SOILS ENGINEERING, INC.

GEOTECHNICAL INVESTIGATION

FOR

BAKERSFIELD CITY SCHOOL DISTRICT

NEW ELEMENTARY SCHOOL

SECTION 17, T29S, R29E

APN 531-012-02 and 531-012-03

BAKERSFIELD, KERN COUNTY, CA

Prepared for:

The Bakersfield City School District
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By:

SOILS ENGINEERING, INC.
SEI File No. 19-17179
November 13, 2019

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INTRODUCTION

In accordance with your request, we have performed a Geotechnical Investigation at the subject site. Recommendations for site preparation and grading, and criteria for foundation design are provided in the attached report.

Appendix A, "Guide Specifications for Earthwork," is provided as a supplement to Section I, "Earthwork," in the recommendations of the report.

Appendix B, "Field Investigation," contains the Boring Location Map as Figure 1, showing the approximate location the test bores, and the Logs of Test Borings, Figures 2 through 22.

Appendix C, "Soils Test Data," contains tabulations of laboratory test data.

Appendix D, "Seismic Investigation," contains data from EQFault, LiquefyPro and the USGS.

We hope this provides the information you require. If you have any questions regarding the contents of our report, or if we can be of further assistance, please contact us.

Respectfully submitted,
SOILS ENGINEERING, INC.

SITE INFORMATION

A. SITE LOCATION AND CONDITIONS

The proposed new school site is in the southwest quadrant of the intersection of Masterson Street and Paladino Drive in northeast Bakersfield, California. This is the northeast quarter of the northeast quarter of Section 17, T29S, R29E, MDM. The site, which is about twenty-two acres, is situated between Paladino Drive on the north and Panorama Drive on the south. The site extends from Masterson Street on the east to a (proposed) city street about 1,100 feet to the west. The topography is nominally flat and level.

In 2006 and 2007 this proposed school site was part of a graded and partially developed residential subdivision. In the northeast third of the site, there are stockpiles of soil from the subdivision grading and numerous piles of spoil, apparently from footing excavations in the residential tracts to the south and west. At the northeast corner of the site there is a small asphalt concrete paved area, about 80 feet x 130 feet. There is negligible to moderate weed growth on the site. There are single-family dwellings on large parcels to the north. There is a single-family residential subdivision to the south. The land to the east is undeveloped. To the west is the remainder of the partially developed residential subdivision from which this school site was subdivided.

B. GEOLOGIC SETTING

According to the California Department of Conservation's Geologic Atlas of California - Bakersfield Sheet, the project site rests on Plio--Pleistocene non-marine deposits (QP). Based on the California Department of Conservation's Geological Survey maps, there is an Alquist-Priolo (earthquake fault) Special Study Zone in the far eastern portion of the site. Nearby active earthquake faults include the following:

Kern Front	9.6 miles/ 15.5 kilometers
White Wolf	16.2 miles/ 26.0 kilometers
Pleito Thrust	29.9 miles/ 48.1 kilometers
Garlock West	35.2 miles/ 56.7 kilometers
San Andreas - Whole M-1a	41.3 miles/ 66.4 kilometers
Big Pine	41.7 miles/ 67.1 kilometers
San Gabriel	48.4 miles/ 77.9 kilometers
Garlock East	48.5 miles/ 78.0 kilometers
Southern Sierra Nevada	50.5 miles/ 81.2 kilometers

Fault investigations have been conducted at this site by SEI in 2004 and 2019 in which multiple fault trenches were conducted to evaluate the presence of active faulting at the site. Based on these investigations no active fault traces have been confirmed at the site or within 50 feet of the proposed school building locations. See the complete Geological Hazard Study already issued under this same file number, dated October 31, 2019 for more detail.

C. SUBSURFACE CONDITIONS

Surface soils encountered in our field investigation consisted of mostly of reddish-brown, dry, medium dense to dense, Clayey Sand; light yellowish-brown, dry, medium dense to dense, Silty Sand and Poorly-Graded Sand; reddish-brown, dry, Sandy Clay and Clay. These soils are classified as SC, SM, SP and CL, respectively in the Unified Soil Classification System (USCS).

Testing performed in our laboratory showed an Expansion Index (EI) ranging from 37 to 59; which indicates a low to moderate expansion potential. Expansive soils are defined in the 2019 California Building Code (CBC), Section 1803A.5.3. Soils are considered to be expansive when the EI result is greater than 20, per ASTM D4829, Expansion Index of Soils. Design of foundations for structures shall be designed in accordance with the 2019 CBC, Sections 1808A.6.1, & 1808A.6.2.

Detailed descriptions of the various soils encountered during our field investigation are shown on Figures 2 through 22 in Appendix B, "Field Investigation." A "Key to Symbols" legend describing the symbols in the boring logs is also attached.

D. GROUNDWATER

Groundwater was not encountered in the field exploration test borings, which extended to a maximum depth of 51.5 feet. It is our opinion that groundwater will remain below the zone of influence of the project foundations and that it will not affect the foundation stability of the project.

E. SEISMIC DESIGN VALUES

The seismic design values presented in the table below are based on the new 2019 CBC. The Site Class for the proposed project was determined using standard penetration test data obtained at the site and are provided in the attached Boring Logs. The far eastern portion of the site is located within an Alquist-Priolo (earthquake fault) Special Study Zone. Fault investigations within the site have not confirmed the presence of any active faults. The following table on page 6 details the design criteria.

SEISMIC DESIGN CRITERIA		**VALUE**	**SOURCE**
Risk Category		**III**	2019 CBC Table 1604.5 or 1604*A*.5
Site Class		**D**	2019 CBC § 1613.2.2 or 1613*A*.2.2; ASCE 7-16 Table. 20.3-1; Site Specific Soils Report
Mapped MCE_R Spectral Response Acceleration, short period	**S_S**	**0.923g**	SEAOC-OSHPD software; 2019 CBC Figure 1613.2.1(1)
Mapped MCE_R Spectral Response Acceleration, at 1-sec. Period	**S_1**	**0.328g**	SEAOC-OSHPD software; 2019 CBC Figure 1613.2.1(2)
Site Coefficient	**F_a**	**1.131**	SEAOC- OSHPD software; 2019 CBC Table 1613.2.3(1) or 1613*A*.2.3(1)
Site Coefficient	**F_v***	**1.97***	2019 CBC Table 1613.2.3(2) or 1613*A*.2.3(2)
Adjusted MCE_R Spectral Response Acceleration, short period, $F_a * S_s$	**S_{MS}**	**1.044g**	SEAOC- OSHPD software; 2019 CBC § 1613.2.3 or 1613*A*.2.3
Adjusted MCE_R Spectral Response Acceleration, 1-sec. period, $F_v * S_1$	**S_{M1}***	**0.646***	2019 CBC § 1613.2.3 or 1613*A*.2.3
Design Spectral Response Acceleration, short period, 2/3 * S_{MS}	**S_{DS}**	**0.696g**	SEAOC- OSHPD software; 2019 CBC § 1613.2.4 or 1613*A*.2.4
Design Spectral Response Acceleration, 1-sec. period, 2/3 * S_{MI}	**S_{D1}***	**0.431***	2019 CBC § 1613.2.4 or 1613*A*.2.4
Peak Ground Acceleration for Max. Considered Earthquake (MCE_G)	**PGA**	**0.398g**	SEAOC- OSHPD software; ASCE 7-16 Fig 22-9
Site Coefficient, F_{PGA} = 1.202, F_{PGA}* PGA	**PGA_M**	**0.478g**	SEAOC- OSHPD software; ASCE 7-16 § 11.8.3.2
Mapped Risk Coefficient at 0.2 second Spectral Response Period	**C_{RS}**	**0.925**	SEAOC- OSHPD software; ASCE 7-16 Figure 22-18A
Mapped Risk Coefficient at 1 second Spectral Response Period	**C_{R1}**	**0.923**	SEAOC- OSHPD software; ASCE 7-16 Figure 22-19A
Seismic Design Category, short period		**D**	2019 CBC § 1613.2.5
Seismic Design Category, 1second period *		**D***	2019 CBC § 1613.2.5

* *The project Structural Engineer shall confirm that a ground motion hazard analysis is not required in accordance with ASCE 7-16 § 11.4.8-Exception 2. The values tabulated above for S_{M1}, S_{D1}, and the Seismic Design Category/1-second period are based on the site coefficient, F_v, interpolated from 2019 CBC Table 1613.2.3(2) or 1613A.2.3(2). The use of that table is predicated on the above referenced Exception 2 being applicable for the site and the structure(s). The project Structural Engineer or designer shall confirm that the above referenced Exception 2 is applicable. Where the above referenced Exception 2 does not apply, the values for F_v, S_{M1}, S_{D1}, and for the Seismic Design Category/1-second period may not be applicable for the site and structure(s).*

MCE_R = Maximum Considered Earthquake (risk targeted)
MCE_G = Maximum Considered Earthquake (geometric mean)

Major fault systems and their distances from the site are given in the EQFault Summary attached in Appendix E. The largest estimated peak site acceleration, based on deterministic methods, is 0.260g from a 7.3 magnitude earthquake on the White Wolf fault. See Appendix E for copies of the computer modeling data. Also see the complete Geological Hazard Study already issued under this same file number, dated October 31, 2019 for more detail.

EARTHWORK RECOMMENDATIONS

A. COMPACTION & OPTIMUM MOISTURE

Unless otherwise specified herein, soil and other similar materials placed on this site shall be compacted to not less than 90 percent of the laboratory maximum density for each material as determined in accordance with ASTM Test Method D1557. Soils and similar materials should be compacted at or near the "optimum moisture" for each material, as determined in accordance with ASTM Test Method D1557. Potentially expansive materials should be compacted at a moisture content which is two to three percent higher than the "optimum moisture".

B. STRIPPING

Prior to site grading, existing ground surfaces should be stripped of surface vegetation and high-volume root masses. A stripping depth of one to three inches is generally adequate. Stripped material shall not be used as engineered fill or blended with or incorporated into any materials which will underlie any structures or other improvements on the project. Removal of trees or other large plants shall include all roots larger than ¾" diameter. If necessary, root remnants are to be removed by hand-picking. Remove existing structures and improvements, including within the limits of grading or as depicted in the project documents.

C. GROUND SURFACE PREPARATION

As mentioned in the "Subsurface Conditions" section earlier in this report the native materials encountered during our investigation are considered expansive in accordance with the CBC. Accordingly ground surfaces in the proposed construction area should be prepared in accordance with the procedures and recommendations provided within this section. Various options are provided and will provide mitigation measures for the expansion potential of the onsite materials if all of the recommendations are followed and verified by the Geotechnical Engineering of Record (GEOR).

Two options for ground surface preparation are provided. The first option consists of excavating existing native soils, moisture conditioning, and replacing and compacting those soils. Due to the expansive nature of the native soils, specially designed foundation and slab-on-ground systems would be required. Please, refer to the section *Foundations on Expansive Soil Recommendations* later in this report. The second option consists of removal of existing expansive soils and replacement with non-expansive soils, moisture conditioned and compacted as recommended. Requirements for specially designed foundation and slab-on-ground systems would depend on the thickness of the non-expansive soils on the building pad. Please, refer to the section *Foundations on Expansive Soil Recommendations* later in this report.

1. Building pad preparation using native soils:

Building pad preparation using native soils should consist of excavation to a depth of four feet (4.0') below finish grade or below existing grade, whichever is deeper. Excavated soils should be moisture conditioned to not less than two percent (2%) over the optimum moisture content as determined in accordance with ASTM D1557.

Place and spread the moisture conditioned soils in thin lifts (less than ten inches uncompacted thickness). Compact moisture conditioned soil to not less than ninety percent (90%) and not more than ninety-three percent (93%) of the laboratory maximum density as determined in accordance with ASTM D1557. Soil placed in the building pad which is drier than or which is more compact than recommended above shall be scarified, or removed, moistened as needed, and re-worked to conform with these recommendations.

Building pad preparation as described above should extend laterally at least five feet (5.0') beyond the outermost edges of the structure foundation, including canopies or other appurtenances on spread footings. The elevated moisture content shall be maintained until the concrete is placed.

The bottom of the excavation shall be reviewed by the GEOR or his representative prior to any backfill operations.

2. Building pad preparation using non-expansive imported soils:

The *removal and replacement* option requires that a sufficient depth of non-expansive soils be placed over the native expansive soils so that the confining pressure reduces the estimated differential movement to an amount which can be resisted by the stiffness of conventionally designed foundations or by simplified post-tensioned systems. The thickness of the upper layer of non-expansive should be selected by the project structural engineer to correspond with the foundation and slab-on-ground system. The imported soils should have relatively low permeability when compacted.

Volflo 1.5 software was used to model the estimated differential soil movement based on various thicknesses of the upper layer of non-expansive soil.

Thickness of Non-Expansive Upper Layer	Center Lift		Edge Lift	
	e_m	y_m	e_m	y_m
3.0 feet	9.0 feet	0.43 inch	5.1 feet	0.49 inch
4.0 feet	9.0 feet	0.28 inch	5.2 feet	0.29 inch
5.0 feet	9.0 feet	0.18 inch	5.2 feet	0.15 inch

Building pad preparation should consist of excavation to a minimum depth of four feet (4.0') below finish grade or below existing grade, whichever is deeper. When excavated native soils are to be placed in the bottom of the building pad those soils should be moisture conditioned to not less than two percent (2%) over the optimum moisture content as determined in accordance with ASTM D1557. Place and spread the moisture conditioned soils in thin lifts (less than ten inches uncompacted thickness). Compact moisture conditioned native soil to not less than ninety percent (90%) and not more than ninety-three percent (93%) of the laboratory maximum density as determined in accordance with ASTM D1557.

Soil placed in the building pad which is drier than or more compact than recommended above shall be scarified, or removed, moistened as needed, and re-worked to conform with these recommendations. Place native soils to an elevation which will permit placement and compaction of non-expansive engineered fill of not less than the specified thickness. Moisture condition, place, and compact imported non-expansive engineered fill as described above, excluding the upper compaction limit. The building pad preparation as described above should extend laterally at least five feet (5.0') beyond the outermost edges of the structure foundation, including canopies or other appurtenances on spread footings

The bottom of the excavation shall be reviewed by the GEOR or his representative prior to any backfill operations.

It should be noted that construction on expansive soils with a post-tensioned or other specially reinforced slab system does not eliminate differential soil and structure movement. The building pad soils in the upper four (4) feet shall be placed and compacted at elevated moisture conditions (2% to 3% above optimum moisture) and elevated moisture conditions should be maintained until concrete placement. Grading and construction of all improvements shall be performed in such a manner that there will be no opportunity for standing water to collect on or percolate into the soils adjacent to or near the structure(s) or other improvements. Where utility trenches extend under or adjacent to the structure(s) or other improvements, the soil in the entire depth of the trench shall be compacted. Compaction shall extend at least five feet (5.0') beyond the outside edge of the structure or improvement and low permeability soils shall be used for the backfill. Clean sand or other permeable soils which could serve as a path for the lateral movement of water should not be used in the immediate vicinity.

Landscape irrigation shall be stringently controlled. Water, in excess of that needed by the landscape plantings, shall not be applied to the ground adjacent to or near the structure(s) and other improvements. Mature trees and large shrubs shall be provided sufficient irrigation water so that soil desiccation does not occur due to evapotranspiration by the trees or shrubs. Trees or large shrubs should not be planted closer than 15 feet to the structure(s) and landscape plantings should include root barriers.

Pavement:

Ground surfaces to receive concrete driveways or bituminous pavements should be scarified and compacted to a minimum depth of 12 inches below the grading plane in cut areas or to 12 inches in areas to receive fill.

Engineered fill placed in proposed pavement areas should conform to the requirements of Section 5.4, "Placing, Spreading and Compacting Fill Materials," of Appendix A.

Compaction in proposed pavement areas should be a minimum of 90 percent of the maximum density as obtained by ASTM Test Method D1557 and should extend to a minimum of two feet beyond the outside edges of pavements. The top eight (8) inches of subgrade below the grading plane shall be compacted to a minimum of 95%.

Utility Lines:

Backfill for utility lines traversing areas proposed for facilities, pavements, concrete slabs-on-grade, or areas to receive engineered fill for future construction should be compacted in accordance with the same requirements for adjacent and/or overlying fill materials.

Where utility trenches extend under, adjacent to, or near the structure, including patio(s), porch(es), garage, etc., the soil in the entire depth of the trench, shall be compacted. Compaction shall extend at least five feet beyond the outside the edge of the structure. Low-permeability, non-expansive, soils shall be used for backfill.

Compaction should include haunch area, spring line and from top of pipe to finished subgrade. The haunch area up to one foot above the top of the pipe should be backfilled with "cohesionless" material.

Cohesionless native materials may be used for trench and pipe or conduit backfill. The term "cohesionless," as used herein, is defined as material which when dry, will flow readily in the haunch areas of the pipe trench. Pipe backfill materials should not contain rocks larger than two inches in maximum dimension. Where adjacent native materials exposed on the trench bottoms contain protruding rock fragments larger than two inches in maximum dimension, conduits and pipelines should be laid on a bedding consisting of clean, cohesionless sand (SP), in the Unified Soils Classification System.

Compaction Requirements - where not otherwise specified in the project documents, or in the manufacturer's specifications, or in these recommendations, the following compaction requirements are applicable to all electrical, gas or water conduits:

TABLE A
COMPACTION DEPTH

Area	**Haunch to 1 ft. Above Top Of Pipe**	**1 ft. Above Top of Pipe to 2'6" Below Finished Grade**	**2'6" Below Finished Grade to Finished Subgrade**
Structural	90%	90%	90%
Pavements	90%	90%	90%
Non-Structural	90%	90%	90%

D. ENGINEERED FILL

Earth materials obtained on site are acceptable for use as engineered fill provided that vegetation and other deleterious debris are removed by proper stripping and separation.

Engineered fill material which has been moisture-conditioned to near the optimum moisture content, or to a moisture content commensurate with effective compaction and soil stability, should be placed in thin uniform layers (less than ten inches uncompacted thickness) and compacted. Refer to "Placing, Spreading and Compacting Fill Materials," in Appendix A.

E. IMPORTED FILL

Tabulated below are general guidelines for acceptance of imported engineered fill. Materials of equal of better quality than on-site material could be reviewed by the Geotechnical Engineer on a case by case basis. No soil materials shall be imported onto the project site without prior approval by the Geotechnical Engineer. Any deviation from the specifications given below shall be approved by the Geotechnical Engineer prior to import operations.

Maximum Percent Passing #200 Sieve	40
Maximum Percent Retained 3" Sieve	0
Maximum Percent Retained 1½" Sieve *for building areas*	10
Maximum Percent Retained ¾" Sieve *for landscape areas*	5
Maximum Liquid Limit	40
Maximum Plasticity Index	14
Minimum R-Value *for pavement areas*	50
Minimum R-Value *for building areas*	35
Maximum Expansion Index (per 2019 CBC)	20

Furthermore, the soils proposed for import shall be generally homogenous and shall not contain cemented and/or clayey and/or silty lumps larger than one inch. When such lumps are present, they shall not represent more than ten percent (10%) of the material by dry weight. Where a proposed import source contains obviously variable soils, such as clay and/or silt layers, the soils which do not meet the above requirements shall be segregated and not used for this project or the various layers shall be thoroughly mixed prior to sampling and testing by the Geotechnical Engineer.

The contractor shall provide sufficient notice, prior to import operations, to allow sampling, testing, and evaluation of the proposed import material(s). Because of the time needed to perform the above tests, the contractor shall provide a means by which the Geotechnical Engineer, or others, can verify that the material which was sampled and tested is the same material which is being imported to the project.

F. DRAINAGE

Finish grading and construction of all improvements should be completed in such a manner that there will be no opportunity for water to collect on and/or percolate into the soils adjacent to or near the appurtenant structures or improvements including driveways and sidewalks).

Finish ground surfaces adjacent to the proposed structures should be graded to provide positive, free, and unobstructed drainage away from the foundations for at least five (5) feet. The recommended drainage should be established prior to enclosing the structure.

Drainage should continue by way of drain inlets and pipes or by surface grading to the street.

No construction or finish grading should be established or maintained that would allow surface water, from on-site or off-site sources, to pond or accumulate near foundations or slabs or behind curbs. In areas where such adverse drainage conditions may exist or be created, area drains and/or catch basins with subsurface piping should be installed to collect and convey water to the adjacent street gutter.

Landscape irrigation should be stringently controlled. Do not apply irrigation water in excess of that needed by the landscape plantings. No water shall be applied to the ground adjacent to or near the structure or appurtenant structures or improvements (including patio(s), porch(es), garage, driveways, sidewalks, etc.).

Where ground surfaces adjacent to subsurface walls are to be landscaped, walls should be waterproofed. Installation of gravel-filled drains to route subsurface drainage away from walls is recommended.

G. SLOPES

Permanent fill and cut slopes should be constructed at 2:1 (horizontal to vertical) in accordance with the 2019 California Building Code. Finished slopes nearer than five feet from building foundations should be graded no steeper than five-horizontal to one-vertical (5H:1V) and not flatter than two-horizontal to one vertical (2H:1V) .

A slope ratio of 2:1 (horizontal to vertical) should provide adequate stability for slopes farther than five feet from footing lines. The fill slopes shall be compacted to a minimum of 90% of ASTM D1557 and in accordance with the Guide Specifications for Earthwork, Appendix A.

This may be achieved by overfilling the constructed slope and trimming to a compacted finished surface, rolling the slope face with a sheepsfoot as the level of the fill is raised, or any method that achieves the desired product. The cut portion of the slope should be constructed first. Prior to construction of the fill slope, incompetent surface soils should be removed from the top of the cut. Areas to receive fill or to support structures, slabs or pavements should be cleared of all vegetation, debris, and disturbed soils.

Existing underground pipelines, private sewage disposal systems and any water or oil wells, if encountered during grading, should be removed or capped in accordance with procedures considered acceptable by the appropriate governing agency. Tree roots with diameters greater than to 2 inches should be removed. Both fill and cut slopes will be subject to erosion immediately after grading and should be designed to reduce surficial sloughing by implementing a permanent slope maintenance program as soon as practical after completion of slope construction. Slope maintenance should include proper care of erosion and drainage control devices, rodent control, and immediate planting with deep-rooting, lightweight, drought-resistant vegetation. An erosion control geotextile may also be used in combination with vegetation to control erosion. Experience has shown that slope performance is largely dependent upon proper slope maintenance (i.e., planting, proper watering, clearing of drainage devices, etc.). Slopes properly placed and conscientiously maintained are not expected to display excessive raveling or sloughing.

FOUNDATION RECOMMENDATIONS

As noted above in this report, the site soils are expansive. It is recommended that the proposed structure(s) be founded in soils prepared in accordance with the recommendations contained in this report. It is recommended that the project structural engineer design the proposed foundations for expansive soils in accordance with the 2019 CBC, Section 1808A.6. The following options are presented for use in the design.

SEI has prepared the following list of options for use in addressing the expansive soils. The options considered include: Options (I) & (II) design to resist the forces resulting from differential soil expansion/shrinkage of underlying expansive soils, or (III) remove and replace using non-expansive imported soils.

Option I: Mat Foundation

The proposed structure may be supported on mat foundation system with the bottom embedded a minimum of 12 inches below the adjacent ground surface and a deepened footings/edges with a minimum depth of 30 inches from the lowest adjacent grade. Mat foundation should be designed to cantilever lengthwise and widthwise one half of the pertinent slab dimension.

Modulus of subgrade reaction for use in design of foundations is based on ranges of values for soil types provided by Foundation Analysis and Design by Joseph E Bowles.[1] Equation 1 should be used for footings on sandy soils. Foundations on clay soils should employ Equation 2. Equation 3 is for rectangular footings having dimensions B and mB. Ks1 is the modulus of subgrade reaction from the source referenced above based on a 1 foot x 1 foot square plate. Based on the subsurface fine soils, a K_{s1} value 85 kcf can be used for the project. *(Please, note that the above modulus of subgrade reaction is an estimate since plate bearing tests cannot be performed until the building pads have been constructed.)*

Equation (1) $k_{sf} = K_{s1} \times \left(\frac{B+1}{2B}\right)^2$

Equation (2) $\mathrm{k_{sf}} = \mathrm{K_{s1}} / \mathrm{B}$

Equation (3) $k_{sf} = K_{s1} \times \frac{m+.5}{1.5 \times m}$

An allowable bearing value of 1500 psf shall be used as a net bearing value; the weight of concrete below grade may be neglected. These bearing values may be increased by one-third (1/3) for temporary loads, such as, wind and seismic forces.

All footing excavation depths will be measured from the lowest adjacent grade of recommended bearing material. Footing depths will not be measured from any proposed elevations or grades. Any foundation excavations that are not the recommended depth <u>into</u> the recommended bearing materials will not be acceptable to this office.

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[1] Bowles, Joseph E; FOUNDATION ANALYSIS AND DESIGN; McGraw-Hill Book Company (1977); Table 9-1 pg 269

Option II: Post-Tension Slab Foundation

Post-tensioned slab on ground foundation systems, designed to resist damage caused by differential soil movement, may be used to support the proposed structures. Expansion Index test results indicate moderate expansion potential. The following parameters should be incorporated into the design of the post-tensioned slabs-on-ground.

Post-tensioned slab foundation systems should have continuous perimeter footings with minimum depths of 2.5 feet below the actual lowest adjacent grade as noted above. Reinforcing in the foundation system and slabs should be designed by the project structural engineer.

The estimated soil parameters provided below were generated using Volflo 1.5 software and are based on the laboratory test results. The estimated soil parameters tabulated below were calculated assuming continuous perimeter footings or moisture barriers with minimum depths of 2.5 feet below adjacent finish grades. Deviations from this depth would affect the estimated values.

Depth of continuous perimeter moisture barrier and/or foundation	Center Lift		Edge Lift	
	e_m	y_m	e_m	y_m
2.5 feet	9.0 feet	0.80 inch	4.7 feet	0.74 inch
3.5 feet	9.0 feet	0.77 inch	4.7 feet	0.48 inch

Refer to the "Earthwork Recommendations, Section C" earlier in this report for ground surface preparation requirements.

Option III: Removal and Replacement with Non-Expansive Soils

The *removal and replacement* option requires that a sufficient depth of non-expansive soils be placed over the native expansive soils so that the confining pressure reduces the estimated differential movement to an amount which can be resisted by the stiffness of conventionally designed foundations or by simplified post-tensioned systems. Imported soils should have relatively low permeability when compacted. Volflo 1.5 software was used to model the estimated differential soil movement. In the Volflo model, various thicknesses of a non-expansive layer were used, and the resultant differential soil movements were estimated.

Thickness of Non-Expansive Upper Layer	Center Lift		Edge Lift	
	e_m	y_m	e_m	y_m
3.0 feet	9.0 feet	0.43 inch	5.1 feet	0.49 inch
4.0 feet	9.0 feet	0.28 inch	5.2 feet	0.29 inch
5.0 feet	9.0 feet	0.18 inch	5.2 feet	0.15 inch

Refer to the "Earthwork Recommendations, Section C" earlier in this report for ground surface preparation requirements.

The soil parameter estimates provided above are predicated on implementation of the site preparation and site drainage recommendations. Sidewalks next to structure(s) should be doweled to the slab edges and sidewalk subgrades should be kept moist as recommended above or should be re-moistened prior to concrete placement.

Drilled piers should extend a minimum twelve feet deep when the supported structures or portions of structures could be adversely affected by differential movement caused by upward drag.

LATERAL EARTH PRESSURES

Lateral earth pressures and friction coefficients for determining the passive lateral resistance of foundations against lateral movement and the active lateral forces against retaining walls and subsurface walls, expressed as equivalent fluid pressures, are given below in Table C. Lateral earth pressures were computed assuming that backfill materials are essentially free draining and level; and that no surcharge loads or sloping backfills are present within a distance from the wall equal to or less than the height (H)* of the wall.

(H)* = the height of backfill above the lowest adjacent ground surface.

TABLE C
LATERAL EARTH PRESSURES

Case	Lateral Earth Pressures
Active	33 P.C.F.
Passive	350 P.C.F.
At-Rest	49 P.C.F.

Active Case: Active lateral earth pressures should be used when computing forces against free standing retaining walls, unrestrained at the tops. Active pressures should not be used where tilting outward of the walls is greater than .002H would not be desirable.

Passive Case: Passive lateral earth pressures should be used when computing the lateral resistance provided by undisturbed or compacted native soils against the movement of footing. When computing passive resistance, the upper one foot of embedment depth should be discounted.

At-Rest Case: At-rest pressures should be used for subsurface walls restrained at their tops by floor diaphragms or tie-backs and for retaining walls where tilting outward greater than .002 H would not be desirable.

Frictional Resistance: A friction coefficient of 0.40 may be used when computing the frictional resistance to sliding of footings, grade beams, and slabs-on-grade. Frictional resistance and passive lateral soil resistance may be combined without reduction.

SOIL CORROSIVITY

Soluble Sulfates (SO_4)

The highest Sulfate (SO_4) concentration measured was 380 ppm. Generally, soil sulfate concentrations greater than 1,500 ppm are considered to be deleterious to foundation elements (Ref: ACI 318, Section 4.3, Table 4.3.1).

Chlorides (Cl)

The highest Chloride (Cl) concentration measured was 110 ppm. Generally, chloride concentrations greater than 500 ppm are considered to be corrosive to foundation elements. (Ref: Caltrans Corrosion Guidelines / Version 1.0)

pH

The soil pH measured in a range of 8.21 to 8.30. Generally, a pH level less than 5.5 is considered to be corrosive to metals in foundation elements. (Ref: Caltrans Corrosion Guidelines/ Version 1.0).

Although preliminary test results indicate that soil corrosivity at the locations and depths tested is low to negligible, we anticipate that site grading operations will result in a blend of native and/or imported materials at finished subgrade elevations. Accordingly, additional tests should be performed after rough grading has been completed and prior to concrete design.

SLABS-ON-GROUND

Slabs-on-ground may be supported on materials prepared in accordance with the recommendations of this Geotechnical Investigation.

It is recommended, and may be required by the California Building Code, that a vapor retarder/waterproofing system be placed below the concrete slab on grade. Vapor/moisture transmission through slabs does occur and can impact various components of the structure. Waterproofing design and inspection of installation is not the responsibility of the geotechnical engineer. We do not practice in the field of water and moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged or consulted to evaluate the general and specific water and moisture vapor transmission paths and any impact on the proposed development. This person/firm should provide recommendations for mitigation of potential adverse impact of water and moisture vapor transmission on various components of the structure as deemed necessary. The actual waterproofing design shall be provided by the architect, structural engineer or contractor with experience in waterproofing.

Slab thicknesses, reinforcing, and the concrete characteristics should be in accordance with the project designers' recommendations.

Pressurized water lines should not be installed beneath slabs-on-ground. Where pressurized water lines must be routed beneath the slab, they should be routed entirely inside continuous sleeves with both ends open to the atmosphere above the slab surface. Gravity flow sewer lines may underlie slabs-on-ground, but they should be routed to the point of connection by the shortest feasible path.

LIMITATIONS, OBSERVATION AND TESTING

Conclusions and recommendations in this report are given for the proposed new school site near the intersection of Masterson Street and Paladino Drive in northeast Bakersfield, California

a. The information retrieved from the exploratory borings drilled at the subject site to a maximum depth of 51.5 feet below the existing ground surface;

b. Our laboratory testing program results;

c. Our engineering analysis based on the information defined in this report;

d. Our experience in the Kern County area.

Variations in soil type, strength and consistency may exist between specific boring locations. These variations may not become evident until after the start of construction. If such variations appear, a re-evaluation of the soils test data and recommendations may be necessary.

Unless a Geotechnical Engineer of this firm is afforded the opportunity to review plans and specifications, we accept no responsibility for compliance with design concepts or interpretations made by others with regard to foundation support, fill selection, fill placement or other recommendations presented in this report.

Changes in conditions of the subject property can occur with time because of natural processes or the works of man on the subject site or on adjacent properties. Changes in applicable engineering and construction standards can also occur as the result of legislation or from the broadening of knowledge. Accordingly, the finding of this report may be invalidated, wholly or in part, by changes beyond our control. Therefore, this report is subject to review and should not be relied upon without review after a period of two years or after any modifications to the site.

REVIEW OF EARTHWORK OPERATIONS

Review of earthwork operations relating to site clearing, ground stabilization, placement and compaction of fill materials, and finished grading is critical to the structural integrity of building foundation and floor systems.

While the preliminary Geotechnical investigation and report provide guidelines which are used by the design team, i.e., architects, grading engineers, structural engineers, landscape engineers, etc., in completing their respective tasks, review of plans and site review and testing during earthwork operations are vital adjuncts to the completion of the Geotechnical engineer's tasks. The most prevalent cause of failure of a structure foundation system is lack of adequate review and testing during the earthwork phase of the project.

Projects rarely reach completion without some alteration being required such as may result from a change in subsurface conditions, an amendment in the size and scope of the project, a revision of the grading plans or a variation in structural details. Occasionally, even minor changes can significantly affect the performance of foundations. The most prevalent secondary cause for foundation failure is inadequate implementation of Geotechnical recommendations during the formulation of foundation designs and grading plans. The error in a foundation design or an omission of a key element from a grading plan occurs most often as a result of inadequate communication between the various project consultants and -- when a change in consultants occurs -- improper transfer of authority and responsibility.[2]

It is imperative, therefore, that any revisions to the project scope, any change in structural detail, or change in consultant, be brought to the attention of Soils Engineering, Inc. to allow for timely review and revision of recommendations and for an orderly transfer of responsibility and approval.

It is the responsibility of the owner or his representative to ensure that a representative of our firm is present at all times during earthwork operations relating to site preparation and grading, so that relative compaction tests can be performed, earthwork operations can be observed and compliance with the recommendations provided herein can be established. This engineering report has been prepared within the limits prescribed to us by the client or his representative, in accordance with the generally accepted principles and practices of Geotechnical engineering. No other warranty, expressed or implied, is included or intended in this report.

Respectfully Submitted,
SOILS ENGINEERING, INC.

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[2] If the civil engineer, the soils engineer, the engineering geologist or the testing agency of record is changed during the course of the work, the work shall be stopped until the replacement has agreed to accept the responsibility within the area of his technical competence for approval upon completion of the work.

APPENDIX A

GENERAL GUIDE SPECIFICATIONS FOR EARTHWORK

1. GENERAL

1.1 Scope

These specifications and plans include all earthwork pertaining to site rough grading including, but not limited to, furnishing all labor and equipment necessary for clearing and grubbing; stripping; preparation of ground surfaces to receive fill; excavation; placement and compaction of structural and non-structural fill; disposal of excess materials and products of clearing, grubbing, and stripping; and any other work necessary to bring ground elevations to the lines and grades shown on the project plans. Wherever exist discrepancies between these guide-specifications and the earthwork recommendations in Section I of the above geotechnical report, the most stringent recommendations shall supersede.

1.2 Performance:

It shall be the responsibility of the contractor to complete all earthwork in accordance with project plans and specifications. No variance from plans and specifications shall be permitted without written approval of the Engineer-of-Record, hereinafter referred to as the "Engineer" or his designated representative, hereinafter referred to as the "Soils Engineer." Earthwork shall not be considered complete until the "engineer" has issued a written statement confirming substantial compliance of earthwork operations to these specifications and to the project plans. The contractor shall assume sole responsibility for job site conditions during earthwork operations on the project, including safety of all persons and preservation of all property. This requirement shall apply continuously and not be limited to normal working hours. The contractor shall defend, indemnify, and hold harmless the owners, engineer, and soils engineer from all liability and claims, real or alleged, arising out of performance of earthwork on this project, except from liability incurred through sole negligence of the owner, engineers, or soils engineers.

2. DEFINITIONS

2.1 Excavations:

Excavation shall be defined within the content of these specifications as earth material excavated for constructing fill embankment; grading the site to elevations shown on project plans; or placing underground pipelines, conduits, or other subsurface utilities or minor structures.

Excavations shall be made true to the lines shown on project plans and to within plus or minus one-tenth (0.1) of a foot, of grades shown on the accepted site grading plans.

2.2 Engineered Fill:

Engineered fill shall be construed within the body of these specifications as earth materials conforming to specifications provided in the soils or geotechnical report placed to raise the grade of the site, to backfill excavations, or to construct asphaltic concrete or Portland cement concrete pavement; and upon which the soils engineer has performed sufficient tests and has made sufficient observation during placement and compaction to enable him to issue a written statement confirming substantial conformance of the work to project earthwork specifications.

2.3 On-Site Material:

On-site material is earth material obtained in excavation made on the project site.

2.4 Imported Material:

Imported materials are earth materials obtained off the site, hauled in, and placed as fill.

2.5 "Compaction" or "Compacted:"

Wherever expressed or implied within the context of these specifications shall be interpreted as compaction to ninety (90) percent of the maximum density obtainable by ASTM Test Method D1557.

2.6 Grading Plane:

The grading Plane is the surface of the basement material upon which the lowest layer of subbase, base, asphaltic or Portland cement concrete, surfacing, or another specified layer is placed.

3. SITE CONDITIONS

The contractor shall visit the site, prior to bid submittal, to explore existing subsurface conditions; to survey site topographic, and to define the nature of materials that may be encountered while performing its work under this contract. Moreover, the contractor shall make his own interpretation of the contents of the Geotechnical Report, as they pertain to said conditions. The contractor shall assume all liability under the contract for any loss sustained as a result of variations which may exist between specific soil boring locations or changed conditions resulting from natural or man-made circumstances occurring after the date of the Preliminary Field Investigations.

4. CLEARING AND GRUBBING

4.1 Clearing and Grubbing

Clearing and grubbing shall consist of removing all debris such as metal, broken concrete, trash, vegetation growth and other biodegradable substances, from all areas to be graded. Existing obstructions below shall be removed in accordance with the following procedures:

4.1.1 Slabs and Pavements - Shall be completely removed. Asphaltic or Portland Cement, concrete fragments may be used in engineered fills provided they are broken down to a maximum dimension of six (6.0) inches and thoroughly dispersed within a friable soil matrix. Engineered fill containing said fragments should not be placed above the elevation of the bottom of the lowest structure footing.

4.1.2 Foundations - Existing at the time of grading shall be removed to a depth not less than two (2.0) feet below the bottom of the lowest structure footing.

4.1.3 Basements, Septic Tanks – Buried concrete containers of similar construction located within areas destined to receive pavements, structures, or engineered fills should be completely removed and disposed of off the site. Basements, septic tanks, etc., situated outside structures, or structural fill areas shall be disposed of by breaking an opening in bottoms to permit drainage, and by breaking walls down to not less than two (2.0) feet below finished subgrade.

4.1.4 Buried Utilities – Such as sewer, water and gas lines or electrical conduits to remain in service shall be re-routed to pass no closer than four (4.0) feet to the outside edge of proposed exterior footings of structures. Lines to be abandoned shall be completely removed to a minimum depth of two (2.0) feet below finished building pad grade. Concrete lines deeper than two (2.0) feet below finished building pad grade and having diameters less than six (6.0) inches can be crushed in place.

4.1.5 Root Systems – Shall be completely removed to a minimum depth of two (2.0) feet below the bottom of the lowest proposed structure footing or to two (2.0) feet below finished subgrade, whichever depth is lower. Root systems deeper than the elevation indicated above shall be excavated to allow no roots larger than two (2.0) inches in diameter.

4.1.6 Cavities – Resulting from clearing and grubbing or cavities existing on the site because of man-made or natural activity shall be backfilled with earth materials placed and compacted in accordance with Sections 5.3 and 5.4 of these specifications.

4.1.7 Preservation or Monuments, Construction Stakes, Property Corner Stakes, or other temporary or permanent horizontal or vertical control reference points shall be the responsibility of the contractor. Where these markers are disturbed, they shall be replaced at the contractor's expense.

5. SITE GRADING

Site grading shall consist of excavation and placement of fills to lines and grades shown on the project plans and in accordance with project specifications and recommendations of this report, whichever is more stringent. The following are recommendations issued in this report:

5.1 Areas to Receive Fill:

5.1.1 Surfaces to receive fill shall be scarified to a depth of at least six (6.0) inches, or as recommended in this report, whichever is greater, until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the equipment to be used.

5.1.2 After the area to receive fill has been cleared and scarified, it shall be moistened and compacted to a depth of at least six (6.0) inches in accordance with specifications for compacting fill material in paragraph 5.4, below.

5.2 Excavation:

5.2.1 Excavations shall be cut to elevations plus or minus 0.1 foot of the grades shown on the accepted plans.

5.2.2 When excavated materials are to be used in engineered fill, the excavation shall be made in a manner to produce as much mixing of the excavated materials as practicable.

5.2.3 When excavations are to be backfilled, and where surfaces exposed by excavation are to support structures or concrete floor slabs, the exposed surfaces shall be scarified, moistened and compacted, as stated above, for areas to receive fill. Over excavation below specified depths will not eliminate the requirement for exposed surface compaction.

5.3 Fill Materials:

5.3.1 Materials obtained from on-site excavations will be considered satisfactory for construction of on-site engineered fills, unless otherwise stated in the Soils Report or Foundation Investigation. If unexpected pockets of poor or weak materials are encountered in excavations, and they cannot be upgraded by mixing with other materials or by other means, they may be rejected by the soils engineer for use in engineered fill. Rocks larger than 12 inches in size in any dimension shall not be allowed in the proposed building area. If a large amount of rocks greater than 12 inches in size in any dimension is encountered, a rock disposal area shall be located on the grading plan. Rocks shall be mixed with well-graded soils to assure that the voids in these areas will fill properly.

5.3.2 When imported fill materials are necessary to bring the site up to planned grades, no material shall be imported prior to its approval and acceptance by the soils engineer.

5.3.2 The soils engineer shall be given notice of the proposed source of imported materials with adequate time allowance for his testing of the proposed materials. The time required for testing will vary with different types of materials, job conditions, and ultimate function of filled areas. Under best conditions the time requirement will not be less than 48 hours.

5.4 Placing, Spreading, and Compacting Fill Material:

5.4.1 The fill materials shall be placed in layers which, when compacted, shall not exceed six (6.0) inches in thickness. Each layer shall be spread evenly and shall be thoroughly mixed during the spreading to insure uniformity of material in each layer. Increased thickness of layers may be approved by the soils engineer when conditions warrant.

5.4.2 All fills shall be placed in level layers; layers shall be continuous over the area of any structural unit, and all portions of the fill shall be brought up simultaneously within the area of any structural unit. When imported material is used, it must be placed so that its thickness is as uniform as possible within the area of any structural unit.

5.4.3 When materials are to be excavated and replaced in a compacted condition, segmented, or leap-frogging of cut-fill operations within the area of any structural unit will not be permitted unless the method is specifically described by the soils engineer.

5.4.4 When the moisture content of fill material is below the lower limit specified by the Soils Engineer, water shall be added until the moisture content is as specified; and when it is above the upper limit specified, the material shall be aerated by blading or other satisfactory methods until the moisture content is as specified.

5.4.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted to not less than ninety (90) percent of maximum density in accordance with ASTM Density Test Method D1557. Compaction shall be by equipment of such design that it will be able to compact the fill to specified density. When the soils engineer specifies a specific type of compaction equipment to be used, such equipment shall be used as specified.

5.4.6 Compaction of each layer shall be continuous over its entire area and the equipment shall make sufficient trips to ensure that the desired density has been obtained.

5.4.7 Field density tests shall be made by the soils engineer. The compaction of each layer of fill shall be subject to testing. Where sheepsfoot rollers are used, the soil may be disturbed to a depth of several inches.

Density tests shall be taken in the compacted material below the disturbed surface. When tests indicate the density of any layer of fill or portion thereof is below the required ninety (90) percent density, the layer or portion shall be re-worked until the required density has been obtained.

5.4.8 When the soils engineer specifies compaction to other standards or to percentages other than ninety (90) percent, such specification, with respect to the items, shall supersede these specifications.

5.4.9 The fill operation shall be continued in six (6) inch compacted layers, as specified above, until the fill has been brought to within 0.1 foot, plus or minus, of the finished slopes and grades, as shown on the accepted plans. The finished surface of fill areas shall be graded or bladed to a smooth and uniform surface and no loose material shall be left on the surface.

5.4.10 No fill materials shall be placed, spread, or compacted while it is frozen or thawing or during unfavorable weather conditions. When work is interrupted by weather conditions, fill operations shall not be resumed until the soils engineer indicates that moisture content and density of previously placed fill are satisfactory.

5.5 <u>Observations and Testing:</u>

5.5.1 The soils engineer shall be provided with a 48-hour notice, in order that he may be present at the site during all earthwork activities related to excavation, tree root removal, stripping, backfill, and compaction and filling of the site and to perform periodic compaction tests so that substantial conformance to these recommendations can be established.

APPENDIX B

FIELD INVESTIGATION

Our initial investigation included 21 test borings drilled at the subject site and terminated at a maximum depth of 51.5' feet below the existing ground surface. Borings were advanced using an eight (8.0) inch hollow-stem auger. Test data and descriptions from these holes form the basis of the conclusions and recommendations contained in this report.

Undisturbed samples and disturbed bulk samples were obtained. Undisturbed samples were taken using either a 2-3/8" (inside diameter) split-barrel sampler or a 1-3/8" (inside diameter), 2" (outside diameter) Standard Penetration Sampler (SPT). Penetration resistance of undisturbed soils was obtained by driving the above described sampler using a one-hundred forty pound hammer falling a distance of thirty (30.0) inches and recording blow counts for each six (6.0) inch increment of drive on Test Boring Logs. In addition, bulk soil samples, selected as most representative of near surface soils encountered, were taken for laboratory testing.

As drilling progressed, earth materials encountered were logged and classified in accordance with the Unified Soils Classification System and presented graphically on Logs of Test Borings, Figures 2 through 22, along with the Legend.

Approximate locations of test borings from our initial investigation are shown on the Boring Location Map, Figure 1.

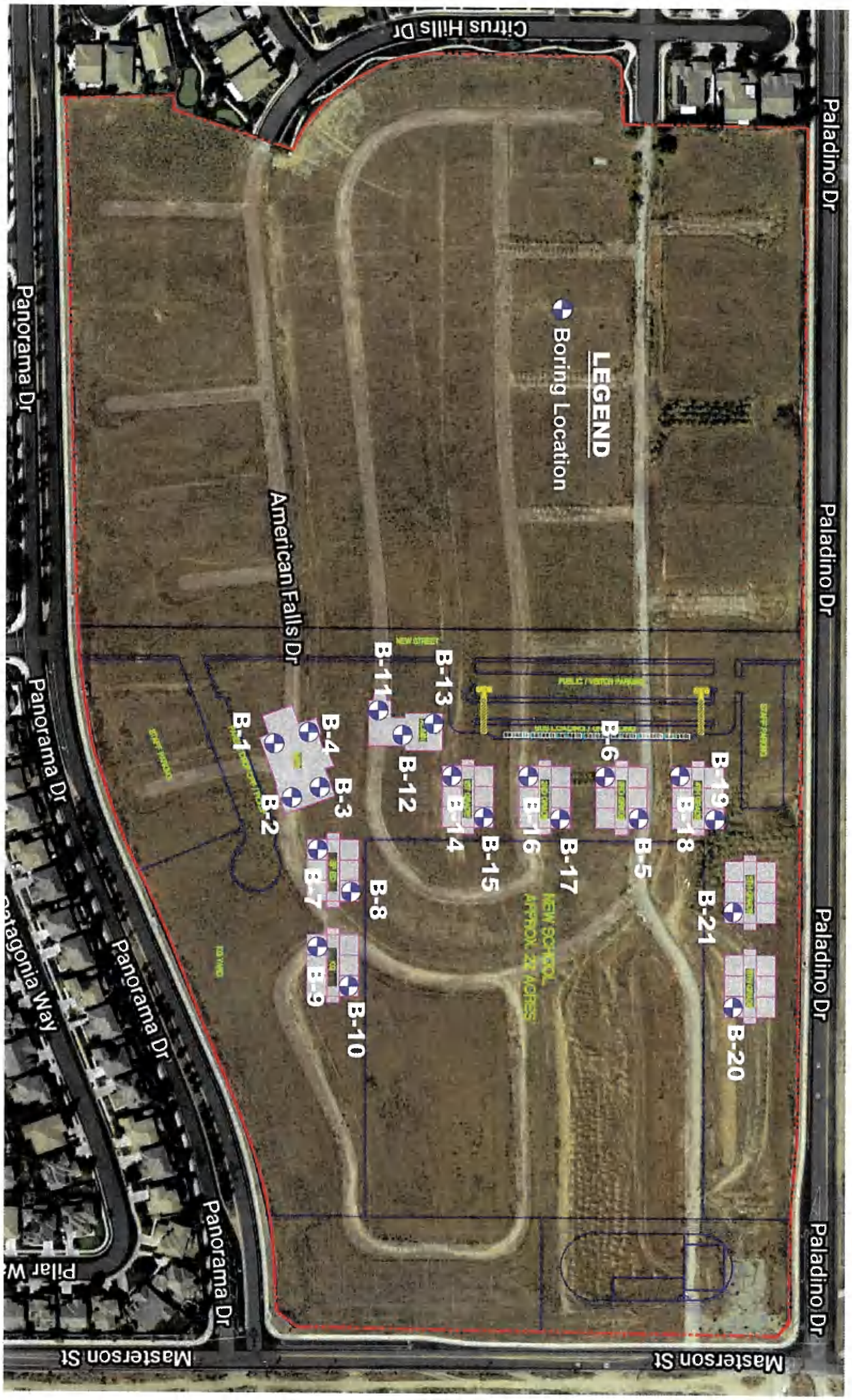

LEGEND
Boring Location
Citrus Hills Dr
Paladino Dr
Panorama Dr
American Falls Dr
Patagonia Way
Pilar Way
Masterson St
NEW STREET
PUBLIC / VISITOR PARKING
STAFF PARKING
NEW SCHOOL APPROX. 22 ACRES
B-1
B-2
B-3
B-4
B-5
B-6
B-7
B-8
B-9
B-10
B-11
B-12
B-13
B-14
B-15
B-16
B-17
B-18
B-19
B-20
B-21

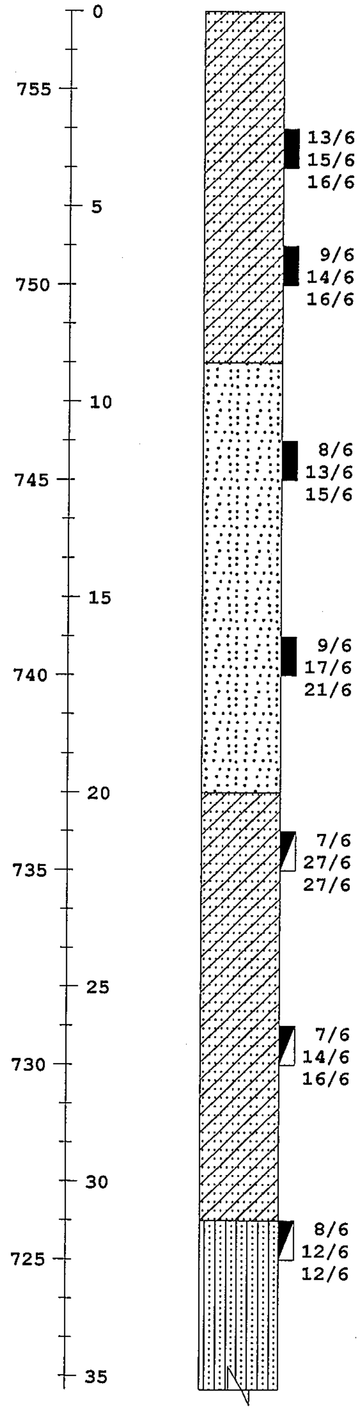
Figure 1

LOG OF TEST BORING
BORING B-1

Page 1 of 2

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/24/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ≚ **:** *N/A* **CAVING -** ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/23/19*
FINISH: *9/23/19*
LOGGER: *M. WATTS*

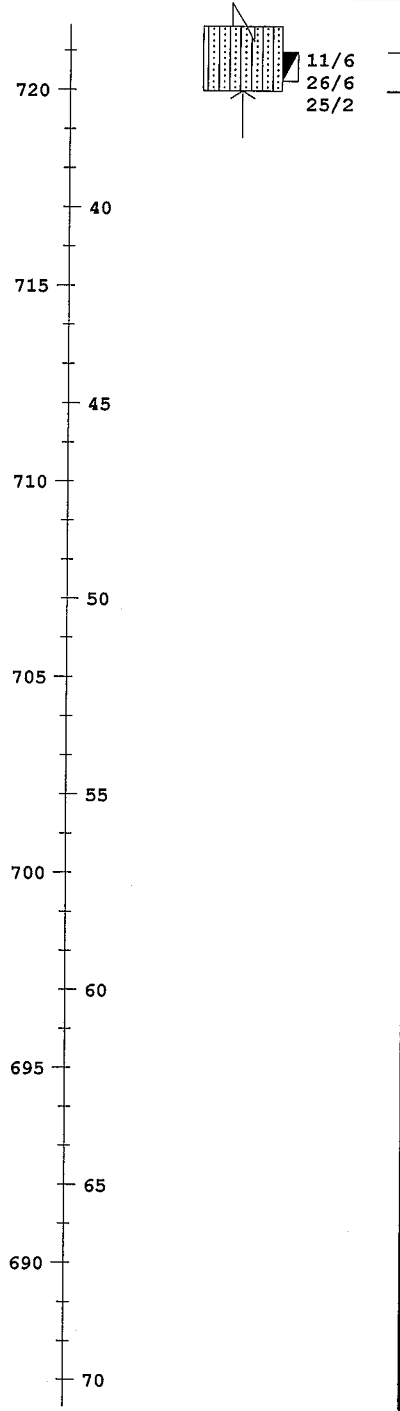


ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; light reddish-brown; dry; low plasticity.			
	13/6 15/6 16/6		Dense.		109.5	5.3
	9/6 14/6 16/6				118.1	4.8
		SP	POORLY GRADED SAND; light yellowish-brown; dry; fine to medium.			
	8/6 13/6 15/6		Medium dense; fine.		113.0	1.4
	9/6 17/6 21/6		Dense.		101.8	1.3
		SC	CLAYEY SAND; yellowish-brown; dry to damp; low plasticity.			
	7/6 27/6 27/6		Very dense.			7.3
	7/6 14/6 16/6		Dense.			7.4
	8/6 12/6 12/6	SM	SILTY SAND; light yellowish-brown; medium dense; cohesive; trace of gravel.			3.4

LOG OF TEST BORING
BORING B-1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/24/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ≑ : *N/A* **CAVING - ➤ :** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/23/19*
FINISH: *9/23/19*
LOGGER: *M. WATTS*



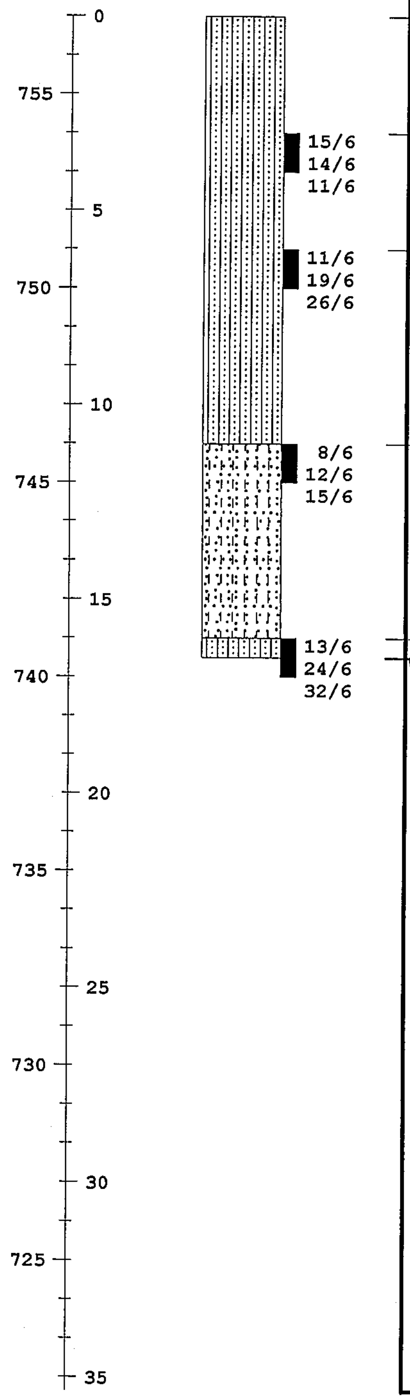
ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	11/6 26/6 25/2		Dense; rock.	Sampler bouncing on rock.		1.2
			BOTTOM. Refusal at 37' due to rock.			

LOG OF TEST BORING
BORING B-2

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/24/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ≡ **:** *N/A*
CAVING - ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/23/19*
FINISH: *9/23/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SM	SILTY SAND; light reddish-brown; trace of clay; dry; fine.			
	15/6 14/6 11/6		Medium dense.		110.4	3.4
	11/6 19/6 26/6		Dense.		119.4	1.1
	8/6 12/6 15/6	SP-SM	POORLY GRADED SAND with low fine content; yellowish-brown; non cohesive; medium dense; fine to medium.		108.5	2.8
	13/6 24/6 32/6	SM	SILTY SAND; yellowish-brown; dry to damp; very dense; fine.		120.3	5.1
			BOTTOM.			

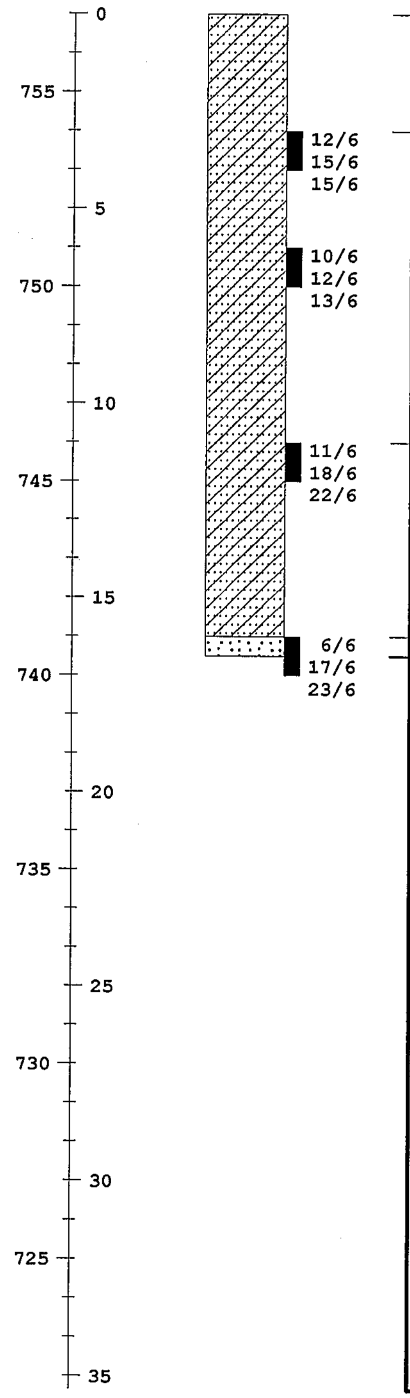
Figure Number 3

LOG OF TEST BORING
BORING B-3

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/24/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ▽ **:** *N/A*
CAVING - ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/23/19*
FINISH: *9/23/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; reddish-brown; dry to damp; low plasticity.			
	12/6 15/6 15/6		Medium dense.		98.7	6.3
	10/6 12/6 13/6				109.4	3.3
	11/6 18/6 22/6		Dense.		108.2	1.5
	6/6 17/6 23/6	SP	POORLY GRADED SAND; light yellowish-brown; non cohesive; dense.		102.1	1.4
			BOTTOM.			

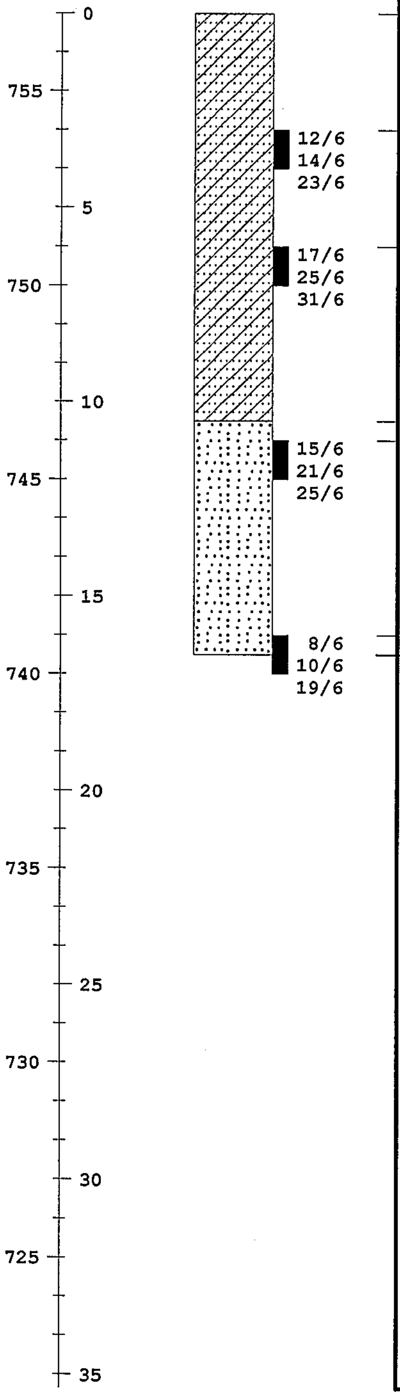
Figure Number 4

SOILS ENGINEERING, INC.

LOG OF TEST BORING
BORING B-4

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/26/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ▼ **:** *N/A*
CAVING - ► **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/24/19*
FINISH: *9/24/19*
LOGGER: *M. WATTS*



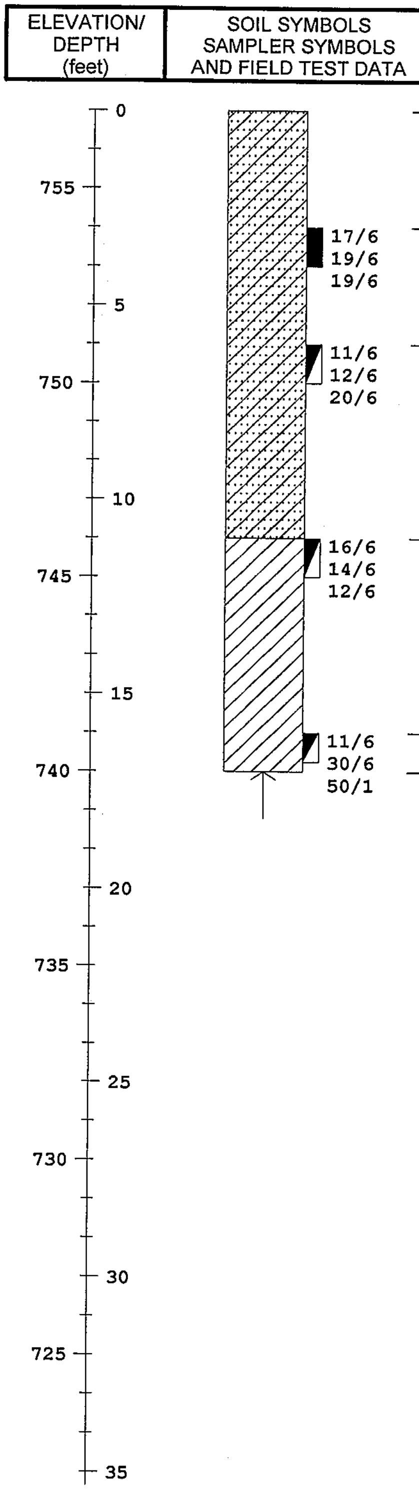
ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; light reddish-brown; dry; low plasticity.			
	12/6 14/6 23/6		Dense.		110.6	7.7
	17/6 25/6 31/6		Very dense		104.6	6.1
	15/6 21/6 25/6	SP	POORLY GRADED SAND; light yellowish-brown; dry; fine to medium. Dense.		113.8	1.5
	8/6 10/6 19/6		Medium dense; fine. BOTTOM.		100.8	1.8

LOG OF TEST BORING
BORING B-5

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/26/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊽ **:** *N/A*
CAVING - ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/24/19*
FINISH: *9/24/19*
LOGGER: *M. WATTS*

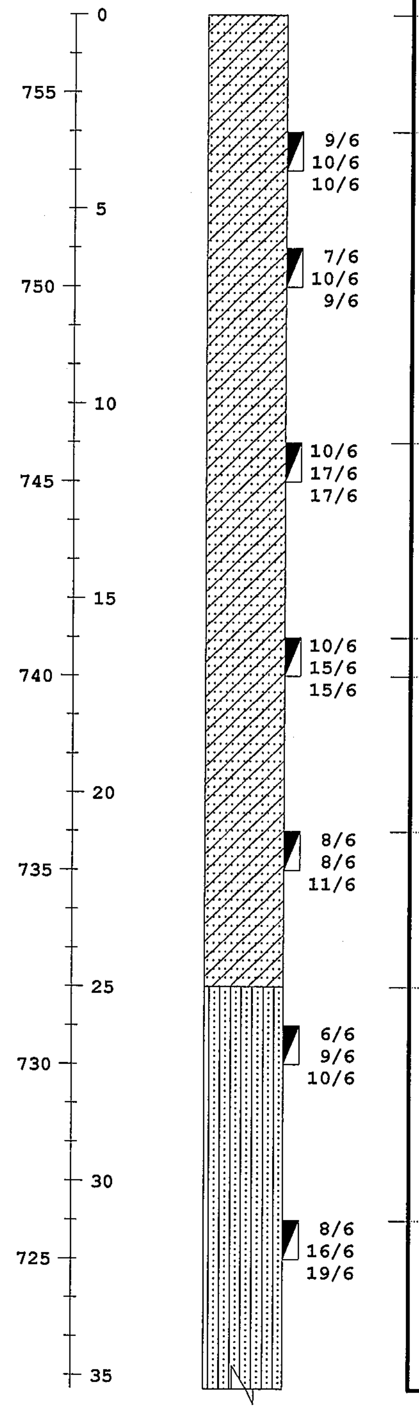


USCS	Description	Remarks	Density pcf	Moisture %
SC	CLAYEY SAND; light reddish-brown; dry; low plasticity.			
	Dense.		114.8	4.6
	Slow drilling due to rock.			5.0
CL	SILTY CLAY; yellowish-brown; dry; very stiff; low plasticity.			4.7
	Hard; rock.			3.1
	BOTTOM. Refusal due to rock at 17'.	Rock snapped off center stem bit and chewed up auger bit.		

LOG OF TEST BORING
BORING B-6

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ≑ **:** *N/A*
CAVING - ➧ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/30/19*
FINISH: *9/30/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; light reddish-brown; dry; low plasticity.			
	9/6 10/6 10/6		Medium dense.			7.2
	7/6 10/6 9/6					3.4
	10/6 17/6 17/6		Dense.			5.9
	10/6 15/6 15/6		Light yellowish-brown.			6.5
			Rock.			
	8/6 8/6 11/6	SC	Medium dense.			5.7
		SM	SILTY SAND; light yellowish-brown; dry to damp; fine; traces of clay.			
	6/6 9/6 10/6					11.0
	8/6 16/6 19/6		Dense.			3.9

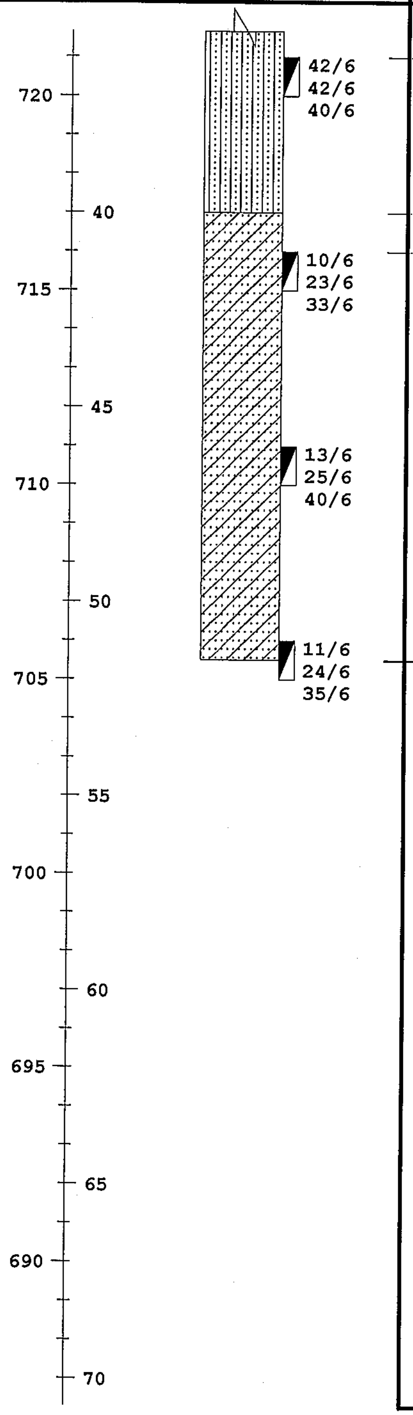
LOG OF TEST BORING

BORING B-6

Page 2 of 2

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ≡ **:** *N/A* **CAVING -** ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/30/19*
FINISH: *9/30/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
720	42/6 42/6 40/6		Very dense; rock; slow drilling.			1.3
715	10/6 23/6 33/6	SC	CLAYEY SAND; light yellowish-brown; dry to damp; low plasticity. Very dense.			10.2
710	13/6 25/6 40/6					12.3
705	11/6 24/6 35/6		BOTTOM.			12.5

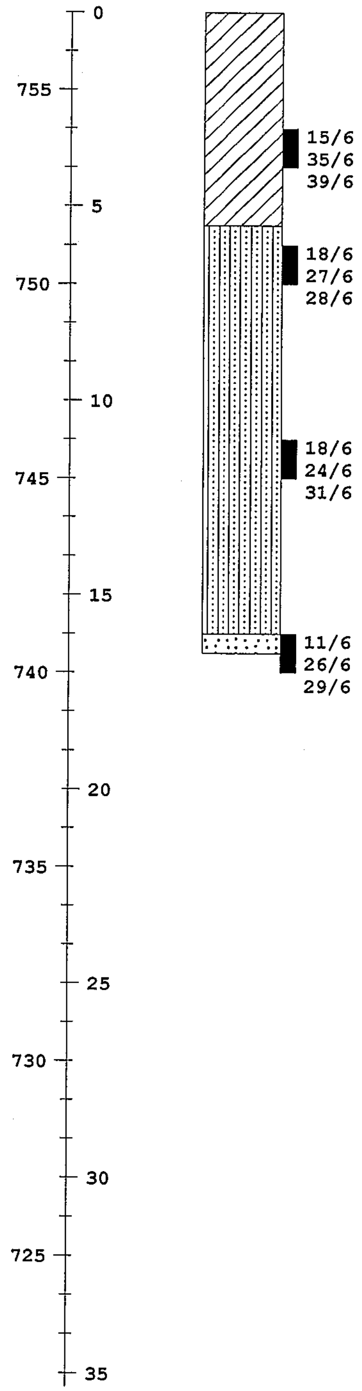
Figure Number 7

LOG OF TEST BORING
BORING B-7

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/26/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ▽ **:** *N/A*
CAVING - ► **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/24/19*
FINISH: *9/24/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		CL	SANDY CLAY; light reddish-brown; dry; low plasticity.			
	15/6 35/6 39/6		Reddish-brown; hard.		121.2	7.7
	18/6 27/6 28/6	SM	SILTY SAND; light reddish-brown; dry to damp; fine; traces of clay.		115.0	3.5
			Very dense.			
	18/6 24/6 31/6				114.6	4.5
	11/6 26/6 29/6	SP	POORLY GRADED SAND; light brown; non cohesive; very dense, dry.		112.5	1.9
			BOTTOM.			

Figure Number 8

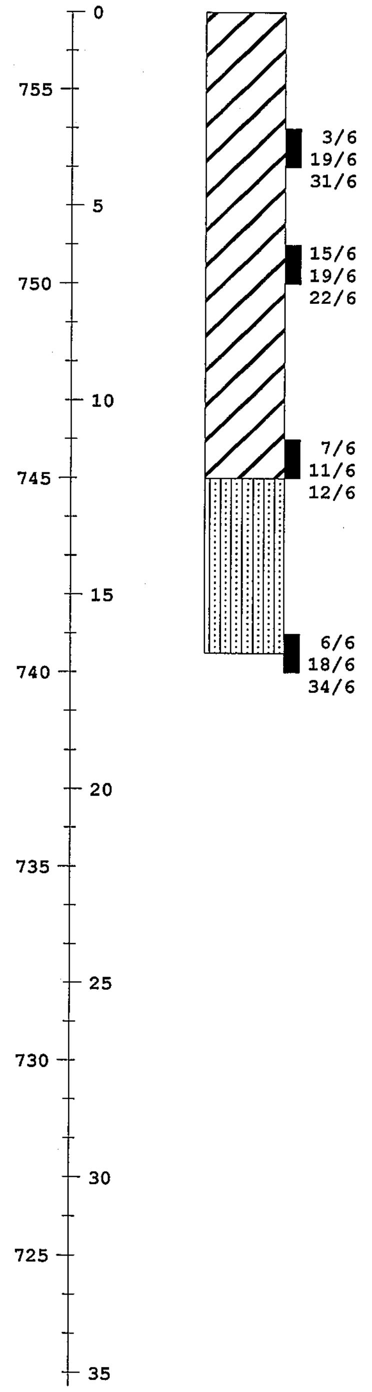
SOILS ENGINEERING, INC.

LOG OF TEST BORING
BORING B-8

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/26/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊻ : *N/A*
CAVING - ➤ : *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/24/19*
FINISH: *9/24/19*
LOGGER: *M. WATTS*



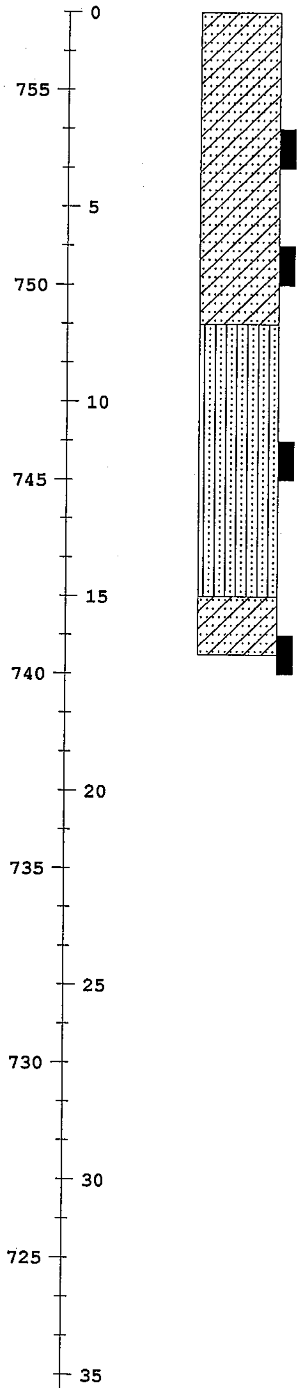
ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		CH	SANDY CLAY; light reddish-brown; dry; high plasticity.			
	3/6 19/6 31/6		Hard.		115.5	6.3
	15/6 19/6 22/6				110.8	3.3
	7/6 11/6 12/6		Very stiff.		100.3	1.2
		SM	SILTY SAND; light yellowish-brown; dry; fine; nose cone.			
	6/6 18/6 34/6		Very dense.		112.4	6.1
			BOTTOM.			

Figure Number 9

LOG OF TEST BORING
BORING B-9

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/27/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊽ : *N/A* **CAVING - ➧ :** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/26/19*
FINISH: *9/26/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; yellowish-brown; dry; low plasticity.			
	10/6 13/6 17/6		Dense.		111.6	7.7
	13/6 18/6 21/6				113.9	8.0
		SM	SILTY SAND; yellowish-brown; dry to damp; fine.			
	7/6 10/6 12/6		Medium dense.		110.2	4.6
	6/6 22/6 38/6	SC	CLAYEY SAND; yellowish-brown; damp; low to medium plasticity.		123.5	13.5
			Very dense.			
			BOTTOM.			

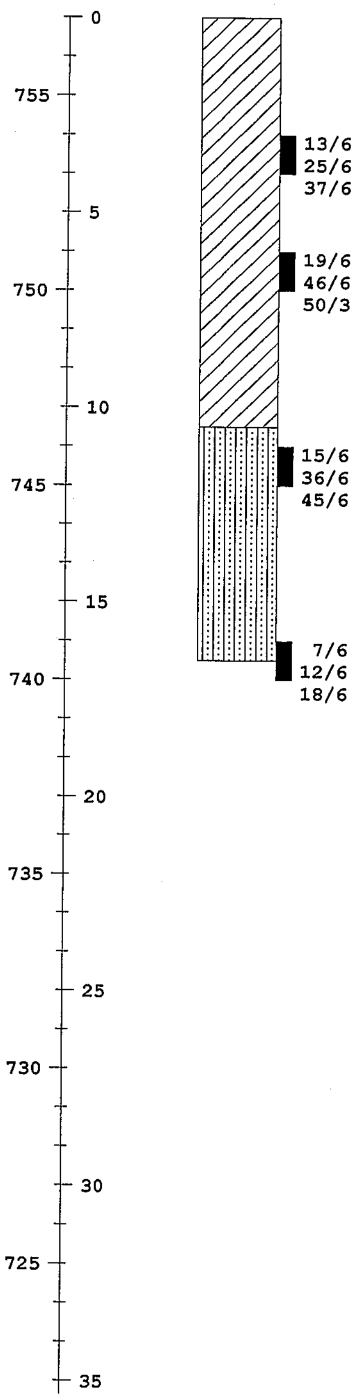
LOG OF TEST BORING
BORING B-10

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: */19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊻ : *N/A*   **CAVING - ➤ :** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/26/19*
FINISH: *9/26/19*

LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		CL	SANDY CLAY; reddish-brown; dry to damp; low to medium plasticity.			
	13/6 25/6 37/6		Hard.		125.4	10.1
	19/6 46/6 50/3				121.5	9.1
	15/6 36/6 45/6	SM	SILTY SAND; light reddish-brown; dry; fine; traces of clay. Very dense.		123.5	4.1
	7/6 12/6 18/6		Dense.		102.7	2.4
			BOTTOM.			

Figure Number 11

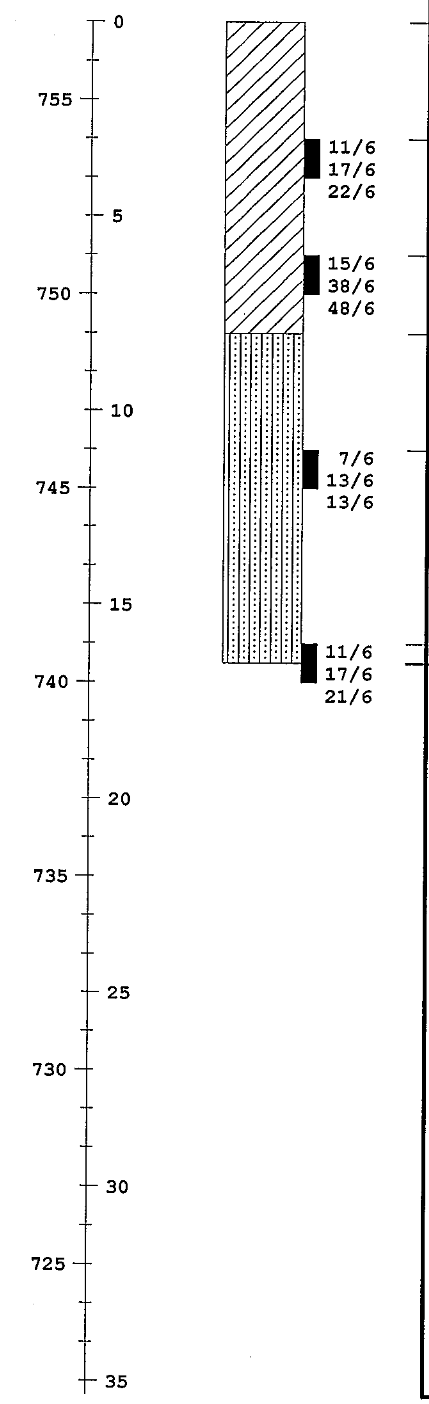
LOG OF TEST BORING
BORING B-11

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/27/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ▽ : *N/A* **CAVING - ➤ :** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/26/19*
FINISH: *9/26/19*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet) | SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA



USCS	Description	Remarks	Density pcf	Moisture %
CL	SANDY CLAY; light reddish-brown; dry; low plasticity.			
	Hard.		113.2	11.4
	Rock.		104.7	5.3
SM	SILTY SAND; light yellowish-brown; dry; fine to medium.			
	Medium dense.		110.9	2.5
	Dense.		106.6	1.7
	BOTTOM.			

Figure Number 12

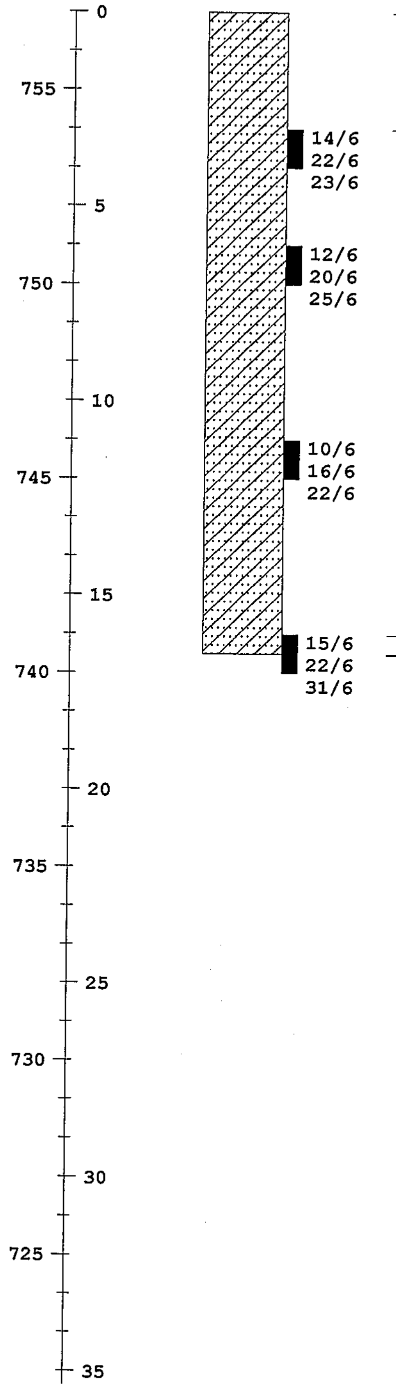
LOG OF TEST BORING
BORING B-12

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/27/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ≡ **:** *N/A*
CAVING - ► **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/26/19*
FINISH: *9/26/19*

LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; light reddish-brown; dry; low plasticity.			
	14/6 22/6 23/6		Dense.		109.6	8.3
	12/6 20/6 25/6				112.9	9.1
	10/6 16/6 22/6				112.0	2.4
	15/6 22/6 31/6		Very dense.		111.1	1.6
			BOTTOM.			

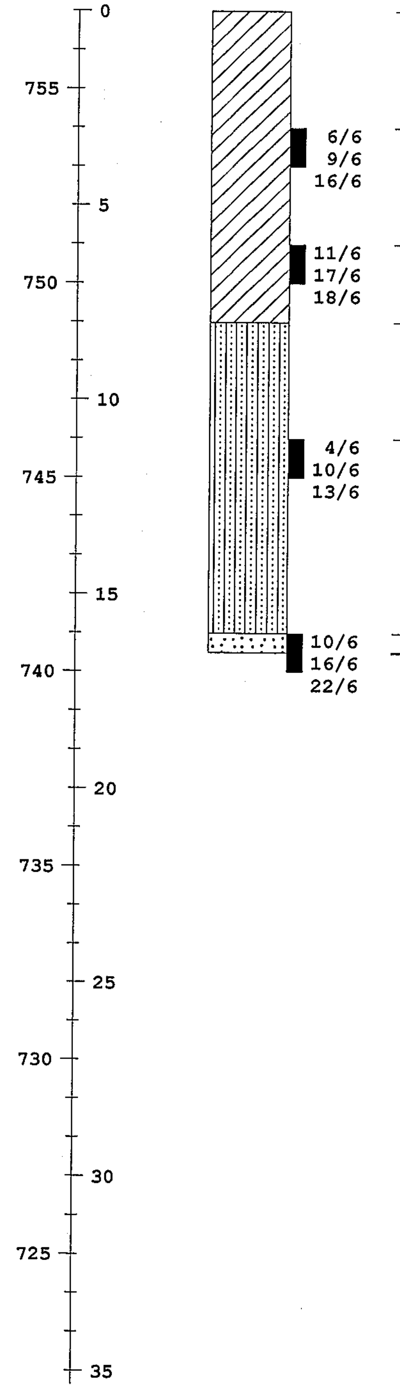
Figure Number 13

LOG OF TEST BORING
BORING B-13

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *9/27/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊻ : *N/A*
CAVING - ➧ : *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/26/19*
FINISH: *9/26/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		CL	SANDY CLAY; light reddish-brown; dry; low plasticity.			
	6/6 9/6 16/6		Very stiff.		99.0	9.3
	11/6 17/6 18/6		Hard.		105.6	6.7
		SM	SILTY SAND; light yellowish-brown; dry; fine to medium.			
	4/6 10/6 13/6		Medium dense.		110.2	1.8
	10/6 16/6 22/6	SP	POORLY GRADED SAND; light yellowish-brown; non cohesive; dense.		107.2	2.2
			BOTTOM.			

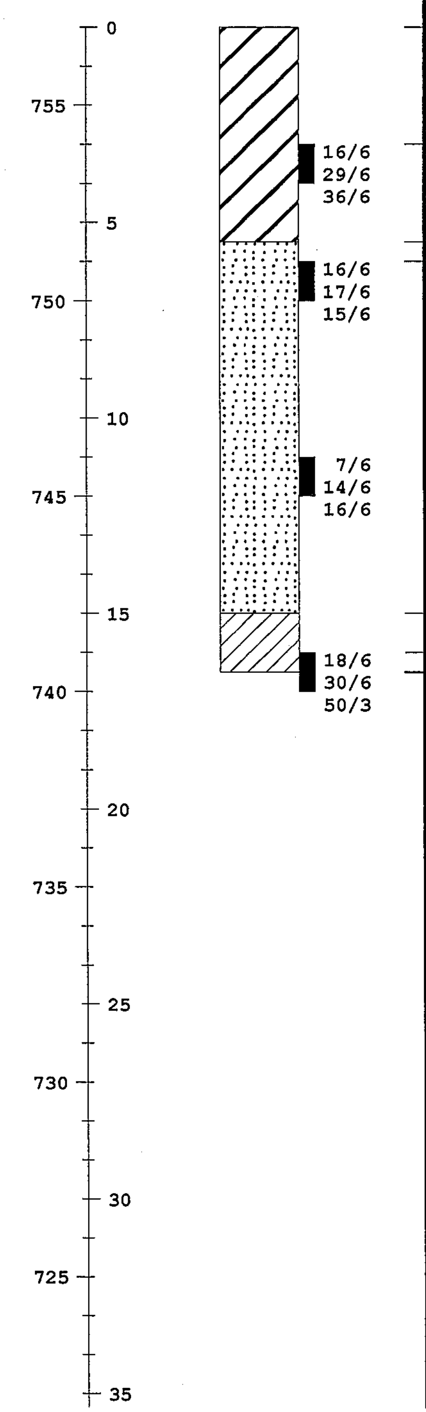
Figure Number 14

LOG OF TEST BORING
BORING B-14

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊽ **:** *N/A*
CAVING - ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/27/19*
FINISH: *9/27/19*
LOGGER: *M. WATTS*

ELEVATION/ DEPTH (feet) — SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA



USCS	Description	Remarks	Density pcf	Moisture %
CH	SANDY CLAY; light reddish-brown; dry; high plasticity.			
	Hard; rock.		119.2	7.5
SP	POORLY GRADED SAND; light reddish-brown; dry; fine; traces of clay.		110.5	4.8
	Dense; slow drilling due to rock.			
			104.9	2.1
CL	SANDY CLAY; light reddish-brown; dry; low to medium plasticity.		130.3	8.7
	Hard.			
	BOTTOM.			

Figure Number 15

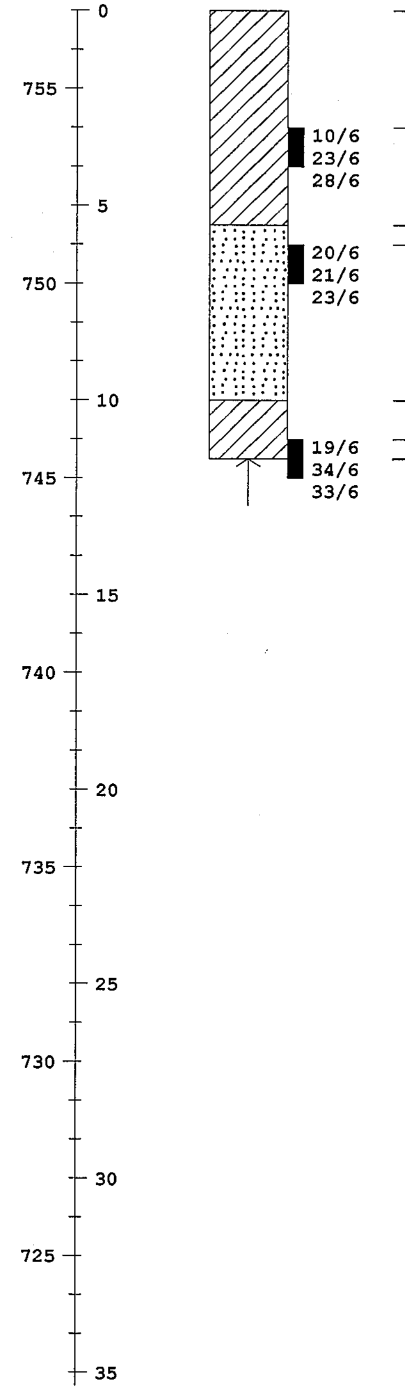
LOG OF TEST BORING

BORING B-15

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊻ **:** *N/A*
CAVING - ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/27/19*
FINISH: *9/27/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		CL	SANDY CLAY; light reddish-brown; dry; low to medium plasticity.			
	10/6 23/6 28/6		Hard; rock.		124.9	12.1
	20/6 21/6 23/6	SP	POORLY GRADED SAND; light yellowish-brown; dry; fine; traces of clay.		104.7	5.3
			Dense.			
	19/6 34/6 33/6	CL	CLAY; reddish-brown; dry to damp; low to medium plasticity.		113.2	12.7
			Hard.			
			BOTTOM. Refusal due to hard/ tight drilling.			

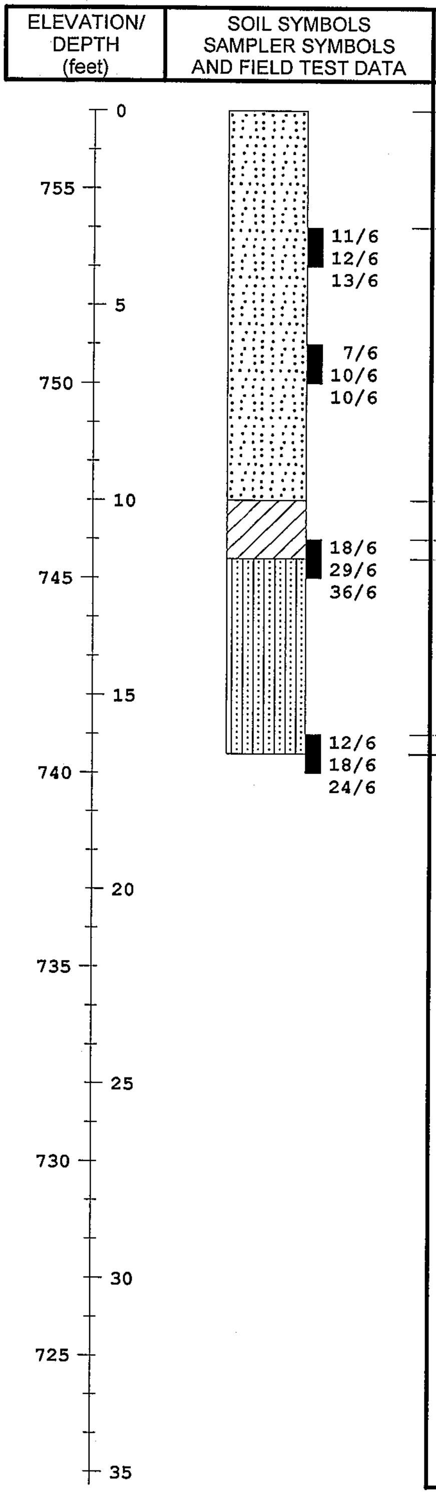
Figure Number 16

LOG OF TEST BORING
BORING B-16

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⚲ : *N/A*
CAVING - ➤ : *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/30/19*
FINISH: *9/30/19*
LOGGER: *M. WATTS*

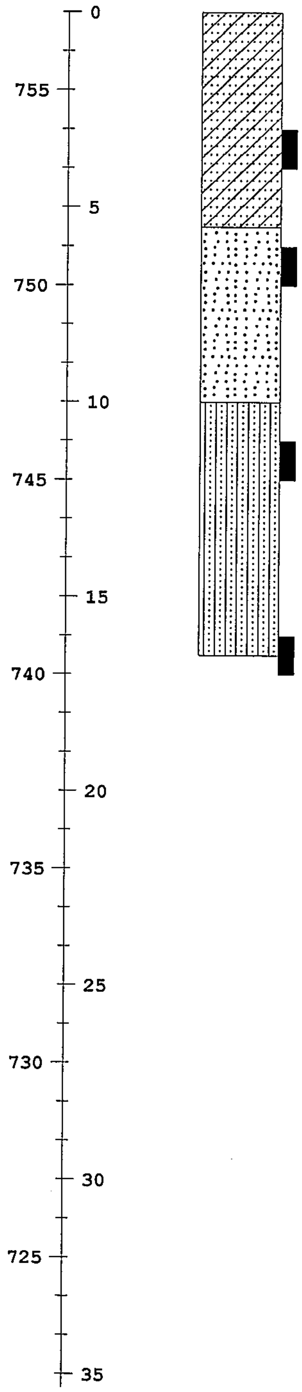


USCS	Description	Remarks	Density pcf	Moisture %
SP	POORLY GRADED SAND; light reddish-brown; dry; fine; traces of clay.			
	Medium dense.		108.1	3.0
			104.2	2.3
CL	SANDY CLAY; reddish-brown; damp; low plasticity.			
	Very dense.		115.7	6.9
SM	SILTY SAND; light yellowish-brown; dry; fine; clay.			
	Dense.		116.8	10.7
	BOTTOM.			

LOG OF TEST BORING
BORING B-17

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊽ : *N/A*
CAVING - ➤ : *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *9/30/19*
FINISH: *9/30/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		SC	CLAYEY SAND; light reddish-brown; dry; low plasticity.			
	15/6 27/6 32/6		Very dense.		95.2	14.8
	13/6 17/6 21/6	SP	POORLY GRADED SAND; light reddish-brown; dry; fine to medium.		114.7	3.0
			Dense.			
	11/6 18/6 34/6	SM	SILTY SAND; yellowish-brown; dry to damp; fine; traces of clay.		118.7	5.8
			Very dense; rock.			
	16/6 19/6 18/6		Dense.		108.0	7.1
			BOTTOM.			

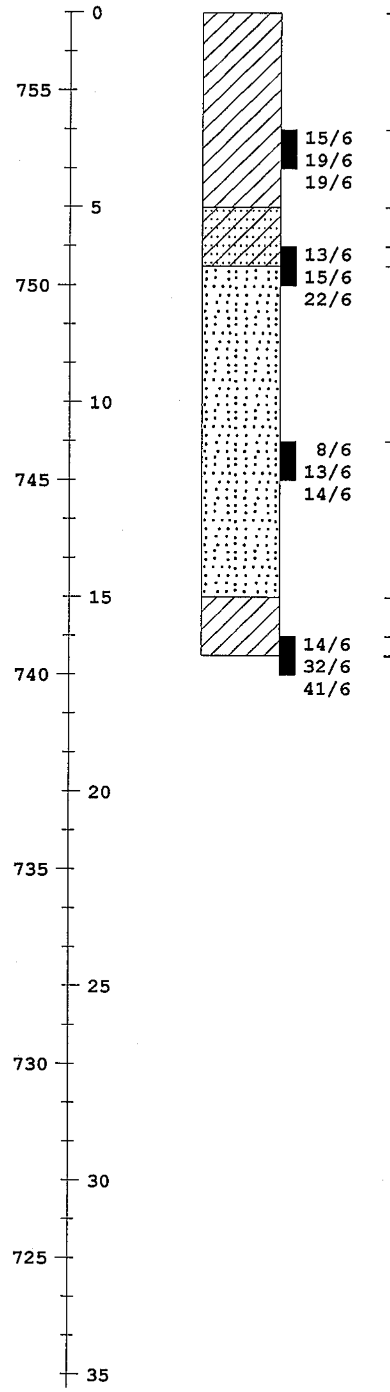
Figure Number 18

LOG OF TEST BORING
BORING B-18

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ≡ : *N/A*
CAVING - ➧ : *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *10/1/19*
FINISH: *10/1/19*
LOGGER: *M. WATTS*



SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	CL	CLAY; light reddish-brown; dry; low plasticity.			
15/6 19/6 19/6		Hard.		96.9	18.8
13/6 15/6 22/6	SC	CLAYEY SAND; reddish-brown; dry to damp; fine to medium. Dense.		108.8	5.5
	SP	POORLY GRADED SAND; light yellowish-brown; dry; fine to medium; nose cone.			
8/6 13/6 14/6		Medium dense.		110.5	1.5
14/6 32/6 41/6	CL	CLAY; reddish-brown; dry to damp; low to medium plasticity. Hard.		101.5	1.5
		BOTTOM.			

Figure Number 19

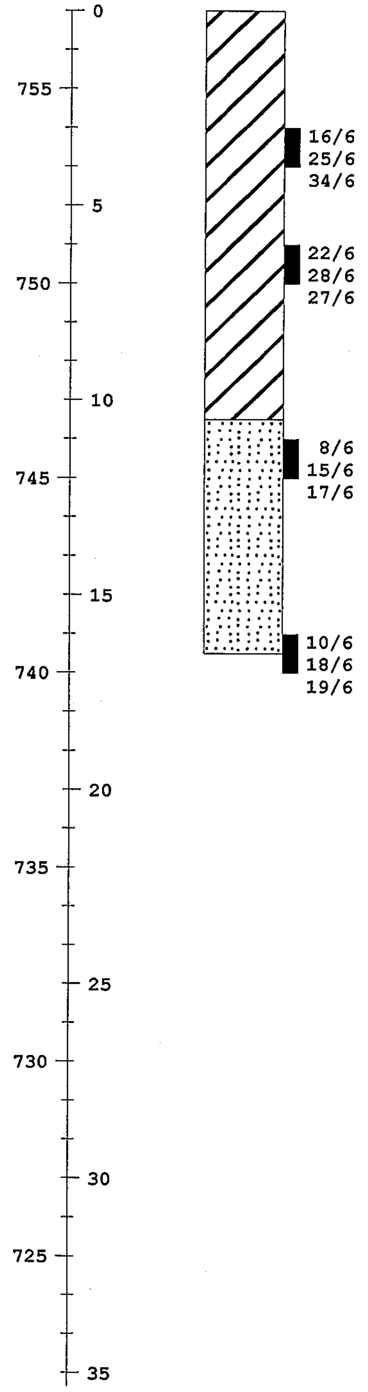
SOILS ENGINEERING, INC.

LOG OF TEST BORING
BORING B-19

Page 1 of 1

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ▼ **:** *N/A*
CAVING - ➤ **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *10/1/19*
FINISH: *10/1/19*
LOGGER: *M. WATTS*



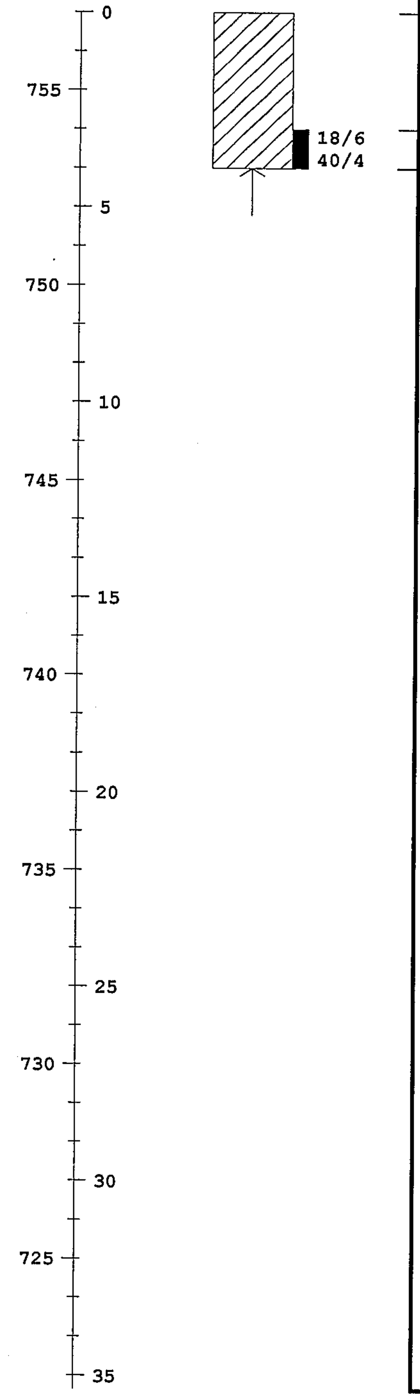
SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	CH	SANDY CLAY; light reddish-brown; dry; high plasticity.			
16/6 25/6 34/6		Hard.		108.0	8.5
22/6 28/6 27/6				116.5	4.7
8/6 15/6 17/6	SP	POORLY GRADED SAND; light yellowish-brown; dry; fine to medium. Dense.		110.5	1.5
10/6 18/6 19/6		BOTTOM.		101.5	1.5

Figure Number 20

LOG OF TEST BORING
BORING B-20

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ▼ **:** *N/A*
CAVING - ► **:** *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *10/1/19*
FINISH: *10/1/19*
LOGGER: *M. WATTS*



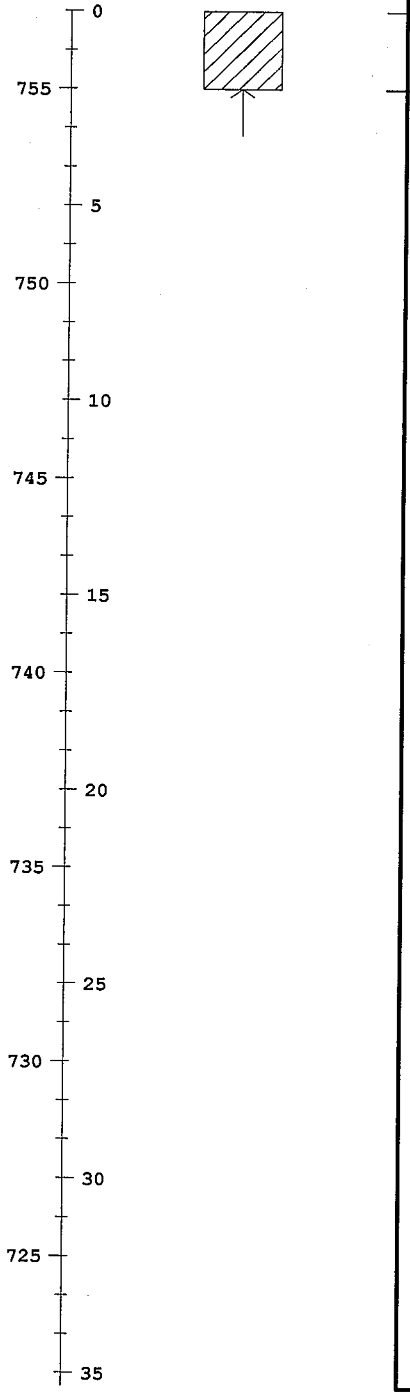
ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
		CL	SANDY CLAY; light reddish-brown; dry; low plasticity.			
	18/6 40/4		Hard; rock; minimal recovery due to rock.	Moved 3 times, - 15' E. of original & - 15' W.	97.8	3.3
			BOTTOM. Refusal due to rock.			

Figure Number 21

LOG OF TEST BORING
BORING B-21

PROJECT: *BCSD New Elementary School*
BORING DATE: *10/10/19*
BORING LOCATION: *See Boring Location Map, Figure 1*
DRILL METHOD: *4.25" I.D. Hollow-Stem Auger*
DESCRIPTION: *Geotechnical Feasibility, Geohazard & FAULT Study*
DEPTH TO WATER - ⊻ : *N/A*
CAVING - ➤ : *N/A*

FILE NO: *17179*
ELEV.: *757'*
START: *10/1/19*
FINISH: *10/1/19*
LOGGER: *M. WATTS*



ELEVATION/ DEPTH (feet)	SOIL SYMBOLS SAMPLER SYMBOLS AND FIELD TEST DATA	USCS	Description	Remarks	Density pcf	Moisture %
	▨	CL	CLAY; light reddish-brown; dry; low plasticity; rock.			
			BOTTOM. Refusal due to rock.			

Figure Number 22

KEY TO SYMBOLS

Symbol	Description
Strata symbols	
▨	Clayey sand
░	Poorly graded sand
▥	Silty sand
▦	Poorly graded sand with silt
▨	Low plasticity clay
▧	High plasticity clay
Misc. Symbols	
↑	Drill rejection
⌁	Boring continues
Soil Samplers	
■	California sampler
◩	Standard penetration test

Notes:

1. Twenty-one (21) exploratory borings were drilled between 9/23/19 and 10/1/19 using an 8-inch outside diameter hollow-stem auger.
2. No free groundwater was encountered to the maximum depth drilled of 51.5'.
3. Boring locations are shown on the Boring Location Map, Figure 1.
4. These logs are subject to the limitations, conclusions, and recommendations in this report.
5. Results of tests conducted on samples recovered are reported on the logs.

APPENDIX C

SOIL TEST DATA

SIEVE ANALYSES (ASTM D422 and/or ASTM D1140)

Grain size distributions for specimens retrieved from various subsurface elevations were tested to classify the materials. Test results are presented on Figures A-1 through A-10.

IN-SITU DENSITY & MOISTURE RELATIONSHIPS (ASTM D2216 & D2937)

Moisture & density data for undisturbed native soils was obtained by use of a 2-3/8-inch (inside diameter) split-barrel sampler. Test results are given on the Logs of Test Borings, Figures 2 through 22.

CONSOLIDATION TESTS (ASTM D2435)

Compressibility of soils was determined on saturated, undisturbed samples of native materials. Consolidation Test Diagrams, Figures B-1 through B-5, graphically express the relationship of vertical strain vs. applied vertical (normal) load for earth materials selected as most representative of the soil strata within the anticipated zone of influence of foundation loads.

DIRECT SHEAR TESTS (ASTM D3080)

Quick-consolidated direct shear tests were performed on an undisturbed, saturated sample of native earth materials. This test provides information on soil shear strength vs. normal load and is used to determine the angle of internal friction and cohesion of earth materials under essentially drained conditions. Test results are presented on Figures C-1 through C-4.

EXPANSION INDEX (ASTM D4829)

The Expansion Index test is designed to measure a basic index property of soil and in this respect is comparable to other index tests such as the Atterberg Limits. In formulating the test procedures, no attempt has been made to duplicate any particular moisture or loading conditions which may occur in the field. Rather, an attempt has been made to control all variables which influence the expansive characteristics of a particular soil and still retain a practical test for general engineering usage. Near surface soils were obtained and tested for expansiveness. Test results are presented on the Laboratory Testing Recap, Table 1.

MAXIMUM DENSITY - OPTIMUM MOISTURE RELATIONSHIPS

Maximum density - optimum moisture test results provide a relationship between soil moisture content at compaction vs. dry density for a fixed compactive effort. Specimens were compacted using ASTM Test Method D1557. Results are shown in Figure D-1 and D-2.

UNCONFINED COMPRESSIVE STRENGTH (ASTM D2166)

Tests were performed to determine the unconfined compressive strength of cohesive soil in the undisturbed, remolded, or compacted condition, using strain-controlled application of the axial load. Test results are presented on Figure E-1.

SOIL CORROSIVITY (SO_4 / pH / Chlorides)

Tests for Soluble Sulfates (SO4), Soluble Chlorides (Cl), and pH values were performed on three (3) composite samples retrieved from the upper 3 feet to determine the corrosion potential of the soils. Corrosion prevention measures and the extent to which measures should be taken (if any) should be addressed with the corrosion engineer. Soluble Sulfates and Soluble Chlorides values were determined according to EPA 300.0M. The pH values were determined according to EPA 9045C. Results of all the constituents are discussed in the Soil Corrosivity section.

Bakersfield City School District

Geotechnical Soils Investigation
BCSD New Elementary School
APNs: 531-012&531-012-03 | SW of Paladino Drive and Masterson St, Bakersfield, CA

SEI File No. 19-17179
October 31, 2019

TABLE 1

TEST LOCATION	USCS	% < # 200	CONSOLIDATION				DIRECT SHEAR		UNCONFINED COMPRESSION		E.I.	ATTERBERG LIMITS			R-VALUE @ 300 psi		HYDRO RESULTS	
			C_C	C_S	S.P. (psf)	HV %	C, (ksf)	F.A.	Q_U, (psi)	C, (ksf)		LL	PL	PI	R.V.	E.P. (psi)	% SILT	% CLAY
B-1 @ 3'	SC		0.14	0.01	0	-0.6												
B-1 @ 11'	SP	2.5																
B-1 @ 26'	SC	47																
B-1 @ 31'	SM	18																
B-2 @ 3'	SM						0	35.2										
B-3 @ 3'	SC		0.11	0.01	0	-0.6												
B-5 @ 3'	CL						0.15	30.8										
B-5 @ 6'	SC										37							
B-6 @ 6'	SC	14																
B-6 @ 21'	SC	48																
B-6 @ 31'	SM	25																
B-6 @ 41'	SC	19																
B-6 @ 51'	SC	22																
B-7 @ 0-5'	SC	43									55	41	22	19			18	25.0%
B-8 @ 3'	CH		0.19	0.03	5197	4	0.65	26.1										
B-13 @ 3'	CL		0.16	0.02	668	0.2												
B-14 @ 0-5'	SC	46									59	46	22	24			23	23.0%
B-14 @ 3'	CH								97.2	7								
B-17 @ 3'	SC		0.22	0.04	1462	0.9												
B-19 @ 0-5'	CH										45							
B-19 @ 3'	CH						0.65	24.4										
B-20 @ 2.5'	CL										56							

CONSOLIDATION
Cc - Compression Index
Cs - Swell Index
S.P. (psf) - Swell Pressure
HV % - Heave Precentage / Collapase

UNCONFINED COMPRESSION
Q_U (psi) - Unconfined Compression Strength
C, (ksf) - Cohesion

DIRECT SHEAR
C (ksf) - Cohesion
F.A. - Friction Angle

E.I. - EXPANSION INDEX

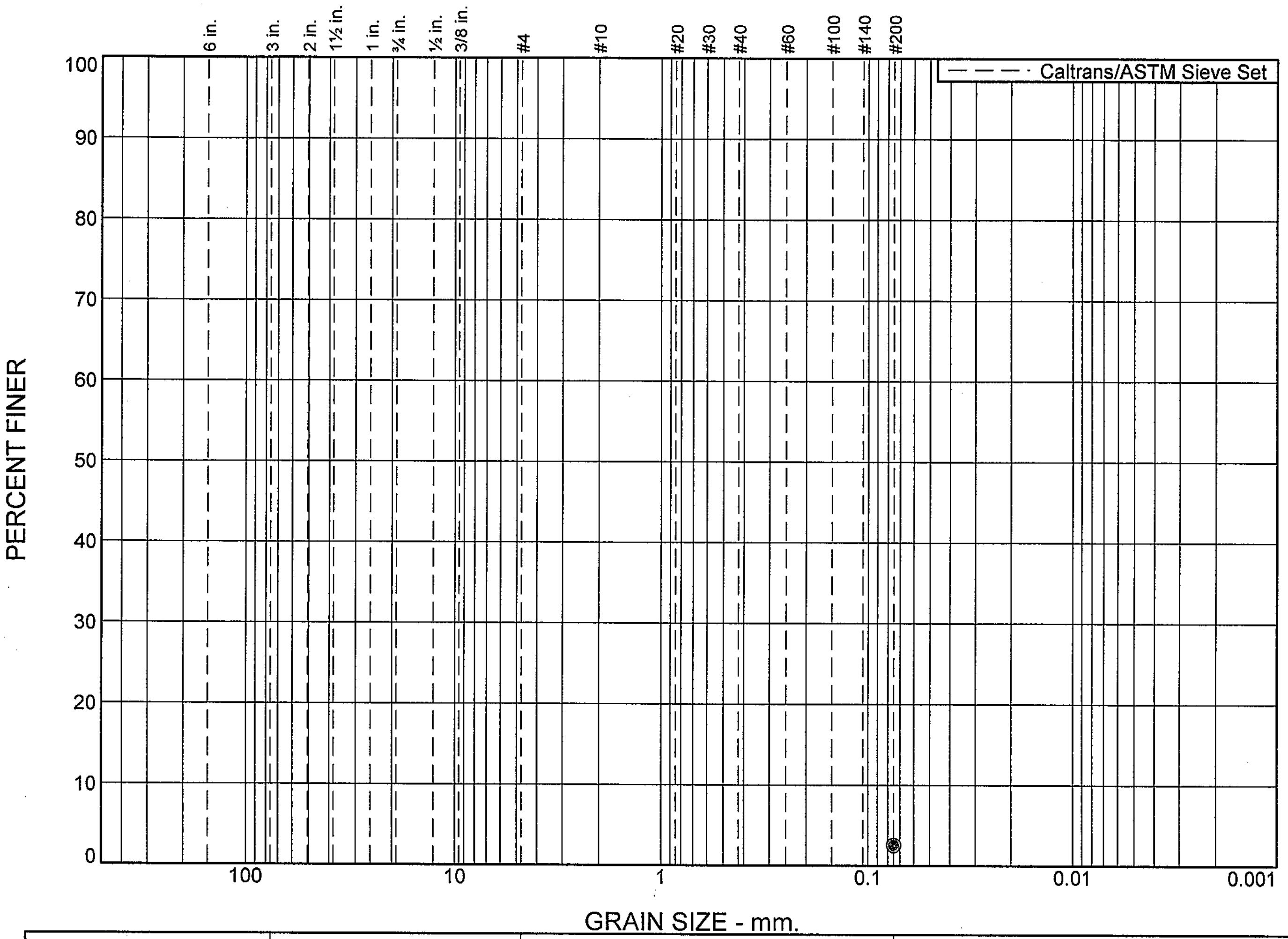
ATTERBERG LIMITS
LL - Liquid Limit
PL - Plastic Limit
PI - Plasticity Index

(R)ESISTANCE VALUE
RV - R-Value @ 300 psi
EP - Expansion Press @ 300 psi

MAXIMUM DENSITY
MDD (pcf) - Max Dry Density
O.M. - Optimum Moisture

SOILS ENGINEERING, INC.

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							2.5	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		11'	POORLY GRADED SAND	SP

SOILS ENGINEERING, INC.

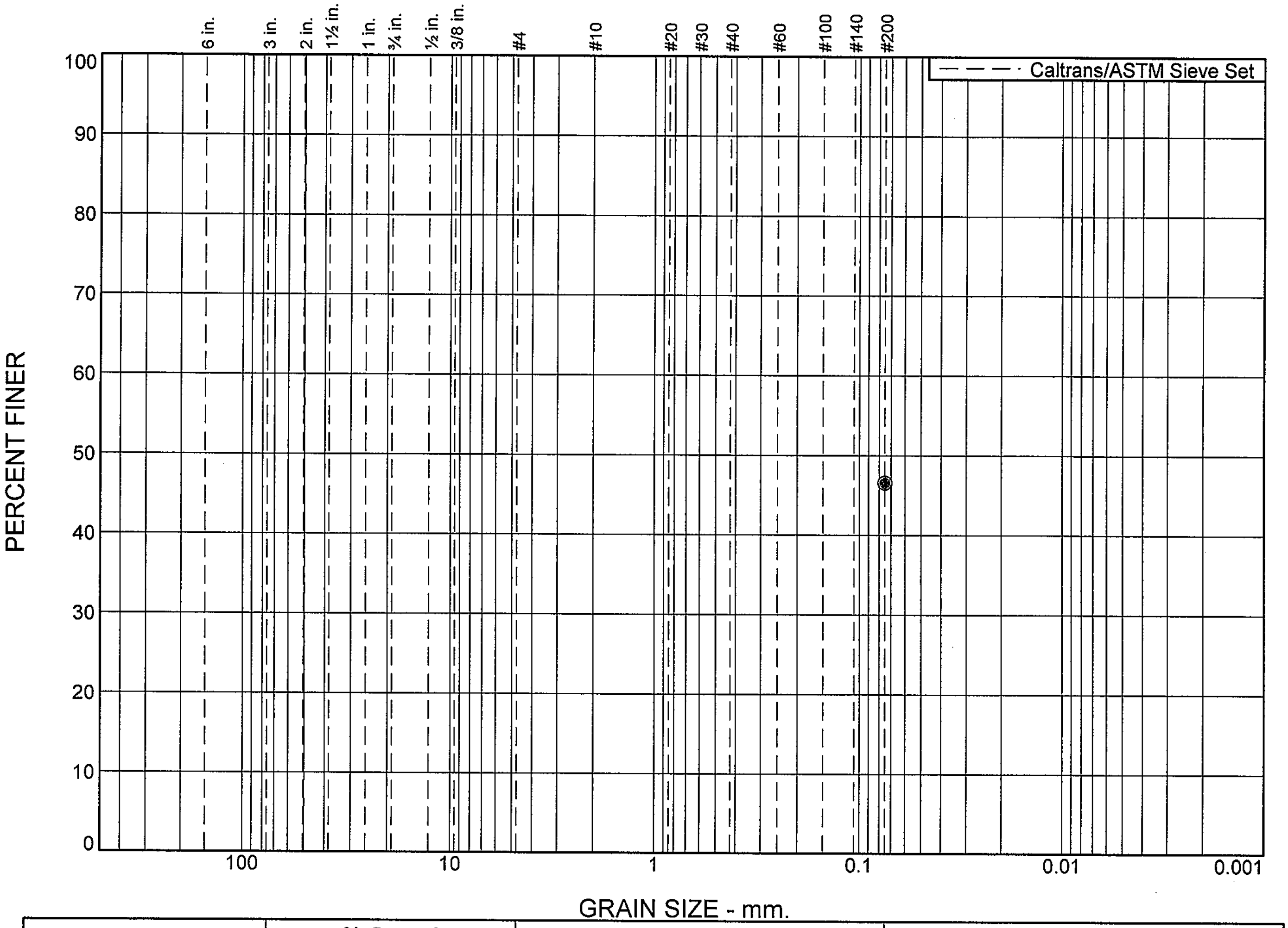
Client: Bakersfield City School District

Project: BCSD New Elementary School

Project No.: 17179

Figure A-1

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							47	

SOIL DATA

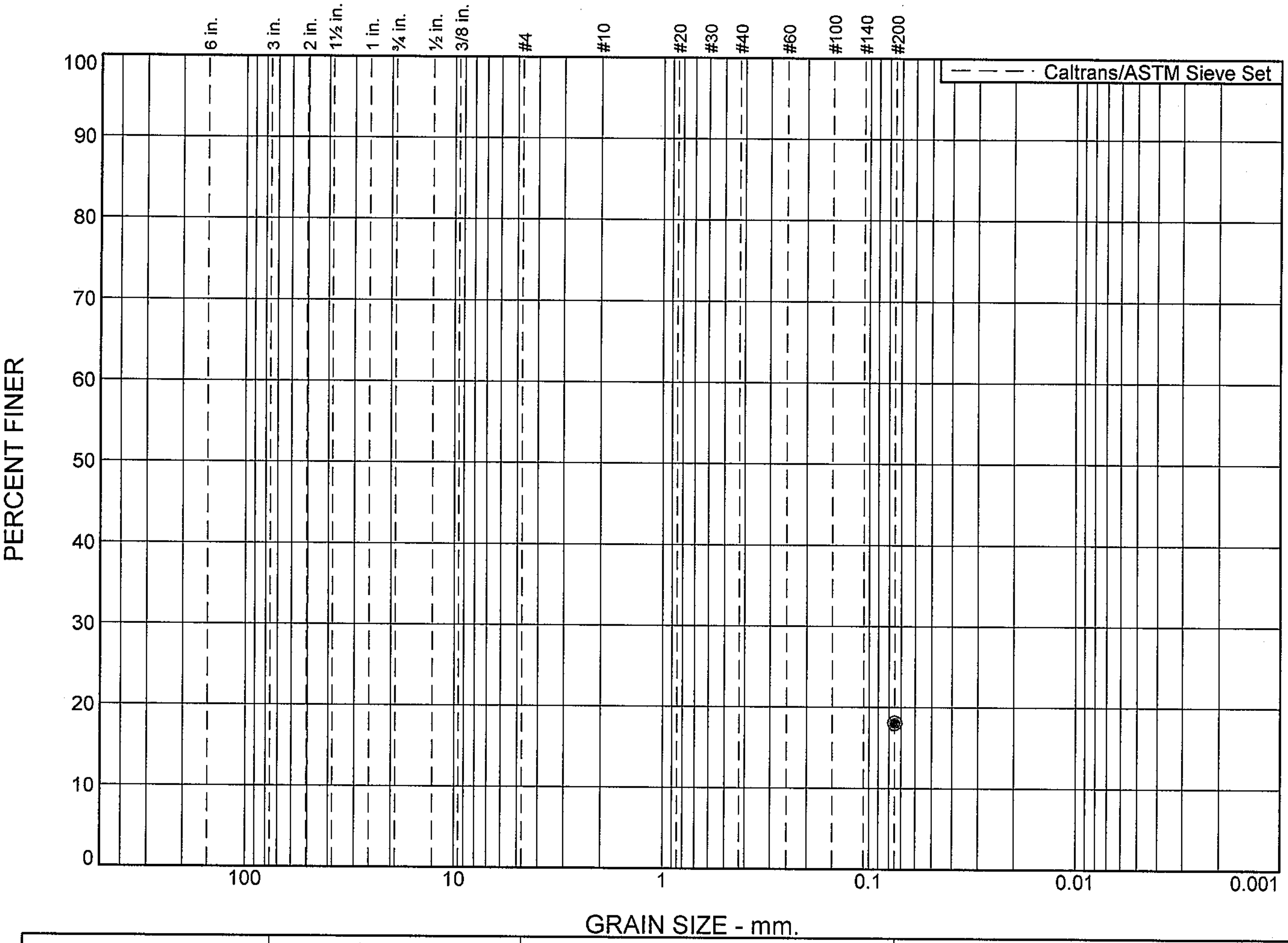
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		26'	CLAYEY SAND	SC

SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179
Figure A-2

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							18	

SOIL DATA

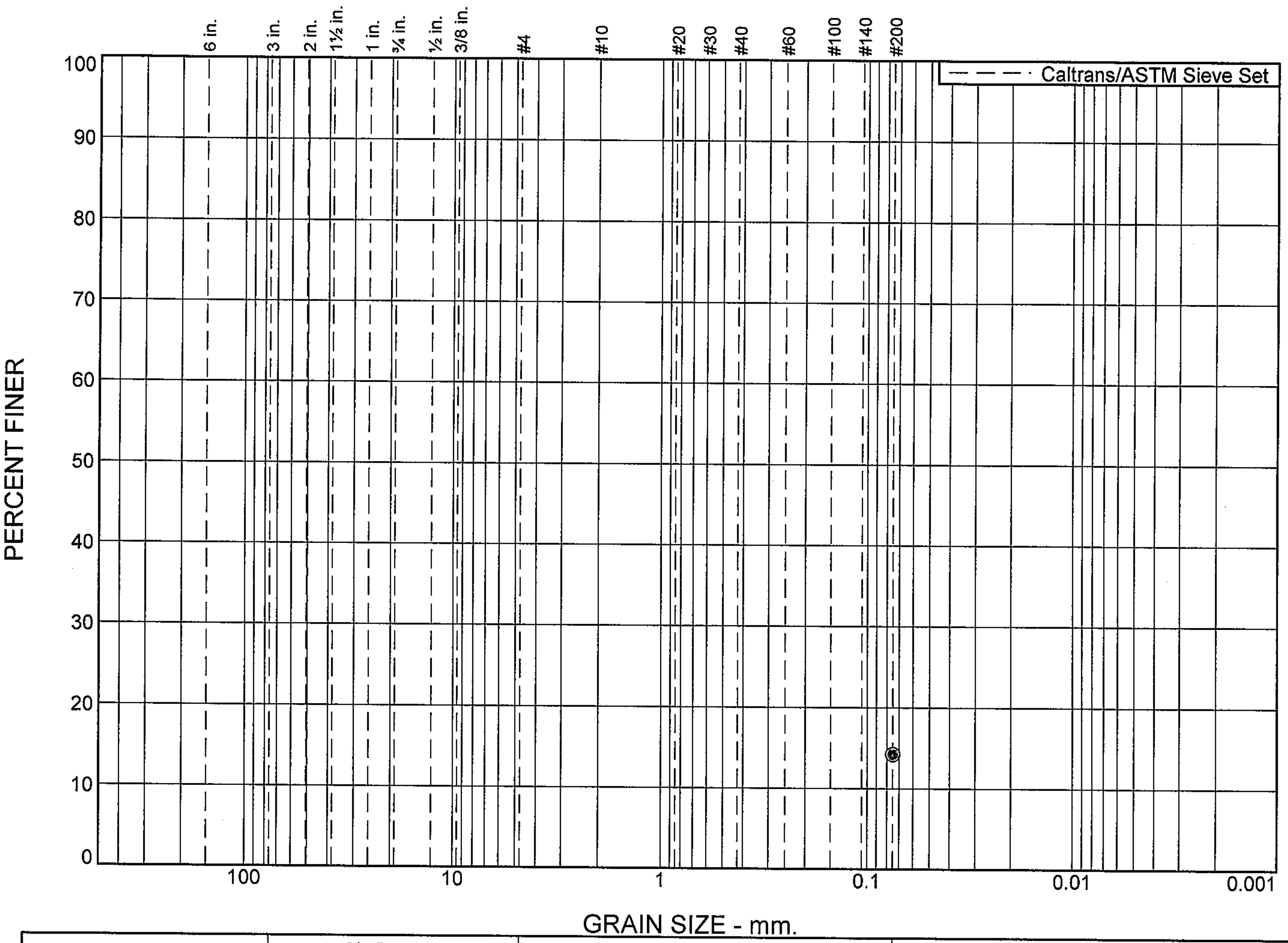
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-1		31'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179 **Figure** A-3

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							14	

SOIL DATA

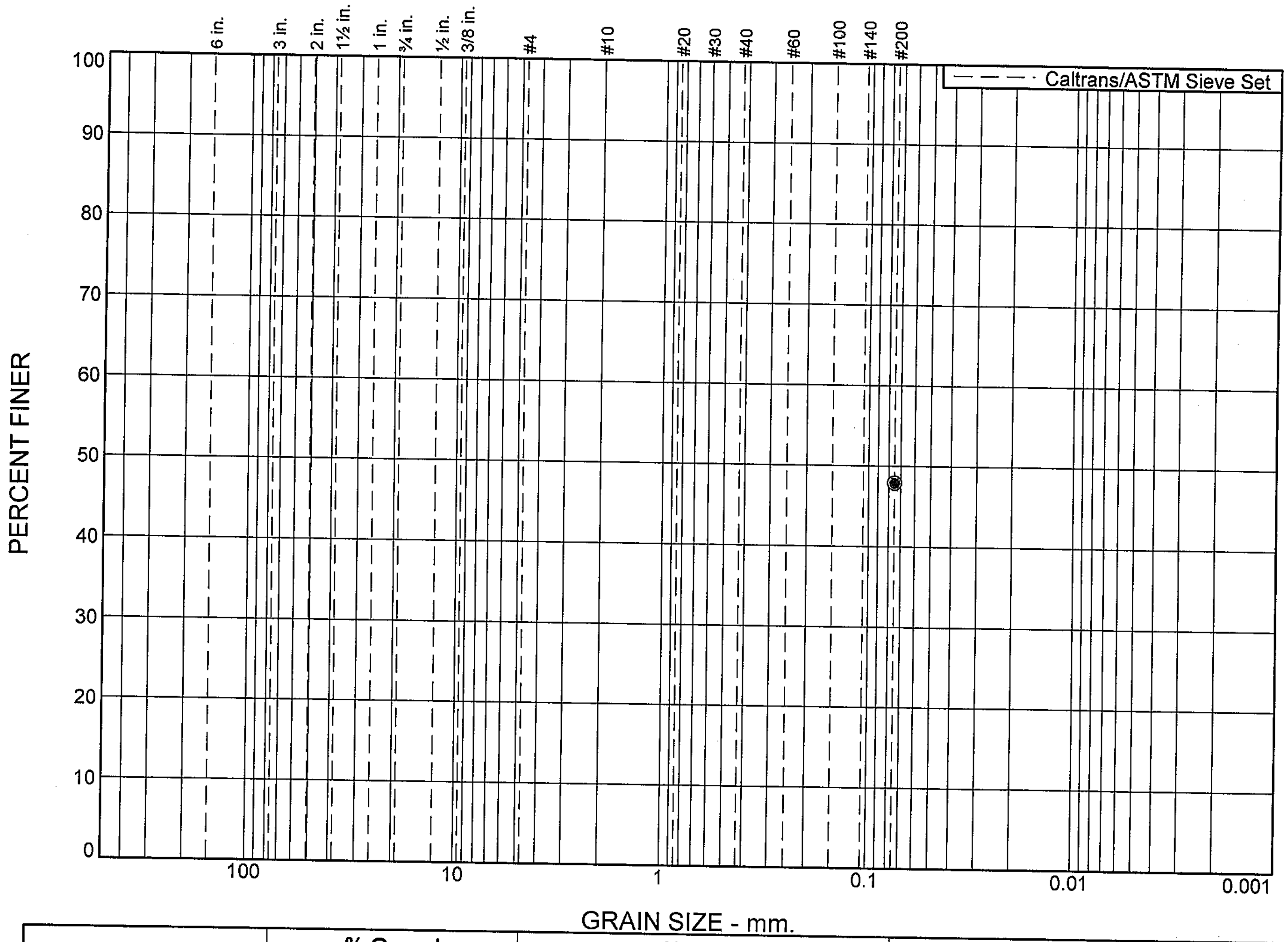
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6		6'	CLAYEY SAND	SC

SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179 **Figure** A-4

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							48	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6		21'	CLAYEY SAND	SC

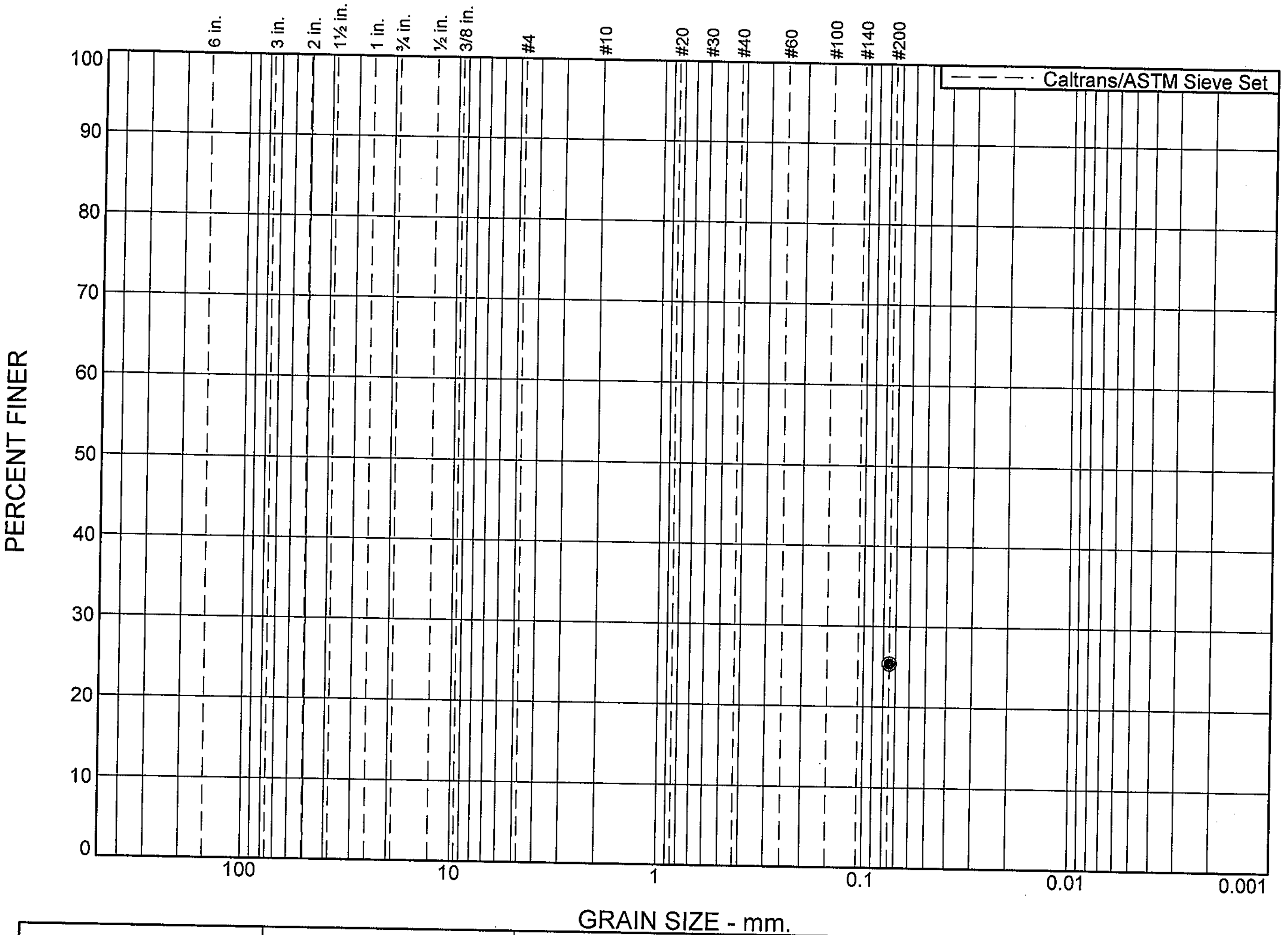
SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179

Figure A-5

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							25	

SOIL DATA

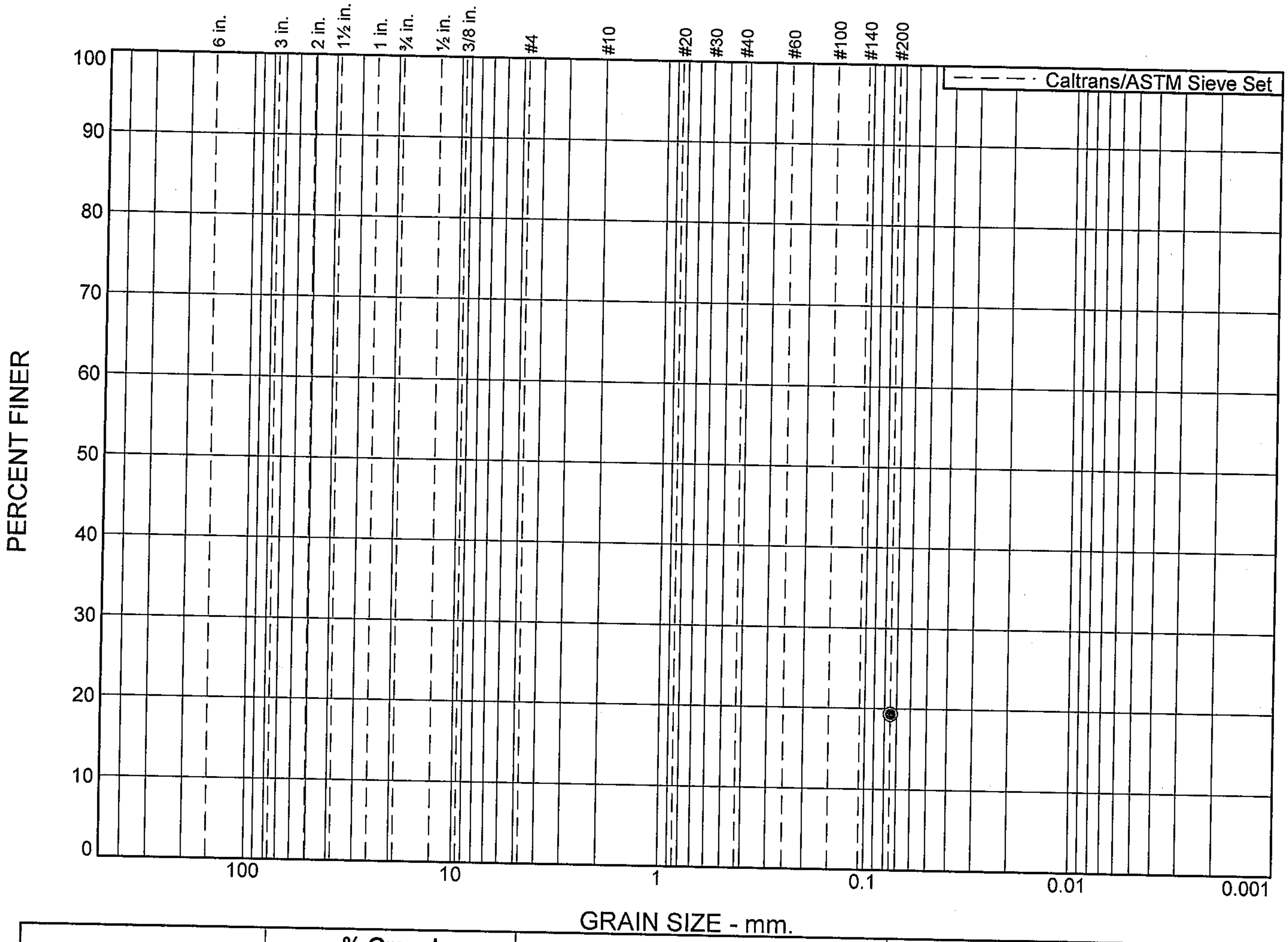
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6		31'	SILTY SAND	SM

SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179 **Figure** A-6

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							19	

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6		41'	CLAYEY SAND	SC

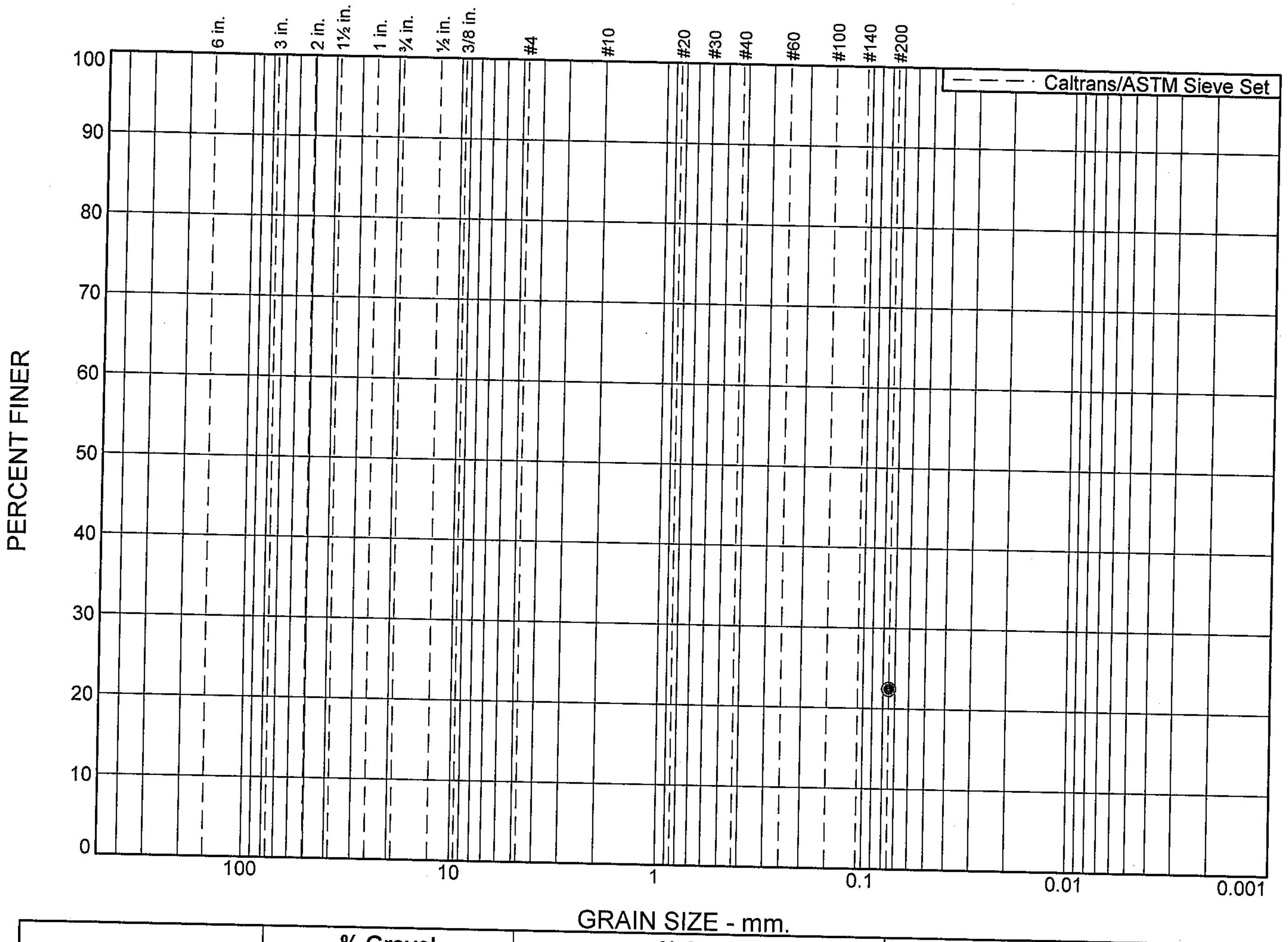
SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179

Figure A-7

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○							22	

SOIL DATA

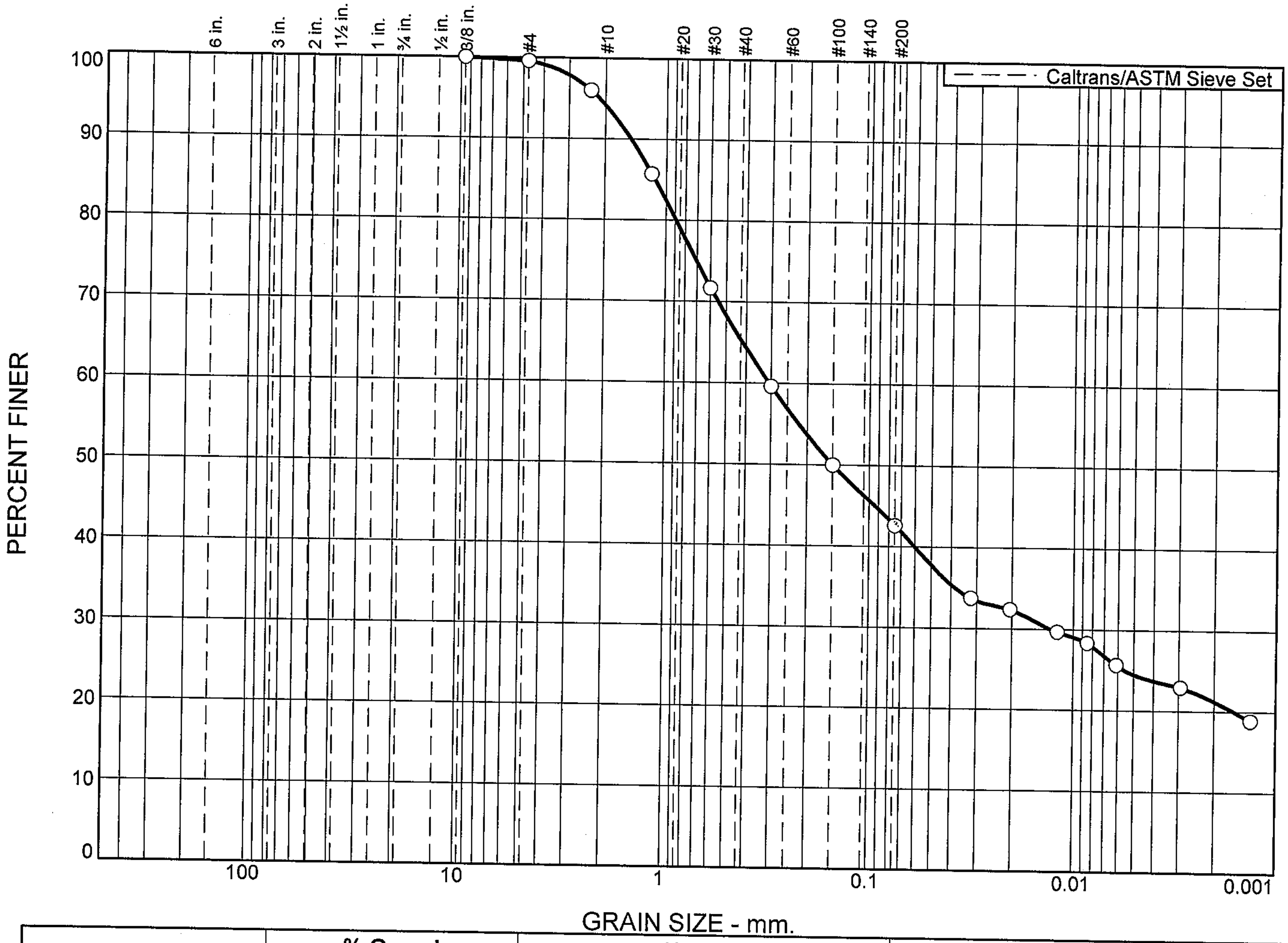
SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○	B-6		51'	CLAYEY SAND	SC

SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179
Figure A-8

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	0	6	29	22	18	25

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		71723	0-5'	CLAYEY SAND	SC
				Location: B-7 @ 0-5'	
				Small Bulk Sample	

SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179

Figure A-9

GRAIN SIZE DISTRIBUTION TEST DATA

10/30/2019

Client: Bakersfield City School District
Project: BCSD New Elementary School
Project Number: 17179
Location: B-7 @ 0-5'
Depth: 0-5'
Sample Number: 71723
Material Description: CLAYEY SAND
Location: B-7 @ 0-5'
Small Bulk Sample
USCS: SC
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
494.90	0.00	0.00	3					
			2					
			1.5					
			1					
			0.75					
			0.5					
			0.375	0.00	100	0	0	*+100*
			#4	2.10	100	0	0	*+100*
			#8	19.90	96	0	0	*+96*
			#16	70.80	86	0	0	*+86*
			#30	140.10	72	0	0	*+72*
			#50	199.80	60	0	0	*+60*
			#100	247.50	50	0	0	*+50*
			#200	283.90	43	0.0	0.0	*+43*

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =78
Hygroscopic moisture correction:
Moist weight and tare = 322.10
Dry weight and tare = 315.70
Tare weight = 196.70
Hygroscopic moisture = 5.4%
Table of composite correction values:

Temp., deg. C:	21.0	24.0	18.0
Comp. corr.:	-5.0	-4.0	-6.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	21.0	30.0	25.0	0.0135	30.0	11.4	0.0321	33.8
5.00	21.0	29.0	24.0	0.0135	29.0	11.5	0.0205	32.4
15.00	21.0	27.0	22.0	0.0135	27.0	11.9	0.0120	29.7
30.00	21.0	26.0	21.0	0.0135	26.0	12.0	0.0085	28.4
60.00	21.0	24.0	19.0	0.0135	24.0	12.4	0.0061	25.7
250.00	24.0	21.0	17.0	0.0130	21.0	12.9	0.0029	23.0
1440.00	18.0	20.0	14.0	0.0140	20.0	13.0	0.0013	18.9

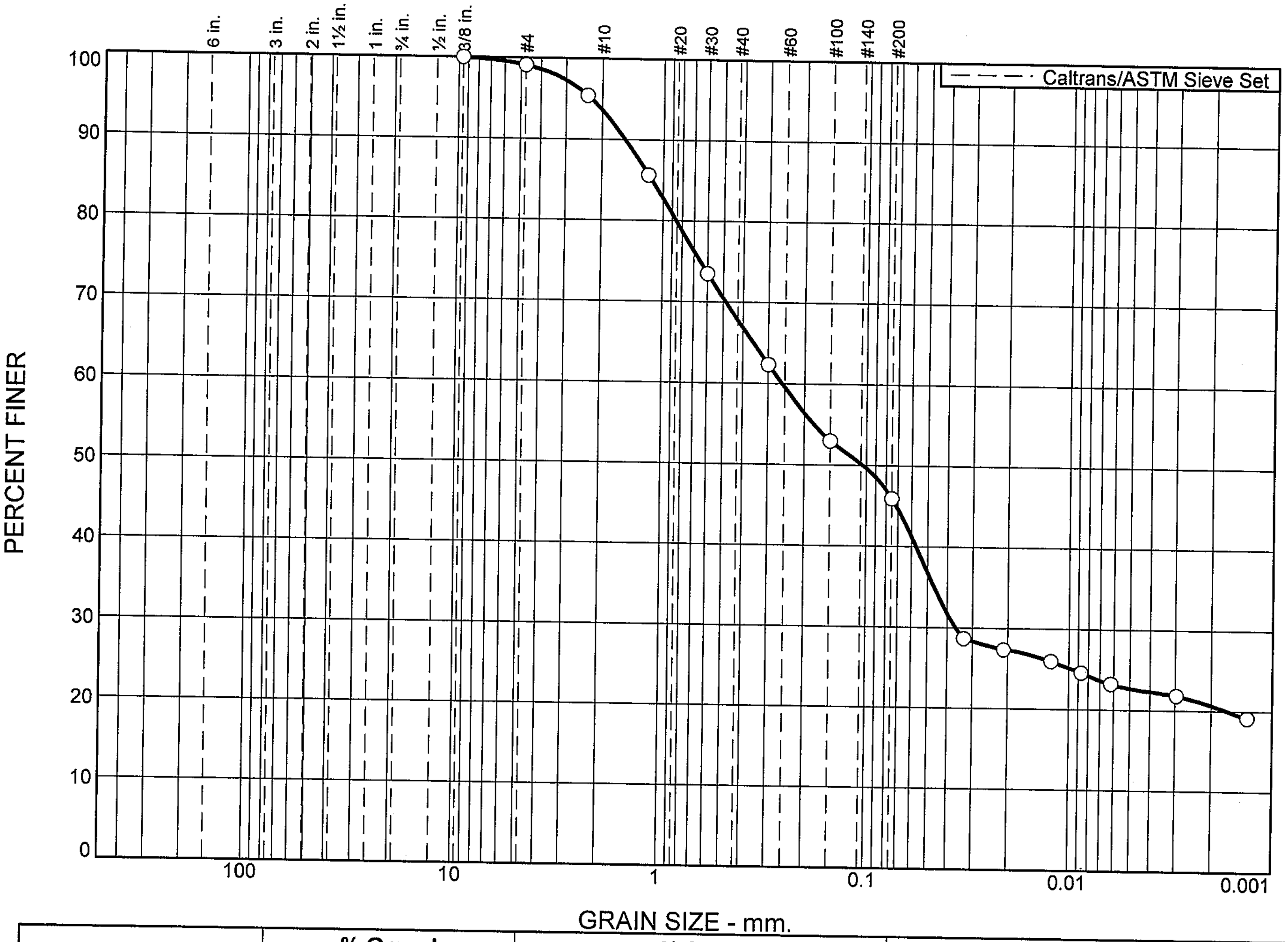
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0	0	0	0	6	29	22	57	18	25	43

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.0016	0.0128	0.0602	0.1501	0.3072	0.8928	1.1387	1.5010	2.1495

Fineness Modulus
1.37

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0	0	1	5	26	22	23	23

SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH (ft.)	Material Description	USCS
○		71724	0-5'	CLAYEY SAND	SC
				Location: B-14 @ 0-5'	
				Large Bulk Sample	

SOILS ENGINEERING, INC.

Client: Bakersfield City School District
Project: BCSD New Elementary School

Project No.: 17179

Figure A-10

GRAIN SIZE DISTRIBUTION TEST DATA

10/31/2019

Client: Bakersfield City School District
Project: BCSD New Elementary School
Project Number: 17179
Location: B-14 @ 0-5'
Depth: 0-5'
Sample Number: 71724
Material Description: CLAYEY SAND
Location: B-14 @ 0-5'
Large Bulk Sample
USCS: SC
Material specification: Caltrans/ASTM Sieve Set

Sieve Test Data

Dry Sample and Tare (grams)	Tare (grams)	Cumulative Pan Tare Weight (grams)	Sieve Opening Size	Cumulative Weight Retained (grams)	Percent Finer	Lower Spec. Limit, %	Upper Spec. Limit, %	Deviation From Spec., %
490.90	0.00	0.00	3					
			2					
			1.5					
			1					
			0.75					
			0.5					
			0.375	0.00	100	0	0	*+100*
			#4	4.40	99	0	0	*+99*
			#8	22.60	95	0	0	*+95*
			#16	70.50	86	0	0	*+86*
			#30	130.10	73	0	0	*+73*
			#50	184.80	62	0	0	*+62*
			#100	230.70	53	0	0	*+53*
			#200	265.30	46	0.0	0.0	*+46*

Hydrometer Test Data

Hydrometer test uses material passing #10
Percent passing #10 based upon complete sample = 100
Weight of hydrometer sample =77.5
Hygroscopic moisture correction:
Moist weight and tare = 267.70
Dry weight and tare = 260.60
Tare weight = 141.80
Hygroscopic moisture = 6.0%
Table of composite correction values:

Temp., deg. C:	21.0	24.0	18.0
Comp. corr.:	-5.0	-4.0	-6.0

Meniscus correction only = 0.0
Specific gravity of solids = 2.65
Hydrometer type = 152H
Hydrometer effective depth equation: L = 16.294964 - 0.164 **x Rm**

Elapsed Time (min.)	Temp. (deg. C.)	Actual Reading	Corrected Reading	K	Rm	Eff. Depth	Diameter (mm.)	Percent Finer
2.00	21.0	26.0	21.0	0.0135	26.0	12.0	0.0331	28.7
5.00	21.0	25.0	20.0	0.0135	25.0	12.2	0.0210	27.3
15.00	21.0	24.0	19.0	0.0135	24.0	12.4	0.0122	26.0
30.00	21.0	23.0	18.0	0.0135	23.0	12.5	0.0087	24.6
60.00	21.0	22.0	17.0	0.0135	22.0	12.7	0.0062	23.2
250.00	24.0	20.0	16.0	0.0130	20.0	13.0	0.0030	21.9
1440.00	18.0	20.0	14.0	0.0140	20.0	13.0	0.0013	19.1

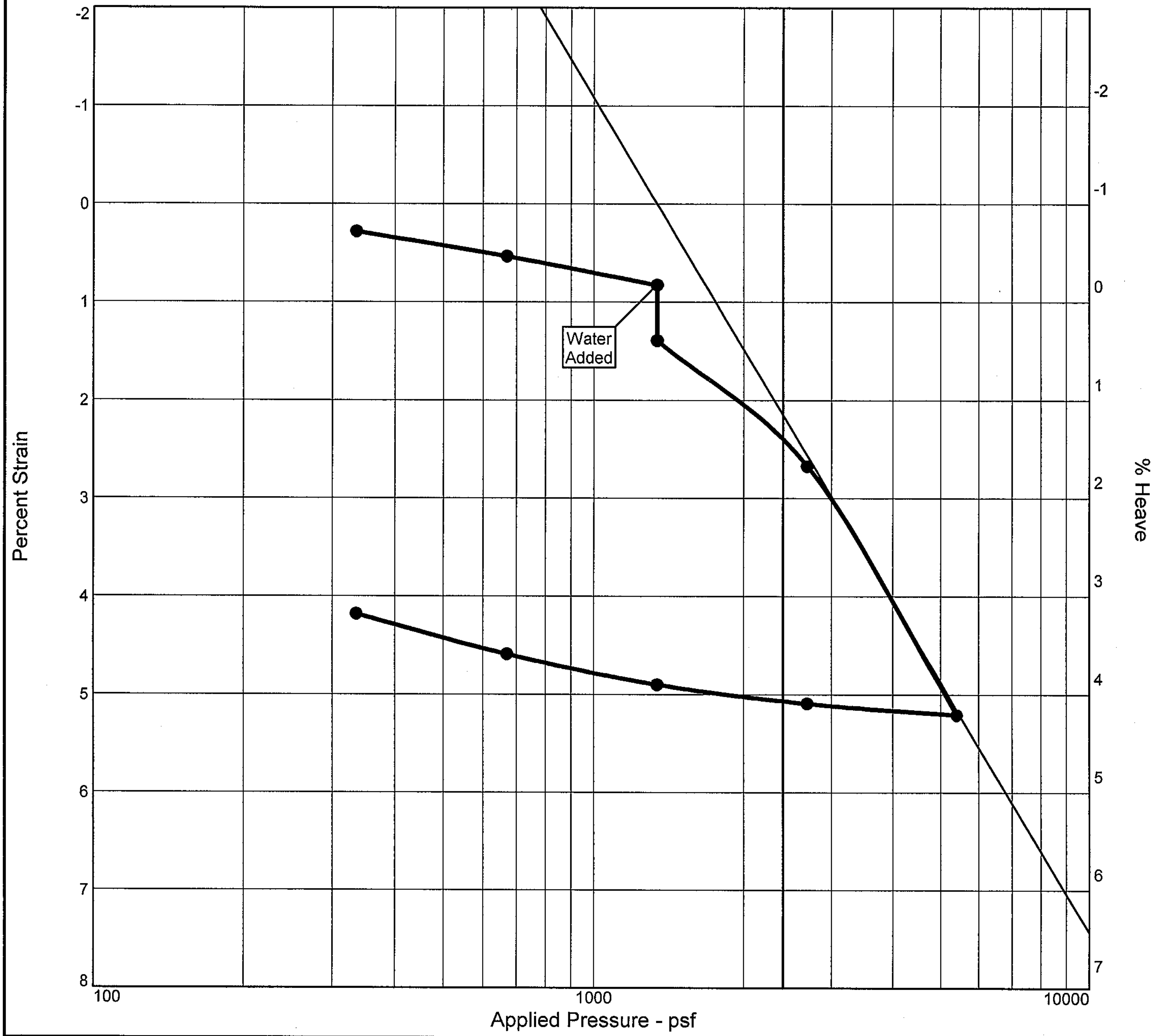
Fractional Components

Cobbles	Gravel			Sand				Fines		
	Coarse	Fine	Total	Coarse	Medium	Fine	Total	Silt	Clay	Total
0	0	1	1	5	26	22	53	23	23	46

D_5	D_{10}	D_{15}	D_{20}	D_{30}	D_{40}	D_{50}	D_{60}	D_{80}	D_{85}	D_{90}	D_{95}
			0.0016	0.0364	0.0571	0.1037	0.2574	0.8613	1.1375	1.5409	2.2680

Fineness Modulus
1.31

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
27.9 %	7.4 %	97.1	N/A	N/A	2.65	336	2635	0.14	0.01		-0.6	0.703

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SAND	SC	N/A

Project No. 17179 **Client:** Bakersfield City School District

Project: BCSD New Elementary School

Source of Sample: B-1 **Depth:** 3'

Remarks:

Test Date: 10/30/19

SOILS ENGINEERING, INC.

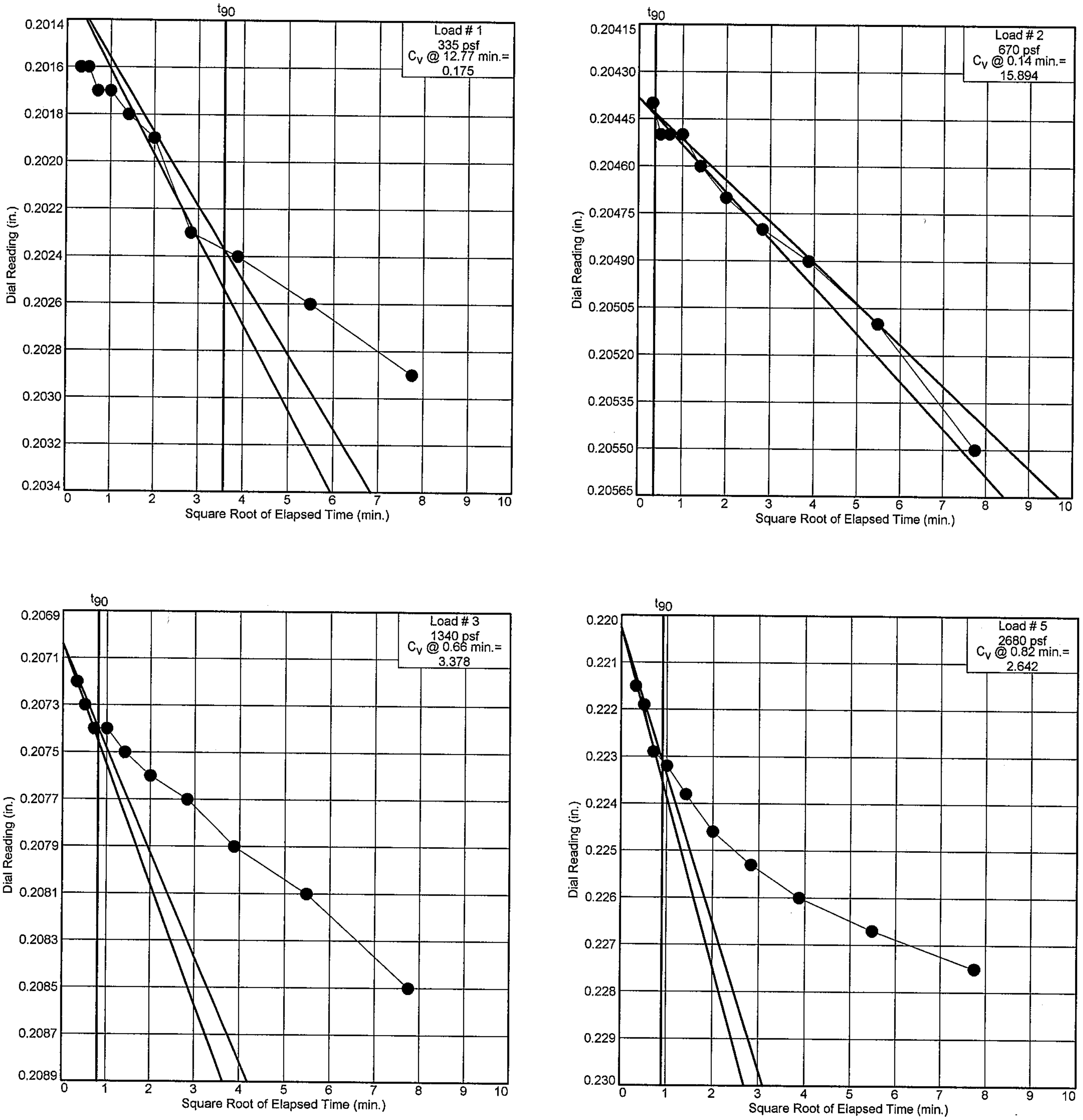
Figure B-1

Tested By: CD **Checked By:** AL

Dial Reading vs. Time

Project No.: 17179
Project: BCSD New Elementary School

Source of Sample: B-1 Depth: 3'



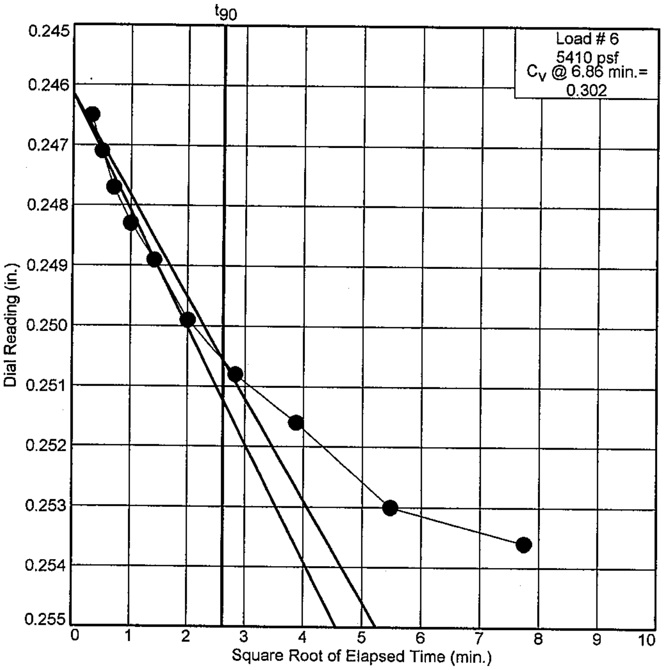
SOILS ENGINEERING, INC.

Figure B-1

Dial Reading vs. Time

Project No.: 17179
Project: BCSD New Elementary School

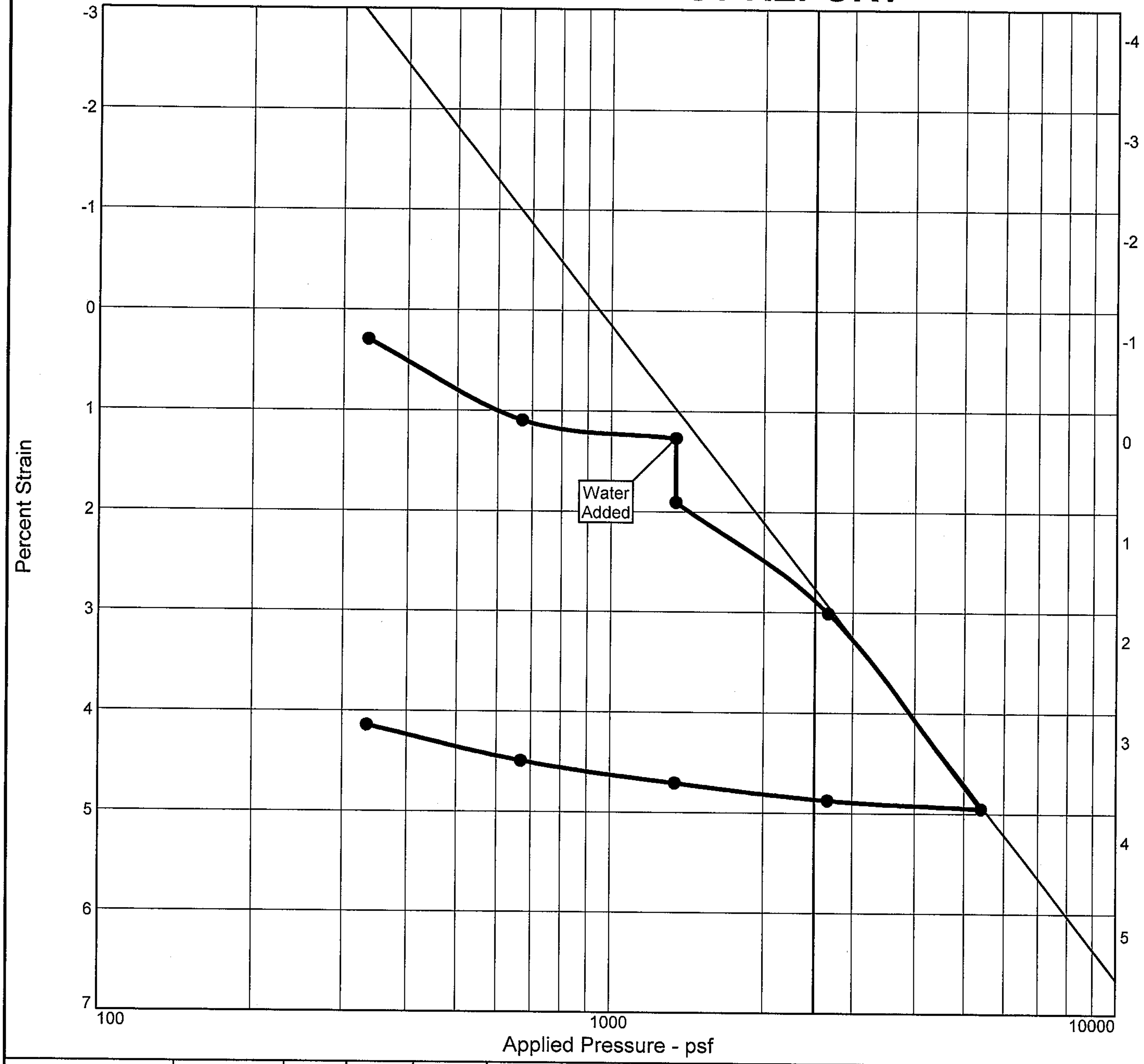
Source of Sample: B-1 Depth: 3'



SOILS ENGINEERING, INC.

Figure B-1

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
20.8 %	5.1 %	100.4	N/A	N/A	2.65	336	2690	0.11	0.01		-0.6	0.647

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SAND	SC	N/A

Project No. 17179 **Client:** Bakersfield City School District
Project: BCSD New Elementary School

Source of Sample: B-3 **Depth:** 6'

Remarks:
Test Date: 10/30/19

SOILS ENGINEERING, INC.

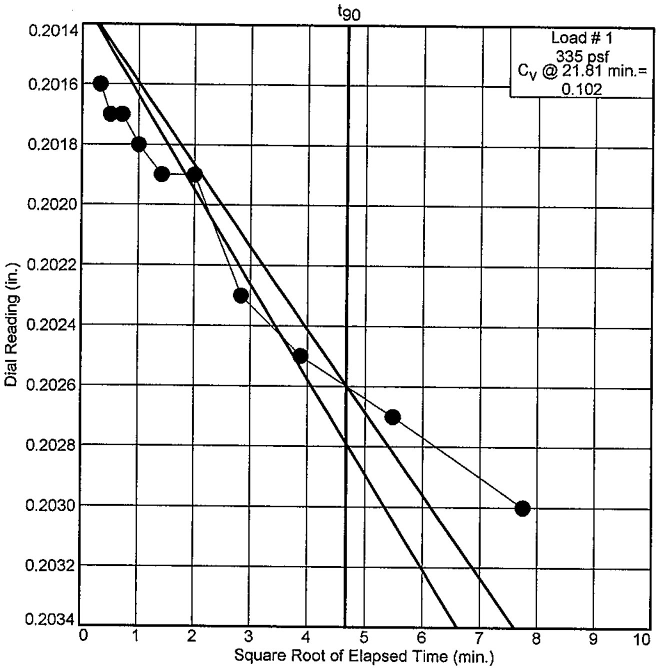
Figure B-2

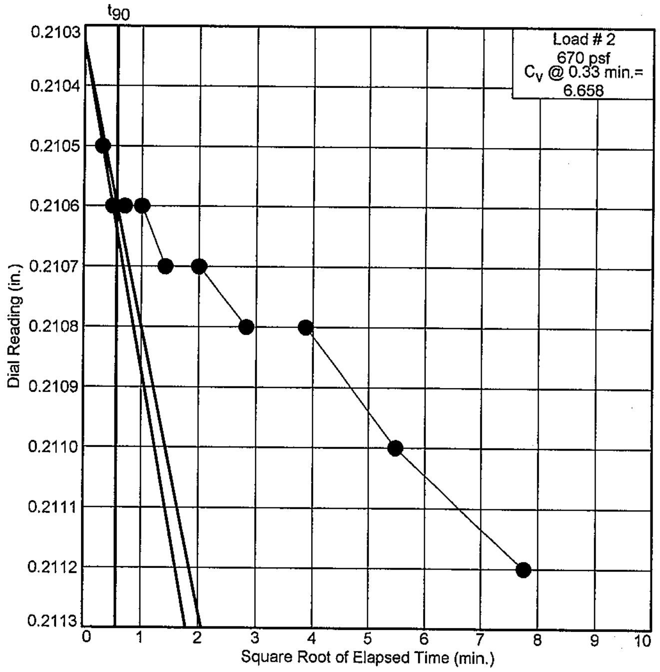
Tested By: CD **Checked By:** AL

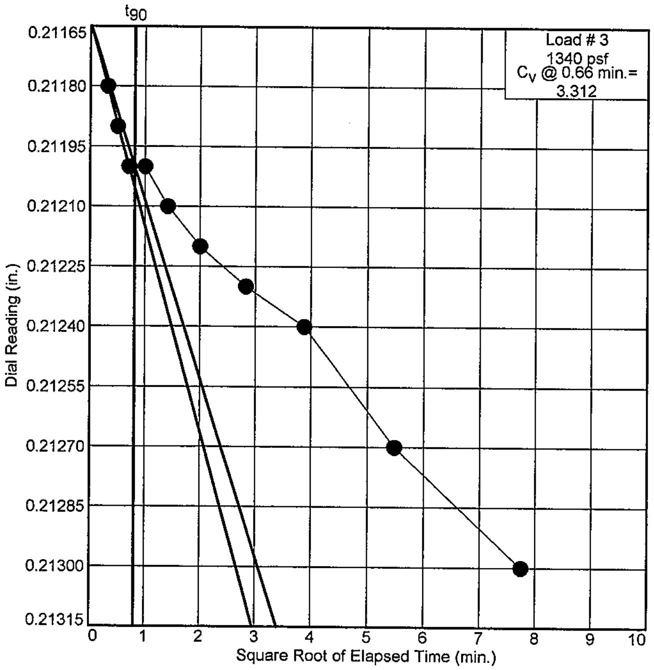
Dial Reading vs. Time

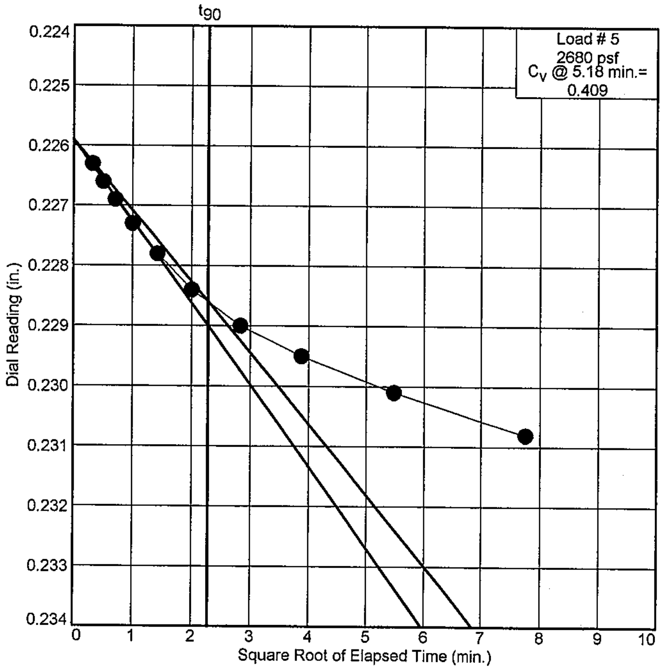
Project No.: 17179
Project: BCSD New Elementary School

Source of Sample: B-3 Depth: 6'









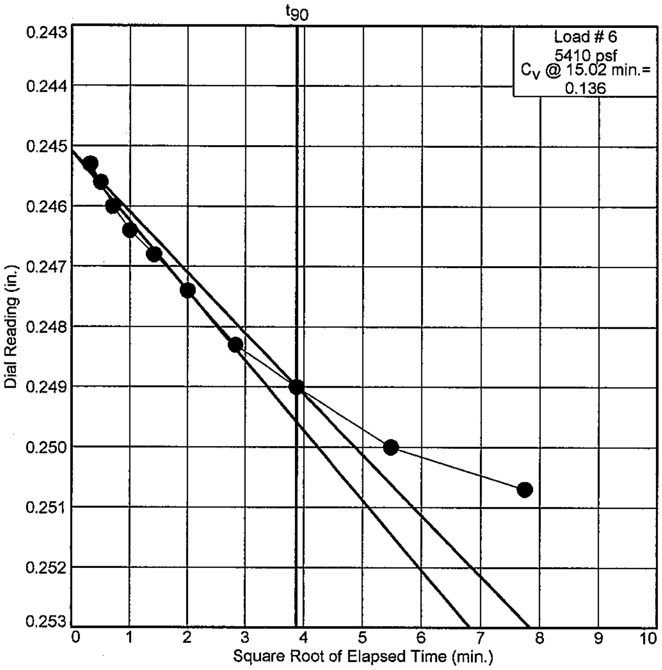
SOILS ENGINEERING, INC.

Figure B-2

Dial Reading vs. Time

Project No.: 17179
Project: BCSD New Elementary School

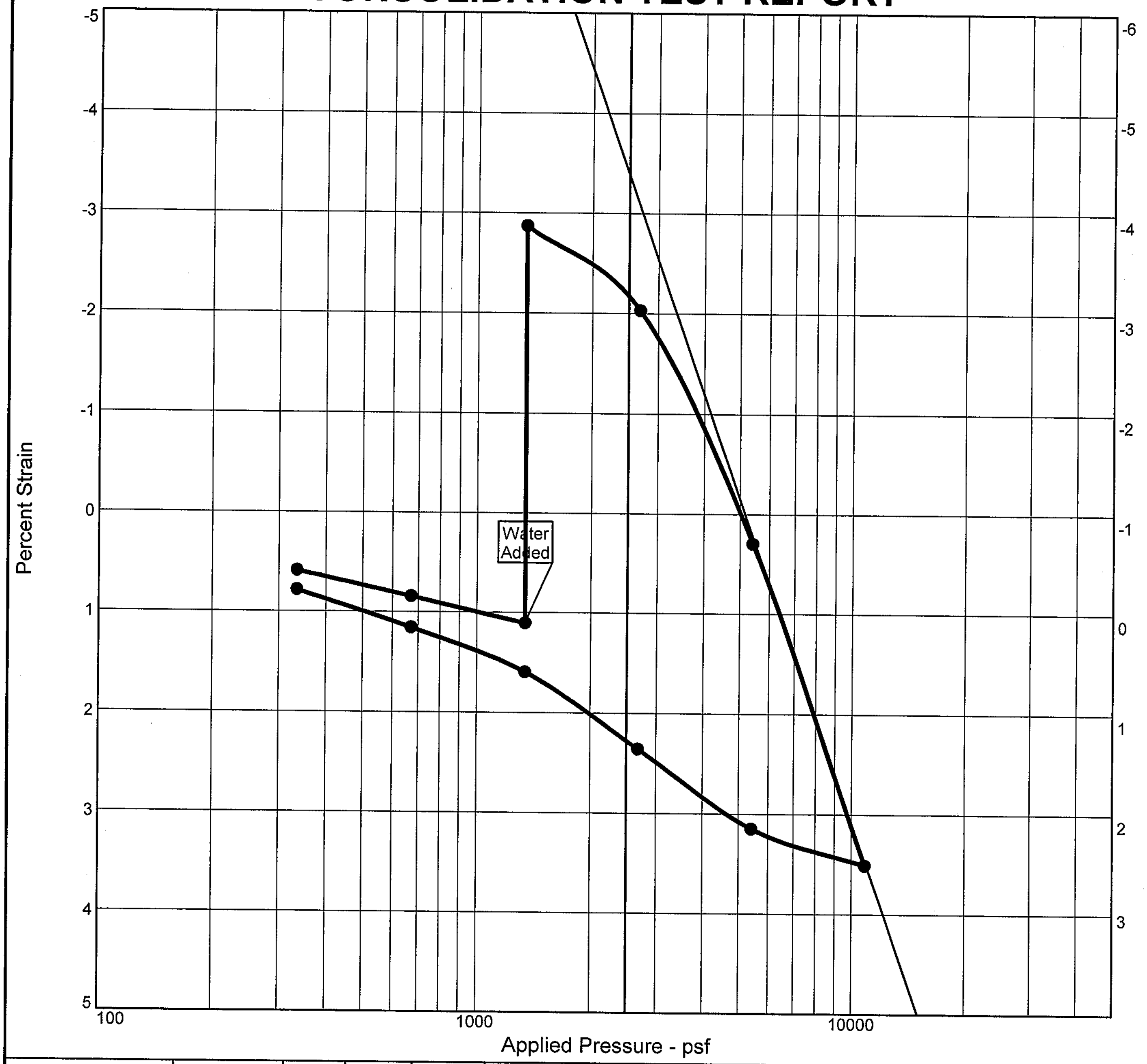
Source of Sample: B-3 Depth: 6'



SOILS ENGINEERING, INC.

Figure B-2

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
49.9 %	14.5 %	93.4	N/A	N/A	2.65	336	3462	0.19	0.03	5197	4.0	0.772

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY CLAY	CH	N/A

Project No. 17179 **Client:** Bakersfield City School District
Project: BCSD New Elementary School

Source of Sample: B-8 **Depth:** 3'

Remarks:
Test Date: 10/30/19

SOILS ENGINEERING, INC.

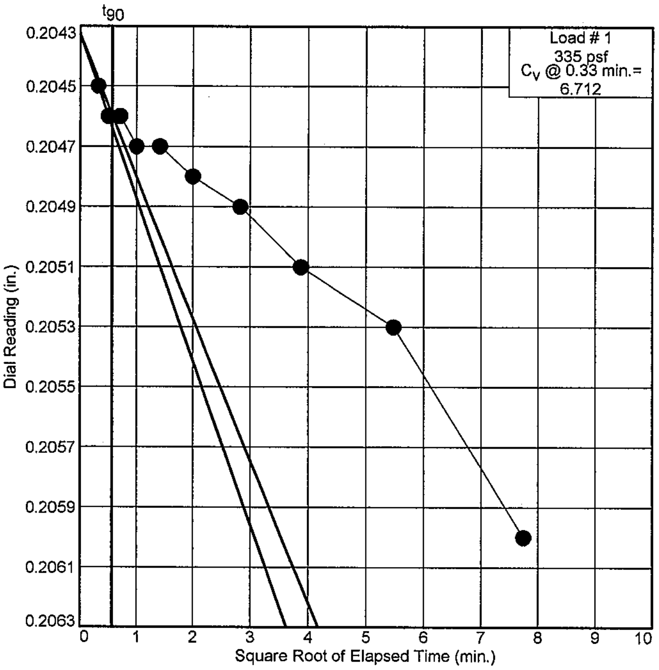
Figure B-3

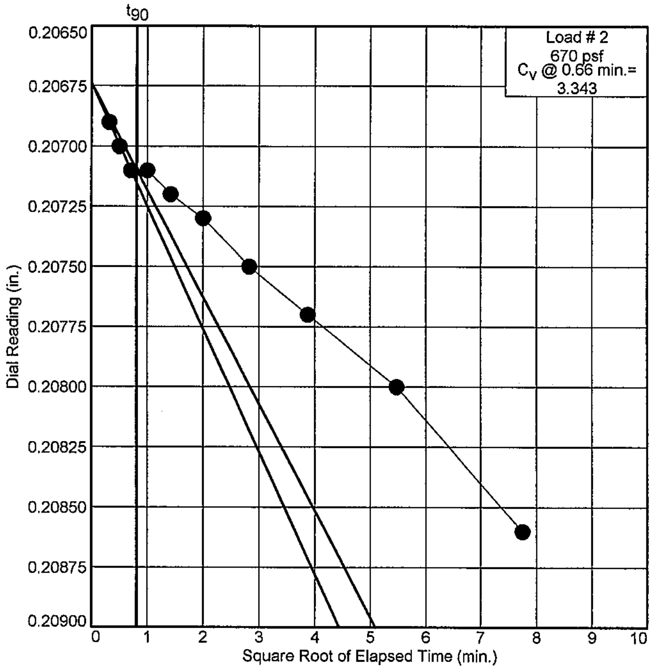
Tested By: CE **Checked By:** AL

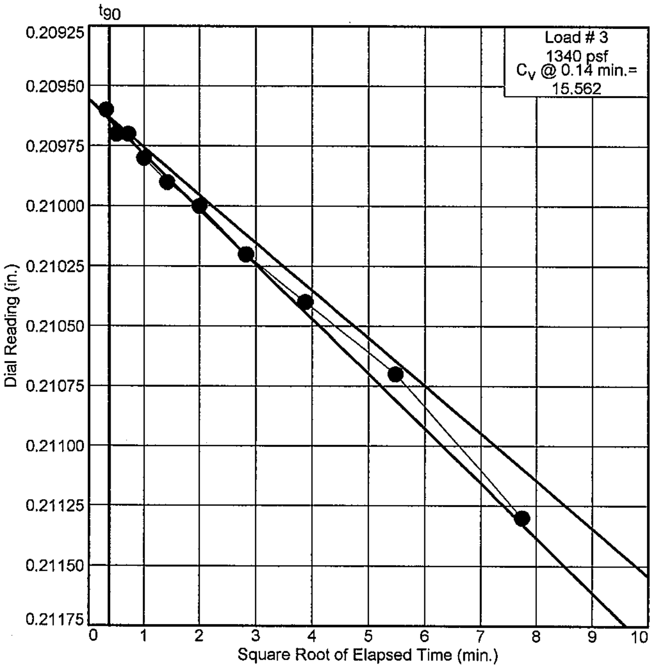
Dial Reading vs. Time

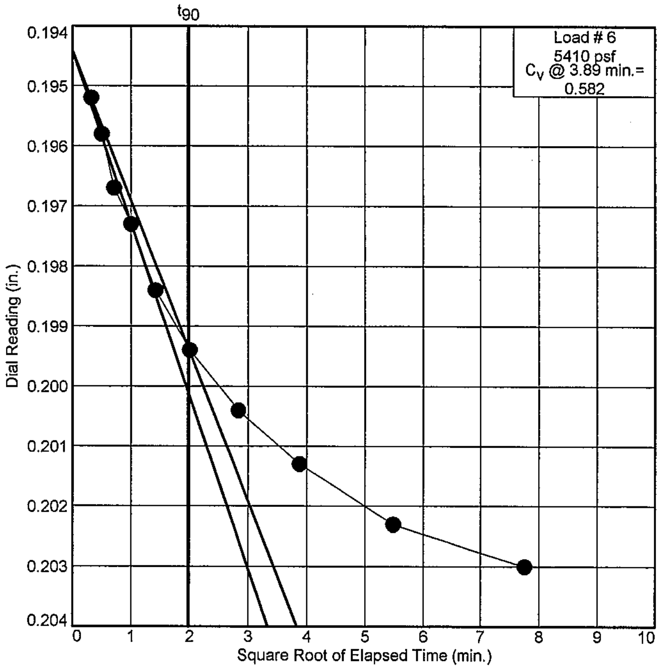
Project No.: 17179
Project: BCSD New Elementary School

Source of Sample: B-8 Depth: 3'









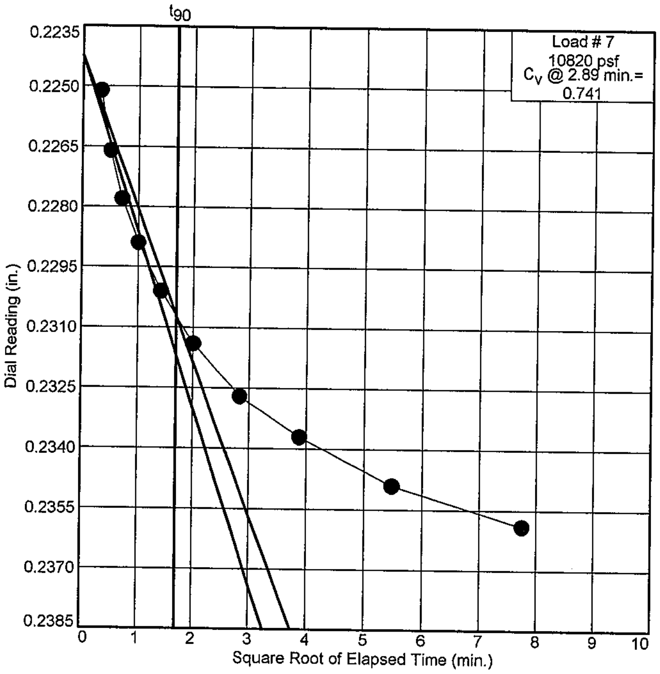
SOILS ENGINEERING, INC.

Figure B-3

Dial Reading vs. Time

Project No.: 17179
Project: BCSD New Elementary School

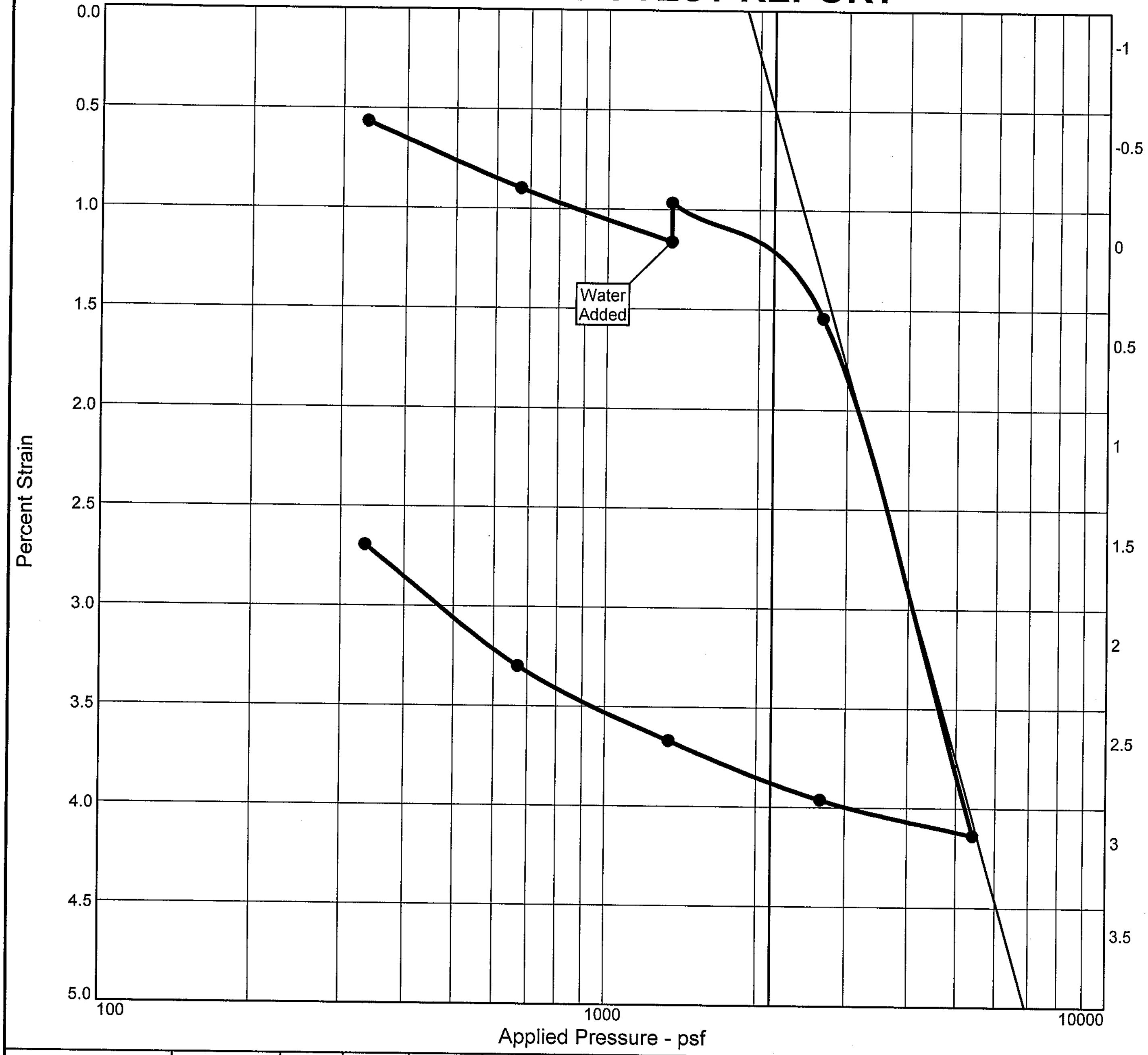
Source of Sample: B-8 Depth: 3'



SOILS ENGINEERING, INC.

Figure B-3

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
36.3 %	10.7 %	92.7	N/A	N/A	2.65	336	2626	0.16	0.02	668	0.2	0.784

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY CLAY	CL	N/A

Project No. 17179 **Client:** Bakersfield City School District

Project: BCSD New Elementary School

Source of Sample: B-13 **Depth:** 3'

Remarks:

Test Date: 10/30/19

SOILS ENGINEERING, INC.

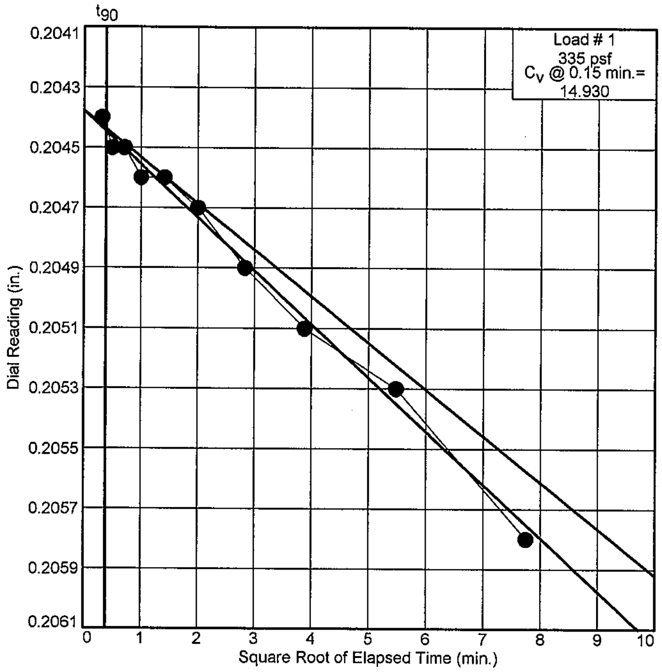
Figure B-4

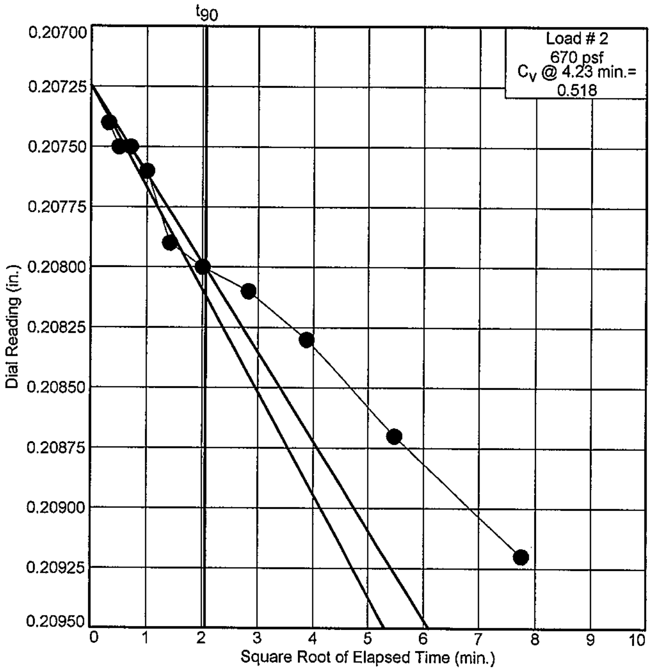
Tested By: CE **Checked By:** AL

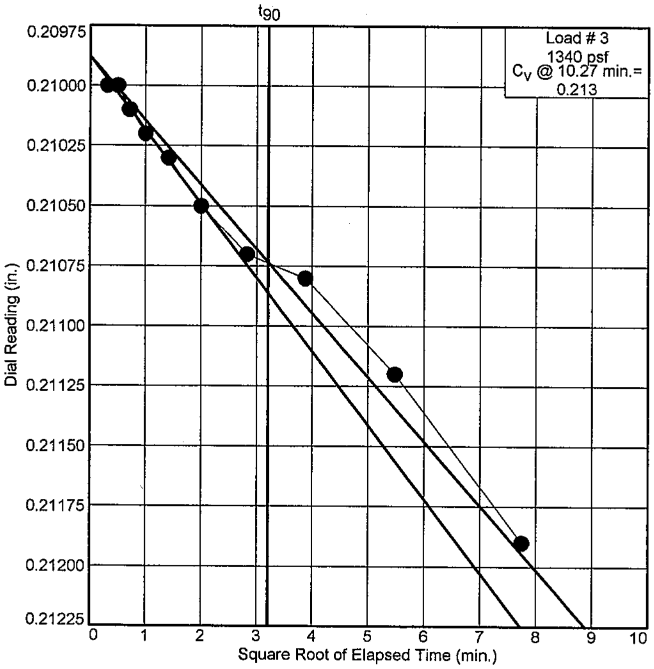
Dial Reading vs. Time

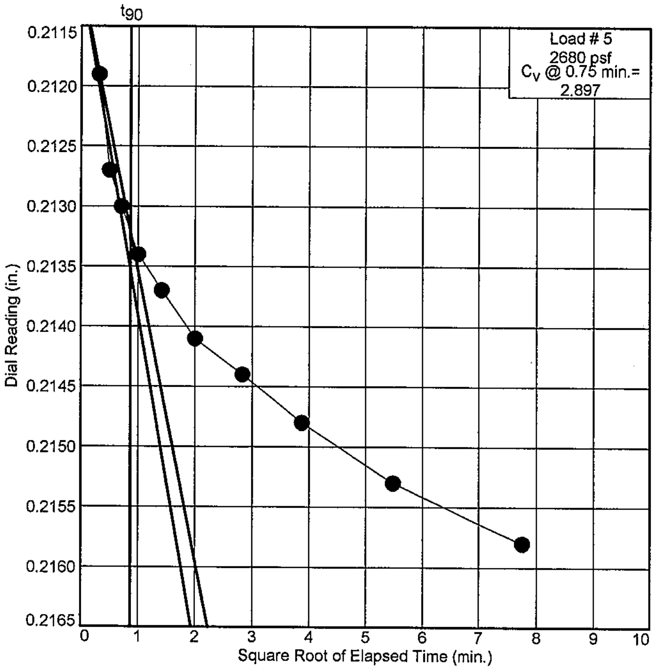
Project No.: 17179
Project: BCSD New Elementary School

Source of Sample: B-13 Depth: 3'









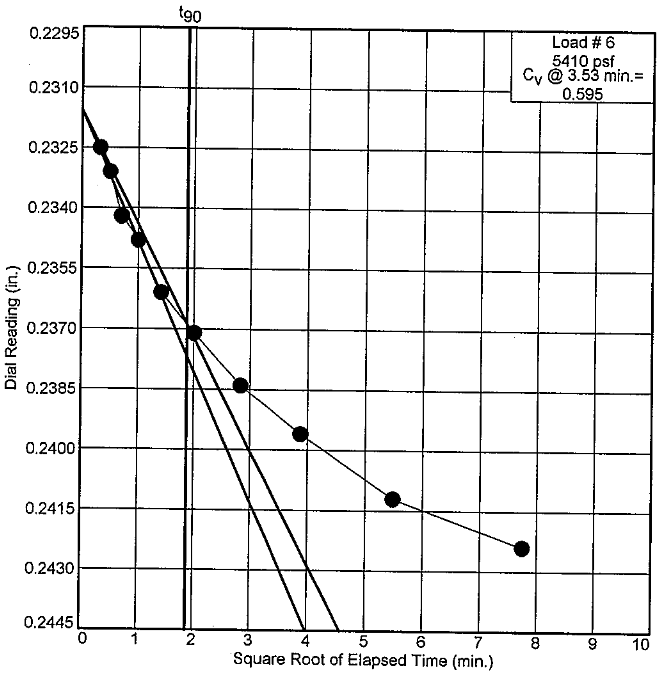
SOILS ENGINEERING, INC.

Figure B-4

Dial Reading vs. Time

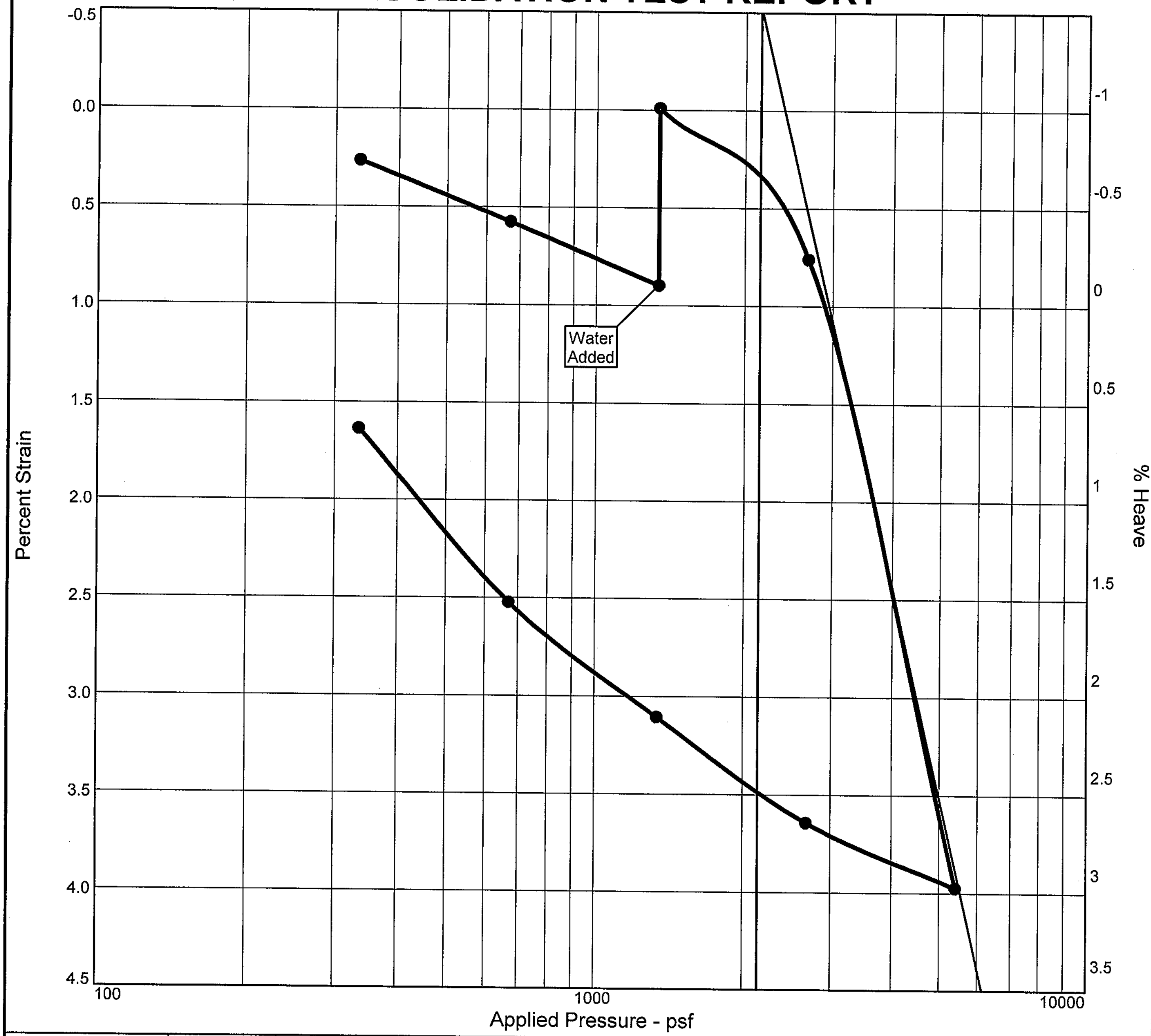
Project No.: 17179
Project: BCSD New Elementary School

Source of Sample: B-13 Depth: 3'



SOILS ENGINEERING, INC.

CONSOLIDATION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (psf)	P_c (psf)	C_c	C_s	Swell Press. (psf)	Heave %	e_o
Sat.	Moist.											
43.8 %	16.2 %	83.6	N/A	N/A	2.65	336	2622	0.22	0.04	1462	0.9	0.978

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SAND	SC	N/A

Project No. 17179 **Client:** Bakersfield City School District

Project: BCSD New Elementary School

Source of Sample: B-17 **Depth:** 3'

SOILS ENGINEERING, INC.

Remarks:

Test Date: 10/30/19

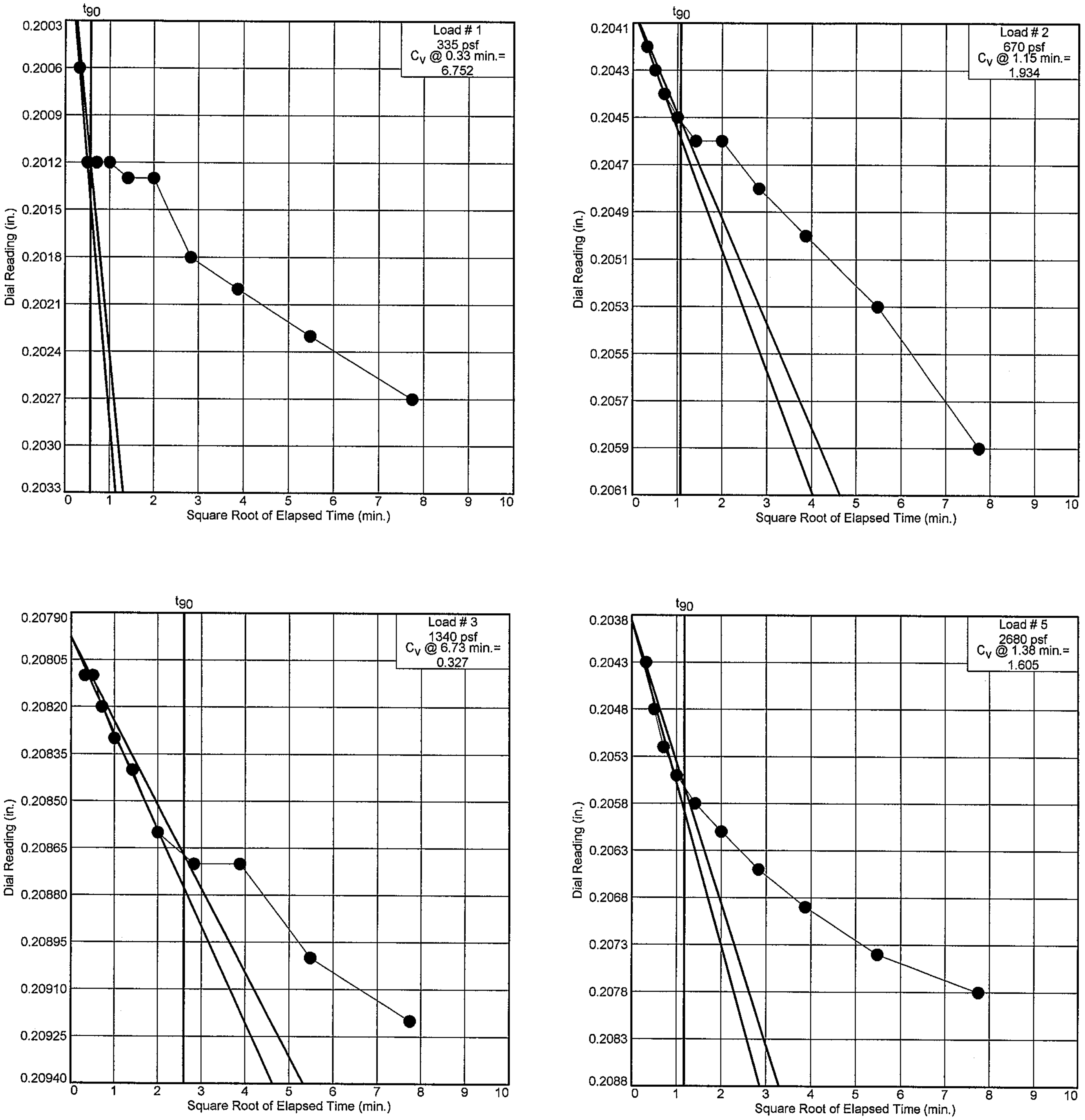
Figure B-5

Tested By: CE **Checked By:** AL

Dial Reading vs. Time

Project No.: 17179
Project: BCSD New Elementary School

Source of Sample: B-17 Depth: 3'



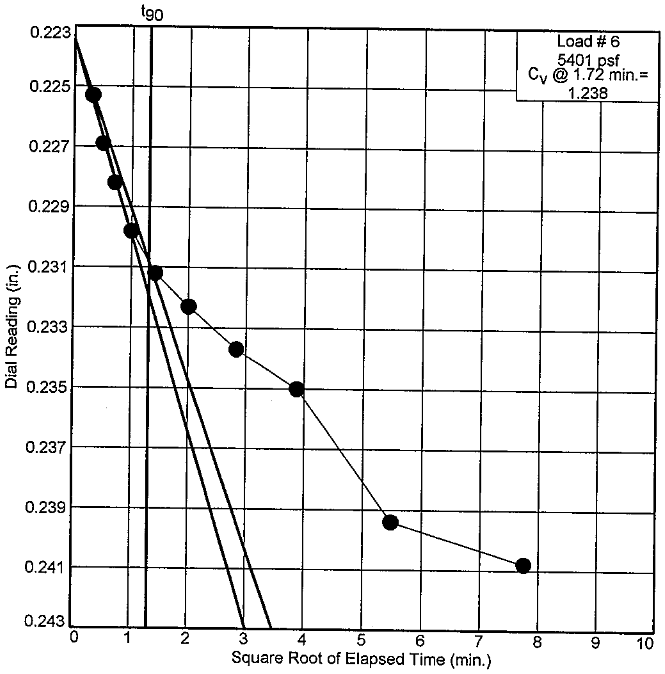
SOILS ENGINEERING, INC.

Figure B-5

Dial Reading vs. Time

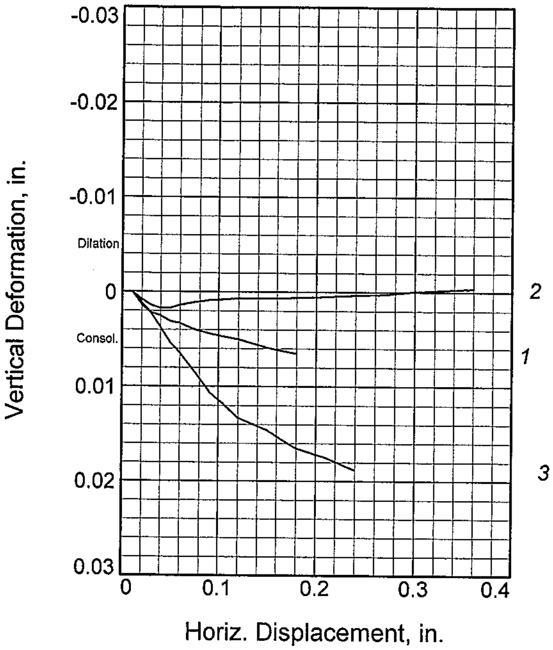
Project No.: 17179
Project: BCSD New Elementary School

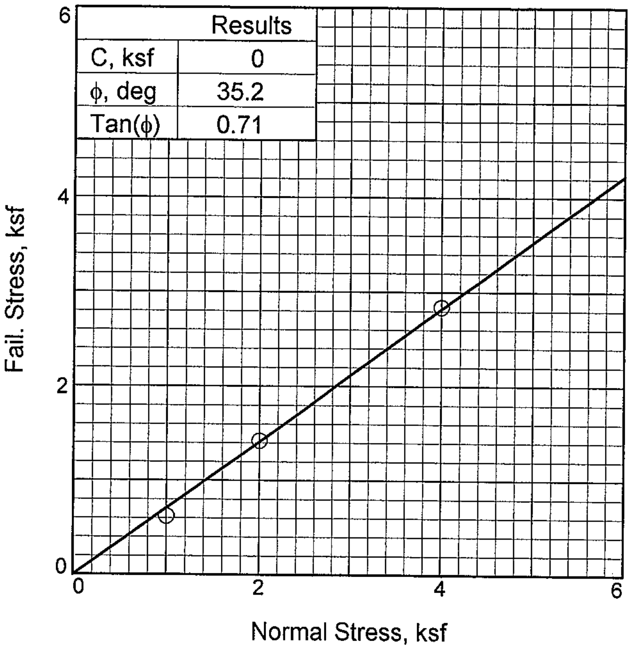
Source of Sample: B-17 Depth: 3'



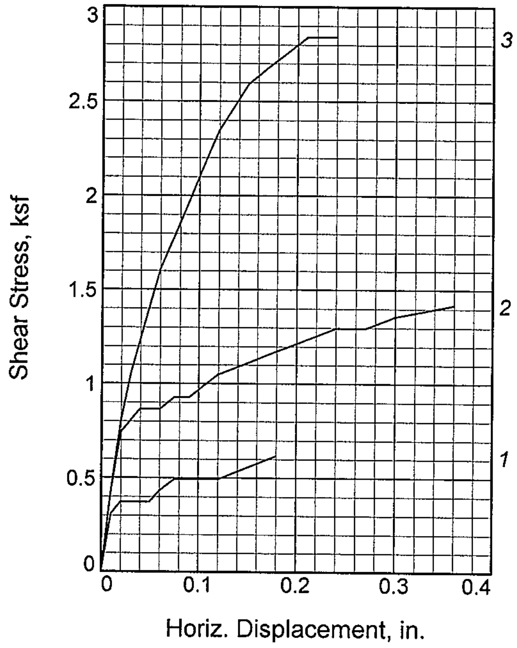
SOILS ENGINEERING, INC.

Figure B-5





	Results
C, ksf	0
ϕ, deg	35.2
Tan(ϕ)	0.71



Sample No.		1	2	3
Initial	Water Content, %	4.8	5.3	5.9
	Dry Density, pcf	90.7	90.6	98.2
	Saturation, %	15.6	17.0	22.7
	Void Ratio	0.8235	0.8270	0.6846
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	25.5	23.4	16.7
	Dry Density, pcf	90.7	90.6	98.2
	Saturation, %	82.0	74.9	64.7
	Void Ratio	0.8235	0.8270	0.6846
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		0.62	1.42	2.84
Displacement, in.		0.18	0.36	0.21
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.50" x 6" TUBE
Description: SILTY SAND; light reddish-brown; trace of clay; dry; fine; medium dense.
LL= N/A **PI=** N/A
Assumed Specific Gravity= 2.65
Remarks: Test Date: 10/24/19

Figure C-1

Client: Bakersfield City School District

Project: BCSD New Elementary School

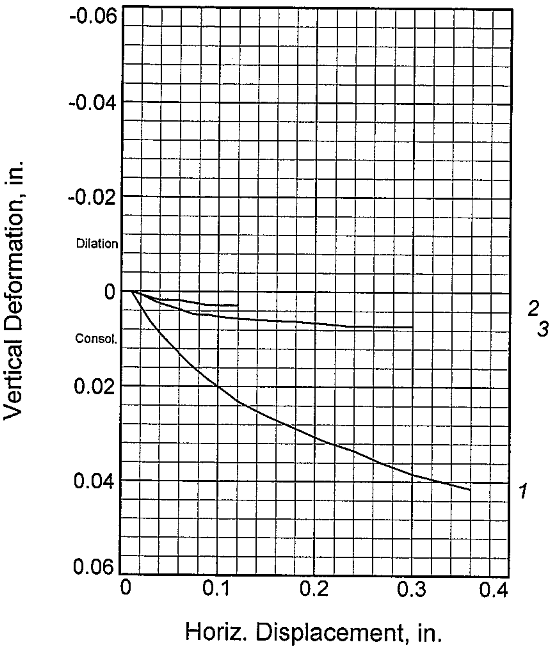
Source of Sample: B-2 **Depth:** 3'

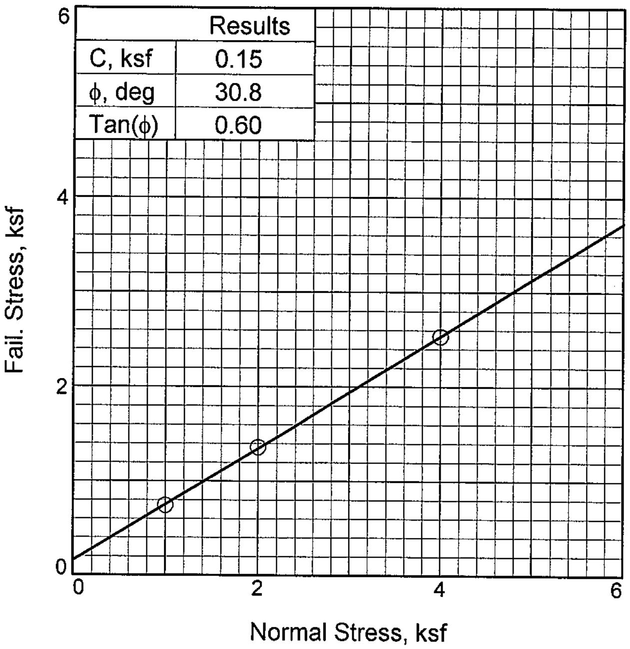
Proj. No.: 17179 **Date Sampled:** 09/23/19

DIRECT SHEAR TEST REPORT

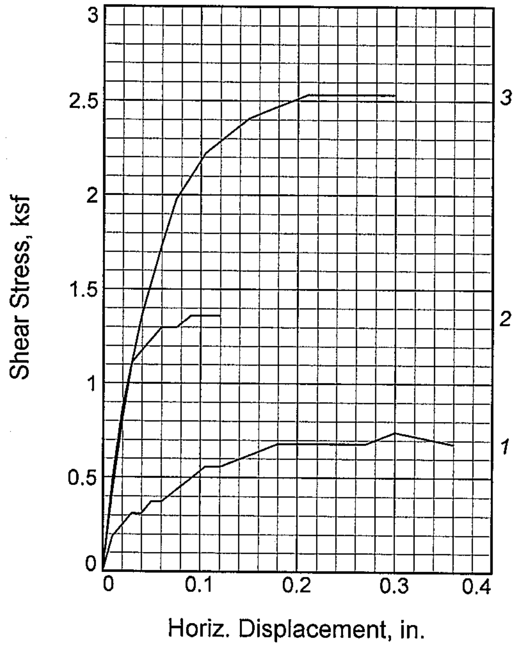
SOILS ENGINEERING, INC.

Tested By: JMB **Checked By:** AL





	Results
C, ksf	0.15
ϕ, deg	30.8
Tan(ϕ)	0.60



Sample No.		1	2	3
Initial	Water Content, %	5.8	6.4	7.4
	Dry Density, pcf	89.9	85.6	92.0
	Saturation, %	18.4	18.3	24.5
	Void Ratio	0.8410	0.9315	0.7980
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	20.4	27.8	17.9
	Dry Density, pcf	89.9	85.6	92.0
	Saturation, %	64.2	79.1	59.3
	Void Ratio	0.8410	0.9315	0.7980
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		0.74	1.36	2.53
Displacement, in.		0.30	0.09	0.21
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.50" x 6" TUBE

Description: CLAYEY SAND; light reddish-brown; dry; low plasticity; dense.

LL= N/A **PI=** N/A

Assumed Specific Gravity= 2.65

Remarks: Test Date: 10/24/19

Figure C-2

Client: Bakersfield City School District

Project: BCSD New Elementary School

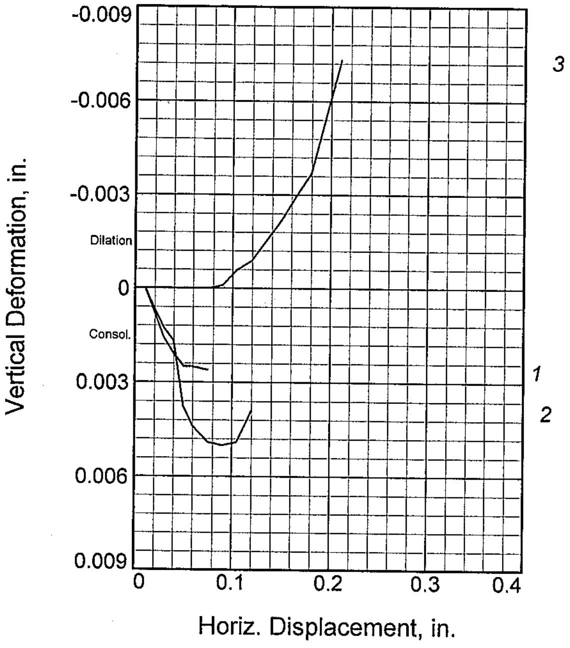
Source of Sample: B-5 **Depth:** 3'

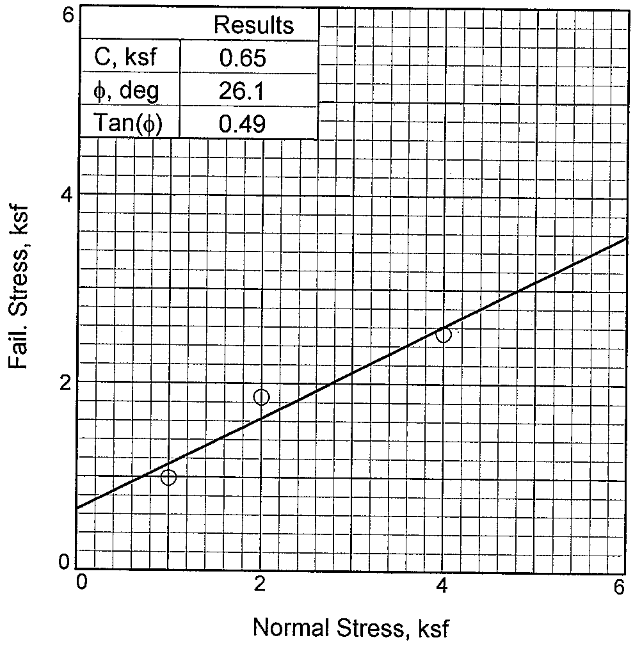
Proj. No.: 17179 **Date Sampled:** 09/24/19

DIRECT SHEAR TEST REPORT

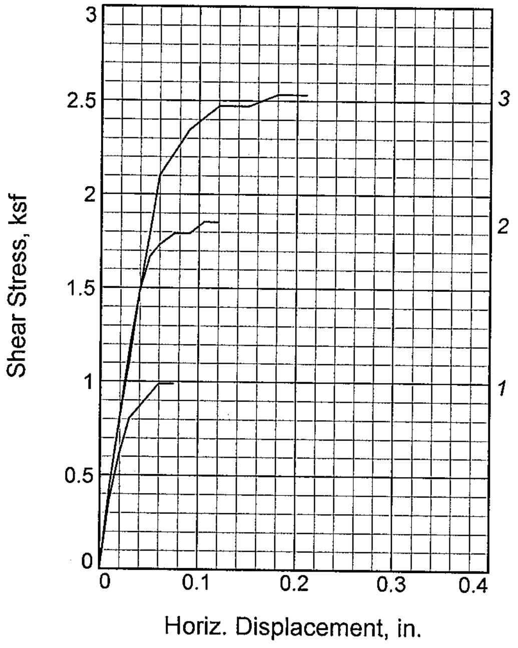
SOILS ENGINEERING, INC.

Tested By: JMB **Checked By:** AL





	Results
C, ksf	0.65
ϕ, deg	26.1
Tan(ϕ)	0.49



Sample No.		1	2	3
Initial	Water Content, %	9.1	11.3	8.1
	Dry Density, pcf	101.7	99.9	101.6
	Saturation, %	38.6	45.6	34.3
	Void Ratio	0.6262	0.6556	0.6276
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	20.0	19.3	21.0
	Dry Density, pcf	101.7	99.9	101.6
	Saturation, %	84.8	77.9	88.6
	Void Ratio	0.6262	0.6556	0.6276
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
Normal Stress, ksf		1.00	2.00	4.00
Fail. Stress, ksf		0.99	1.85	2.53
Displacement, in.		0.06	0.11	0.18
Ult. Stress, ksf				
Displacement, in.				
Strain rate, in./min.		N/A	N/A	N/A

Sample Type: 2.50" x 6" TUBE

Description: SANDY CLAY; light reddish brown, dry, dense, low plasticity.

LL= N/A **PI=** N/A

Assumed Specific Gravity= 2.65

Remarks: Test Date: 10/24/19

Figure C-3

Client: Bakersfield City School District

Project: BCSD New Elementary School

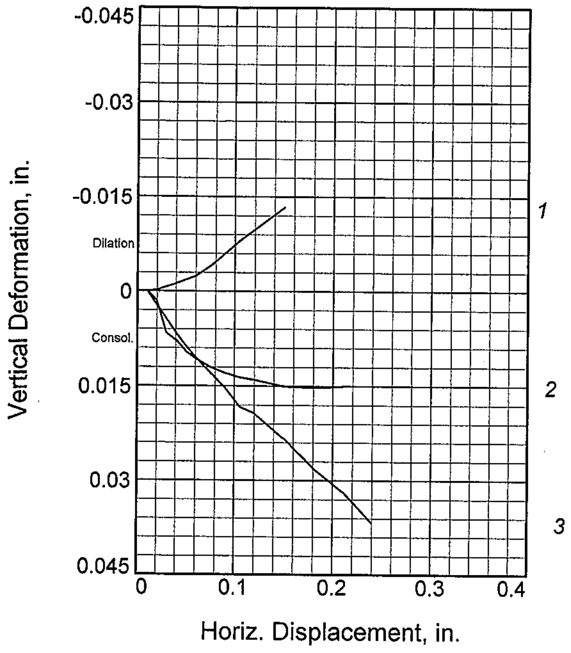
Source of Sample: B-8 **Depth:** 3'

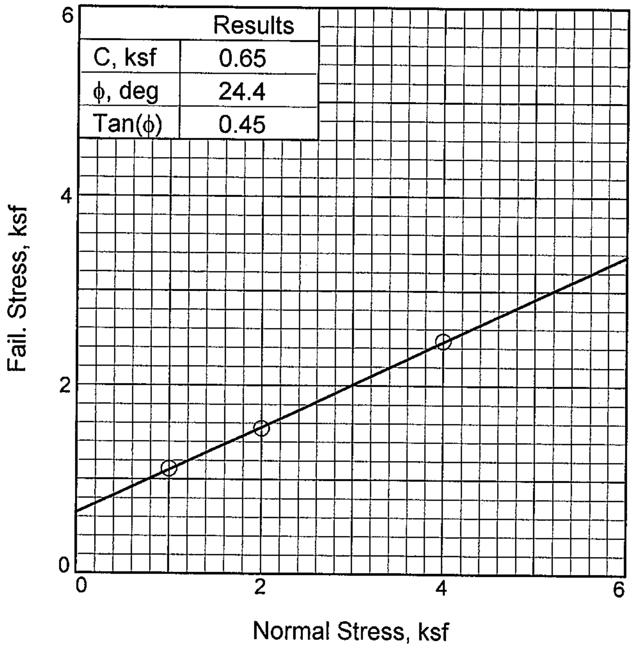
Proj. No.: 17179 **Date Sampled:** 09/24/19

DIRECT SHEAR TEST REPORT

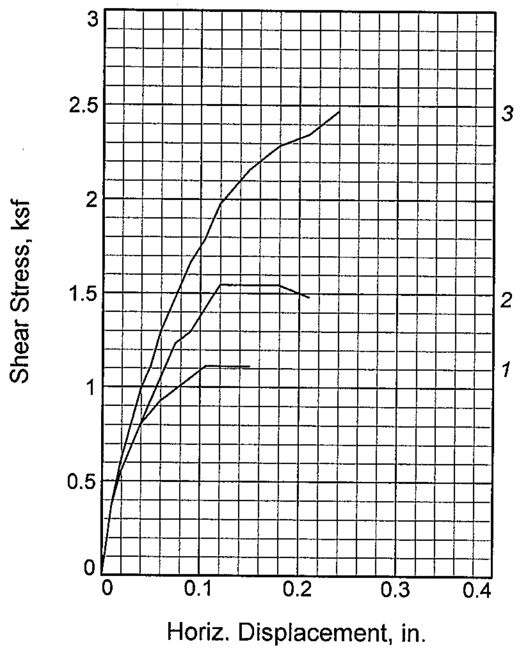
SOILS ENGINEERING, INC.

Tested By: JMB **Checked By:** AL





	Results
C, ksf	0.65
ϕ, deg	24.4
Tan(ϕ)	0.45



	Sample No.	1	2	3
Initial	Water Content, %	3.4	7.8	7.3
	Dry Density, pcf	111.2	102.2	105.8
	Saturation, %	18.5	33.5	34.4
	Void Ratio	0.4879	0.6194	0.5641
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
At Test	Water Content, %	16.9	21.0	19.3
	Dry Density, pcf	111.2	102.2	105.8
	Saturation, %	92.0	90.0	90.9
	Void Ratio	0.4879	0.6194	0.5641
	Diameter, in.	2.38	2.38	2.38
	Height, in.	1.00	1.00	1.00
	Normal Stress, ksf	1.00	2.00	4.00
	Fail. Stress, ksf	1.11	1.54	2.47
	Displacement, in.	0.11	0.12	0.24
	Ult. Stress, ksf			
	Displacement, in.			
	Strain rate, in./min.	N/A	N/A	N/A

Sample Type: 2.50" x 6" TUBE

Description: SANDY CLAY; light reddish-brown; dry; high plasticity; hard.

LL= N/A **PI=** N/A

Assumed Specific Gravity= 2.65

Remarks: Test Date: 10/26/19

Figure C-4

Client: Bakersfield City School District

Project: BCSD New Elementary School

Source of Sample: B-19 **Depth:** 3'

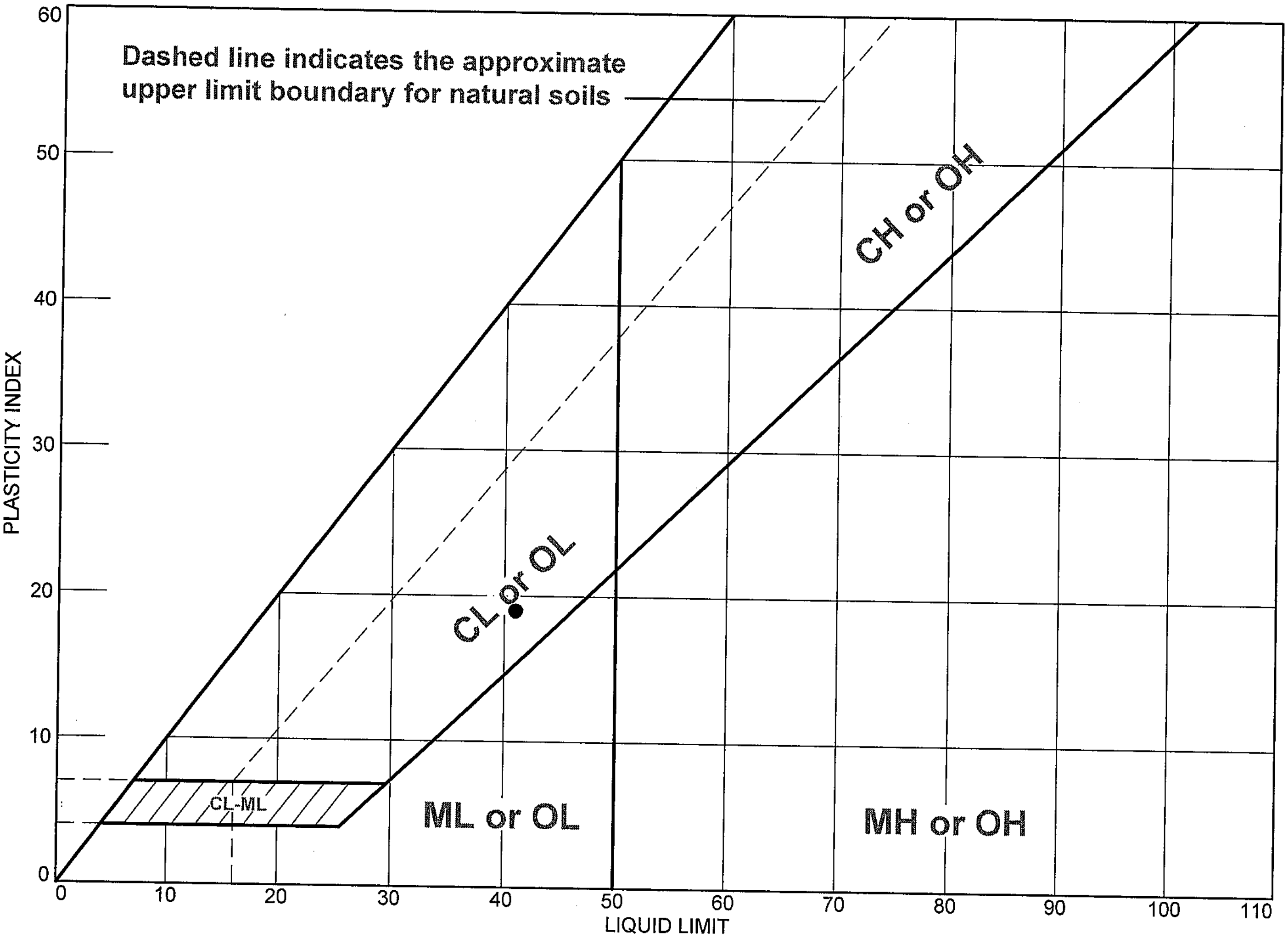
Proj. No.: 17179 **Date Sampled:** 10/01/19

DIRECT SHEAR TEST REPORT

SOILS ENGINEERING, INC.

Tested By: CE **Checked By:** AL

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	CLAYEY SAND; yellowish-brown; meidum plasticity; trace of gravel.	41	22	19	65	43	SC

Project No. 17179 **Client:** Bakersfield City School District

Project: BCSD New Elementary School

● **Location:** B-7 @ 0-5' **Depth:** 0-5' **Sample Number:** 71723

Remarks:

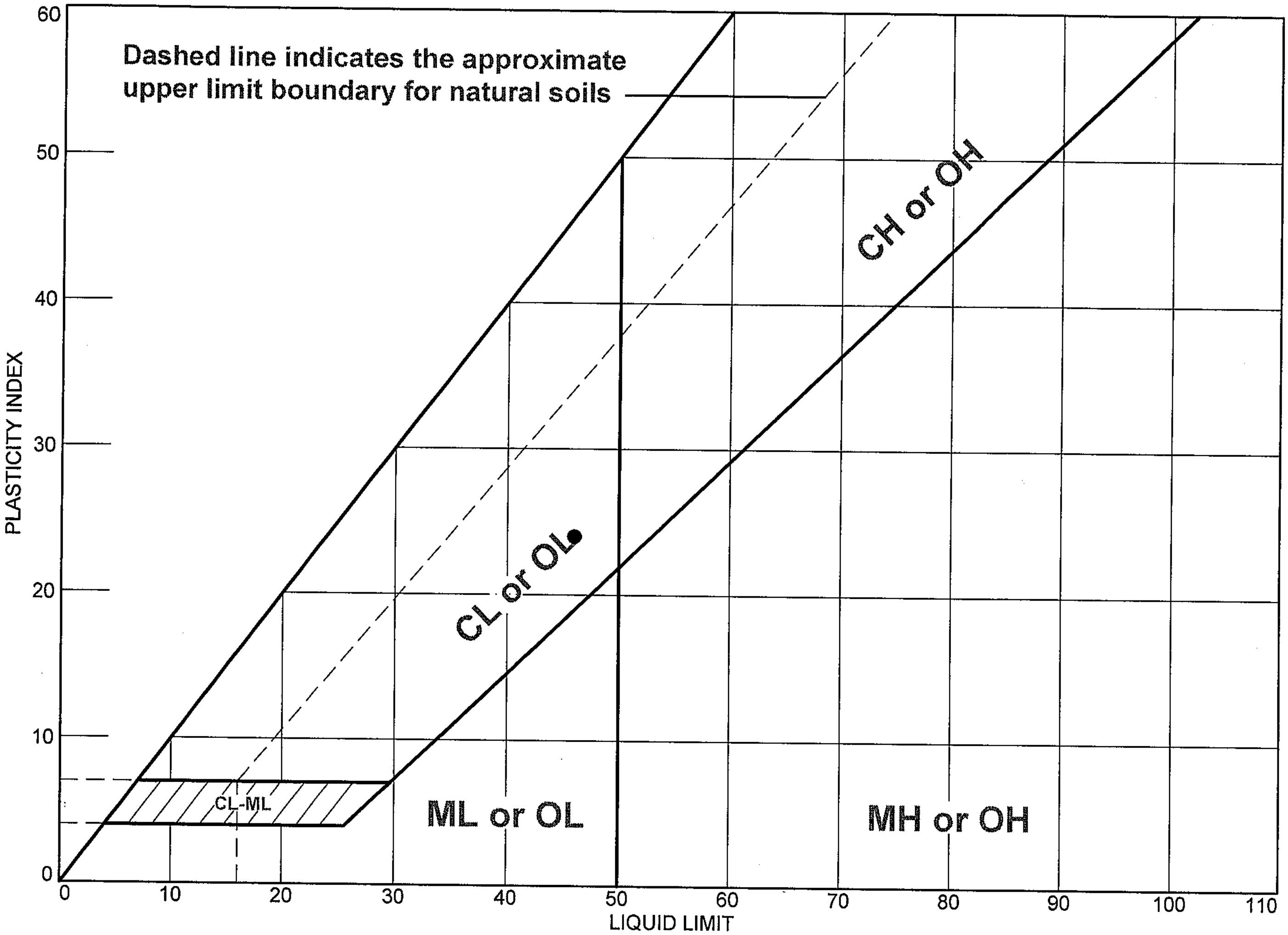
● Test Date: 10/25/19

SOILS ENGINEERING, INC.

Figure D-1

Tested By: RG **Checked By:** AL

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	CLAYEY SAND; yellowish-brown; meidum plasticity; trace of gravel.	46	22	24	68	46	SC

Project No. 17179 **Client:** Bakersfield City School District

Project: BCSD New Elementary School

● **Location:** B-14 @ 0-5' **Depth:** 0-5' **Sample Number:** 71724

Remarks:

● Test Date: 10/29/19

SOILS ENGINEERING, INC.

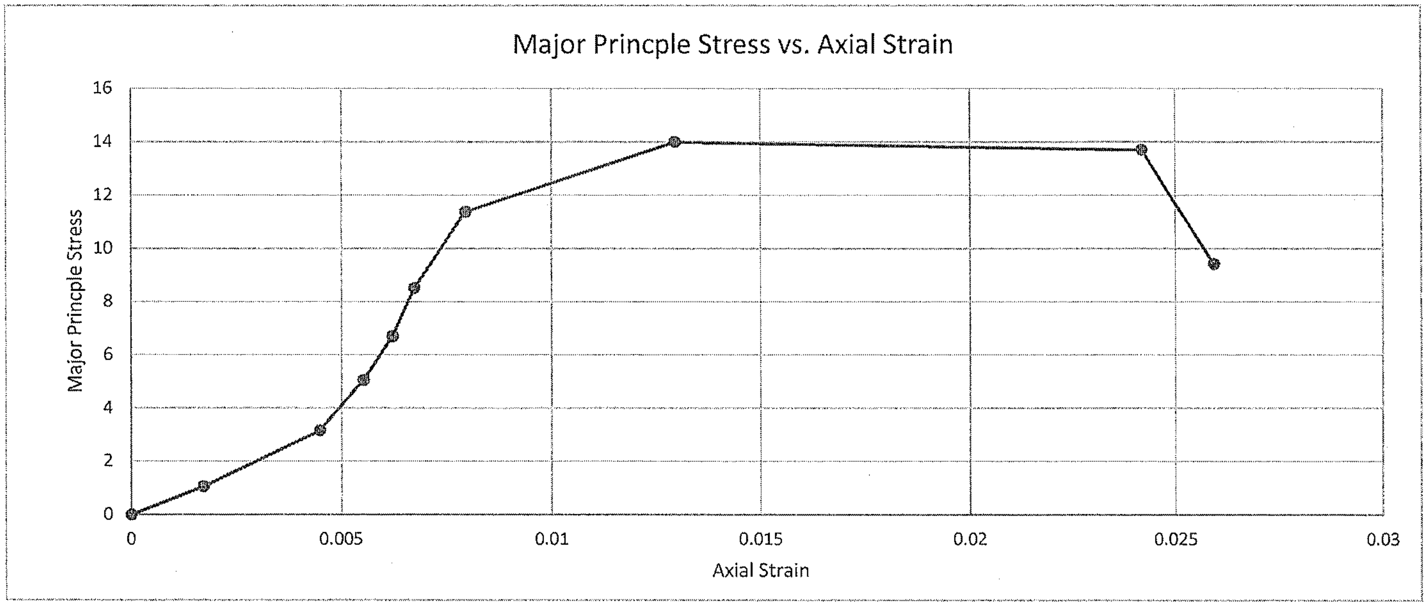
Figure D-2

Tested By: RG **Checked By:** AL

Unconfined Compression Report

Initial Average Diameter D_0(in.)= 2.41 should be close to 2.375 which is the inside diameter of boring tube
Initial Average Height H_0(in.)= 5.79 shoot for 5.5", acceptable range is 4.75"-5.90" based on boring tube diameter
Initial Area A_0(in^2)= 4.56
Initial Volume V_0(in^3)= 26.41
Height to Diameter ratio= 2.40 ASTM specifies 2-2.5 ratio
Strain rate (%/min)= 1.25 strain rate must be between .5-2(%/min)
rate of hand crank (seconds/turn)= 4.15

	elapsed time	load dial	axial load	strain dial	total strain	unit strain	corrected area	stress	stress
Units	(sec)	(.001")	(lbs)	(.01")	(.001")		(in^2)	(lbs/in^2)	(ksf)
	0	0	2.06	0	0	0	0.00	0.00	0
	15	35	33.66	10	0.01	0.00172712	4.57	7.37	1.06
	30	109	100.49	26	0.026	0.0044905	4.58	21.93	3.16
	45	176	160.99	32	0.032	0.00552677	4.59	35.10	5.05
	60	234	213.37	36	0.036	0.00621762	4.59	46.49	6.69
	75	298	271.16	39	0.039	0.00673575	4.59	59.05	8.50
	90	400	363.27	46	0.046	0.00794473	4.60	79.02	11.38
	105	495	449.06	75	0.075	0.01295337	4.62	97.19	13.99
	120	490	444.55	140	0.14	0.02417962	4.67	95.11	13.70
	135	337	306.38	150	0.15	0.02590674	4.68	65.44	9.42



Unconfined Compressive strength Q_u= 97.19 (psi)
Cohesion C = 7.00 (ksf)

SOILS ENGINEERING, INC.

Client: Bakersfield City School District

Project: BCSD New Elementary School

Location: B-14 **Depth:** 3'

Material Description: SANDY CLAY; brown, high plasticity.

Project No.: 19-17179 **Figure** E-1

APPENDIX D

SEISMIC INVESTIGATION

SEISMIC DESIGN INFORMATION

USGS Design Map Summary and Detail Report

EQFAULT

Version 3.00

California Fault Map

ADDITIONAL EXTERNAL REFERENCE:

Geological Hazard Study
SEI File No. 19-17179
Dated, October 31, 2019

STRUCTURAL ENGINEERS ASSOCIATION CALIFORNIA

OSHPD

17179 New City School Masterson at Paladino

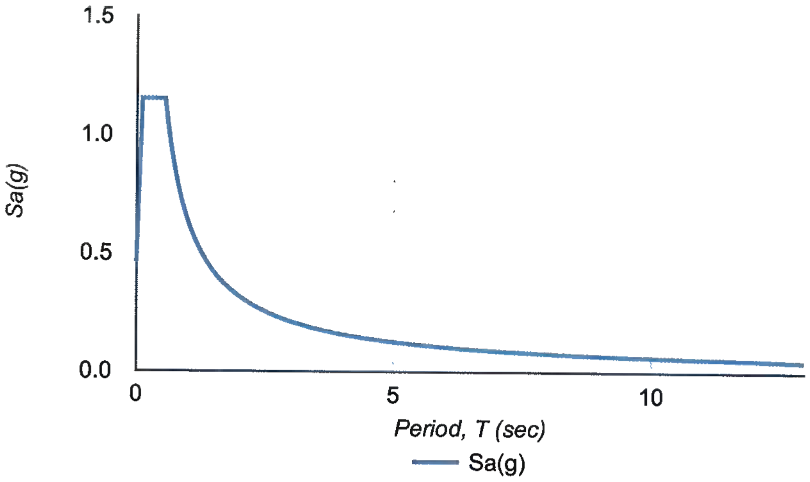
Latitude, Longitude: 35.4109, -118.8818

Date	10/8/2019, 2:45:12 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

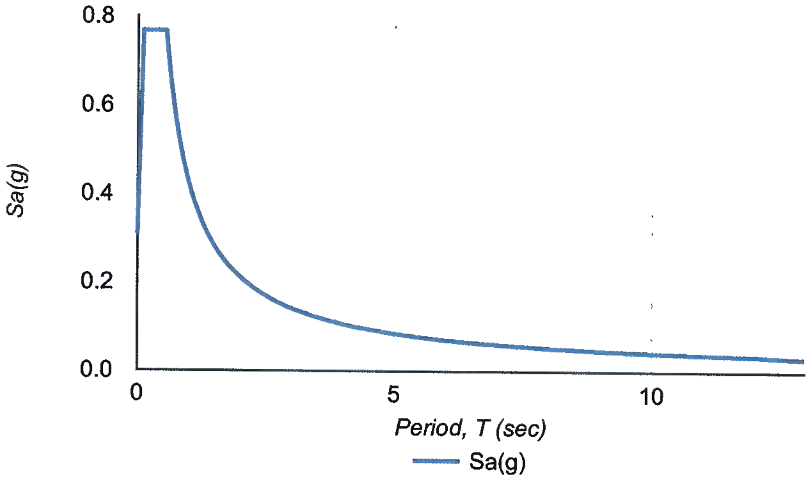
Type	Value	Description
S_S	1.076	MCE_R ground motion. (for 0.2 second period)
S_1	0.391	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.151	Site-modified spectral acceleration value
S_{M1}	0.633	Site-modified spectral acceleration value
S_{DS}	0.767	Numeric seismic design value at 0.2 second SA
S_{D1}	0.422	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.07	Site amplification factor at 0.2 second
F_v	1.618	Site amplification factor at 1.0 second
PGA	0.412	MCE_G peak ground acceleration
F_{PGA}	1.088	Site amplification factor at PGA
PGA_M	0.448	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.076	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.069	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.391	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.369	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	1.007	Mapped value of the risk coefficient at short periods
C_{R1}	1.06	Mapped value of the risk coefficient at a period of 1 s

MCER Response Spectrum



Design Response Spectrum



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                         *     E Q F A U L T   *
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                         *     Version 3.00    *
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                      DETERMINISTIC ESTIMATION OF
                 PEAK ACCELERATION FROM DIGITIZED FAULTS


JOB NUMBER: 17179
                                                        DATE: 09-10-2019

JOB NAME: 17179 New City School

CALCULATION NAME: 17179 New City School

FAULT-DATA-FILE NAME: CGSFLTE.DAT


SITE COORDINATES:
   SITE LATITUDE:  35.4109
   SITE LONGITUDE:  118.8818

SEARCH RADIUS:   100  mi

ATTENUATION RELATION:   3) Boore et al. (1997) Horiz. - NEHRP D (250)
   UNCERTAINTY (M=Median, S=Sigma): M       Number of Sigmas:  0.0
   DISTANCE MEASURE:  cd_2drp
   SCOND:   0
   Basement Depth:  5.00 km     Campbell SSR:        Campbell SHR:
   COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED:  CGSFLTE.DAT


MINIMUM DEPTH VALUE (km):  0.0
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                                DETERMINISTIC SITE PARAMETERS
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                                |              |ESTIMATED MAX. EARTHQUAKE EVENT
                                | APPROXIMATE  |------------------------------
        ABBREVIATED             |  DISTANCE    | MAXIMUM  |   PEAK   |EST. SITE
        FAULT  NAME             |  mi    (km)  |EARTHQUAKE|   SITE   |INTENSITY
                                |              | MAG.(Mw) | ACCEL. g |MOD.MERC.
================================|==============|==========|==========|=========
Kern Front                      |   9.0(  14.5)|   6.3    |  0.233   |   IX
WHITE WOLF                      |  16.2(  26.1)|   7.3    |  0.260   |   IX
PLEITO THRUST                   |  29.5(  47.4)|   7.0    |  0.141   |  VIII
GARLOCK (West)                  |  35.2(  56.7)|   7.3    |  0.118   |  VII
SAN ANDREAS - Whole M-1a        |  40.8(  65.7)|   8.0    |  0.153   |  VIII
SAN ANDREAS - Carrizo M-1c-2    |  40.8(  65.7)|   7.4    |  0.111   |  VII
SAN ANDREAS - 1857 Rupture M-2a |  40.8(  65.7)|   7.8    |  0.137   |  VIII
SAN ANDREAS - Cho-Moj M-1b-1    |  40.8(  65.7)|   7.8    |  0.137   |  VIII
BIG PINE                        |  41.3(  66.5)|   6.9    |  0.085   |  VII
SAN GABRIEL                     |  48.2(  77.5)|   7.2    |  0.088   |  VII
GARLOCK (East)                  |  49.1(  79.0)|   7.5    |  0.102   |  VII
So. SIERRA NEVADA               |  51.1(  82.3)|   7.3    |  0.108   |  VII
SAN ANDREAS - Mojave M-1c-3     |  53.5(  86.1)|   7.4    |  0.090   |  VII
SAN ANDREAS - Cholame M-1c-1    |  55.8(  89.8)|   7.3    |  0.083   |  VII
SANTA YNEZ (East)               |  56.9(  91.6)|   7.1    |  0.073   |  VII
SAN CAYETANO                    |  61.5(  98.9)|   7.0    |  0.080   |  VII
SAN JUAN                        |  63.4( 102.1)|   7.1    |  0.068   |  VI
M.RIDGE-ARROYO PARIDA-SANTA ANA |  63.9( 102.9)|   7.2    |  0.086   |  VII
LENWOOD-LOCKHART-OLD WOMAN SPRGS|  64.4( 103.7)|   7.5    |  0.082   |  VII
LITTLE LAKE                     |  66.1( 106.4)|   6.9    |  0.059   |  VI
HOLSER                          |  67.4( 108.5)|   6.5    |  0.057   |  VI
SANTA SUSANA                    |  67.5( 108.6)|   6.7    |  0.063   |  VI
OAK RIDGE (Onshore)             |  70.0( 112.7)|   7.0    |  0.072   |  VI
NORTHRIDGE (E. Oak Ridge)       |  70.2( 112.9)|   7.0    |  0.072   |  VI
NORTH CHANNEL SLOPE             |  71.3( 114.8)|   7.4    |  0.088   |  VII
RED MOUNTAIN                    |  71.9( 115.7)|   7.0    |  0.071   |  VI
SIERRA MADRE (San Fernando)     |  72.1( 116.0)|   6.7    |  0.060   |  VI
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SIMI-SANTA ROSA                   | 72.3( 116.4)|   7.0    |   0.070   |   VI
GREAT VALLEY 14                   | 72.6( 116.9)|   6.4    |   0.051   |   VI
VENTURA - PITAS POINT             | 73.8( 118.7)|   6.9    |   0.066   |   VI
OWENS VALLEY                      | 73.9( 118.9)|   7.6    |   0.078   |   VII
SANTA YNEZ (West)                 | 74.7( 120.2)|   7.1    |   0.059   |   VI
OAK RIDGE MID-CHANNEL STRUCTURE   | 78.0( 125.6)|   6.6    |   0.054   |   VI
VERDUGO                           | 79.0( 127.2)|   6.9    |   0.062   |   VI
SAN LUIS RANGE (S. Margin)        | 80.5( 129.6)|   7.2    |   0.072   |   VI
GRAVEL HILLS - HARPER LAKE        | 81.1( 130.5)|   7.1    |   0.056   |   VI
HELENDALE - S. LOCKHARDT          | 81.4( 131.0)|   7.3    |   0.062   |   VI
SIERRA MADRE                      | 81.6( 131.3)|   7.2    |   0.071   |   VI
CHANNEL IS. THRUST (Eastern)      | 81.7( 131.5)|   7.5    |   0.083   |   VII
BLACKWATER                        | 82.8( 133.2)|   7.1    |   0.055   |   VI
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                         DETERMINISTIC SITE PARAMETERS
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                                  |             |ESTIMATED MAX. EARTHQUAKE EVENT
                                  | APPROXIMATE |-------------------------------
          ABBREVIATED             |  DISTANCE   | MAXIMUM  |   PEAK   |EST. SITE
          FAULT  NAME             |  mi   (km)  |EARTHQUAKE|   SITE   |INTENSITY
                                  |             | MAG.(Mw) | ACCEL. g |MOD.MERC.
==================================|=============|==========|==========|=========
SAN ANDREAS - Parkfield           | 83.3( 134.0)|   6.5    |   0.040  |   V
LOS ALAMOS-W. BASELINE            | 85.6( 137.8)|   6.9    |   0.059  |   VI
ANACAPA-DUME                      | 87.2( 140.3)|   7.5    |   0.079  |   VII
GREAT VALLEY 13                   | 87.4( 140.7)|   6.5    |   0.047  |   VI
INDEPENDENCE                      | 87.5( 140.8)|   7.1    |   0.064  |   VI
OAK RIDGE(Blind Thrust Offshore)  | 88.1( 141.8)|   7.1    |   0.064  |   VI
LIONS HEAD                        | 89.6( 144.2)|   6.6    |   0.048  |   VI
TANK CANYON                       | 90.0( 144.8)|   6.4    |   0.043  |   VI
CLAMSHELL-SAWPIT                  | 90.3( 145.3)|   6.5    |   0.046  |   VI
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LOS OSOS                           |  90.9( 146.3)|   7.0    |   0.059  |   VI
MALIBU COAST                       |  91.8( 147.8)|   6.7    |   0.050  |   VI
RINCONADA                          |  92.0( 148.0)|   7.5    |   0.062  |   VI
HOLLYWOOD                          |  92.1( 148.2)|   6.4    |   0.043  |   VI
CASMALIA (Orcutt Frontal Fault)    |  93.1( 149.9)|   6.5    |   0.044  |   VI
UPPER ELYSIAN PARK BLIND THRUST    |  93.2( 150.0)|   6.4    |   0.042  |   VI
PUENTE HILLS BLIND THRUST          |  94.0( 151.3)|   7.1    |   0.061  |   VI
RAYMOND                            |  94.5( 152.1)|   6.5    |   0.044  |   VI
SANTA MONICA                       |  94.9( 152.8)|   6.6    |   0.046  |   VI
NEWPORT-INGLEWOOD (L.A.Basin)      |  98.5( 158.5)|   7.1    |   0.048  |   VI
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-END OF SEARCH-   59 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE Kern Front                     FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 9.0 MILES (14.5 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.2595 g
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CALIFORNIA FAULT MAP

17179 New City School