Design Response Spectrum Transition Periods (Seconds)	
T_0 = 20% of S_{D1}/S_{DS}	0.179
$T_S = S_{D1}/S_{DS}$	0.897
T_L = Mapped Long Period Transition	8.0

9.0 GEOLOGIC HAZARDS

A comprehensive assessment of the potential geologic hazards at the site was provided in our Geotechnical Engineering and Geologic Hazards Report (copy in Appendix B) for the Modular Classrooms Project at the site (ESP 2017). That assessment is generally considered to be applicable for the current project; we reevaluated the geologic hazards and have compiled the following summary of findings:

- The site is not within a State, County, or community designated hazard zone for fault rupture.

- The geologic map included with the 2017 report is still currently the best available regional geologic map of the site; however, because the Dana Elementary School campus is located very close to the western edge of the Nipomo 7.5 minute quadrangle map we have presented a revised geologic map that is a mosaic of portions of the Nipomo 7.5 minute quadrangle and the Oceano 7.5 minute quadrangle to better depict the relationship of the Oceano fault to the project site. Inferred strands of the San Luis Range fault system (Wilmar Avenue and Oceano faults) have been mapped or are modeled by USGS (2013) trending northwest-southeast in the vicinity of the campus. The Wilmar Avenue fault is modeled approximately 1.1 miles (1.8 km) northeast of the campus and the Oceano fault is modeled 1.4 miles (2.2 km) southwest of the campus. These faults are mapped as “inferred” and the location is poorly constrained. The USGS fault model is based on widely spaced “nodes” and is noted to be potentially several kilometers from the actual fault location. The revised regional geologic map is presented on Figure 3 - Geologic Map, in Appendix D. The distances of faults from the site presented in Table F-1 in Appendix F are based on the modeled geometry provided by USGS and may not represent the actual distance to the faults.
- The site is in a County-designated zone of low landslide potential (SLOCO 2025).
- The site is not within any State, County, or community designated hazard zone for tsunami inundation. The forecast runup elevation for tsunami is approximately 20 feet locally, while the site is at an elevation of approximately 368 feet (ASCE 2025).
- The Site is not within the downstream inundation zone for Lopez or Twitchell dams (SLOCO 2025).
- FEMA has mapped the site within a Zone X (area of minimal flood hazard) (FEMA 2008).
- The site is in a State-designated zone of low radon potential (Churchill 2008), as indicated on Figure 5 - Indoor Radon Potential Map in Appendix D.
- The potential for naturally occurring asbestos on site is low because serpentinite or serpentinized ultramafic rocks are not exposed at the ground surface, nor are they known to be present at shallow depths that may be disturbed by development at the site.

10.0 CONCLUSIONS

In our opinion, the site is suitable for the proposed buildings and associated improvements, as described in the “Introduction” Section of this report, provided the recommendations contained in the previous Modular Classrooms report (ESP 2017), as modified in the following Section 11.0

Geotechnical Recommendations, are implemented. The primary geotechnical concerns are the potential for strong ground shaking, the presence of fill and the potential for differential settlement, the soil's corrosive potential and erodible nature, and seismic settlement of unsaturated soils.

The site is in a County-designated zone of moderate liquefaction potential (SLOCO 2025). However, as noted in the previous report (ESP 2017), due to the lack of groundwater and the increasing density of the sands with depth, in our opinion, the potential for liquefaction is very low. Also as noted in the previous report (ESP 2017), potential seismic settlement of the unsaturated soils in the upper 50 feet bgs is not anticipated to exceed ¼-inch; however, we performed an updated analysis for seismic settlement of the unsaturated soils, which is discussed below.

The site soils are nonexpansive, therefore no special measures with respect to expansive soils are considered necessary. Frost depth is also not a concern on this site. Provided that the building areas are prepared as recommended, continuous perimeter and interior spread (pad) foundations may be used to support the proposed buildings.

Strong Ground Shaking

The site is in a region of high seismic activity, with the potential for large seismic events that could generate strong ground shaking. A seismic analysis was undertaken to provide current seismic acceleration design parameters. Our methods and the results of the seismic analysis are presented in the "Seismicity" Section of this report. Seismic acceleration parameters should be utilized in the design of the structure so that potential damage is reduced during a seismic event.

Presence of Fill and Potential for Differential Settlement

Fill was found in Borings 1 and 2, on the west sides of the two building areas, to depths of 6.5 and 8.5 feet bgs, respectively. Based on the site plan provided for our use (CLAD 2024), an abandoned conventional on-site effluent disposal system is in the west half of the planned building area. The fill found in the borings is likely related to this effluent disposal system. We are unaware of the disposition of the system (either completely or partially removed, or still in place) and we are unaware of any documentation (i.e., records of grading observation and/or soil compaction testing) regarding the fill. The undocumented fill, and the variable moisture and density conditions of the soils in the borings, can create a potential to stress and damage foundations, which could include severe cracks and displacement, if they are not mitigated. To reduce this potential, a program of overexcavation and recompaction of the bearing soils in the building areas is recommended prior to foundation construction.

Corrosion Potential

As indicated in the Soil Corrosivity Study by CERCO Analytical (ESP 2017, in Appendix B), electrical resistivities of the samples tested were in the mildly corrosive category. The chloride and sulfate ion concentrations were not detected and are therefore insufficient to damage reinforced concrete structures and cement mortar-coated steel. The redox potentials were indicative of aerobic soil conditions. The Soil Corrosivity Study is provided in the previous report (ESP 2017, in Appendix B).

Soil Erosion

The soils are considered to be highly erodible. It is essential that all surface drainage be controlled and directed to appropriate discharge points, and that surface soils, particularly those disturbed during construction, are stabilized by vegetation or other means during and following construction. The architect/engineer should ensure appropriate nonerosive overland escape if storm water drainage systems fail or are overwhelmed during significant storm event(s), so that soils are not eroded.

Settlement of Unsaturated Soils

Use of ⅔ PGA_M as Design Acceleration for Analysis

The reasoning for using ⅔ PGA_M originally stemmed from the limitations of the Pradel method (1998) of calculating dry seismic settlement. This occurred during the code change from ASCE 7-05 to ASCE 7-10 (2013), where it was no longer codified to evaluate liquefaction and seismic settlement as $S_{DS}/2.5$ and evaluation was to be at full PGA. When using the full PGA_M in Pradel's method of calculating dry sand settlement, the potential settlements increased dramatically at high accelerations and resulted in unreasonable amounts of settlement as the data curves defaulted to 10 percent vertical strain. Given these unreasonably high potential settlements, and after much discussion with various jurisdictions, the PGA used for dry seismic analysis was returned to a "design" value since dry seismic shaking will typically not cause bearing failure (unlike liquefaction), which is consistent with this site. PGA_M was considered a maximum credible-type value and S_{DS} is equal to ⅔ S_{MS}, where S_{MS} is the maximum credible-type value.

The method developed above was in response to the PGA recommendation for use in ASCE 7-10. Given that the language regarding the use of PGA_M in Chapter 12 of ASCE 7-16 is consistent with that discussed in ASCE 7-10, it is our interpretation that the use of ⅔ PGA_M may be used as an appropriate acceleration in the analysis of seismic settlement of unsaturated soils.

Analysis and Results

We evaluated the loose to dense, unsaturated sand layers in Boring 3, which we considered representative for our analysis. We used the work of Pradel (1998) to perform our analysis, which required input parameters for PGA, earthquake magnitude and corrected penetration resistance, among others. The input PGA was ⅔ PGA_M as noted in the previous subsection and the earthquake magnitude was developed using a PSHA deaggregation (USGS 2025b). The corrected penetration resistance included that for hammer energy ratio, where our hammer was measured at an energy ratio of 88.9 percent (SPT CAL 2023) (report attached in Appendix E), resulting in an energy ratio (C_E) of 1.48, which was applied to the calculations.

Our analyses indicated that seismically induced settlement corresponding to unsaturated soils will be less than 0.1-inch at the site, and, therefore, does not provide a significant contribution to the total potential settlement at the site. Please see the unsaturated soil settlement calculations in Appendix E for more information on the parameters used.

11.0 UPDATED GEOTECHNICAL RECOMMENDATIONS

All geotechnical recommendations contained in the previous report (ESP 2017) are considered applicable for the current project, with the following additions or modifications:

General (All Sections as Applicable):

- References to ASTM test methods should be understood to mean the latest published versions.
- All references to the 2016 CBC should be understood to mean the equivalent section in the 2022 CBC (CBSC 2022).
- All references to American Concrete Institute (ACI) Documents 318 and 302.1R should be understood to mean the latest published versions.
- All references to the Caltrans Standard Specifications should be understood to mean the 2024 version (Caltrans 2024).
- Any mention of "buildings" in the previous report, as three buildings were planned, should be understood to mean only two buildings that are planned for this project.

Definitions Section: No Updated Recommendations

Site Preparation Section: No Updated Recommendations

Grading Section:

- Replace Paragraph 1 with the following: "Following site preparation, all existing fill soils and deleterious items (septic tank, piping, gravel, etc.) on the west sides of the two building areas should be removed to expose the underlying native soils. Based on the exploratory borings, the depth of removal is expected to be at least 6.5 feet bgs for the northerly building pad, and at least 8.5 feet bgs for the southerly building pad. Overexcavation operations should proceed in an easterly direction; the depth of removal should follow the depth of the existing fill. However, to provide acceptable bearing and settlement conditions, as the depth to native soil becomes shallower, the minimum depth of excavation should be maintained at a minimum of 75 percent of the maximum depth within each building area. If encountered, debris and/or any elements of the abandoned effluent disposal system reportedly in this area should be removed. The excavated soils, once cleared of all debris and deleterious material, may be stockpiled for reuse as engineered fill in the building areas. The resulting excavated native soil surfaces should then be scarified, moisture conditioned to optimum moisture content or just above, and compacted using heavy vibratory compaction equipment."

- Add Paragraph 20: "The architect/engineer should incorporate appropriate measures for grading operations, as needed, to mitigate the low potential for radon activity."

Utility Trenches Section:

- Renumber Paragraph 9 to Paragraph 10.
- Add Paragraph 9: "The architect/engineer should incorporate appropriate measures for utility improvements, as needed, to mitigate the low potential for radon activity."

Foundations Section:

- Delete the term "modular" from all recommendation paragraphs in this Section, as the planned structures will be site-built.
- Add Paragraph 9: "The architect/engineer should incorporate appropriate measures for foundations, as needed, to mitigate the low potential for radon activity."

Slabs-on-Grade and Exterior Pedestrian Flatwork Section:

- Interior Slabs-on-Grade - No Updated Recommendations

- Exterior Pedestrian Flatwork - No Updated Recommendations
- Slabs-on-Grade – General - Add Paragraph 4: "The architect/engineer should incorporate appropriate measures for slabs-on-grade, as needed, to mitigate the low potential for radon activity."

Retaining Walls Section:

In general, due to the relatively flat condition of the site, we assumed that this project would not utilize retaining walls. If retaining walls are not utilized in the final project design, this section of the previous report (ESP 2017, in Appendix B) would still be applicable to provide lateral values for conventional foundation design. If the final design does incorporate retaining walls, we have assumed that they will be a maximum of 3 feet tall, and the following paragraph should be added:

- Add Paragraph 14: "The architect/engineer should incorporate appropriate measures for foundations, as needed, to mitigate the low potential for radon activity."

Asphalt Concrete Paths Section: No Updated Recommendations

Drainage and Maintenance Section: No Updated Recommendations

Observation and Testing Section: No Updated Recommendations

12.0 CLOSURE

Our intent was to provide this update report in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This update report is intended for the exclusive use by the client as discussed in the "Scope of Services" Section. Application beyond the stated intent is strictly at the user's risk.

This report is valid for conditions as they exist at this time for the type of project described herein. The conclusions and recommendations contained in this report could be rendered invalid, either in whole or in part, due to changes in building codes, regulations, standards of geotechnical or construction practice, changes in physical conditions, or the broadening of knowledge.

If changes with respect to the project become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report should comply with the CBC of other applicable standards, and the requirements of the governing jurisdiction.

The recommendations presented in this updated geotechnical report are based upon the geotechnical conditions encountered at the site and may be augmented by additional requirements of the client, or by additional recommendations provided by the geotechnical engineer based on peer or jurisdiction reviews, or conditions exposed at the time of construction. If Earth Systems Pacific is *not* retained to provide construction observation and testing services, it shall not be responsible for the interpretation of the information by others or any consequences arising therefrom.

This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

End of Text.

TECHNICAL REFERENCES

ANSS (Advanced National Seismic System). 2025. *Comprehensive Earthquake Catalog.* Accessed at https://earthquake.usgs.gov/earthquakes/search/

ASCE (American Society of Civil Engineers). 2017. *Minimum Design Loads for Buildings and other Structures.* Standards ASCE/SEI 7-16, ASCE.

ASCE (American Society of Civil Engineers). 2018. *Minimum Design Loads for Buildings and other Structures, Supplement 1.* Effective December 12, 2018.

ASCE (American Society of Civil Engineers). 2021. *Minimum Design Loads for Buildings and other Structures, Supplement 3.* Effective November 5, 2021.

ASCE (American Society of Civil Engineers). 2025. *ASCE Tsunami Design Geodatabase, V.2025-1.0*.

California, State of. 1972. Department of Conservation, California Public Resources Code, Division 2, Chapter 7.5, *Alquist-Priolo Earthquake Fault Zoning Act*.

Caltrans (California Department of Transportation). 2024. *Standard Specifications*.

Cao, Tianqing; Bryant, William A.; Rowshandel, Badie; Branum, David; and Wills, Christopher J. June 2003. *The Revised 2002 California Probabilistic Seismic Hazard Maps.*

CBSC (California Building Standards Commission). 2022. *California Building Code.* California Code of Regulations, Title 24, Part 2.

CDMG (California Division of Mines and Geology). 1986a. *State of California Special Studies Zones, Cholame Quadrangle, Official Map, Effective July 1, 1986.* Scale 1:24,000.

CDMG (California Division of Mines and Geology). 1986b. *State of California Special Studies Zones, Piedras Blancas Quadrangle, Official Map, Effective July 1, 1986.* Scale 1:24,000.

CDMG (California Division of Mines and Geology). 1986c. *State of California Special Studies Zones, San Simeon Quadrangle, Official Map, Effective July 1, 1986.* Scale 1:24,000.

CDWR (California Department of Water Resources). 2025. *Water Data Library. Accessed at:* http://water.ca.gov/waterdatalibrary/

CGS (California Geologic Survey). 2018. *Earthquake Fault Zones - A Guide for Government Agencies, Property Owners/Developers, and Geoscience Practitioners for Assessing Fault Rupture Hazards in California*. Special Publication 42.

TECHNICAL REFERENCES (continued)

CGS (California Geologic Survey). November 2022. *Checklist for Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings.* Note 48.

CGS (California Geological Survey). 2002. *California Geomorphic Provinces*. Note 36.

Churchill, R. K. 2008. *Radon Potential in San Luis Obispo County*. Special Report 208, California Geologic Survey.

CLAD (CLAD Consulting). July 29, 2024. *Preliminary Site Plan with Survey Markers Found and Easements Plotted, Titled "Dana Elementary Survey, 092-121-087, 920 West Tefft Street, Nipomo, California."*

Clark, D.G., D.B. Slemmons, S.J. Caskey, and D.M. dePolo. 1994. *Seismotectonic Framework of Coastal Central California.* Seismotectonics of the Central California Coast Ranges, Geological Society of America Special Paper 292, Ina B. Alterman, Richard B. McMullen. Lloyd S. Cluff, and D. Burton Slemmons eds.

Delattre, Marc, and Mark O. Wiegers, 2014, Preliminary Geologic Map of the Nipomo 7.5' Quadrangle, San Luis Obispo County, California: A Digital Database, scale 1:24,000

Dibblee, T.W., Jr. 1976. *The Rinconada and Related Faults in the Southern Coast Ranges, California, and Their Tectonic Significance*. USGS Professional Paper 981.

DSA (Division of the State Architect). June 11, 2021. *IR A-4 - Geohazard Report Requirements: 2019 California Building Code.*

EERI (Earthquake Engineering Research Institute). January 2005. *The San Simeon, California, Earthquake, December 22, 2003.* An EERI Learning From Earthquakes Reconnaissance Report.

ESP (Earth Systems Pacific). October 27, 2017. *Geotechnical Engineering and Geologic Hazards Report, Dana Elementary School, Modular Classroom Wings, 920 West Tefft Street, Nipomo, California*. File No. SL-17187-SB. Doc. No. 1710-106.SGR.

FEMA (Federal Emergency Management Agency). August 2008. *Flood Insurance Rate Map, Map Number 06079C1638F.*

Finney (Finney Architects). Email dated December 11, 2024. *Information Regarding Planned Project at Dana Elementary School*

TECHNICAL REFERENCES (continued)

Google Earth. 2025. *Google Earth, interactive website.* Accessed at: http://www.google.com/earth/index.html

Helmberger, D.V., P. G. Somerville and E. Garnero. 1992. *The Location and Source Parameters of the Lompoc, California Earthquake of 4 November 1927.* Bulletin of the Seismological Society of America, Vol. 82 No. 4, August 1992.

Holland, Peter J. 2013. *Preliminary Geologic Map of the Oceano 7.5' Quadrangle, San Luis Obispo County, California: A Digital Database.* Scale 1:24,000

Lettis, W. R., and T. N. Hall. 1994. *The Los Osos Fault Zone, San Luis Obispo County, California*. Geological Society of America, Special Paper 292, Ina B. Alterman, Richard B. McMullen, Lloyd S. Cluff, and D. Burton Slemmons eds.

Lettis, W.R., Hanson, K.L., Unruh, J.R., McLaren, M., and Savage, W.U. 2004. *Quaternary Tectonic Setting of South-Central Coastal California.* Evolution of Sedimentary Basins/Offshore Oil and Gas Investigations—Santa Maria Province, U.S. Geological Survey Bulletin 1995-AA, Keller, M.A. ed. Accessed at: http://pubs.usgs.gov/ bul/1995/aa/.

PEER (Pacific Earthquake Engineering Research Center). 2015. *Next Generation Attenuation (NGA)-West ground motion attenuation models and database*. Accessed at https://ngawest2.berkeley.edu/

Pradel, Daniel. 1998. *Procedure to Evaluate Earthquake-Induced Settlements in Dry Sandy Soils.*

SCEDC (Southern California Earthquake Data Center). 2020. *Significant Earthquakes and Faults, Chronological Earthquake Index.* Accessed at: https://scedc.caltech.edu/significant/lompoc1927.html

SEAOC (Structural Engineers Association of California). 2025. *Seismic Design Map Tool*. Accessed at: https://seismicmaps.org/

SLOCO (San Luis Obispo, County of). 2025. Department of Planning and Building, *Land Use View*, interactive website. Accessed at: https://www.slocounty.ca.gov/Departments/Planning-Building/Information-Systems/Services/Land-Use-View.aspx.

SPT Cal. 2023. *SPT Hammer Energy Measurements, Project Title: Earth Systems Santa Maria, Project Description: Gtechdrill GT8Max*.

Treiman, J. A. 1989. *Fault Evaluation Report FER-200, Los Osos Fault Zone, San Luis Obispo County, California.* California Division of Mines and Geology, Fault Evaluation Report FER-200.

TECHNICAL REFERENCES (continued)

USGS (United States Geological Survey). 2025b. “USGS Earthquake Hazard Toolbox" United States Geological Survey. Retrieved from: https://earthquake.usgs.gov/nshmp/

USGS (United States Geological Survey). 2013. *The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3) – The Time Dependent Model.* USGS Open File Report 2013-1165.

USGS (United States Geological Survey). 2014. *Earthquake Scenario Map - An interactive web-based application to access possible earthquake event scenarios*. Accessed at https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=14d2f75c7c4f4619936dac0d14e1e468

USGS (United States Geological Survey). 2025a. *The National Map - A web-based interactive tool to access public domain mapping products and data.* Accessed at: https://viewer.nationalmap.gov/advanced-viewer/

USGS (United States Geological Survey). August 5, 2019. *Earthquake Hazards, M7.9 1857 Fort Tejon Earthquake, The Last “Big One” in Southern California.*

APPENDIX A

BASE MAP PROVIDED BY: Google Earth (2025)

N

NOT TO SCALE

Earth Systems Pacific

4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

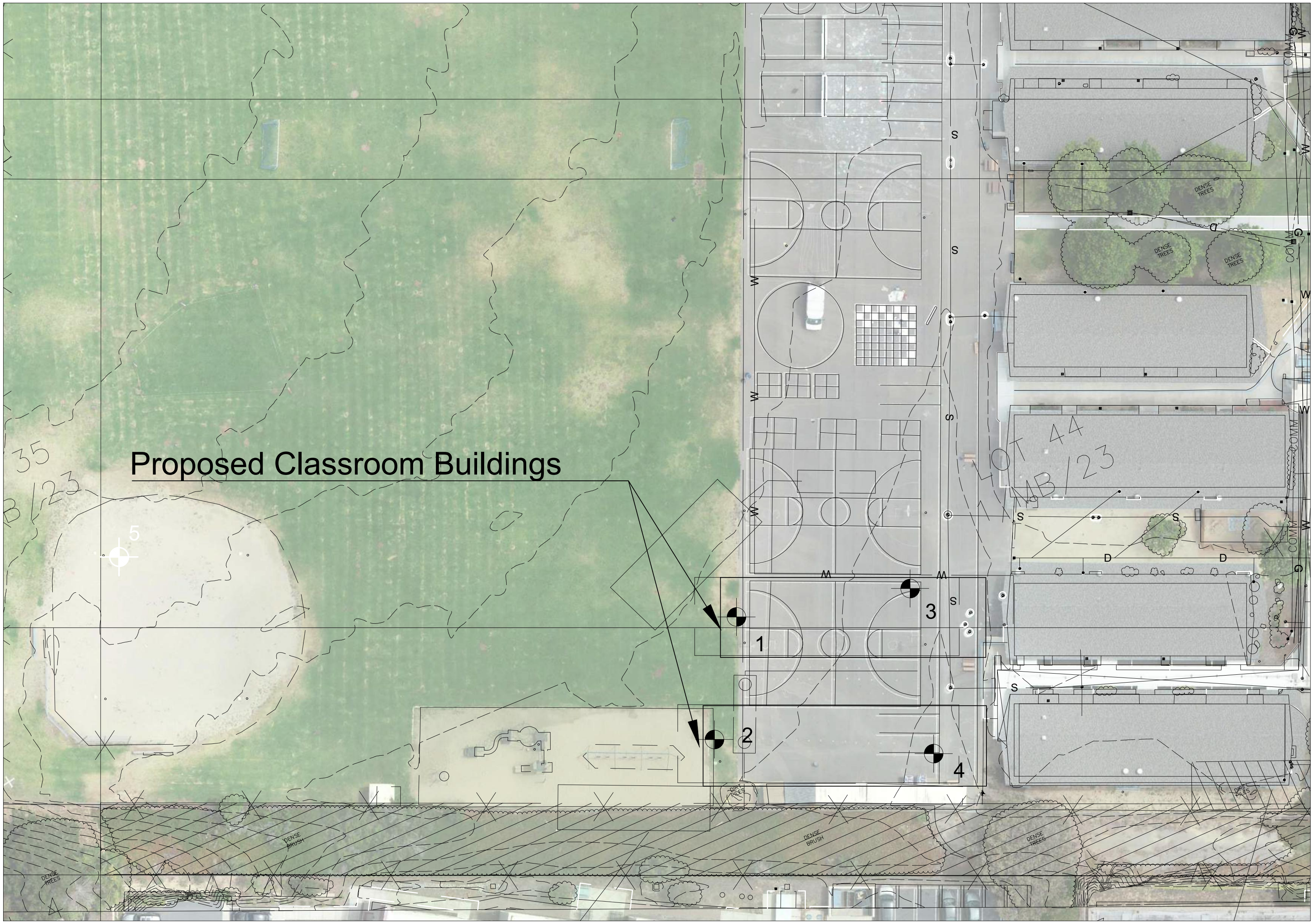
SITE VICINITY MAP

Dana Elementary School Two New Classroom Buildings
920 West Tefft Street
Nipomo, California

Date
February 2025

Project No.
301260-005

Figure 1 of 2



Legend

● Boring Location (Approx.)

BASE MAP PROVIDED BY: CLAD Consulting (July 2024)

True North

Project North
NOT TO SCALE

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

EXPLORATION LOCATION MAP
Dana Elementary School Two New Classroom Buildings
920 West Tefft Street
Nipomo, California

Date
February 2025

Project No.
301260-005

Figure 2 of 2

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	▬
STANDARD PENETRATION TEST (SPT)	●
SHELBY TUBE	▭
BULK	○
SUBSURFACE WATER DURING DRILLING	▼
SUBSURFACE WATER AFTER DRILLING	▽

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
COARSE GRAINED SOILS	MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	○
		GP	POORLY GRADED GRAVELS, OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	⬡
		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	▥
		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	▨
		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	░
		SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	░
		SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	▥
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	▧
FINE GRAINED SOILS	HALF OR MORE OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	▥
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	▧
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	▤
		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	▥
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	▧
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	▤
		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	▽

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET (SATURATED)

CONSISTENCY

COARSE GRAINED SOILS

BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER	
0-10	0-16	LOOSE
11-30	17-50	MEDIUM DENSE
31-50	51-83	DENSE
OVER 50	OVER 83	VERY DENSE

FINE GRAINED SOILS

BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER	
0-2	0-3	VERY SOFT
3-4	4-7	SOFT
5-8	8-13	MEDIUM STIFF
9-15	14-25	STIFF
16-30	26-50	VERY STIFF
OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL BEDROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL BEDROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
UNWEATHERED	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM, FRACTURES: SOME FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY", FELDSPAR CRYSTALS ARE "CLOUDY"
HIGHLY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT, OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend 062719.dwg

Earth Systems Pacific

Boring No. 1

PAGE 1 OF 1
JOB NO.: 301260-005
DATE: 02/25/2025

LOGGED BY: A. Flynn
DRILL RIG: GTech GT 8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

Dana Elementary School
Two New Classroom Buildings
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SP-SM		POORLY GRADED SAND WITH SILT: brown, loose, slightly moist (Fill)					
1				0.0 - 5.0	○			
2			trace pvc tubing and wires	2.0 - 3.5	▬	102.8	6.9	2 3 5
5			medium dense	5.0 - 6.5	▬			3 7 9
7	SP		POORLY GRADED SAND: yellowish brown, medium dense, slightly moist (Older Dune Sand)					
10				10.0 - 11.5	▬	100.8	3.8	4 11 14
15				15.0 - 16.5	▬			6 15 20
20				20.0 - 21.5	▬			5 13 23
22			dense					
23				23.0 - 24.5	▬			9 18 30
25			End of Boring @ 24.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

LOGGED BY: A. Flynn
DRILL RIG: GTech GT 8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

PAGE 1 OF 1
JOB NO.: 301260-005
DATE: 02/25/2025

Dana Elementary School
Two New Classroom Buildings
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SP-SM		POORLY GRADED SAND WITH SILT: brown, loose, slightly moist (Fill)					
1				0.0 - 4.0	○			
2				2.0 - 3.5	▬			4 6 7
3			very moist					
5				5.0 - 6.5	▬	111.2	9.3	1 2 4
8.5	SP		POORLY GRADED SAND: yellowish brown, medium dense, slightly moist (Older Dune Sand)					
10				10.0 - 11.5	▬	104.2	4.4	4 10 13
14			yellowish brown with orange and black mottling					
15				15.0 - 16.5	▬			7 14 20
16.5			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3

LOGGED BY: A. Flynn
DRILL RIG: GTech GT 8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

PAGE 1 OF 1
JOB NO.: 301260-005
DATE: 02/25/2025

DEPTH (feet)	USCS CLASS	SYMBOL	**Dana Elementary School** **Two New Classroom Buildings** **920 West Tefft Street** **Nipomo, California**	SAMPLE DATA				
			SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		■	4.5" ASPHALT CONCRETE / 4.5" AGGREGATE BASE					
1	SP		POORLY GRADED SAND: brown, medium dense, slightly moist (Older Dune Sand)	1.0 - 5.0	○			
2				2.0 - 3.5	▬	102.1	3.0	4 8 10
3			yellowish brown					
4								
5				5.0 - 6.5	▬	104.2	2.4	5 9 13
			light yellowish brown					
6								
7								
8								
9								
10				10.0 - 11.5	▬	102.1	3.0	5 9 13
11								
12								
13								
14								
15				15.0 - 16.5	▬	101.8	3.1	6 15 23
16								
17			End of Boring @ 16.5' No subsurface water encountered					
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4

LOGGED BY: A. Flynn
DRILL RIG: GTech GT 8 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem

PAGE 1 OF 1
JOB NO.: 301260-005
DATE: 02/25/2025

Dana Elementary School
Two New Classroom Buildings
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		■	4.5" ASPHALT CONCRETE / 4.5" AGGREGATE BASE					
1	SP	⁘	POORLY GRADED SAND: brown, medium dense, slightly moist (Older Dune Sand)	1.0 - 5.0	○			
2		⁘		2.0 - 3.5	▬	101.6	2.5	5 9 12
3		⁘	yellowish brown					
5		⁘		5.0 - 6.5	▬	102.5	2.7	4 9 11
10		⁘		10.0 - 11.5	▬			5 13 21
14		⁘	dense					
15		⁘		15.0 - 16.5	▬	105.3	3.0	7 21 30
19		⁘	medium dense					
20		⁘		20.0 - 21.5	▬			5 12 18
22			End of Boring @ 21.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Geotechnical Engineering and Geologic Hazards Report, Dana Elementary School Modular Classroom Wings, Earth Systems Pacific, Doc. No. 1710-106.SGR, dated October 27, 2017

GEOTECHNICAL ENGINEERING AND GEOLOGIC HAZARDS REPORT DANA ELEMENTARY SCHOOL MODULAR CLASSROOM WINGS 920 WEST TEFFT STREET NIPOMO, CALIFORNIA

October 27, 2017

Prepared for

Ms. Cindy Naber
Lucia Mar Unified School District

Prepared by

Earth Systems Pacific
4378 Old Santa Fe Road
San Luis Obispo, CA 93401

Earth Systems
Pacific

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October 27, 2017

FILE NO.: SL-17187-SB

Ms. Cindy Naber
Lucia Mar Unified School District
222 Stanley Avenue
Arroyo Grande, CA 93420

PROJECT: DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 WEST TEFFT STREET
NIPOMO, CALIFORNIA

SUBJECT: Geotechnical Engineering and Geologic Hazards Report

CONTRACT REF: Lucia Mar Unified School District Purchase Order No. 180475, dated August 3, 2017, Referencing Proposal to Provide a Geotechnical Engineering Investigation, Soil Corrosivity Testing, and a Geologic Hazards Assessment, by Earth Systems Pacific, Doc. No.1708-002.PRP, dated August 1, 2017

Dear Ms. Naber:

In accordance with the referenced purchase order, this geotechnical engineering and geologic hazards report has been prepared for use in the development of plans and specifications for the modular classroom wings planned for Dana Elementary School in Nipomo, California.

This report describes the general geotechnical and geologic characteristics, identifies existing and potential geotechnical and geologic hazards, and discusses the impacts that these conditions could have upon the project. Preliminary geotechnical recommendations for site preparation, grading, utility trenches, foundations, slabs-on-grade and exterior pedestrian flatwork, retaining walls, asphalt concrete paths, drainage and maintenance, and observation and testing are presented herein. Soil corrosivity testing and a brief analysis, which were subcontracted to CERCO Analytical of Concord, California, are also provided. Two bound copies and an electronic copy of this report are being provided for your use. As authorized, electronic copies have also been forwarded to Mr. Bryan Hagwood of LMUSD, and Mr. Steve Lane of PMSM Architects.

We appreciate the opportunity to have provided services for this project and look forward to working with you again in the future. If there are any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,
Earth Systems Pacific

Fred J. Potthast, GE
Principal Engineer

Fredrick J. Potthast
GE 2369
Exp. 03/31/18

10/27/17

Richard T. Gorman, CEG
Principal Geologist

Richard T. Gorman
No. CEG 1325

Copy to: LMUSD, Attn.: Mr. Bryan Hagwood
PMSM Architects, Attn.: Mr. Steve Lane

Doc. No.: 1710-106.SGR/tb

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APPENDICES

1.0 INTRODUCTION

Four wings of modular classroom buildings are planned at Dana Elementary School in Nipomo, California. The approximate location of the school is shown on the Site Vicinity Map, Figure 1, in Appendix A. The proposed classroom locations are on the north side of the campus, per the Exploration Location Map ("the Map"), Figure 2, in Appendix A; all directional references are with respect to Project North on the Map. The building areas will range from approximately 2,900 to 4,300 square feet. The stud-frame, single-story modular buildings will be supported by continuous perimeter and interior foundations. The modular buildings could have concrete slabs-on-grade, or raised floors with underlying concrete housekeeping slabs ("rat slabs").

Maximum dead plus live loads on continuous footings of 2 klf, and maximum isolated loads of 25 kips, have been assumed. Cuts and fills a maximum of 2 feet from the existing topography have been assumed. Retaining walls for site work, or connected to or forming part of the structures, may also be constructed. We have assumed the maximum height of retaining walls, if used, will be 3 feet.

The new classroom buildings will be served by the existing campus utility systems. New landscaping, and walkways of either Portland cement concrete (PCC) or asphalt concrete (AC) over aggregate base (AB) will be constructed or re-constructed around the new structures. No vehicle pavement, LID/BMP, or other improvements are planned.

2.0 SCOPE OF SERVICES

The scope of work for this report included site reconnaissance by a registered geotechnical engineer and certified engineering geologist, subsurface exploration, geotechnical and corrosivity laboratory testing (subcontracted to CERCO Analytical) of samples obtained during the field investigation, geotechnical and geologic analyses of the field and laboratory data, and preparation of this report. The analysis and subsequent recommendations were based on general information provided by the client, and by PMSM Architects (PMSM 2017).

This report and preliminary geotechnical recommendations are intended to comply the considerations of Sections 1803A.1 through 1803A.7, J104.3 and J104.4, as applicable, of the 2016 California Building Code (CBC); California Geological Survey Note 48 (CGS 2013); Interpretation of Regulations (IR) Document A-4.13 (DSA 2016); and common geotechnical engineering and engineering geology practice in this area under similar conditions at this time.

The geotechnical test procedures were accomplished in general conformance with the standards noted, as modified by common geotechnical engineering practice in this area under similar conditions at this time.

Preliminary geotechnical recommendations for site preparation, grading, utility trenches, foundations, slabs-on-grade and exterior pedestrian flatwork, retaining walls, asphalt concrete paths, drainage and maintenance, and observation and testing are presented to guide the development of project plans and specifications. The results of geotechnical corrosivity testing and a brief analysis of the results, which were subcontracted to CERCO Analytical, are also provided.

As there may be geotechnical issues yet to be resolved, the geotechnical engineer should be retained to provide consultation as the design progresses, to assist in verifying that pertinent geotechnical issues have been addressed and to aid in conformance with the intent of this report. It may also be advantageous to retain the geotechnical engineer to review the project plans and details as they near completion, to further aid in conformance with the intent of this report.

It is our intent that this report be used exclusively by the client in the preparation of plans and specifications. Application beyond this intent is strictly at the user's risk.

This report does not address issues in the domain of contractors such as, but not limited to, site safety, loss of volume due to stripping of the site, shrinkage of soils during compaction, excavatability, dewatering, shoring, temporary slope angles, construction means and methods, etc. Analyses of the soil for mold potential, man-made products containing asbestos, lead, radioisotopes, hydrocarbons, or chemical properties other than geotechnical corrosivity are beyond the scope of this report. Evaluation of the site for suitability for LID/BMP improvements or drainage basins; ancillary features such as temporary access roads, fences, flag and light poles, signage; and nonstructural fills are not within our scope and are also not addressed.

In the event that there are any changes in the nature, design, or location of improvements, or if any assumptions used in the preparation of this report prove to be incorrect, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are verified or are modified in writing. The criteria presented in this report are considered preliminary until such time as any peer review or review by any jurisdiction has been completed, conditions are observed by the geotechnical engineer and/or geologist in the field during construction, and the recommendations have been verified as appropriate or modified in writing.

3.0 SITE SETTING

Nipomo Elementary School is at 920 West Tefft Street, in Nipomo, California. The school site is located within a developed, primarily residential area. The approximate site coordinates and elevation, as obtained from the Google Earth website (Google 2017), are latitude 35.0284° N and longitude 120.4977° W, and approximately 373 feet above mean sea level (msl). The proposed building area is currently occupied by portable buildings, flatwork, AC pavement and turf, that will all be removed. The building area is generally flat, with a slight slope to the south; the elevation difference (Google 2017) from north to south is approximately 2 feet. The locations and dispositions of utility lines in the proposed building area are unknown.

4.0 FIELD INVESTIGATION

The field investigation consisted of drilling a total of eight exploratory borings on August 26 and September 23, 2017. The borings were drilled to a maximum depth of 51.5 feet below the existing ground surface (bgs), with a Mobile Drill Model B-53 rig, equipped with 6-inch outside diameter hollow stem auger and an automatic trip hammer for sampling. The approximate locations of the borings are shown on the Exploration Location Map, Figure 2, in Appendix A. As the borings were drilled, soil samples were obtained using a ring-lined barrel sampler (ASTM D 3550-17/07 with shoe similar to D 2937-17). Standard penetration tests were also performed in the drill rig borings (ASTM D 1586-11) at selected depths. Bulk soil samples were obtained from the auger cuttings. Upon completion of the drilling operations, all borings were backfilled as required by the San Luis Obispo County Public Health Department.

Soils encountered in the borings were categorized and logged in general accordance with the Unified Soil Classification System and ASTM D 2488-17a. Copies of the boring logs and a Boring Log Legend are included in Appendix A. In reviewing the boring logs and legend, the reader should recognize that the legend is intended as a guideline only, and there are a number of conditions that may influence the soil characteristics as observed during drilling. These include, but are not limited to, cementation, variations in soil moisture, presence of groundwater, and other factors. Consequently, the logger must exercise judgment in interpreting the subsurface characteristics, possibly resulting in descriptions that vary somewhat from the legend.

5.0 LABORATORY ANALYSIS

The ring samples were tested for bulk density (ASTM D 2937-17, as modified for ring liners) and moisture (ASTM D 2216-10). Three ring samples were also tested for consolidation characteristics (ASTM D 2435/D 2435M-11). Bulk samples were tested for maximum density and optimum moisture content (ASTM D 1557-12), cohesion and angle of shearing resistance by direct shear (ASTM D 3080/D 3080M-11, recompacted to 90 percent of maximum dry density, saturated and modified for consolidated, undrained conditions). The geotechnical laboratory test results are presented in Appendix B.

Two bulk samples of the upper soils were sent to CERCO Analytical of Concord, California for geotechnical corrosivity testing. The results of these tests, and CERCO Analytical's brief analysis of the results, are presented in Appendix C.

6.0 GENERAL SUBSURFACE AND GEOLOGIC PROFILE

The general subsurface profile observed in the borings consisted of Fill and Older Dune Sand deposits. The Fill found at the surface in Boring 6 was approximately 6 inches thick, and consisted of well graded sand in a slightly moist condition, with a loose consistency. The Older Dune Sand consisted of poorly graded sand that was slightly moist to moist, with a loose to medium dense consistency. Pavement sections consisting of 1.75 to 4.5 inches of AC over 0.0 to 7.5 inches of AB were also encountered at surface in Borings 1,2,3,5 and 8. Please refer to the boring logs in Appendix A for a more complete description of the subsurface conditions.

7.0 GEOLOGY

Geologic Setting

The site is situated in the Coast Range Geomorphic Province of California. This province is characterized by a system of longitudinal mountain ranges separated by valleys. The mountains generally range in elevation from 2,000 to 4,000 feet, and occasionally to 6,000 feet, above sea level. One of the mountain ranges that lies within this province is the northwest-trending Santa Lucia Range, located approximately 3.5 miles northeast of the site. The general region of the site is bounded to the east by the Nipomo Valley and the Santa Lucia Mountain Range, to the south by Santa Maria Valley and to the west by sand dunes and the Pacific Ocean.

Locally, the site lies within the Nipomo Mesa, which consists of late Pleistocene age (1 million to 11,000 years before present) Older Dune Sand deposits. The preliminary geologic map of the Nipomo Quadrangle prepared by Delattre & Wiegers (2014), indicates that the study area is underlain by older sand dune deposits (see the Geologic Map, Figure 3, in Appendix D). Based on our borings, we concur with Delattre & Wiegers preliminary geologic map, as Older Dune Sand deposits were encountered during the subsurface investigation.

Faulting

Significant Faults

The San Andreas, Hosgri-San Simeon, and Los Osos Faults are the most significant regional *active* faults within a 65-mile radius of the site, which could affect the site. The late Pleistocene-age San Luis Range Fault (Wilmar Avenue Fault segment) is the closest mapped fault (regardless of activity) to the school site. The Wilmar Avenue Fault segment lies approximately 1.2 miles northeast of the site, (see the Historical Earthquake/Fault Map, Figure 4, in Appendix D). Regional faults and locations of historic earthquake events are also depicted on the Historical Earthquake/Fault Map.

San Andreas Fault

The San Andreas Fault, considered to be the most active fault in the general region, lies approximately 40 miles to the east of the site. The San Andreas Fault undergoes a major change in character between Parkfield and Cholame. North of Cholame, the fault moves more or less constantly in a process called creep, whereas the south end of the fault is locked, moving only in very large earthquakes. The last major quake on this part of the fault was the 1857 event (magnitude 7.9). In the immediate vicinity of Parkfield, there is a 20-mile segment that is locked, generating an earthquake every 20 years or so on average. Dated quakes on this segment are 1881, 1901, 1922, 1934, and 1966, and are usually in the magnitude 5.5 to 6.0 range (Bakun 1988). A 6.0 magnitude earthquake occurred on this fault segment on September 28, 2004.

Hosgri-San Simeon Fault

The Hosgri-San Simeon Fault system lies approximately 15 miles to the west of the site. A northwest-trending strike-slip fault, the San Simeon Fault extends from offshore of Ragged Point to just offshore of San Simeon Point, where it joins the northern end of the Hosgri Fault. From this point, the Hosgri Fault extends to an ocean shelf 2 miles west of Point Buchon, and then trends toward the Point Sal area. The fault system is considered active by the United States Geologic Survey (Jennings & Bryant 2010), based on Hall's claims of recent offset terrace deposits along San Simeon Cove, and also by a relocation of the 1927 "Lompoc Earthquake" onto the southern end of the Hosgri Fault (Hall 1975, 1976, 1977).

On December 22, 2003, a 6.5 magnitude earthquake occurred approximately 6 miles northeast of San Simeon, California and approximately 59 miles northwest of the subject site. Analysis by the USGS and the University of California at Berkeley indicated that the event had a thrust (reverse-faulting) mechanism (Goel 2003). The earthquake occurred in the vicinity of the northern end of the Hosgri-San Simeon Fault.

Los Osos Fault

The Los Osos Fault, at its closest point to the site, is approximately 7 miles to the northeast. It consists of four distinct segments. From northwest to southeast, these are the Estero Bay, the Irish Hills, the Lopez Reservoir, and the Newsome Ridge segments. PG&E (1988) suggests that the Irish Hills segment displays the best expressed geomorphic features, displacing late Pleistocene and Holocene deposits. The Irish Hills segment starts in the vicinity of Los Osos and extends to just past San Luis Obispo Creek. A two-mile long segment west of Laguna Lake is considered to be active (Treiman 1989) and is zoned as a State Earthquake Fault Zone under the Alquist-Priolo Act. This active segment lies about 20 miles to the northwest of the site. The Los Osos Fault comprises a northwest-trending series of high- and low-angle faults that exhibit a complex history of both strike-slip and reverse displacement. However, during late Quaternary, movement appears to have been primarily reverse displacement (PG&E, 1988).

San Luis Range Fault (Wilmar Avenue segment)

The San Luis Range Fault is a northwest trending fault with an approximate length of 40 miles (Peterson and others, 1996). The fault system includes the San Luis Bay Fault, the Wilmar Avenue Fault, the Olsen Fault and the Santa Maria River Fault.

The Wilmar Avenue Fault is a northwest-trending, northeast-dipping reverse fault that separates the uplifting San Luis/Pismo structural block from the subsiding Santa Maria Valley block. Cumulative displacement of the 120,000-year-old marine terrace suggests multiple faulting events during the late Pleistocene, but the recurrence interval and timing of the most recent event is uncertain. The fault has poor geomorphic expression suggesting a low rate of activity with little or no Holocene activity. The fault may extend a total of 18 miles from approximately 3 miles offshore to the northern part of the Santa Maria Valley.

Groundwater

Groundwater was not encountered in any of the borings to the maximum depth explored of 51.5 feet bgs.

Information regarding approximate historic highest groundwater (GW) elevations available from the Water Data library website from the Department of Water Resources (DWR 2017) for wells closest to the site is summarized in the following table:

Well Location and State Well No.	GW Elevation, msl
Nipomo Regional Park, Nipomo #11N34W18P002S	92 feet
Nipomo Regional Park, Nipomo #11N34W18P001S	101 feet
Division Street, Nipomo #11N34W19Q001S	257 feet

The two wells listed on the Water Data Library (DWR 2017) website at Nipomo Regional Park are approximately 550 to 1,000 feet northwest of the center of the project area, and the well listed on Division Street is approximately 1.1 miles southeast of the center of the project area. The site is at approximately elevation 373 feet msl (Google 2017), therefore the data for wells closest to the site suggest an historic groundwater elevation in excess of 100 feet below the ground surface.

8.0 SEISMICITY

Earthquake History

The historic seismicity in the site region was researched using EQSEARCH (Blake 2016). The ground motion attenuation relationship used was Boore and others (Boore et al. 1997) for a 2016 CBC Site Class D – stiff soil. EQSEARCH is a software program that performs automated searches of a custom catalog of historical Central California earthquakes. As the program searches the catalog, it computes the epicentral distance from the selected site to each of the earthquakes within the specified search area. The epicentral distances should be considered estimates, particularly for earthquake data prior to 1932, when modern instruments were first used to record earthquake data. The parameters used for the search consisted of earthquake Richter magnitudes ranging from 5.0 to 9.0 that occurred within a 65-mile radius from the site from 1800 to 2016. The site coordinates used in this search are latitude 35.0284° N and longitude 120.4977° W. The Historical Earthquake/Fault Map, Figure 4, in Appendix D graphically depicts the results of the search, including historical earthquake epicenters, their corresponding magnitudes, and faults within the general region of the project.

Results of the search indicated that within the search parameters, 41 earthquakes have occurred. The closest earthquake to the site had a magnitude of 5.0. This earthquake occurred in 1927, was located approximately 2 miles southwest of the site, and was the event with the second highest peak horizontal ground acceleration estimated to have occurred at the site (0.24g). The highest peak horizontal ground acceleration estimated to have occurred at the site from those historical earthquakes is 0.31g. This earthquake had a 7.5 magnitude; it also occurred in 1927, and was located approximately 14.5 miles southwest of the site. This earthquake probably occurred on the southern end of the Hosgri Fault Zone, and is known as the Lompoc earthquake. The largest magnitude earthquake that the search revealed was a 7.9 magnitude earthquake. This earthquake was located approximately 43 miles east and is known as the 1857 earthquake on the San Andreas Fault. It produced an estimated peak horizontal ground acceleration of 0.17g at the site.

Design Acceleration Parameters

In accordance with CGS Note 48 (CGS 2013), Item 16, an assessment was made to determine the need for employing "Site Specific Ground Procedures" for the proposed buildings. It was determined that the site is not located in an Alquist-Priolo Earthquake Fault Zone. In addition, the S_1 ground motion value obtained from the United States Geological Survey Earthquake Hazards Program website (USGS 2017) using the ASCE 7-10 (2013) Standard Analysis Method, for Site Class "D", a "stiff soil" profile, was below 0.75g (S_1= 0.429g), per the table in the following paragraph. Therefore, the project does not require a site-specific ground motion analysis.

To characterize the seismicity at the site and to provide seismic design parameters for the architect/engineer, a General Procedure Ground Motion Analysis was performed to calculate the potential ground motions at the site, using the methods previously described. The results of this analysis are presented in the following table:

SUMMARY OF DESIGN RESPONSE ACCELERATION PARAMETERS

Mapped Spectral Response Acceleration for Site Class B		Site Coefficients for Site Class D		Adjusted MCE Spectral Response Accelerations for Site Class D		Design Spectral Response Accelerations for Site Class D	
Seismic Parameter	Value (g)	Site Coefficient	Value	Seismic Parameter	Value (g)	Seismic Parameter	Value (g)
S_S	1.137	F_a	1.045	S_{MS}	1.188	S_{DS}	0.792
S_1	0.429	F_v	1.571	S_{M1}	0.674	S_{D1}	0.449
Peak Mean Ground Acceleration (PGA_M) = 0.479 g							

Seismic Design Category

Section 1613A.3.5 of the 2016 CBC indicates that structures will be assigned to Seismic Design Category D unless $S_1 \geq 0.75$. The S_1 calculated for the site is 0.429g; therefore, the site would be classified a Seismic Design Category D

9.0 GEOLOGIC HAZARDS

Surface Ground Rupture

Surface ground rupture generally occurs at sites that are traversed by, or lie very near to, a causative fault. The site is not located in any State Earthquake Fault Zones (Bryant & Hart 2007) and there are no mapped faults crossing the site. The closest mapped active fault to the site is the Irish Hills segment of the Los Osos Fault, located approximately 20 miles northwest. Therefore, the potential for surface fault rupture to occur at the site is considered to be very low.

Liquefaction and Seismically Induced Settlement of Dry Sand

The term liquefaction refers to the liquefied condition and subsequent softening that can occur in sandy soils when they are subjected to cyclic strains, such as those generated during a seismic event. Previous studies have concluded that liquefaction within the upper 50 feet of soil can potentially affect improvements at or near the ground surface. Liquefaction refers to a phenomenon that tends to occur in saturated soils of low density that have grain sizes within a certain range, usually fine- to medium-grained poorly graded sands, silty sands, and silts. A sufficiently strong earthquake is also required to cause liquefaction. During liquefaction, the energy from the earthquake causes the water pressure within the pores of the soil to increase. The increase in water pressure decreases the friction between the soil grains, allowing the soil grains to move relative to one another. During this state, the soil will behave as a viscous liquid, temporarily losing its ability to support foundations and other improvements. The high pressure water will flow through the soil along the path of least resistance. As the pressure is released, the soils typically settle in a process called "dynamic settlement." Dynamic settlement can cause damage to structures and other surface and subsurface improvements.

The subsurface investigation encountered loose to medium dense Older Dune Sand deposits. Groundwater was not encountered in any of the borings to the maximum depth drilled of 51.5 feet below the ground surface. As previously noted, historical data from the California Department of Water Resources (DWR), indicates the depth to ground water exceeds 100 feet bgs. It is our opinion that any significant increase in regional groundwater levels is unlikely, therefore the potential for liquefaction to affect the site is considered to be very low to nil.

Due to the variable densities of the sands found in the borings, there does appear to be a potential for a minor amount of seismically induced settlement of dry sand. For additional supporting information and analysis on this topic, please refer to the Seismically Induced Settlement discussion in the "Geotechnical Engineering" Section of this report.

Slope Stability

The site is generally flat with no significant natural slopes on or adjacent to it; therefore, there is no potential for instability of natural slopes to impact the proposed improvements.

Flooding

According to the Flood Insurance Rate Map Number 06079C1638F (see the FEMA Flood Zone Map, Figure 5, in Appendix D), published by the Federal Emergency Management Agency (FEMA 2008), the site is not located within a 100-year flood zone or within Flood Zone X, which indicates that the site area has been determined to have less than a 0.2 percent chance of being flooded in any given year.

Tsunami and Seiche Potential

According to the State of California Tsunami Inundation Zone Map for the County of San Luis Obispo, Oceano Quadrangle (State of California 2009), the project site does not lie within a Tsunami Inundation Zone. Furthermore, the site is located approximately 8 miles from the Pacific Ocean, and at an approximate elevation of 373 feet msl; therefore, the potential for a tsunami to flood the site is nil.

A seiche is a single water wave that can be generated in a reservoir, lake or pond as the result of long-period surface waves normally generated by strong local earthquakes or larger earthquakes at farther distances. There are no reservoirs, lakes, or ponds near the site, therefore, there is no potential for a seiche to affect the project site.

Naturally Occurring Asbestos

There are no naturally occurring asbestos-bearing rock formations (serpentinite or ultramafic rock) on the site. The site is underlain by Older Dune Sand (poorly graded sand), which is not an asbestos-bearing geologic unit. Therefore, there is no potential for naturally occurring asbestos on the site.

Radon

Radon is a naturally-occurring, colorless, odorless gas present in certain soils and rock, which is derived from the decay of radium atoms. The occurrence of radon correlates with the presence of specific minerals, and its concentrations in soil or rock will vary depending on the mineralogy of the surrounding bedrock, temperature, barometric pressure, moisture and other factors. Prolonged exposure to elevated levels of radon is associated with an increased risk of lung cancer. The route of exposure is via inhalation in an enclosed space, such as a structure.

According to Special Report 208, by the California Geological Survey (Churchill 2008) radon is most commonly found in areas of San Luis Obispo County that are underlain by bedrock of the Monterey Formation. As the site is underlain by Older Dune Sand, it is considered to be in an area of low radon potential. The state Radon Potential Map for San Luis Obispo County, California (Churchill 2008) also indicates that the site has a low potential for radon.

10.0 CONCLUSIONS

Geology

It is our opinion that there are no significant local or regional geologic conditions or hazards that would preclude the proposed modular classroom wings and other improvements as described in the "Introduction and Site Setting" section of this report, provided the recommendations contained herein are implemented in the design and construction.

Site Geology

The site is underlain by Older Dune Sand that generally consists of poorly graded sand.

Groundwater

Groundwater was not encountered in any of the borings to the maximum depth explored of 51.5 feet bgs. Based on historic data from the Water Data Library (DWR 2017), the groundwater elevation (not perched) is likely in excess of 100 feet bgs.

Slope Stability

The site is generally flat with no significant natural slopes on or adjacent to it; therefore, there is no potential for instability of natural slopes to impact the proposed improvements.

Seismicity

The site is located within the seismically active southern California area, and moderate to severe ground shaking can be expected during the lives of the proposed improvements. The highest historical mean peak horizontal acceleration estimated to have occurred in the near vicinity of the site within the last 216 years was 0.31g.

Surface Ground Rupture

The site is not located in any State Earthquake Fault Zones and there are no mapped faults crossing the site. The closest *active* fault to the site is the Irish Hills segment of the Los Osos Fault, located approximately 20 miles northwest. Therefore, the potential for surface fault rupture to occur at the site is very low.

Liquefaction and Seismically Induced Settlement

Due to the absence of groundwater in the exploratory borings to the maximum depth explored of 51.5 feet bgs, and as historic data for wells closest to the site suggest a groundwater elevation (not perched) in excess of 100 feet bgs, in our opinion, the potential for liquefaction to occur is considered to be very low to nil. Due to the variable density of the sand soils, there does appear to be a potential for a minor amount of seismically induced settlement of dry sand. For additional information on this topic, please refer to the Seismically Induced Settlement discussion in the "Geotechnical Engineering" Section of this report.

Flooding

The site is not located within a 100-year flood zone or within Flood Zone X, which has been determined to be areas that have less than a 0.2 percent chance of being flooded in any given year.

Tsunami and Seiche Potential

As site is approximately 8 miles from the Pacific Ocean, and at an approximate elevation of 373 feet above sea level, there is no potential for a tsunami to flood the site. There are no reservoirs, lakes, or ponds nearby, therefore there is no potential for a seiche to affect the project site.

Radon

The Radon Potential Hazard Map for Western San Luis Obispo County (Churchill 2008) indicates the site is located within a low radon potential zone.

Naturally Occurring Asbestos

There are no naturally occurring asbestos-bearing rock formations (serpentinite or ultramafic rock) on the site, therefore there is no potential for naturally occurring asbestos to occur on the site.

Geotechnical Engineering

In our opinion, the site is suitable, from a geotechnical engineering standpoint, for the construction of the proposed modular classroom wings and the other site improvements as described in the "Introduction" Section of this report, provided the recommendations contained herein are implemented in the design and construction. The primary geotechnical engineering concerns are as follows: the potential for excessive total and differential settlement due to soil's loose consistency and variable moisture and density conditions; the potential for hydroconsolidation; the potential for a minor amount of settlement under seismic conditions; and the mildly corrosive potential and highly erodible nature of the soils. The site soils were classified as nonexpansive, therefore no special measures with respect to expansive soils are considered necessary. Provided that the building areas are prepared as recommended in the "Grading" Section of this report, continuous perimeter and interior spread (pad) foundations may be used to support the modular classroom buildings.

Total and Differential Settlement

During drilling, the upper soils were classified as being loose to medium dense. The results of our laboratory tests also indicate the upper soils have variable moisture and density characteristics. Such conditions could stress and possibly damage foundations, often resulting in severe cracks and displacement, if they are not mitigated. Therefore, to reduce this potential for excessive total and differential settlement, a program of overexcavation and recompaction of the upper soils in the building areas is recommended prior to foundation construction.

Hydroconsolidation

The results of one-dimensional consolidation testing on ring samples secured from the borings indicate the upper soils have a variable potential for hydroconsolidation, or collapse, under their existing loads if subjected to saturation. The recommended earthwork program to reduce the potential for total and differential settlement, as described in the previous paragraph, will also mitigate the potential for hydroconsolidation, provided the earthwork operations are accomplished with heavy vibratory equipment and that the soils are compacted with moisture contents well above optimum.

Seismically Induced Settlement

As previously noted in the Geology Section of this report, due to the absence of groundwater in the exploratory borings to the maximum depth explored of 51.5 feet bgs, and as historic data for wells closest to the site suggest a groundwater elevation (not perched) in excess of 100 feet bgs, the potential for liquefaction to occur on this site is considered to be very low to nil. However, due to the variable density of the sand soils, there does appear to be a potential for a minor amount of seismically induced settlement. Using the earthquake modal magnitude of 6.5 and a modified PGA value of $2/3(PGA_M)$, and the information contained in Boring 3, total seismically induced settlement of dry sands was calculated at 0.4 inches (see the calculation summary sheet in Appendix E). This analysis neglected the densification of the upper 4 to 5 feet of soil that will occur as part of the recommended earthwork program. In our opinion, if dry sand settlement of the calculated magnitude were to occur, it would be partially attenuated by the layer of recompacted soil at the surface. This magnitude of potential settlement is also considered to be tolerable by properly constructed conventional foundation systems.

Soil Corrosivity

As indicated in the Soil Corrosivity Study by CERCO Analytical in Appendix C, the electrical resistivities of the samples tested resulted in soil classifications of " mildly corrosive". The chloride and sulfate ion concentrations were not detected, and are therefore insufficient to damage reinforced concrete structures and cement mortar-coated steel. The redox potentials were indicative of aerobic soil conditions. The Soil Corrosivity Study provided in Appendix C presents a summary of the test results.

Soil Erosion

The site soils are considered to be highly erodible. It is essential that all surface drainage be controlled and directed to appropriate discharge points, and that surface soils, particularly those disturbed during construction, are stabilized by vegetation or other means during and following construction. The architect/engineer should ensure appropriate non-erosive overland escape if stormwater drainage systems fail or are overwhelmed during significant storm event(s), so that soils are not eroded.

11.0 PRELIMINARY GEOTECHNICAL RECOMMENDATIONS

The following recommendations are for improvements constructed as described in the "Introduction" section of this report. If locations, elevations, structural loads, etc., change, the recommendations contained herein may require modification. In developing the following recommendations, it was assumed that irrigated landscaping or flatwork will be installed within a zone of at least five feet around the perimeter of all structures or other; the intent is to keep the soils in a relatively uniform moisture condition year round.

Two distinct types of Portland cement concrete (PCC) slabs are discussed in the following recommendations. The modular building's interior slabs are defined as "slabs-on-grade"; if the buildings will have raised floors with underlying housekeeping slabs ("rat slabs"), the housekeeping slabs are also defined as "slabs-on-grade". Sidewalks that will not support vehicle traffic are referred to as "exterior pedestrian flatwork", and are also addressed under the "Slabs-On-Grade" section.

Unless otherwise noted, the following definitions are used in the recommendations presented in this report. Where terms are not defined, definitions commonly used in the construction industry are intended.

- **Building Areas –** The building areas are defined as the areas within and extending a minimum of 5 feet beyond the perimeter foundations of each building wing. The building areas include any retaining walls or other improvements that are connected to a structure and that are intended to act in a manner similar to it.
- **Exterior Pedestrian Flatwork and AC Path Areas –** The areas within the footprints of all exterior pedestrian flatwork and AC paths.

- **Sitework Retaining Wall Areas –** The areas within and extending a minimum of 3 feet beyond the foundation limits of all sitework retaining walls.
- **Grading Area –** The entire area to be graded, including the building areas, exterior pedestrian flatwork and AC path areas, and sitework retaining wall areas.
- **Existing Grade:** Elevations of the site that existed as of the date of this report.
- **Finish Pad Grade:** The elevation in the building areas where earthwork operations are typically considered to be complete. It does not include any sand or gravel that might be placed below slabs-on-grade in association with vapor protection for the slabs.
- **Subgrade:** The elevation in exterior pedestrian flatwork and AC path areas where sand or aggregate base AB are placed to support the flatwork or AC path.
- **Scarified:** Plowed or ripped in two orthogonal directions to a depth of not less than 8 inches.
- **Moisture Conditioned:** Unless otherwise noted, adjusting the soil moisture to optimum moisture content, or just above, prior to application of compactive effort.
- **Compacted/Recompacted:** Soils placed in level lifts not exceeding 8 inches in loose thickness and compacted to a minimum of 90 percent of maximum dry density. Based on maximum dry density by ASTM D 1557-12 and field density by ASTM D 6938-17, or other methods acceptable to the geotechnical engineer and jurisdiction.
- **AB (Aggregate Base):** Per Section 26 of the Standard Specifications (Caltrans 2015).

Site Preparation

1. The ground surface in the grading areas should be prepared for construction by removing the existing structures and their foundations, flatwork, and all other improvements not to remain; and all vegetation, large roots, debris, organic topsoil, and other deleterious materials. Existing utility lines that will not remain in service should be either removed or abandoned. The appropriate method of abandonment will depend upon the type and depth of the utility. Recommendations for abandonment can be made as necessary.

2. Voids created by the removal of materials or utilities described above should be called to the attention of the geotechnical engineer. No fill should be placed unless the underlying soil has been observed by the geotechnical engineer.

Grading

1. Following site preparation, the site soils in each building area should be overexcavated to a level plane at 3 feet below the bottom of the deepest foundation, or to 3 feet below lowest existing grade within the building area, whichever is deeper. The resulting excavation should then be scarified, moisture conditioned to at least 3 percent above optimum moisture content, and compacted using heavy vibratory compaction equipment.

2. To create as uniform conditions as possible for each building area, all earthwork operations should be completed throughout each building area in a uniform manner at the same time, from the bottom of the overexcavation through fill placement to finish pad grade. Earthwork operations that complete only a portion of the building area at one time (i.e., "flip-flopping", "checkerboarding," etc.) should not be allowed.

3. Following site preparation, all soil in sitework retaining wall areas should be overexcavated to a level plane at a minimum of 3 feet below the bottom of footing elevation (not including any keyway). The resulting excavated surfaces should be scarified, moisture conditioned to at least 3 percent over optimum moisture content and compacted using heavy vibratory compaction equipment. Overexcavation elevations may be stepped where retaining walls are stepped to conform to any site contours. To reduce the potential for cracking in sitework retaining walls, construction joints should be placed in the wall and the foundation where overexcavation operations have been stepped to conform to any site contours.

4. Following site preparation and any excavations to grade, or prior to placement of fill, the exposed soil surfaces should be scarified, moisture conditioned to at least 3 percent above optimum moisture content and compacted using heavy vibratory compaction equipment.

5. In the balance of the grading areas, following site preparation and any excavations to grade or prior to placement of fill, the prepared soil surfaces should be scarified, moisture conditioned to at least 3 percent above optimum moisture content and compacted using heavy vibratory compaction equipment.

6. Voids created by dislodging cobbles and/or debris during scarification should be backfilled and recompacted, and the dislodged materials should be removed from the work area.

7. In the building areas, previously removed site soils and imported nonexpansive soils may be used to finish pad grade.

8. All fill soil (site derived or imported) should be placed in uniform lifts across the particular building area being constructed; these soils should not be mixed or placed in non-uniform layer thicknesses.

9. In sitework retaining wall areas, previously removed site soils and imported nonexpansive soils may be used as fill.

10. Nonexpansive materials are defined as soils (imported or site derived) that fall in the GW, GM, GC, SP, SW, SC and SM categories per ASTM D 2487-11, and that have an expansion index of 10 or less (ASTM D 4829-11).

11. Imported nonexpansive soils used in the building areas should have strength qualities equal to or better than the site soils, and they should not exceed the geotechnical corrosivity potential of the site soils. See the Soil Corrosivity Study in Appendix C for the corrosivity parameters of the site soils. Proposed imported materials should be reviewed by the geotechnical engineer before being brought to the site, and on an intermittent basis during placement.

12. All materials used as fill should be cleaned of any debris and rocks larger than 3 inches in diameter. When fill material includes rocks, the rocks should be placed in a sufficient soil matrix to ensure that voids caused by nesting of the rocks will not occur and that the fill can be properly compacted.

13. Moisture conditioning of site soils or imported nonexpansive soils used as fill should be to optimum moisture content or just above, prior to applying compaction effort. Heavy vibratory equipment is recommended to compact all site and imported nonexpansive fill soils.

14. Imported soils to be used in landscape areas should be reviewed and approved by the architect or others.

15. Site and imported nonexpansive fill soils and/or AB used to support exterior pedestrian flatwork, as well as the top 12 inches of subgrade in these areas, should be compacted to a minimum of 90 percent of maximum dry density.

16. AB used to support AC paths should be compacted to a minimum of 95 percent of maximum dry density. The top 12 inches of subgrade in these areas should also be compacted to a minimum of 95 percent of maximum dry density.

17. If the soils are overly moist so that they become unstable, or if the minimum recommended compaction cannot be readily achieved, drying the soil so that it is nearer optimum moisture content, may be necessary. Placement of gravel layers, geotextiles, or geogrids may also be necessary to help stabilize unstable soils. Additional overexcavation may also be recommended to correct unstable conditions or if soft or loose conditions are encountered during grading. No fill should be placed in any grading area if the underlying soil is unstable.

18. The recommended soil moisture contents should be maintained throughout construction, and during the lives of the structures and sitework improvements. Failure to maintain the soil moisture content can result in loosening of the soil and disturbance, which are an indication of degradation of the soil compaction. If soils near improvements such as foundations, flatwork, etc. are disturbed, damage to those improvements may result. Soils that have been disturbed should be removed, moisture conditioned, and recompacted.

19. Permanent cut and fill slopes should not be steeper than 2:1 (horizontal to vertical), unless otherwise recommended by the geotechnical engineer.

Utility Trenches

1. Utility trenches adjacent to foundations should not be excavated within the zone of foundation influence, as shown in Typical Detail A in Appendix F.

2. Utilities that must pass beneath foundations should be placed with properly compacted utility trench backfill and the foundation should be designed to span the trench. The architect/engineer should designate an appropriate detail for deepening of the footing and encasement of utility lines that pass within 3 footing widths below the bottom of foundations.

3. A select, noncorrosive, granular, easily compacted material should be used as bedding and shading immediately around utilities. Within building areas, trench backfill above the select material should match the type of material exposed in the sidewalls with respect

to expansion potential. In exterior pedestrian flatwork and AC path areas, trench backfill should match the thickness of the nonexpansive material or AB used to support these improvements.

4. In general, trench backfill should be compacted to a minimum of 90 percent of maximum dry density. Trench backfill in top 12 inches of subgrade, and all AB, in AC path areas should be compacted to a minimum of 95 percent of maximum dry density.

5. Prior to applying compactive effort, soils should be moisture conditioned. Trench backfill should be placed in level lifts not exceeding 6 inches in loose thickness and compacted to the minimums recommended above.

6. Due to the erodibility of the site soils, compaction of trench backfill by jetting or flooding is not recommended at this site. However, to aid in *encasing* utility conduits, particularly corrugated drain pipes, and multiple, closely-spaced conduits in a single trench with the bedding and shading material, jetting or flooding may be useful. Flooding or jetting should only be attempted with extreme caution, and any flooding or jetting operation should be subject to review by the geotechnical engineer.

7. Long-term settlement of properly compacted imported site soils or imported nonexpansive material should be assumed to be about 0.25 to 0.5 percent of the depth of the backfill. Improvements that are constructed over or near trenches should be designed to accommodate the potential for settlement.

8. The Soil Corrosivity Study by CERCO Analytical in Appendix C should be used by the architect/engineer in specifying appropriate corrosion protection measures for utility improvements.

9. The recommendations of this section are minimums only, and may be superseded by the architect/engineer based upon soil corrosivity or the requirements of pipe manufacturers, utility companies or the governing jurisdiction.

Foundations

1. The modular buildings may be supported by continuous perimeter and interior spread footings bearing in firm recompacted soils, as recommended in the "Grading" Section of this report.

2. Due to the potential for loosening at the surface, all footings for the modular buildings should have a minimum embedment depth of 18 inches below the lowest adjacent grade within 7 feet laterally from the bottom of the footing, and a minimum width of 12 inches. Spread footings should be at least 24 inches square.

3. Continuous footings for the modular buildings should be reinforced in accordance with the requirements of the architect/engineer; minimum continuous footing reinforcement for the modular buildings should consist of two No. 4 rebars, one at the top and one at the bottom. Modular building spread footing reinforcement should be determined by the architect/engineer.

4. Modular building footings bearing in firm nonexpansive recompacted soil may be designed using a maximum allowable bearing capacity of 2,000 psf dead load plus live loads. Using this value, maximum settlement and differential settlement are expected to be less than 3/4- inch and less than 3/8-inch in 25 feet, respectively.

5. The allowable bearing capacity may be increased by one-third when transient loads such as wind or seismicity are included. Foundations may be designed using the site design response parameters contained in the Summary of Design Response Parameters table in the "Seismicity" Section of this report.

6. To calculate resistance to lateral loads, the values presented in the "Retaining Walls" Section of this report should be used. Lateral capacity is based on the assumption that any backfill adjacent to conventional foundations has been properly compacted. Passive and friction components of resistance may be combined in the analysis without reduction to either value. The architect/engineer should designate lateral force resisting systems for adjustable foundations.

7. Footing excavations should be observed by the geotechnical engineer prior to placement of reinforcing steel. Footing excavations should be moistened and no desiccation cracks should be present prior to concrete placement.

8. The Soil Corrosivity Study by CERCO Analytical in Appendix C should be used by the architect/engineer in specifying appropriate corrosion protection measures for all foundation elements.

Slabs-on-Grade and Exterior Pedestrian Flatwork

Interior Slabs-on-Grade

1. Interior slabs-on-grade should have a minimum thickness of 4 full inches. They should be reinforced and doweled to foundations per the specifications of the architect/engineer. At a minimum, interior slabs should be reinforced with No. 3 rebar at 24 inches on center each way. All structural slabs should contain minimum rebar meeting the criteria of ACI 318, Section 7.6.1.1 (ACI 2014). At a minimum, foundation dowels should be lap spliced to the slab rebar. The size and spacing of the dowels should match the size and spacing of the slab rebar.

2. Housekeeping slabs ("rat slabs"), if used below raised floors, should have a minimum thickness of 2 inches. These slabs can be placed directly on subgrade compacted as recommended in the "Grading" Section of this report. Depending upon tolerable cracking, as determined by the architect/engineer and/or the client, housekeeping slabs can be unreinforced, or welded wire mesh (6x6 – 10/10) could be placed at the slab midpoint, or minimum rebar meeting the criteria of ACI 318, per Paragraph 1 of this section, could be used.

Exterior Pedestrian Flatwork

1. Exterior pedestrian flatwork should have a minimum thickness of 4 inches. Minimum reinforcement for exterior pedestrian flatwork should consist of No. 3 rebar placed at 24 inches on-center each way.

2. In conventional construction, it is common to use 4 to 6 inches of sand below exterior pedestrian flatwork. As the site soils, and any imported soils used to support exterior pedestrian flatwork, will be nonexpansive, this conventional construction practice is considered acceptable.

3. Flatwork should be constructed with frequent joints to allow articulation as the flatwork moves in response to seasonal soil temperature and moisture variations. The soil below flatwork should be moisture conditioned prior to casting the flatwork.

4. Flatwork at doorways, and at other areas where maintaining the elevation of the flatwork is desired, should be doweled to the perimeter foundations, at a minimum, by No. 3 dowels lapped to the flatwork rebar at 24 inches on center. In other areas, the flatwork may be doweled to the foundation or the flatwork may be allowed to "float free," at the discretion of the architect/engineer. Flatwork that is intended to float free should be separated from foundations by a felt joint or other means.

Moisture Vapor Transmission

1. Due to the current use of impermeable floor coverings, water-soluble flooring adhesives, and the speed at which buildings are now constructed, moisture vapor transmission through slabs is a much more common problem than in past years. Where moisture vapor transmitted from the underlying soil would be undesirable, slabs should be protected from subsurface moisture vapor. A number of options for vapor protection are discussed below; however, the means of vapor protection, including the type and thickness of the vapor retarder, if specified, are left to the discretion of the architect/engineer.

2. Where specified, vapor retarders should conform to ASTM Standard E 1745-17. This standard specifies properties for three performance classes; Class A, B and C. The appropriate class should be selected based on the sensitivity of floor coverings to moisture intrusion and the potential for damage to the vapor retarder during placement of slab reinforcement and concrete.

3. Several recent studies, including ACI 302.1R15 (ACI 2015), have concluded that excess water above the vapor retarder increases the potential for moisture damage to floor coverings and could increase the potential for mold growth or other microbial contamination. The studies also concluded that it is preferable to eliminate the typical sand layer beneath the slab and place the slab concrete in direct contact with a Class A vapor retarder, particularly during wet weather construction. However, placing the concrete directly on the vapor retarder requires special attention to using the proper vapor retarder, a very low water-cement ratio in the concrete mix, and special finishing and curing techniques.

4. Probably the next most effective option would be the use of vapor-inhibiting admixtures in the slab concrete mix and/or application of a sealer to the surface of the slab. This would also require special concrete mixes and placement procedures, depending upon the recommendations of the admixture or sealer manufacturer.

5. Another option that may be a reasonable compromise between effectiveness and cost considerations is the use of a subslab vapor retarder protected by a sand layer. If a Class A vapor retarder is specified, the retarder can be placed directly on the site soil. The retarder should be covered with a minimum 2 inches of *clean* sand. If a less durable vapor retarder is specified (Class B or C), a minimum of 4 inches of clean sand should be provided, and the retarder should be placed in the center of the clean sand layer. Clean

sand is defined as a well or poorly graded sand (ASTM D 2487-11) of which less than 3 percent passes the No. 200 sieve. The site soils do not fulfill the criteria to be considered clean sand.

6. Regardless of the underslab vapor retarder selected, proper installation of the retarder per ASTM E 1643-11/17 is critical for optimum performance. Where utilized, the vapor retarder should be placed a minimum of 1 inch above the flow line of the drainage path surrounding the structures, or 1 inch above the area drain grates if area drains are used to collect runoff around the structures, or 2 inches above the invent of any adjacent retaining wall drains. All seams must be properly lapped, and all seams and utility penetrations properly sealed in accordance with the vapor retarder manufacturer's recommendations.

7. If the sand is used between the vapor retarder and the slab, it should be moistened only as necessary to promote concrete curing; saturation of the sand should be avoided, as the excess moisture would be on top of the vapor retarder, potentially resulting in vapor transmission through the slab for months or years.

8. Positive drainage away from the buildings should be maintained; see the "Drainage and Maintenance" section of this report for additional discussion of this issue. If water is allowed to pond near the structures, it may seep into the ground and migrate laterally through cracks or utility penetrations in the foundations, ultimately gaining access above the vapor retarder.

Slabs-on-Grade - General

1. To reduce shrinkage cracks in all interior and exterior slabs-on-grade, the concrete aggregates should be of appropriate size and proportion, the water/cement ratio should be low, the concrete should be properly placed and finished, contraction joints should be installed, and the concrete should be properly cured. This is particularly applicable to slabs that will be cast directly upon a vapor retarder and those that will be protected from transmission of vapor by use of admixtures or surface sealers. Concrete materials, placement, and curing specifications should be at the direction of the architect/engineer; AC 302.1R15 (ACI 2015) is suggested as a resource for the architect/engineer in preparing such specification.

2. To provide stability for curbs adjacent to pavement areas or exterior pedestrian flatwork, they should be set back a minimum distance equal to one-third the height of any adjacent descending slope, but not less than 5 feet from the tops of slopes. Alternately, curbs may be deepened to provide stability. The geotechnical engineer should review, on an individual basis, any situation where curbs must be deepened to meet this recommendation.

3. The Soil Corrosivity Study by CERCO Analytical in Appendix C should be used by the architect/engineer in specifying appropriate corrosion protection measures for all slabs-on-grade.

Retaining Walls

1. Retaining walls connected to or forming part of a building should be founded in firm soil that has been recompacted per the "Grading" Section of this report. Foundations for all retaining walls should have minimum overall depths (not including any keyway) of 18 inches below lowest grade within 7 feet laterally of any adjacent slope.

2. Retaining wall footings should be reinforced in accordance with the requirements of the architect/engineer; minimum retaining wall footing reinforcement should consist of two No. 4 rebars, one at the top and one at the bottom.

3. Retaining wall design may be based on the following parameters:

Retaining Wall Design Parameters

Parameter	Backfill Type	Value
Active Equivalent Fluid Pressure	Onsite Soils or Imported Nonexpansive Sand/Gravel	35 pcf
At-rest Equivalent Fluid Pressure	Onsite Soils or Imported Nonexpansive Sand/Gravel	50 pcf
Passive Equivalent Fluid Pressure	Recompacted Onsite or Imported Nonexpansive Soil	375 pcf
Maximum Toe Pressure	Recompacted Onsite or Imported Nonexpansive Soil	2,000 psf
Coefficient of Sliding Friction	Recompacted Onsite or Imported Nonexpansive Soil	0.40

4. No surcharges are taken into consideration in the values presented in the previous paragraph. The maximum toe pressure is an *allowable* value; no factors of safety, load factors or other factors have been applied to the remaining values. With the exception of the maximum toe pressure, these values will require application of appropriate factors of safety, load factors, and/or other factors as deemed appropriate by the architect/engineer.

5. The upper foot of backfill behind all retaining walls should consist of native soil, except in areas where exterior pedestrian flatwork or AC paths will abut the top of the wall. In such cases, the backfill soil should extend to the sand, aggregate base, or other material below the improved surface, as appropriate. If gravel backfill is utilized, the gravel should be encased in a permeable synthetic filter fabric conforming to standard specification section 96-1.02B – Class C (Caltrans 2015).

6. The active and at-rest pressures presented in Paragraph 3 are applicable to a horizontal retained surface behind the wall. Walls having a retained surface that slopes upward from the wall should be designed for an additional equivalent fluid pressure of 1 pcf for the active case and 1.5 pcf for the at-rest case, for every two degrees of slope inclination.

7. It is assumed that retaining wall heights will not exceed 4 feet. Therefore, per Section 1803A.5.12.1 of the 2016 CBC, dynamic seismic lateral earth pressures are not required. If retaining walls are planned with more than 6 feet of backfill, the geotechnical engineer should be notified to provide dynamic seismic lateral earth pressure coefficients.

8. Long-term settlement of properly compacted native soil or imported sand or gravel retaining wall backfill should be assumed to be about 0.25 to 0.5 percent of the depth of the backfill. Improvements that are constructed near the tops of retaining walls should be designed to accommodate long-term settlement.

9. All retaining walls should be drained with perforated pipe encased in a free-draining gravel blanket. The pipe should be placed perforations downward, and should discharge in a nonerosive manner away from foundations and other improvements. The gravel blanket should have a width of approximately 1 foot and should extend upward to approximately 1 foot from the top of the wall backfill. The upper foot should be backfilled with native soil, except in areas where pavement or exterior pedestrian flatwork or AC paths will abut the top of the wall. In such cases, the gravel should extend to the sand, aggregate base, or other material below the improved surface, as appropriate. To reduce

infiltration of the soil into the gravel, a permeable synthetic filter fabric conforming to Standard Specifications Section 96-1.02B – Class C (Caltrans 2015), should be placed between the two. Manufactured synthetic drains, such as Miradrain or Enkadrain are acceptable alternatives to the use of gravel, provided they are installed in accordance with the recommendations of the manufacturer.

10. Where weep hole drainage can be properly discharged, the perforated pipe may be omitted in lieu of weep holes on maximum 4-foot centers. A filter fabric as described above should be placed between the weep holes and the drain gravel.

11. Walls facing areas where moisture transmission through the wall would be undesirable should be *thoroughly* waterproofed in accordance with the specifications of the architect/engineer.

12. The architect/engineer should bear in mind that retaining walls by their nature are flexible structures, and that surface treatments on walls often crack. Where walls are to be plastered or otherwise have a finish applied, the flexibility should be considered in determining the suitability of the surfacing material, spacing of horizontal and vertical control joints, etc. The flexibility should also be considered where a retaining wall will abut or be connected to a rigid structure, and where the geometry of the wall is such that its flexibility will vary along its length.

13. The Soil Corrosivity Study by CERCO Analytical in Appendix C should be used by the architect/engineer in specifying appropriate corrosion protection measures for retaining walls.

Asphalt Concrete Paths

1. Paths for pedestrian access may be constructed of AC over AB. Design methods for AC pavement do not typically consider pedestrian loading only. Therefore, the section design is typically based on local experience and anticipated life span. For this application, a pavement section of at least 2.0 inches of AC over at least 2.0 inches of AB is considered appropriate.

2. AB should conform to the requirements of Section 26 of the Standard Specifications (Caltrans 2015). AC should conform to the requirements of Section 32 of the Standard Specifications (Caltrans 2015).

3. AB used to support AC paths should be compacted to a minimum of 95 percent of maximum dry density. The top 12 inches of subgrade in these areas, if consisting of nonexpansive or low expansion material, should also be compacted to a minimum of 95 percent of maximum dry density.

4. Subgrade and aggregate base should be firm and unyielding when proofrolled with heavy, rubber-tired grading equipment prior to continuing construction.

Drainage and Maintenance

1. Per Section 1804A.4 of the 2016 CBC, unpaved ground surfaces should be *finish graded* to direct surface runoff away from foundations and other improvements at a minimum 5 percent grade for a minimum distance of 10 feet. The site should be similarly sloped to drain away from foundations, and other improvements during construction. Where this is not practicable due to other improvements, etc., swales with improved surfaces, area drains, or other drainage facilities, should be used to collect and discharge runoff.

2. All eaves of the buildings should be fitted with roof gutters. Runoff from flatwork, roof gutters, downspouts, planter drains, area drains, etc. should discharge in a nonerosive manner away from foundations and other improvements in accordance with the requirements of the governing agencies. Erosion protection should be placed at all discharge points unless the discharge is to a pavement surface.

3. To reduce the potential for planter drainage gaining access to subslab areas, any raised planter boxes adjacent to foundations should be installed with drains and sealed sides and bottoms. Drains should also be provided for areas adjacent to the structures and in landscape areas that would not otherwise freely drain.

4. If housekeeping slabs ("rat slabs") are not used below the raised floors of the modular buildings, the subfloor areas should be graded to a low point or a series of low points, and drain inlets should be provided at the low points to direct any accumulated water to an appropriate outlet. As an alternative to surface drain inlets in the subfloor area, gravel drains or prefabricated panel-type intercept drains can be provided in the subfloor area to collect and discharge accumulated water. The gravel drains should be a minimum of 12 inches wide and 12 inches deep, and drained with a rigid perforated PVC pipe. If gravity flow to an appropriate outlet cannot be provided, the drains should be extended to a sump that can be monitored and pumped as needed.

5. The on-site soils are highly erodible. If soils are disturbed during construction, stabilization of soils by vegetation or other means, *during* and *following* construction, is essential to reduce erosion damage. Care should be taken to establish and maintain vegetation. The landscaping should be planned and installed to maintain the surface drainage recommended above. Surface drainage should also be maintained during construction.

6. Maintenance of drainage and other improvements is critical to the long-term stability of the site and the integrity of the structures. Site improvements should be maintained on a regular basis.

7. Finished flatwork surfaces should be sloped to freely drain toward appropriate drainage facilities. Water should not be allowed to stand or pond on or adjacent to exterior pedestrian flatwork, or other improvements as it could infiltrate into the AB and/or subgrade, causing premature deterioration of flatwork or other improvements.

8. All exterior drains, retaining wall drains, and drain outlets should be maintained to be free-flowing. Care should be taken to establish and maintain vegetation. Vegetation and erosion matting (if utilized) should be maintained or augmented as needed. Irrigation systems should be maintained so that soils around structures are maintained at a relatively uniform year-round moisture content, and are neither over-watered nor allowed to dry and desiccate.

9. To reduce the potential for disruption of drainage patterns and undermining of structures, fill areas, etc., all rodent activity should be aggressively controlled.

Observation and Testing

1. It must be recognized that the recommendations contained in this report are based on a limited number of borings and rely on continuity of the subsurface conditions encountered.

2. It is assumed that the geotechnical engineer will be retained to provide consultation during the design phase, to interpret this report during construction, and to provide construction monitoring in the form of testing and observation.

3. At a minimum, the geotechnical engineer should be retained to provide:
    - Professional observation during grading, trench and retaining wall backfill, and foundation construction
    - Oversight of special inspection and compaction testing grading, trench and retaining wall backfill, and foundation construction

4. Special inspection of grading and backfill should be provided as per Section 1705A.6 and Table 1705A.6 of the 2016 CBC. The special inspector should be under the direction of the geotechnical engineer. At a minimum, the following items should be inspected and/or tested by the special inspector:
    - Stripping and clearing of all existing improvements, vegetation, and deleterious materials
    - Overexcavation of the building and sitework retaining wall areas to the recommended depths
    - Scarification and moisture conditioning of overexcavated areas
    - Scarification and moisture conditioning of exterior pedestrian flatwork and AC path areas, and all other grading areas
    - Fill quality, placement, moisture conditioning and compaction
    - Utility trench backfill
    - Foundation excavations

5. A program of quality assurance should be developed prior to beginning construction. At a minimum, the program should include all geotechnical items shown on the testing and inspection schedule of the approved plans. It should also include any additional inspection items required by the engineer and/or the governing jurisdiction. These items should be discussed at a preconstruction site meeting among a representative of the owner, the geotechnical engineer, special inspector, the project inspector, the engineer, and contractors. The geotechnical engineer should be notified at least 48 hours prior to beginning grading operations.

6. Locations and frequency of compaction tests should be as per the recommendation of the geotechnical engineer at the time of construction. The recommended test location and frequency may be subject to modification by the geotechnical engineer, based upon soil and moisture conditions encountered, size and type of equipment used by the contractor, the general trend of the results of compaction tests, or other factors.

12.0 CLOSURE

Our intent was to perform the investigation in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing in the locality of this project under similar conditions. No representation, warranty, or guarantee is either expressed or implied. This report is intended for the exclusive use by the client as discussed in the "Scope of Services" section. Application beyond the stated intent is strictly at the user's risk.

This report is valid for conditions as they exist at this time for the type of project described herein. The conclusions and recommendations contained in this report could be rendered invalid, either in whole or in part, due to changes in building codes, regulations, standards of geotechnical or construction practice, changes in physical conditions, or the broadening of knowledge.

If changes with respect to the project become necessary, if items not addressed in this report are incorporated into plans, or if any of the assumptions used in the preparation of this report are not correct, this firm shall be notified for modifications to this report. Any items not specifically addressed in this report should comply with the CBC of other applicable standards, and the requirements of the governing jurisdiction.

The preliminary recommendations presented in this geotechnical report are based upon the geotechnical conditions encountered at the site, and may be augmented by additional requirements of the client, or by additional recommendations provided by the geotechnical engineer based on peer or jurisdiction reviews, or conditions exposed at the time of construction.

This document, the data, conclusions, and recommendations contained herein are the property of Earth Systems Pacific. This report shall be used in its entirety, with no individual sections reproduced or used out of context. Copies may be made only by Earth Systems Pacific, the client, and the client's authorized agents for use exclusively on the subject project. Any other use is subject to federal copyright laws and the written approval of Earth Systems Pacific.

Thank you for this opportunity to have been of service. If you have any questions, please feel free to contact this office at your convenience.

TECHNICAL REFERENCES

ACI (American Concrete Institute). 2014. “Building Code Requirements for Structural Concrete.” *Document 318-14.*

ACI (American Concrete Institute). 2015. "Guide for Concrete Floor and Slab Construction." *Document 302.1R15.*

ASCE (American Society of Civil Engineers). 2013 *Minimum Design Loads for Buildings and other Structures (7-10, third printing), Standards ASCE/SEI 7-10*

Bakun, W. H. 1988. “The Earthquake Prediction Experiment at Absence, California.” *Earthquakes and Volcanoes* 20 (2), United States Geological Survey.

Blake, T. F. [2000] 2016. EQSEARCH: A Computer Program for the Estimation of Peak Horizontal Acceleration from California Historical Earthquake Catalogs [software]. http://thomasfblake.com.

Boore, D. M., W. B. Joyner, and T. E. Fumal. 1997. *Equations for Estimating Horizontal Response Spectra and Peak Acceleration from Western North American Earthquakes: A Summary of Recent Work,* United States Geological Survey Open File Report (93-509).

Bryant, W. A. & Hart, E. W. [1997] Revised 2007. *Fault-Rupture Hazard Zones in California,* California Division of Mines and Geology Special Publication 42.

Caltrans (California Department of Transportation). 2015. *Standard Specifications.*

CGS (California Geologic Survey) Note 48. October 2013. Checklist for Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings.

Jennings, C. W. and Bryant, W. A., “Fault Activity Map of California,” *California Geological Survey*, 2010.

Churchill, R. K. 2008. “Radon Potential in San Luis Obispo County.” *Special Report 208,* California Geologic Survey.

Delattre, M., P. & Wiegers, M.O., 2014. “Preliminary Geologic Map of the Nipomo Quadrangle, San Luis Obispo County, California,” California Geological Survey.

DSA. (Division of the State Architect). October 7, 2016. Interpretation of Regulations IR A-4.13, “Geohazard Report Requirements: 2013 and 2016 CBC”.

DWR. (Department of Water Resources). 2017. Water Data Library [website], retrieved from: http://www.water.ca.gov/waterdatalibrary/index.cfm

TECHNICAL REFERENCES (Continued)

FEMA (Federal Emergency Management Agency). August 28, 2008. “Flood Insurance Rate Map,” Map Number 06079C1638F

Google. (US Dept. of State Geographer). 2017. Google Earth [website], retrieved from: http://www.google.com/earth/index.html

Goel, Rakesh K. 2003. "Preliminary Report on December 22, 2003 San Simeon Earthquake," Earthquake Engineering Research Institute, http://works.bepress.com/rgoel/28

Hall, C. A. 1975. "San Simeon-Hosgri Fault System, Coastal California: Economic and Environmental Implications." *Science* 190 (4221), 1291-1294.

Hall, C. A. 1976. "San Simeon-Hosgri Fault System, Coastal Central California: Economic and Environmental Implications." *Geological Society of America Abstracts with Programs* vol. 8 p. 38.

Hall, C. A., “Origin and Development of Lompoc-Santa Maria Pull-Apart Basin and Its Relation to the San Simeon-Hosgri Fault, California (abstract),” *Abstracts with Programs,* Vol. 9, No. 4, Geological Society of America, 1977.

Jennings, Charles W. and William A. Bryant. 2010. " Fault Activity Map of California," *California Geological Survey.*

Petersen, Mark D., William A. Bryant, Chris H. Cramer, Tianqing Cao, and Michael Reichle. 1996. *Probabilistic Seismic Hazard Assessment for the State of California,* California Division of Mines and Geology Open File Report 96-08.

PG&E. Pacific Gas & Electric, Diablo Canyon Power Plant Long Term Seismic Program, Pacific Gas & Electric Company, *United States Government Document*, 1988.

PMSM (PMSM Architects). June 14, 2017. Code Site Plan for Dana Elementary School, Modular Classroom Wings

State of California, 2009. “Tsunami Inundation Map for Emergency Planning.” County of San Luis Obispo. *Oceano Quadrangle.*

Treiman, J. A. 1989. “Fault Evaluation Report FER-200, Los Osos Fault Zone, San Luis Obispo County, California.” *California Division of Mines and Geology, Fault Evaluation Report FER-200.*

USGS (United States Geological Survey). 2017. Earthquake Hazards Program, retrieved from: http://earthquake.usgs.gov/hazards/designmaps/

APPENDIX A

Figure 1 – Site Vicinity Map
Figure 2 - Exploration Location Map
Boring Log Legend
Boring Logs

BASE MAP PROVIDED BY: GOOGLE EARTH, 2017

NOT TO SCALE

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

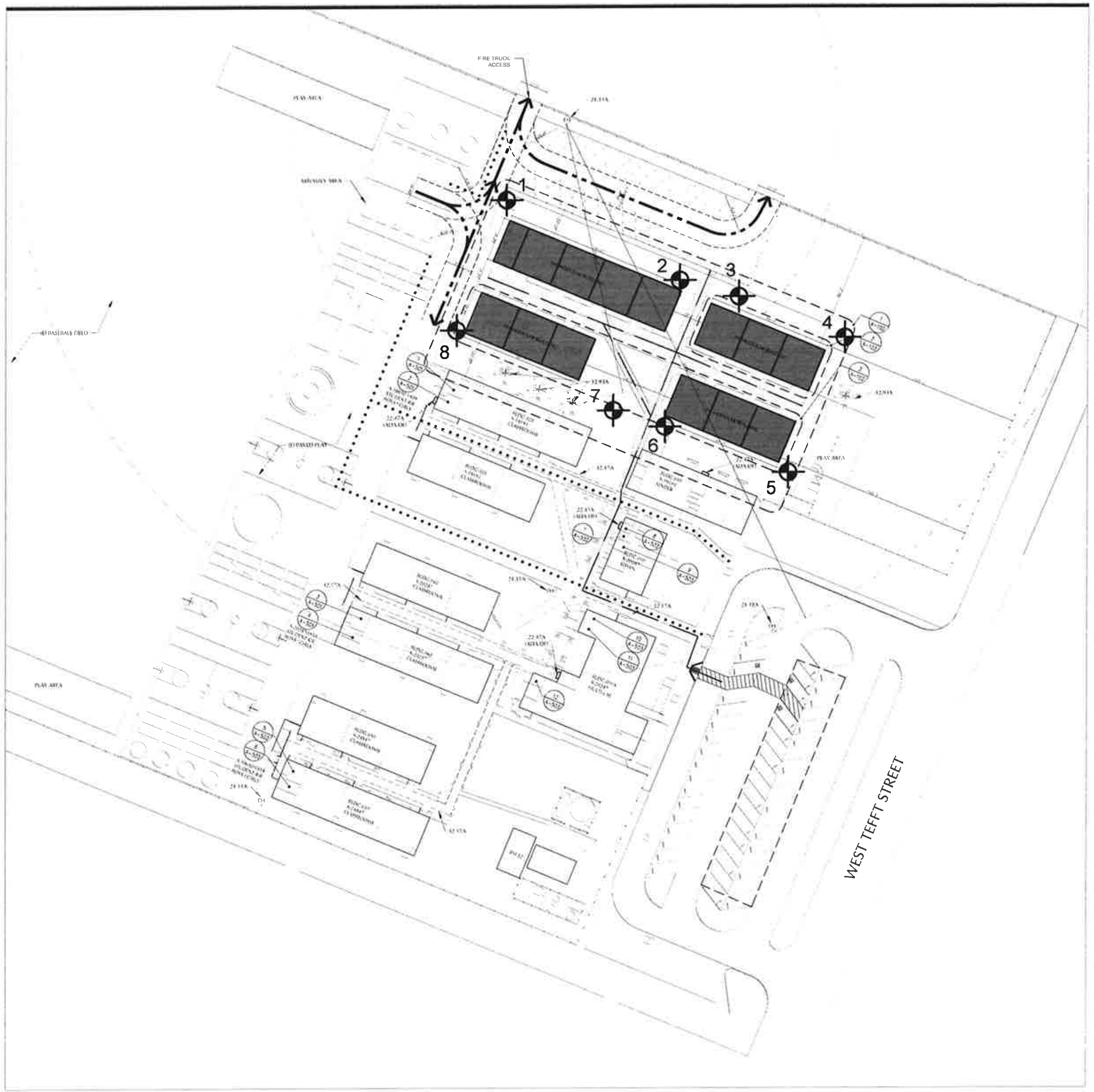
SITE VICINITY MAP
Dana Elementary School
Modular Classroom Wings
920 West Tefft Street
Nipomo, California

Date
September 5, 2017

Project No.
SL-17187-SB

Figure 1

DANA ELEMENTARY SCHOOL MODULAR CLASSROOM WINGS-102517borings



LEGEND

8 ⊕ Boring Location (Approx.)

BASE MAP PROVIDED BY: PMSM Architects

NOT TO SCALE

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com
(805) 544-3276 • Fax (805) 544-1786

EXPLORATION LOCATION MAP

Dana Elementary School
Modular Classroom Wings
920 West Tefft Street
Nipomo, California

Date
October 25, 2017

Project No.
SL-17187-SB

Figure 2

DANA ELEMENTARY SCHOOL MODULAR CLASSROOM WINGS-102517borings

Earth Systems Pacific

BORING LOG LEGEND

SAMPLE / SUBSURFACE WATER SYMBOLS	GRAPH. SYMBOL
CALIFORNIA MODIFIED	■
STANDARD PENETRATION TEST (SPT)	●
SHELBY TUBE	▭
BULK	○
SUBSURFACE WATER DURING DRILLING	▼
SUBSURFACE WATER AFTER DRILLING	▽

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

MAJOR DIVISIONS		GROUP SYMBOL	TYPICAL DESCRIPTIONS	GRAPH. SYMBOL
COARSE GRAINED SOILS	MORE THAN HALF OF MATERIAL IS LARGER THAN #200 SIEVE SIZE	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	○
		GP	POORLY GRADED GRAVELS, OR GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	○
		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, NON-PLASTIC FINES	○
		GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES, PLASTIC FINES	○
		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	
		SP	POORLY GRADED SANDS OR GRAVELLY SANDS, LITTLE OR NO FINES	
		SM	SILTY SANDS, SAND-SILT MIXTURES, NON-PLASTIC FINES	▥
		SC	CLAYEY SANDS, SAND-CLAY MIXTURES, PLASTIC FINES	▨
FINE GRAINED SOILS	HALF OR MORE OF MATERIAL IS SMALLER THAN #200 SIEVE SIZE	ML	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY	▥
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS	▨
		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	▤
		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS	▥
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	▨
		OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS	▤
		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	▽

OBSERVED MOISTURE CONDITION

DRY	SLIGHTLY MOIST	MOIST	VERY MOIST	WET (SATURATED)

CONSISTENCY

COARSE GRAINED SOILS

BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER	
0-10	0-16	LOOSE
11-30	17-50	MEDIUM DENSE
31-50	51-83	DENSE
OVER 50	OVER 83	VERY DENSE

FINE GRAINED SOILS

BLOWS/FOOT		DESCRIPTIVE TERM
SPT	CA SAMPLER	
0-2	0-3	VERY SOFT
3-4	4-7	SOFT
5-8	8-13	MEDIUM STIFF
9-15	14-25	STIFF
16-30	26-50	VERY STIFF
OVER 30	OVER 50	HARD

GRAIN SIZES

U.S. STANDARD SERIES SIEVE				CLEAR SQUARE SIEVE OPENING		
# 200	# 40	# 10	# 4	3/4"	3"	12"

SILT & CLAY	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

TYPICAL BEDROCK HARDNESS

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
EXTREMELY HARD	CORE, FRAGMENT, OR EXPOSURE CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CAN ONLY BE CHIPPED WITH REPEATED HEAVY HAMMER BLOWS
VERY HARD	CANNOT BE SCRATCHED WITH KNIFE OR SHARP PICK; CORE OR FRAGMENT BREAKS WITH REPEATED HEAVY HAMMER BLOWS
HARD	CAN BE SCRATCHED WITH KNIFE OR SHARP PICK WITH DIFFICULTY (HEAVY PRESSURE); HEAVY HAMMER BLOW REQUIRED TO BREAK SPECIMEN
MODERATELY HARD	CAN BE GROOVED 1/16 INCH DEEP BY KNIFE OR SHARP PICK WITH MODERATE OR HEAVY PRESSURE; CORE OR FRAGMENT BREAKS WITH LIGHT HAMMER BLOW OR HEAVY MANUAL PRESSURE
SOFT	CAN BE GROOVED OR GOUGED EASILY BY KNIFE OR SHARP PICK WITH LIGHT PRESSURE, CAN BE SCRATCHED WITH FINGERNAIL; BREAKS WITH LIGHT TO MODERATE MANUAL PRESSURE
VERY SOFT	CAN BE READILY INDENTED, GROOVED OR GOUGED WITH FINGERNAIL, OR CARVED WITH KNIFE; BREAKS WITH LIGHT MANUAL PRESSURE

TYPICAL BEDROCK WEATHERING

MAJOR DIVISIONS	TYPICAL DESCRIPTIONS
FRESH	NO DISCOLORATION, NOT OXIDIZED
SLIGHTLY WEATHERED	DISCOLORATION OR OXIDATION IS LIMITED TO SURFACE OF, OR SHORT DISTANCE FROM, FRACTURES: SOME FELDSPAR CRYSTALS ARE DULL
MODERATELY WEATHERED	DISCOLORATION OR OXIDATION EXTENDS FROM FRACTURES, USUALLY THROUGHOUT; Fe-Mg MINERALS ARE "RUSTY", FELDSPAR CRYSTALS ARE "CLOUDY"
INTENSELY WEATHERED	DISCOLORATION OR OXIDATION THROUGHOUT; FELDSPAR AND Fe-Mg MINERALS ARE ALTERED TO CLAY TO SOME EXTENT, OR CHEMICAL ALTERATION PRODUCES IN SITU DISAGGREGATION
DECOMPOSED	DISCOLORATION OR OXIDATION THROUGHOUT, BUT RESISTANT MINERALS SUCH AS QUARTZ MAY BE UNALTERED; FELDSPAR AND Fe-Mg MINERALS ARE COMPLETELY ALTERED TO CLAY

drafting/masters/Boring Log Legend121714.dwg

Earth Systems Pacific

Boring No. 1

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

PAGE 1 OF 1
JOB NO.: SL-17187-SB
DATE: 08/26/17

DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			4.5" ASPHALT CONCRETE OVER 0.0 AGGREGATE BASE					
1	SP		POORLY GRADED SAND: brown, loose, slightly, moist (Older Dune Sand)	1.0 - 2.5	▬	105.9	5.2	3 3 3
3			moist					
5				5.0 - 6.5	▬	102.0	7.4	3 8 11
6			yellow brown, medium dense					
9			light yellow brown					
10				10.0 - 11.5	●			3 5 6
15				15.0 - 16.5	●			3 4 7
20				20.0 - 21.5	●			4 7 9
22			End of Boring @ 21.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 2

PAGE 1 OF 1
JOB NO.: SL-17187-SB
DATE: 09/23/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0			2.0" ASPHALT CONCRETE over 3.0" AGGREGATE BASE					
1	SP		POORLY GRADED SAND: brown, loose, slightly moist (Older Dune Sand)	0.5 - 2.5	○			
2								
3			yellow brown, medium dense	3.0 - 4.5	▬	102.4	1.6	4 9 13
4			light yellow brown					
5				5.0 - 6.5	▬	105.2	2.2	5 11 12
6								
7								
8								
9								
10				10.0 - 11.5	▬	103.4	1.9	4 10 14
11								
12								
13								
14								
15				15.0 - 16.5	●			3 7 9
16								
17			End of Boring @ 16.5' No subsurface water encountered					
18								
19								
20								
21								
22								
23								
24								
25								
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 3

PAGE 1 OF 2
JOB NO.: SL-17187-SB
DATE: 09/23/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		■	2.0" ASPHALT CONCRETE over 3.0" AGGREGATE BASE					
1	SP		POORLY GRADED SAND: orange brown, loose, slightly moist (Older Dune Sand)					
3			light yellow brown	3.0 - 4.5	▬	100.6	2.3	3 5 8
5				5.0 - 6.5	●			2 4 5
10			medium dense, moist	10.0 - 11.5	●			4 7 9
15				15.0 - 16.5	●			4 5 6
20				20.0 - 21.5	●			3 6 9
25				25.0 - 26.5	●			4 7 9
26								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Boring No. 3

PAGE 2 OF 2
JOB NO.: SL-17187-SB
DATE: 09/23/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

DEPTH (feet)	USCS CLASS	SYMBOL	DANA ELEMENTARY SCHOOL MODULAR CLASSROOM WINGS 920 West Tefft Street Nipomo, California SOIL DESCRIPTION	SAMPLE DATA: INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
27	SP		POORLY GRADED SAND: as above					
28								
29								
30				30.0 - 31.5	●			4 7 8
31								
32								
33								
34								
35				35.0 - 36.5	●			5 6 8
36								
37								
38								
39								
40				40.0 - 41.5	●			4 7 10
41								
42								
43								
44								
45				45.0 - 46.5	●			5 9 13
46								
47								
48								
49								
50				50.0 - 51.5	●			5 11 14
51								
52			End of Boring @ 51.5' No subsurface water encountered					
53								

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 4

PAGE 1 OF 1
JOB NO.: SL-17187-SB
DATE: 08/26/17

LOGGED BY: R. Wagner
DRILL RIG: Simco EP 200
AUGER TYPE: 6" Solid Stem Auger

DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SP		POORLY GRADED SAND: light brown, medium dense, slightly moist, trace to some silt (Older Dune Sand)					
2.5			light yellow brown					
5				5.0 - 6.5	▬	101.3	4.5	5 10 12
10				10.0 - 11.5	▬	103.5	4.3	7 15 18
15				15.0 - 16.5	●			5 8 9
16.5			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

LOGGED BY: R. Wagner
DRILL RIG: Simco EP 200
AUGER TYPE: 6" Solid Stem Auger

Boring No. 5
PAGE 1 OF 1
JOB NO.: SL-17187-SB
DATE: 08/26/17

DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

			SOIL DESCRIPTION	SAMPLE DATA				
DEPTH (feet)	USCS CLASS	SYMBOL		INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		■	1.75" ASPHALT CONCRETE OVER 7.5" AGGREGATE BASE					
1	SP	▨	POORLY GRADED SAND: light brown, medium dense, moist, trace silt (Older Dune Sand)					
5		▨	light yellow brown	5.0 - 6.5	■	106.0	5.0	4 7 9
10		▨		10.0 - 11.5	■	104.9	5.7	7 11 15
15		▨		15.0 - 16.5	●			5 10 11
20		▨		20.0 - 21.5	●			7 8 13
22			End of Boring @ 21.5' No subsurface water encountered					

LEGEND: ■ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Earth Systems Pacific

Boring No. 6

PAGE 1 OF 1
JOB NO.: SL-17187-SB
DATE: 08/26/17

LOGGED BY: R. Wagner
DRILL RIG: Simco EP 200
AUGER TYPE: 6" Solid Stem Auger

DANA ELEMENTARY SCHOOL MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SW		WELL GRADED SAND: light brown, loose, slightly moist (Fill)					
1	SP		POORLY GRADED SAND: brown, loose, slightly moist (Older Dune Sand)					
5				5.0 - 6.5	▬	103.1	4.4	3 7 8
6			yellow brown					
9			light yellow brown, medium dense, moist					
10				10.0 - 11.5	●			4 7 9
15				15.0 - 16.5	●			5 12 14
17			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ▭ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Boring No. 7

PAGE 1 OF 1
JOB NO.: SL-17187-SB
DATE: 08/26/17

LOGGED BY: R. Wagner
DRILL RIG: Simco EP 200
AUGER TYPE: 6" Solid Stem Auger

DANA ELEMENTARY SCHOOL MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SYMBOL	SOIL DESCRIPTION	SAMPLE DATA				
				INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0	SP		POORLY GRADED SAND: brown, loose, slightly moist (Older Dune Sand)					
				1.0 - 5.0	○			
5				5.0 - 6.5	▬	103.7	2.5	3 7 9
6			light yellow brown, medium dense, moist					
10				10.0 - 11.5	●			3 7 10
15				15.0 - 16.5	●			5 8 9
17			End of Boring @ 16.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

Boring No. 8

PAGE 1 OF 1
JOB NO.: SL-17187-SB
DATE: 08/26/17

LOGGED BY: R. Wagner
DRILL RIG: Mobile B-53 with Automatic Hammer
AUGER TYPE: 6" Hollow Stem Auger

DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

DEPTH (feet)	USCS CLASS	SOIL DESCRIPTION	INTERVAL (feet)	SAMPLE TYPE	DRY DENSITY (pcf)	MOISTURE (%)	BLOWS PER 6 IN.
0		3" ASPHALT CONCRETE OVER 4" AGGREGATE BASE					
1	SP	POORLY GRADED SAND: brown, loose, slightly moist (Older Dune Sand)	1.0 - 2.5	▬	108.5	5.9	4 6 6
3			3.0 - 4.5	▬	102.1	6.6	1 3 3
4			3.0 - 5.0	○			
5			5.0 - 6.5	▬	103.7	5.3	1 3 6
6		light yellow brown					
10		medium dense, moist	10.0 - 11.5	●			3 5 8
15			15.0 - 16.5	●			4 7 10
20			20.0 - 21.5	●			5 9 12
22		End of Boring @ 21.5' No subsurface water encountered					

LEGEND: ▬ Ring Sample ○ Grab Sample ☐ Shelby Tube Sample ● SPT

NOTE: This log of subsurface conditions is a simplification of actual conditions encountered. It applies at the location and time of drilling. Subsurface conditions may differ at other locations and times.

APPENDIX B

Geotechnical Laboratory Test Results

Dana Elementary School
Modular Classroom Wings

SL-17187-SB

BULK DENSITY TEST RESULTS

ASTM D 2937-17 (modified for ring liners)

October 17, 2017

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	2.0 - 2.5	5.2	111.4	105.9
1	6.0 - 6.5	7.4	109.5	102.0
2	4.0 - 4.5	1.6	104.1	102.4
2	6.0 - 6.5	2.2	107.5	105.2
2	11.0 - 11.5	1.9	105.3	103.4
3	4.0 - 4.5	2.3	102.9	100.6
4	6.0 - 6.5	4.5	105.9	101.3
4	11.0 - 11.5	4.3	108.0	103.5
5	6.0 - 6.5	5.0	111.3	106.0
5	11.0 - 11.5	5.7	110.9	104.9
6	6.0 - 6.5	4.4	107.7	103.1
7	6.0 - 6.5	2.5	106.3	103.7
8	2.0 - 2.5	5.9	115.0	108.5
8	4.0 - 4.5	6.6	108.9	102.1
8	6.0 - 6.5	5.3	109.1	103.7

Dana Elementary School
Modular Classroom Wings

SL-17187-SB

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: A

PREPARATION METHOD: Moist

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.65 (assumed)

October 17, 2017

Boring #2 @ 0.5 - 2.5'

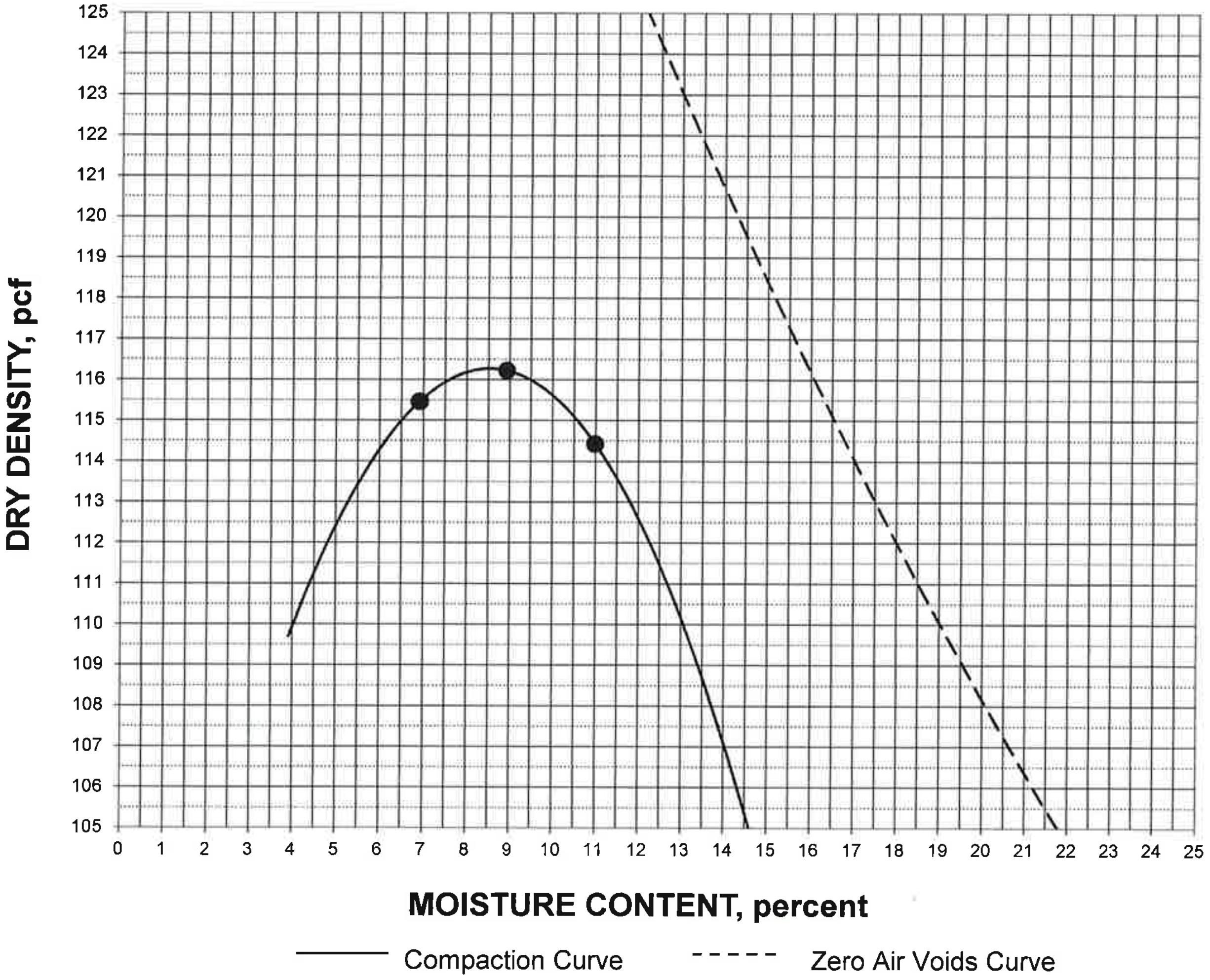
Brown Poorly Graded Sand (SP)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 116.3 pcf

OPTIMUM MOISTURE: 8.5%



Dana Elementary School
Modular Classroom Wings

SL-17187-SB

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: A

PREPARATION METHOD: Moist

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.65 (assumed)

October 17, 2017

Boring #8 @ 3.0 - 5.0'

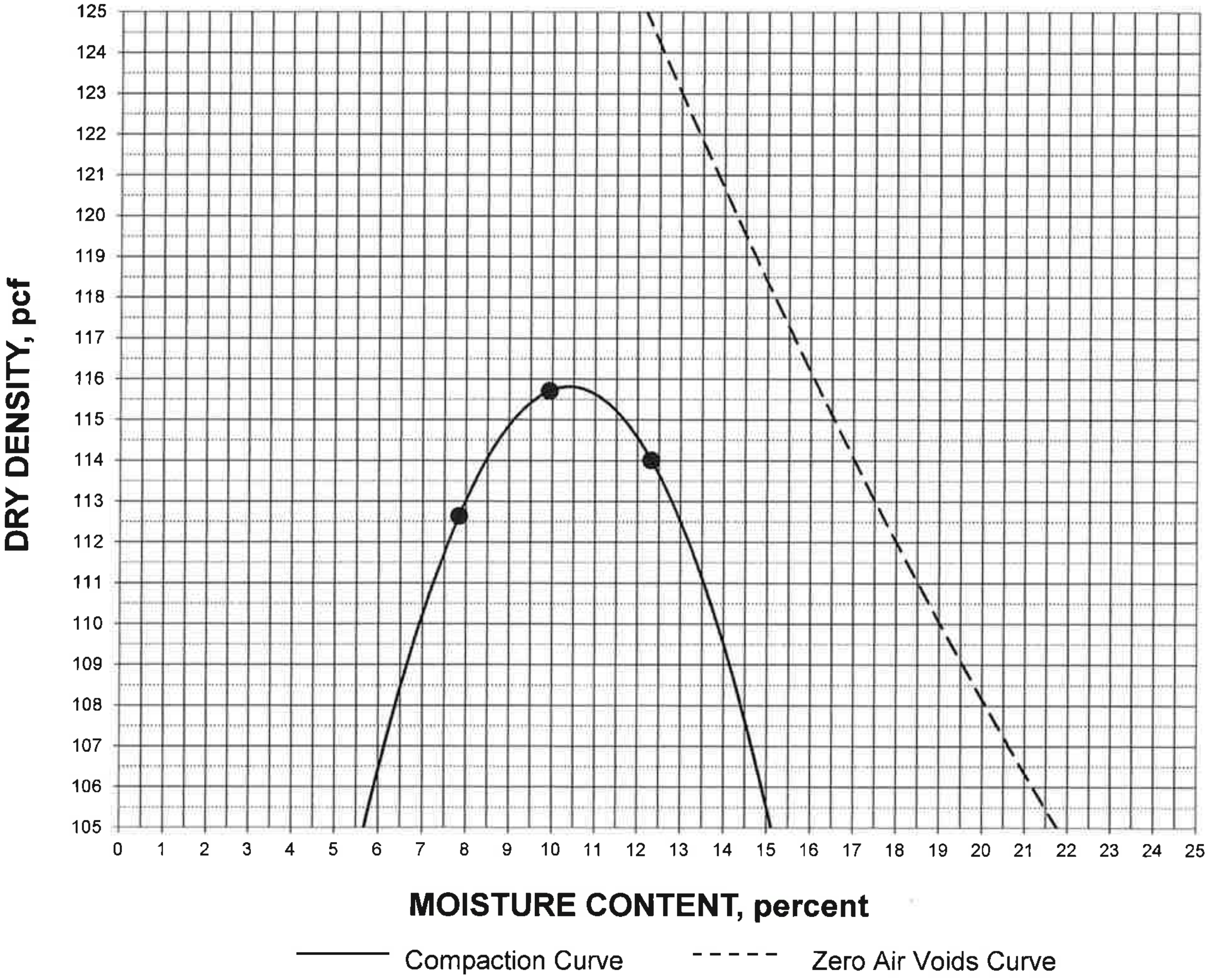
Brown Poorly Graded Sand (SP)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 115.8 pcf

OPTIMUM MOISTURE: 10.4%



Dana Elementary School
Modular Classroom Wings

SL-17187-SB

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (Modified)

PROCEDURE USED: A

PREPARATION METHOD: Moist

RAMMER TYPE: Mechanical

SPECIFIC GRAVITY: 2.65 (assumed)

October 17, 2017

Boring #7 @ 1.0 - 5.0'

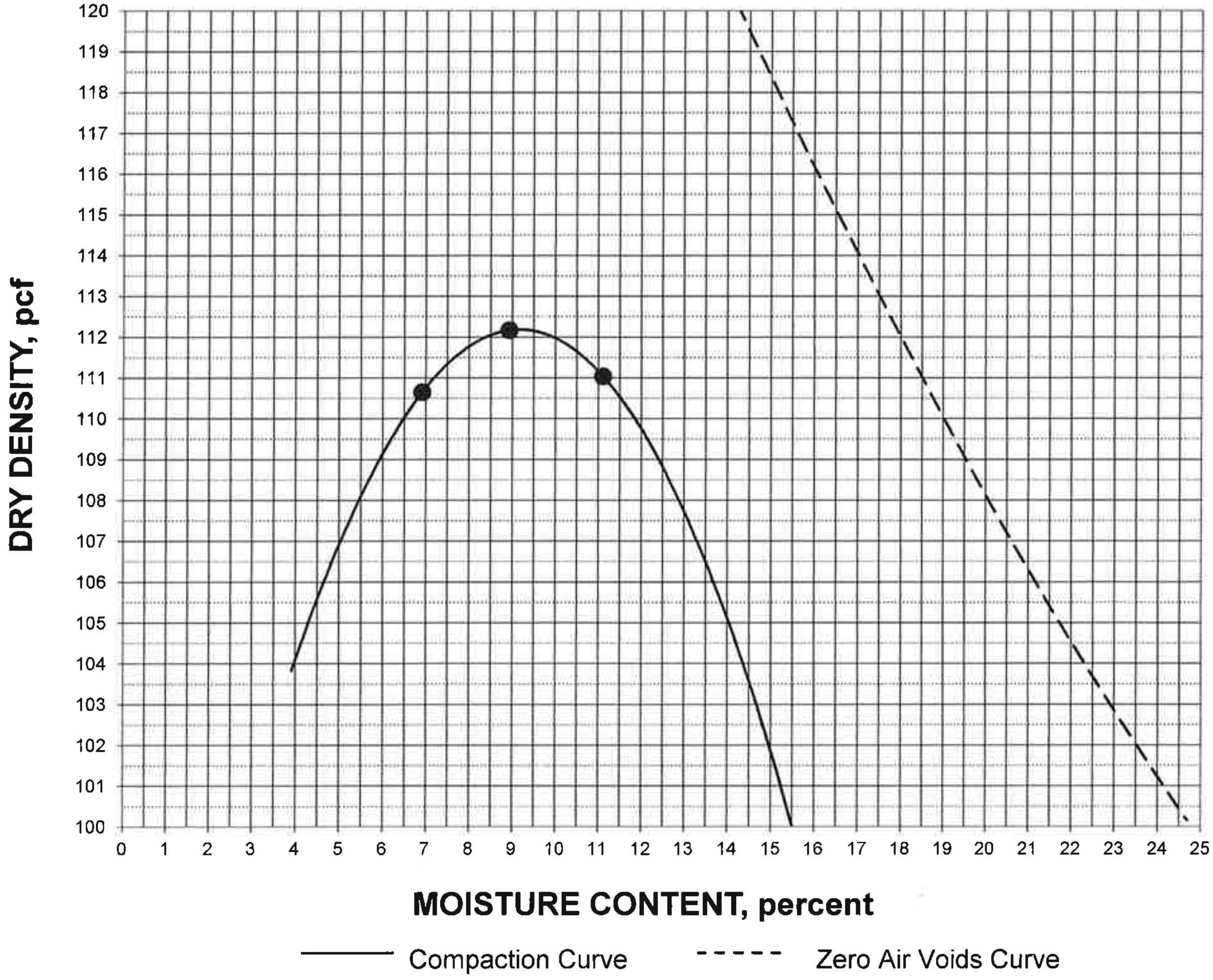
Brown Poorly Graded Sand (SP)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 112.2 pcf

OPTIMUM MOISTURE: 9.2%



Dana Elementary School
Modular Classroom Wings

SL-17187-SB

DIRECT SHEAR

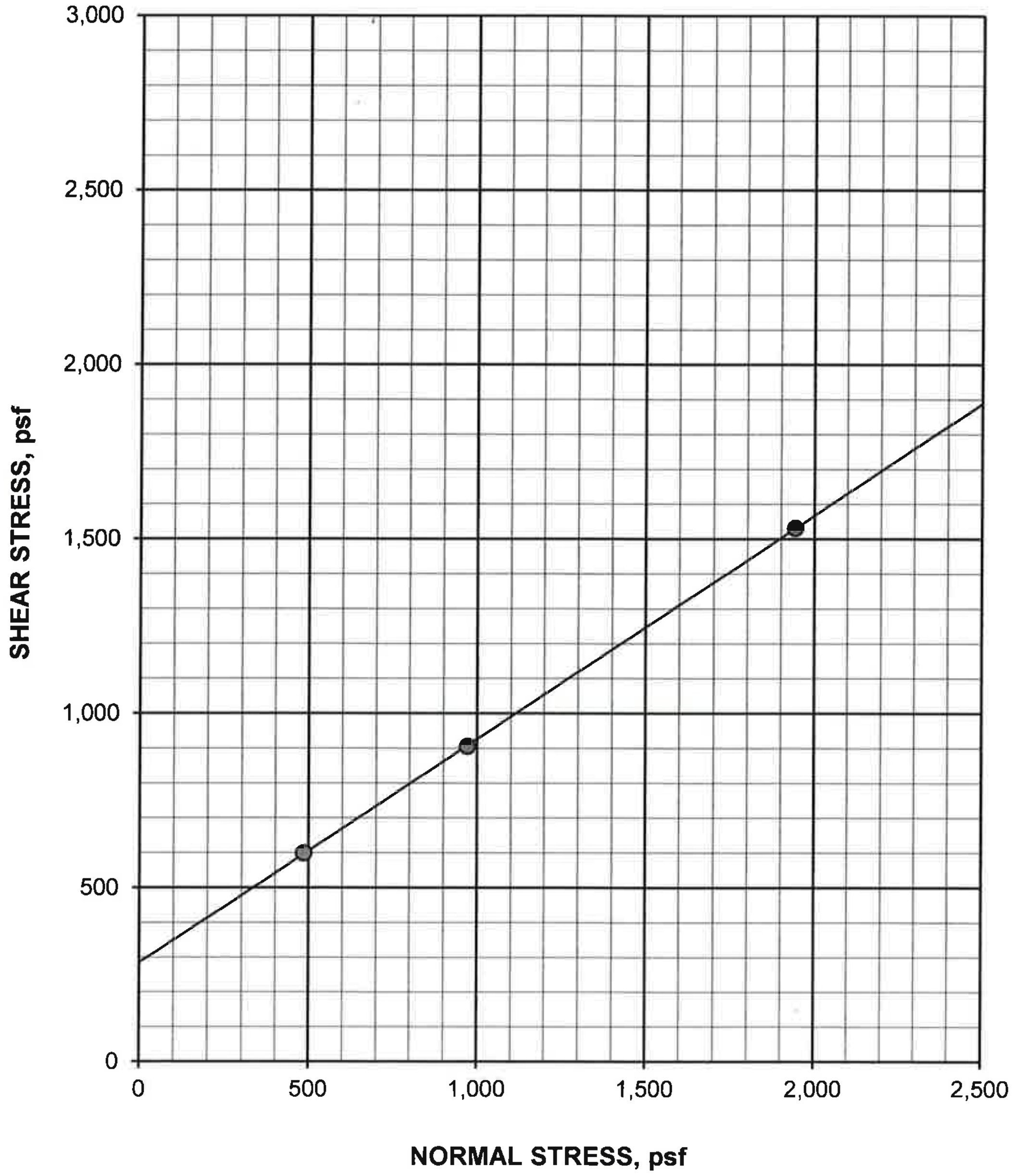
ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

October 17, 2017

Boring #7 @ 1.0 - 5.0'
Poorly Graded Sand (SP)
Compacted to 90% RC, saturated

INITIAL DRY DENSITY: 101.0 pcf
INITIAL MOISTURE CONTENT: 9.2 %
PEAK SHEAR ANGLE (Ø): 33°
COHESION (C): 286 psf

SHEAR vs. NORMAL STRESS



DIRECT SHEAR continued

ASTM D 3080/D3080M-11 (modified for consolidated, undrained conditions)

Boring #7 @ 1.0 - 5.0'

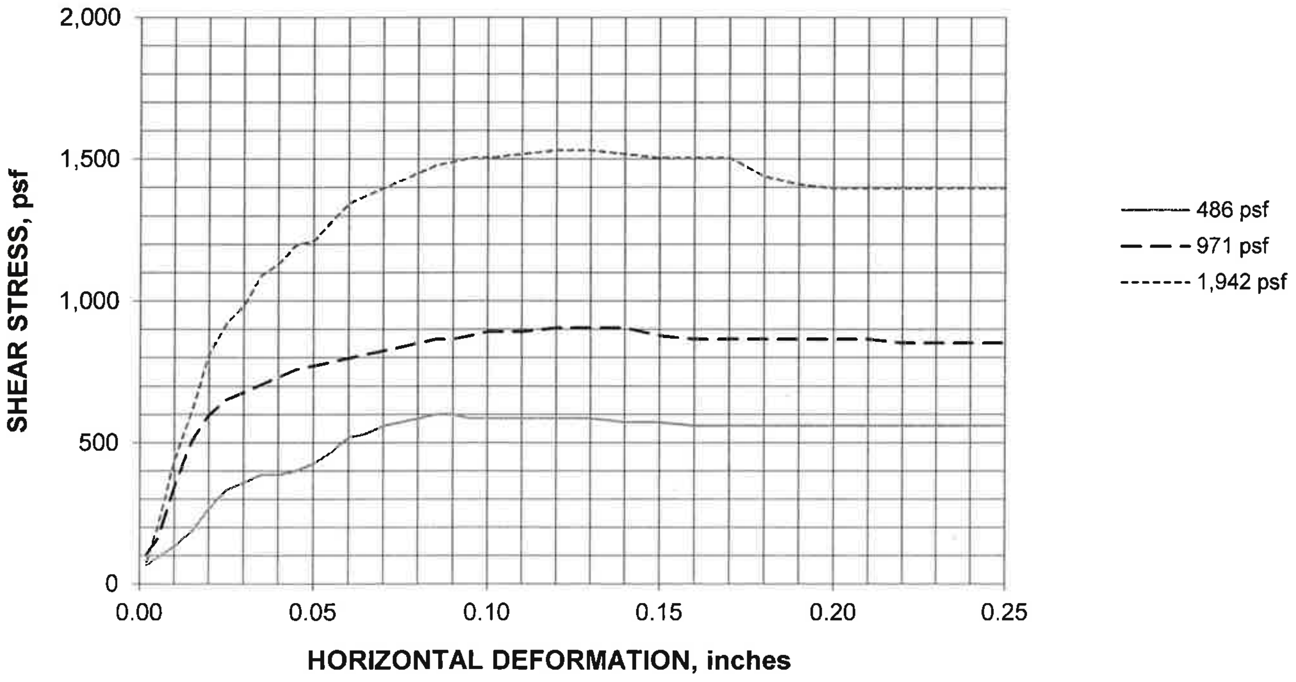
October 17, 2017

Poorly Graded Sand (SP)

Compacted to 90% RC, saturated

SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	1	2	3	AVERAGE
INITIAL				
WATER CONTENT, %	9.2	9.2	9.2	9.2
DRY DENSITY, pcf	101.0	101.0	101.0	101.0
SATURATION, %	38.2	38.2	38.2	38.2
VOID RATIO	0.638	0.638	0.638	0.638
DIAMETER, inches	2.410	2.410	2.410	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	23.6	22.9	22.4	
DRY DENSITY, pcf	101.9	103.0	103.8	
SATURATION, %	100.0	100.0	100.0	
VOID RATIO	0.623	0.605	0.594	
HEIGHT, inches	0.99	0.98	0.97	



Dana Elementary School
Modular Classroom Wings

SL-17187-SB

CONSOLIDATION TEST

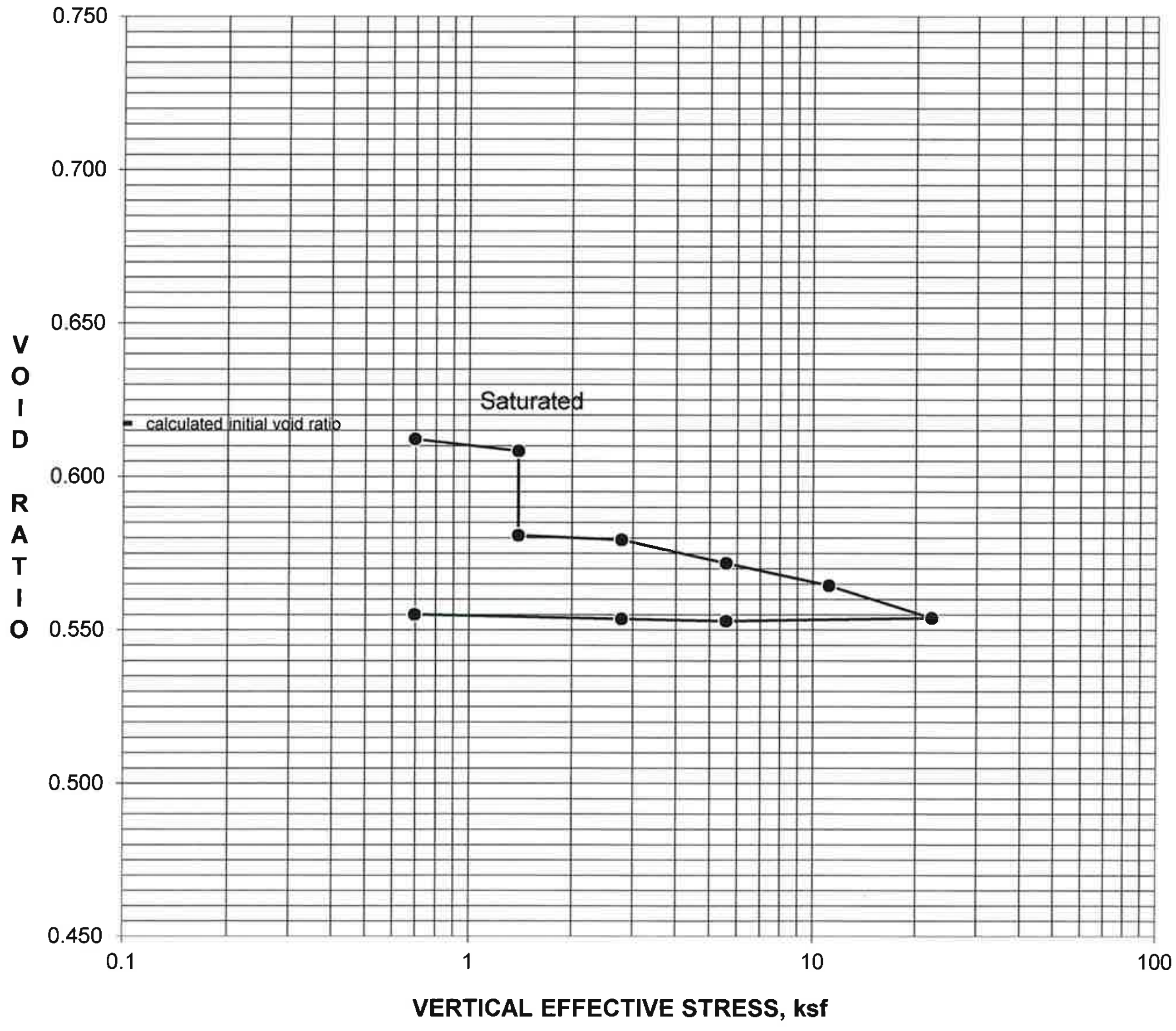
ASTM D 2435/D2435M-11

October 17, 2017

Boring #2 @ 6.0 - 6.5'
Poorly Graded Sand (SP)
Ring Sample

DRY DENSITY: 102.3 pcf
MOISTURE CONTENT: 2.2%
SPECIFIC GRAVITY: 2.65 (assumed)
INITIAL VOID RATIO: 0.617

VOID RATIO vs. NORMAL PRESSURE DIAGRAM



Dana Elementary School
Modular Classroom Wings

SL-17187-SB

CONSOLIDATION TEST

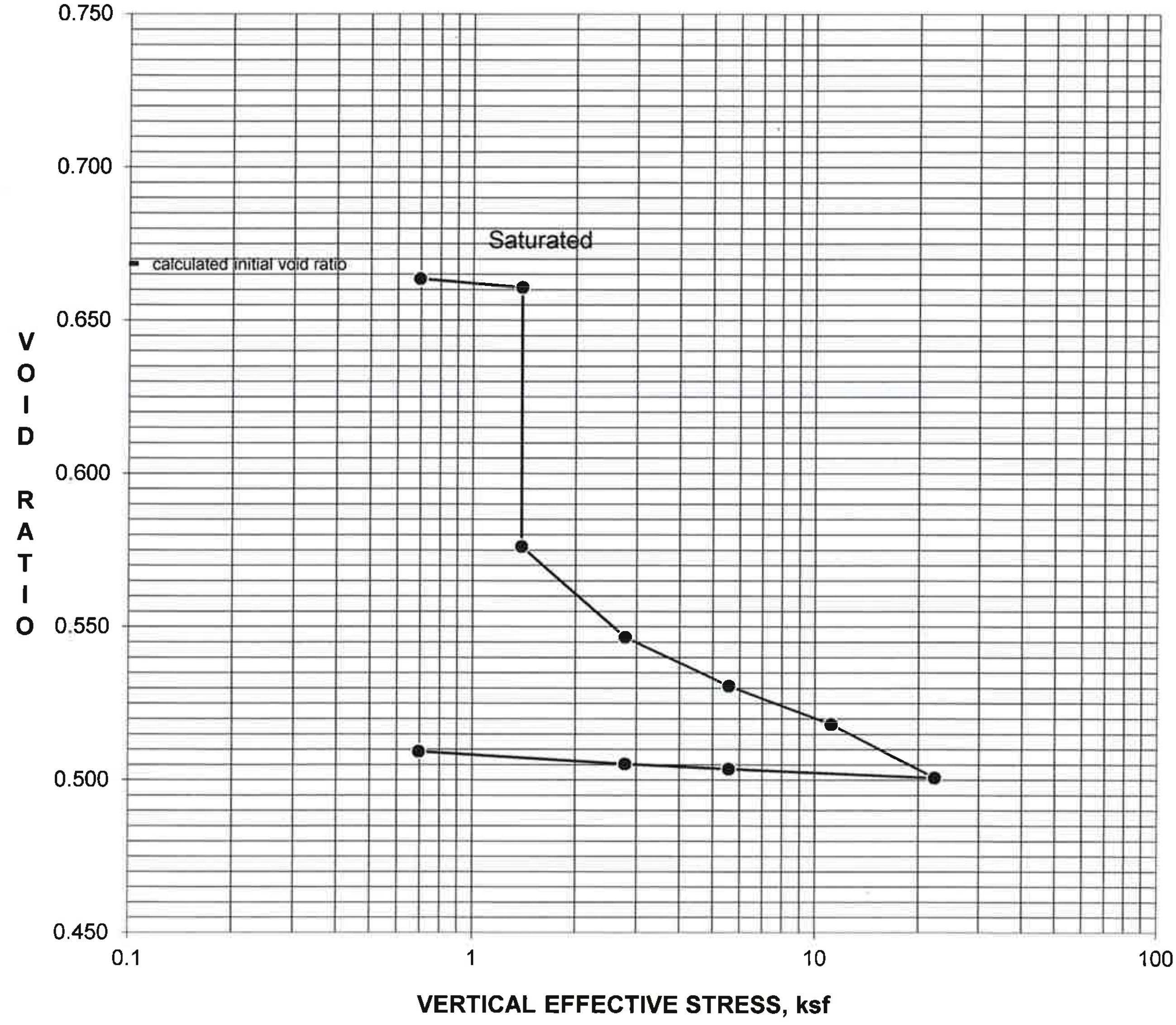
ASTM D 2435/D2435M-11

October 17, 2017

Boring #2 @ 11.0 - 11.5'
Poorly Graded Sand (SP)
Ring Sample

DRY DENSITY: 99.2 pcf
MOISTURE CONTENT: 1.9%
SPECIFIC GRAVITY: 2.65 (assumed)
INITIAL VOID RATIO: 0.668

VOID RATIO vs. NORMAL PRESSURE DIAGRAM



Dana Elementary School
Modular Classroom Wings

SL-17187-SB

CONSOLIDATION TEST

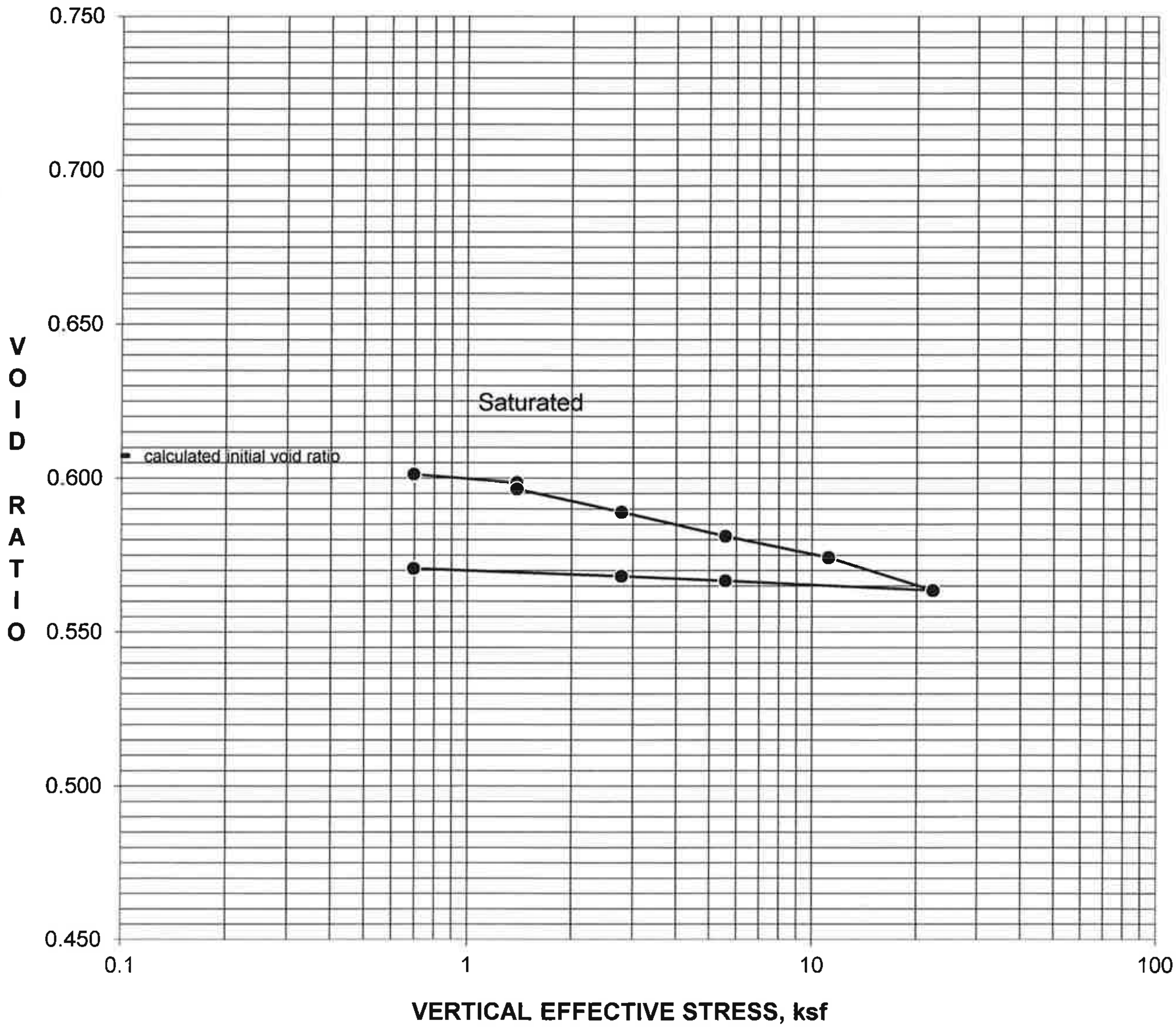
ASTM D 2435/D2435M-11

October 17, 2017

Boring #8 @ 6.0 - 6.5'
Poorly Graded Sand (SP)
Ring Sample

DRY DENSITY: 102.9 pcf
MOISTURE CONTENT: 5.3%
SPECIFIC GRAVITY: 2.65 (assumed)
INITIAL VOID RATIO: 0.607

VOID RATIO vs. NORMAL PRESSURE DIAGRAM



APPENDIX C

Soil Corrosivity Study by CERCO Analytical

California State Certified Laboratory No. 2153

CERCO
analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 **462 2771** Fax. 925 **462 2775**
www.cercoanalytical.com

21 September, 2017

Job No. 1709105
Cust. No. 11974

Mr. Fred J. Potthast, GE
Earth Systems Pacific
4378 Santa Fe Road
San Luis Obispo, CA 93401

Subject: Project No.: SL-17187-SB
Project Name: Dana Elementary School, Modular Classroom Wings, Nipomo, CA
Corrosivity Analysis – ASTM Methods

Dear Mr. Potthast:

Pursuant to your request, CERCO Analytical has analyzed the soil samples submitted on September 18, 2017. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity (100% Saturation) measurements, both samples are classified as "mildly corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentrations reflect none detected with a reporting limit of 15 mg/kg.

The sulfate ion concentrations reflect none detected with a reporting limit of 15 mg/kg.

The pH of the soils were 6.87 & 7.64, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential for both samples is 420-mV, which is indicative of aerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc. at (925) 927-6630.*

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,
CERCO ANALYTICAL, INC.

Cheryl McMillen for

J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: Earth Systems Pacific
Client's Project No.: SL-17187-SB
Client's Project Name: Dana Elementary School, Modular Classroom Wings, Nipomo, CA
Date Sampled: 26-Aug-17
Date Received: 18-Sep-17
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 21-Sep-2017

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Resistivity (As Recieved) (ohms-cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1709105-001	Boring 7 @ 1-5'	420	6.87	>80,000	23,000	-	N.D.	N.D.
1709105-002	Boring 8 @ 3-5'	420	7.64	34,000	15,000	-	N.D.	N.D.

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	-	-	50	15	15
Date Analyzed:	21-Sep-2017	20-Sep-2017	21-Sep-2017	21-Sep-2017	-	20-Sep-2017	20-Sep-2017

Cheryl McMillen

Cheryl McMillen
Laboratory Director

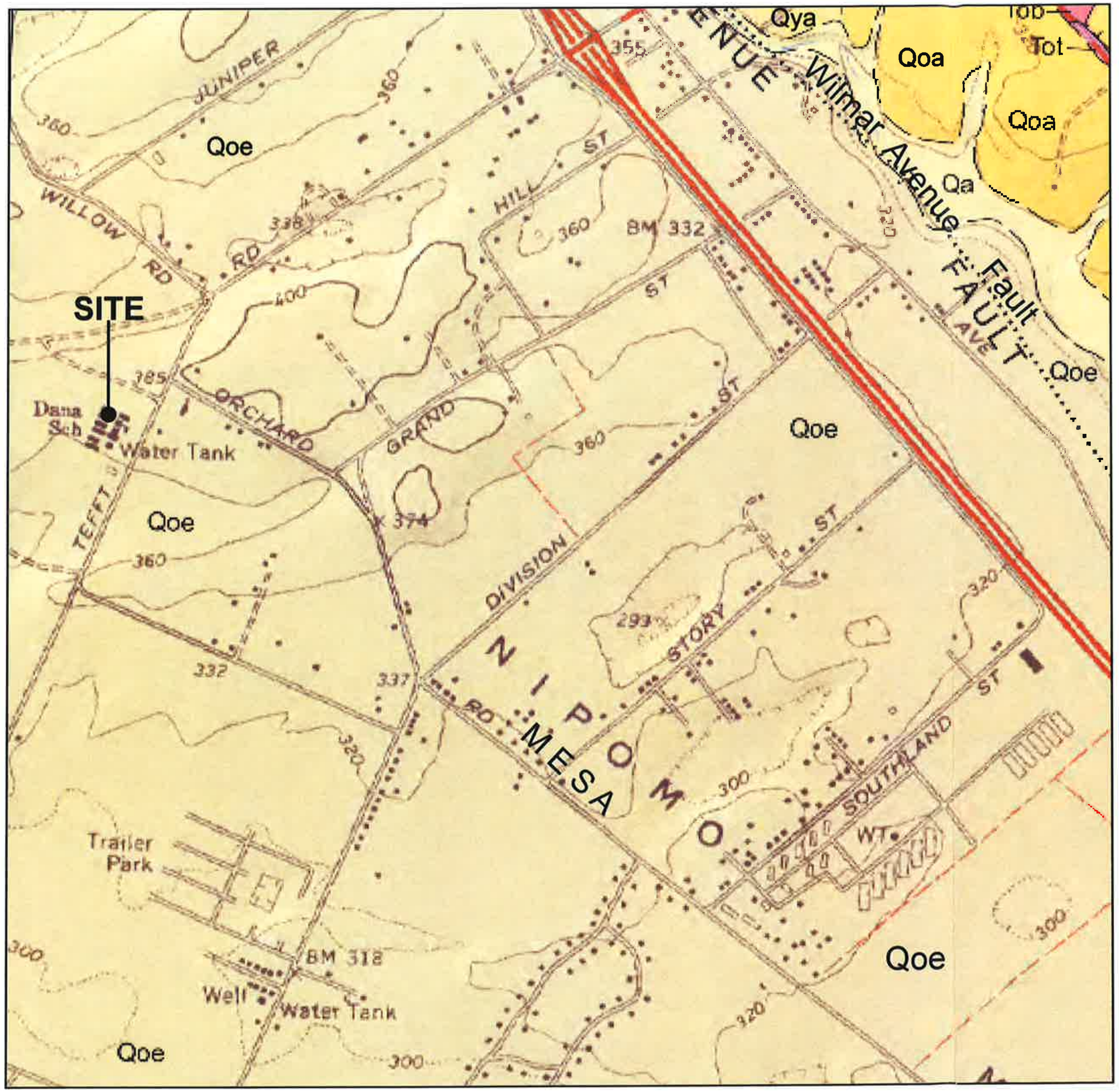
* Results Reported on "As Received" Basis

N.D. - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

APPENDIX D

Figure 3 - Geologic Map
Figure 4 - Historical Earthquake/Fault Map
Figure 5 - Fema Flood Zone Map



Extract from: Preliminary Geologic Map of the Nipomo Quadrangle, San Luis Obispo County, California: by Delattre & Wiegers, 2014.

EXPLANATION

Geologic Units

Qa
Alluvial Flood-Plain Deposits
(Holocene)

Qya
Young Alluvial Deposits
(Holocene to late Pleistocene)

Qoe
Old Eolian (dune sand) Deposits
(Late Pleistocene)

Qoa
Older Alluvium Deposits
(Pleistocene)

Tmc
Monterey Formation
Tmc: siliceous shale
(Miocene)

Tot **Tob**
Obispo Formation
Tot: tuff & tuff breccia
Tob: mafic volcanic rocks
(Miocene)

Geologic Symbols

Contact
Dashed where approximately located or inferred

High-angle fault
Dashed where approximately located or inferred; dotted where concealed

Thrust or reverse fault
Dashed where approximately located or inferred; dotted where concealed. Saw-teeth on upper plate. Dip of fault plane between 30° and 80°

Anticline
Showing axis at surface. Dashed where approximately located; dotted where concealed

Syncline
Showing axis at surface. Dashed where approximately located; dotted where concealed

⊕ Horizontal
30 Inclined
90 Vertical
Strike and dip of beds

N

Approx. Scale: 1" = 1,000'

EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

GEOLOGIC MAP
DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

Date
October 2017
Project No.
SL-17187-SB
Figure 3

LEGEND

🟥 Historic rupture (<200 years)
🟧 Holocene fault (<10,000 years)
🟨 Late Quaternary (<700,000 years)
🟦 Quaternary fault (<1.6 million)

HISTORICAL EARTHQUAKE MAGNITUDE

○ 5.0 to 5.9 ● 6.0 to 6.9 🟡 7.0 to 7.9

FAULTS

1 Los Osos
2 San Juan
3 La Panza
4 South Cuyama
5 East Huasna
6 West Huasna
7 San Miguelito
8 Hosgri-San Simeon
9 Oceano
10 Orcutt Frontal (Casmalia)
11 Lions Head
12 Santa Maria River
13 Little Pine
14 Los Alamos
15 Santa Ynez River
16 Santa Ynez
17 Mission Ridge/ Arroyo Parida
18 San Luis Bay
19 San Luis Range (Wilmar Avenue)

Note: Not all faults are shown on map

REFERENCES

Blake, T.F., EQSEARCH, updated 2016,
Jennings, C.W, & Bryant, W.A., 2010

N

(Approximate Scale: 1" = 6 miles)

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4378 Old Santa Fe Road, San Luis Obispo, CA 93401
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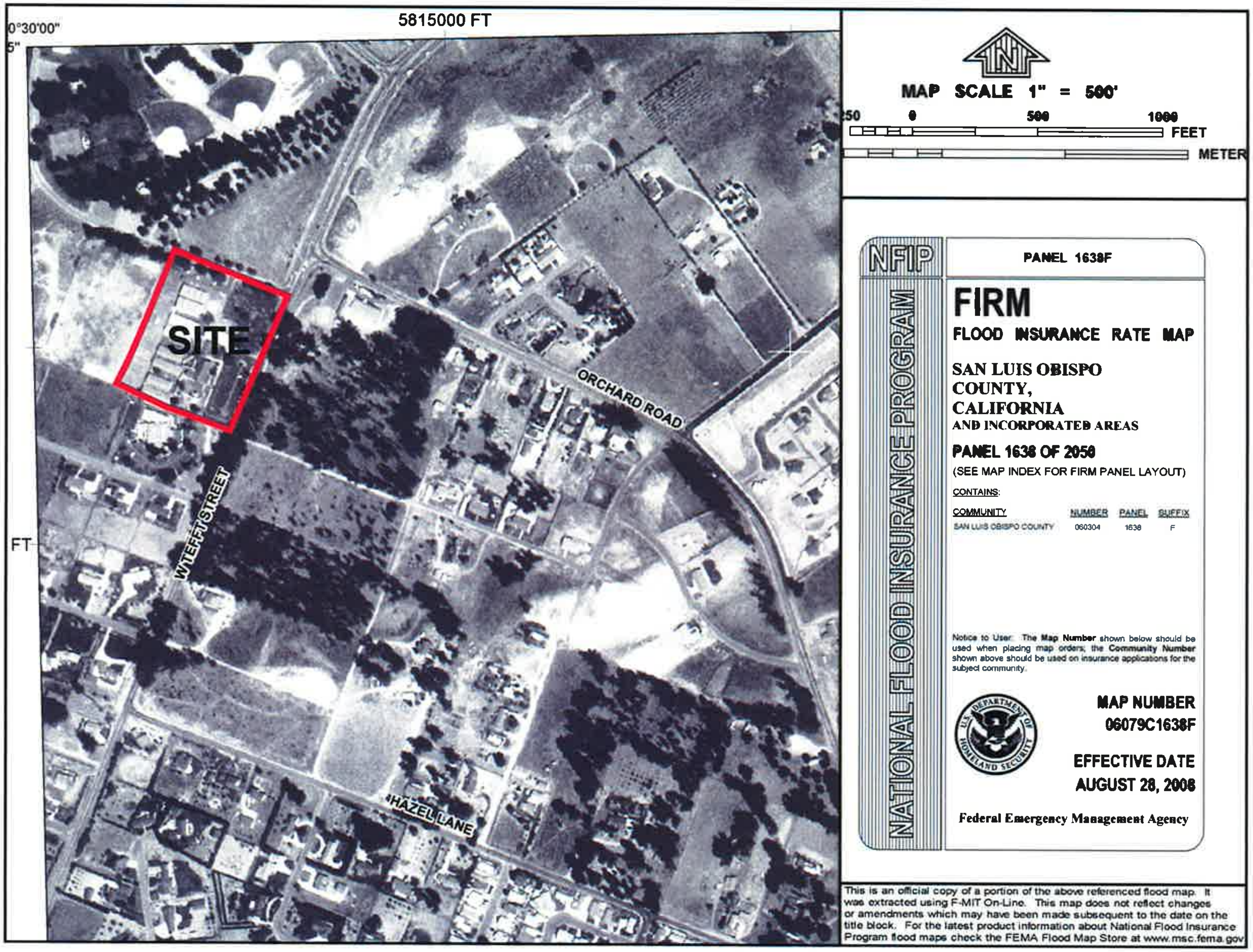
(805) 544-3276

HISTORICAL EARTHQUAKE/ FAULT MAP
DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

Date
October 2017
Project No.
SL-17187-SB
Figure 4



PANEL 1638F

FIRM

FLOOD INSURANCE RATE MAP

SAN LUIS OBISPO
COUNTY,
CALIFORNIA
AND INCORPORATED AREAS

PANEL 1638 OF 2050

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
SAN LUIS OBISPO COUNTY	060304	1638	F

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06079C1638F

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

EARTH SYSTEMS PACIFIC
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
www.earthsystems.com - email: esp@earthsystems.com
(805) 544-3276

FEMA FLOOD ZONE MAP
DANA ELEMENTARY SCHOOL
MODULAR CLASSROOM WINGS
920 West Tefft Street
Nipomo, California

Date
October 2017
Project No.
SL-17187-SB
Figure 5

APPENDIX E

Calculation Summary Sheet for Settlement (Subsidence) of Dry Sands

Project: Dana Elementary School - Modular Classroom
Job No: SL-17187-SB
Date: 10/25/2017
Boring: B-3 Data Set: 1

Methods: Liquefaction Analysis using 1996 & 1998 NCEER workshop method (Youd & Idriss, editors)
Journal of Geotechnical and Enviromental Engineering (JGEE), October 2001, Vol 127, No. 10, ASCE
Settlement Analysis from Tokimatsu and Seed (1987), JGEE,Vol 113, No.8, ASCE
Modified by Pradel, JGEE, Vol 124, No. 4, ASCE

EARTHQUAKE INFORMATION:

Magnitude: 6.5 7.5
PGA, g: 0.48 0.33
MSF: 1.44
GWT: 52.0 feet
Calc GWT: 52.0 feet
Remediate to: 0.0 feet

SPT N VALUE CORRECTIONS:

Energy Correction to N60 (C_E): 1.33 Automatic Hammer
Drive Rod Corr. (C_R): 1 Default
Rod Length above ground (feet): 3.0
Borehole Dia. Corr. (C_B): 1.05
Sampler Liner Correction for SPT?: 0 No
Cal Mod/ SPT Ratio: 0.63

Threshold Acceler., g: #N/A

Total (ft) Liquefied Thickness: 0

Total (in.) Induced Subsidence: 0.4

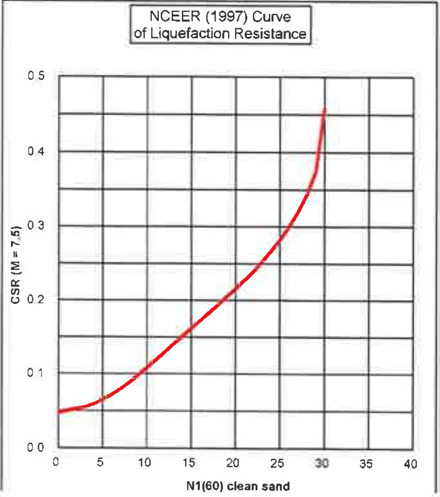
Required SF: 1.25
Minimum Calculated SF: #N/A

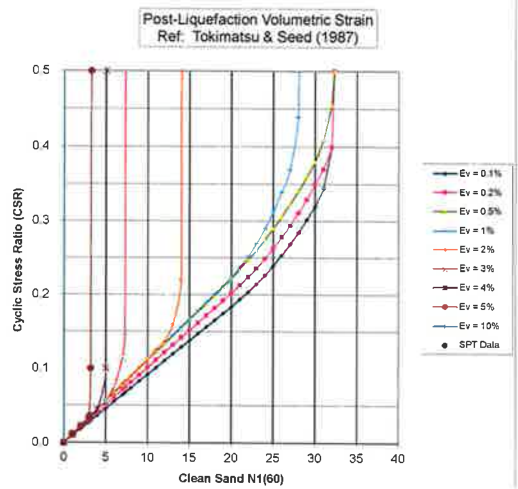
Base Depth (feet)	Cal Mod N	SPT N	Liquef. Suscept. (0 or 1)	Total Unit Wt (pcf)	Fines Content (%)	Depth of SPT (feet)	Rod Length (feet)	Tot Stress at SPT po (tsf)	Eff Stress at SPT p'o (tsf)	rd	C_N	C_R	C_S	$N_{1(60)}$	Rel. Dens Dr (%	Trigger FC Adj. $\Delta N_{1(60)}$	Equiv. Sand $N_{1(60)CS}$	Kσ	M = 7.5 Available CRR	M =7.5 Induced CSR*	Liquefac. Safety Factor	Post FC Adj. $\Delta N_{1(60)}$	$N_{1(60)CS}$	Volumetric Strain (%)	Induced Subsidence (in.)
								0.000																	
5.0	13	8	1	105	4	3.5	6.5	0.184	0.184	0.99	1.70	0.75	1.00	14.6	46	0.0	14.6	1.00	0.158	0.215	Non-Liq.	0.0	14.6	0.04	0.02
10.0		9	1	105	4	8.5	11.5	0.446	0.446	0.98	1.54	0.75	1.00	14.6	46	0.0	14.6	1.00	0.157	0.212	Non-Liq.	0.0	14.6	0.06	0.03
12.5		16	1	105	4	11.0	14.0	0.578	0.578	0.98	1.35	0.78	1.00	23.8	58	0.0	23.8	1.00	0.264	0.211	Non-Liq.	0.0	23.8	0.03	0.01
17.5		11	1	105	4	16.0	19.0	0.840	0.840	0.97	1.12	0.88	1.00	15.2	47	0.0	15.2	1.00	0.164	0.209	Non-Liq.	0.0	15.2	0.07	0.04
22.5		15	1	105	4	21.0	24.0	1.103	1.103	0.95	0.98	0.94	1.00	19.4	53	0.0	19.4	0.99	0.210	0.209	Non-Liq.	0.0	19.4	0.05	0.03
27.5		16	1	105	4	26.0	29.0	1.365	1.365	0.94	0.88	0.99	1.00	19.6	53	0.0	19.6	0.93	0.211	0.219	Non-Liq.	0.0	19.6	0.05	0.03
32.5		15	1	105	4	31.0	34.0	1.628	1.628	0.92	0.81	1.00	1.00	16.9	49	0.0	16.9	0.92	0.183	0.215	Non-Liq.	0.0	16.9	0.07	0.04
37.5		14	1	105	4	36.0	39.0	1.890	1.890	0.88	0.75	1.00	1.00	14.7	46	0.0	14.7	0.89	0.159	0.214	Non-Liq.	0.0	14.7	0.09	0.06
42.5		17	1	105	4	41.0	44.0	2.153	2.153	0.84	0.70	1.00	1.00	16.7	49	0.0	16.7	0.87	0.180	0.210	Non-Liq.	0.0	16.7	0.07	0.04
47.5		22	1	105	4	46.0	49.0	2.415	2.415	0.79	0.66	1.00	1.00	20.4	54	0.0	20.4	0.78	0.221	0.219	Non-Liq.	0.0	20.4	0.05	0.03
51.5		25	1	105	4	50.0	53.0	2.625	2.625	0.75	0.63	1.00	1.00	22.2	56	0.0	22.2	0.76	0.243	0.213	Non-Liq.	0.0	22.2	0.04	0.02

SETTLEMENT (SUBSIDENCE) OF DRY SANDS

Nc = 7.3

p (tsf)	G_{max} (tsf)	τ_{av} (tsf)	tav/Gmax	a	b	Shear Strain γ	Strain E_{15}	Strain Enc	Dry Sand Subsidence (in.)
0.123	384	0.038	0.0001	0.129	22,490	1.9E-04	2.8E-04	2.0E-04	0.02
0.299	597	0.091	0.0002	0.136	13,207	2.7E-04	4.0E-04	2.9E-04	0.03
0.387	799	0.117	0.0001	0.139	11,314	2.2E-04	1.8E-04	1.3E-04	0.01
0.563	831	0.168	0.0002	0.146	9,036	3.4E-04	4.7E-04	3.4E-04	0.04
0.739	1,033	0.218	0.0002	0.153	7,676	3.3E-04	3.4E-04	2.4E-04	0.03
0.915	1,152	0.266	0.0002	0.160	6,752	3.5E-04	3.6E-04	2.6E-04	0.03
1.090	1,199	0.309	0.0003	0.166	6,076	4.0E-04	4.9E-04	3.5E-04	0.04
1.266	1,231	0.347	0.0003	0.173	5,555	4.4E-04	6.4E-04	4.6E-04	0.06
1.442	1,372	0.376	0.0003	0.180	5,138	4.0E-04	5.0E-04	3.6E-04	0.04
1.618	1,553	0.398	0.0003	0.187	4,795	3.5E-04	3.5E-04	2.5E-04	0.03
1.759	1,667	0.410	0.0002	0.192	4,561	3.3E-04	2.9E-04	2.1E-04	0.02





$N_{1(60)}$ = C_N*C_E*C_B*C_R*C_S*N
C_R = 0.75 for Rod lengths < 3m, 1.0 for > 10m
= min(1,max(0.75,1.4666-2.556/$(z(ft))^{0.5}$))
C_N = $(1 atm/p'o)^{0.5}$, max 1.7
C_S = max(1.1,min(1.3,1+$N_{1(60)}$/100)) for SPT without liners
MSF = $10^{2.24}/M^{2.56}$
z = Depth (m)
pa = 1 atm = 101 KPa = 1.058 tsf

p = 0.67*po
τ_{av} = 0.65*PGA*po*rd
G_{max} = 447*$N_{1(60)CS}^{(1/3)}$*$p^{0.5}$
a = 0.0389*(p/1)+0.124
b = 6400*$(p/1)^{(-0.6)}$
γ = [1+a*EXP(b*τ_{av}/G_{max})]/[(1+a)*τ_{av}/G_{max}]
E_{15} = γ*$(N_{1(60)CS}/20)^{-1.2}$
E_{nc} = $(Nc/15)^{0.45}$*E15

Nc = $(MAG-4)^{2.17}$
S = 2*H*E_{nc}

rd = (1-0.4113*z^0.5+0.04052*z+0.001753*z^1.5)/(1-0.4177*z^0.5+0.05729*z-0.006205*z^1.5+0.00121*z^2))
$\Delta N_{1(60)}$ = min(10,IF(FC<35,exp(1.76-(190/FC^2)),5)+IF(FC<=5,1,IF(FC<35,0.99+(FC^1.5/1000),1.2))*N1(60) - N1(60)
$N_{1(60)CS}$ = $N_{1(60)CS}$ + $\Delta N_{1(60)}$
Kσ = min of 1.0 or $(p'o/1.058)^{(IF(Dr>0.7,0.6,IF(Dr<0.5,0.8,0.7))-1)}$
Dr = $(N_{1(60)}/70)^{0.5}$
CSReq = 0.65*PGA*(po/p'o)*rd
CSR* = CSReq/MSF/Kσ
$CRR_{7.5}$ = (0.048-0.004721*N+0.0006136*N^2-0.00001673*N^3)/(1-0.1248*N+0.009578*N^2-0.0003285*N^3+0.000003714*N^4))
N = $N_{1(60)CS}$

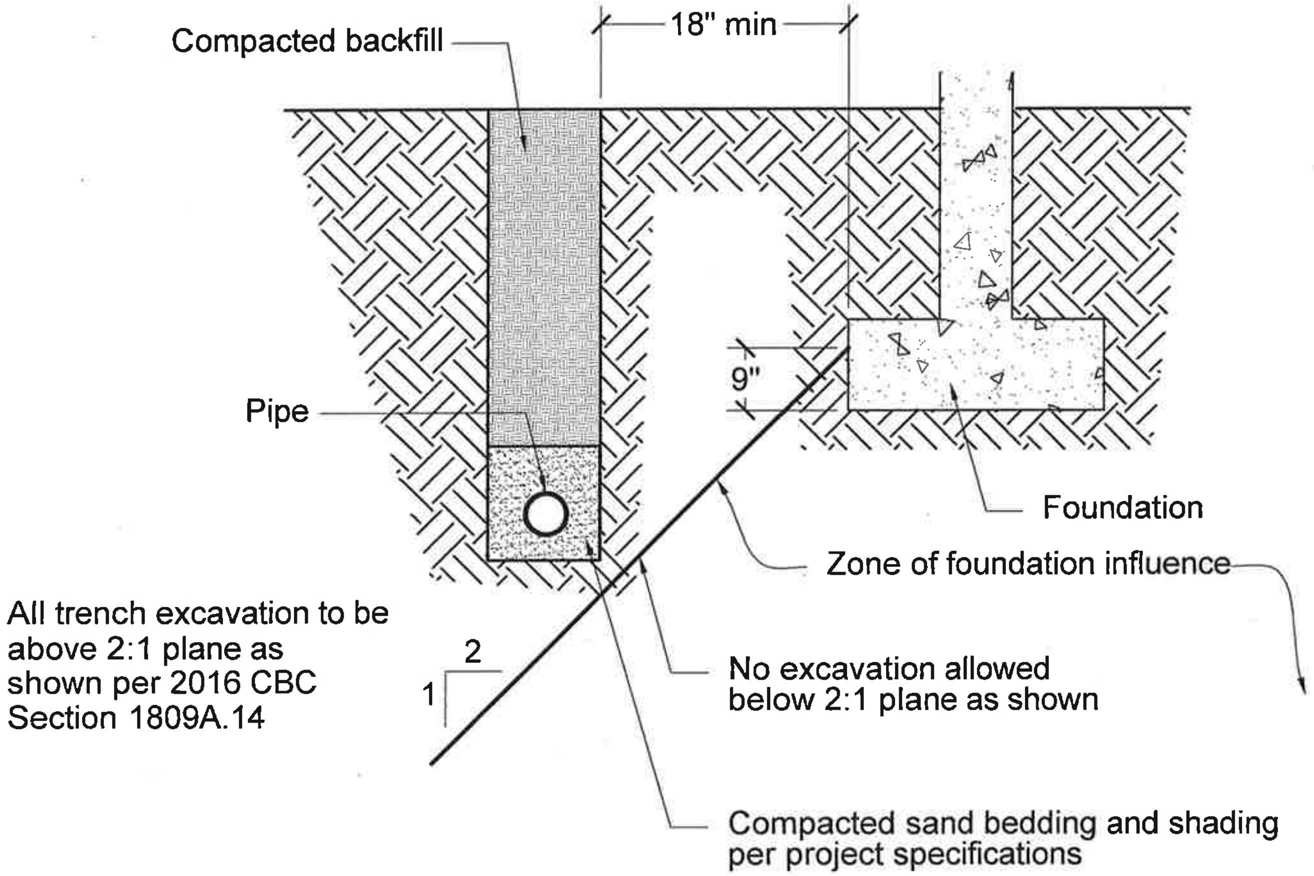
SF = $CRR_{7.5,1atm}$/CSR*

APPENDIX F

Typical Detail A: Pipe Placed Parallel to Foundations

TYPICAL DETAIL A

PIPE PLACED PARALLEL TO FOUNDATIONS*



SCHEMATIC ONLY
NOT TO SCALE

APPENDIX C

Laboratory Test Results

Dana Elementary School
Two New Classroom Buildings

301260-005

BULK DENSITY TEST RESULTS

ASTM D 2937-17 (modified for ring liners)

May 5, 2025

BORING NO.	DEPTH feet	MOISTURE CONTENT, %	WET DENSITY, pcf	DRY DENSITY, pcf
1	3.0 - 3.5	6.9	109.8	102.8
1	11.0 - 11.5	3.8	104.7	100.8
2	6.0 - 6.5	9.3	121.6	111.2
2	11.0 - 11.5	4.4	108.8	104.2
3	3.0 - 3.5	3.0	105.1	102.1
3	6.0 - 6.5	2.4	106.8	104.2
3	11.0 - 11.5	3.0	105.1	102.1
3	16.0 - 16.5	3.1	104.9	101.8
4	3.0 - 3.5	2.5	104.2	101.6
4	6.0 - 6.5	2.7	105.2	102.5
4	16.0 - 16.5	3.0	108.4	105.3

Dana Elementary School
Two New Classroom Buildings

301260-005

MOISTURE-DENSITY COMPACTION TEST

ASTM D 1557-12 (2021) (Modified)

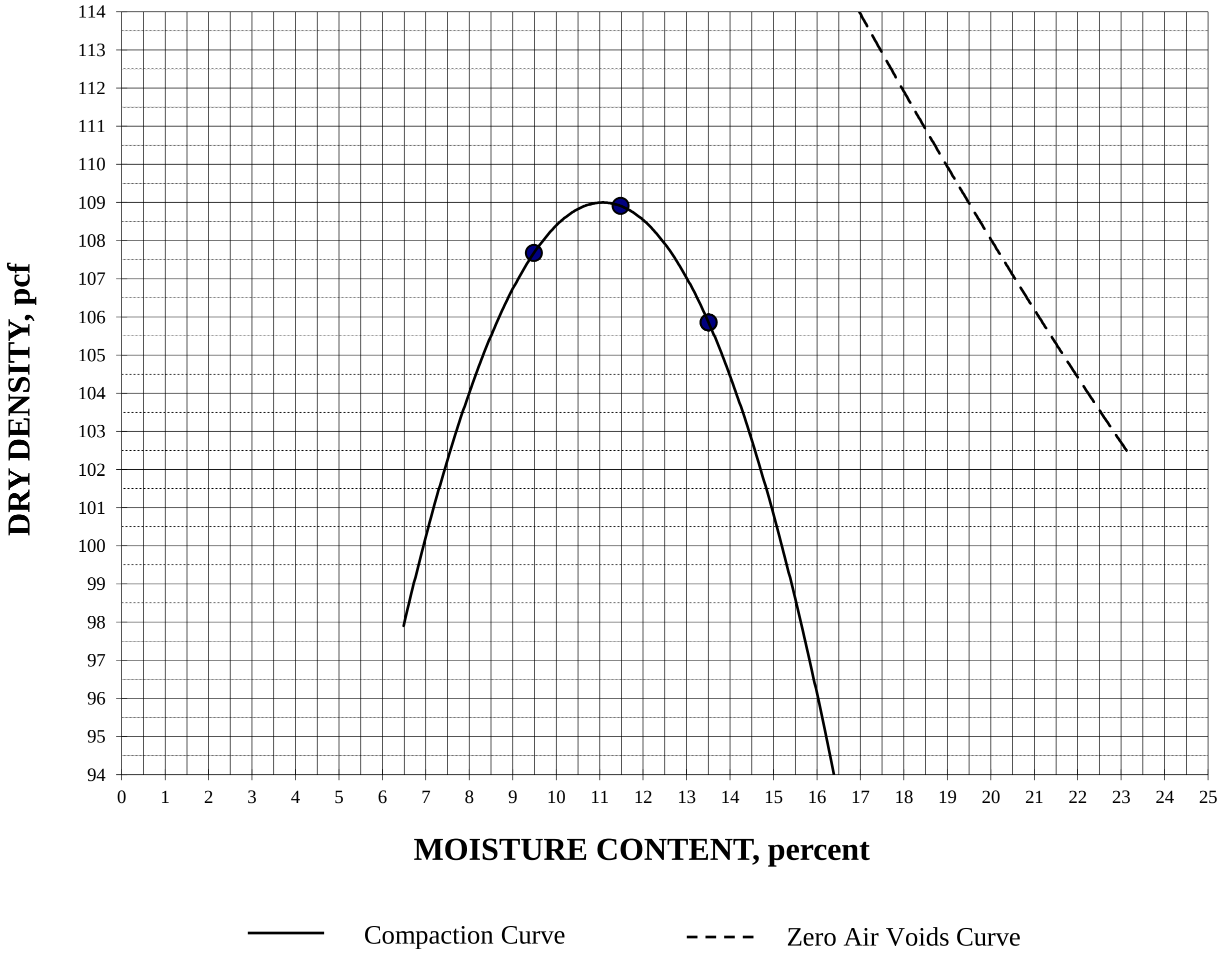
PROCEDURE USED: A
PREPARATION METHOD: Moist
RAMMER TYPE: Mechanical
SPECIFIC GRAVITY: 2.65 (assumed)

May 5, 2025
Boring #3 @ 1.0 - 5.0'
Brown Poorly Graded Sand (SP)

SIEVE DATA:

Sieve Size	% Retained (Cumulative)
3/4"	0
3/8"	0
#4	0

MAXIMUM DRY DENSITY: 109.1 pcf
OPTIMUM MOISTURE: 11.1%



DIRECT SHEAR

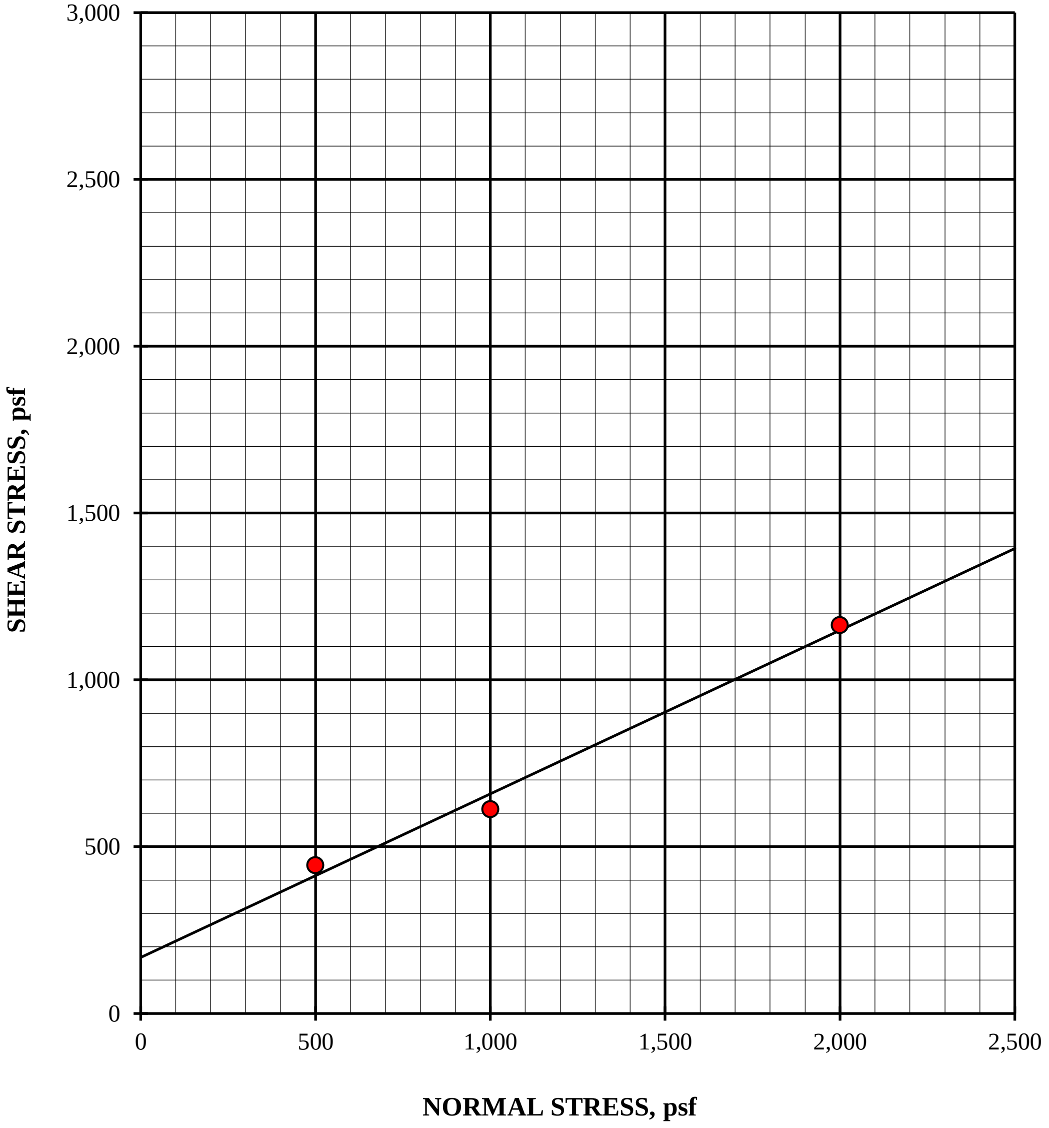
ASTM D 3080 (modified for consolidated, undrained conditions)

May 5, 2025

Boring #3 @ 1.0 - 5.0'
Poorly Graded Sand (SP)
Compacted to 90% RC, saturated

INITIAL DRY DENSITY: 98.2 pcf
INITIAL MOISTURE CONTENT: 11.1 %
PEAK SHEAR ANGLE (Ø): 26°
COHESION (C): 168 psf

SHEAR vs. NORMAL STRESS



DIRECT SHEAR continued

ASTM D 3080 (modified for consolidated, undrained conditions)

Boring #3 @ 1.0 - 5.0'

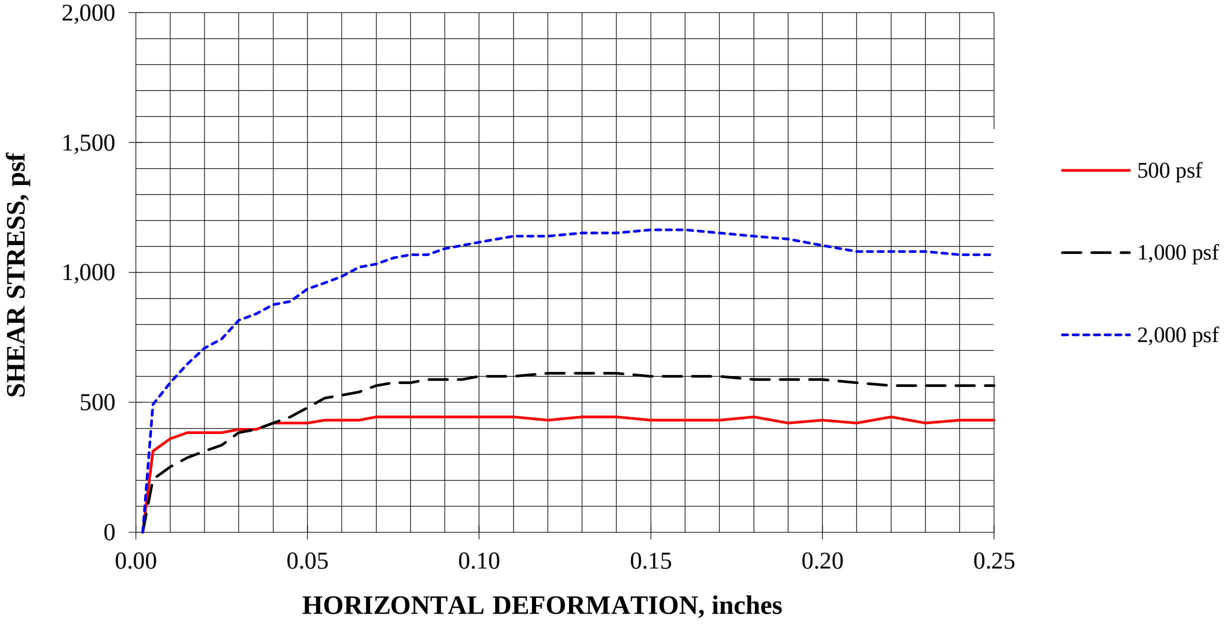
May 5, 2025

Poorly Graded Sand (SP)

Compacted to 90% RC, saturated

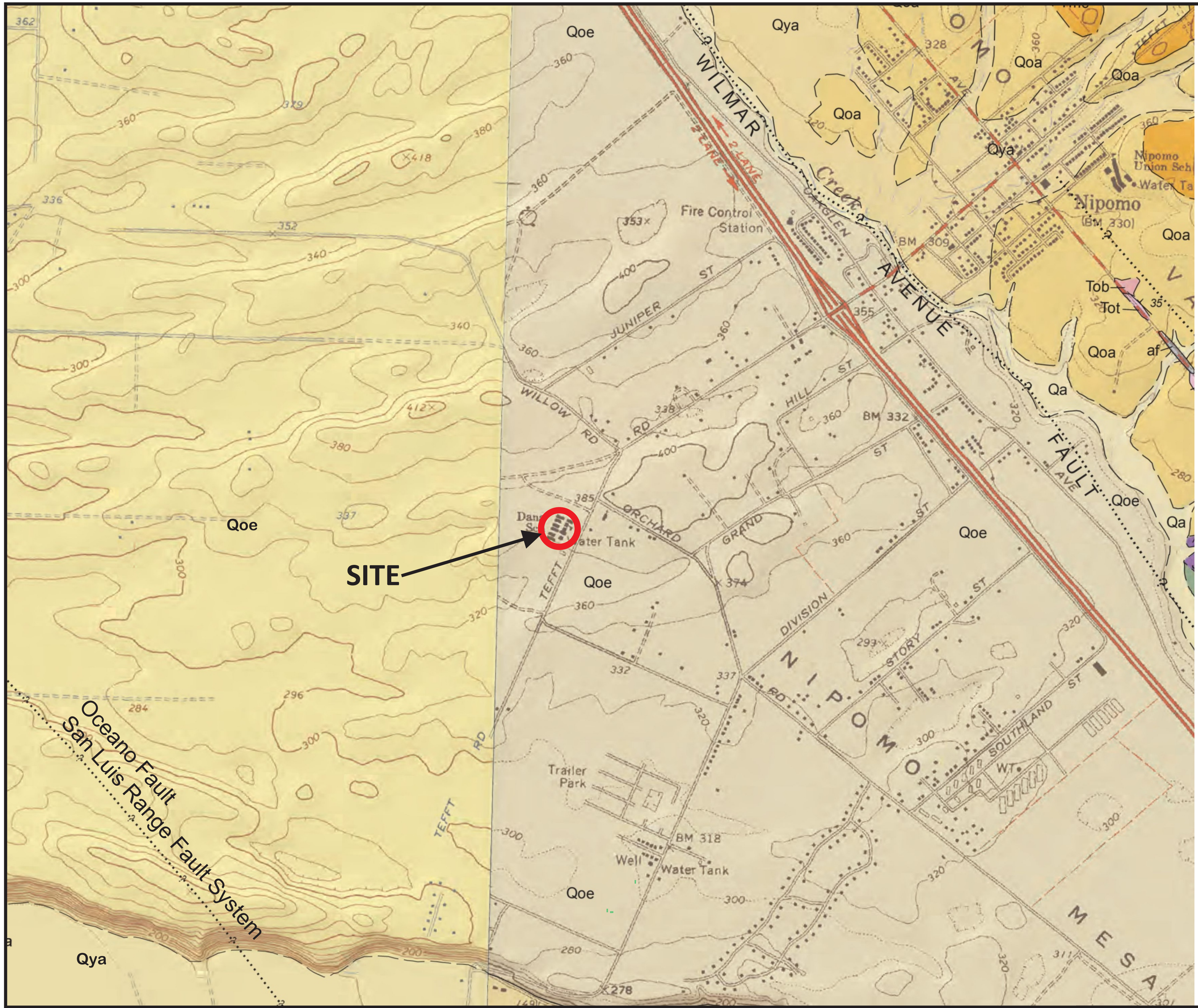
SPECIFIC GRAVITY: 2.65 (assumed)

SAMPLE NO.:	**1**	**2**	**3**	**AVERAGE**
INITIAL				
WATER CONTENT, %	11.1	11.1	11.1	11.1
DRY DENSITY, pcf	98.2	98.2	98.2	98.2
SATURATION, %	43.0	43.0	43.0	43.0
VOID RATIO	0.684	0.684	0.684	0.684
DIAMETER, inches	2.410	2.410	2.410	
HEIGHT, inches	1.00	1.00	1.00	
AT TEST				
WATER CONTENT, %	22.3	22.0	22.8	
DRY DENSITY, pcf	99.8	101.5	103.1	
SATURATION, %	90.0	92.7	99.9	
VOID RATIO	0.657	0.629	0.604	
HEIGHT, inches	0.98	0.97	0.95	



APPENDIX D

Figure 3 – Geologic Map
Figure 4 – Historical Seismicity Map
Figure 5 – Indoor Radon Potential Map



EXPLANATION

Qa	**Alluvial flood-plain deposits (late Holocene)** - Active and recently active flood-plain deposits. Consists of unconsolidated sandy, silty, and clay-bearing alluvium.
Qye	**Young eolian deposits (Holocene)** – Vegetated stationary sand dune deposits displaying dune morphology. Well-sorted white to brown windblown sand. Inception of dune sheet occurred at approximately 3.5 to 4.3 ka (Knott and Eley, 2006).
Qya	**Young alluvial valley deposits, undivided (Holocene to late Pleistocene)** – Unconsolidated sand, silt, and clay-bearing alluvium deposited on flood-plains and along valley floors. Surfaces are slightly dissected and display weak soil development. Approximately 4.3 to 11 ka in the Santa Maria Valley (Knott and Eley, 2006).
Qoe	**Old eolian deposits (late Pleistocene)** – well sorted red to brown wind blown sand with weak soil development in places. Surfaces are dissected and dune morphology is generally obscured.
Qoa	**Older alluvium (late to middle Pleistocene)** – Unconsolidated boulders, cobbles, gravel, sand, silt and clay poorly to moderately sorted; some discontinuous horizontal bedding, weakly to strongly cemented horizons (duripans) present locally, clasts generally consist of Franciscan Complex, Obispo and Monterey Formation lithologies.
Qm	**Marine deposits (middle to late Pleistocene)** – Unconsolidated, well to moderately sorted cobbles and sand; clasts are typically subrounded to rounded and consist of Franciscan Complex, Obispo and Monterey Formation lithologies. (Hansen, et al, 1994).
Tot	**Obispo Formation (lower Miocene)** – Coarse-grained tuff with subangular clasts of pumice (5%-50%), perlite (5%-15%), white to dark-gray glass shards (20%) and feldspar (5%) in a vitric ashy matrix; locally zeolitized or silicified (Tor) and commonly altered to montmorillonite (Hall, 1973).
Tor	**Zeolitized tuff** – Resistant, hard, fine-grained, zeolitized or silicied tuff. Forms resistant outcrops.
Tr	**Rincon Shale (Oligocene to lower Miocene)** – Dark brown siltstone that is exposed in a road cut along Highway 101.
sp	**Serpentinite**
msw	**Mélange and slope wash** – Areas surrounding resistant blocks interpreted to be mélange matrix largely covered by slope wash.

Approximate Scale: 1' = 2,000 feet

N

Source: Western half - Holland, Peter J., 2013, Preliminary Geologic Map of the Oceano 7.5 minute Quadrangle
Eastern half - Delattre, Marc P., and Mark O. Wiegers, 2014, Preliminary Geologic Map of the Nipomo 7.5 minute Quadrangle
Map Revised May 2025, added Excerpt of Oceano Quadrangle to depict site relation to Oceano fault, San Luis Range Fault System

Earth Systems Pacific
4378 Old Santa Fe Road, San Luis Obispo, CA 93401
(805) 544-3276 Fax - (805) 544-1786
www.earthsystems.com - email: esp@earthsystems.com

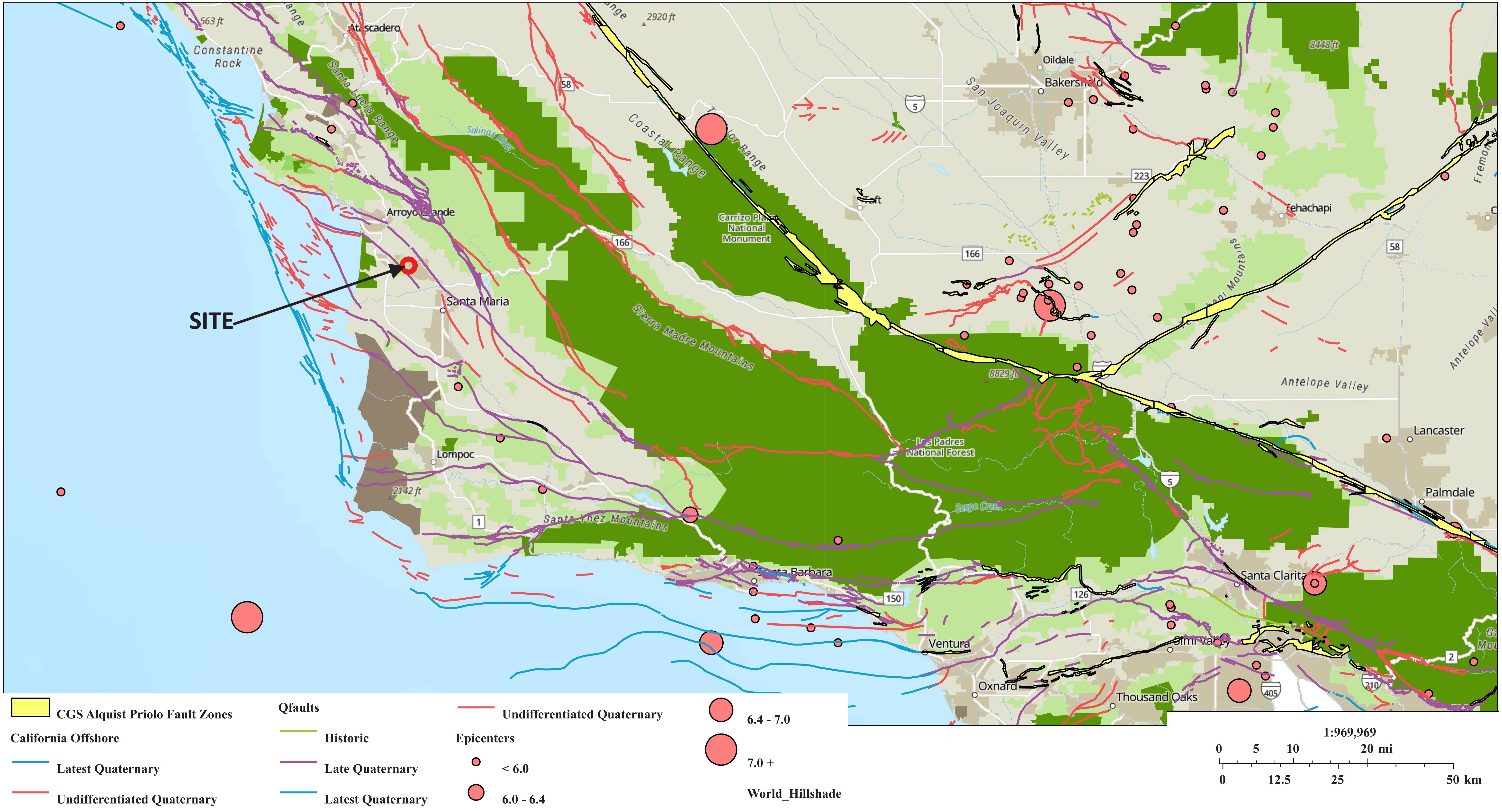
Regional Geologic Map

Dana Elementary School
Two New Classroom Buildings
920 West Teft Street
Nipomo, California

Figure 3

Date
May 2025

Project No.
301260-005



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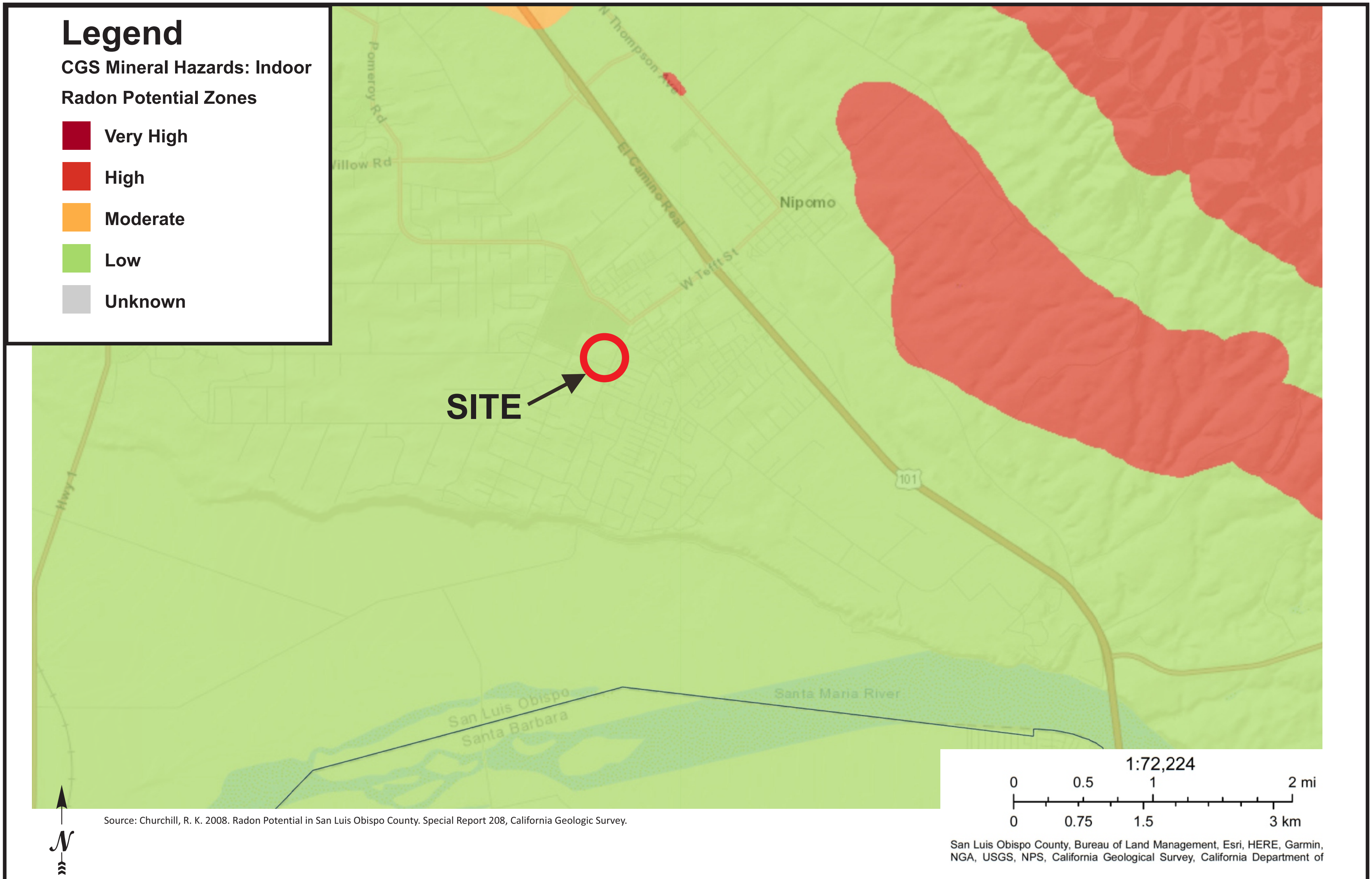
Historical Seismicity Map

Dana Elementary School
Two New Classroom Buildings
920 West Teft Street
Nipomo, California

Figure 4

Date
May 2025

Project No.
301260-005



Source: Churchill, R. K. 2008. Radon Potential in San Luis Obispo County. Special Report 208, California Geologic Survey.

San Luis Obispo County, Bureau of Land Management, Esri, HERE, Garmin, NGA, USGS, NPS, California Geological Survey, California Department of

EARTH SYSTEMS PACIFIC
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(805) 544-3276

Indoor Radon Potential Map

Dana Elementary School
Two New Classroom Buildings
920 West Teft Street
Nipomo, California

FIGURE 5

Date
May 2025

Project No.
301260-005

APPENDIX E

SPT Hammer Energy Measurements Report
Seismic Settlement Calculations for Unsaturated Soils

SPT HAMMER ENERGY MEASUREMENTS

Prepared for;

Earth Systems

Prepared by;

SPT CAL
5512 Belem Dr
Chino Hills, CA 91709

909-730-2161
bc@sptcal.com

Date: 06/27/2023

Project Title: Earth Systems Santa Maria

Project Description: Gtechdrill GT8Max

Energy Transfer Ratio = 88.9% @ 53.6 blows per minute

Testing was performed on June 27, 2023 in Santa Maria, California

Hammer Energy Measurements performed per ASTM D4633 using an approved and calibrated SPT Analyzer from Pile Dynamics, Inc. meeting the criteria of ASTM D4633-05 and per the process defined in ASTM D4633-05, The process and equipment requirements followed per ASTM D4633-05 meet the criteria of ASTM D4633-16.

PRESENTATION OF SPT ANALYZER TEST DATA

1. Introduction

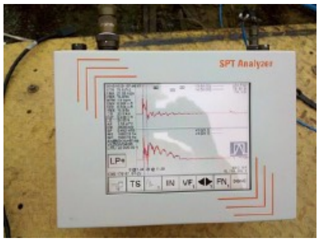
This report presents the results of SPT Hammer Energy Measurements recorded with an SPT Analyzer from Pile Dynamics carried out on June 27, 2023 in Santa Maria, California.

2. Field Equipment and Procedures

The drill used is a Gtechdrill GT8 Max, serial number 8070-G515A0057. The operator was Matt Starr of Earth Systems. It has an attached Gtechdrill Automatic Hammer. The Gtechdrill Automatic Hammer uses a 140 lb. weight dropped 30” on to an anvil above the bore hole. The drill rod connects the anvil to a split spoon type soil sampler inside an 8” o.d. hollow stem auger at the designated sample depth. After a seeding blow the sampler is driven 18”. The number of blows required to penetrate the last 12" is referred to as the “N value”, which is related to soil strength.

The first recording was taken at 5' below ground surface and then every 5' to final recording at 25’.

3. Instrumentation



An SPT Analyzer from Pile Dynamics was used to record and the process the data. The raw data was stored directly in the SPT Analyzer computer with subsequent analysis in the office with PDA-W and PDIPlot software. The measurements and analysis were conducted in general accordance with ASTM D4945 and ASTM D6066 test standards.

The SPT Analyzer is fully compliant with the minimum digital sampling frequency requirements of ASTM D4633-05 (50 kHz) and EN ISO 22476-3:2005 (100 kHz), as well as with the low pass filter, (cutoff frequency of 5000 Hz instead of 3000 Hz) requirements of ASTM D4633-05. All equipment and analysis also conform to ASTM D6066.

A 2' instrumented section of NWJ rod, with two sets of accelerometers and strain transducers mounted on opposite sides of the drill rod, was placed below the anvil. It measured strain and acceleration of every hammer blow. The SPT Analyzer then calculates the amount of energy transferred to the rod by force and velocity measurements.

4. Observations

The drill rig motor is diesel fueled. The drill and sample equipment looked to be well operated and maintained.

5. Results

Results from the SPT Hammer Energy Measurements are summarized on the following pages. It shows the Energy Transfer Ratio (ETR) at each sampling depth. ETR is the ratio of the measured maximum transferred energy to rated energy of the hammer which is the product of the weight of the hammer times the height of the fall. 140 lb x 30” = 4200 lb-in = 0.350 kip-ft. N60=(ETR/60)N. The reported average value is a weighted average based on the number of blows at each sample interval.

6. Recommendations

Recalibration of the auto hammer is recommended annually. Recalibration is also recommended for change of operator, engine modifications and repair, hydraulic system modifications and repair, auto hammer adjustments and repair and anything else that may affect speed, function and weight of the auto-hammer

Energy Transfer Ratio = 88.9% @ 53.6 blows per minute

N60=(ETR/60)N

Depth	ETR%	BPM
5	87.8	50.7
10	87.1	51.9
15	88.5	53.7
20	89.9	55.4
25	91.1	56.3
Average	**88.9**	**53.6**

If you have any questions please do not hesitate to call or email.

Thank you,

Brian Serl
Calibration Engineer
SPT CAL
909-730-2161
bc@sptcal.com

Project: Dana Elementary School Two New Classroom Buildings
Job No: 301260-005
Date: 5/6/2025
Boring: B3 Data Set: 1

Methods: **Liquefaction Analysis using 1996 & 1998 NCEER workshop method (Youd & Idriss, editors)**
Journal of Geotechnical and Enviromental Engineering (JGEE), October 2001, Vol 127, No. 10, ASCE
Settlement Analysis from Tokimatsu and Seed (1987), JGEE,Vol 113, No.8, ASCE
Modified by Pradel, JGEE, Vol 124, No. 4, ASCE

EARTHQUAKE INFORMATION:

Magnitude: 6.78 7.5
PGA, g: 0.33 0.26
MSF: 1.29
GWT: 50.0 feet
Calc GWT: 50.0 feet
Remediate to: 0.0 **feet**

SPT N VALUE CORRECTIONS:

Energy Correction to N60 (C_E): 1.48 Automatic Hammer
Drive Rod Corr. (C_R): 1 Default
Rod Length above ground (feet): 5.0
Borehole Dia. Corr. (C_B): 1.05
Sampler Liner Correction for SPT?: 0 No
Cal Mod/ SPT Ratio: 0.63

Threshold Acceler., g: #N/A

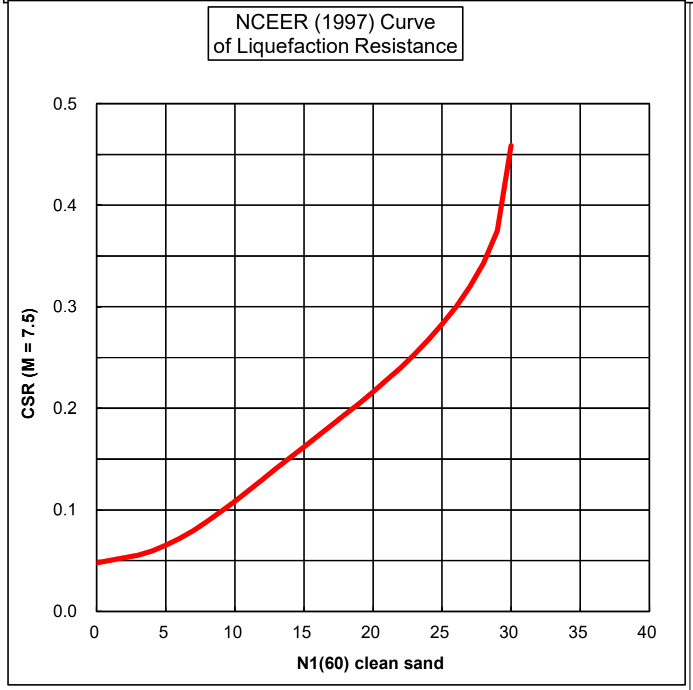
Total (in.) Induced Subsidence
0.04
upper 50 ft

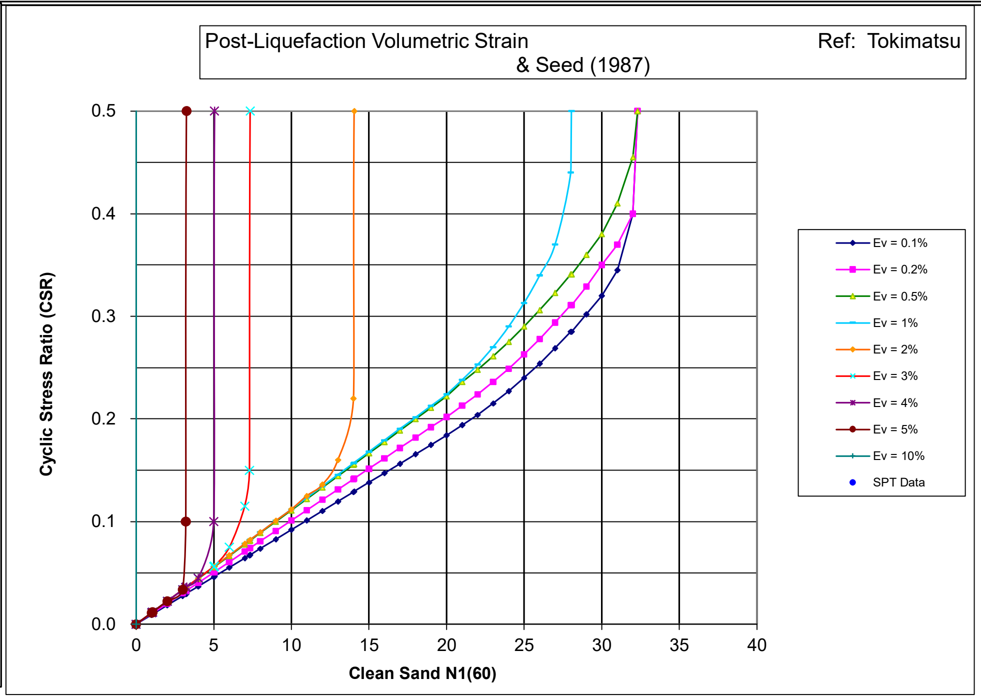
Required SF: 1.30
Minimum Calculated SF: #N/A

SETTLEMENT (SUBSIDENCE) OF DRY SANDS

Nc = 9.2

Base Depth (feet)	Cal Mod N	SPT N	Liquef. Suscept. (0 or 1)	Total Unit Wt. (pcf)	Fines Content (%)	Depth of SPT (feet)	Rod Length (feet)	Layer Thick (ft)	Tot.Stress at SPT po (tsf)	Depth m	Eff.Stress at SPT p'o (tsf)	Eff.Stress Design GW p'o (tsf)	rd	C_N	C_R	C_S	$N_{1(60)}$	Rel. Dens. Dr (%)	*Trigger FC Adj.* $\Delta N_{1(60)}$	*Equiv. Sand* $N_{1(60)CS}$	Kσ	M = 7.5 Available CRR	M =7.5 Induced CSR*	**Liquefac. Safety Factor**	*Post FC Adj.* $\Delta N_{1(60)}$	$N_{1(60)CS}$	Volumetric *Strain (%)*	**Induced Subsidence (in.)**	p (tsf)	G_{max} (tsf)	τ_{av} (tsf)	Shear Strain γ	Strain E_{15}	Strain Enc	**Dry Sand Subsidence (in.)**
									0.000																										
4.5	18	**11**	1	105	3	3.0	8.0	4.50	0.158	0.91	0.158	0.158	0.99	1.70	0.75	1.00	22.5	57	0.0	22.5	1.00	0.246	0.165	**Non-Liq.**	0.0	22.5	0.02	**0.01**	0.106	410	0.034	1.4E-04	1.3E-04	1.0E-04	**0.01**
8.0	22	**14**	1	107	3	6.0	11.0	3.50	0.317	1.83	0.317	0.317	0.99	1.70	0.75	1.00	27.5	63	0.0	27.5	1.00	0.330	0.164	**Non-Liq.**	0.0	27.5	0.02	**0.01**	0.212	621	0.067	1.7E-04	1.2E-04	9.3E-05	**0.01**
13.0	22	**14**	1	105	3	11.0	16.0	5.00	0.581	3.35	0.581	0.581	0.98	1.35	0.83	1.00	24.0	59	0.0	24.0	1.00	0.268	0.162	**Non-Liq.**	0.0	24.0	0.03	**0.02**	0.389	805	0.122	2.4E-04	1.9E-04	1.5E-04	**0.02**
16.5	38	**24**	1	105	3	16.0	21.0	3.50	0.844	4.88	0.844	0.844	0.97	1.12	0.91	1.00	37.9	74	0.0	37.9	1.00	1.200	0.161	**Non-Liq.**	0.0	37.9	0.02	**0.01**	0.565	1,128	0.175	2.2E-04	1.0E-04	8.1E-05	**0.01**


NCEER (1997) Curve
of Liquefaction Resistance


Post-Liquefaction Volumetric Strain
& Seed (1987)
Ref: Tokimatsu

$N_{1(60)}$ = C_N*C_E*C_B*C_R*C_S*N
C_R = 0.75 for Rod lengths < 3m, 1.0 for > 10m
= min(1,max(0.75,1.4666-2.556/(z(ft))$^{0.5}$))
C_N = (1 atm/p'o)$^{0.5}$, max 1.7
C_S = max(1.1,min(1.3,1+$N_{1(60)}$/100)) for SPT without liners
MSF = $10^{2.24}/M^{2.56}$
z = Depth (m)
pa = 1 atm = 101 KPa = 1.058 tsf

p = 0.67*po
Nc = (MAG-4)$^{2.17}$
τ_{av} = 0.65*PGA*po*rd
G_{max} = 447*$N_{1(60)CS}{}^{(1/3)}$*$p^{0.5}$
a = 0.0389*(p/1)+0.124
b = 6400*(p/1)$^{(-0.6)}$
γ = [1+a*EXP(b*τ_{av}/G_{max})]/[(1+a)*τ_{av}/G_{max}]
E_{15} = γ*($N_{1(60)CS}$/20)$^{-1.2}$
E_{nc} = (Nc/15)$^{0.45}$*E15
S = 2*H*E_{nc}

rd = (1-0.4113*z^0.5+0.04052*z+0.001753*z^1.5)/(1-0.4177*z^0.5+0.05729*z-0.006205*z^1.5+0.00121*z^2))
$\Delta N_{1(60)}$ = min(10,IF(FC<35,exp(1.76-(190/FC^2)),5)+IF(FC<=5,1,IF(FC<35,0.99+(FC^1.5/1000),1.2))*N1(60) - N1(60)
$N_{1(60)CS}$ = $N_{1(60)CS}$ + $\Delta N_{1(60)}$
Kσ = min of 1.0 or (p'o/1.058)$^{(IF(Dr>0.7,0.6,IF(Dr<0.5,0.8,0.7))-1)}$
Dr = $(N_{1(60)}/70)^{0.5}$
CSReq = 0.65*PGA*(po/p'o)*rd
CSR* = CSReq/MSF/Kσ
$CRR_{7.5}$ = (0.048-0.004721*N+0.0006136*N^2-0.00001673*N^3)/(1-0.1248*N+0.009578*N^2-0.0003285*N^3+0.000003714*N^4))
N = $N_{1(60)CS}$

SF = $CRR_{7.5,1atm}$/CSR*

APPENDIX F

Site Specific Ground Motion Analysis – Tables F-1 through F-4

Table F-1
Fault Parameters

Fault Section Name	Distance		Upper Seis. Depth	Lower Seis. Depth	Avg Dip Angle	Avg Dip Direction	Avg Rake	Trace Length	Fault Type	**Mean Mag**	Mean Return Interval	Slip Rate
	(miles)	(km)	(km)	(km)	(deg.)	(deg.)	(deg.)	(km)			(years)	(mm/yr)
San Luis Range (So Margin) FM3.2	1.1	1.8	0.0	12.0	45	37	90	115	B	**7.1**		0.2
San Luis Range 2011 CFM, FM3.1	1.3	2.0	0.0	12.0	52	na	na	79	B'	**7.2**		
San Luis Range - Oceano 2011 CFM, FM3.1	1.4	2.2	0.0	12.0	45	na	na	21	B'	**6.6**		
Oceanic-West Huasna FM3.1, 3.2	6.4	10.3	0.0	7.0	58	49	na	122	B'	**7.1**		
Los Osos 2011 CFM FM3.1, 3.2	6.8	11.0	0.0	12.0	45	208	90	58	B	**6.9**		0.5
Casmalia 2011 CFM	9.2	14.8	0.0	12.0	75	na	na	48	B'	**6.9**		
San Luis Range - Pecho FM3.1, 3.2	10.8	17.3	0.0	12.0	90	na	na	26	B'	**6.6**		
East Huasna 2011 CFM FM3.1, 3.2	12.7	20.4	0.0	15.0	90	na	na	74	B'	**7.2**		
Lions Head 2011 CFM FM3.1, 3.2	13.0	21.0	0.0	12.0	75	29	90	65	B	**6.7**		0.02
Shoreline FM3.1, 3.2	15.5	25.0	0.0	12.0	90	na	na	23	B'	**6.5**		
San Luis Bay 2011 CFM FM3.2	15.7	25.3	0.0	10.0	90	na	na	16	B'	**6.3**		
South Cuyama FM3.1, 3.2	17.5	28.2	0.0	13.9	33	210	na	83	B'	**7.5**		
Hosgri FM3.1, 3.2	17.7	28.5	0.0	6.8	80	59	180	171	B	**7.3**		2.5
Hosgri (Extension) FM3.1, 3.2	18.4	29.6	0.0	7.5	80	79	na	29	B'	**6.4**		
Rinconada 2011 CFM FM3.1, 3.2	18.9	30.5	0.0	8.5	82	233	180	123	B	**7.5**		1
Los Alamos 2011 CFM FM3.1, 3.2	20.8	33.5	0.0	12.0	30	na	na	27	B'	**6.9**		
La Panza FM3.1, 3.2	21.4	34.4	0.0	13.9	51	45	na	72	B'	**7.3**		
Santa Ynez River FM3.1, 3.2	26.6	42.8	0.0	12.0	70	na	na	73	B'	**7.1**		
San Juan FM3.1, 3.2	28.5	45.8	0.0	13.0	90	243	180	82	B	**7.1**		1
Morales (West) FM3.1, 3.2	34.0	54.7	0.0	8.6	32	49	na	28	B'	**6.8**		
Los Alamos extension FM3.1, 3.2	35.5	57.1	0.0	12.0	30	na	na	22	B'	**6.8**		
Santa Ynez (West) FM3.1, 3.2	35.6	57.2	0.0	9.2	70	182	0	80	B	**6.9**		2
San Andreas (Cholame) rev FM3.1, 3.2	40.0	64.4	0.0	12.0	90	51	180	63	A	**6.8**	89	3.5
San Andreas (Carrizo) rev FM3.1, 3.2	40.8	65.7	0.0	15.1	90	224	180	59	A	**6.8**	89	3.5
Ozena FM3.1, 3.2	45.9	73.9	0.0	13.9	33	na	na	41	B'	**7.2**		
Red Mountain FM3.1, 3.2	46.7	75.2	0.0	14.1	56	2	90	101	B	**7.4**		2
Morales (East) FM3.1, 3.2	46.8	75.2	0.0	8.6	32	14	na	18	B'	**6.6**		
San Andreas (Parkfield) FM3.1, 3.2	51.3	82.5	0.0	10.2	90	50	180	36	A	**6.4**	13	20
Mission Ridge-Arroyo Parida-Santa Ana FM3.1, 3	53.5	86.2	0.0	7.6	70	176	90	69	B	**6.8**		0.4
North Channel FM3.2	54.4	87.5	1.1	4.5	26	10	90	51	B	**6.7**		1
Pitas Point (Upper) FM3.2	54.9	88.4	1.4	10.0	42	15	90	35	B	**6.8**		1
Big Pine (West) FM3.1, 3.2	55.4	89.1	0.0	11.0	50	2	na	18	B'	**6.5**		
Pitas Point (Lower, West), FM 3.1	57.6	92.7	1.5	8.8	13	3	90	35	B	**7.2**		2.5
Oak Ridge (Offshore), west extension FM3.2	57.7	92.9	0.0	3.1	67	195	na	28	B'	**6.1**		
Channel Islands Western Deep Ramp FM3.1, 3.2	58.2	93.7	4.8	12.5	21	204	90	62	B'	**7.3**		
Lost Hills FM3.1, 3.2	58.8	94.7	4.2	12.0	29	233	na	33	B'	**6.8**		
Santa Ynez (East) FM3.1, 3.2	61.0	98.2	0.0	13.3	70	172	0	68	B	**7.2**		2
San Andreas (Big Bend) FM3.1, 3.2	62.3	100.2	0.0	15.1	90	198	180	50	A	**6.8**	89	3.5
Pine Mtn FM3.1, 3.2	65.7	105.7	0.0	16.3	45	5	na	62	B'	**7.3**		
San Andreas (Creeping Section) FM3.1, 3.2	67.4	108.5	0.0	12.0	90	227	180	121	A	**6.8**	89	9

Reference: USGS OFR 2013-1165 (CGS SP 228)

Based on Site Coordinates of 35.0276 Latitude, -120.4987 Longitude

Mean Magnitude for Type A Faults based on 0.1 weight for unsegmented section, 0.9 weight for segmented model (weighted by probability of each scenario with section listed as given on Table 3 of Appendix G in OFR 2008-1437). Mean magnitude is average of Ellworths-B and Hanks & Bakun moment area relationship.

Site Coordinates: 35.0276 N 120.4987 W

Table F-2

Historical Earthquakes in Vicinity of Project Site, M >= 5.0

		Epicenter		*Distance*	
		Latitude	*Longitude*	*from*	*Magnitude*
Day	*Year*	*(Degrees)*		*Site (mi)*	M_W
7/28	1902	34.80	120.40	16.7	**5.8**
9/5	1922	35.30	120.70	22.0	**5.5**
99/99	1830	35.35	120.65	23.8	**6.0**
7/31	1902	34.70	120.30	25.3	**5.8**
1/12	*1915	34.60	120.20	34.0	**5.7**
11/4	*1927	34.60	120.90	37.3	**7.1**
4/27	1908	35.60	120.20	43.0	**5.5**
5/30	1877	35.70	120.30	47.8	**5.5**
1/1	1821	34.55	119.85	49.4	**6.3**
12/7	1906	35.50	121.20	51.3	**5.7**
3/10	1922	35.75	120.25	51.8	**6.3**
8/18	1922	35.75	120.25	51.8	**5.7**
6/8	1934	35.79	120.29	53.9	**6.0**
9/28	2004	35.82	120.37	55.2	**6.0**
6/28	1966	35.81	120.27	55.5	**6.0**
4/7	1885	35.00	119.50	56.5	**5.5**
2/1	1853	35.70	121.10	57.5	**5.5**
12/22	2003	35.70	121.10	57.5	**6.6**
5/31	1854	34.45	119.70	60.4	**6.0**
11/5	1969	34.65	121.50	62.4	**5.5**
3/25	1806	34.40	119.70	62.7	**5.5**
11/16	1956	35.95	120.47	63.7	**5.0**
9/29	2004	35.95	120.50	63.7	**5.1**
6/29	1925	34.30	119.80	64.0	**6.8**

From full earthquake catalog in USGS OFR 2008-1437h as updated with current events through 2024 (ANSS 2025). For events with an asterisk, alternate solutions are given in the OFR. Ordered By Closest Event. Maximum 40 Closest Events

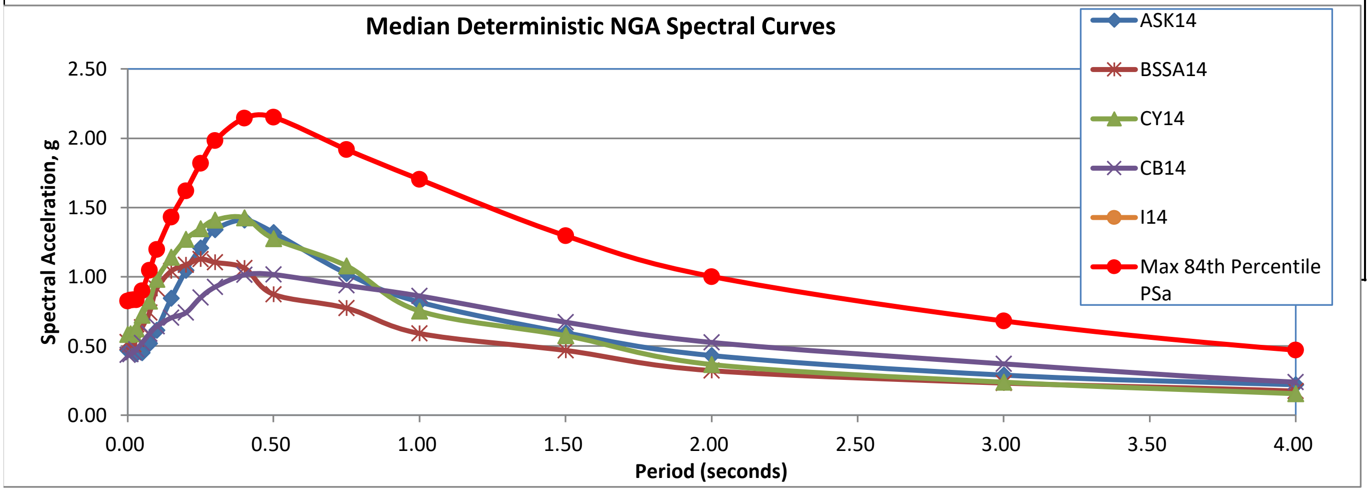
35.0276 -120.4987 Lat/Long

Table F-3 - Deterministic Spectral Response Values
Deterministic NGA Response Spectra for Largest Median Earthquake Ground Motion

Average of NGA: Abrahamson - Silva - Kamai (2014), Boore - Stewart - Seyhan - Atkinson (2013), Campbell-Bozorgnia (2013), Chiou - Youngs (2014), and Idriss (2013)

Mean Spectra Response from Attentuation Relationships

	ASK14		BSSA14	CB14	CY14	I14	Average			
Input Variables	**Period (sec)**	Median PSa (g)	Median PSa (g)	Median PSa (g)	Median PSa (g)	Median PSa (g)	**Period (sec)**	Mean PSa (g)	Max 84th Percentile PSa (g)	**Max Rotated Determ. PSa**
	Weight:	**0.25**	**0.25**	**0.25**	**0.25**	**0.00**				
M	**0.00**	0.47	0.52	0.44	0.58	-	**0.00**	0.503	0.824	**0.907**
7.49	**0.01**	0.47	0.53	0.44	0.58	-	**0.01**	0.506	0.830	**0.913**
R_{RUP}	**0.02**	0.47	0.51	0.45	0.59	-	**0.02**	0.506	0.834	**0.917**
1.80	**0.03**	0.44	0.51	0.47	0.59	-	**0.03**	0.504	0.834	**0.918**
R_{JB}	**0.05**	0.45	0.55	0.52	0.62	-	**0.05**	0.537	0.899	**0.989**
1.80	**0.075**	0.52	0.63	0.59	0.72	-	**0.075**	0.616	1.046	**1.151**
V_{S30}	**0.10**	0.61	0.74	0.64	0.82	-	**0.10**	0.705	1.196	**1.315**
260	**0.15**	0.85	0.92	0.70	0.98	-	**0.15**	0.861	1.430	**1.573**
F_{RV}	**0.20**	1.05	1.04	0.74	1.14	-	**0.20**	0.992	1.620	**1.782**
0	**0.25**	1.21	1.08	0.85	1.27	-	**0.25**	1.104	1.818	**2.085**
F_{NM}	**0.30**	1.34	1.13	0.93	1.35	-	**0.30**	1.185	1.984	**2.295**
0	**0.40**	1.41	1.10	1.01	1.41	-	**0.40**	1.234	2.145	**2.526**
W	**0.50**	1.32	1.06	1.02	1.43	-	**0.50**	1.206	2.153	**2.579**
17.00	**0.75**	1.02	0.87	0.94	1.28	-	**0.75**	1.027	1.919	**2.397**
Z_{TOR}	**1.00**	0.82	0.77	0.86	1.08	-	**1.00**	0.883	1.702	**2.213**
0.00	**1.50**	0.59	0.59	0.67	0.75	-	**1.50**	0.652	1.295	**1.716**
Z_{BOT}	**2.00**	0.43	0.47	0.53	0.57	-	**2.00**	0.500	1.001	**1.351**
12.00	**3.00**	0.29	0.32	0.37	0.37	-	**3.00**	0.337	0.680	**0.953**
dip	**4.00**	0.22	0.23	0.24	0.24	-	**4.00**	0.233	0.469	**0.681**
45	**5.00**	0.17	0.18	0.17	0.16	-	**5.00**	0.168	0.337	**0.505**
	7.50	0.10	0.09	0.07	0.07	-	**7.50**	0.080	0.159	**0.239**
	10.00	0.06	0.05	0.04	0.04	-	**10.00**	0.046	0.090	**0.135**



35.0276 -120.4987 Lat/Long

Table F-4 - Site Specific Spectral Response Values
Probabilistic and Deterministic Response Spectra for MCE compared to Code Spectra for 5% Viscous Damping Ratio

	GeoMean Probab. 2% in 50 year MCE Spectrum	Rotated Probab. 2% in 50 year MCEr Spectrum	Rotated 84th Percentile Determ. MCE Spectrum	Determ. Lower Limit MCE Spectrum	Determ. MCE Spectrum	Site Specific MCE_R, Ground Response (SaM)	Site Specific MCE Spectrum Comparator	2022 CBC MCE Spectrum	Site Specific Design Spectrum (Sa)	2022 CBC Design Spectrum
Natural Period T (seconds)	(1) 2475-year (ASCE 21.2.1)	(2) 2475-year (ASCE 21.2.1.1)	(3) (ASCE 21.2.2)	(4) (3) * 1.00=Scaling (ASCE 21.2.2)	(5) Max (3),(4) (ASCE 21.2.2)	(6) Min (2),(5) (ASCE 21.2.3)	(6b) Max (6),1.5*(8) (ASCE 21.2.3)	(7)	(8) (ASCE 21.3)	(9) 2/3*(7)
0.00	0.496	0.491	0.907	0.907	0.907	0.491	0.491	0.446	0.327	0.297
0.05	0.679	0.672	0.989	0.989	0.989	0.672	0.672	0.645	0.448	0.430
0.10	0.863	0.854	1.315	1.315	1.315	0.854	0.854	0.843	0.569	0.562
0.15	1.058	1.047	1.573	1.573	1.573	1.047	1.047	1.041	0.698	0.694
0.20	1.197	1.185	1.782	1.782	1.782	1.185	1.185	1.115	0.790	0.743
0.30	1.331	1.387	2.295	2.295	2.295	1.387	1.387	1.115	0.925	0.743
0.40	1.300	1.379	2.526	2.526	2.526	1.379	1.379	1.115	0.919	0.743
0.50	1.275	1.378	2.579	2.579	2.579	1.378	1.378	1.115	0.918	0.743
0.75	1.000	1.129	2.397	2.397	2.397	1.129	1.129	1.115	0.752	0.743
1.00	0.805	0.947	2.213	2.213	2.213	0.947	0.947	0.940	0.632	0.627
1.50	0.597	0.715	1.716	1.716	1.716	0.715	0.715	0.627	0.477	0.418
2.00	0.449	0.548	1.351	1.351	1.351	0.548	0.548	0.470	0.365	0.313
3.00	0.286	0.362	0.953	0.953	0.953	0.362	0.362	0.313	0.241	0.209
4.00	0.213	0.280	0.681	0.681	0.681	0.280	0.280	0.235	0.187	0.157
5.00	0.163	0.222	0.505	0.505	0.505	0.222	0.222	0.188	0.148	0.125
8.00	0.095	0.129	0.283	0.283	0.283	0.129	0.129	0.118	0.086	0.078
10.00	0.067	0.091	0.135	0.135	0.135	0.091	0.091	0.075	0.060	0.050
			0.075							

C_{RS}:	0.900	
C_{R1}:	0.905	
Site Specific To:	0.179	$= 0.2*S_{D1}/S_{DS}$
Site Specific Ts:	0.897	$= S_{D1}/S_{DS}$

The value of Fa used in Column (3) is defined within ASCE 21.2.2 Supplement 1. This Fa value only applies within Column (3).

Site Coefficients	
F_{PGA}	1.15
F_a	1.09
F_v	2.50

Probabilistic spectrum from 2018 USGS Ground Motion Mapping Program adjusted for site conditions and scaled to represent maximum response in a horizontal plane, in accordance with ASCE 7-16 Section 21.2

Mapped MCE Acceleration Values		
PGA	0.449	g
S_S	1.022	g
S_1	0.376	g

Risk Coefficients have been applied to Column (2); If Method 1 was utilized the Risk Coefficients, CRS and CR1 are presented above, if Method 2 was utilized the Risk Coefficients were obtained from the USGS Risk Targeted Ground Motion Calculator (https://earthquake.usgs.gov/designmaps/rtgm).

Seismic Site Class	D
Risk Category	II

Reference: ASCE 7-16, Chapters 21.2, 21.3, 21.4, 21.5, 11.4, and 11.8

Calculation Utilized ASCE7-16, Section 21.2.1.1 - Method 1

Site-Specific Design Acceleration Values		
PGA_M	**0.496**	**g**
S_{DS}	**0.832**	**g**
S_{D1}	**0.747**	**g**

Short-Period Seismic Design Category:	**1-Second Period Seismic Design Category:**
D	D

Vertical Coefficient (C_V)
1.30

Deterministic Fault Parameters			
San Luis Range (So Margin) Fl		R_{JB} (km)	1.8
Magnitude	7.49	R_{RUP} (km)	1.8
Distance (km)	1.8	Z_{TOR} (km)	0.0
Width (km)	17	Z_{BOT} (km)	12.0
Dip (Deg.)	45	V_{S30} (m/s)	260

Site-Specific MCE_R, 5% damped, Spectral Response Acceleration Parameter		
S_{MS}	**1.249**	**g**
S_{M1}	**1.120**	**g**

1 g = 980.6 cm/sec^2 =32.2 ft/sec^2

PSV (ft/sec) = $32.2(S_a)T/(2p)$

Key: Probab. = Probabilistic, Determ. = Deterministic, MCE = Maximum Considered Earthquake