Appendix C:

Geotechnical Exploration Report

Geotechnical Exploration Report

New Classroom Buildings & Parking Lot
Franklin Elementary School
2400 Montana Avenue
Santa Monica, Los Angeles County California

Prepared for:
Santa Monica-Malibu
Unified School District
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Santa Monica, California 90405-4308

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Project No. 036.0000025103

November 22, 2024
(Revised February 10, 2025)

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November 22, 2024
(Revised February 10, 2025)

Project No. 036.0000025103

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Subject: Revised Geotechnical Exploration Report
New Classroom Buildings and Parking Lot
Franklin Elementary School, 2400 Montana Avenue
Santa Monica, Los Angeles County, California

Per our July 18, 2024 proposal, authorized on September 23, 2024; Verdantas Inc. (formerly Leighton Consulting, Inc.) is pleased to present this revised geotechnical exploration report for the subject project. This report is intended to meet requirements of Section 1803A.2 of the 2022 California Building Code (CBC) and the California Geologic Survey's (CGS's) Note 48 checklist for review of engineering geology and seismology reports for California public schools.

The site is within a state-designated earthquake fault zone for east-west oriented traces of Santa Monica fault. California Geological Survey (CGS) review of fault rupture hazard assessments under CGS Application 03-CGS5557 dated January 12, 2024 agreed that prior studies demonstrated the footprint of the current Campus Master Plan project was not underlain by Holocene active faults and no fault related structural setbacks are required. Based on our subsurface exploration and fault hazard assessments (Leighton, 2022, 2023a, 2023b) the potential for surface fault rupture at the site is considered low and has been adequately addressed. As is the case for most of Southern California, strong ground shaking has and will occur at this site.

Specific recommendations for site grading, foundations, and other geotechnical aspects of the project are presented in this revised report.

We appreciate this opportunity to be of service. If you have any questions regarding this report or if we can be of further service, please call us at your convenience at **(949) *250-1421***, directly at the phone extensions or e-mail addresses listed below:

Respectfully submitted,

VERDANTAS INC.

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1.0 Introduction

1.1 Site Description and Proposed Development

Franklin Elementary is an active Transitional Kindergarten (TK) through 5th grade school located at 2400 Montana Avenue in the City of Santa Monica. The school campus location (latitude 34.0388°, longitude -118.4843°) and immediate vicinity are shown on Figure 1, *Site Location Map*.

The main campus is a rectangular parcel of land in a residential neighborhood developed with one- and two-story classroom buildings, a playfield, an asphalt concrete (AC) blacktop, and an AC parking lot. The main campus is bounded on the northeast and southwest by single-family and multi-family homes, on the southeast by Idaho Avenue, and on the northwest by Montana Avenue. In addition to the main campus, there is a satellite site accommodating the TK yard at the northeast corner of Montana Avenue and 24th Place, located immediately across an alleyway. According to the United States Geological Survey (USGS) 7.5-Minute Beverly Hills Quadrangle (USGS, 1981), the site surface is relatively flat at approximately Elevation (El.) +255 to +265 feet mean sea level (msl).

Our understanding of the proposed development is based on email correspondence with DSK Architects and review of undated and annotated site plans. We understand the development consists of two (2) new, one-story classroom buildings with footprints ranging from approximately 6,000 to 6,800 square feet, a new track and field planned south of the proposed classroom buildings, and a new parking lot with solar carports. Ancillary improvements are anticipated to include new pavement, landscaping, utility infrastructure, and a stormwater infiltration system. Subterranean levels are not currently proposed.

Specifically, the project area for the proposed new buildings is located in the southeast portion of the campus in an area currently occupied by an existing grass field and asphalt paved track around the perimeter of the field. The existing track and field will be relocated south of the proposed new classroom buildings, in the area that is currently occupied by the existing parking lot at the southernmost corner of the campus. The existing parking lot will be replaced by a new parking lot to be constructed in the far northeastern portion of the campus, where the existing TK classrooms are located. The footprints of the proposed new classroom buildings are shown on Plate 1, *Exploration Location Map.*

1.2 Previous Site Explorations

Verdantas Inc. (formerly Leighton Consulting, Inc.) performed a series of previous geotechnical and geologic/fault hazard assessments at the Franklin Elementary School campus dating back to 2021. Information collected during previous explorations supplemented explorations performed as part of the current study. The locations of previous explorations are presented on Plate 1.

2021-2022: New Makerspace Building: In late 2021, Leighton Consulting, Inc. (Leighton, 2022) performed a geotechnical and seismic hazard field assessment in support of the proposed Makerspace Building. The scope of work included drilling five (5) hollow-stem auger borings, three (3) continuous core borings, and five (5) cone penetrometer test (CPT) soundings. Our findings, conclusions, and recommendations were presented in Leighton (2022).

2022-2023: CGS Response to Review Comments, Supplemental Fault Hazard Assessment: In late 2022, in response to comments from California Geological Survey (CGS), Leighton (2023a) performed a supplemental fault hazard assessment of the site. This supplemental scope of work included advancing three (3) continuous core borings and twenty-five (25) CPTs to depths ranging from 30 to 50 feet bgs along the northeast property line of the campus. Based on our findings and analysis, we determined that an active trace of the Santa Monica Fault Zone is not present within the northern and central limits of the campus (Leighton, 2023a). CGS approved our findings in their *Second Engineering Geology and Seismology Review* dated May 23, 2023.

2023: Seismic Hazard Assessment: At the District's request, an additional seismic hazard assessment (Leighton, 2023b) was performed in summer 2023 in the southeastern portion of the site in support of the 2023 Master Campus Plan. An approximately 90-foot long and 11½-foot deep fault trench was excavated at the southern corner of the existing playfield to assess the potential for Holocene active faulting within the southern limits of the campus. Based on the results of our study, we concluded that the subject site is free of Holocene active faults and recommended no structural setbacks. Our Report (Leighton, 2023b) was approved by CGS in their *Fault Rupture Hazard Review* letter dated January 12, 2024. However, CGS concluded that additional exploration may be required in the southernmost corner of the campus of exiting parking lot if a new habitable structure considered (not current as part of 2023 Campus Plan) in the area (Leighton, 2023b).

1.3 Purpose and Scope of Exploration

The purpose of our geotechnical exploration was to evaluate the subsurface soil conditions at the site and provide geotechnical recommendations in accordance with the California Building Code (2022) for design and construction of the project as currently proposed (see Section 1.1). The scope of this geotechnical exploration included the following tasks:

- Background Review: A background review was performed of readily available geotechnical, civil, and geological documents pertinent to the project site. References reviewed in preparation of this report are listed in Section 8.0.

- Pre-Field Exploration Activities: Prior to the field exploration, the explorations were marked and Underground Service Alert (USA) was notified for utility clearance. In addition, a private utility locator was utilized to locate any unknown or unmarked utilities in the areas of the proposed boring locations prior to drilling and hand auguring.

- **Field Exploration:** Our field exploration was performed October 3, 2024 and January 2, 2025 consisted of drilling four (4) hollow-stem auger borings (designated 2024-LB-1 through 2024-LB-4) within the footprints of the proposed new classroom buildings in the southeast portion of the campus. An additional three (3) hollow-stem borings (LP-1 through LP-3) were advanced as near as feasible to locations identified by DSK Architects for proposed stormwater infiltration devices and converted to temporary percolation test wells. All borings were advanced to an approximate depth of 31½ feet below ground surface (bgs).

Additionally, Verdantas advanced five (5) hand auger borings (HA-1 through HA-5) to approximate depths ranging from 3 to 10 feet bgs within the TK Yard in support of the proposed new parking lot and solar carports. Each hand auger boring targeted a depth of 10 feet bgs. Hand auger borings terminated before reaching 10 feet bgs encountered refusal on concrete debris and and/or coarse gravel and cobbles. Two of the hand auger borings (HA-2 and HA-5) were converted to temporary percolation wells for infiltration testing. The approximate locations and depths of subsurface explorations (both current and previous) are shown on Plate 1.

Soils encountered in the borings were logged in the field by a Verdantas geologist and described in accordance with the Unified Soil Classification System (ASTM D 2488). During drilling of hollow stem auger borings, bulk and relatively undisturbed drive samples were obtained from the borings for geotechnical laboratory testing and evaluation. The relatively undisturbed samples were collected utilizing a Modified California Ring sampler conducted in accordance with ASTM Test Method D 3550. Standard Penetration Tests (SPTs) were performed using a 24-inch-long, 1-3/8-inch I.D. and 2-inch O.D. split spoon sampler. The samplers were driven for a total penetration of 18 inches unless practical refusal, using a 140-pound automatic hammer falling freely for 30 inches in general accordance with ASTM Test Method D 1586 Standard Test Method for Standard Penetration Test (SPT). Blow counts per 6 inches of penetration were recorded on the boring logs. At hand auger boring locations, grab samples were collected at selected intervals from spoils generated during advancement. After completion drilling and logging all borings were backfilled with tamped soil cuttings and surface patched to match existing conditions (i.e. concrete, asphalt, grass). Boring logs from the current exploration are included in Appendix A, *Field Exploration Logs*.

- Percolation Testing: Borings LP-1 through LP-3 and HA-2 and HA-5 were converted into temporary percolation test wells upon completion of drilling and sampling. In-situ percolation testing was performed in general accordance with the County of Los Angeles Department of Public Works (LADPW) *Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration* (LADPW, 2021). The results of the percolation testing are presented in Appendix B, *Percolation Test Results*. Refer to the discussion of infiltration rate presented in Section 2.3 *Infiltration*. Upon completion of the percolation testing, the well casing was removed and the borings backfilled with soil cuttings and patched with asphalt concrete (AC) to match existing site conditions. Detailed results of the percolation testing are presented in Appendix B, *Percolation Test Results.*

- **Laboratory Testing**: Geotechnical laboratory tests were conducted on selected bulk and undisturbed soil samples obtained from our borings. This laboratory testing program was designed to evaluate geotechnical characteristics of site soil. A description of geotechnical laboratory test-procedures and results are presented in Appendix C, *Laboratory Test Results*.

The following laboratory tests were performed:

- In-situ Moisture Content and Dry Density (ASTM D2216 and ASTM D2937);
- Expansion Index (ASTM D4829);
- Modified Proctor Compaction Test (ASTM D1557);
- Direct Shear (ASTM D 3080);
- R Value (DOT CA Test 301);
- Consolidation (ASTM D2435); and
- Corrosivity (Soluble Sulfate DOOT 417, Soluble Chloride DOT CA Test 422 pH DOT CA Test 643, and Resistivity DOT CA Test 643).

The in-situ moisture and density of soil samples at depth are shown on the borings logs included in Appendix A. The results of the remaining laboratory tests are presented in Appendix C.

► Engineering Analysis: Data obtained from field explorations and geotechnical laboratory testing were evaluated and analyzed to develop geotechnical conclusions and provide recommendations in accordance with the 2022 California Building Code and the California Geological Survey's (CGS) Note 48 (November 2022 version). Subsurface interpretations relevant to this project are presented on Plate 2, *Geologic Cross Section C-C' to F-F'* (in pocket).

► Report Preparation*:* Results of our geologic hazards review and geotechnical exploration have been summarized in this report, presenting our findings, conclusions and geotechnical design recommendations for design and construction of the Franklin Elementary School New Classroom Buildings and Parking Lot as currently proposed.

It should be noted that the recommendations in this report are subject to the limitations presented in Section 7.0 of the report.

2.0 Geotechnical Findings

2.1 Geologic Setting

The site is located in the Santa Monica Plain, an uplifted and inclined alluvial surface within the southwestern block of the Los Angeles Basin (Hoots, 1931; Poland and Piper, 1956). The Los Angeles Basin (Basin), a structural trough, is a northwest-trending, alluviated lowland plain approximately 50 miles long and 20 miles wide. Mountains and hills that generally expose Late Cretaceous to Late Pleistocene-age sedimentary and igneous rocks bound the Basin along the north, northeast, east, and southeast (Yerkes, 1965). The Basin is part of the Peninsular Ranges geomorphic province of California characterized by sub parallel blocks sliced longitudinally by young, steeply dipping northwest-trending fault zones. The Basin, located at the northerly terminus of the Peninsular Ranges, is the site of active sedimentation and the strata are interpreted to be as much as 31,000 feet thick in the center of the synclinal trough of the Central Block of the Los Angeles Basin.

The Santa Monica Plain formed during the Pleistocene epoch by continental aggradation and has since been uplifted and heavily incised by both current and former drainage patterns (Hoots, 1931). As shown on Figure 2, *Regional Geology Map,* the Franklin Elementary School campus is mapped as being underlain by Quaternary old alluvial fan deposits (map symbol Qof).

2.2 Local Geologic Units and Subsurface Conditions

Presented below are brief descriptions of the geologic units encountered in the exploratory borings. Detailed descriptions of the geologic units encountered are presented on the boring logs in Appendix A. Geotechnical conditions described on the logs represent the conditions at the actual exploratory excavation locations. Other variations may occur beyond and/or between the excavations. Lines of demarcation between the geologic units and the various earth materials on the logs represent approximated boundaries, and (unless otherwise noted) actual transitions may be gradual. The locations of the subsurface explorations are shown on *Plate 1* and a subsurface profile based on data obtained and interpreted from the current borings is shown on *Plate 2.*

Local geology was interpreted from published regional geologic maps of the area (Yerkes and Campbell, 2005; Dibblee, 1991). Figure 2, *Regional Geology Map*, illustrates the approximate distribution of geologic units at the site. Native geologic units underlying the artificial fill materials consist of Quaternary old alluvial fan deposits.

Undocumented Artificial Fill (Map Symbol: Afu): Artificial fill materials were encountered to a depth of approximately 5 feet bgs within the northeast TK yard area, and to depths ranging from 1½ to 3 feet bgs within the southeastern athletic field area. Fill, as encountered, is characterized as dark brown to reddish brown sandy lean clay, silty sand to silty clay with varying amounts of slaty gravel. No documentation or records related to fill placement was available at the time of this report preparation. Therefore, for purposes of this report, all fill encountered onsite and anticipated in future explorations is considered undocumented and unsuitable for support of new improvements in its current condition. Fill can be reconditioned and compacted for reuse onsite.

Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof): The Pleistocene alluvial fan deposits encountered beneath the artificial fill generally consist of brown, dark grayish brown, and reddish brown silty clay and sandy clay locally channelized with sand and slaty gravels. In general, the fine-grained material ranges from very stiff to hard. The channelized coarse-grained soils consist of a series of fining upward sequences and range from medium dense to very dense.

The stratigraphy of the subsurface soils encountered in each soil boring is presented on the boring logs (Appendix A). The general subsurface conditions across the site, interpreted from the boring data are shown on Plate 2.

2.3 Infiltration

Percolation testing was performed to evaluate the infiltration characteristics of subsurface soils. The percolation tests were conducted in general accordance with the County of Los Angeles Department of Public Works (LADPW) *Guidelines for Geotechnical Investigation and Reporting Low Impact Development Stormwater Infiltration* document (LADPW, 2021). Results of the percolation testing are presented in Appendix B, *Percolation Test Results.* The test locations are shown on Plate 1.

A boring percolation test is useful for field measurements of the infiltration rate of soils and is suited for testing when the design depth of the infiltration device is deeper than current existing grades, especially in areas where it is difficult to dig test pits, or where the depths of these test pits would be considerably deep. At the subject site, testing consisted of advancing the boring to the invert depth of typical infiltration devices.

Falling Head: Percolation testing for well HA-2 was performed using a falling-head method, which records the average drop in water height from the top of the screened portion of the well over a set time interval during the testing period. The infiltration rate was calculated by dividing the rate of discharge by the infiltration surface area, or flow area. The volume of discharge was calculated by adding the total volume of water that dropped within the PVC pipe and within the annulus and incorporating a porosity reduction factor to account for the porosity of the annulus material. The flow area was based on the average water height within the test well.

Constant Head: Percolation testing for wells LP-1 through LP-3 and HA-5 was performed using a constant-head method, which records the approximate volume of water delivered to the test zone while maintaining a relatively constant height of water in the well over the testing period. An on-site water source was used to deliver water to the well at a relatively constant rate while recording the water height in the well. The measured infiltration rate for the percolation test was calculated by dividing the total volume of water infiltrated by the total duration of the test and dividing by the percolation surface area.

Per County of Los Angeles Guidelines (LADPW, 2021), the design infiltration rate incorporates a reduction factor for the test procedure, site variability, number of tests, thoroughness of subsurface investigation and long-term siltation, plugging and maintenance, with a minimum reduction factor of 3. The high-flow rate test (constant-head method) increases the minimum reduction rate to a factor of safety of 5. As such, we have applied a minimum reduction factor to the small-scale infiltration rates measured at the test wells for use in design of the system(s) according to County of Los Angeles Guidelines (LADPW, 2021).

Table 1 – Measured (Unfactored) Infiltration Rate

Test Well Designation	Approximate Depth of Test Zone (feet bgs)	Measured Infiltration Rate (inch per hour)	Design Infiltration Rate (inch per hour)
LP-1	10-30	13.9	2.78**
LP-2	10-30	14.8	2.96**
LP-3	10-30	4.9	0.98**
HA-2	5-10	1.04	0.34*
HA-5	3-8	33.3	6.66**

* Includes Reduction Factor of 3
** Includes Reduction Factor of 5

Based on the requirements of LADPW (2021), **infiltration is considered feasible for wells LP-1 through LP-3, HA-2, and HA-5** at the locations and depths evaluated.

The infiltration facilities should be routinely monitored, especially before and during the rainy season, and corrective measures should be implemented as/when needed. Things to check for include proper upkeep, proper infiltration, absence of accumulated silt, and that de-silting filters/features are clean and functioning. Pre-treatment desilting features should be cleaned and maintained per manufacturers' recommendations. Even with measures to prevent silt from flowing into the infiltration facility, accumulated silt may need to be removed occasionally as part of maintenance.

2.4 Corrosion

Corrosion: In general, soil resistivity, which is a measure of how easily electrical current flows through soils, is the most influential factor for ferrous corrosivity. Based on findings of studies presented in the American Society for Testing and Materials (ASTM) STP 1013 titled "Effects of Soil Characteristics on Corrosion" (February, 1989), an approximate relationship between soil resistivity and soil corrosiveness was developed as shown in Table 2 below.

Table 2 - Soil Corrosivity as a Function of Resistivity

Soil Resistivity (ohm-cm)	Classification of Soil Corrosiveness
0 to 900	Very severe corrosion
900 to 2,300	Severely corrosive
2,300 to 5,000	Moderately corrosive
5,000 to 10,000	Mildly corrosive
10,000 to >100,000	Very mildly corrosive

Sulfate Exposure: Sulfate ions in the soil can lower the soil resistivity and can be highly aggressive to Portland cement concrete by combining chemically with certain constituents of the concrete, principally tricalcium aluminate. This reaction is accompanied by expansion and eventual disruption of the concrete matrix. A potentially high sulfate content could also cause corrosion of reinforcing steel in concrete. Section 1904A of the 2022 California Building Code (CBC) defers to the American Concrete Institute's (ACI's) ACI 318-14 for concrete durability requirements. Table 19.3.1.1 of ACI 318-14 lists "*Exposure categories and classes*," including sulfate exposure as follows:

Table 3 - Sulfate Concentration and Exposure

Water-Soluble Sulfate (SO_4) in soil (percentage by weight)	ACI 318-14 Sulfate Class
0.00 - 0.10	S0 (negligible)
0.10 - 0.20	S1 (moderate)
0.20 - 2.00	S2 (severe)
>2.00	S3 (very severe)

Three (3) representative composite, near surface (0-5 feet) bulk soil samples collected from LB-1, LB-3 and HA-3, characterized as Clayey Sand (SC), Silty Clayey Sand (SC-SM) and Silty Sand (SM) were tested to evaluate corrosion potential. The chemical analysis test results for the onsite soil from our geotechnical exploration are included in Appendix C of this report and are summarized below.

Table 4 - Corrosivity Test Results

Test Parameter	Test Results LB-1, 0-5’	Test Results LB-3, 0-5’	Test Results HA-3, 0-5’	General Classification of Hazard
Water-Soluble Sulfate-SO_4 in Soil (ppm)	0.078	0.078	0.062	Negligible sulfate exposure to buried concrete (S0)
Water-Soluble Chloride in Soil (ppm)	0.18	0.28	0.090	An exposure class of C1 may be assumed for concrete in contact with soil exposed to moisture but not due to external sources of chlorides
pH	6.84	7.36	6.53	Neutral to Mildly alkaline
Minimum Resistivity (saturated, ohm-cm)	3100	2580	2600	Moderately Corrosive to buried ferrous pipes

Additional corrosion testing is recommended upon completion of grading to confirm the findings and conclusions presented above.

2.5 Expansive Soils

Expansion Index (EI) testing of three (3) representative bulk samples collected from borings LB-1, LB-3 and HA-3 within the upper 5 feet indicates an expansion index (EI) of 12, 3 and 18, corresponding to a very low potential for expansion. The expansion properties of the soil below the proposed new classroom should be considered as low (EI=21 to 50). Additional testing of soils upon completion of grading should be performed to confirm the results of the initial testing.

Based on geotechnical laboratory testing performed on selected soil samples collected from the site and review of previous laboratory test results, a synopsis of geotechnical properties of the site soils is provided in Table 3 below. Geotechnical laboratory testing results are presented in Appendix C.

Table 5 - Soil Geotechnical Properties Synopsis

Parameters	Soil Properties
In-situ Moisture:	Slightly moist to very moist
In-situ Density:	Stiff to hard/Medium dense to very dense
Swell/Expansion Potential:	swell/expansion potential is **low**
Collapse Potential:	Not susceptible to collapse when wetted
Strength:	Adequate to provide structural support
Corrosivity:	Negligible sulfate attack potential of concrete but **moderately corrosive to ferrous metals**.

2.6 Groundwater

Groundwater was not encountered during the current exploration to the maximum depth explored of 31½ feet bgs. Previous site explorations (Leighton 2022, 2023a) did not encountered groundwater to the maximum depth explored of 50 feet bgs. Historic groundwater levels, as interpreted from the Beverly Hills 7.5 Minute Quadrangle, Los Angeles County, California (CGS, 1998) indicate historic high groundwater was at a level of approximately 40 to 50 feet bgs.

Review of environmental data reported through the State Water Resources Control Board (see http://geotracker.waterboards.ca.gov/) shows that a series of eight monitoring wells were installed in association with a leaking underground storage tank remediation at Providence St. Johns Medical Center; located approximately 0.6 miles south of the project site. Groundwater levels as measured within these monitoring wells was documented at depths ranging from approximately 110 to 132 feet bgs. Groundwater is not expected to pose a constraint to the proposed development as currently planned.

3.0 Geologic Seismic Hazards

Geologic and seismic hazards include surface fault rupture, seismic shaking, liquefaction, seismically-induced settlement, lateral spreading, seismically-induced landslides, flooding, seismically-induced flooding, seiches and tsunamis. The following sections discuss these hazards and their potential impact at the project site.

3.1 Faulting

Based on our review of available geologic literature and aerial photographs, the site **is** located within a currently established *Alquist-Priolo (AP) Earthquake Fault Zone* (Bryant and Hart, 2007, CGS, 2018) for the Santa Monica Fault. The limits of the AP Zone for the Santa Monica Fault Zone (SMFZ), as mapped by CGS (2018), are located approximately 20 feet north of the proposed New Classroom building footprint. The AP Zone was established based on recommendations provided in the Fault Evaluation Report 259 (FER 259) prepared by CGS dated June 28, 2017 (CGS, 2017). A fault rupture hazard assessment was performed in support of the proposed Makerspace building at Franklin Elementary School (Leighton, 2023a, 2023b). Based on the results of our study, approved by CGS in their *Fault Rupture Hazard Review* letter dated January 12, 2024, we concluded that the subject site is free of Holocene active faults.

Several active and potentially active faults are mapped within approximately 10 km (6.2 miles) of the site. Figure 3, *Regional Fault and Historical Seismicity Map*, shows the proximity of known active and potentially active faults within the region.

Santa Monica Fault: The California Geological Survey (CGS, 2018) has zoned the Santa Monica Fault, which is the closest known fault to the site, currently mapped as crossing the southwest corner the Franklin Elementary campus with average strike of the inferred location of Santa Monica Fault Zone as approximately N86°W. This fault zone trends roughly east-west along the southern boundary of the Santa Monica Mountains. Included in the Transverse Ranges Southern Boundary fault system, which consists of east-west trending, left-lateral and oblique-reverse movements along several active faults. The SMFZ consists of one or more strands, is about 40 km (24.8 miles) in length, and is one of a series of reverse, left-lateral oblique-slip structures that extend more than 200 km (125 miles) across southern California and accommodate westward motion of the Transverse Ranges (Dolan *et al*., 1997). Pleistocene or Holocene movement has been postulated, but not directly proven along some upper plate secondary fault segments related to the SMFZ (Dolan *et al.*, 2000). Recurrence interval and recency of movement along many fault segments are neither well documented nor understood, mainly because intense urbanization has modified or destroyed any surface traces of the fault (Hill *et al*., 1979). Southern California Earthquake Center (SCEC) identifies the most recent rupture as Late Quaternary with intervals between events unknown.

The State of California Geological Survey (CGS, 2018) has established an Earthquake fault Zone based on the criteria of "sufficiently active" and "well defined" (Bryant and Hart, 2007) in their FER 259 dated June 28, 2017.

Malibu Coast Fault*:* Located approximately 2.5 miles (3.9 km) northeast of the project site, the fault exhibits left-lateral oblique displacement, with a reported vertical slip rate component of about 0.4 millimeters per year (Lajoie et al., 1979) and a horizontal slip rate component of 0.3 millimeters per year (Petersen et al., 1996). The entire 23-mile-long fault zone is considered to be a potential source in the present statewide probabilistic seismic hazard model and is considered capable of generating a maximum magnitude earthquake of 6.7 (Petersen et al., 1996).

Newport-Inglewood Fault: The onshore southeast-trending Newport-Inglewood fault zone (NIFZ), located approximately 5.4 miles (8.7 km) east of the site, is discontinuous at the surface and consists of a series of primarily left-stepping *en echelon* fault strands, each up to 6.5 km (4 miles) long that extend from near Beverly Hills south to Newport Beach, a distance of approximately 65 km (41 miles). At Newport Beach, the fault continues offshore where it lines up with the deeply incised Newport Submarine Canyon and is comprised of five strands and three step overs. To the south, back onshore, the fault continues as the Rose Canyon fault, extending in a southeasterly direction through San Diego and the international border to Baja California, where it continues as the Agua Blanca fault. Overall, from Beverly Hills to Baja California, the fault zone is more than 300 km (185 miles) long. At least five earthquakes of magnitude 4.9 or larger have been associated with the NIFZ since 1920 (Barrows, 1974). Estimated maximum deterministic magnitude earthquake is generally modeled between magnitude 6.5 and 7.5.

Hollywood Fault: Located approximately 5.4 miles (8.7 km) northeast of the site, the Hollywood Fault begins near the Los Angeles River and eastern edge of the Santa Monica Mountains and extends westward for approximately 9½ miles where it is thought to shift its locus of active deformation to the area near the West Beverly Hills Lineament (WBHL), where faulting takes a left step to the Santa Monica Fault. The Hollywood Fault is deemed capable of producing a magnitude 6.4 to 6.6 earthquake (Dolan et al., 1997). Investigators have estimated the lateral slip rate to be about 1.0 ±0.5 mm/year, with a vertical slip rate to be 0.25 mm/year (Dolan et al., 1997). Conversely, a lower slip rate of 0.04 - 0.4 mm/year (Ziony and Yerkes, 1985) leads to a longer return period.

Recent detailed geologic and geotechnical studies have provided cumulative physical evidence for Holocene displacements resulting in an Alquist-Priolo Special Study Zone being established for the Hollywood Fault (CGS, 2014). Exposures identified in prior explorations (Crook and Proctor, 1992), coupled with bulk-soil radiocarbon ages provide scant evidence for an early to mid-Holocene age for the most recent surface rupture approximately 6,000 years to 11,000 years ago; suggesting a long period of quiescence between surface rupturing on the Hollywood Fault (Dolan, 1997, 2000) (Ziony and Yerkes, 1985).

Palos Verdes Fault: The main trace of the onshore Palos Verde Hills (PVH) fault is recognized as a general topographic escarpment along the northeast margin of Palos Verdes Hills, based on the presence of linear drainages, saddles, and tilted or uplifted surfaces (Fischer and others, 1987). The PVH fault is reportedly a high-angle southwest-dipping dextral oblique fault (with reverse component) which forms the southwestern boundary of the Los Angeles basin at the Palos Verdes uplift (Wright, 1991, McNeilan and others, 1996). The sense of movement is dominantly right-lateral as interpreted by Stephenson et al. (1995). The ratio of horizontal to vertical offset is on the order of 7:1 to

8:1, as estimated by McNeilan and others (1996). Most of the PVH section may have a larger reverse component than the other sections due to the change in strike of the fault.

Little or no historic seismicity has been recorded on its onshore trend. The fault is thought to be capable of producing a magnitude 6.0 to 7.0 earthquake; however, the fault geometry most likely precludes fault rupture over its entire length of 80 kilometers (www.scec.org/fault_index/palos). The fault, penetrated by deep oil exploration wells in the seafloor offshore to the southeast, apparently cuts the seafloor and is thus considered active. Onshore, the character of the fault changes along with its strike direction due to compression. However, extensive deformation of the 120,000-year-old marine terrace on the peninsula, and the apparent Holocene folding of the Gaffey Street anticline, a feature related to drag movement along the Palos Verdes fault, are possible indications of the fault's potential activity.

3.2 Historical Seismicity

An evaluation of historical seismicity from significant past earthquakes related to the site was performed (see Figure 3). Peak ground accelerations (PGA) at the site resulting from significant past earthquakes between 1800 to 2018, with magnitudes 4.0 or greater, were estimated using the EQSEARCH computer program (Blake, 2000) with 2018 updates. This historical seismicity search was performed for a 100-kilometer (62-mile) radius from the project site, and is included in Appendix D, *Seismicity Data*. The largest earthquake magnitude found in the search was the magnitude 7.7 earthquake, known as the Arvin-Tehachapi quake that occurred on July 21, 1952 approximately 73 miles (117 kilometers) from the site producing an estimated PGA of approximately 0.05g at the site. The largest estimated PGA found in the search was approximately 0.23g from the 1994 magnitude 6.7 Northridge Earthquake located approximately 12½ miles (20 kilometers) north of the site.

Review of additional data publicly available from the Center for Engineering Strong Motion Data (CESMD) website (http://strongmotioncenter.org/) was reviewed for stations near the project site. The data reviewed indicates that a site (CGS Station 24048) located near the corner of 19th Street and Wilshire, approximately 0.5 mile southwest of the project site, experienced a PGA of 0.15g from the March 17, 2014 magnitude 4.4 Encino Earthquake. Another (CSMIP Station 24202-Providence St. John's Hospital) approximately 0.6 mile to the south of the project site experienced a PGA of 0.03g from the magnitude 5.4 Chino Hills Earthquake on July 29, 2008. We are unaware of any reported damage to this campus as a result of earthquakes occurring over the last century.

3.3 Liquefaction and Lateral Spreading

Liquefaction is the loss of soil strength due to a buildup of excess pore-water pressure during strong and long-duration ground shaking. Liquefaction is associated primarily with loose (low density), saturated, relatively uniform fine- to medium-grained, clean cohesionless soils. As shaking action of an earthquake progresses, soil granules are rearranged and the soil densifies within a short period. This rapid densification of soil results in a buildup of pore-water pressure. When the pore-water pressure approaches the total overburden pressure, soil shear strength reduces abruptly and temporarily behaves similar to a fluid. For liquefaction to occur there must be:

(1) loose, clean granular soils,
(2) shallow groundwater, **and**
(3) strong, long-duration ground shaking.

Review of both the Beverly Hills Quadrangle Seismic Hazard Zone Map (CGS, 1999) and the City of Santa Monica Geologic Hazards map (City of Santa Monica, 2014) indicates that the site is not within an area potentially susceptible to liquefaction (Figure 4, *Seismic Hazard Map*). The site is mapped within an area identified by the City of Santa Monica as a low Liquefaction Risk.

The site is underlain by stiff to hard clays interbedded with medium dense to dense sands and slaty gravels and groundwater is interpreted below a depth of 50 feet. Given these factors, the potential for liquefaction and lateral spreading to affect the site is considered low.

3.4 Seismically-Induced Settlement

Seismically-induced settlement consists of dry dynamic settlement (above groundwater) and liquefaction-induced settlement (below groundwater). These settlements occur primarily within loose to moderately dense sandy soil due to reduction in volume during and shortly after an earthquake event.

Based on our analysis, the total seismically-induced settlement is expected to be on the order of ½ inch or less. Accordingly, seismically-induced differential settlement is expected to be on the order of ¼ inch over 40 feet.

3.5 Seismically-Induced Landslides

The proposed project site is not located in an area mapped as potentially susceptible to seismically-induced landslides (Figure 4, *Seismic Hazard Map*). No landslides are mapped or known to exist at the project site or vicinity. The site is relatively flat and is not located adjacent to a significant slope. The potential for seismically induced landslides to affect the site is low.

3.6 Flooding

As shown on Figure 5, *Flood Hazard Zone Map*, the site is located outside of areas recognized by the Federal Emergency Management Agency (FEMA) to within 0.2% annual flood potential (FEMA, 2008). Earthquake-induced flooding can be caused by failure of dams or other water-retaining structures as a result of an earthquake. As shown on Figure 6, *Dam inundation Map*, the site is located outside of a dam inundation area due to the absence of such structures near the site, therefore the potential for earthquake-induced flooding at the site is considered low.

3.7 Seiches and Tsunamis

Seiches are large waves generated in enclosed bodies of water in response to ground shaking. Tsunamis are sea waves generated by large-scale disturbance of the ocean floor that induces a rapid displacement of the water column above. The most frequent causes of tsunamis are shallow underwater earthquakes and submarine landslides.

The site is not located within the tsunami run up area as mapped on the Los Angeles Tsunami Hazard: Maximum Run-up map (CalEMA, 2010). The run-up area indicates zones along the Pacific Coast below an elevation of 42 feet (msl) are susceptible to tsunami inundation. The project site is topographically at least 120 feet above the areas identified to have a potential for Tsunamis impact. In addition, the site is not located within a tsunami inundation area as mapped by the State of California (CGS, 2009).

Based on the site’s elevation of approximately 258 feet above sea level and the lack of nearby enclosed water bodies, the risks associated with tsunamis and seiches are considered negligible.

4.0 Findings and Conclusions

Presented below is a summary of findings and conclusions based upon the results of our evaluation of the project site:

- This site **is** located within a currently designated Alquist-Priolo Special Studies Zone (CGS, 2018) for surface fault rupture. Based on previous fault hazard assessments (Leighton 2022, 2023a, 2023b) and soil age dating, Holocene active faults do not underlie the subject site.
- Pleistocene-aged soil extends unbroken across the study area and any faults underlying the site are not active. No fault related setbacks are recommended for this site.
- The site is **not** located within a designated liquefaction hazard zone or seismically induced landslide zone.
- The site is underlain by undocumented artificial fill to a depth of approximately 1½ to 3 feet within the southeast portion of the camply (existing grass field) and to depths of approximately 5 to 5½ feet within the far northeastern portion of the campus (existing TK and K classrooms). Artificial fill overlays native alluvial valley deposits generally consisting of stiff to hard clays interbedded with medium dense to very dense sands; with varying proportions of predominantly slate gravels.
- Groundwater was not encountered during the current exploration. Groundwater is not expected to pose a constraint to construction. The historic high groundwater level at the site is interpreted to be on the order of 40 to 50 feet bgs.
- The potential for liquefaction and liquefaction-induced ground failure to occur at the site is considered low.
- The potential seismically-induced settlement at the site is estimated to be on the order of ½ inch or less.
- Based on field soil classification and testing, the onsite soils that will be in contact with the planned structures are expected to have a low expansion potential. Additional testing is recommended at completion of grading.
- Concrete in contact with the onsite soil is expected to have negligible exposure to water-soluble sulfates and low exposure to chloride in the soil. The onsite soil, however, is considered moderately corrosive to ferrous metal. Additional testing is recommended at completion of grading.
- The subsurface materials are anticipated to be readily excavated using conventional earthmoving equipment in good working condition.
- The proposed improvements may be supported on conventional spread footings established on engineered fill or undisturbed natural soils.

Based on the results of this study, it is our opinion that the subject site is suitable for the proposed project from a geotechnical viewpoint. Geotechnical recommendations for the proposed development are presented in the following sections and are intended to provide sufficient geotechnical information to develop the project plans in accordance with the 2022 edition of the California Building Code (CBC) requirements.

5.0 Recommendations

The following recommendations have been developed based on the exhibited engineering properties of the onsite soils and their anticipated behavior during and after construction. Recommendations are specifically provided for design of foundations, seismic design considerations, floor slabs, retaining structures, paving, and grading. The proposed structure may be supported on spread-type shallow foundation systems established on engineered fill or undisturbed natural soils. Verdantas should review the grading plan, foundation plans and specifications when they are available to verify that the recommendations presented in this report have been properly interpreted and incorporated.

Loading and bearing pressure diagrams should be provided for our review once prepared to confirm recommendations and settlement estimates remain valid for the project as currently proposed.

5.1 Grading

Project earthwork is expected to include complete demolition/removal of existing surface pavements, landscaping, utilities and complete overexcavation and recompaction of any remaining undocumented fill soils below new improvement footprints as described in the following subsections.

5.1.1 Site Preparation

After the site is cleared, the soils should be carefully observed for the removal of all unsuitable deposits. We recommend that after removal of pavements, hardscape, and existing utilities, all undocumented fill soils should be removed and recompacted within the proposed improvement footprint. Undocumented fill was encountered as deep as 5½ feet bgs in our borings. Deeper fill may be encountered between boring locations.

This overexcavation bottom should extend horizontally either the thickness of fill below spread footings or at least 5 feet horizontally beyond the outside edges of proposed footings, whichever is deeper. Overexcavation is not required for footings established directly on undisturbed natural soils. Any underground obstructions encountered should be removed. Utility lines should be removed or rerouted where interfering with proposed construction. *It is essential that excavation not undermine foundations of the existing buildings and structures that will remain in place along the boundaries of the project. As-Built details of any structure to remain should be provided to Verdantas and the structural engineer prior to incorporation into the new design.*

Areas outside the classroom footprint limits, planned for new asphalt and/or concrete pavement, should be over-excavated to a minimum depth of 24 inches below existing or finish grade, or 18 inches below proposed pavement sections; whichever is deeper.

Resulting removal excavation bottom-surfaces should be observed by Verdantas prior to placement of any backfill or new construction. After these over-excavations are completed, and prior to fill placement, exposed surfaces should be scarified to a minimum depth of 8 inches, moisture-conditioned to 2 percent above optimum moisture content, and recompacted (proof rolled) to a minimum 90 percent relative compaction as determined by ASTM D 1557 (modified Proctor compaction curve).

5.1.2 Earthwork Observation and Testing

Verdantas Inc. should observe and test all grading and earthwork, to check that the site is properly prepared, the selected fill materials are satisfactory, and that placement and compaction of fills has been performed in accordance with our recommendations and the project specifications. Sufficient notification to us prior to earthwork is essential. Project plans and specifications should incorporate recommendations contained in the text of this report.

Variations in site conditions are possible and may be encountered during construction. To confirm correlation between soil data obtained during our field and laboratory testing and actual subsurface conditions encountered during construction, and to observe conformance with approved plans and specifications, it is essential that we be retained to perform continuous or intermittent review during earthwork, excavation and foundation construction phases. Therefore, conclusions and recommendations presented in this report are contingent upon us performing construction observation services.

5.1.3 Fill Placement and Compaction

Onsite soils free of organics, debris and oversized material (greater-than 6 inches in largest dimension) are suitable for use as compacted structural fill. However, any soil to be placed as fill, whether onsite or imported material, should be first viewed by Verdantas and then tested if and as necessary, prior to approval for use as compacted fill. All structural fill must be free of hazardous materials.

All fill soil should be placed in thin, loose lifts, moisture-conditioned, as necessary, to 2 percent above optimum moisture content and compacted to a minimum 90% relative compaction as determined by ASTM D 1557 standard test method (modified Proctor compaction curve) within building footprints. Aggregate base for pavement sections should be compacted to a minimum of 95% relative compaction. At least the upper 12 inches of the exposed soils in roadways and access drives, parking lots and (concrete –paver) flatwork areas, should be compacted to at least 95 percent relative compaction based on ASTM Test Method D 1557.

Fill Materials: The onsite soils, less any deleterious material or organic matter, can be used in required fills. Cobbles or slaty clasts larger than 6 inches in largest diameter should not be used in the fill. Any required import material should consist of relatively non-expansive soils with a very low Expansion Index (EI<20). All proposed import materials should be approved by the geotechnical engineer of record prior to being placed at the site.

Surface Drainage: Water should not be allowed to pond or accumulate anywhere except in detention basins. Pad drainage should be designed to collect and direct surface water away from structures to approved drainage facilities. Hardscape drains should be installed and drain to storm water disposal systems. Drainage patterns approved at the time of fine grading should be maintained throughout the life of proposed structures. Irrigation and/or percolation should not be allowed for at least 10 feet horizontally around buildings.

5.1.4 Reuse of Concrete and Asphalt in Fill Pulverized demolition concrete free of rebar and other materials and demolished asphalt pavement can be pulverized to particles no-larger-than (≤) 3-inches and mixed with site soils for use in compacted fill. Blended pulverized concrete and asphalt should be mixed with at least 25% soils by weight. Such materials must be free of and segregated from any hazardous materials and/or organic material of any kind.

5.1.5 Temporary Excavations

All temporary excavations, including utility trenches, retaining wall excavations, and other excavations should be performed in accordance with project plans, specifications and all State of California Occupational Safety and Health Administration (CalOSHA) requirements.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the slope, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundations should be properly shored to maintain support of these structures.

Temporary excavations should be treated in accordance with CalOSHA excavation regulations. The sides of excavations should be shored or sloped accordingly. CalOSHA allows the sides of unbraced excavations, up to a maximum height of 20 feet, to be cut to a ¾:1 (horizontal:vertical) slope for Type A soils, 1:1 for Type B soils, and 1½:1 for Type C soils.

The onsite soils within the proposed structural depths generally conform to CalOSHA Type B soils. CalOSHA regulations are applicable in areas with no restriction of surrounding ground deformations. Shoring should be designed for areas with deformation restrictions. The soil type should be verified or revised based on geotechnical observation and testing during construction, as soil classifications may vary over short horizontal distances. Heavy construction loads, such as those resulting from stockpiles and heavy machinery, should be kept a minimum distance equivalent to the excavation height or 5 feet, whichever is greater, from the excavation unless the excavation is shored and these surcharges are considered in the design of the shoring system.

5.1.6 Trench Backfill

Pipeline trenches should be backfilled with compacted fill in accordance with this report, and applicable *Standard Specifications for Public Works Construction* (Greenbook), current edition standards. Backfill in and above the pipe zone should be as follows:

- ***Pipe Zone****:* Any proposed pipe should be placed on properly placed bedding materials. Pipe bedding should extend to a depth in accordance with the pipe manufacturer's specification. The pipe bedding should extend to least 1 foot over the top of the conduit. The bedding material may consist of compacted free-draining sand, gravel, or crushed rock. If sand is used, the sand should have a sand equivalent greater than 30. As an alternate, the pipe bedding zone can be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, conforming to Section 201-6 of the 2021 Edition of the Standard Specifications for Public Works Construction (Greenbook). CLSM bedding should be placed to 1 foot over the top of the conduit, and vibrated. CLSM should not be jetted.

  Where granular backfill is used in utility trenches adjacent moisture sensitive subgrades and foundation soils, we recommend that a cut-off "plug" of impermeable material be placed in these trenches at the perimeter of buildings, and at pavement edges adjacent to irrigated landscaped areas. A "plug" can consist of a 5-foot long section of clayey soils with more than 35-percent passing the No. 200 sieve, or a Controlled Low Strength Material (CLSM) consisting of one sack of Portland-cement plus one sack of bentonite per cubic-yard of sand. CLSM should generally conform to Section 201-6 of the "Greenbook". This is intended to reduce the likelihood of water permeating trenches from landscaped areas, then seeping along permeable trench backfill into and under the building and pavement subgrades, resulting in wetting of moisture sensitive subgrade earth materials under buildings and pavements.

- ***Over Pipe Zone****:* Above the pipe zone, trenches can be backfilled with excavated on-site soils free of debris, organic and oversized material larger than 3 inches in largest dimension. As an option, the whole trench can be backfilled with one-sack CLSM same as presented above for the pipe bedding zone. Native soil backfill over the pipe-bedding zone should be placed in thin lifts, moisture conditioned, as necessary, and mechanically compacted using a minimum standard of 90% relative compaction relative to the ASTM D 1557 laboratory maximum dry density within building footprints. The upper 12-inches under hardscape, parking, paver etc. should be compacted to 95% relative compaction. Backfill above the pipe zone should **not** be jetted. In any case, backfill above the pipe zone (bedding) should be observed and tested by Verdantas.

5.1.7 Corrosion Protection Measures

Water-soluble sulfates in soil can react adversely with concrete. As referenced in the 2022 California Building Code (CBC), Section 1904A, concrete subject to exposure to sulfates shall comply with requirements set forth in ACI 318. Based on laboratory testing results of the onsite soils from subsurface explorations, concrete structures in contact with the onsite soil will likely have **"negligible"** (S0) exposure to water-soluble sulfates in the soil. Therefore, common Type II Portland cement may be used for concrete construction in contact with site soils.

An exposure class of C1 may be assumed for concrete in contact with soil exposed to moisture per ACI 318, but not due to external sources of chlorides.

Based on corrosivity test results, the onsite soil is considered moderately corrosive to ferrous metals. Therefore, based on these results, ferrous pipe buried in moist to wet site earth materials should be avoided by using high-density polyethylene (HDPE), polyvinyl chloride (PVC) and/or other non-ferrous pipe when possible. Ferrous pipe can also be protected by polyethylene bags, tap or coatings, di-electric fittings or other means to separate the pipe from on-site soils.

Subgrade soil should be tested for corrosion potential once grading is complete. Import fill soil should be tested for corrosivity before import to the site.

5.2 Foundations

The proposed new structures may be supported on spread footings established on engineered fill or undisturbed natural soils.

5.2.1 Shallow Spread Footings

Footings for proposed structures should have a minimum embedment of 2 feet and have a minimum width of 18 inches. Footings for proposed temporary structures may be supported directly on grade.

Bearing Value: Footings or post-tensioned concrete slabs with thickened edges established on engineered fill or undisturbed natural soils may be designed to impose an allowable bearing pressure of 3,000 pounds per square foot (psf).

The excavations should be deepened as necessary to extend into satisfactory soils.

The ultimate bearing capacity can be taken as 9,000 psf. This value does not incorporate a factor of safety and may only be used for an ultimate bearing capacity check with appropriate factored loads.

The recommended bearing value is a net value, and the weight of concrete in the footings can be taken as 50 pounds per cubic foot (pcf); the weight of soil backfill can be neglected when determining the downward loads.

Settlement: The above recommended allowable bearing capacities are generally based on a total post-construction settlement of about ½ inch for column loads not exceeding 300 kips.

Differential settlement due to static loading is generally estimated at ¼ inch over a horizontal distance of 40 feet. Once developed by the structural engineer, we should review total dead and sustained live loads for each column including plan location and span distance, to evaluate if differential settlements between dissimilarly loaded columns will be tolerable. Excessive differential settlement can be mitigated with the use of reduced bearing pressures, deeper footing embedment, possibly changing overexcavation schemes and using imported base material under spread footings, or possibly other methods.

Lateral Resistance: Soil resistance available to withstand lateral loads on a shallow foundation is a function of the frictional resistance along the base of the footing and the passive resistance that may develop as the face of the structure tends to move into the soil. The frictional resistance between the base of the foundation and the subgrade soil may be computed using a coefficient of friction of 0.35. The passive resistance may be computed using an equivalent fluid pressure of 300 pounds-per-cubic-foot (pcf), assuming there is constant contact between the footing and undisturbed soil. The passive resistance can be increased by one-third when considering short-duration wind or seismic loads. The friction resistance and the passive resistance of the soils can be combined without reduction in determining the total lateral resistance.

Uplift Resistance: To evaluate uplift resistance provided by the dead weight of soils above the footing, the frustum of soil above the footing may be estimated by a 30 degree outward projection from vertical. A unit weight of 120 pcf may be used for the soil volume within the frustum.

To evaluate uplift resistance provided by the shear resistance soils above the footing, an allowable shear value of 75 psf may be used along vertical shear planes from the bottom of the footing to the ground surface along the perimeter the footings. A factor of safety of 3 was used to develop the allowable shear value.

5.2.2 Modulus of Subgrade Reaction

For foundations established in undisturbed natural soil or engineered fill, an initial unit modulus of subgrade reaction (k_1) value of 150 pounds per cubic inch (pci) may be used.

The k_1 value presented herein, which corresponds to a 1-foot-square footing, should be reduced as shown below to incorporate foundation size effects:

$$k = k_1 \left(\frac{B+1}{2B}\right)^2$$

where B is the square footing width.

Verdantas should review the resulting foundation deformation contours developed by the structural engineer for conformance with geotechnical settlement estimates.

5.2.3 Flagpole-Type Foundations

Canopy structures, light poles, and fencing may be supported on flagpole-type foundations. Flagpole-type foundations may be designed to impose an allowable vertical bearing pressure of 3,000 psf and an allowable lateral bearing pressure of 600 psf per foot below grade. The allowable vertical and lateral bearing pressures may be increased by one-third for short-duration loading such as wind or seismic loading. The recommended bearing value is a net value, and the weight of concrete in the flagpole footings can be taken as 50 pounds per cubic foot.

5.2.4 Utilities and Trenches

Open or backfilled trenches paralleling any new or existing footings to remain shall not be below a 1:1 projection from outer lowest edge of footings or slab on grade. Where pipes cross under footings the footings shall be specifically designed by the engineer in charge. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall be designed to account for potential settlement of not less than 1 inch around the pipe. Alternate and approved clearances can be provided by the design professional in charge of the utility.

5.3 Seismic Design Parameters

To accommodate effects of ground shaking produced by regional seismic events, seismic design can be performed by the project structural engineer in accordance with the 2022 CBC. The table below, *2022 CBC Mapped Seismic Parameters*, lists seismic design parameters based on the 2022 CBC, Section 1613A.3 (ASCE 7-16) methodology:

Table 6 - 2022 CBC Mapped Seismic Parameters

Categorization/Coefficients	Code-Based [(1) (2)]
Site Longitude (decimal degrees) West	-118.4843
Site Latitude (decimal degrees) North	34.0388
Site Class	D
Mapped Spectral Response Acceleration at 0.2s Period, S_s	1.963
Mapped Spectral Response Acceleration at 1s Period, S_1	0.701
Short Period Site Coefficient at 0.2s Period, F_a	1.0
Long Period Site Coefficient at 1s Period, F_v	1.7[3]
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS}	1.963
Adjusted Spectral Response Acceleration at 1s Period, S_{M1}	1.192[3]
Design Spectral Response Acceleration at 0.2s Period, S_{DS}	1.309
Design Spectral Response Acceleration at 1s Period, S_{D1}	0.795[3]
Design Peak Ground Acceleration, PGA_M	0.921

1. All were derived from the SEA web page: https://seismicmaps.org/
2. All coefficients in units of g (spectral acceleration)
3. See Section 11.4.8 of ASCE 7-16. A site-specific ground motion hazard analysis in accordance with Section 21.2 of ASCE 7-16 is required for this site. Per Supplement 3 to ASCE 7-16, a site-specific ground motion hazard analysis is not required where the value of the parameters S_{M1} and S_{D1} in the table are increased by 50%
4. See Appendix C for details of the seismic evaluation

5.4 Slabs-on-Grade

Concrete slabs-on-grade should be designed by the structural engineer in accordance with 2022 CBC requirements for soils with a low expansion potential. More stringent requirements may be required by the structural engineer and/or architect; however, slabs-on-grade should have the following minimum recommended components:

- ***Subgrade:*** Slab-on-grade subgrade soil should be moisture conditioned to 2% over optimum moisture content, to a minimum depth of 18 inches within building footprints and compacted to 90% of the modified proctor (ASTM D 1557) laboratory maximum density prior to placing either a moisture barrier, steel and/or concrete. Onsite soil may be suitable for this use; however additional expansion testing should be performed upon completion of grading to verify expansive properties of onsite soil.

- ***Moisture Barrier:*** A moisture barrier consisting of at least 15-mil-thick Stego-wrap vapor barriers (see: http://www.stegoindustries.com/products/stego_wrap_vapor_barrier.php), or equivalent, should then be placed below slabs where moisture-sensitive floor coverings or equipment will be placed.

- ***Reinforced Concrete****:* A conventionally reinforced concrete slab-on-grade with a thickness of at least 5 inches within the building footprint and 6 inches for exterior SOG be placed in pedestrian areas without heavy loads. Reinforcing steel should be designed by the structural engineer, but as a minimum should be No. 3 rebar placed at 18 inches on-center, each direction (perpendicularly), mid-depth in the slab. A modulus of subgrade reaction (k) as a linear spring constant, of 75 pounds-per-square-inch per inch deflection (pci) can be used for design of heavily loaded slabs-on-grade, assuming a linear response up to deflections on the order of ¾ inch.

  Minor cracking of concrete after curing due to expansion, drying and shrinkage is normal and will occur. However, cracking is often aggravated by a high water-to-cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. The use of low-slump concrete or low water/cement ratios can reduce the potential for shrinkage cracking.

5.5 Lateral Earth Pressures

Recommended lateral earth pressures are provided as equivalent fluid unit weights, in psf/ft. or pcf. These values do not contain an appreciable factor of safety, so the structural engineer should apply the applicable factors of safety and/or load factors during design.

On-site soils may be suitable to be used as retaining wall backfill due to its low expansion potential (Appendix C), however, field and laboratory verification are recommended before use. Site soils can be variable in composition and expansive characteristics, See Section 2.4. Should site soil be desired for reuse behind retaining walls the material should be tested to ensure Expansion potential is less than 20 (EI<20). Recommended lateral earth pressures for retaining walls backfilled with sandy soils with drained conditions as shown on Figure 8 are as follows:

Table 7 - Retaining Wall Design Earth Pressures

Retaining Wall Condition (Level Backfill)	Equivalent Fluid Pressure (pounds-per-cubic-foot)*
Active (cantilever)	35
At-Rest (braced)	55
Passive Resistance (compacted fill)	300
Seismic Increment (add to active pressure)	30

*Only for level and drained properly compacted backfill

Walls that are free to rotate or deflect may be designed using active earth pressure. For walls that are fixed against rotation, the at-rest pressure should be used. For seismic condition, the pressure should be distributed as an inverted triangular distribution and the dynamic thrust should be applied at a height of 0.6H above the base of the wall.

Retaining Wall Surcharges: In addition to the above lateral forces due to retained earth, surcharge due to above grade loads on the wall backfill, such as existing building foundations, should be considered in design of retaining walls.

Vertical surcharge loads behind a retaining wall on or in backfill within a 1:1 (horizontal:vertical) plane projection up and out from the retaining wall toe, should be considered as lateral and vertical surcharge. Unrestrained (cantilever) retaining walls should be designed to resist one-third of these surcharge loads applied as a uniform horizontal pressure on the wall. Braced walls should also be designed to resist an additional uniform horizontal-pressure equivalent to one-half of uniform vertical surcharge loads. Consideration should be given to underpinning existing structures to remain in this zone, to reduce surcharge loads on the wall and to reduce the potential for inducing damaging settlement within these existing buildings, due to soil movement within the wall influence zone.

In areas where autos and pickup trucks will drive, we suggest assuming a uniform vertical surcharge of 300 psf, which would result in active and at-rest horizontal surcharges of 100 psf and 150 psf, respectively. This should be doubled in areas of heavy construction traffic (such as concrete trucks, heavy equipment delivery-trucks, etc.). If crane outrigger loads or other point load sources are applied as wall surcharge, this will require additional analyses based on load source and location relative to the wall.

5.5.1 Sliding and Overturning Total depth of retained earth for design of walls and for uplift resistance, should be measured as the vertical height of the stem below the ground surface at the wall face for stem design, or measured at the heel of the footing for overturning and sliding. A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing, if drained, or 60 pcf if submerged, for properly compacted backfill.

5.5.2 Drainage

Adequate drainage may be provided by a subdrain system positioned behind the walls. Typically, this system consists of a 4-inch minimum diameter perforated pipe placed near the base of the wall (perforations placed downward). The pipe should be bedded and backfilled with pervious backfill material described in Section 300-3.5.2 of the Standard Specifications for Public Works Construction (Green Book), current edition. This pervious backfill should extend at least 2 feet out from the wall and to within 2 feet of the outside finished grade. This pervious backfill and pipe should be wrapped in filter fabric, such as Mirafi 140N or equivalent, placed as described in Section 300-8.1 of the Standard Specifications for Public Works Construction (Green Book). The subdrain outlet should be connected to a free-draining outlet or sump.

Miradrain, Geotech Drainage Panels, or Enkadrain drainage geocomposites, or similar, may be used for wall drainage as an alternative to the Class 2 Permeable Material or drain rock backfill, particularly where horizontal space is limited adjacent to shoring (where walls are cast against shoring). These drainage panels should be connected to the perforated drainpipe at the base of the wall.

5.6 Pavement Design

To provide support for paving, the subgrade soils should be prepared as recommended in Section 5.1, Grading. Compaction of the subgrade, including trench backfills, to at least 90 to 95 percent as recommended relative compaction based on ASTM Test Method D 1557 and achieving a firm, hard and unyielding surface will be important for paving support. The upper 12-inches of pavement subgrade should be compacted to 95% relative compaction. The preparation of the paving area subgrade should be performed immediately prior to placement of the base course. Proper drainage of the paved areas should be provided since this will reduce moisture infiltration into the subgrade and increase the life of the paving.

5.6.1 Base Course

The base course for both asphalt concrete and Portland Cement Concrete paving should meet the specifications for Class 2 Aggregate Base as defined in Section 26 of the latest edition of the State of California, Department of Transportation, and Standard Specifications. Alternatively, the base course could meet the specifications for untreated base as defined in Section 200-2 of the latest edition of *Standard Specifications for Public Works Construction* (Greenbook). Crushed Miscellaneous Base (CMB) may be used for the base course provided the geotechnical consultant evaluates and tests it before delivery to the site.

5.6.2 Asphalt Concrete

The required asphalt paving and base thicknesses will depend on the expected wheel loads and volume of traffic (Traffic Index or TI). Assuming that the paving subgrade will consist of the onsite or comparable soils with an R-value of at least 30 (see test result in Appendix B) compacted to at least 90 percent relative compaction based on ASTM Test Method D 1557 below 12-inches and 95% relative compaction in the upper 12 inches, the minimum recommended paving thicknesses are presented in the following table:

Area	Traffic Index	Asphalt Concrete (inches)	Base Course (inches)
Car Parking	4	3	4
Light Truck	5	3	6
Heavy Truck	6	4	6½
Main Drives	7	4	9½

The asphalt paving sections were determined using the Caltrans design method. We can determine the recommended paving and base course thicknesses for other Traffic Indices if required. Careful inspection is recommended to verify that the recommended thicknesses or greater are achieved, and that proper construction procedures are followed.

5.6.3 Portland Cement Concrete Paving

Based on results of R-value testing, we have assumed that the subgrade will have an R-value of at least 30, which will need to be verified during grading. Portland Cement Concrete (PCC) paving sections were determined in accordance with procedures developed by the Portland Cement Association. Concrete paving sections for a range of Traffic Indices are presented in the table below. We have assumed that the PCC will have a compressive strength $(f_c^{'})$ of at least 4,000 pounds per square inch (psi).

Area	Traffic Index	Portland Cement Concrete (inches)	Base Course (inches)
Car Parking	4	5	4
Light Truck	5	5½	4
Heavy Truck	6	6½	4
Main Drives	7	7	4

The paving should be provided with expansion joints at regular intervals no more than 15 feet in each direction. Load transfer devices, such as dowels or keys, are recommended at joints in the paving to reduce possible offsets. The paving sections in the above table have been developed based on the strength of unreinforced concrete. Steel reinforcing may be added to the paving to reduce cracking and to prolong the life of the paving.

6.0 Construction Considerations

6.1 Excavations

Based on our field observations, caving of cohesionless strata and loose fill soils will likely be encountered in unshored excavations. To protect workers entering excavations, excavations should be performed in accordance with OSHA and Cal-OSHA requirements, and the current edition of the California Construction Safety Orders, see:

http://www.dir.ca.gov/title8/sb4a6.html

Contractors should be advised that fill soils should be considered Type C soils as defined in the California Construction Safety Orders. As indicated in Table B-1 of Article 6, Section 1541.1, Appendix B, of the California Construction Safety Orders, excavations less-than (<) 20 feet deep within Type C soils should be sloped back no steeper than 1½:1 (horizontal:vertical), where workers are to enter the excavation. This may be impractical near adjacent existing utilities and structures; so shoring may be required depending on trench depth and locations. Stiff undisturbed native clays will stand steeper.

During construction, soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor is responsible for providing the "competent person" required by OSHA standards to evaluate soil conditions. Close coordination between the competent person and Verdantas Inc. should be maintained to facilitate construction while providing safe excavations.

Excavations must not undermine foundations for existing buildings. Excavations must not encroach within a 1:1 (horizontal:vertical) wedge extending down and out from existing shallow footings to remain. Shoring or underpinning of existing building foundations may be required depending upon final footprint and floor elevations.

6.2 Geotechnical Services During Construction

Our geotechnical recommendations are contingent upon Verdantas Inc., providing geotechnical observation and testing services during earthwork and foundation construction. There is a potential for encountering deeper undocumented fill, underground obstructions or otherwise unacceptable existing soils between or beyond our boring locations. We are unaware of any existing fill placement documentation for this site. Therefore, inconsistent existing fill materials may be encountered during construction, possibly requiring revised geotechnical recommendations.

Our geotechnical recommendations provided in this report are based on information available at the time the report was prepared and may change as plans are developed. Additional geotechnical exploration, testing and/or analysis may be required should the proposed location of the building change drastically from its currently proposed footprint (Plate 1). Verdantas Inc. should review site grading, foundation, and shoring plans when available, to comment further on geotechnical aspects of this project and check to see general conformance of final project plans to recommendations presented in this report.

Verdantas Inc. should be retained to provide geotechnical observation and testing during excavation and all phases of earthwork. Our conclusions and recommendations should be reviewed and verified by us during construction and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- During all excavation,
- During compaction of all fill materials,
- After excavation of all footings and prior to placement of concrete,
- During utility trench backfilling and compaction,
- During pavement subgrade and base preparation, and/or
- If and when any unusual geotechnical conditions are encountered.

7.0 Limitations

Verdantas' work was performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable geotechnical consultants practicing in this or similar localities. No other warranty, express or implied, is made as to the conclusions and professional opinions included in this report. As in many projects, conditions revealed in excavations may be at variance with our current findings. If this occurs, the changed conditions must be evaluated by the geotechnical consultant and additional recommendations be obtained, as warranted.

The identification and testing of hazardous, toxic or contaminated materials were outside the scope of Verdantas' work. Should such materials be encountered at any time, or their existence is suspected, all measures stipulated in local, county, state and federal regulations, as applicable, should be implemented.

This report is issued with the understanding that it is the responsibility of the owner or a duly authorized agent acting on behalf of the owner, to ensure that the information and recommendations contained herein are brought to the attention of the necessary design consultants for the project and incorporated into the plans; and that the necessary steps are taken to see that the contracts carry out such recommendations in the field.

The findings of this report are considered valid as of the present date. However, changes in the condition of a property can occur with the passage of time, whether due to natural processes or the work of man on the subject or adjacent properties. In addition, changes in standards of practice may occur from legislation or the broadening of knowledge. Accordingly, the findings of this report may at some future time be invalidated wholly or partially by changes outside Verdantas' control.

The conclusions and recommendations in this report are based in part upon data that were obtained from a necessarily limited number of observations, site visits, excavations, samples and testes. Such information can be obtained only with respect to the specific locations explored, and therefore may not completely define all subsurface conditions throughout the site. The nature of many sites is that differing geotechnical and/or geological conditions can occur within small distances and under varying climatic conditions. Furthermore, changes in subsurface conditions can and do occur over time. Therefore, the findings, conclusions, and recommendations presented in this report should be considered preliminary if unanticipated conditions are encountered and additional explorations, testing and analyses may be necessary to develop alternative recommendations.

This report has been prepared for the express use of Santa Monica Malibu Unified School District and its design consultants, and only as related expressly to the assessment of the geotechnical constraints of developing the subject site and for construction purposes. This report may not be used by others or for other projects without the express written consent of Santa Monica - Malibu Unified School District and our firm.

If parties other than Verdantas are engaged to provide construction geotechnical services, they must be notified that they will be required to assume complete responsibility for the geotechnical phase of the project by concurring with the findings and recommendations in this report or by providing alternative recommendations. Any persons using this report for bidding or construction purposes should perform such independent investigations as they deem necessary to satisfy themselves as to the surface and/or subsurface conditions to be encountered and the procedures to be used in the performance of work on the subject site.

8.0 References

American Society of Civil Engineers (ASCE), 2013, Minimum Design Loads for Buildings and Other Structures, ASCE/SEI 7-10, Third Printing, Errata Incorporated through March 15.

Barrows, A.G., 1974, A Review of the Geology and Earthquake History of the Newport-Inglewood Structural Zone, Southern California: California Division of Mines and Geology Special Report 114, 115 p.

Bryant, W.A., 1988, Recently Active Traces of the Newport-Inglewood Fault Zone, Los Angeles and Orange Counties, California: California Division of Mines and Geology Open-File Report 88-14, 15 p.

Bryant, W.A., and Hart, E.W., 2007, Fault Rupture Hazard Zones in California, Alquist-Priolo Earthquake Fault Zoning Act with Index to Earthquake Fault Zones Maps, California Geological Survey: Special Publication 42.

California Geological Survey (CGS; previously known as the California Division of Mines and Geology), 1986, State of California Special Study Zones, Beverly Hills Quadrangle, Revised Official Map, July 1, 1986.

_____, 1998, Seismic Hazard Zone Report for the Beverly Hills 7.5-Minute Quadrangle, Los Angeles County, California, Seismic Hazard Zone Report 023, 1998.

_____, 1999, State of California Official Seismic Hazard Zones Map, Beverly Hills Quadrangle, Released March 25, 1999 map scale 1: 24,000.

______, 2000, CD-ROM containing digital images of Official Maps of Alquist-Priolo Earthquake Fault Zones that affect the Southern Region, CDMG CD 2000-003 2000.

______, 2008, Special Publication 117a, Guidelines for Evaluating and Mitigating Seismic Hazards in California.

_____, 2009, Tsunami Inundation Map for Emergency Planning, Beverly Hills Quadrangle, Los Angeles County, California, map scale 1:24,000.

_____, 2017, California Geological Survey Fault Evaluation Report FER 259, The Hollywood, Santa Monica and Newport-Inglewood Faults in the Beverly Hills and Topanga 7.5 Minute Quadrangles, dated June 28, 2017

_____, 2018, Earthquake Zones of Required Investigation Beverly Hills Quadrangle, Revised Official Map January 11, 2018

_____, 2022a, Engineering Geology and Seismology Review for Franklin Elementary School New makerspace building 2400 Montana Avenue Santa Monica, CA, CGS Application No. 03-CGS5557, dated November 3, 2022

______, 2022b, Note 48, Checklist for the Review of Engineering Geology and Seismology Reports for California Public Schools, Hospitals, and Essential Services Buildings, dated November 2022.

_____, 2023, Second Engineering Geology and Seismology Review for Franklin Elementary School New makerspace building 2400 Montana Avenue Santa Monica, CA, CGS Application No. 03-CGS5557, dated May 23, 2023

_____, 2024, Fault Rupture Hazard Review for Franklin Elementary School New Master Campus Plan, 2400 Montana Avenue Santa Monica, CA, CGS Application No. 03-CGS6152, dated January 12, 2024

California Office of Emergency Services (CalEMA), posted 2010, Los Angeles Tsunami Hazard: Maximum Runup, posted July 7, 2010.

California State Water Resources Control Board (CSWRCB), GeoTracker, http://geotracker.waterboards.ca.gov/.

City of Santa Monica, 1995, Safety Element of the General Plan, dated January 1995.

City of Santa Monica, 2014, City of Santa Monica Geologic Hazards Map, Information Systems Department, Geographic Information Systems, January 2014.

Cooke, Michele L. and Marshall, Scott T., 2006, Fault Slip Rates from Three-Dimensional Models of the Los Angeles metropolitan area, California; Geophysical Research Letters, Vol. 33, November 9, 2006.

County of Los Angeles, Department of Public Works (LADPW), 2021, Guidelines for Design, Investigation, and Reporting Low Impact Development Stormwater Infiltration, Department of Public Works, Geotechnical and Materials Engineering Division, dated June 30, 2021.

Crook, R., Jr., and Proctor, R., 1992, *The Hollywood and Santa Monica Faults and the Southern Boundary of the Transverse Ranges Province*: in Pipkin B., and Proctor, R., Engineering Geology Practice in Southern California.

Dibblee, Jr., T.W., 1991, Geologic Map of the Beverly Hills and South ½ Van Nuys Quadrangles, Los Angeles County, California, Dibblee Geological Foundation Map DF-31, Santa Barbara, California, map scale 1:24,000.

Dolan, J.F., Sieh, K, Rockwell, T.K., Guptill, P., and Miller, G., 1997, Active Tectonics, Paleoseismology, and Seismic Hazards of the Hollywood Fault, Northern Los Angeles Basin, California: Geological Society of America Bulletin, Volume 109, No. 12, pp. 1595-1616.

Dolan, J.F., Sieh, K., and Rockwell, T.K., 2000, Late Quaternary Activity and Seismic Potential of the Santa Monica Fault System, Los Angeles, California: Geological Society of America Bulletin, Volume 112, No. 10, pp. 1559-1581.

Dolan, J.F., Gath, E.M., Grant, L.B., Legg, M., Lindvall, S., Mueller, K., Oskin, M., Ponti, D.F., Rubin, C.M., Rockwell, T.K., Shaw, J.H., Treiman, J.A., Walls, C., and Yeats, R.S. (compiler), 2001, Active Faults in the Los Angeles Metropolitan Region: Report by the Southern California Earthquake Center Group C.

Federal Emergency Management Agency (FEMA), 2008, Flood Insurance Rate Map, Los Angeles County, California and Incorporated Areas, Map No. 06037C1590F, Panel 1590F, September 26, 2008.

Fischer, P. J., Mesa, Inc. R. H. Patterson, A. C. Darrow, J. H. Rudat, and G. Simila, 1987, The Palos Verdes Fault Zone: onshore to offshore, in Geology of the Palos Verdes Peninsula and San Pedro Bay; Society of Economic Paleontologists and Mineralogists and American Association of Petroleum Geologists, Los Angeles, California 91-134.

Hoots, H.W., 1931, Geology of the Eastern Part of the Santa Monica Mountains, Los Angeles County, California: USGS Professional Paper No. 165-C: p83-134, map scale 1:24,000.

Lajoie, K.R., Kern, J.P., Wehmiller, J.F., Kennedy, G.L., Mathieson, S.A., Sarna-Wojcicki, A.M., Yerkes, R.F., McCrory, P.F., 1979. Quaternary marine shorelines and crustal deformation, San Diego to Santa Barbara, California. In: Abbott, P.L. (Ed.), Geological Excursions in the Southern California Area. Department of Geological Sciences, San Diego State University, San Diego, pp. 3e15.

Leighton and Associates, 1994, Technical Background Report to the Safety Element of the City of Santa Monica General Plan, Project No. 7910399.001, dated March 30, 1994.

Leighton Consulting, Inc. 2022, Geotechnical Exploration Report New Makerspace Building Franklin Elementary School 2400 Montana Avenue Santa Monica, Los Angeles County, California, dated January 5, 2022, Project No. 11428.035

_____, 2023a, Response to Review Comments New Makerspace Building Franklin Elementary School 2400 Montana Avenue Satna Monica Los Angeles County, California, dated February 17, 2023, Project No. 11428.039

_____, 2023b, Seismic Hazard Assessment Report, Master Campus Plan, Franklin Elementary School 2400 Montana Avenue, Santa Monica, Los Angeles County, California, dated September 21, 2023, Project No. 11428.047

McNeilan, T. W., Rockwell, T. K., and Resnick, G. S., 1996, Style and Rate of Holocene Slip, Palos Verdes Fault, Southern California; in Journal of Geophysical Research, v. 101, no. B4, p. 8317-8334.

.Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008, Documentation for the 2008 Update of the United States National Seismic Hazard Maps: U.S. Geological Survey Open File Report 2008-1128, 61 p.

Poland, J.F. and Piper, A.M., and others, 1956, Ground Water Geology of the Coastal Zone, Long Beach and Santa Ana Area, California. Geological Survey Water Supply Paper 1109.

PSOMAS, 2021, ALTA/NSPS Land Title and Design Survey for Santa Monica Malibu Unified School District Franklin Elementary School 2400 Montana Avenue, City of Santa Monica, County of Los Angeles, California, dated August 16, 2021, 6 Sheets, Scale 1”=30’

Stephenson, W. J., T. K. Rockwell, J. K. Odum, K. M. Sedlock, and D. A. Okaya, 1995, Seismic Reflection and Geomorphic Characterization of the Onshore Palos Verdes Fault Zone, Los Angeles, California; in: Bulletin of the Seismological Society of America, Vol. 85, No. 3, pp. 943-950, dated June 1995

Treiman, J. A., Lundberg, M., and Bryant, W. A., 2017, Palos Verdes Fault Zone, Palos Verdes Hills Section.

United States Geological Survey (USGS) Topographic Map, 1981, Beverly Hills 7.5-Minute Quadrangle, dated 1966, Photo revised 1981.

_____, 2018, U.S. Seismic Design Maps, https://earthquake.usgs.gov/designmaps/us/application.php

Wright, T.L., 1991, Structural Geology and Tectonic Evolution if the Los Angeles Basin, California, in Biddle, K.T. (editor), Active Margin Basins: American Association of Petroleum Geologists Memoir 52, pp. 35-134.

Yerkes, R.F.; McCulloch, T.H.; Schoellhamer, J.E.; Vedder, J.G, 1965, Geology of the Los Angeles Basin, California- An Introduction: U.S. Geological Survey Professional Paper 420-A pp. 57.

Yerkes, R.F., and Campbell, R.H., 2005, Preliminary Geologic Map of the Los Angeles 30’ x 60’ Quadrangle, Southern California, United States Geological Survey: Open-File Report 2005-1019, Version 1.0, Map Scale 1:100,000.

Ziony, J.I., and Yerkes, R.F., 1985, Evaluating Earthquake and Surface-Faulting Potential *in* Ziony, J.I. (editor), Evaluating Earthquake Hazards in the Los Angeles Region - An Earth-Science Perspective: U.S. Geological Survey Professional Paper 1360, pp. 43-91.

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GBA GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

Project: 25103	Eng/Geol: CCK/EMH
Scale: 1 " = 2,000 '	Date: February 2025

Base Map: ESRI ArcGIS Online 2024
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

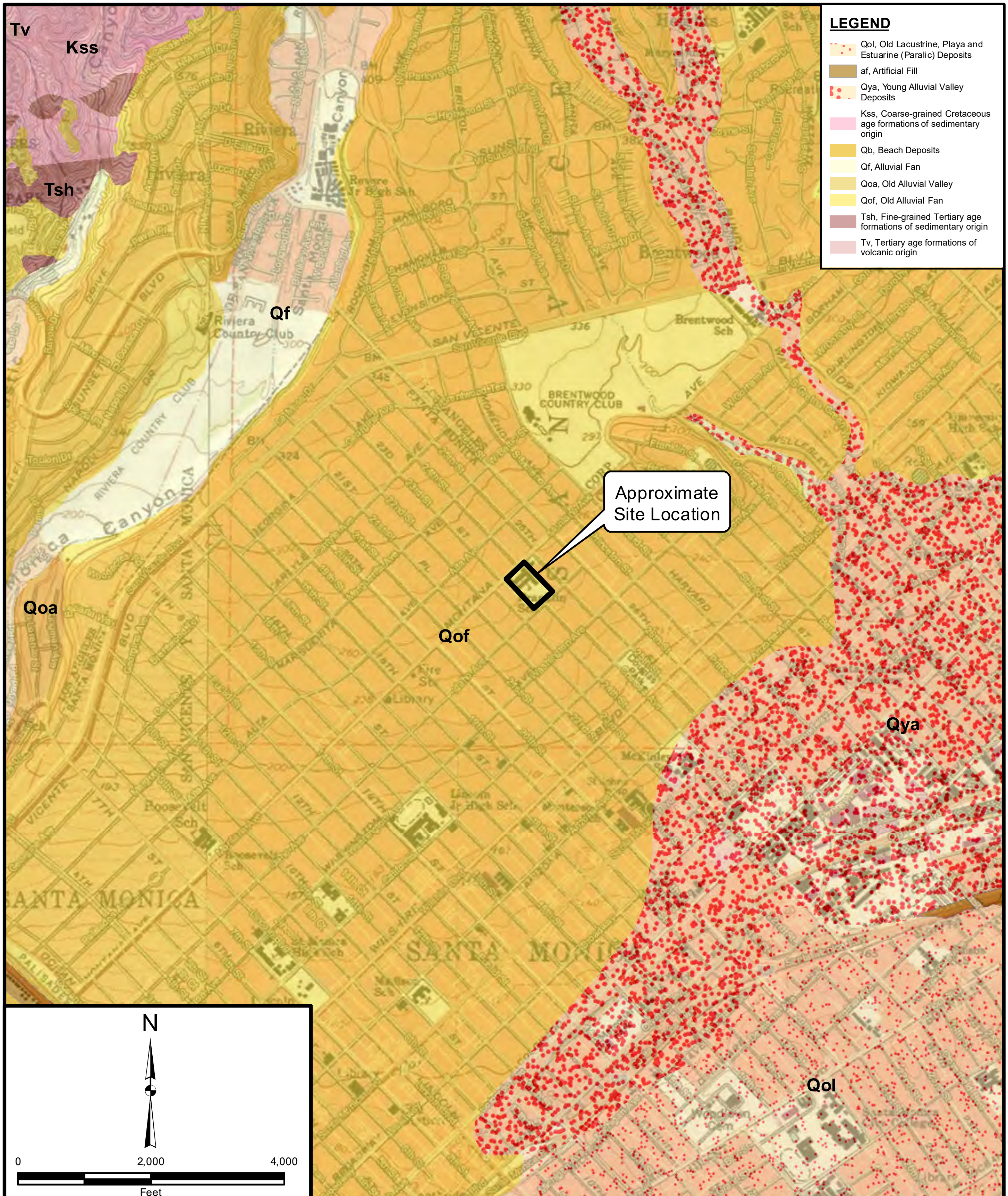
SITE LOCATION MAP

SMMUSD - Franklin Elementary School
2400 Montana Avenue
Santa Monica, California

FIGURE 1

Leighton

Map Saved as Z:\Project Files\SA-TZ\SMMUSD\25103 - Franklin ES New Classrooms\Verdantas Files\GIS\Maps\25103_F01_SLM_20210-14.mxd on 10/14/2024 11:43:48 AM



Project: 25103	Eng/Geol: CCK/EMH
Scale: 1 " = 2,000 '	Date: February 2025

Base Map: ESRI ArcGIS Online 2024
Socal Preliminary Geology, 2010

Author: Leighton Geomatics (btran)

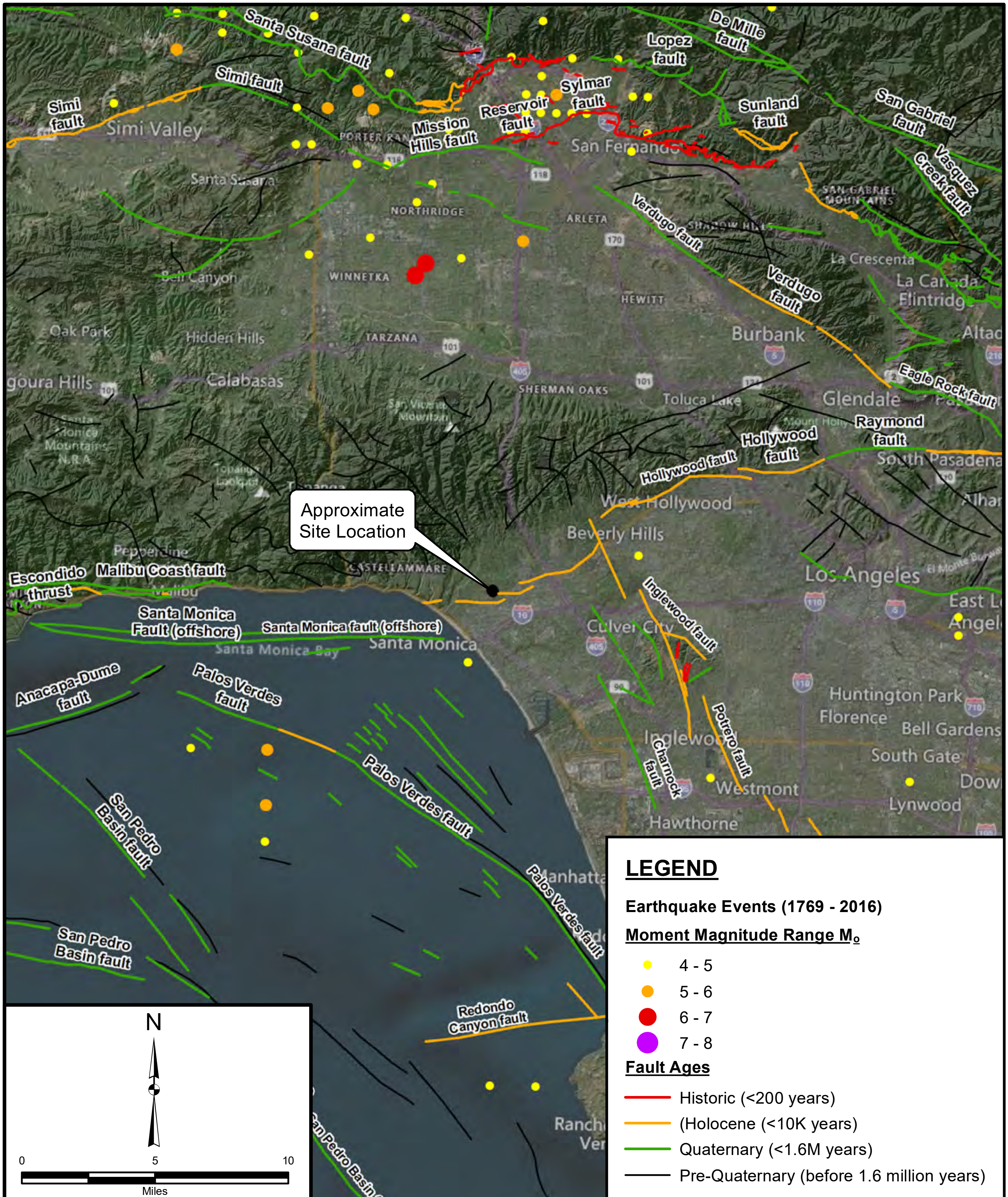
REGIONAL GEOLOGY MAP

SMMUSD - Franklin Elementary School
2400 Montana Avenue
Santa Monica, California

FIGURE 2

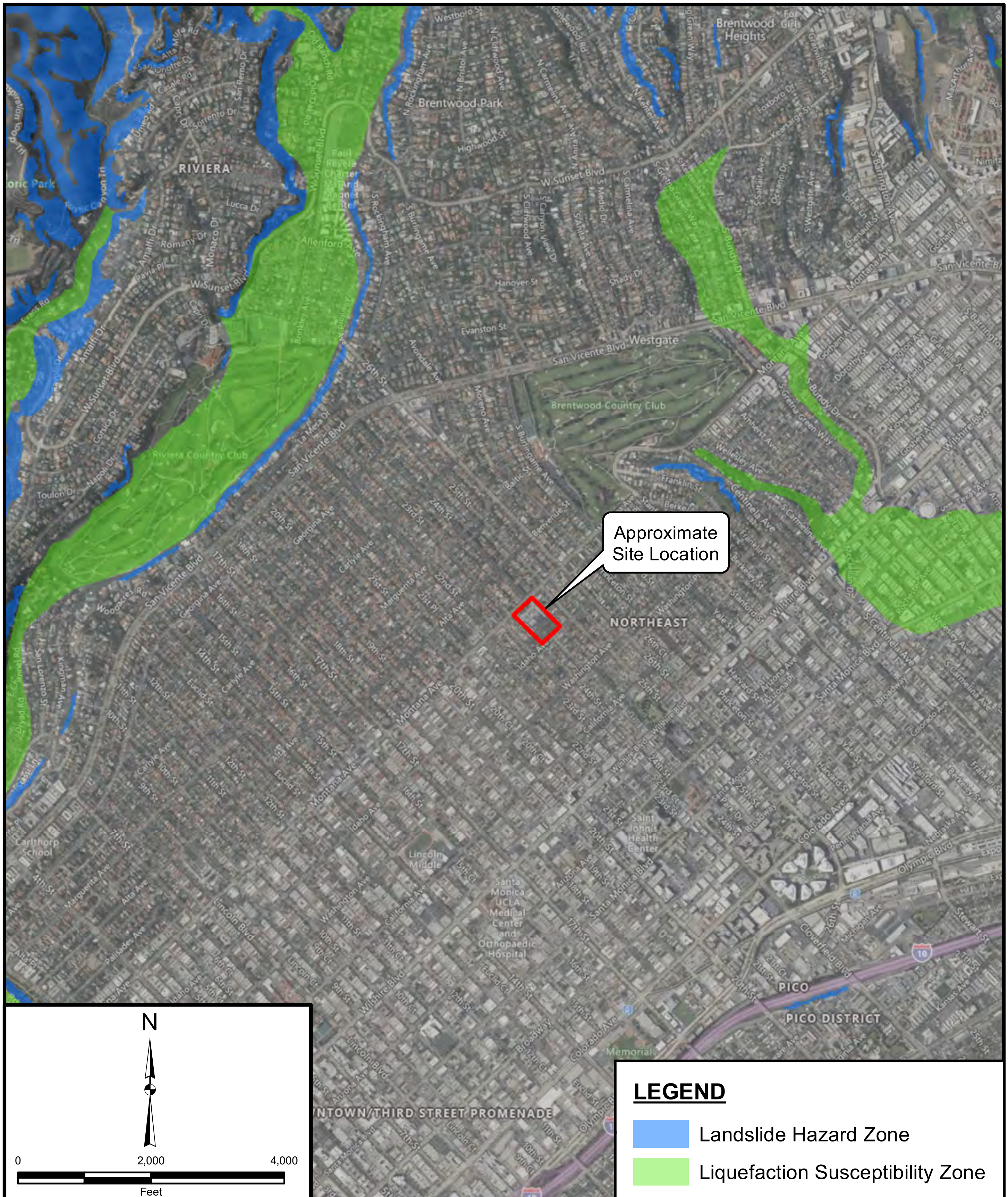
Leighton

Map Saved as Z:\Project Files\SA-TZ\SMMUSD\25103 - Franklin ES New Classrooms\Verdantas Files\GIS\Maps\25103_F02_RGM_2024-10-14.mxd on 10/21/2021 9:08:51 AM



Project: 25103	Eng/Geol: CCK/EMH	**REGIONAL FAULT AND HISTORICAL SEISMICITY MAP**	**FIGURE 3**
Scale: 1 " = 5 miles	Date: February 2025	SMMUSD - Franklin Elementary School 2400 Montana Avenue Santa Monica, California	Leighton
Reference: ESRI ArcGIS Online 2024 Bryant, W. A. (compiler), 2005, Digital Database of Quaternary and Younger Faults from the Fault Activity Map of California, version 2.0: CGS, USGS, SCEC. Author: Leighton Geomatics (btran)			

Map Saved as Z:\Project Files\SA-TZ\SMMUSD\25103 - Franklin ES New Classrooms\Verdantas Files\GIS\Maps\25103_F03_RF&HSM_2024-10-11.mxd on 10/20/2021 10:05:11 AM



Project: 25103	Eng/Geol: CCK/EMH
Scale: 1 " = 2,000 '	Date: February 2025

Base Map: ESRI ArcGIS Online 2024

Author: Leighton Geomatics (btran)

SEISMIC HAZARD MAP

SMMUSD - Franklin Elementary School
2400 Montana Avenue
Santa Monica, California

FIGURE 4

Leighton

Map Saved as Z:\Project Files\SA-TZ\SMMUSD\25103 - Franklin ES New Classrooms\Verdantas Files\GIS\Maps\25103_F04_SHM_2024-10-14.mxd on 10/20/2021 10:06:20 AM

Project: 25103 | Eng/Geol: CCK/EMH
Scale: 1 " = 2,000 ' | Date: February 2025

Base Map: ESRI ArcGIS Online 2024
Reference: CA DWR, FEMA
Author: Leighton Geomatics (btran)

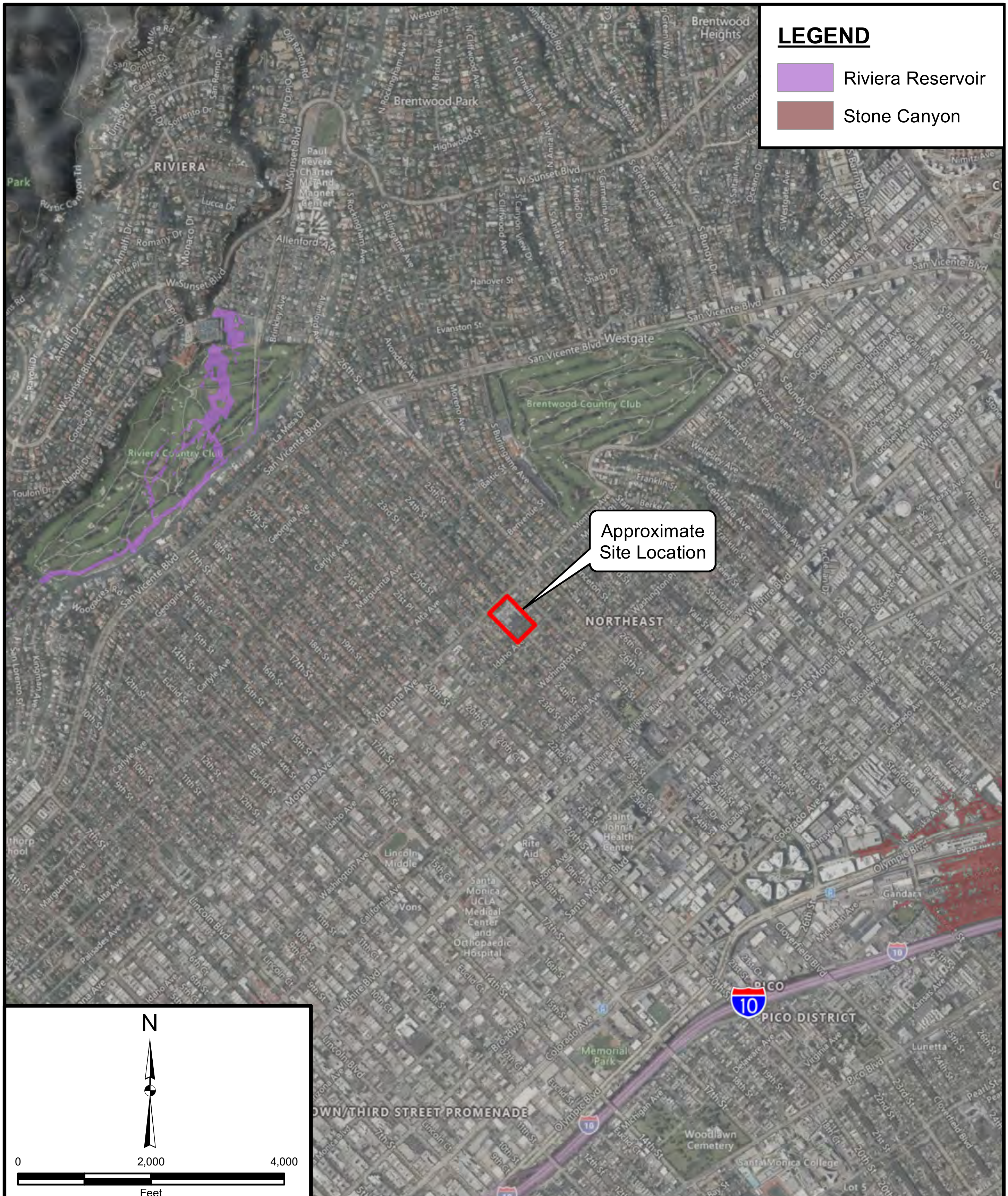
FLOOD HAZARD ZONE MAP

SMMUSD - Franklin Elementary School
2400 Montana Avenue
Santa Monica, California

FIGURE 5

Leighton

Map Saved as Z:\Project Files\SA-TZ\SMMUSD\25103 - Franklin ES New Classrooms\Verdantas Files\GIS\Maps\25103_F05_FHM_2024-10-14.mxd on 10/20/2021 10:07:34 AM



Project: 25103	Eng/Geol: CCK/EMH
Scale: 1 " = 2,000 '	Date: February 2025
Base Map: ESRI ArcGIS Online 2024	
Author: Leighton Geomatics (btran)	

DAM INUNDATION MAP

SMMUSD - Franklin Elementary School
2400 Montana Avenue
Santa Monica, California

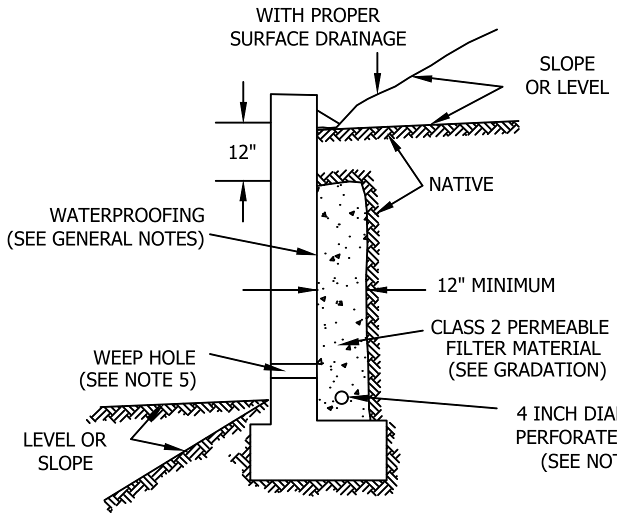
FIGURE 6

Leighton

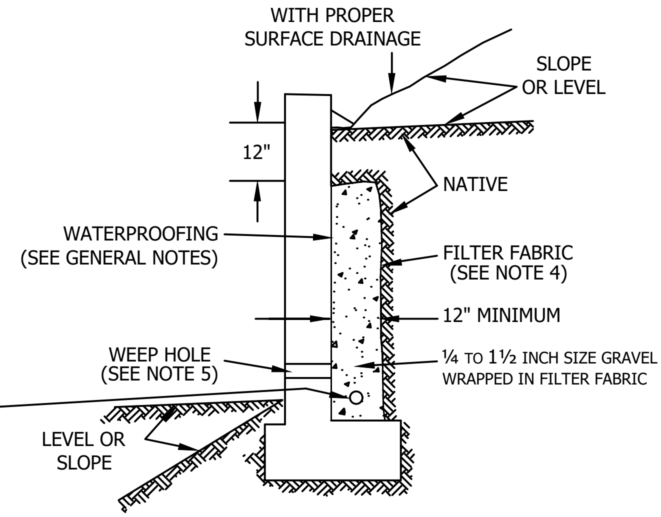
Map Saved as Z:\Project Files\SA-TZ\SMMUSD\25103 - Franklin ES New Classrooms\Verdantas Files\GIS\Maps\25103_F06_DIM_2024-11-20.mxd on 11/20/2024 7:38:21 AM

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

OPTION 1: PIPE SURROUNDED WITH CLASS 2 PERMEABLE MATERIAL



OPTION 2: GRAVEL WRAPPED IN FILTER FABRIC



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF ≤50

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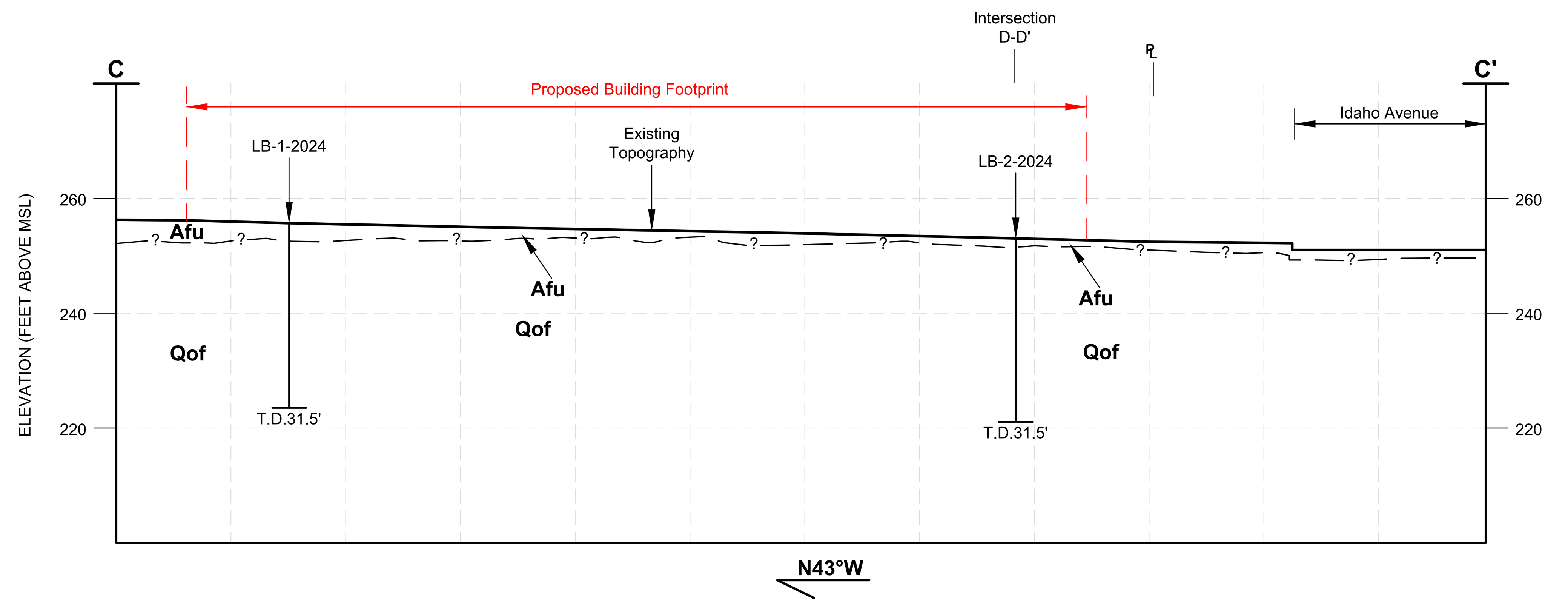

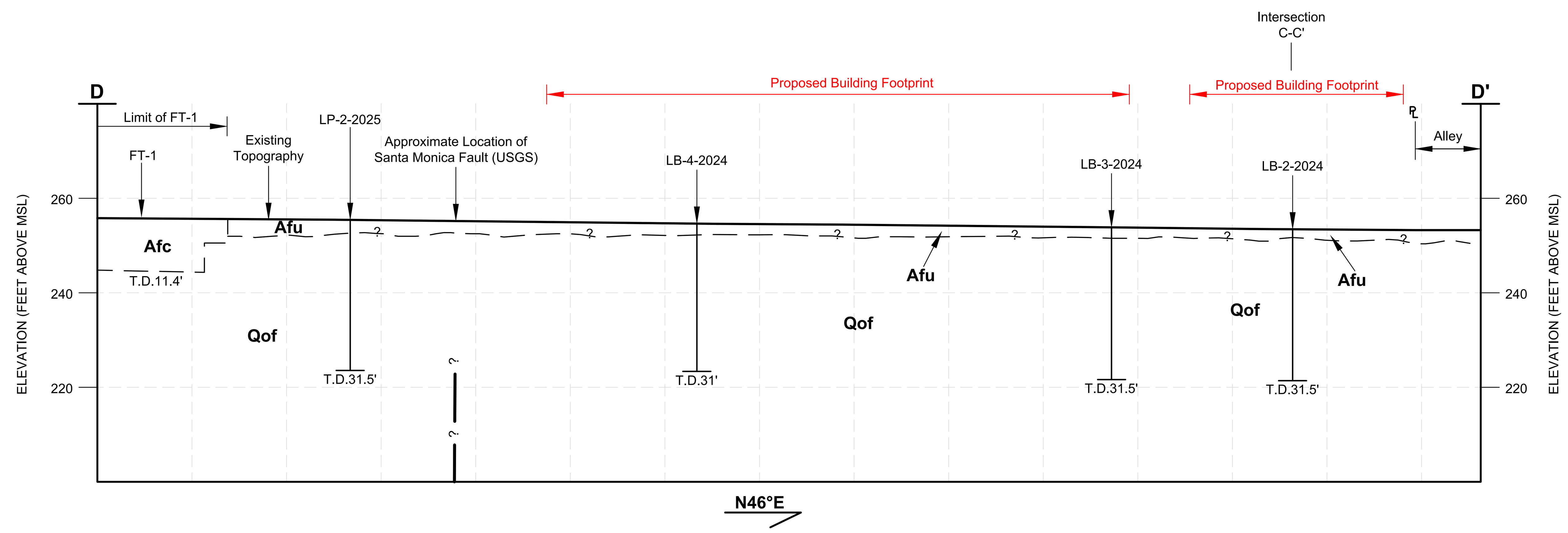

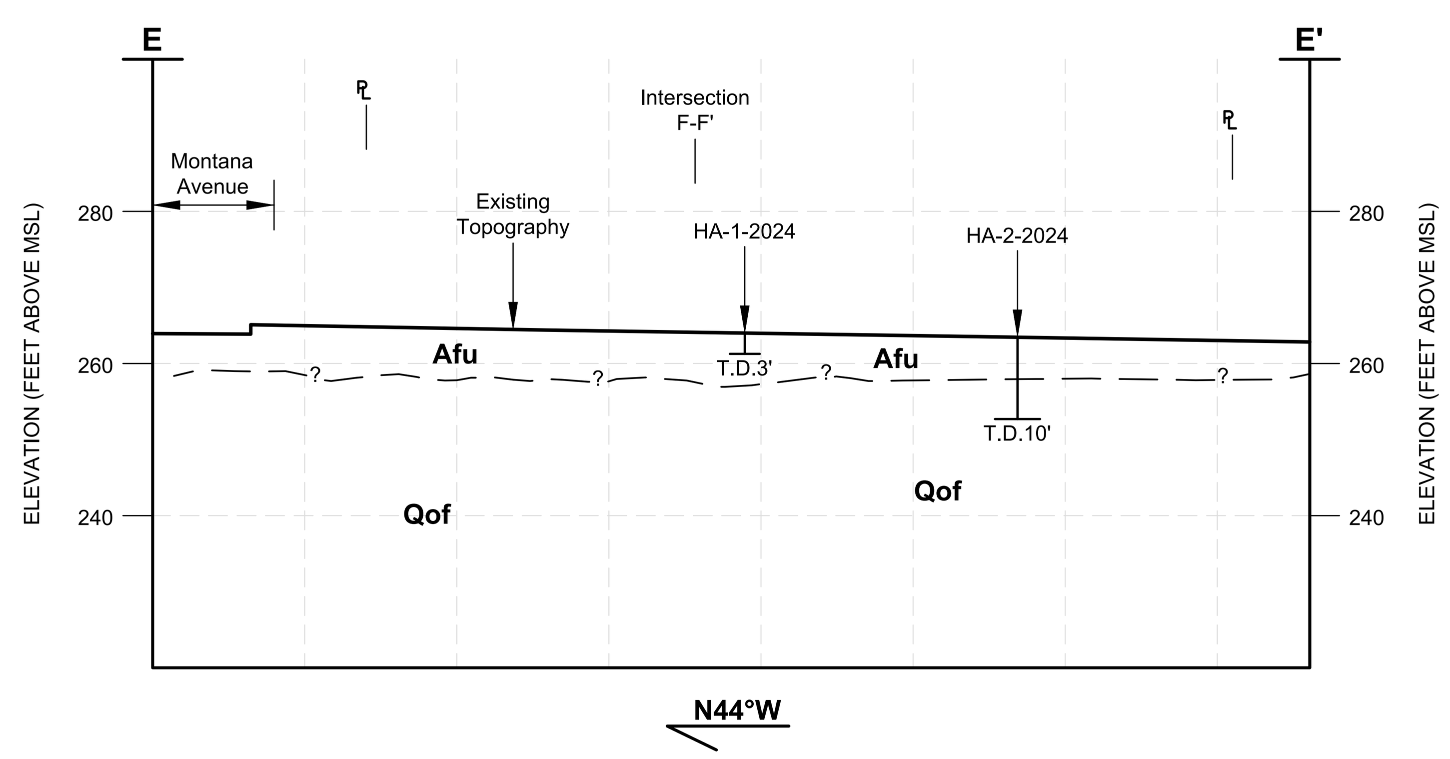

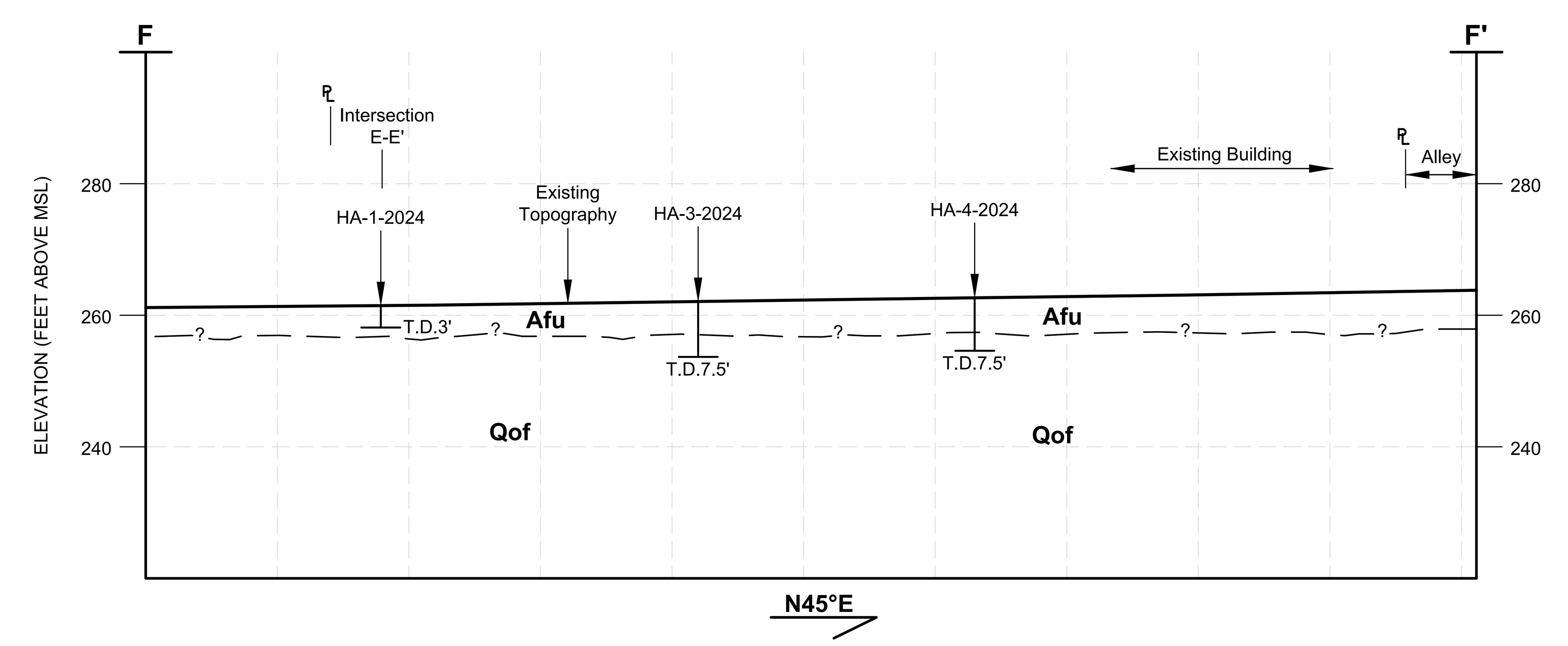

GEOTECHNICAL CROSS SECTIONS
C-C' THROUGH F-F'

SMMUSD - Franklin Elementary School
2400 Montana Avenue
Santa Monica, California

PLATE 2	
Scale: 1"=20'	
Date: February 2025	
Proj: 25103	
Eng/Geol: CCK/JAR	

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Appendix A.

Field Exploration Logs

GEOTECHNICAL BORING LOG LB-1-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	255'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
255	0			B-1	Bulk		116	15	SC	@ Surface: Grass **Artificial Fill, Undocumented (Map Symbol: Afu)** @ 0': Clayey SAND, brown, very moist, medium to high plasticity, some rootlets, gravel and siltstone fragments, trace medium to coarse sand	DS, EI, CN, RV
									SC	**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)** @ 3': Grades sandier and less moist with depth	
250	5			R-1	Driven	10 17 27	115	19	CL	@ 5': Lean CLAY, brown, hard, moist, primarily medium plasticity clay, few fine subrounded gravel and siltstone fragments, grades light brown and coarser with depth	DS, CN
245	10			S-1	Driven	4 5 7		14	CL	@ 10': Sandy CLAY, dark olive brown, very stiff, moist, fine to coarse sand, medium plasticity, FeO spotting, subangular coarse sand and fine gravel, siltstone fragments throughout, decomposing and friable, trace micas	
240	15			R-2	Driven	16 20 23	126	7	GC	@ 15': Sandy Clayey GRAVEL, dark gray/reddish brown, dense, slightly moist to moist, primarily subangular to angular slate fragments, easily friable, clay forming in fracture seams, matrix of fine to coarse sand and low plasticity clay, some oxidation along gravel/matrix contacts	
235	20			S-2	Driven	4 4 4		14	SM/CL	@ 20': Silty SAND interlayered with Sandy Silty CLAY, dark reddish brown, medium dense to stiff, moist, few well graded sand layers, low plasticity clay, subangular coarse sand/fine gravels, trace oxidation	
230	25			R-3	Driven	32 44 50/4"	133	6	SM	@ 25': Silty Gravelly SAND, dark brown, very dense, moist, approximately 15-20% (field estimate) fine subrounded to subangular gravel and subangular siltstone fragments, friable, oxidation on some coarse material, fine to coarse SAND, few clay, low plasticity	
225	30										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-1-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	255'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
225	30			S-3		15 42 32		6	GC	@ 30': Sandy Clayey GRAVEL, light to dark reddish brown, very dense, moist, primarily fine to coarse gravels, primarily siltstone composition, friable, some granitic gravels, mechanically fractured to subangular, highly oxidized/weathered on unfractured faces, matrix of clayey SAND, low plasticity, fine-grained	
										Total Depth: 31.5' bgs **No groundwater encountered** **Backfilled to surface with soil cuttings and grass patched on 10/3/2024**	
220	35										
215	40										
210	45										
205	50										
200	55										
195	60										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-2-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	252'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0			B-1			16	CL	@ Surface: Grass **Artificial Fill, Undocumented (Map Symbol: Afu)**	
250								CL	@ 0': Sandy CLAY, dark brown, very moist to wet, some subrounded gravels, brick fragments	
									Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof) @ 1.5': Sandy CLAY, reddish brown, moist, slate fragments at 2.5', micaceous, low to medium plasticity, some fine to medium sand, some coarse subround to round granitic gravels	
	5			S-1	6 6 8		13	CL	@ 5': Silty Sandy CLAY with gravel, reddish brown, very stiff, moist, subround to angular slate fragments, silty CLAY matrix, low plasticity, fine to coarse sand, some oxidation	
245										
	10			R-2	22 28 40	134	7	GP	@ 10': GRAVEL, dark olive brown/gray slate fragments, ranging from fine to coarse sand, and fine gravel (2.5-inches max dimension), smaller fragments are decomposed and friable with clay forming along fracture planes, unfractured faces are weathered and slightly oxidized, platy, angular siltstone fragments; matrix of clayey SAND, fine to coarse sand, low plasticity	
240										
	15			S-2	12 18 20		5	GP	@ 15': very dense, finer-grained slate fragments, higher clay content in matrix	
235										
	20			R-2	30 50/5"	121	4	CL/SM	@ 20': Silty SAND with gravel interlayered with Sandy CLAY with gravel, dark olive brown, very dense/hard, moist, fine to coarse subrounded to subangular siltstone fragments, slight oxidation, fine to coarse SAND layers, slate fragments micaceous on parting surfaces	
230										
	25			S-3	12 15 19		7	SC-SM	@ 25': Clayey Silty SAND with gravel, brown, very dense, moist, mostly fine to coarse sand, subangular fine gravel and slate fragments, some friable slate fragments, some oxidation	
225										
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-2-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	252'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			R-3	Driven	15 20 30	120	6	SC-SM	@ 30': Clayey Silty SAND, dark reddish brown, moist, dense, finer-grained, fewer coarse sand and gravels, friable slate fragments	
220										**Total Depth: 31.5' bgs** **No groundwater encountered** **Backfilled to surface with soil cuttings and grass patched on 10/3/2024**	
	35										
215											
	40										
210											
	45										
205											
	50										
200											
	55										
195											
	60										

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-3-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	253'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1	Bulk		118	14	SM	@ Surface: Grass **Artificial Fill, Undocumented (Map Symbol: Afu)** @ 0': Silty SAND, brown, moist, fine to coarse sand, low plasticity, some fine to medium sand, small fragments of asphalt and brick debris, subangular gravels	DS, EI, CN, RV
250				B-2	Bulk			14	CL	**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)** @ 2': Sandy CLAY with gravel, reddish brown, moist, low to medium plasticity clay, fine to medium sand, some slate and gravels	
	5			R-1	Driven	13 23 26	118	17	CL	@ 5': Lean CLAY, brown, moist, hard, approximately 15-20% (field estimate) subrounded gravel and subangular slate fragments in a CLAY matrix, medium plasticity, some oxidation	DS, CN
245											
	10			S-1	Driven	7 9 11		6	SM	@ 10': Silty SAND with gravel, dark olive brown, moist, medium dense to dense, fine to coarse SAND, abundant slate fragments (decomposed/friable), weathered with micas along slate parting surface, trace clay	
240											
	15			R-2	Driven	18 22 34	129	6	GC	@ 15': Clayey Sandy GRAVEL, abundant slate fragments in matrix of grayish brown Sandy CLAY, very dense, moist, slate decomposed, breaking down into angular sand-sized grains, micas along parting surfaces, oxidized red clay formed along weak foliation planes, trace precipitates	
235											
	20			S-2	Driven	4 4 5		13	CL/SM	@ 20': Gravelly CLAY interlayered with Silty SAND, reddish brown, stiff, moist to wet (silty SAND), high plasticity clay with abundant subangular slate fragments, silty SAND layers confined between clay layers, fine to coarse sand, olive gray, highly oxidized along soil contact zones	
230											
	25			R-3	Driven	26 50/6"	125	6	GC	@ 25': Clayey Sandy GRAVEL, abundant slate fragments in matrix of grayish brown Sandy CLAY, moist, very dense	
225											
	30										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-3-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	253'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	30			S-3		5 7 9		12	CL	@ 30': Sandy CLAY with gravel, reddish brown, very stiff, moist to very moist, medium plasticity, abundant slate fragments, some friable, trace oxidation	
220										**Total Depth: 31.5' bgs** **No groundwater encountered** **Backfilled to surface with soil cuttings and grass patched on 10/3/2024**	
	35										
215											
	40										
210											
	45										
205											
	50										
200											
	55										
195											
	60										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

verdantas

GEOTECHNICAL BORING LOG LB-4-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	255'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
255	0			B-1	Bulk			8	SM	@ Surface: Grass **Artificial Fill, Undocumented (Map Symbol: Afu)** @ 0': Silty SAND with gravel, slight moisture, nonplastic fines, fine to medium SAND, some fine to coarse subrounded to subangular gravel, difficult to hand auger	
									CL	**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)** @ 3': Sandy CLAY with siltstone gravels, reddish brown, moist, low to medium plasticity, angular siltstone fragments, subrounded gravels	
250	5			S-1	Driven	7 9 11		14	CL	@ 5': Silty CLAY with gravel, olive brown, very stiff, moist, low to medium plasticity, some fine subangular slate fragments, oxidation along gravel contacts	
245	10			R-1	Driven	9 11 13	109	18	ML	@ 10': Clayey SILT with gravel, olive brown, very stiff, moist, low plasticity, some fine to medium subrounded gravel, fractured slate	
240	15			S-2	Driven	4 7 10		8	CL	@ 15': Sandy silty CLAY, dark grayish brown, very stiff, very moist, low plasticity, some fine sand, trace coarse sand, some fractured slate, approximately 0.25-inch thick beds of wet sand	
235	20			R-2	Driven	40 50/5"	122	5	GP	@ 20': Sandy GRAVEL, primarily dark gray siltstone, very dense, slightly moist to moist, fractured to subangular, oxidized and weathered on non-fractured faces, matrix of well graded sand comprised of fractured slate, some low plasticity clay in matrix	
230	25			S-3	Driven	8 9 9		11	ML	@ 25': Clayey SILT with gravel, reddish brown, very stiff, moist, nonplastic to low plasticity, trace medium sand, some siltstone fragments	
225	30										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

verdantas

GEOTECHNICAL BORING LOG LB-4-2024

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	ECB
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	LAR Hollow Stem Auger - Autohammer	**Ground Elevation**	255'
Location	See Plate 1: Exploration Location Map	**Sampled By**	ECB

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
225	30			R-3		31 50/6"	133	8	SC-SM	@ 30': Clayey Silty SAND with gravel, olive brown, very dense, moist, primarily fine to medium sand, nonplastic to low plasticity fines, coarse slate fragments, friable, some oxidation **Total Depth: 31.5' bgs** **No groundwater encountered** **Backfilled to surface with soil cuttings and grass patched on 10/3/2024**	
220	35										
215	40										
210	45										
205	50										
200	55										
195	60										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

verdantas

GEOTECHNICAL BORING LOG LP-1-2025

Project No.	25103	**Date Drilled**	1-2-25
Project	Franklin ES New Classroom	**Logged By**	AS
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	256'
Location	See Plate 1: Exploration Location Map	**Sampled By**	AS

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0									@ Surface: Grass **Artificial Fill, Undocumented (Map Symbol: Afu)** @ 0': Clayey SAND, brown, moist, low to medium plasticity, scattered rootlets	
255										**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)**	
									SC		
250	5										
245	10			S-1		6 7 8			CL	@ 10': Sandy CLAY, brown to dark olive brown, moist, very stiff, medium to fine grained sand, scattered gravels, subrounded to subangular, friable, mottled structure	
240	15			S-2		3 4 6			CL	@ 15': Sandy CLAY, brown, moist, stiff, fine grained sand, scattered gravel matrix, subangular, oxidized along fractured gravel surfaces, friable	
235	20			S-3		5 6 9			SM/CL	@ 20': Silty SAND interlayered with Sandy CLAYS, brown to reddish brown, medium dense to very stiff, medium grained sand, low to medium plasticity clays, fine gravels, subangular to angular slate fragments, slight oxidation	
230	25			S-4		12 16 22			SM	@ 25': Silty Gravelly SAND, brown, very dense, moist, medium to coarse grained sand, scattered gravels, subangular to angular slate fragments, few clays, low plasticity	
	30										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

verdantas

GEOTECHNICAL BORING LOG LP-1-2025

Project No.	25103	**Date Drilled**	1-2-25
Project	Franklin ES New Classroom	**Logged By**	AS
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	256'
Location	See Plate 1: Exploration Location Map	**Sampled By**	AS

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
225	30			S-5		7 9 13			CL	@ 30': Sandy CLAY with Gravels, reddish brown to brown, moist, hard, medium plasticity, scattered gravels, subrounded to subangular, friable gravels	
220	35									**Total Depth: 31.5 feet bgs** **No groundwater encountered** **Installed temporary 2-inch diamter percolation well** **0'-10': Solid PVC casing** **10'-30': 0.020-inch slotted PVC casing** **Upon completion of testing, casing removed and boring backfilled with soil cuttings**	
215	40										
210	45										
205	50										
200	55										
	60										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LP-2-2025

Project No.	25103	**Date Drilled**	1-2-25
Project	Franklin ES New Classroom	**Logged By**	AS
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	256'
Location	See Plate 1: Exploration Location Map	**Sampled By**	AS

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0									@ Surface: Grass	
255										**Artificial Fill, Undocumented (Map Symbol: Afu)**	
										@ 0': Clayey SAND, brown, moist, medium plasticity, scattered rootlets, scattered gravels, subrounded	
										Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)	
									SC		
	5										
250											
	10			S-1		7 9 12			SM	@ 10': Silty Gravely SAND, gray brown to brown, slightly moist, dense, medium grained sand, scattered gravels, subrounded to subangular, weathered/friable gravels, trace clays, low plasticity	
245											
	15			S-2		10 13 16			GP	@ 15': Sandy GRAVEL, gray brown, slightly moist, dense, medium grained sand, scattered angular gravels, fine subrounded gravels, fractured/fragmented angular slate matrix of fine to coarse grained sand, slight oxidation	
240											
	20			S-3		8 10 13			SM	@ 20': Silty SAND with Gravel, brown to gray brown, slightly moist, dense, medium grained sand, scattered gravels, subrounded, friable angular slate fragments, slight oxidation, micaceous on fractured surfaces	
235											
	25			S-4		7 11 13			SC-SM	@ 25': Clayey Silty SAND, brown to reddish brown, moist, dense, fine to coarse grained sand matrix, subangular to subrounded gravels, fragments of angular slate, slight oxidation on fractured planes, mechanical fractured cobbles approximately 3"-5" in diameter, trace clays, low plasticity	
230											
	30										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LP-2-2025

Project No.	25103	**Date Drilled**	1-2-25
Project	Franklin ES New Classroom	**Logged By**	AS
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	256'
Location	See Plate 1: Exploration Location Map	**Sampled By**	AS

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	30			S-5		12 15 20			SM	@ 30': Silty SAND with Gravel, gray brown to brown, slightly moist, very dense, medium grained sand matrix, subrounded to subangular gravels, fragments of angular slate, some granitic gravels mechanically fractured, trace oxidation	
225											
										Total Depth: 31.5 feet bgs **No groundwater encountered** **Installed temporary 2-inch diamter percolation well** **0'-10': Solid PVC casing** **10'-30': 0.020-inch slotted PVC casing** **Upon completion of testing, casing removed and boring backfilled with soil cuttings**	
	35										
220											
	40										
215											
	45										
210											
	50										
205											
	55										
200											
	60										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG LP-3-2025

Project No.	25103	**Date Drilled**	1-2-25
Project	Franklin ES New Classroom	**Logged By**	AS
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	256'
Location	See Plate 1: Exploration Location Map	**Sampled By**	AS

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0									@ Surface: 4" Asphalt over 7" Base	
255										**<u>Artificial Fill, Undocumented (Map Symbol: Afu)</u>**	
										@ 0': Silty SAND, brown, moist, medium grained sand, scattered gravels, subrounded	
									SM	**<u>Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)</u>**	
	5										
250											
	10			S-1		5 8 10			SM	@ 10': Silty SAND with Gravel, brown, slightly moist, medium dense, medium to coarse grained sand matrix, scattered gravels, subrounded to subangular, scattered fragments of angular slate, oxidation	
245											
	15			S-2		6 6 10			SM	@ 15': Silty SAND with Gravels, brown, slightly moist to moist, medium dense, coarse grained sand, scattered gravels, subrounded to subangular, scattered fragments of angular slate, oxidation staining	
240											
	20			S-3		7 10 12			SM	@ 20': Silty SAND with gravels, reddish brown to brown, moist, dense, medium to coarse grained sand matrix, scattered gravels, subrounded to subangular scattered fragments of angular slate, friable, oxidation of some coarse material	
235											
	25			S-4		8 11 15			SM	@ 25': Silty SAND with gravels, reddish brown to brown, moist, dense, medium to coarse grained sand matrix, scattered gravels, subrounded to subangular, scattered fragments of angular slate, friable, oxidation of some coarse material, trace clays, low plasticity	
230											
	30										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LP-3-2025

Project No.	25103	**Date Drilled**	1-2-25
Project	Franklin ES New Classroom	**Logged By**	AS
Drilling Co.	Choice Drilling	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - Autohammer	**Ground Elevation**	256'
Location	See Plate 1: Exploration Location Map	**Sampled By**	AS

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
										This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
225	30			S-5		15 20 28			SM	@ 30': Silty SAND with Gravel, grayish brown to brown, moist, very dense, medium to coarse grained sand, scattered gravels, subrounded to subangular, scattered fractured angular slate, friable, oxidation of some coarse material,	
220	35									**Total Depth: 31.5 feet bgs** **No groundwater encountered** **Installed temporary 2-inch diamter percolation well** **0'-10': Solid PVC casing** **10'-30': 0.020-inch slotted PVC casing** **Upon completion of testing, casing removed and boring backfilled with soil cuttings**	
215	40										
210	45										
205	50										
200	55										
	60										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG HA-1

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	GZ
Drilling Co.	Strongarm Environmental	**Hole Diameter**	4"
Drilling Method	Hand Auger - Grab Samples	**Ground Elevation**	262'
Location	See Plate 1: Exploration Location Map	**Sampled By**	GZ

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								@ Surface: 5-inches Asphalt Concrete	
				B-1			10	ML	**Artificial Fill, Undocumented (Map Symbol: Afu)** @ 0.42': SILT, brown, slightly moist, rootlets, concrete debris approximately 4- to 6-inch diameter, glass debris	
260									@ 2.5': Fine subangular slate gravel at 2.5'	
									Total Depth: 3.6' bgs **Refusal encountered at 3.0' bgs** **Two additional step-outs encountered refusal at 3.6' and 3.25'** **No groundwater encountered** **Backfilled with soil cuttings, patched at surface with quick-set concrete, dyed black**	
	5									
255										
	10									
250										
	15									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

verdantas

GEOTECHNICAL BORING LOG HA-2

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	GZ
Drilling Co.	Strongarm Environmental	**Hole Diameter**	4"
Drilling Method	Hand Auger - Grab Samples	**Ground Elevation**	262'
Location	See Plate 1: Exploration Location Map	**Sampled By**	GZ

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1			11	ML	**Artificial Fill, Undocumented (Map Symbol: Afu)**	
									@ 0': SILT, brown, slightly moist, subangular gravel, concrete debris approximately 1- to 2-inch diameter, rootlets	
260										
	5							CL	**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)**	
255										
				G-1			14		@ 7.5': CLAY with silt, brown, slighly moist, fine subangular slate gravel, low plasticity, rootlets, blocky structure	
				G-2			14		@ 10': CLAY with silt, brown, slighly moist, fine subangular slate gravel	
	10								**Total Depth: 10' bgs** **No groundwater encountered** **Installed temporary 2 -inch diameter percolation well** **0-5': Solid PVC casing** **5-10': 0.020-inch slotted PVC casing** **Upon completion of testing, casing removed and boring backfilled with soil cuttings, patched at surface with cold-mix asphalt concrete**	
250										
	15									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

verdantas

GEOTECHNICAL BORING LOG HA-3

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	GZ
Drilling Co.	Strongarm Environmental	**Hole Diameter**	4"
Drilling Method	Hand Auger - Grab Samples	**Ground Elevation**	263'
Location	See Plate 1: Exploration Location Map	**Sampled By**	GZ

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No. (Bulk / Driven)	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								@ Surface: 4-inches Asphalt Concrete	
				B-1				SC-SM	**Artificial Fill, Undocumented (Map Symbol: Afu)**	EI, RV, CR
									@ 0.33': Silty Clayey SAND, dark brown, slightly moist, fine subangular slate gravel, trace rootlets	
260										
									@ 4': larger slate gravel, approximately 2-inch diameter	
	5			G-1			13	CL	**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)**	
									@ 5': CLAY, brown, slightly moist, fine subangular slate gravel, blocky structure	
				G-2			13		@ 7.5': CLAY, brown, slightly moist, fine subangular slate gravel	
255										
									@ 8.5': larger slate gravel approximetly 2"	
				G-3			9		@ 10': CLAY, brown, slightly moist, fine to coarse subangular slate gravel	
	10								**Total Depth: 10' bgs** **No groundwater encountered** **Backfilled with soil cuttings, patched at surface with quick-set concrete, dyed black**	
250										
	15									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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*** This log is a part of a report by Leighton and should not be used as a stand-alone document. ***

GEOTECHNICAL BORING LOG HA-4

Project No. 25103
Project SMMUSD - Franklin ES New Classroom Buildings
Drilling Co. Strongarm Environmental
Drilling Method Hand Auger - Grab Samples
Location See Plate 1: Exploration Location Map

Date Drilled 10-3-24
Logged By GZ
Hole Diameter 4"
Ground Elevation 263'
Sampled By GZ

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0									@ Surface: 6-inches Asphalt Concrete	
				B-1				13	CL	**Artificial Fill Undocumented (Map Symbol: Afu)**	
										@ 0.5': CLAY, brown, slightly moist, fine slate gravel	
260											
	5			G-1				13	CL	**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)**	
										@ 5': CLAY, brown, slighly moist, fine slate gravel, blocky structure	
				G-2				13		@ 7.5': CLAY, brown, slightly moist, fine to coarse slate gravel	
255										**Total Depth: 7.5' bgs** **Refusal encountered at 7.5' bgs due to large gravel** **No groundwater encountered** **Backfilled with soil cuttings, patched at surface with quick-set concrete, dyed black**	
	10										
250											
	15										

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG HA-5

Project No.	25103	**Date Drilled**	10-3-24
Project	SMMUSD - Franklin ES New Classroom Buildings	**Logged By**	GZ
Drilling Co.	Strongarm Environmental	**Hole Diameter**	4"
Drilling Method	Hand Auger - Grab Samples	**Ground Elevation**	262'
Location	See Plate 1: Exploration Location Map	**Sampled By**	GZ

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Bulk / Driven	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0									@ Surface: 6-inches Asphalt Concrete	
				B-1				13	SC-SM	**Artificial Fill Undocuemented (Map Symbol: Afu)**	
										@ 0.5': Silty Clayey SAND, dark brown, slightly moist, rootlets, fine to coarse subangular slate gravel, brick fragments	
260											
	5			G-1				13			
									CL	**Quaternary Old Alluvial Fan Deposits (Map Symbol: Qof)**	
										@ 5': CLAY, brown, slightly moist, rootlets @ 6': Larger slate gravel, approximately 3-inch diameter	
255											
				G-2				8		@ 7.5': CLAY, brown, slightly moist, coarse subangular slate gravel	
										Total Depth: 8' bgs **Refusal encountered at 8' due to large gravel** **No groundwater encountered** **Installed temporary 2 -inch diameter percolation well** **0-3': Solid PVC casing** **3-8': 0.020-inch perforated PVC casing** **Filled annulus with one (1) bag of #3 Monterey sand** **Upon completion of testing, casing was removed, and boring backfilled with soil cuttings, patched at surface with cold-mix asphalt concrete**	
	10										
250											
	15										

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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Appendix B.

Percolation Test Results

Boring Percolation Test Data Sheet

Project Number:	25103	**Test Hole Number:**	LP-1
Project Name:	Franklin ES New Classroom	**Date Excavated:**	1/2/2025
Earth Description:	Alluvium	**Date Tested:**	1/3/2025
Liquid Description:	Tap water	**Depth of boring (ft):**	30
Tested By:	AS	**Radius of boring, r (in):**	4
Time Interval Standard		**Diameter of casing (in):**	2
Start Time for Pre-Soak:	10:00 am previous day	**Length of slotted of casing (ft):**	20
Start Time for Standard:	8:55 AM	**Depth to Initial Water Depth (ft):**	12.90
Standard Time Interval		**Porosity of Annulus Material, *n* :**	0.35
Between Readings, mins:	30	**Bentonite Plug at Bottom:**	No

Field Percolation Data - High Flow-Rate Constand Head Test

Reading	Time	Time Interval, Δt (minutes)	Depth to Water (feet bgs)	Water Height, H (inches)	Cumulative Water Volume Delivered (gallons)
1	9:08	-	12.90	205.2	0.0
2	9:38	30	12.50	210.0	166.4
3	10:08	30	12.25	213.0	333.0
4	10:38	30	11.71	219.5	499.6
5	11:08	30	12.18	213.8	657.8
6	11:39	30	12.25	213.0	816.2
7	12:09	30	12.35	211.8	973.3
8					
9					
10					
11					
12					

Total Volume of Water Delivered (gallons)	973.3
Total Volume of Water Delivered (cubic inches)	224832.3
Average Water Height (inches)	212.3
Average Percolation Surface Area (cubic Inches)	5386.7
Duration of Test (minutes)	180
Duration of Test (hours)	3.00

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

Measured Infiltration Rate = **13.9** **in./hr.**

Design Infiltration Rate

Reduction Factor from Test Procedure, RF_t =	3
Reduction Factor for Site Variability, # of Tests and Investigation, RF_v =	1
Reduction Factor for Long Term Siltation, Plugging and Maintenance, RF_t =	1
Reduction Factor, $RF = RF_t + RF_v + RF_s$ =	5
Design Infiltration Rate = Measured Infiltration Rate / Reduction Factor (RF) =	**2.8 in./hr.**

Boring Percolation Test Data Sheet

Project Number:	25103	**Test Hole Number:**	LP-2
Project Name:	Franklin ES New Classroom	**Date Excavated:**	1/2/2025
Earth Description:	Alluvium	**Date Tested:**	1/3/2025
Liquid Description:	Tap water	**Depth of boring (ft):**	30
Tested By:	GZ	**Radius of boring, r (in):**	4
Time Interval Standard		**Diameter of casing (in):**	2
Start Time for Pre-Soak:		**Length of slotted of casing (ft):**	20
Start Time for Standard:	12:50 PM	**Depth to Initial Water Depth (ft):**	11.75
Standard Time Interval Between Readings, mins:	30	**Porosity of Annulus Material, *n* :**	0.35
		Bentonite Plug at Bottom:	No

Field Percolation Data - High Flow-Rate Constand Head Test

Reading	Time	Time Interval, Δt (minutes)	Depth to Water (feet bgs)	Water Height, H (inches)	Cumulative Water Volume Delivered (gallons)
1	12:50	-	11.75	219.0	0.0
2	13:20	30	11.70	219.6	181.9
3	13:50	30	11.71	219.5	358.3
4	14:20	30	11.67	220.0	540.6
5	14:50	30	11.63	220.4	722.1
6	15:20	30	11.62	220.6	896.8
7	15:50	30	11.60	220.8	1075.9
8					
9					
10					
11					
12					

Total Volume of Water Delivered (gallons)	1075.9
Total Volume of Water Delivered (cubic inches)	248532.9
Average Water Height (inches)	220.0
Average Percolation Surface Area (cubic Inches)	5578.9
Duration of Test (minutes)	180
Duration of Test (hours)	3.00

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

Measured Infiltration Rate = 14.8 in./hr.

Design Infiltration Rate

Reduction Factor from Test Procedure, RF_t =	3
Reduction Factor for Site Variability, # of Tests and Investigation, RF_v =	1
Reduction Factor for Long Term Siltation, Plugging and Maintenance, RF_t =	1
Reduction Factor, RF = $RF_t + RF_v + RF_s$ =	5
Design Infiltration Rate = Measured Infiltration Rate / Reduction Factor (RF) =	3.0 in./hr.

Boring Percolation Test Data Sheet

Project Number:	25103	**Test Hole Number:**	LP-3
Project Name:	Franklin ES New Classroom	**Date Excavated:**	1/2/2025
Earth Description:	Alluvium	**Date Tested:**	1/3/2025
Liquid Description:	Tap water	**Depth of boring (ft):**	30
Tested By:	GZ	**Radius of boring, r (in):**	4
Time Interval Standard		**Diameter of casing (in):**	2
Start Time for Pre-Soak:	8:25 AM	**Length of slotted of casing (ft):**	20
Start Time for Standard:	9:15 AM	**Depth to Initial Water Depth (ft):**	11.01
Standard Time Interval Between Readings, mins:	30	**Porosity of Annulus Material, *n* :**	0.35
		Bentonite Plug at Bottom:	No

Field Percolation Data - High Flow-Rate Constand Head Test

Reading	Time	Time Interval, Δt (minutes)	Depth to Water (feet bgs)	Water Height, H (inches)	Cumulative Water Volume Delivered (gallons)
1	9:15	-	11.01	227.9	0.0
2	9:45	30	12.23	213.2	78.2
3	10:15	30	12.25	213.0	139.7
4	10:45	30	12.42	211.0	190.8
5	11:15	30	12.38	211.4	239.8
6	11:45	30	12.22	213.4	294.0
7	12:15	30	12.08	215.0	350.4
8	12:45	30	11.86	217.7	407.2
9					
10					
11					
12					

Total Volume of Water Delivered (gallons)	407.2
Total Volume of Water Delivered (cubic inches)	94063.2
Average Water Height (inches)	215.3
Average Percolation Surface Area (cubic Inches)	5462.0
Duration of Test (minutes)	210
Duration of Test (hours)	3.50

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

Measured Infiltration Rate = **4.9** **in./hr.**

Design Infiltration Rate

Reduction Factor from Test Procedure, RF_t =	3
Reduction Factor for Site Variability, # of Tests and Investigation, RF_v =	1
Reduction Factor for Long Term Siltation, Plugging and Maintenance, RF_t =	1
Reduction Factor, RF = $RF_t + RF_v + RF_s$ =	5

Design Infiltration Rate = Measured Infiltration Rate / Reduction Factor (RF) = **1.0** **in./hr.**

Boring Percolation Test Data Sheet

Project Number:	25103	**Test Hole Number:**	HA-2
Project Name:	Franklin ES	**Date Excavated:**	10/3/2024
Earth Description:	Alluvium	**Date Tested:**	10/3/2024
Liquid Description:	Tap water	**Depth of boring (ft):**	10
Tested By:	JK	**Radius of boring (in):**	4
Time Interval Standard		**Radius of casing (in):**	1
Start Time for Pre-Soak:	9:44AM	**Length of slotted of casing (ft):**	
Start Time for Standard:	10:46AM	**Depth to Initial Water Depth (ft):**	
Standard Time Interval		**Porosity of Annulus Material, *n* :**	0.35
Between Readings, mins:	30min	**Bentonite Plug at Bottom:**	No

Field Percolation Data - Falling Head Test

Reading	Time	Time Interval, Δt (min.)	Initial/Final Depth to Water (ft.)	Initial/Final Water Height, H_0/H_f (in.)	Total Water Drop, Δd (in.)	Infiltration Rate (in./hr.)
P1	9:44	26	3.70	75.6	38.2	1.18
	10:10		6.88	37.4		
P2	10:11	25	4.40	67.2	30.1	1.04
	10:36		6.91	37.1		
1	10:46	30	4.00	72.0	35.5	0.99
	11:16		6.96	36.5		
2	11:17	31	4.00	72.0	36.0	0.97
	11:48		7.00	36.0		
3	11:51	31	4.00	72.0	38.3	1.06
	12:22		7.19	33.7		
4	12:27	30	4.00	72.0	37.0	1.04
	12:57		7.08	35.0		
5	12:58	30	3.60	76.8	40.3	1.07
	13:28		6.96	36.5		
6	13:33	30	3.65	76.2	37.8	1.00
	14:03		6.80	38.4		

Infiltration Rate (I) = Discharge Volume/Surface Area of Test Section/Time Interval

Measured Infiltration Rate, I (Average of Last 3 Readings) = 1.04 in./hr.

Design Infiltration Rate

Reduction Factor from Test Procedure, RF_t = 1

Reduction Factor for Site Variability, # of Tests and Investigation, RF_v = 1

Reduction Factor for Long Term Siltation, Plugging and Maintenance, RF_t = 1

Reduction Factor, RF = $RF_t + RF_v + RF_s$ = 3

Design Infiltration Rate = Measured Infiltration Rate / Reduction Factor (RF) = 0.35 in./hr.

Boring Percolation Test Data Sheet

Project Number:	25103	**Test Hole Number:**	HA-5
Project Name:	Franklin ES	**Date Excavated:**	10/3/2024
Earth Description:	Alluvium	**Date Tested:**	10/3/2024
Liquid Description:	Tap water	**Depth of boring (ft):**	8
Tested By:	JK	**Radius of boring, r (in):**	4
Time Interval Standard		**Diameter of casing (in):**	2
Start Time for Pre-Soak:	12:30 PM	**Length of slotted of casing (ft):**	5
Start Time for Standard:	1:31 PM	**Depth to Initial Water Depth (ft):**	
Standard Time Interval Between Readings, mins:	30min	**Porosity of Annulus Material, *n* :**	0.35
		Bentonite Plug at Bottom:	No

Field Percolation Data - Constant Head Test

Reading	Time	Time Interval, Δt (minutes)	Depth to Water (feet bgs)	Water Height, H (inches)	Cumulative Water Volume Delivered (gallons)
1	13:31	-	-	-	0.0
2	14:01	30	2.70	63.6	118.0
1	14:31	30	2.69	63.7	239.0
2	15:01	30	2.70	63.6	361.0
3	15:31	30	2.70	63.6	482.0
4	16:01	30	2.71	63.5	603.0
5	16:32	30	2.70	63.6	714.0

Total Volume of Water Delivered (gallons)	714.0
Total Volume of Water Delivered (cubic inches)	164934
Average Water Height (inches)	63.6
Average Percolation Surface Area (cubic Inches)	1648.7
Duration of Test (minutes)	180
Duration of Test (hours)	3.00

$$\text{Measured Infiltration Rate} = (\text{Total Volume})/(\text{Test Duration})/(\text{Surface Area})$$

Measured Infiltration Rate (inches per hour) = 33.3

Appendix C.

Laboratory Test Results

APPENDIX C - GEOTECHNICAL LABORATORY TESTING

Our geotechnical laboratory testing program was directed toward a quantitative and qualitative evaluation of physical and mechanical properties of soils underlying this campus at proposed improvements, and to aid in verifying soil classification. This geotechnical testing was performed at our Irvine laboratory (DSA LEA 63).

Modified Proctor Compaction Curve: Laboratory modified Proctor compaction curves (ASTM D 1557) were established for bulk soil-samples to determine sample-specific modified Proctor laboratory maximum dry density and optimum moisture content. Results of these tests are presented on the following "*Modified Proctor Compaction Test*" sheets in this appendix.

Direct Shear Tests: Direct shear tests were performed, in general accordance with ASTM Test Method D 3080, on remolded soil samples remolded to 90% of the ASTM D 1557 laboratory maximum density. Remolded specimens were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1 hour prior to application of shearing force. These specimens were tested under various normal loads with a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of 0.05 inches per minute (depending upon the soil type). Test results are presented on the *Direct Shear Test Results* sheets which follow in this appendix.

Consolidation: Consolidation tests on relatively undisturbed drive samples from our borings were performed in accordance with ASTM D 2435. Results are included in this appendix on the *One-Dimensional Consolidation Properties of Soils* sheets.

Corrosivity Tests: To evaluate corrosion potential of subsurface soils at the site, we tested a bulk sample collected during our subsurface exploration for pH, electrical resistivity (CTM 532/643), soluble sulfate content (CTM 417 Part II) and soluble chloride content (CTM 422) testing. Results of these tests are enclosed at the end of this appendix.

R-Value Tests: Selected samples were tested in accordance with DOT CA Test 301. The R-Value test measures the response of a compacted sample of soil or aggregate to a vertically applied pressure under specific conditions. This test is used by Caltrans for pavement design, replacing the California bearing ratio test. The R-value of a material is determined when the material is in a state of saturation such that water will be exuded from the compacted test specimen when a 16.8 kN load (2.07 MPa) is applied to test a series of specimens prepared at different moisture contents. R-Value is used in pavement design, with the thickness of each layer dependent on the R-value of the layer below and the expected level of traffic loading, expressed as a Traffic Index. Results of these tests are enclosed at the end of this appendix.

Expansion Tests: In accordance with ASTM D 4829 the specimen is compacted into a metal ring so that the degree of saturation is between 40 and 60 % and the specimen and the ring are placed in a consolidometer. A vertical confining pressure of 1 psi is applied to the specimen and then the specimen is inundated with distilled water. The deformation of the specimen is recorded for 24 hours or until the rate of deformation becomes less than 0.005 mm/hour. The Expansion Index, EI, is used to measure a basic index property of soil and therefore, the EI is comparable to other indices such as the liquid limit, plastic limit, and plasticity index of soils. Results of these tests are enclosed at the end of this appendix.

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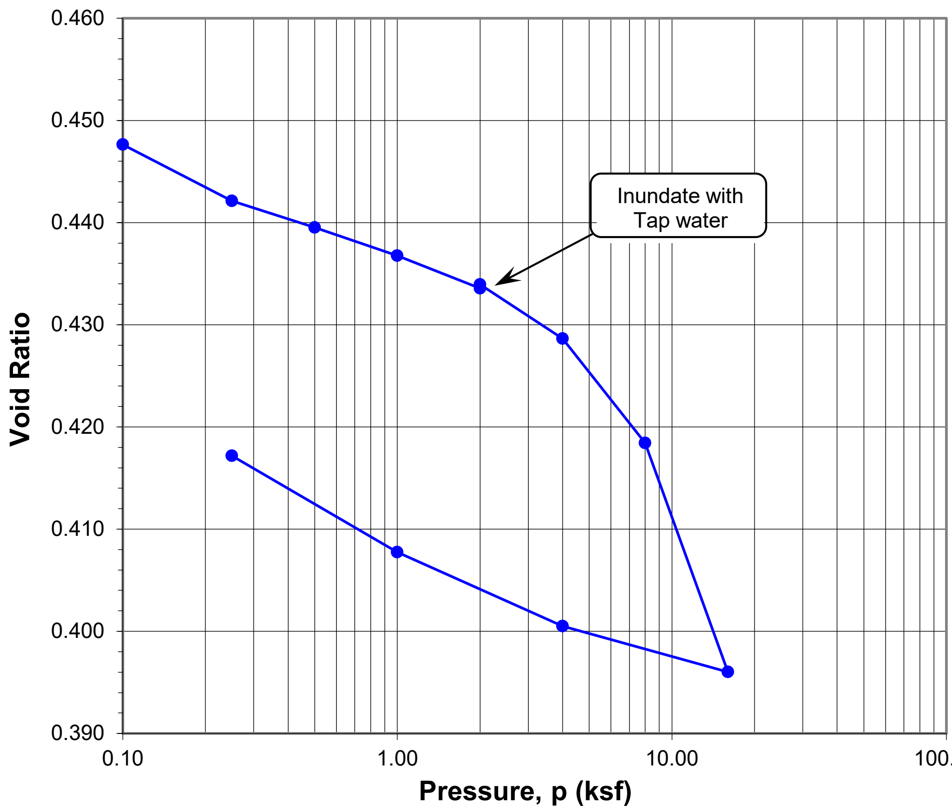
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name: SMMUSD Franklin ES New Classroom
Project No.: 036.0000025103
Boring No.: LB-1
Sample No.: B-1
Soil Identification: Brown clayey sand (SC)

Tested By: JD/GB Date: 10/15/24
Checked By: J. Ward Date: 11/12/24
Depth (ft.): 0-5
Sample Type: 90% Remold

Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	194.17
Weight of Ring (g):	40.63
Height after consol. (in.):	0.9774
Before Test	
Wt. of Wet Sample+Cont. (g):	186.10
Wt. of Dry Sample+Cont. (g):	174.67
Weight of Container (g):	58.52
Initial Moisture Content (%)	9.8
Initial Dry Density (pcf)	116.3
Initial Saturation (%):	59
Initial Vertical Reading (in.)	0.1335
After Test	
Wt. of Wet Sample+Cont. (g):	261.10
Wt. of Dry Sample+Cont. (g):	240.93
Weight of Container (g):	60.92
Final Moisture Content (%)	14.47
Final Dry Density (pcf):	118.6
Final Saturation (%):	93
Final Vertical Reading (in.)	0.1580
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

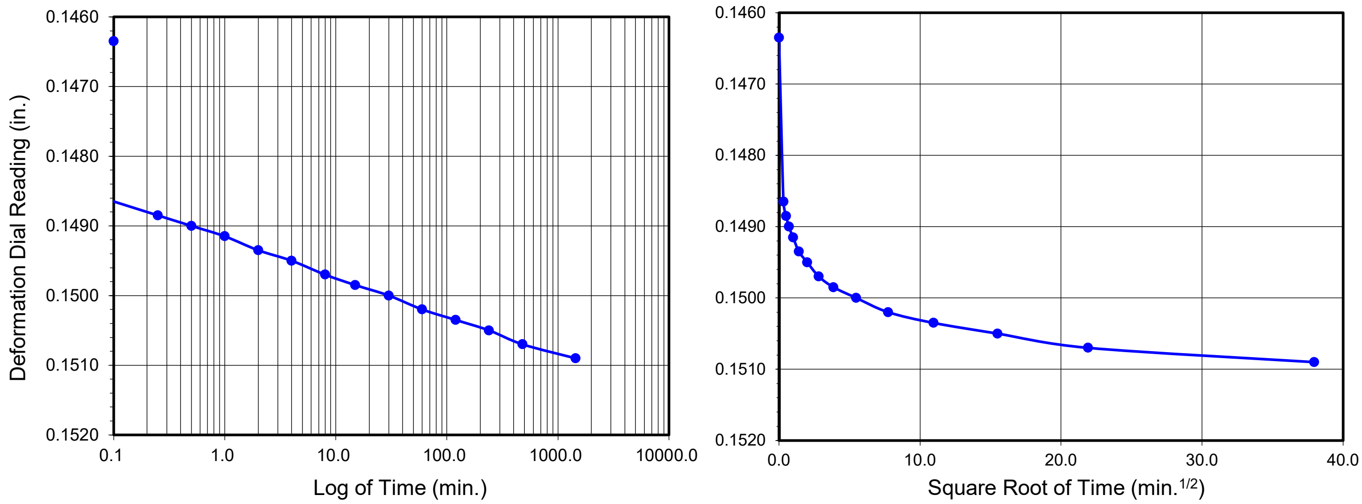


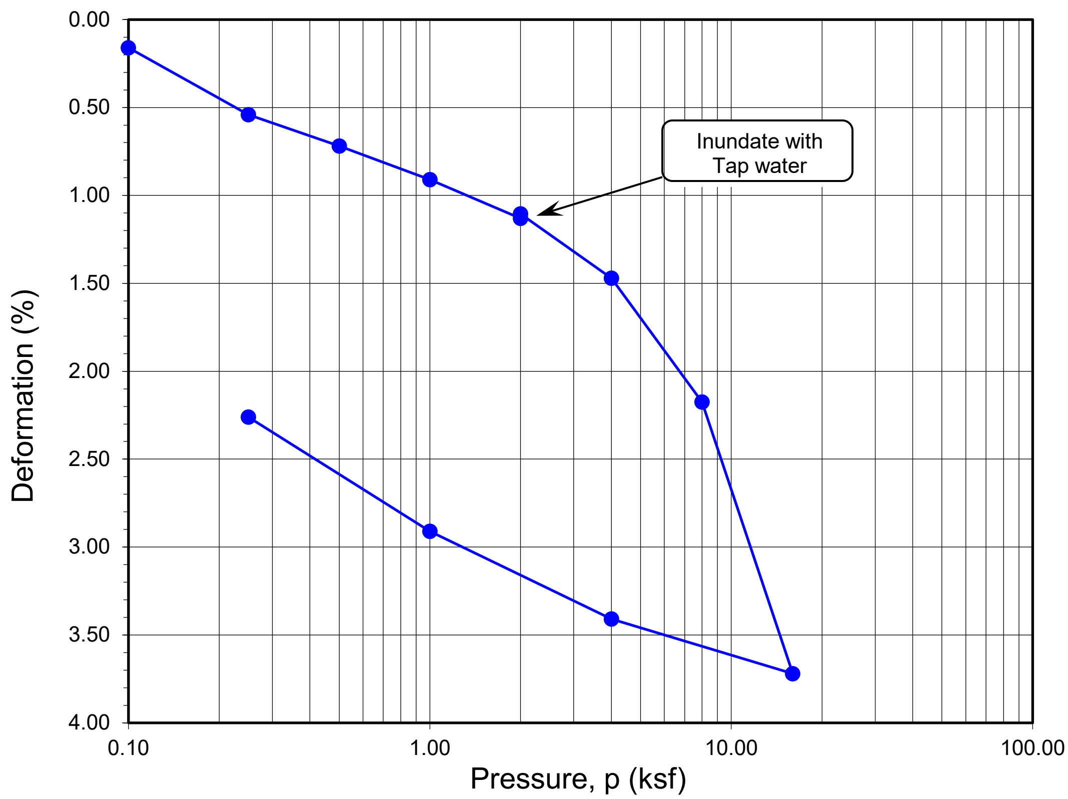
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deforma-tion (%)
0.10	0.1351	0.9984	0.00	0.16	0.448	0.16
0.25	0.1392	0.9943	0.03	0.57	0.442	0.54
0.50	0.1413	0.9922	0.06	0.78	0.440	0.72
1.00	0.1438	0.9897	0.12	1.03	0.437	0.91
2.00	0.1466	0.9869	0.18	1.31	0.434	1.13
2.00	0.1464	0.9872	0.18	1.29	0.434	1.11
4.00	0.1509	0.9826	0.27	1.74	0.429	1.47
8.00	0.1589	0.9747	0.36	2.54	0.418	2.18
16.00	0.1755	0.9580	0.48	4.20	0.396	3.72
4.00	0.1713	0.9622	0.37	3.78	0.401	3.41
1.00	0.1652	0.9683	0.26	3.17	0.408	2.91
0.25	0.1580	0.9755	0.19	2.45	0.417	2.26

Time Readings @ 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
10/18/23	7:15:00	0.0	0.0	0.1464
10/18/23	7:15:06	0.1	0.3	0.1487
10/18/23	7:15:15	0.2	0.5	0.1489
10/18/23	7:15:30	0.5	0.7	0.1490
10/18/23	7:16:00	1.0	1.0	0.1492
10/18/23	7:17:00	2.0	1.4	0.1494
10/18/23	7:19:00	4.0	2.0	0.1495
10/18/23	7:23:00	8.0	2.8	0.1497
10/18/23	7:30:00	15.0	3.9	0.1499
10/18/23	7:45:00	30.0	5.5	0.1500
10/18/23	8:15:00	60.0	7.7	0.1502
10/18/23	9:15:00	120.0	11.0	0.1504
10/18/23	11:15:00	240.0	15.5	0.1505
10/18/23	15:15:00	480.0	21.9	0.1507
10/19/23	7:15:00	1440.0	37.9	0.1509

Time Readings @ 4.0 ksf





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-1	**B-1**	**0-5**	**9.8**	**14.5**	**116.3**	**118.6**	**0.450**	**0.417**	**59**	**93**

Soil Identification: Brown clayey sand (SC)

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

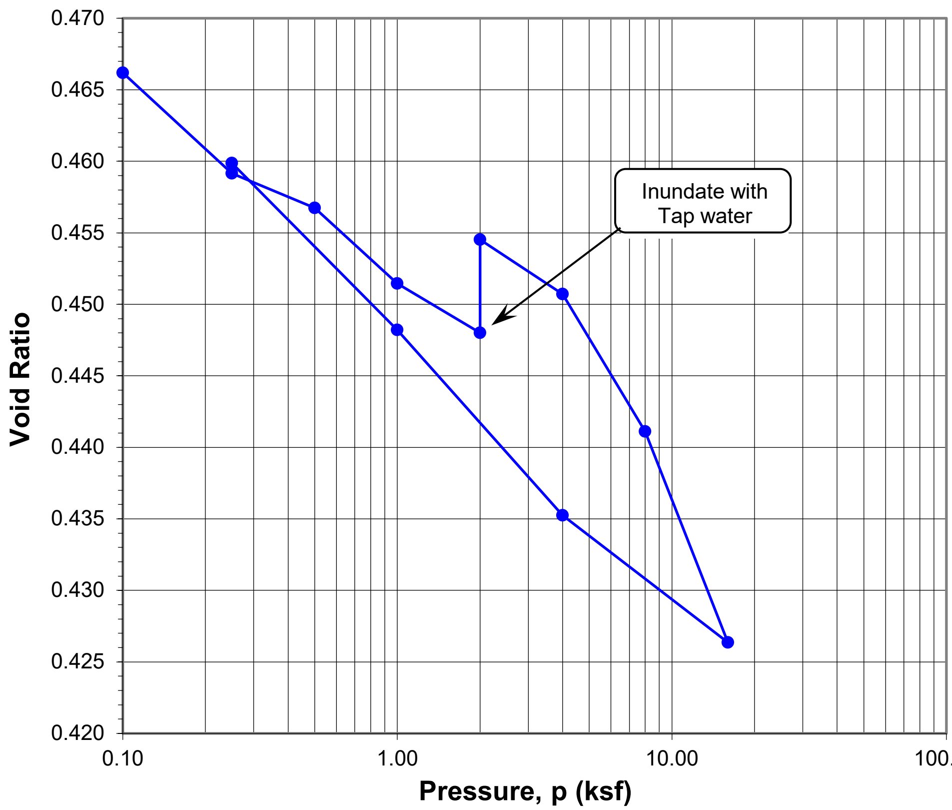
11-24

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	JD/GB	Date:	10/09/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	LB-1	Depth (ft.):	5.0		
Sample No.:	R-1	Sample Type:	Ring		
Soil Identification:	Brown lean clay (CL)				

Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	205.32
Weight of Ring (g):	44.33
Height after consol. (in.):	0.9952
Before Test	
Wt. of Wet Sample+Cont. (g):	185.60
Wt. of Dry Sample+Cont. (g):	167.40
Weight of Container (g):	57.22
Initial Moisture Content (%)	16.5
Initial Dry Density (pcf)	114.9
Initial Saturation (%):	96
Initial Vertical Reading (in.)	0.0663
After Test	
Wt. of Wet Sample+Cont. (g):	263.34
Wt. of Dry Sample+Cont. (g):	239.07
Weight of Container (g):	57.37
Final Moisture Content (%)	17.67
Final Dry Density (pcf):	114.8
Final Saturation (%):	102
Final Vertical Reading (in.)	0.0738
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

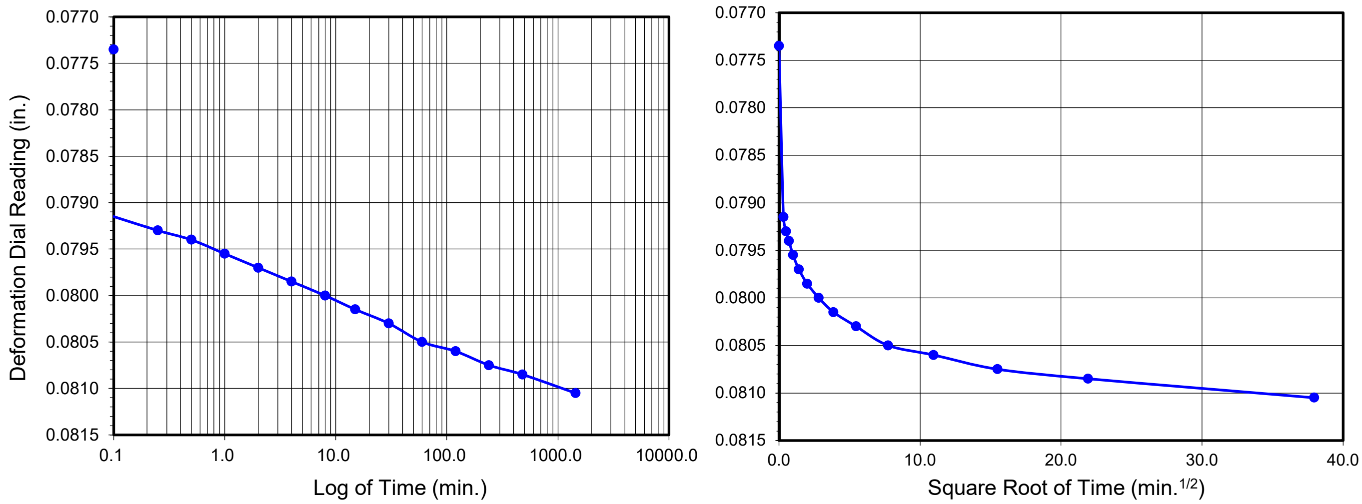


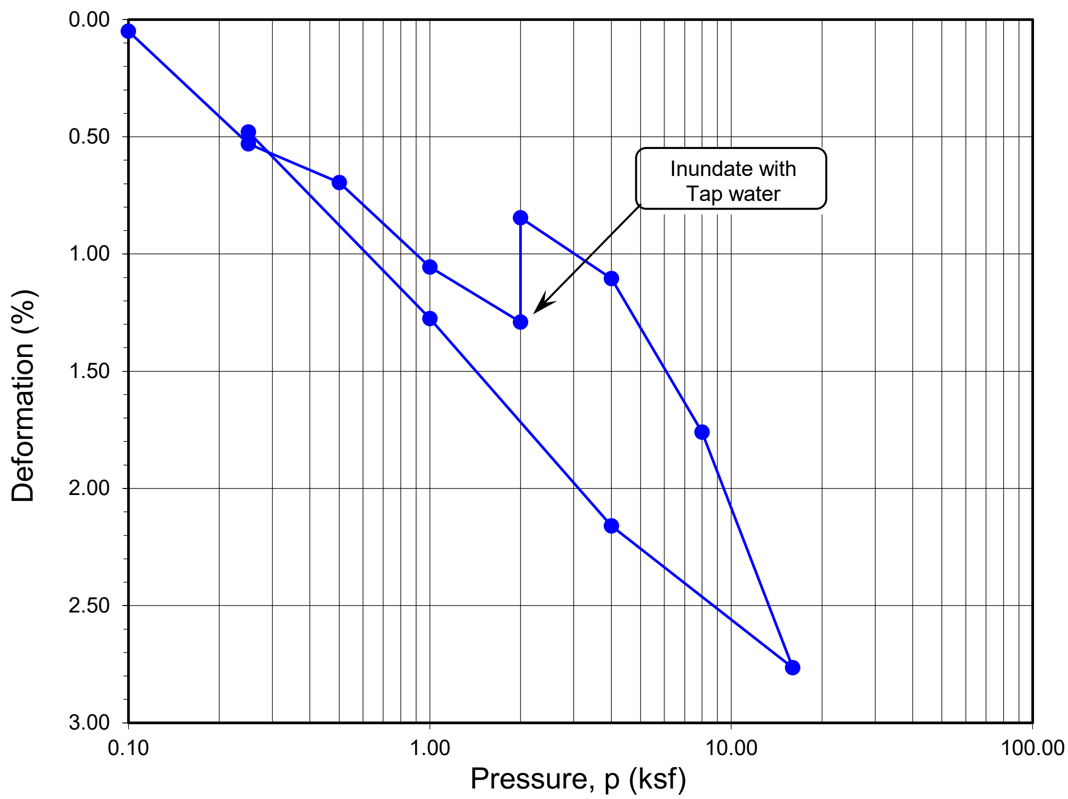
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.0668	0.9995	0.00	0.05	0.466	0.05
0.25	0.0720	0.9943	0.04	0.57	0.459	0.53
0.50	0.0742	0.9922	0.09	0.79	0.457	0.70
1.00	0.0785	0.9879	0.16	1.22	0.451	1.06
2.00	0.0818	0.9845	0.26	1.55	0.448	1.29
2.00	0.0774	0.9890	0.26	1.11	0.455	0.85
4.00	0.0811	0.9853	0.37	1.48	0.451	1.11
8.00	0.0889	0.9774	0.50	2.26	0.441	1.76
16.00	0.1005	0.9659	0.65	3.42	0.426	2.77
4.00	0.0930	0.9733	0.51	2.67	0.435	2.16
1.00	0.0828	0.9836	0.37	1.65	0.448	1.28
0.25	0.0738	0.9925	0.27	0.75	0.460	0.48

Time Readings @ 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
10/14/23	7:20:00	0.0	0.0	0.0774
10/14/23	7:20:06	0.1	0.3	0.0792
10/14/23	7:20:15	0.2	0.5	0.0793
10/14/23	7:20:30	0.5	0.7	0.0794
10/14/23	7:21:00	1.0	1.0	0.0796
10/14/23	7:22:00	2.0	1.4	0.0797
10/14/23	7:24:00	4.0	2.0	0.0799
10/14/23	7:28:00	8.0	2.8	0.0800
10/14/23	7:35:00	15.0	3.9	0.0802
10/14/23	7:50:00	30.0	5.5	0.0803
10/14/23	8:20:00	60.0	7.7	0.0805
10/14/23	9:20:00	120.0	11.0	0.0806
10/14/23	11:20:00	240.0	15.5	0.0808
10/14/23	15:20:00	480.0	21.9	0.0809
10/15/23	7:20:00	1440.0	37.9	0.0811

Time Readings @ 4.0 ksf





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-1	**R-1**	**5**	**16.5**	**17.7**	**114.9**	**114.8**	**0.467**	**0.460**	**96**	**102**

Soil Identification: Brown lean clay (CL)

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

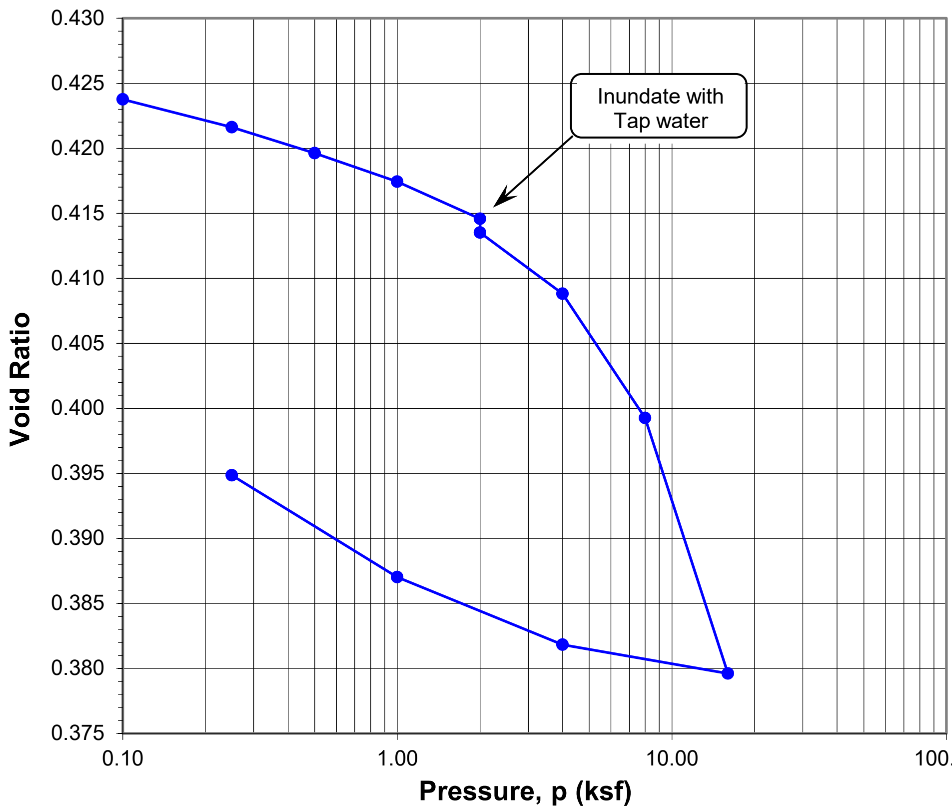
11-24

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	SMMUSD Franklin ES New Classroom	Tested By: JD/GB	Date: 10/15/24
Project No.:	036.0000025103	Checked By: J. Ward	Date: 11/12/24
Boring No.:	LB-3	Depth (ft.): 0-2	
Sample No.:	B-1	Sample Type:	90% Remold
Soil Identification:	Brown silty sand (SM)		

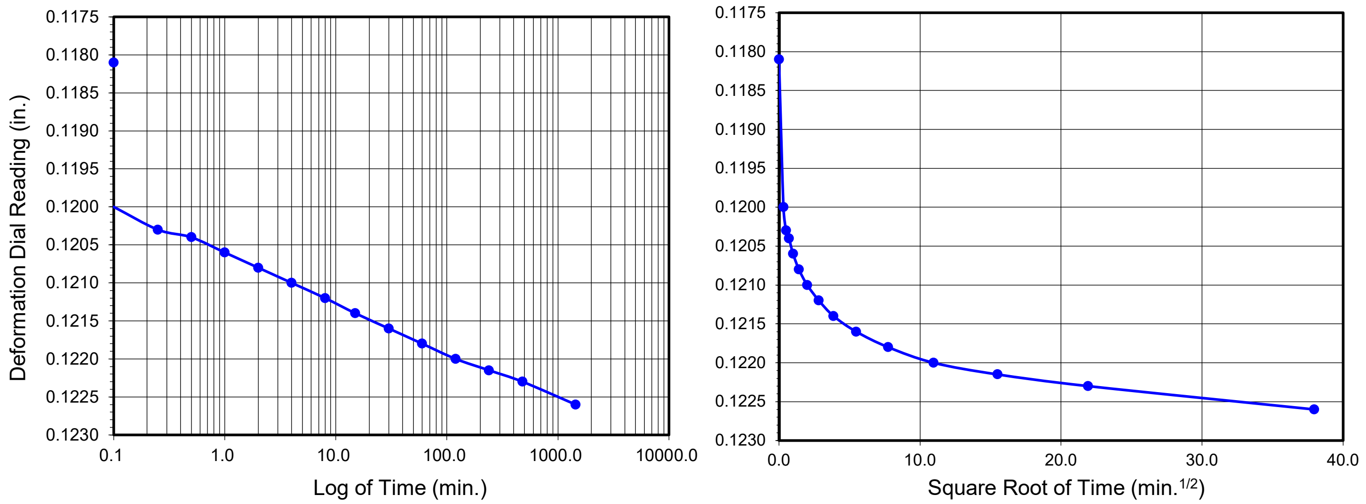
Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	200.10
Weight of Ring (g):	45.19
Height after consol. (in.):	0.9794
Before Test	
Wt. of Wet Sample+Cont. (g):	196.40
Wt. of Dry Sample+Cont. (g):	185.24
Weight of Container (g):	59.16
Initial Moisture Content (%)	8.9
Initial Dry Density (pcf)	118.4
Initial Saturation (%):	56
Initial Vertical Reading (in.)	0.1085
After Test	
Wt. of Wet Sample+Cont. (g):	242.65
Wt. of Dry Sample+Cont. (g):	223.82
Weight of Container (g):	36.51
Final Moisture Content (%)	13.25
Final Dry Density (pcf):	120.7
Final Saturation (%):	90
Final Vertical Reading (in.)	0.1318
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

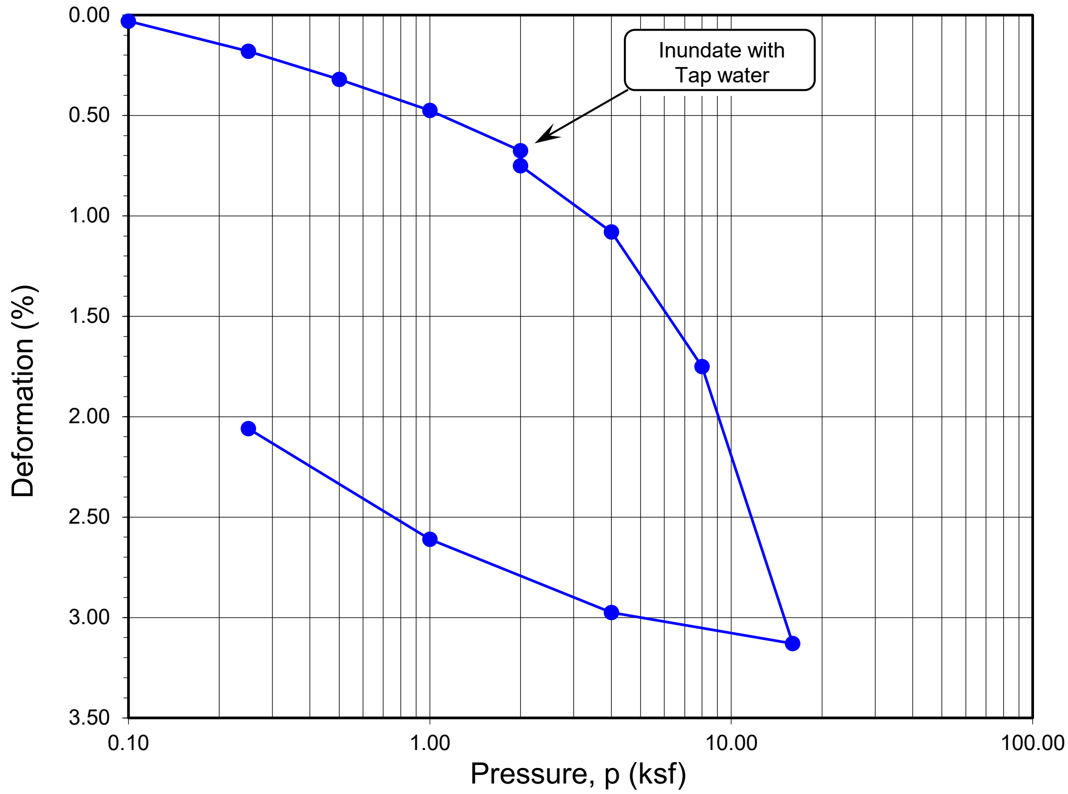


Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.1088	0.9997	0.00	0.03	0.424	0.03
0.25	0.1106	0.9979	0.03	0.21	0.422	0.18
0.50	0.1123	0.9962	0.06	0.38	0.420	0.32
1.00	0.1146	0.9940	0.13	0.61	0.417	0.48
2.00	0.1174	0.9912	0.21	0.89	0.415	0.68
2.00	0.1181	0.9904	0.21	0.96	0.414	0.75
4.00	0.1226	0.9859	0.33	1.41	0.409	1.08
8.00	0.1310	0.9775	0.50	2.25	0.399	1.75
16.00	0.1469	0.9616	0.71	3.84	0.380	3.13
4.00	0.1432	0.9654	0.49	3.47	0.382	2.98
1.00	0.1380	0.9705	0.34	2.95	0.387	2.61
0.25	0.1318	0.9767	0.27	2.33	0.395	2.06

Time Readings @ 4.0 ksf				
Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
10/18/23	7:20:00	0.0	0.0	0.1181
10/18/23	7:20:06	0.1	0.3	0.1200
10/18/23	7:20:15	0.2	0.5	0.1203
10/18/23	7:20:30	0.5	0.7	0.1204
10/18/23	7:21:00	1.0	1.0	0.1206
10/18/23	7:22:00	2.0	1.4	0.1208
10/18/23	7:24:00	4.0	2.0	0.1210
10/18/23	7:28:00	8.0	2.8	0.1212
10/18/23	7:35:00	15.0	3.9	0.1214
10/18/23	7:50:00	30.0	5.5	0.1216
10/18/23	8:20:00	60.0	7.7	0.1218
10/18/23	9:20:00	120.0	11.0	0.1220
10/18/23	11:20:00	240.0	15.5	0.1222
10/18/23	15:20:00	480.0	21.9	0.1223
10/19/23	7:20:00	1440.0	37.9	0.1226

Time Readings @ 4.0 ksf





Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-3	**B-1**	**0-2**	**8.9**	**13.2**	**118.4**	**120.7**	**0.424**	**0.395**	**56**	**90**

Soil Identification: Brown silty sand (SM)

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

11-24

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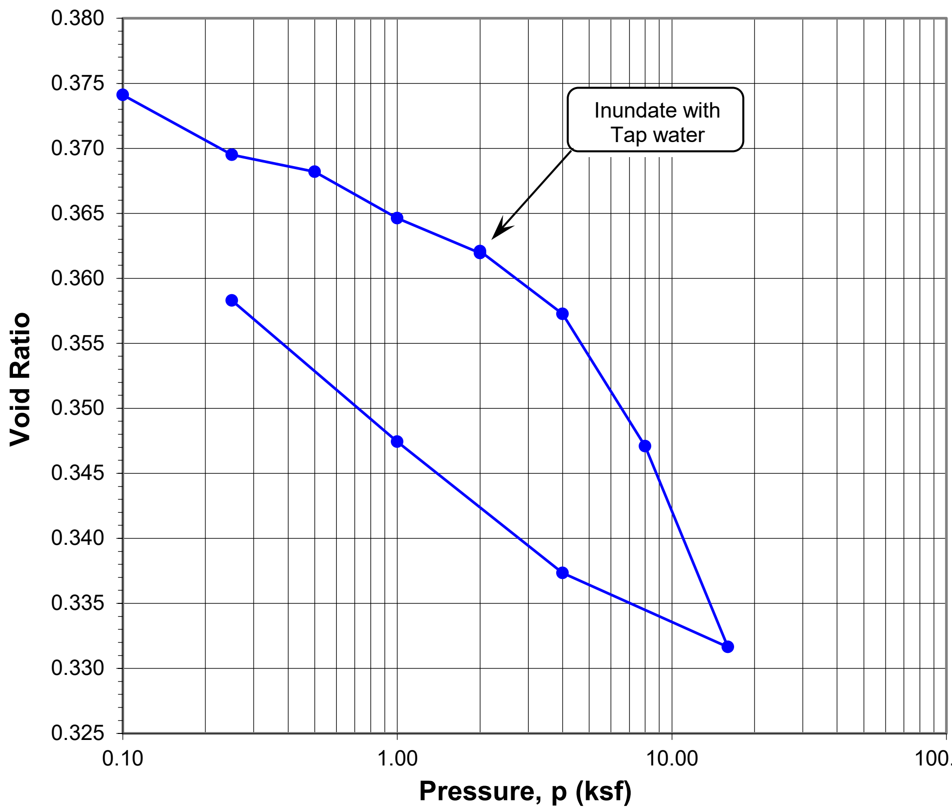
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	SMMUSD Franklin ES New Classroom	Tested By: JD/GB	Date: 10/09/24
Project No.:	036.0000025103	Checked By: J. Ward	Date: 11/12/24
Boring No.:	LB-3	Depth (ft.): 5.0	
Sample No.:	R-1	Sample Type:	Ring
Soil Identification:	Brown lean clay (CL)		

Sample Diameter (in.):	2.415
Sample Thickness (in.):	1.000
Weight of Sample + ring (g):	206.12
Weight of Ring (g):	42.57
Height after consol. (in.):	0.9885
Before Test	
Wt. of Wet Sample+Cont. (g):	191.44
Wt. of Dry Sample+Cont. (g):	176.30
Weight of Container (g):	37.16
Initial Moisture Content (%)	10.9
Initial Dry Density (pcf)	122.7
Initial Saturation (%):	79
Initial Vertical Reading (in.)	0.0475
After Test	
Wt. of Wet Sample+Cont. (g):	280.78
Wt. of Dry Sample+Cont. (g):	260.41
Weight of Container (g):	73.42
Final Moisture Content (%)	14.10
Final Dry Density (pcf):	121.5
Final Saturation (%):	98
Final Vertical Reading (in.)	0.0623
Specific Gravity (assumed):	2.70
Water Density (pcf):	62.43

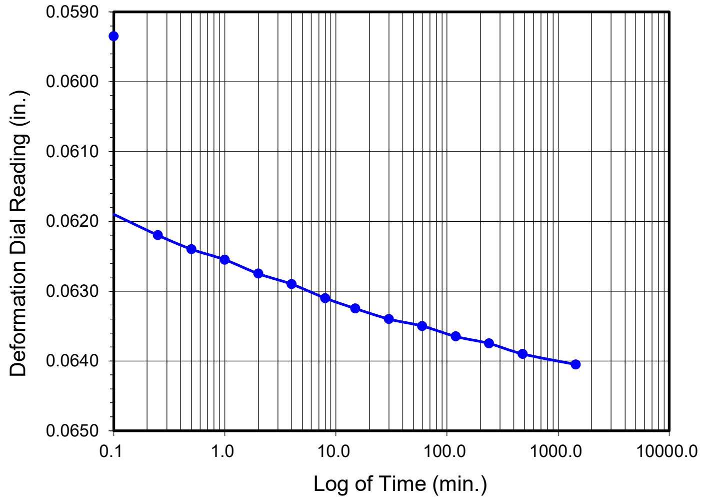


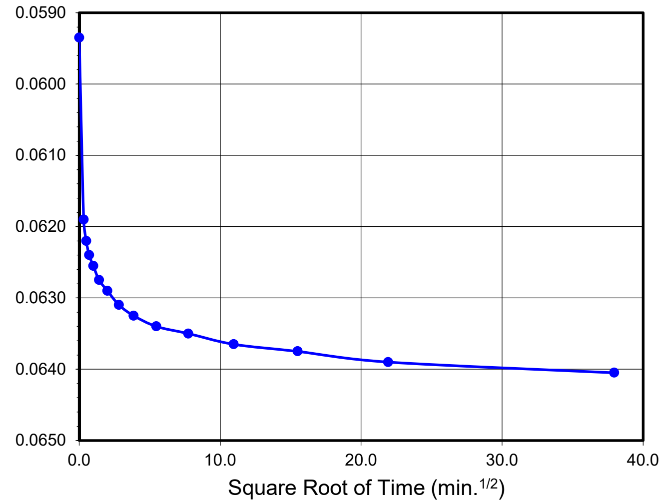
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.0475	1.0000	0.00	0.00	0.374	0.00
0.25	0.0513	0.9963	0.04	0.38	0.369	0.34
0.50	0.0529	0.9946	0.11	0.54	0.368	0.43
1.00	0.0565	0.9910	0.21	0.90	0.365	0.69
2.00	0.0595	0.9881	0.31	1.20	0.362	0.89
2.00	0.0594	0.9882	0.31	1.19	0.362	0.88
4.00	0.0641	0.9835	0.43	1.66	0.357	1.23
8.00	0.0729	0.9747	0.57	2.54	0.347	1.97
16.00	0.0859	0.9616	0.75	3.84	0.332	3.09
4.00	0.0800	0.9676	0.57	3.25	0.337	2.68
1.00	0.0713	0.9762	0.44	2.38	0.347	1.94
0.25	0.0623	0.9852	0.33	1.48	0.358	1.15

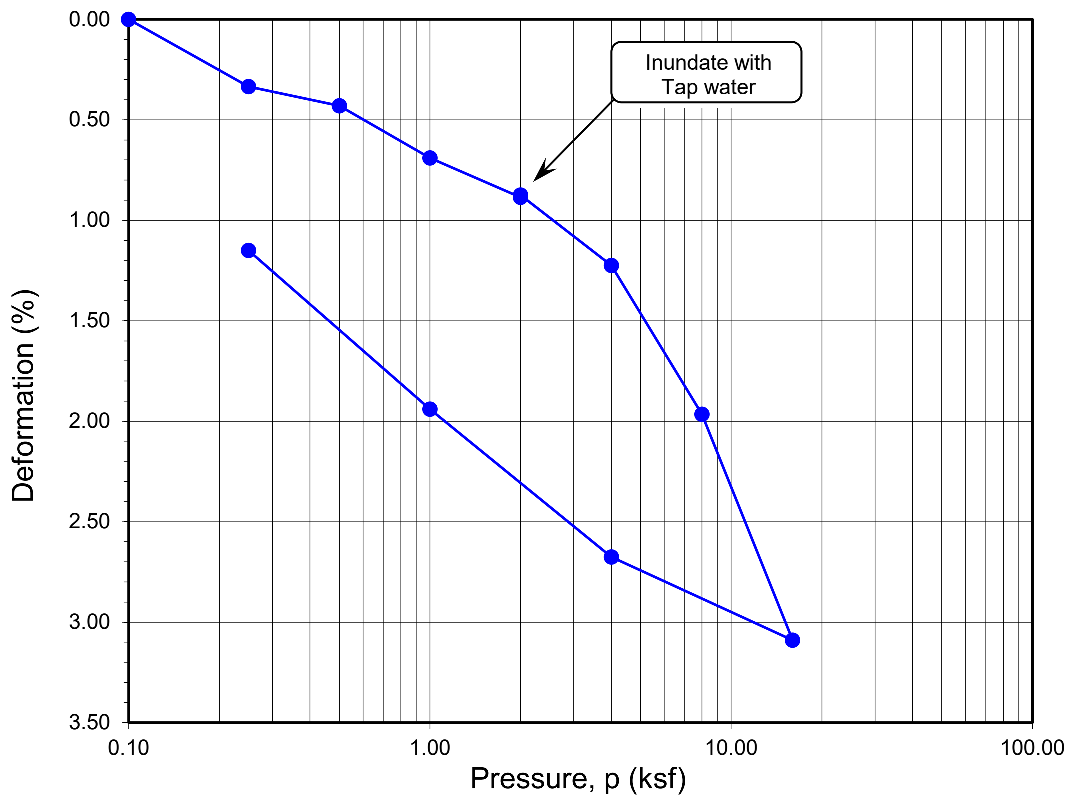
Time Readings @ 4.0 ksf

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)
10/14/23	7:15:00	0.0	0.0	0.0594
10/14/23	7:15:06	0.1	0.3	0.0619
10/14/23	7:15:15	0.2	0.5	0.0622
10/14/23	7:15:30	0.5	0.7	0.0624
10/14/23	7:16:00	1.0	1.0	0.0626
10/14/23	7:17:00	2.0	1.4	0.0628
10/14/23	7:19:00	4.0	2.0	0.0629
10/14/23	7:23:00	8.0	2.8	0.0631
10/14/23	7:30:00	15.0	3.9	0.0633
10/14/23	7:45:00	30.0	5.5	0.0634
10/14/23	8:15:00	60.0	7.7	0.0635
10/14/23	9:15:00	120.0	11.0	0.0637
10/14/23	11:15:00	240.0	15.5	0.0638
10/14/23	15:15:00	480.0	21.9	0.0639
10/15/23	7:15:00	1440.0	37.9	0.0641

Time Readings @ 4.0 ksf







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-3	**R-1**	**5**	**10.9**	**14.1**	**122.7**	**121.5**	**0.374**	**0.358**	**79**	**98**

Soil Identification: Brown lean clay (CL)

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ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

11-24

verdantas

TESTS for SULFATE CONTENT CHLORIDE CONTENT and pH of SOILS

Project Name: SMMUSD Franklin ES New Classroom — Tested By : G. Berdy — Date: 10/11/24

Project No. : 036.0000025103 — Checked By: J. Ward — Date: 11/12/24

Boring No.	LB-1	LB-3	HA-3	
Sample No.	B-1	B-1	B-1	
Sample Depth (ft)	0-5	0-2	0-5	
Soil Identification:	Brown SC	Brown SM	Dark brown SC-SM	
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	
Weight of Container (g)	1.00	1.00	1.00	
Moisture Content (%)	0.00	0.00	0.00	
Weight of Soaked Soil (g)	100.47	100.43	100.67	

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	10	404	310	
Crucible No.	301	300	302	
Furnace Temperature (°C)	860	860	860	
Time In / Time Out	7:00/7:45	7:00/7:45	7:00/7:45	
Duration of Combustion (min)	45	45	45	
Wt. of Crucible + Residue (g)	61.9118	58.5137	62.7733	
Wt. of Crucible (g)	61.9099	58.5118	62.7718	
Wt. of Residue (g) (A)	0.0019	0.0019	0.0015	
PPM of Sulfate (A) x 41150	78.18	78.18	61.73	
PPM of Sulfate, Dry Weight Basis	**78**	**78**	**62**	

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	15	15	30	
ml of AgNO3 Soln. Used in Titration (C)	1.1	1.6	1.1	
PPM of Chloride (C -0.2) * 100 * 30 / B	180	280	90	
PPM of Chloride, Dry Wt. Basis	**180**	**280**	**90**	

pH TEST, DOT California Test 643

pH Value	**6.84**	**7.36**	**6.53**	
Temperature °C	22.2	22.3	22.2	

SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	SMMUSD Franklin ES New Classroom	Tested By :	G. Berdy Date: 10/14/24
Project No. :	036.0000025103	Checked By:	J. Ward Date: 11/12/24
Boring No.:	LB-1	Depth (ft.) :	0-5
Sample No. :	B-1		

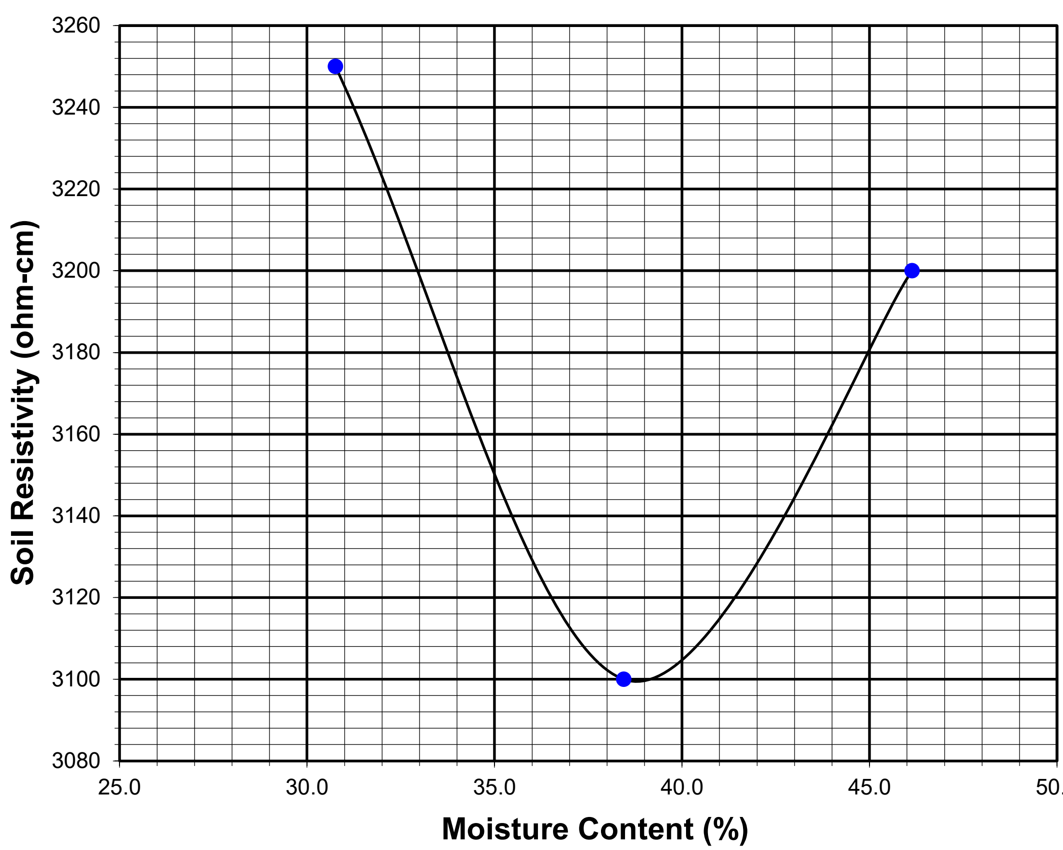
Soil Identification:* Brown SC

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	40	30.76	3250	3250
2	50	38.45	3100	3100
3	60	46.14	3200	3200
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	0.00
Dry Wt. of Soil + Cont. (g)	0.00
Wt. of Container (g)	1.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.05
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
3100	**38.8**	**78**	**180**	**6.84**	**22.2**



SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name:	SMMUSD Franklin ES New Classroom	Tested By :	G. Berdy Date: 10/14/24
Project No. :	036.0000025103	Checked By:	J. Ward Date: 11/12/24
Boring No.:	LB-3	Depth (ft.) :	0-2
Sample No. :	B-1		

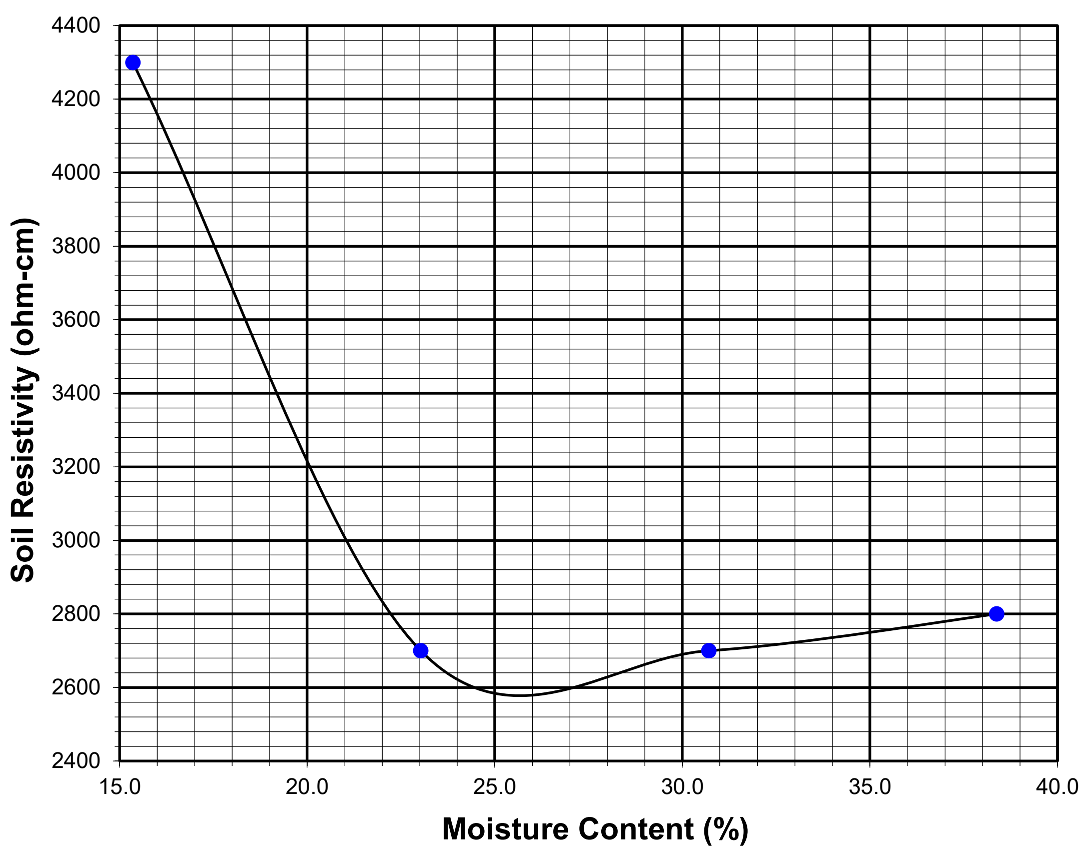
Soil Identification:* Brown SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	15.35	4300	4300
2	30	23.03	2700	2700
3	40	30.70	2700	2700
4	50	38.38	2800	2800
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	0.00
Dry Wt. of Soil + Cont. (g)	0.00
Wt. of Container (g)	1.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.28
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
2580	**25.7**	**78**	**280**	**7.36**	**22.3**



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SOIL RESISTIVITY TEST

DOT CA TEST 643

Project Name: SMMUSD Franklin ES New Classroom　　Tested By : G. Berdy　　Date: 10/14/24

Project No. : 036.0000025103　　Checked By: J. Ward　　Date: 11/12/24

Boring No.: HA-3　　Depth (ft.) : 0-5

Sample No. : B-1

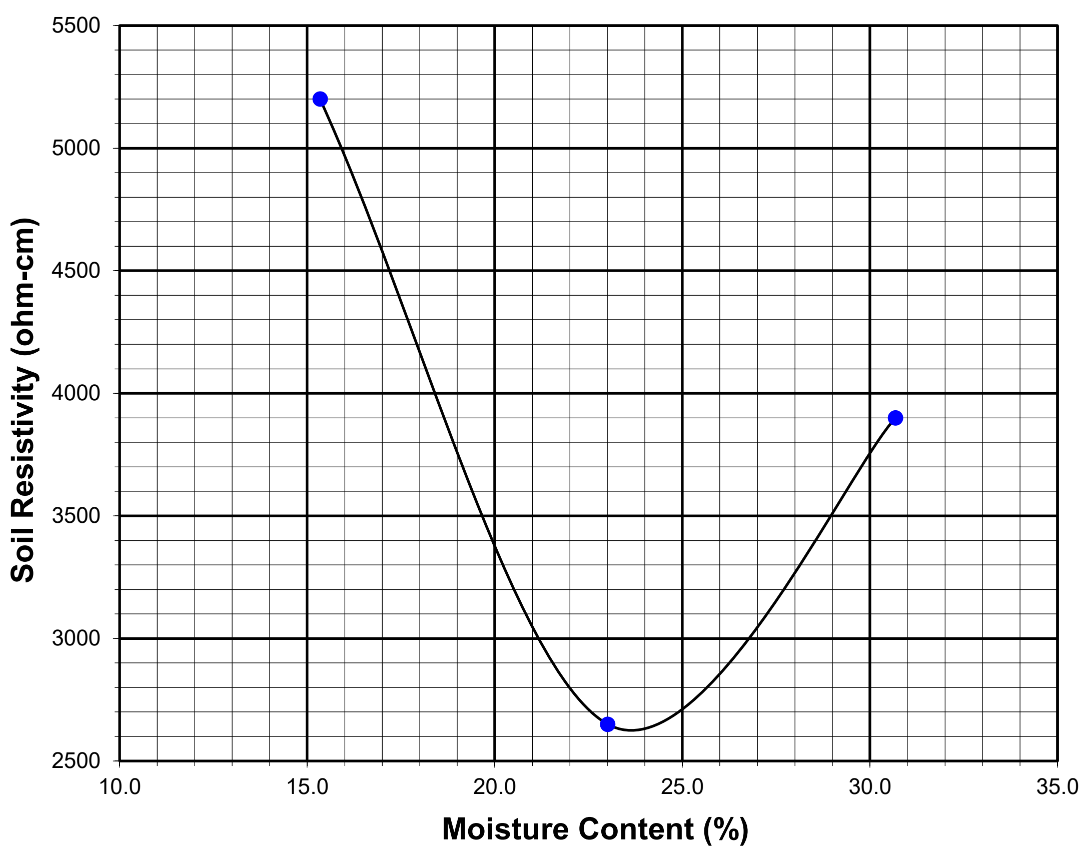
Soil Identification:* Dark brown SC-SM

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	20	15.34	5200	5200
2	30	23.01	2650	2650
3	40	30.68	3900	3900
4				
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	0.00
Dry Wt. of Soil + Cont. (g)	0.00
Wt. of Container (g)	1.00
Container No.	
Initial Soil Wt. (g) (Wt)	130.36
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
2600	**23.7**	**62**	**90**	**6.53**	**22.2**



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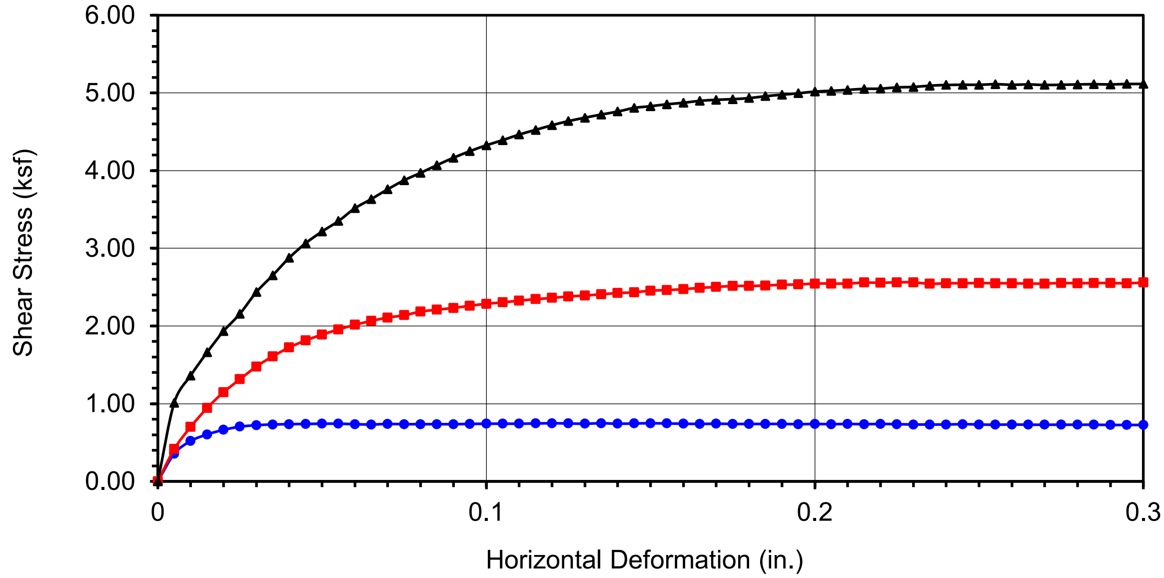
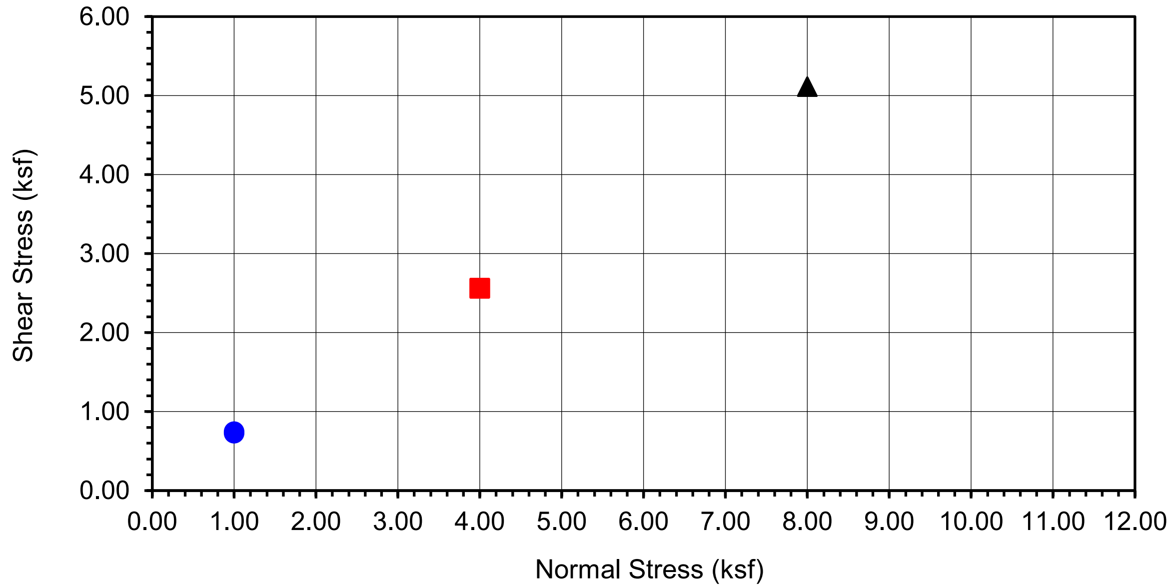
DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	G. Bathala	Date:	10/16/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	LB-1	Sample Type:	90% Remold		
Sample No.:	B-1	Depth (ft.):	0-5		
Soil Identification:	Brown clayey sand (SC)				

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	198.11	198.64	199.16
Weight of Ring(gm):	44.98	45.12	45.42
Before Shearing			
Weight of Wet Sample+Cont.(gm):	186.10	186.10	186.10
Weight of Dry Sample+Cont.(gm):	174.67	174.67	174.67
Weight of Container(gm):	58.52	58.52	58.52
Vertical Rdg.(in): Initial	0.2419	0.2290	0.0000
Vertical Rdg.(in): Final	0.2501	0.2579	-0.0467
After Shearing			
Weight of Wet Sample+Cont.(gm):	214.28	212.14	192.12
Weight of Dry Sample+Cont.(gm):	193.37	192.95	173.99
Weight of Container(gm):	56.77	56.77	36.51
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-1**
Sample No.	**B-1**
Depth (ft)	**0-5**
Sample Type: 90% Remold	
Soil Identification: Brown clayey sand (SC)	

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 0.748	■ 2.562	▲ 5.115
Shear Stress @ End of Test (ksf)	○ 0.726	□ 2.559	△ 5.115
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.84	9.84	9.84
Dry Density (pcf)	115.9	116.2	116.4
Saturation (%)	58.5	59.0	59.3
Soil Height Before Shearing (in.)	0.9918	0.9711	0.9533
Final Moisture Content (%)	15.3	14.1	13.2

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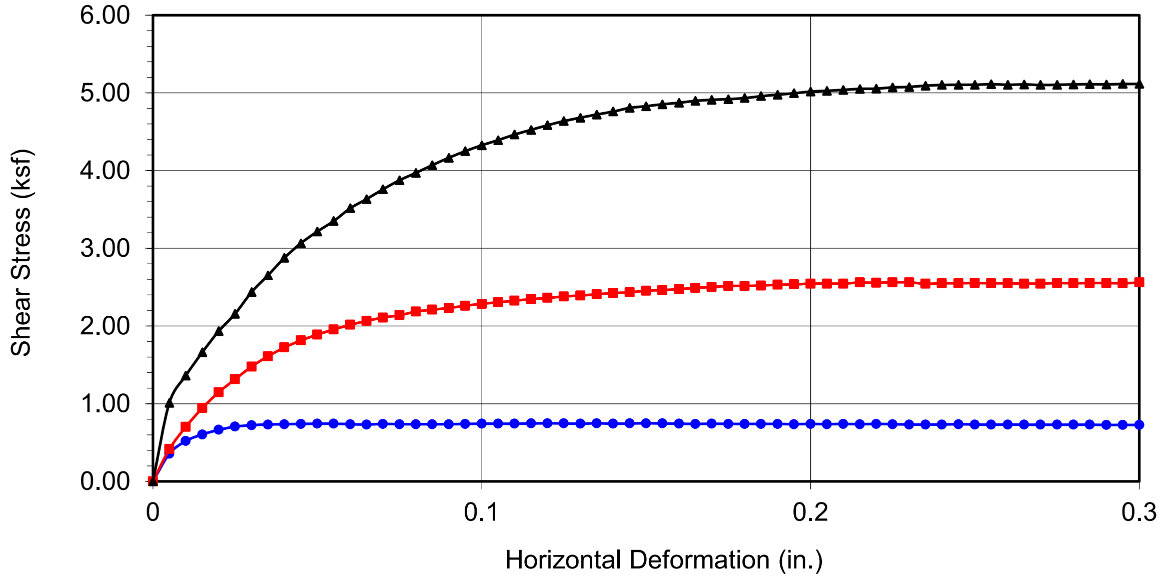
DIRECT SHEAR TEST RESULTS

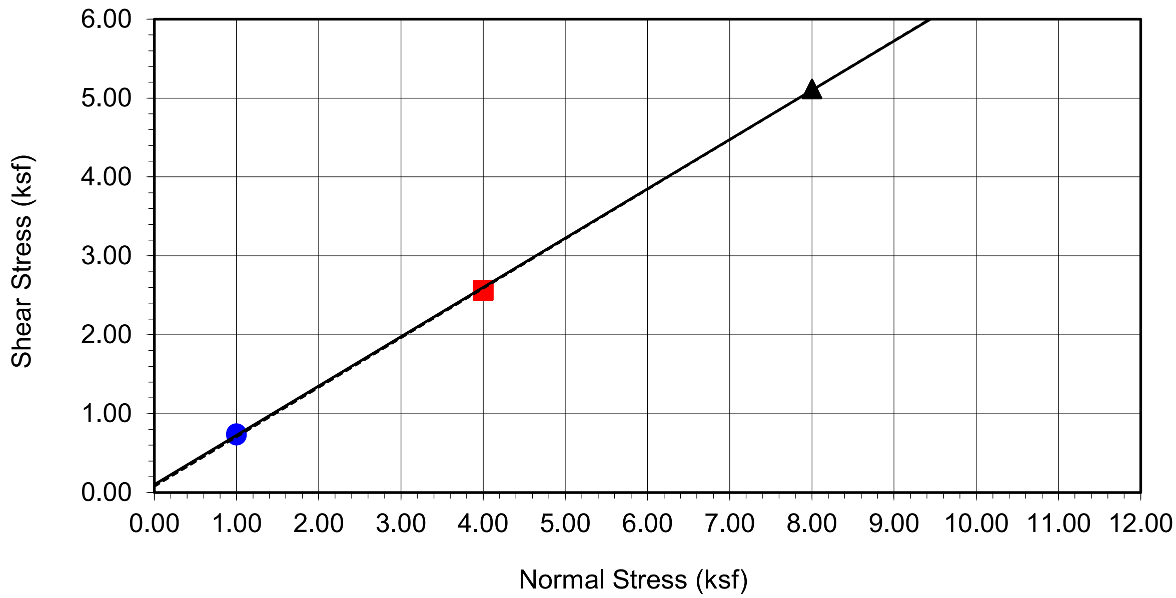
Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

10-24





Boring No.	**LB-1**
Sample No.	**B-1**
Depth (ft)	**0-5**
Sample Type:	90% Remold

Soil Identification:
Brown clayey sand (SC)

Strength Parameters

	C (psf)	ϕ (°)
Peak	102	32
Ultimate	80	32

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 0.748	■ 2.562	▲ 5.115
Shear Stress @ End of Test (ksf)	○ 0.726	□ 2.559	△ 5.115
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	9.84	9.84	9.84
Dry Density (pcf)	115.9	116.2	116.4
Saturation (%)	58.5	59.0	59.3
Soil Height Before Shearing (in.)	0.9918	0.9711	0.9533
Final Moisture Content (%)	15.3	14.1	13.2

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

10-24

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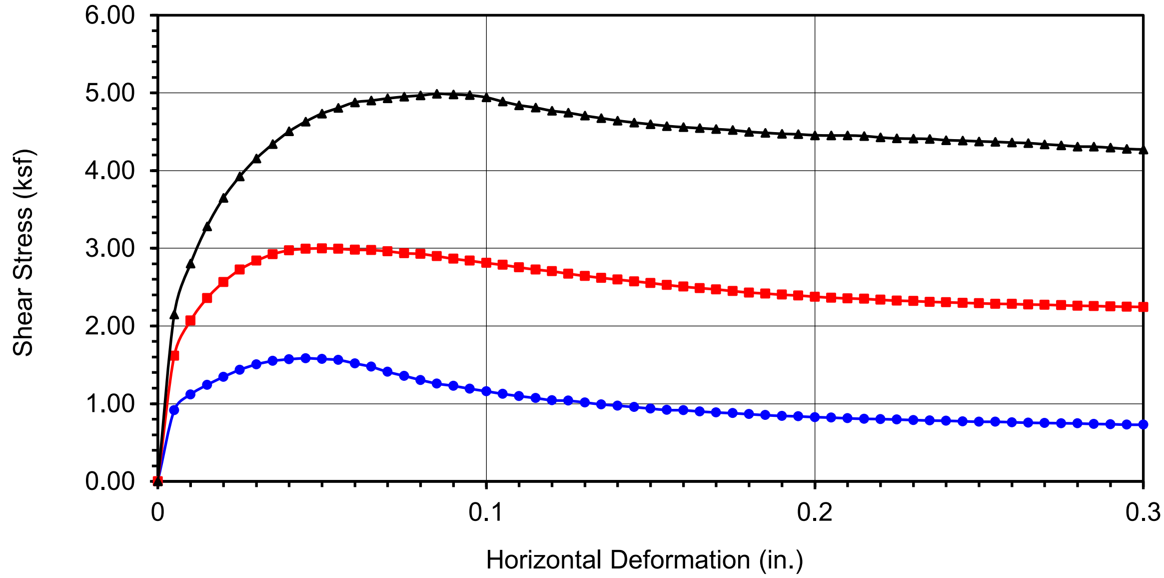
DIRECT SHEAR TEST

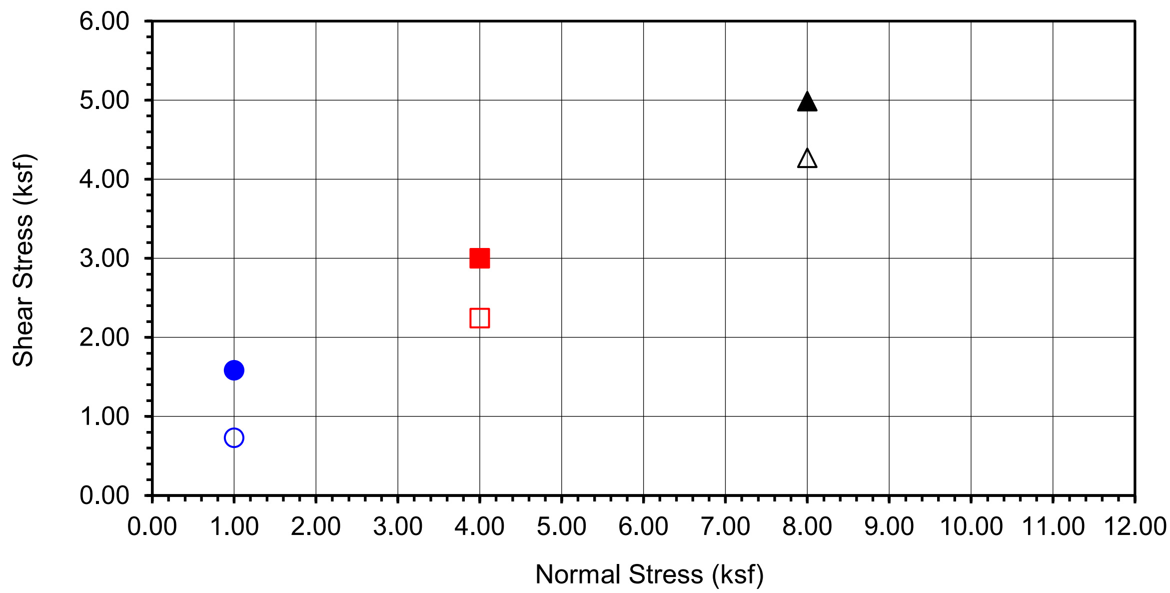
Consolidated Drained - ASTM D 3080

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	G. Bathala	Date:	10/16/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	LB-1	Sample Type:	Ring		
Sample No.:	R-1	Depth (ft.):	5.0		

Soil Identification: Brown lean clay (CL)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	202.60	203.83	207.23
Weight of Ring(gm):	41.84	42.27	44.80
Before Shearing			
Weight of Wet Sample+Cont.(gm):	185.60	185.60	185.60
Weight of Dry Sample+Cont.(gm):	167.40	167.40	167.40
Weight of Container(gm):	57.22	57.22	57.22
Vertical Rdg.(in): Initial	0.2558	0.2351	0.0000
Vertical Rdg.(in): Final	0.2633	0.2496	-0.0242
After Shearing			
Weight of Wet Sample+Cont.(gm):	212.88	229.68	221.06
Weight of Dry Sample+Cont.(gm):	186.67	204.71	197.07
Weight of Container(gm):	50.80	68.08	59.25
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-1**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type: Ring	
Soil Identification: Brown lean clay (CL)	

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.584	■ 2.999	▲ 4.989
Shear Stress @ End of Test (ksf)	○ 0.729	□ 2.245	△ 4.272
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.52	16.52	16.52
Dry Density (pcf)	114.7	115.3	115.9
Saturation (%)	95.1	96.6	98.3
Soil Height Before Shearing (in.)	0.9925	0.9855	0.9758
Final Moisture Content (%)	19.3	18.3	17.4

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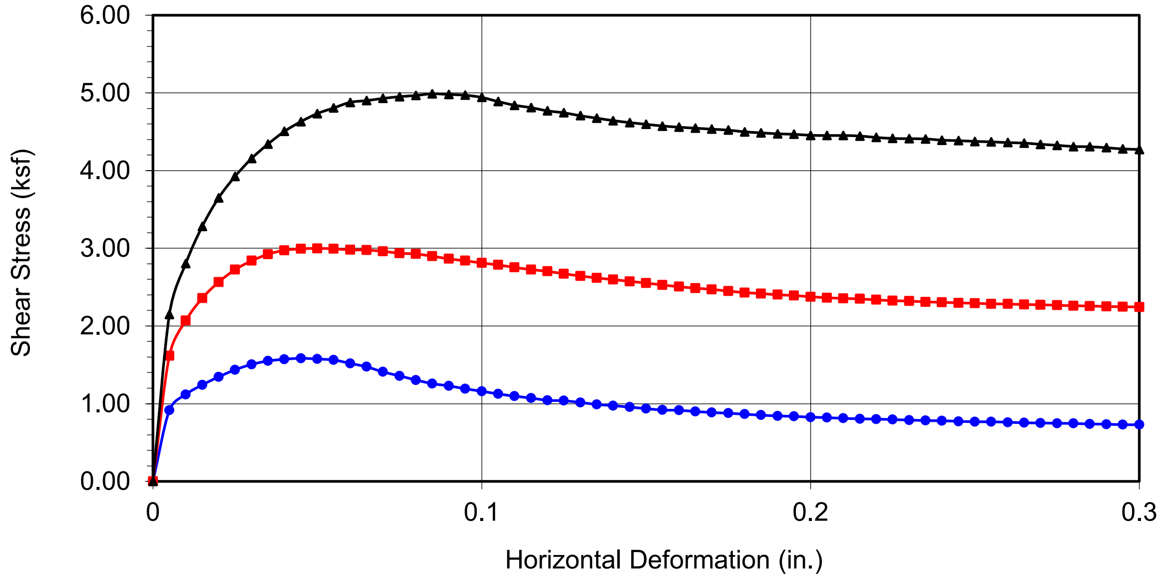
DIRECT SHEAR TEST RESULTS

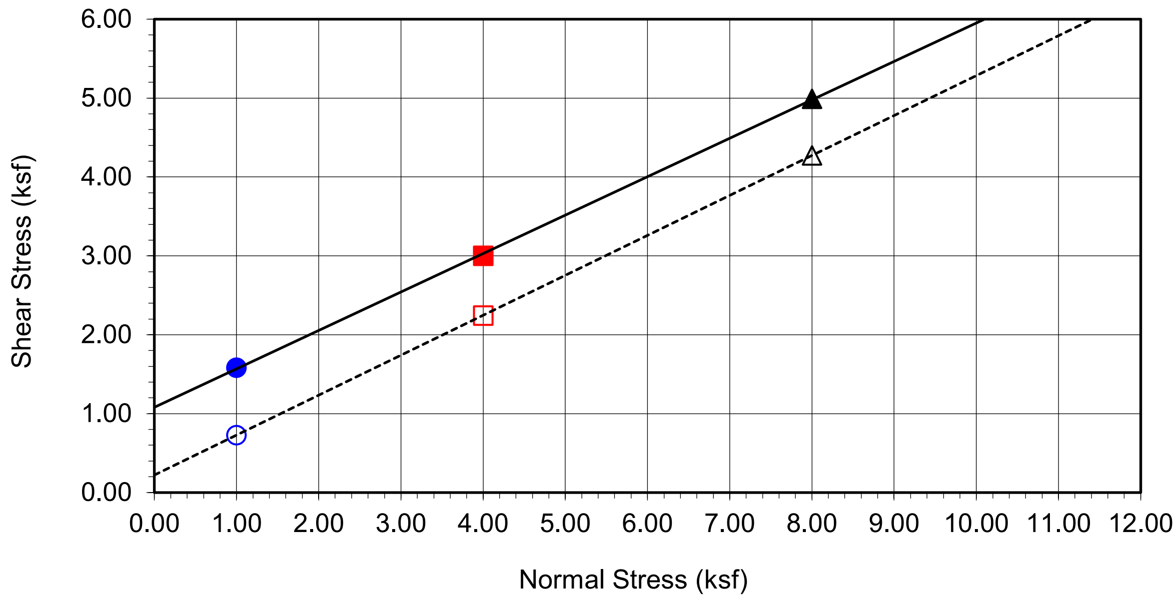
Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

10-24





Boring No.	**LB-1**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type:	Ring
Soil Identification: Brown lean clay (CL)	

Strength Parameters

	C (psf)	ϕ (°)
Peak	1081	26
Ultimate	222	27

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.584	■ 2.999	▲ 4.989
Shear Stress @ End of Test (ksf)	○ 0.729	□ 2.245	△ 4.272
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	16.52	16.52	16.52
Dry Density (pcf)	114.7	115.3	115.9
Saturation (%)	95.1	96.6	98.3
Soil Height Before Shearing (in.)	0.9925	0.9855	0.9758
Final Moisture Content (%)	19.3	18.3	17.4

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

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DS LB-1, R-1 @ 5

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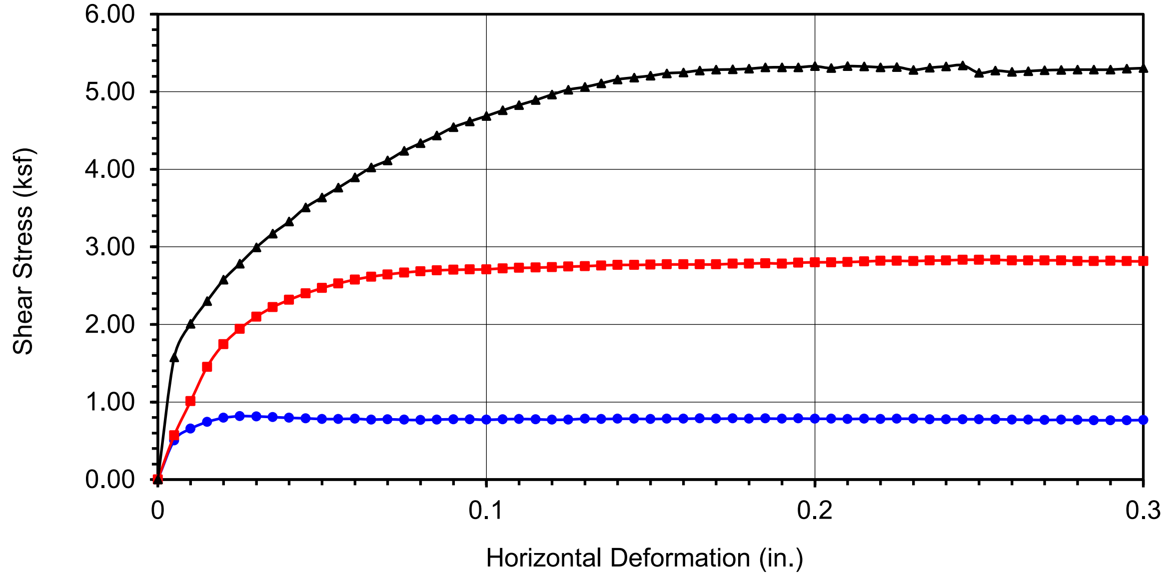
DIRECT SHEAR TEST

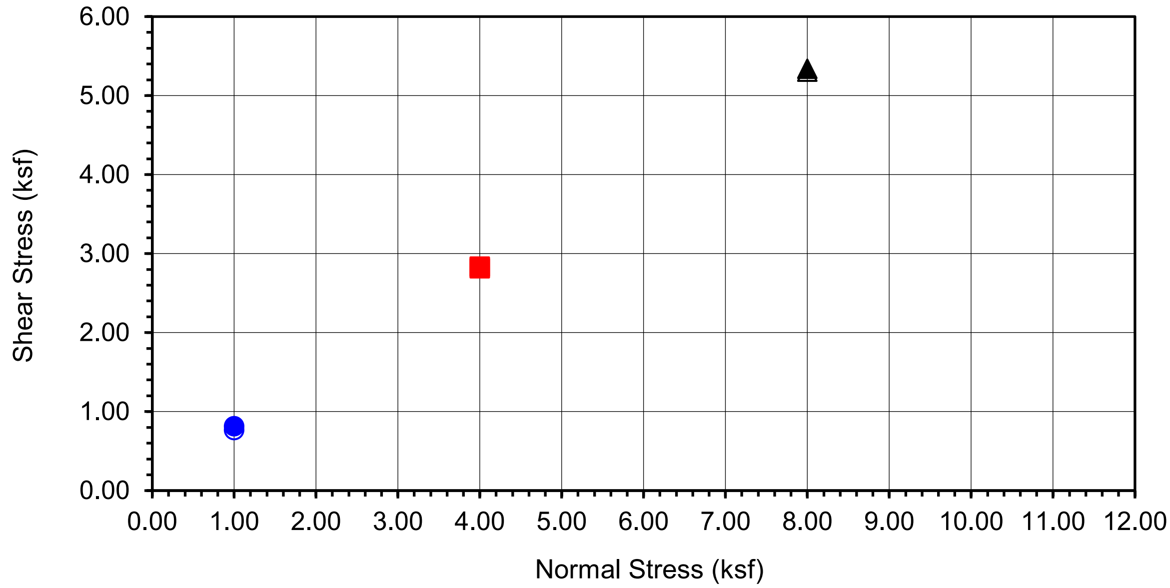
Consolidated Drained - ASTM D 3080

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	G. Bathala	Date:	10/16/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	LB-3	Sample Type:	90% Remold		
Sample No.:	B-1	Depth (ft.):	0-2		

Soil Identification: Brown silty sand (SM)

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	199.55	200.34	200.18
Weight of Ring(gm):	44.98	45.42	45.12
Before Shearing			
Weight of Wet Sample+Cont.(gm):	196.40	196.40	196.40
Weight of Dry Sample+Cont.(gm):	185.24	185.24	185.24
Weight of Container(gm):	59.16	59.16	59.16
Vertical Rdg.(in): Initial	0.0000	0.2454	0.2606
Vertical Rdg.(in): Final	-0.0106	0.2706	0.2977
After Shearing			
Weight of Wet Sample+Cont.(gm):	226.34	218.49	214.44
Weight of Dry Sample+Cont.(gm):	206.82	200.58	196.96
Weight of Container(gm):	66.84	60.93	56.34
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-3**
Sample No.	**B-1**
Depth (ft)	**0-2**
Sample Type: 90% Remold	
Soil Identification: Brown silty sand (SM)	

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 0.817	■ 2.833	▲ 5.341
Shear Stress @ End of Test (ksf)	○ 0.767	□ 2.814	△ 5.304
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	8.85	8.85	8.85
Dry Density (pcf)	118.1	118.4	118.5
Saturation (%)	55.9	56.4	56.5
Soil Height Before Shearing (in.)	0.9894	0.9748	0.9629
Final Moisture Content (%)	13.9	12.8	12.4

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

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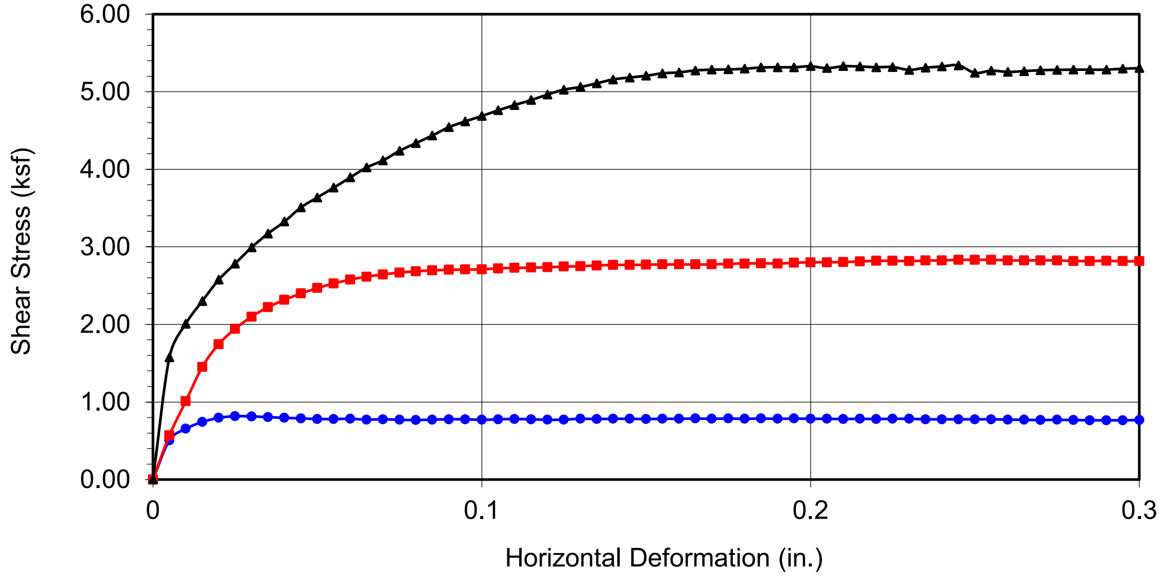

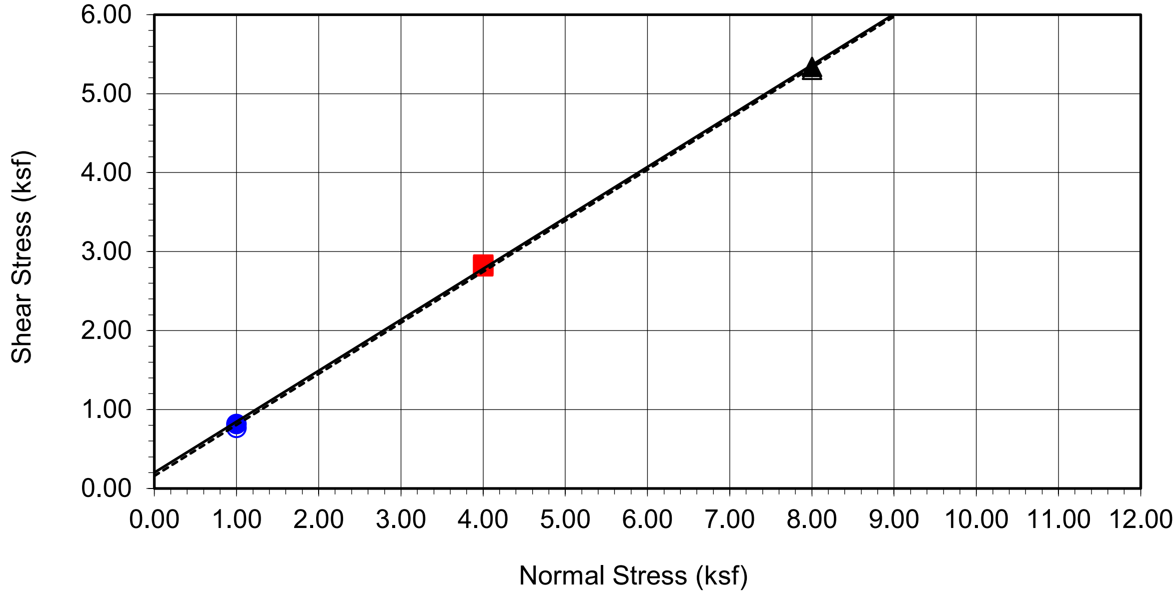

Boring No.	**LB-3**
Sample No.	**B-1**
Depth (ft)	**0-2**
Sample Type:	90% Remold

Soil Identification:
Brown silty sand (SM)

Strength Parameters

	C (psf)	ϕ (°)
Peak	201	33
Ultimate	159	33

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 0.817	■ 2.833	▲ 5.341
Shear Stress @ End of Test (ksf)	○ 0.767	□ 2.814	△ 5.304
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	8.85	8.85	8.85
Dry Density (pcf)	118.1	118.4	118.5
Saturation (%)	55.9	56.4	56.5
Soil Height Before Shearing (in.)	0.9894	0.9748	0.9629
Final Moisture Content (%)	13.9	12.8	12.4

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

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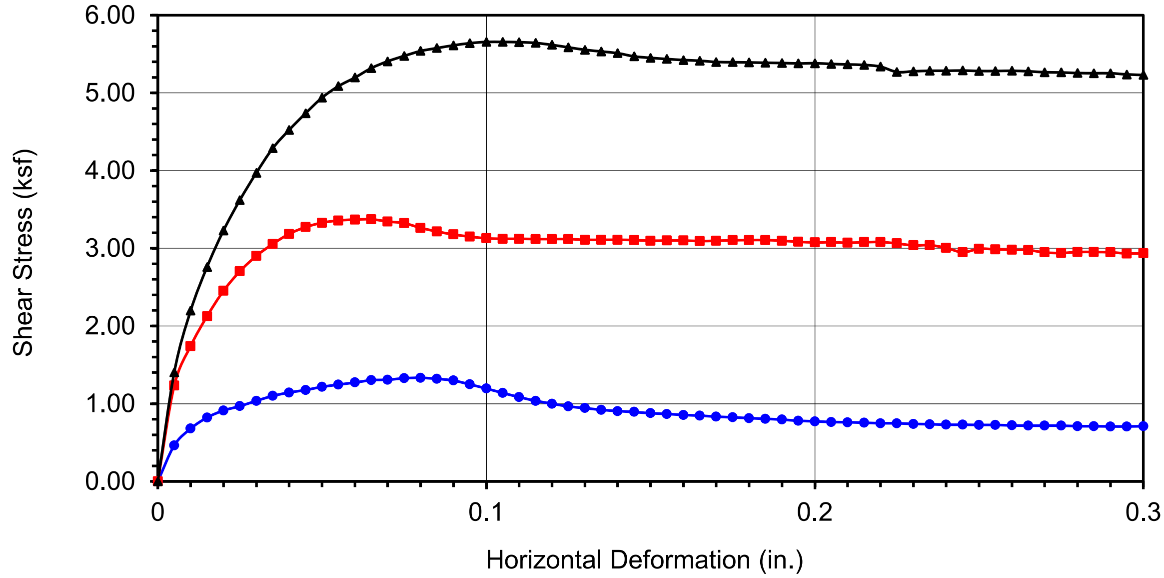
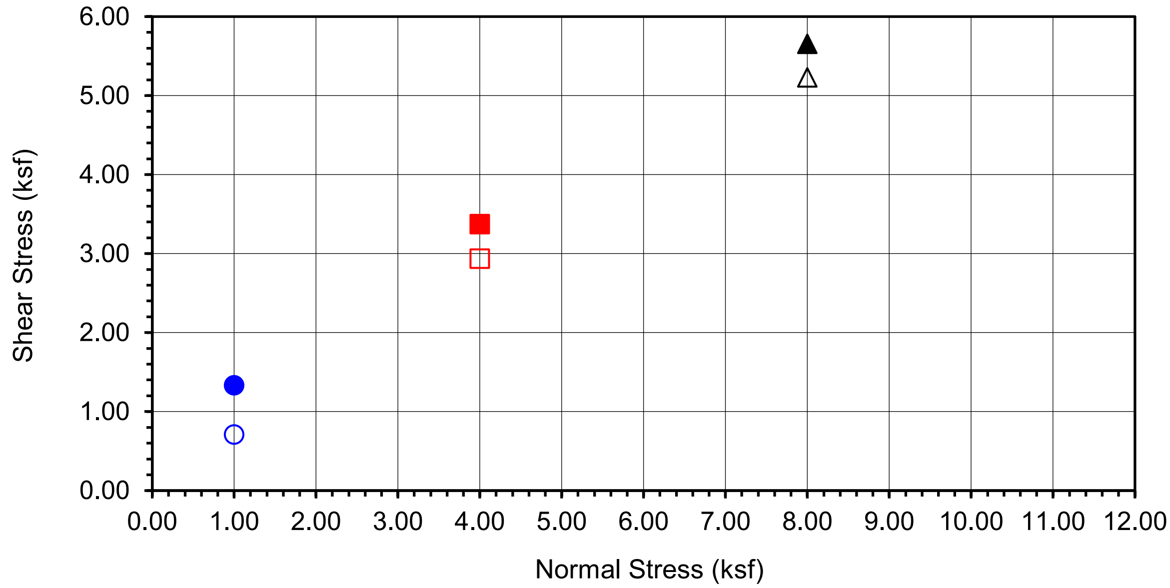
DIRECT SHEAR TEST

Consolidated Drained - ASTM D 3080

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	G. Bathala	Date:	10/17/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	LB-3	Sample Type:	Ring		
Sample No.:	R-1	Depth (ft.):	5.0		
Soil Identification:	Brown lean clay (CL)				

Sample Diameter(in):	2.415	2.415	2.415
Sample Thickness(in.):	1.000	1.000	1.000
Weight of Sample + ring(gm):	218.59	202.56	209.07
Weight of Ring(gm):	61.87	40.93	45.35
Before Shearing			
Weight of Wet Sample+Cont.(gm):	191.44	191.44	191.44
Weight of Dry Sample+Cont.(gm):	176.30	176.30	176.30
Weight of Container(gm):	37.16	37.16	37.16
Vertical Rdg.(in): Initial	0.0000	0.2481	0.2257
Vertical Rdg.(in): Final	-0.0102	0.2722	0.2535
After Shearing			
Weight of Wet Sample+Cont.(gm):	224.02	217.92	223.21
Weight of Dry Sample+Cont.(gm):	201.80	196.73	201.66
Weight of Container(gm):	66.83	56.76	60.93
Specific Gravity (Assumed):	2.70	2.70	2.70
Water Density(pcf):	62.43	62.43	62.43





Boring No.	**LB-3**
Sample No.	**R-1**
Depth (ft)	**5**

Sample Type:

Ring

Soil Identification:

Brown lean clay (CL)

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.333	■ 3.373	▲ 5.656
Shear Stress @ End of Test (ksf)	○ 0.710	□ 2.936	△ 5.231
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	10.88	10.88	10.88
Dry Density (pcf)	117.5	121.2	122.8
Saturation (%)	67.7	75.2	78.8
Soil Height Before Shearing (in.)	0.9898	0.9759	0.9722
Final Moisture Content (%)	16.5	15.1	15.3

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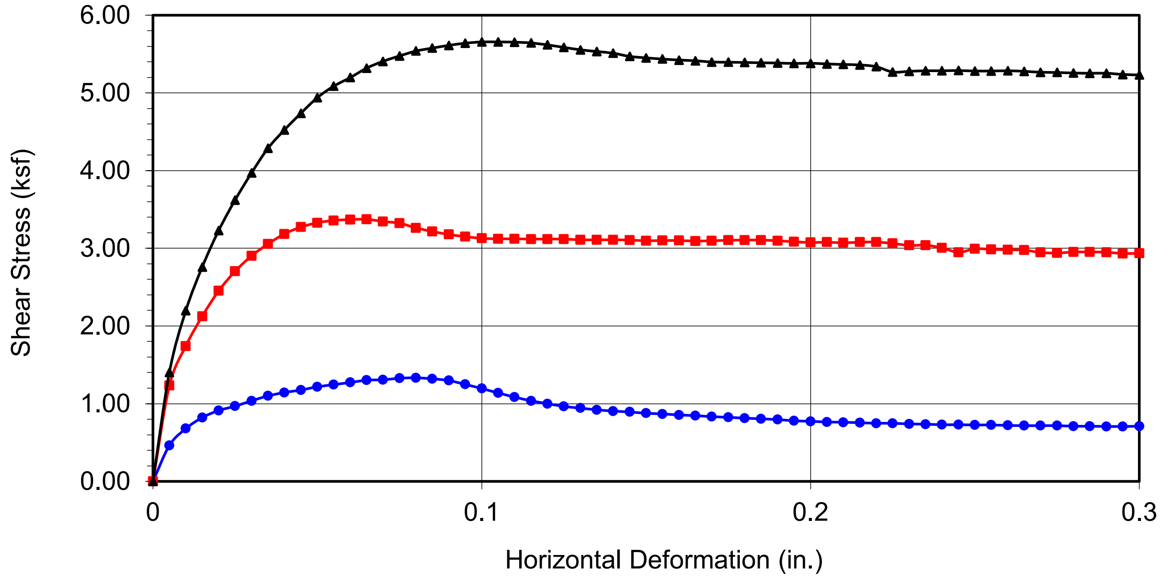
DIRECT SHEAR TEST RESULTS

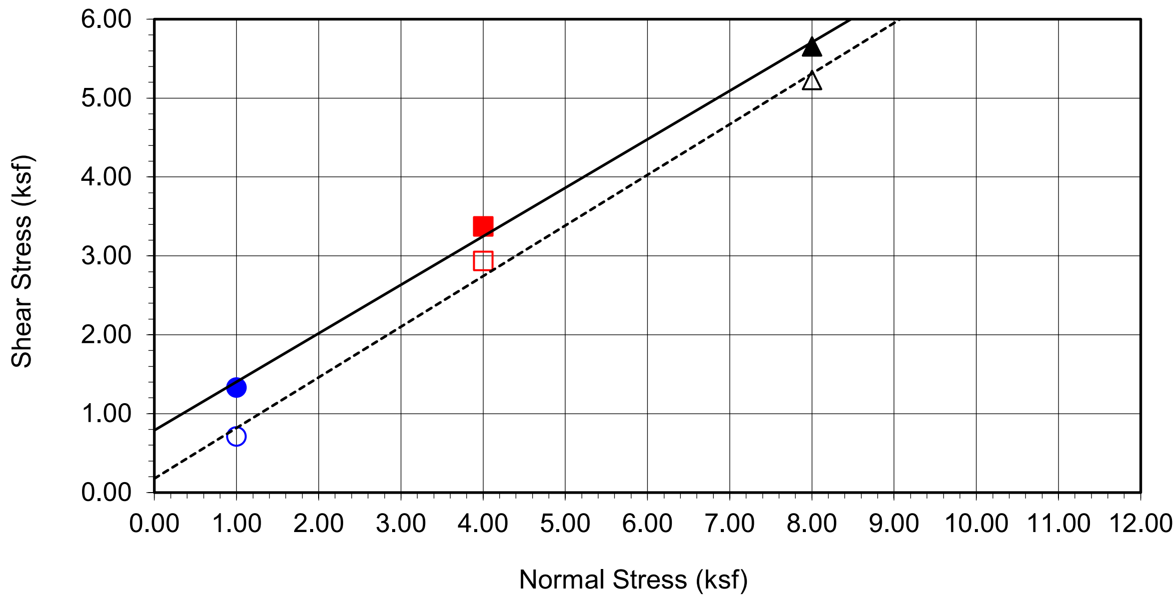
Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

10-24





Boring No.	**LB-3**
Sample No.	**R-1**
Depth (ft)	**5**
Sample Type:	Ring
Soil Identification: Brown lean clay (CL)	

Strength Parameters

	C (psf)	ϕ (°)
Peak	789	32
Ultimate	177	33

Normal Stress (kip/ft²)	1.000	4.000	8.000
Peak Shear Stress (kip/ft²)	● 1.333	■ 3.373	▲ 5.656
Shear Stress @ End of Test (ksf)	○ 0.710	□ 2.936	△ 5.231
Deformation Rate (in./min.)	0.0017	0.0017	0.0017
Initial Sample Height (in.)	1.000	1.000	1.000
Diameter (in.)	2.415	2.415	2.415
Initial Moisture Content (%)	10.88	10.88	10.88
Dry Density (pcf)	117.5	121.2	122.8
Saturation (%)	67.7	75.2	78.8
Soil Height Before Shearing (in.)	0.9898	0.9759	0.9722
Final Moisture Content (%)	16.5	15.1	15.3

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DIRECT SHEAR TEST RESULTS

Consolidated Drained - ASTM D 3080

Project No.: 036.0000025103

SMMUSD Franklin ES New Classroom

10-24

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EXPANSION INDEX of SOILS
ASTM D 4829

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	G. Berdy	Date:	10/14/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	HA-3	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Dark brown silty, clayey sand (SC-SM)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0170
Wt. Comp. Soil + Mold	(g)	578.10	446.40
Wt. of Mold	(g)	163.30	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	831.00	609.70
Dry Wt. of Soil + Cont.	(g)	765.90	545.59
Wt. of Container	(g)	0.00	163.30
Moisture Content	(%)	8.50	16.77
Wet Density	(pcf)	125.1	132.4
Dry Density	(pcf)	115.3	113.4
Void Ratio		0.462	0.487
Total Porosity		0.316	0.327
Pore Volume	(cc)	65.4	68.9
Degree of Saturation (%) [S_{meas}]		**49.7**	93.0

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
10/14/24	10:30	1.0	0	0.4755
10/14/24	10:40	1.0	10	0.4745
Add Distilled Water to the Specimen				
10/14/24	11:25	1.0	45	0.4880
10/15/24	5:17	1.0	1117	0.4925
10/15/24	7:19	1.0	1239	0.4925

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**18**

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EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	G. Berdy	Date:	10/11/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	LB-1	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Brown clayey sand (SC)				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0100
Wt. Comp. Soil + Mold (g)	575.40	447.21
Wt. of Mold (g)	163.30	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	819.60	610.51
Dry Wt. of Soil + Cont. (g)	751.90	541.38
Wt. of Container (g)	0.00	163.30
Moisture Content (%)	9.00	18.28
Wet Density (pcf)	124.3	133.6
Dry Density (pcf)	114.0	112.9
Void Ratio	0.478	0.493
Total Porosity	0.324	0.330
Pore Volume (cc)	67.0	69.0
Degree of Saturation (%) [S_{meas}]	**50.8**	100.1

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
10/11/24	7:55	1.0	0	0.5500
10/11/24	8:05	1.0	10	0.5485
Add Distilled Water to the Specimen				
10/11/24	9:07	1.0	62	0.5575
10/14/24	5:04	1.0	4139	0.5600
10/14/24	6:30	1.0	4225	0.5600

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**12**

EXPANSION INDEX of SOILS
ASTM D 4829

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Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	G. Berdy	Date:	10/14/24
Project No.:	036.0000025103	Checked By:	J. Ward	Date:	11/12/24
Boring No.:	LB-3	Depth (ft.):	0-2		
Sample No.:	B-1				
Soil Identification:	Brown silty sand (SM)				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0025
Wt. Comp. Soil + Mold (g)	603.70	446.67
Wt. of Mold (g)	184.30	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	842.70	630.97
Dry Wt. of Soil + Cont. (g)	780.30	572.65
Wt. of Container (g)	0.00	184.30
Moisture Content (%)	8.00	15.02
Wet Density (pcf)	126.5	134.4
Dry Density (pcf)	117.1	116.9
Void Ratio	0.439	0.443
Total Porosity	0.305	0.307
Pore Volume (cc)	63.2	63.7
Degree of Saturation (%) [S_{meas}]	**49.2**	91.6

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
10/14/24	8:46	1.0	0	0.5240
10/14/24	8:56	1.0	10	0.5230
Add Distilled Water to the Specimen				
10/14/24	10:27	1.0	91	0.5255
10/15/24	5:18	1.0	1222	0.5265
10/15/24	7:17	1.0	1341	0.5265

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**3**

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

verdantas

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	E. Perez	Date:	10/08/24
Project No.:	036.0000025103	Checked By:	A. Santos	Date:	10/14/24
Boring No.:	HA-3	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Dark brown silty, clayey sand (SC-SM)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

			Scalp Fraction (%)			
Preparation Method:	X	Moist	#3/4		Rammer Weight (lb.) =	10.0
		Dry	#3/8		Height of Drop (in.) =	18.0
Compaction Method	X	Mechanical Ram	#4	5.8	Mold Volume (ft³)	0.03320
		Manual Ram				

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3746	3864	3903	3804		
Weight of Mold (g)	1780	1780	1780	1780		
Net Weight of Soil (g)	1966	2084	2123	2024		
Wet Weight of Soil + Cont. (g)	1054.2	1075.5	1017.5	1074.6		
Dry Weight of Soil + Cont. (g)	991.2	989.3	915.6	948.4		
Weight of Container (g)	82.6	76.6	77.2	74.1		
Moisture Content (%)	6.93	9.44	12.15	14.43		
Wet Density (pcf)	130.5	138.4	141.0	134.4		
Dry Density (pcf)	122.1	126.4	125.7	117.4		

Maximum Dry Density (pcf)	**127.0**	**Optimum Moisture Content (%)**	**10.6**
Corrected Dry Density (pcf)	**128.8**	**Corrected Moisture Content (%)**	**10.0**

X **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

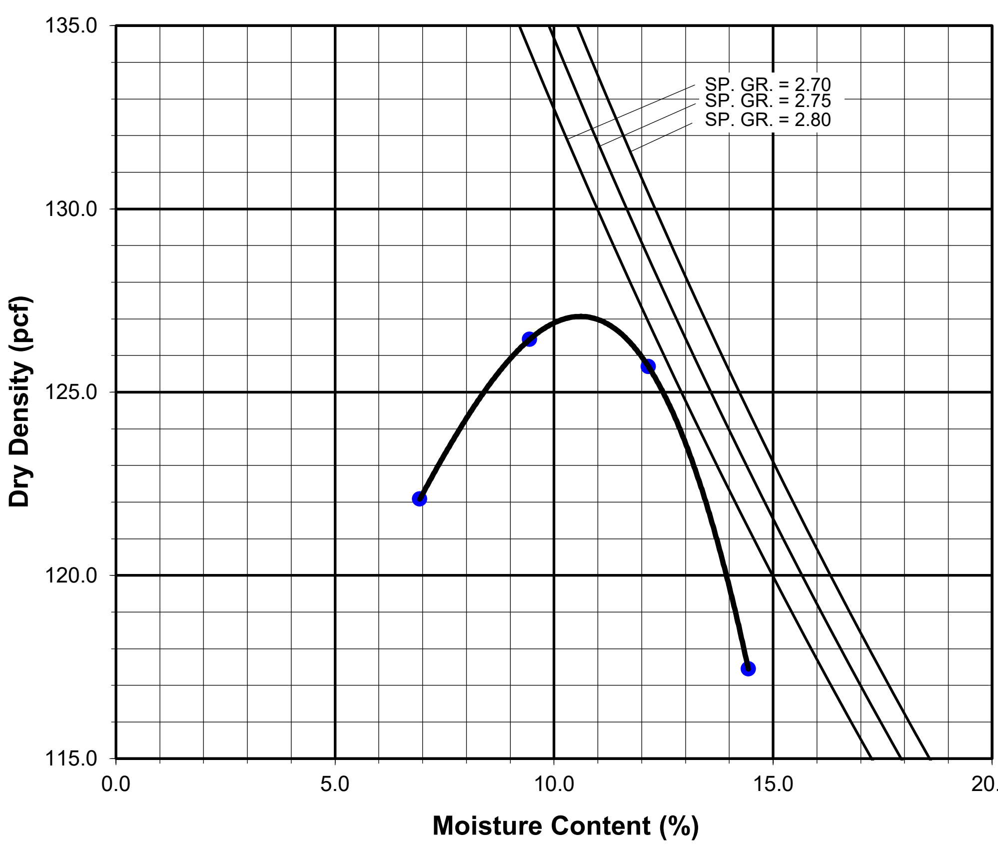
☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST
ASTM D 1557

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	E. Perez	Date:	10/10/24
Project No.:	036.0000025103	Checked By:	A. Santos	Date:	10/14/24
Boring No.:	LB-1	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Brown clayey sand (SC)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

			Scalp Fraction (%)	
Preparation Method:	X	Moist	#3/4	
		Dry	#3/8	
Compaction Method	X	Mechanical Ram	#4	10.2
		Manual Ram		

Rammer Weight (lb.) = 10.0
Height of Drop (in.) = 18.0
Mold Volume (ft³) 0.03320

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3801	3907	3849			
Weight of Mold (g)	1780	1780	1780			
Net Weight of Soil (g)	2021	2127	2069			
Wet Weight of Soil + Cont. (g)	1175.1	1128.2	1024.5			
Dry Weight of Soil + Cont. (g)	1096.8	1031.8	917.5			
Weight of Container (g)	89.1	77.0	77.5			
Moisture Content (%)	7.77	10.10	12.74			
Wet Density (pcf)	134.2	141.2	137.4			
Dry Density (pcf)	124.5	128.3	121.9			

Maximum Dry Density (pcf) 128.3 **Optimum Moisture Content (%)** 9.9

Corrected Dry Density (pcf) 131.5 **Corrected Moisture Content (%)** 9.0

X **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

Procedure B
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

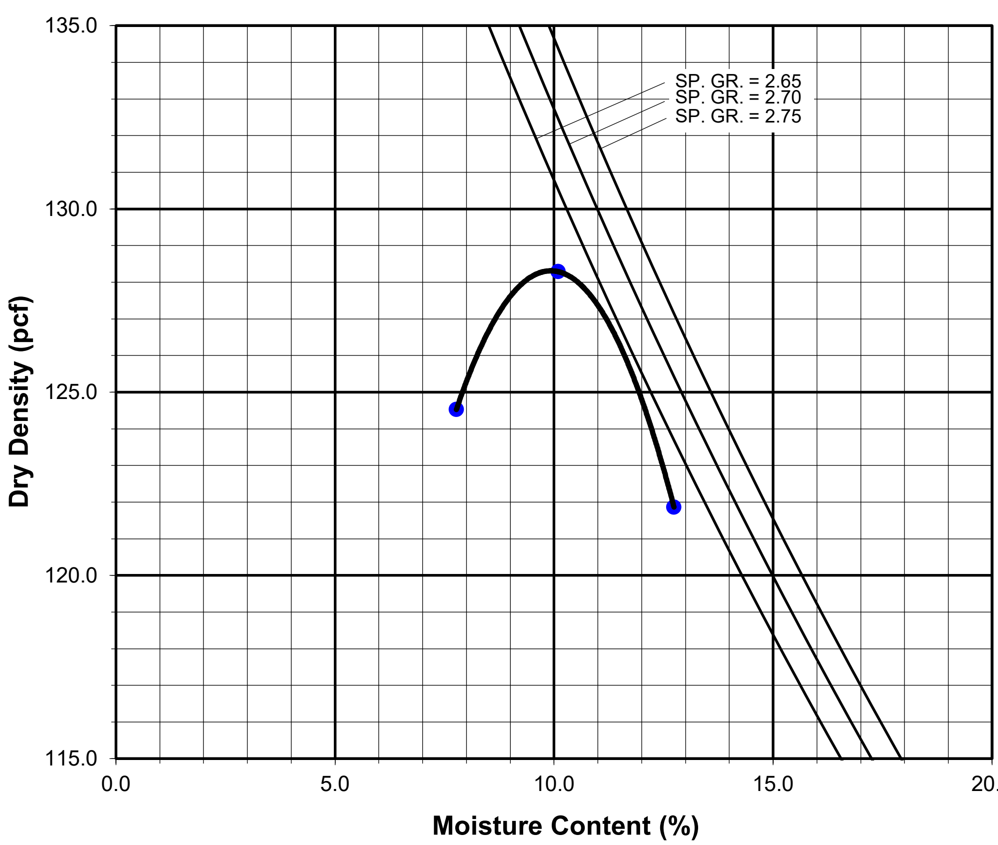
Procedure C
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	SMMUSD Franklin ES New Classroom	Tested By:	E. Perez	Date:	10/08/24
Project No.:	25103	Checked By:	A. Santos	Date:	10/14/24
Boring No.:	LB-3	Depth (ft.):	0-2		
Sample No.:	B-1				
Soil Identification:	Brown silty sand (SM)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

			Scalp Fraction (%)	
Preparation Method:	X	Moist	#3/4	
		Dry	#3/8	
Compaction Method	X	Mechanical Ram	#4	10.5
		Manual Ram		

Rammer Weight (lb.) = 10.0

Height of Drop (in.) = 18.0

Mold Volume (ft³) = 0.03320

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3828	3930	3857			
Weight of Mold (g)	1780	1780	1780			
Net Weight of Soil (g)	2048	2150	2077			
Wet Weight of Soil + Cont. (g)	950.8	1152.5	1053.0			
Dry Weight of Soil + Cont. (g)	892.6	1059.5	947.7			
Weight of Container (g)	75.5	88.4	76.1			
Moisture Content (%)	7.12	9.58	12.08			
Wet Density (pcf)	136.0	142.8	137.9			
Dry Density (pcf)	127.0	130.3	123.1			

Maximum Dry Density (pcf)	**130.5**	**Optimum Moisture Content (%)**	**9.1**
Corrected Dry Density (pcf)	**133.7**	**Corrected Moisture Content (%)**	**8.2**

☒ **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

☐ **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

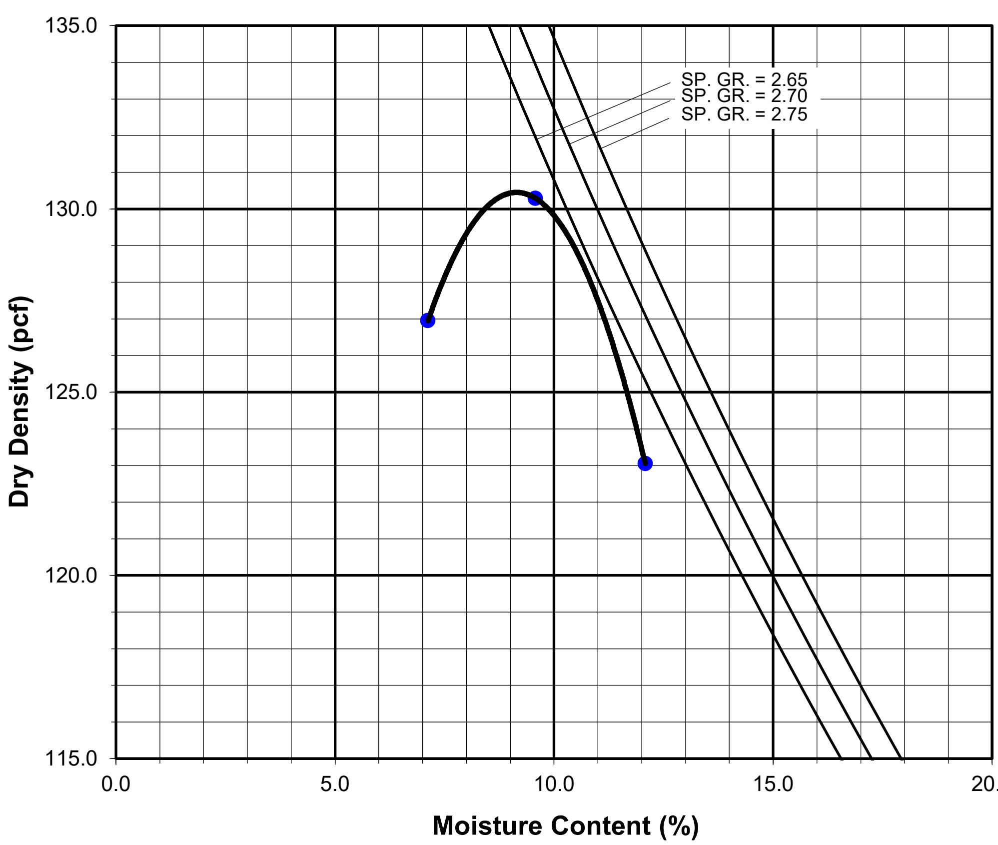
☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



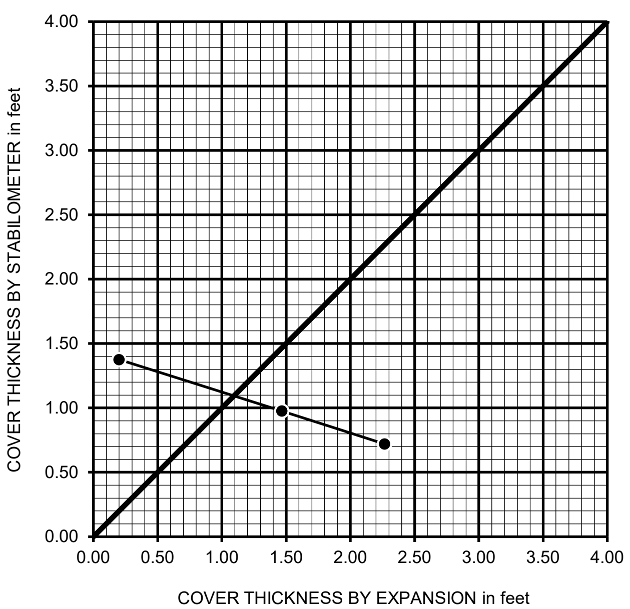
R-VALUE TEST RESULTS
DOT CA Test 301

PROJECT NAME:	SMMUSD Franklin ES New Classroom	PROJECT NUMBER:	036.0000025103
BORING NUMBER:	HA-3	DEPTH (FT.):	0-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	A. Santos
SAMPLE DESCRIPTION:	Dark brown silty, clayey sand (SC-SM)	DATE COMPLETED:	10/15/24

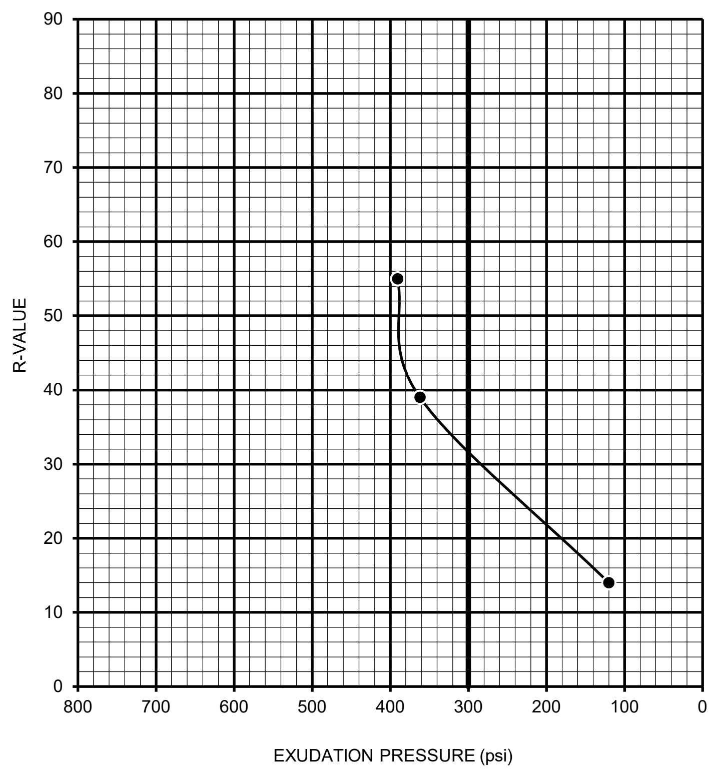
TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	11.1	12.0	13.7
HEIGHT OF SAMPLE, Inches	2.47	2.42	2.66
DRY DENSITY, pcf	124.2	123.3	121.6
COMPACTOR PRESSURE, psi	200	175	125
EXUDATION PRESSURE, psi	391	362	120
EXPANSION, Inches x 10exp-4	68	44	6
STABILITY Ph 2,000 lbs (160 psi)	50	70	125
TURNS DISPLACEMENT	4.45	4.56	4.75
R-VALUE UNCORRECTED	55	41	13
R-VALUE CORRECTED	55	39	14

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.72	0.98	1.38
EXPANSION PRESSURE THICKNESS, ft.	2.27	1.47	0.20

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	31
R-VALUE BY EXUDATION:	32
EQUILIBRIUM R-VALUE:	31

verdantas

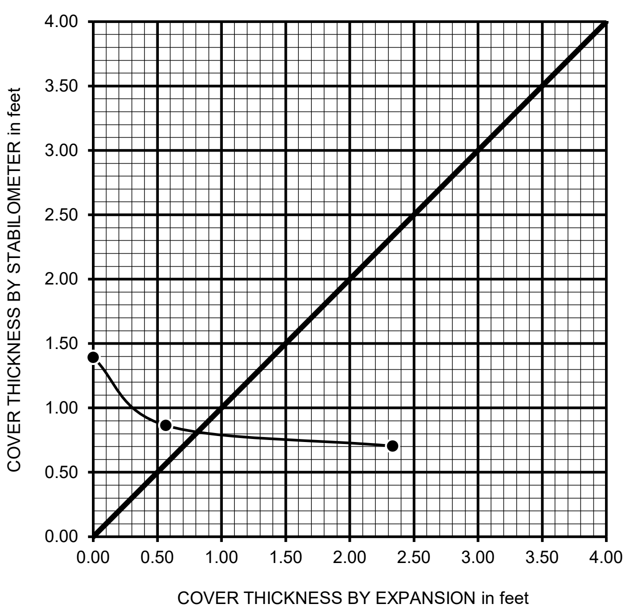
R-VALUE TEST RESULTS
DOT CA Test 301

PROJECT NAME:	SMMUSD Franklin ES New Classroom	PROJECT NUMBER:	036.0000025103
BORING NUMBER:	LB-1	DEPTH (FT.):	0-5
SAMPLE NUMBER:	B-1	TECHNICIAN:	A. Santos
SAMPLE DESCRIPTION:	Brown clayey sand (SC)	DATE COMPLETED:	10/15/24

TEST SPECIMEN	a	b	c
MOISTURE AT COMPACTION %	10.0	11.3	13.0
HEIGHT OF SAMPLE, Inches	2.46	2.57	2.58
DRY DENSITY, pcf	125.5	125.9	122.0
COMPACTOR PRESSURE, psi	250	200	100
EXUDATION PRESSURE, psi	568	316	121
EXPANSION, Inches x 10exp-4	70	17	0
STABILITY Ph 2,000 lbs (160 psi)	48	64	126
TURNS DISPLACEMENT	4.55	4.70	5.05
R-VALUE UNCORRECTED	56	44	12
R-VALUE CORRECTED	56	46	13

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.70	0.86	1.39
EXPANSION PRESSURE THICKNESS, ft.	2.33	0.57	0.00

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART

R-VALUE BY EXPANSION:	49
R-VALUE BY EXUDATION:	44
EQUILIBRIUM R-VALUE:	44

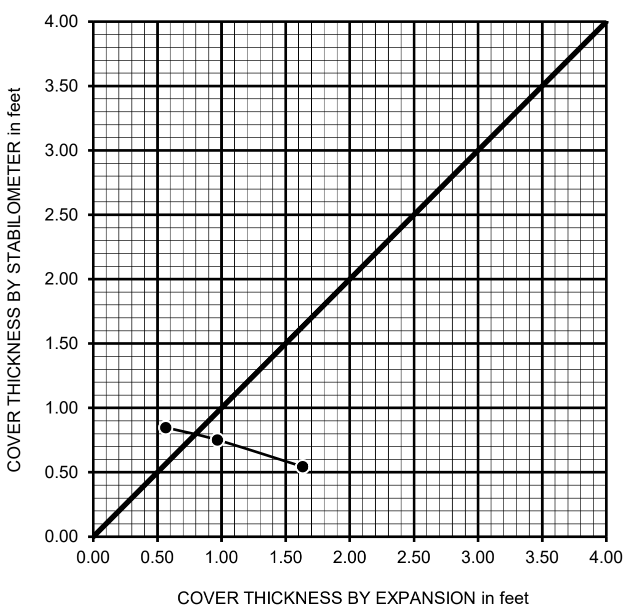
R-VALUE TEST RESULTS
DOT CA Test 301

PROJECT NAME:	SMMUSD Franklin ES New Classroom	PROJECT NUMBER:	036.0000025103
BORING NUMBER:	LB-3	DEPTH (FT.):	0-2
SAMPLE NUMBER:	B-1	TECHNICIAN:	A. Santos
SAMPLE DESCRIPTION:	Brown silty sand (SM)	DATE COMPLETED:	10/15/24

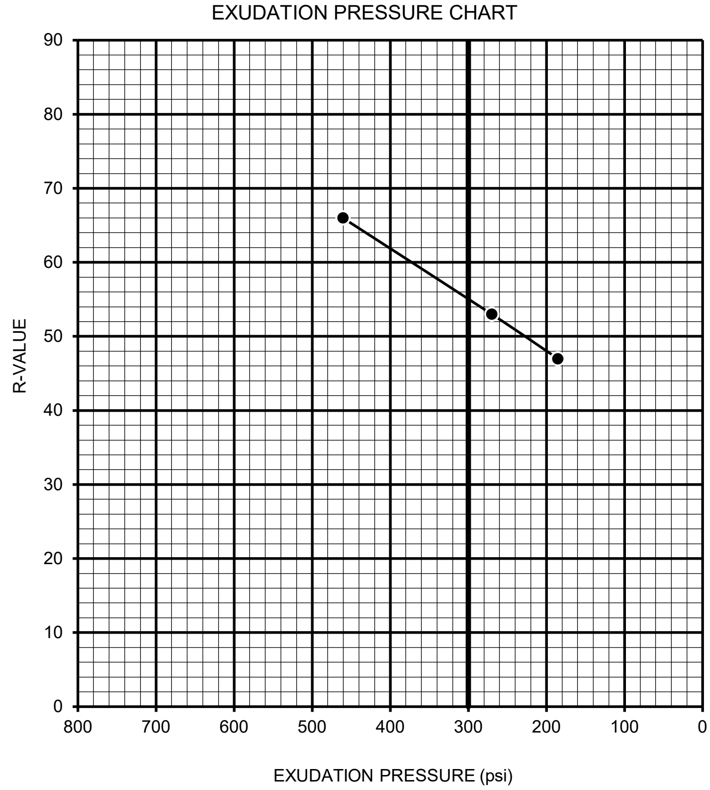
TEST SPECIMEN	**a**	**b**	**c**
MOISTURE AT COMPACTION %	9.6	10.0	10.5
HEIGHT OF SAMPLE, Inches	2.57	2.49	2.59
DRY DENSITY, pcf	125.9	126.7	125.6
COMPACTOR PRESSURE, psi	200	175	150
EXUDATION PRESSURE, psi	461	270	185
EXPANSION, Inches x 10exp-4	49	29	17
STABILITY Ph 2,000 lbs (160 psi)	37	51	60
TURNS DISPLACEMENT	4.65	4.80	5.10
R-VALUE UNCORRECTED	64	53	45
R-VALUE CORRECTED	66	53	47

DESIGN CALCULATION DATA	**a**	**b**	**c**
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	0.54	0.75	0.85
EXPANSION PRESSURE THICKNESS, ft.	1.63	0.97	0.57

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	50
R-VALUE BY EXUDATION:	55
EQUILIBRIUM R-VALUE:	50

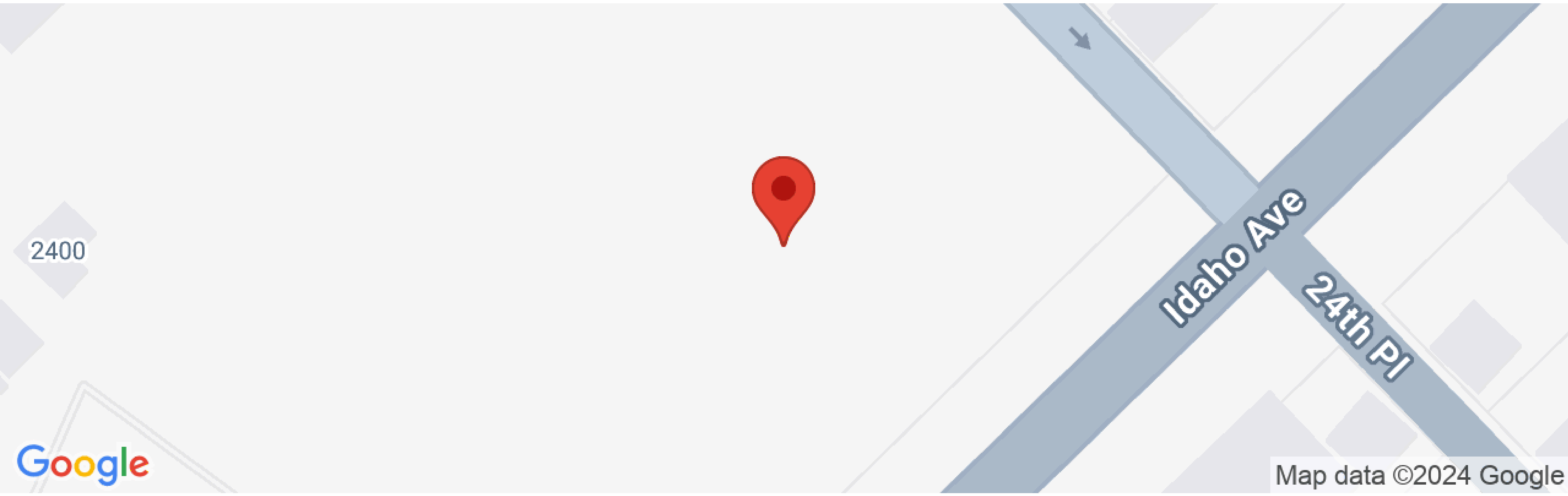
Appendix D.

Seismicity Data

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
USGS web services are now operational so this tool should work as expected.

25103 Franklin ES

Latitude, Longitude: 34.03890118, -118.48423193



Date	11/18/2024, 1:37:12 PM
Design Code Reference Document	NEHRP-2015
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.963	MCE_R ground motion. (for 0.2 second period)
S_1	0.701	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.963	Site-modified spectral acceleration value
S_{M1}	1.192 -See Section 11.4.7	Site-modified spectral acceleration value
S_{DS}	1.308	Numeric seismic design value at 0.2 second SA
S_{D1}	0.795 -See Section 11.4.7	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D -See Section 11.4.7	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.7 -See Section 11.4.7	Site amplification factor at 1.0 second
PGA	0.837	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.921	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.963	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	2.161	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.435	Factored deterministic acceleration value. (0.2 second)
S1RT	0.701	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.776	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.822	Factored deterministic acceleration value. (1.0 second)
PGAd	0.985	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.837	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.908	Mapped value of the risk coefficient at short periods
C_{R1}	0.904	Mapped value of the risk coefficient at a period of 1 s
C_V	1.493	Vertical coefficient

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Appendix E.

General Earthwork and Grading Guidelines

APPENDIX E

EARTHWORK AND GRADING GUIDE SPECIFICATIONS

Table of Contents

STANDARD DETAILS

1.0 General

1.1 Intent

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Verdantas Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Verdantas Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Verdantas Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 Role of Verdantas Inc.

Prior to commencement of earthwork and grading, Verdantas Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Verdantas Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Verdantas Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Verdantas Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Verdantas Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

1.3 The Earthwork Contractor

The earthwork contractor (Contractor) shall be qualified, experienced and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Guide Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Verdantas Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Verdantas Inc. is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish earthwork and grading in accordance with the applicable grading codes and agency ordinances, these Guide Specifications, and recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of Verdantas Inc., unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, Verdantas Inc. shall reject the work and may recommend to the owner that earthwork and grading be stopped until unsatisfactory condition(s) are rectified.

2.0 Preparation of Areas to be Filled

2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies and Verdantas Inc.. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the "drip line" of designated trees to remain.

Verdantas Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

2.2 Processing

Existing ground that has been declared satisfactory for support of fill, by Verdantas Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be over-excavated as specified in the following Section 2.3. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by Verdantas Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Verdantas Inc.. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Verdantas Inc.. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by Verdantas Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Verdantas Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

3.0 Fill Material

3.1 Fill Quality

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Verdantas Inc. prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to Verdantas Inc. or mixed with other soils to achieve satisfactory fill material.

3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Verdantas Inc.. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 3.1, and be free of hazardous materials (“contaminants”) and rock larger than 3-inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than (≤) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Verdantas Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill, as described in Section A-2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Verdantas Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM) Test Method D 1557.

4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, each layer shall be uniformly compacted to not-less-than (≥) 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. In some cases, structural fill may be specified (see project-specific geotechnical report) to be uniformly compacted to at-least (≥) 95 percent of the ASTM D 1557 modified Proctor laboratory maximum dry density. For fills thicker than (>) 15 feet (4.5 m), the portion of fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557 laboratory maximum density. Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by back rolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Verdantas Inc.. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557 laboratory maximum density.

4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Verdantas Inc.. Location and frequency of tests shall be at our field representative(s) discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

4.6 Compaction Test Locations

Verdantas Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Verdantas Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

5.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Verdantas Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Verdantas Inc. based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, then observed and reviewed by Verdantas Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Verdantas Inc..

6.0 Trench Backfills

6.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2009 Edition or more current (see also: http://www.dir.ca.gov/title8/sb4a6.html).

6.2 Bedding and Backfill

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2018 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise, the pipe-bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2018 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Verdantas Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Verdantas Inc..

6.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to Verdantas Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.