GEOTECHNICAL INVESTIGATION REPORT
PROPOSED NEW CITY HALL SITE IMPROVEMENTS
501 AND 509 WEST WEBER AVENUE
STOCKTON, CALIFORNIA
KLEINFELDER PROJECT NO. 20220839.001A

JUNE 21, 2021

June 21, 2021
Kleinfelder Project No: 20220839.001A

Mr. Bruce Playle
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SUBJECT: Geotechnical Investigation Report
Proposed New City Hall Site Improvements
501 and 509 West Weber Avenue
Stockton, California

Dear Mr. Playle:

The attached report presents the results of Kleinfelder's geotechnical investigation for the proposed New City Hall Site Improvements Project located at 501and 509 West Weber Avenue in Stockton, California. The attached report describes the investigation, findings, conclusions, and recommendations for use in project design and construction.

It is Kleinfelder's professional opinion that construction for the proposed project is geotechnically feasible using conventional earthmoving equipment and shallow spread foundation systems, provided settlement tolerances can be incorporated into the design. The presence of undocumented fill throughout the site consisting of variable soil types and relative density/consistency, including moderately to highly plastic clays, are the main geotechnical issues of concern. Additionally, ground shaking due to regional earthquake activity is anticipated during the life of the project and should be considered in project design. Recommendations for use in design of foundations, site grading, pavements, and other geotechnical considerations are presented in this report and should be incorporated into project design and construction.

Kleinfelder appreciates the opportunity to provide geotechnical engineering services during the design phase of this project. If there are any questions concerning the information presented in this report, please contact this office at your convenience.

Respectfully submitted,

KLEINFELDER, INC.

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1 INTRODUCTION

1.1 GENERAL

This report presents the results of our geotechnical investigation for the proposed New City Hall Site Improvements Project located at 501 and 509 West Weber Avenue in Stockton, California. A Site Vicinity Map and Exploration Location Map showing the location of the project site are presented on Figures 1 and 2, respectively. This report contains a description of our site investigation methods and findings including field and laboratory data. It also provides our geotechnical conclusions and recommendations for earthwork, foundation types, and other construction considerations. Conclusions and recommendations presented in this report are based on the subsurface conditions encountered at the locations of our explorations and our previous experience in the area.

1.2 PROJECT UNDERSTANDING

It is our understanding that design of the proposed project is currently underway. On a preliminary basis, we understand the project will include the removal of a portion of the existing pavements, flatwork, and landscaping and replacement with new pavements, flatwork, and landscaping. Additionally, the project will include a new fire pump house and mechanical equipment enclosures along with new metal fencing and gates, vehicle impact bollards, and a new monument sign wall. Based on the preliminary plans prepared by Indigo Hammond & Playle dated December 21, 2020, sheet number C-101, the fire pump house and mechanical equipment enclosures will consist of CMU structures with concrete slab-on-grade floors and conventional spread foundations. The structures range in size from about 220 to 270 square feet. Structural loads are currently unknown but are anticipated to be relatively light. New underground utilities are also planned at several locations throughout the site.

Proposed grading plans have not been made available at this time, however, given the site is currently developed and surrounded by existing development, we anticipate earthwork cuts and/or fills will be minimal and generally match existing grades. Excavations for underground utilities are not anticipated to exceed 10 feet below final site grade. If grading conditions are significantly different, we should be given the opportunity to review our recommendations and provide supplemental recommendations, if appropriate.

1.3 PURPOSE AND SCOPE OF SERVICES

The purpose of this investigation was to explore and evaluate the subsurface conditions at the site in order to provide geotechnical input for use in design and construction of the proposed project and the associated earthwork for this project. The scope of services was outlined in our proposal dated March 18, 2021 (Proposal No.: LOCALMKT.WEOH/STO21P120557R4) and consisted of pre-field activities, field explorations, laboratory testing, engineering analysis, and preparation of this report.

This investigation specifically excluded the assessment of site environmental characteristics, particularly those involving hazardous chemicals. However, soil samples were screened with a photo ionization detector (PID). The PID readings are shown on the exploration logs presented in Appendix A.

1.4 PREVIOUS SITE INVESTIGATIONS

Kleinfelder conducted a geotechnical investigation at the project site in 1980. The previous investigation report was titled, “Report, Soils Investigation, Proposed High Rise Commercial Building, West End Redevelopment Project, Stockton, California,” Dated February 28, 1980, Kleinfelder Project No. S-2094-10. As part of that investigation, six borings were performed at depths of between 5 and 51½ feet below existing ground surface. Pertinent exploration logs and laboratory test results from the 1980 investigation are presented in Appendix C.

2 FIELD EXPLORATION AND LABORATORY TESTING

2.1 FIELD EXPLORATION

2.1.1 Pre-Field Activities

Prior to subsurface exploration, Kleinfelder filed an application for a drilling permit with San Joaquin County Environmental Health Department (EHD), marked exploration locations in the field, and Underground Service Alert (USA) was contacted to provide utility clearance in the public right-of-way. We also prepared a site-specific health and safety plan for the field exploration activities. This plan was discussed with the field crews prior to the start of field exploration work.

2.1.2 Exploratory Borings

To evaluate the subsurface conditions at the site, five (5) hand auger borings (HA-1 through HA-5) and four (4) dynamic cone penetration tests (DCPs) were performed on June 14, 2021. The depth of the borings ranged from approximately 1 to 8½ feet below the existing ground surface. The depth of the DCPs ranged from approximately 5½ to 8½ feet below the existing ground surface. The borings and DCPs were performed by Confluence Environmental using hand operated equipment. The approximate exploration locations are shown on Figure 2. Explorations were visually located in the field using reference points. Horizontal coordinates of the borings were not surveyed.

A Kleinfelder professional maintained logs of the borings and DCPs, visually classified the soils encountered according to the Unified Soil Classification System (presented on Figure A-1 in Appendix A) and obtained samples of the subsurface materials. Soil classifications made in the field from samples were in accordance with American Society for Testing and Materials (ASTM) Method D2488. These classifications were re-evaluated in the laboratory after further observation and testing in accordance with ASTM D2487. Sample classifications, DCP blow counts recorded, and other related information were recorded on the boring and DCP logs.

Keys to the soil descriptions and symbols used on the boring logs are presented on Figures A-1 and A-2 in Appendix A. Logs of the borings are presented on Figures A-3 through A-7. Logs of the DCPs are presented on Figures A-8 through A-11. The exploration locations are shown on Figure 2.

Upon completion of the borings and DCPs, they were backfilled with neat cement grout under the supervision of an EHD inspector.

2.1.3 Sampling Procedures

Soil bag samples were collected at various depth intervals from the hand auger borings. Soil samples obtained from the borings were packaged and sealed in the field to reduce moisture loss. Following completion of the field work, the samples were returned to our laboratory for further observation and testing.

2.2 LABORATORY TESTING

Kleinfelder performed laboratory tests on selected samples recovered from the soil borings to evaluate their physical and engineering characteristics. The following laboratory tests were performed:

- Moisture Content (ASTM D2216)
- Atterberg Limits (ASTM D4318)
- Percent Passing No. 200 Sieve (ASTM D1140)

All laboratory test data are presented in Appendix B.

3 GEOLOGIC SETTING

3.1 REGIONAL GEOLOGY

The project site lies within the central portion of the Great Valley geomorphic province of California. The province is bordered to the north by the Cascade Range and Klamath Mountains, to the west by the structurally complex sedimentary and volcanic rock units of the Coast Ranges, to the east by the granitic and metamorphic basement rocks which form the gently sloping western foothills of the Sierra Nevada Mountains, and to the south by the east-west trending Transverse Ranges. About 645 km long and 80 km wide, the Great Valley is an asymmetrical, synclinal trough formed by tilting of the Sierran block during the late Tertiary and Quaternary periods with the western side dropping to form the valley and the eastern side uplifting to form the Sierra Nevada Mountains. Within the project area, erosion of the adjacent Sierra Nevada Mountains and Coast Ranges has in-filled this valley with a thick sequence of unconsolidated to semi-consolidated Quaternary (Pleistocene and Holocene) age alluvial, basin, and delta plain sediments deposited by the Sacramento and San Joaquin rivers and their tributaries. The thickness of the valley sediments varies from a thin veneer at the edges of the valley to thousands of meters in the western portion. The bedrock complex is likely composed of metamorphosed marine sediments similar to those found in the foothills of the western Sierra Nevada Mountains and the core of the Coast Ranges.

3.2 AREA AND SITE GEOLOGY

The project site is situated within the center portion of the San Joaquin Valley and within the Stockton West 7½-minute quadrangle with the eastern end of the site within the Stockton East 7½-minute quadrangle. This portion of the San Joaquin Valley consists of relatively flat alluvial fan deposits flanked on the east by elevated alluvial fan and terrace surfaces dissected by modern streams. Farther to the east are the foothills of the Sierra Nevada Mountains. This portion of the San Joaquin Valley consists of Quaternary alluvial and fluvial sedimentary deposits that originated from the Sierra Nevada Mountains, which is comprised mostly of older metamorphic bedrock intruded by Cretaceous granitic bedrock.

Based on available published geologic maps covering the site and surrounding areas, the entire project site is mapped as being underlain by Pleistocene age (more than 10,000 years) Modesto Formation (map symbol Qm) (Wagner et al., 1991). This unit is described as follows:

- **Modesto Formation (Qm)** – Pleistocene alluvium consists of distinct alluvial terraces and some alluvial fans and abandoned channel ridges. It consists of tan and light gray gravely sand, silt, and clay except where derived from volcanic rocks of the Tuscan Formation; it then is distinctly red and black with minor brown clasts.

3.3 SEISMIC HAZARD ZONE

The CGS Seismic Hazard Zone maps associated with soil liquefaction and earthquake-induced landslides, prepared by the California Geological Survey (CGS) (1982) for the Stockton West and the Stockton East quadrangles indicate that the project site is not situated within a seismic hazard zone associated with soil liquefaction or earthquake-induced landslides.

4 SITE AND SUBSURFACE CONDITIONS

4.1 SITE DESCRIPTION

The project site is located in Downtown Stockton. The site is bounded to the north by the Ship Channel, to the south by West Weber Avenue, to the west by a parking lot, and to the east by a commercial building. The parcels are currently developed with two existing buildings (the Waterfront Towers) and covered mostly with asphalt pavement, concrete flatwork, and landscaping.

4.2 SUBSURFACE CONDITIONS

The subsurface conditions described herein are based on the conditions encountered during the current and previous geotechnical investigations at the project site. The soils on site generally consisted of fill materials to depths of about 4 to 6 feet. The previous borings at the site showed that fill in some areas may extend to depths up to about 10 feet. The fill materials varied in soil type and relative density/consistency. In general, the fill consisted of loose to medium dense clayey and silty sand, medium stiff to very stiff sandy lean clay, stiff fat clay, and very stiff to hard clayey silt. The underlying materials consisted of very stiff to hard silty clay, fat clay, and clayey silt soils with interbedded layers of medium dense to dense silty sand.

The above is a general description of the subsurface conditions encountered at the site during our current and previous geotechnical investigations. For a more detailed description of the subsurface conditions encountered at our subsurface exploration points, refer to the boring and DCP logs in Appendix A and the logs from our previous investigation in Appendix C.

4.3 GROUNDWATER

Groundwater was not encountered in the borings recently completed. However, groundwater was encountered in the previous borings drilled in 1980 at depths in the range of approximately 19 to 34 feet below existing ground surface.

It should be noted that perched groundwater may be encountered or groundwater levels can fluctuate depending on factors such as river stage in the adjacent ship channel, seasonal rainfall and runoff, groundwater withdrawal/recharge, and construction and irrigation activities on this or adjacent sites. The evaluation of such factors is beyond the scope of this investigation.

4.4 VARIATIONS IN SUBSURFACE CONDITIONS

Our interpretations of soil and groundwater conditions at the site are based on the conditions encountered in the recently completed and previously completed borings and DCPs at the site and our review of available geologic and geotechnical data. Soil conditions can deviate from those conditions encountered at the exploration locations. The recommendations that follow are based on those interpretations. If significant variation in the subsurface conditions is encountered during construction, it may be necessary for Kleinfelder to review the recommendations presented herein and recommend adjustments as necessary.

5 CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

From a geotechnical standpoint, it is our opinion that the proposed construction is feasible provided the recommendations presented in this report are incorporated into the project design and construction. The following sections discuss conclusions and recommendations with respect to California Building Code (CBC) design considerations, site preparation and grading, and foundation design.

5.2 SITE PREPARATION AND EARTHWORK CONSTRUCTION

5.2.1 General

It is anticipated that site grading and excavations can be performed with conventional grading/earth moving equipment and techniques. General recommendations for site preparation and earthwork construction are presented in the following sections of this report. All references to compaction, maximum density and optimum moisture content are based on ASTM D1557, unless otherwise noted.

5.2.2 Stripping and Grubbing

Prior to general site grading, asphalt concrete, concrete flatwork, landscape vegetation, organic topsoil, and all debris should be removed and disposed of outside the construction limits. The organic content of remaining surface soils (as determined by loss-on-ignition tests) should not exceed 5 percent by weight. Deep stripping may be required where concentrations of organic soils or tree roots are encountered during site grading. The depth of stripping should be determined in the field by a representative of Kleinfelder during initial earthwork.

5.2.3 Disturbed Soil, Undocumented Fill and Subsurface Obstructions

As noted in Section 4.2, undocumented fill was encountered throughout the site which had variable soil types, relative density/consistency, and depths (up to about 10 feet below site grade). The variability of the fill suggests that little compaction control was used during placement of the fill. Accordingly, as part of site development, we recommend that existing undocumented fills encountered on site be over-excavated to firm soil or to depths determined by the geotechnical engineer during construction. Given the variability in depth of fill, we anticipate a minimum over-excavation of 4 feet below existing site grade. Over-excavation should extend at least 5 feet beyond the perimeter of the proposed structures and 3 feet beyond the perimeter of proposed pavement areas.

The exposed subgrades (existing and over-excavated) to receive engineered fills should be proof-rolled with a fully loaded tandem-axle dump truck or water truck. Areas identified as being soft or yielding should be over-excavated to firm, native soil, or to depths determined by the geotechnical engineer during construction. After proof-rolling, the subgrade should be scarified to a depth of 8 inches, moisture conditioned, and compacted as engineered fill. Deleterious materials encountered during over-excavation should be removed, and the excavated materials compacted to the requirements for engineered fill. This proof rolling, over-excavation and recompaction operation would serve to provide a uniform, stable subgrade throughout the development area thereby improving foundation design conditions and reducing settlement potential. The zone of proof rolling, over-excavation and compaction should extend horizontally at least 5 feet outside the perimeter of the proposed structures and at least 3 feet outside the perimeter of proposed pavement areas.

All site grading should include a reasonable search to locate soil disturbed by previous activity and abandoned underground structures or existing utilities that may exist within the areas of construction. Any loose or disturbed soils, void spaces made by burrowing animals that may be encountered should be over-excavated to expose firm soil, as approved by a representative of Kleinfelder.

5.2.4 Scarification and Compaction

In areas requiring placement of fill, it is recommended the fill be placed and compacted as engineered fill. Following site stripping and any required grubbing and/or over-excavation, it is recommended areas to receive engineered fill be scarified to a depth of 8 inches, uniformly moisture conditioned to between about 2 and 4 percentage points above the optimum moisture content and be compacted to at least 90 percent relative compaction, as determined by ASTM D1557.

5.2.5 Engineered Fill

5.2.5.1 *Onsite Materials*

The on-site soils are suitable for use as general fill, provided the materials are free of debris, significant organics or other deleterious materials, and have a maximum particle size less than 3 inches in maximum dimension. Where imported material is brought in for engineered and "non-expansive" fill, it is recommended that it be granular in nature and conform to the minimum criteria discussed in Section 5.2.5.2.

5.2.5.2 *Engineered Fill Requirements*

In addition to the above requirements, specific requirements for imported engineered fill and non-expansive fill as well as applicable test procedures to verify material suitability are provided in Table 5-1.

Table 5-1
Imported Engineered Fill Requirements

Fill Requirement		**Test Procedures**	
Gradation		**ASTM**[1]	**Caltrans**[2]
Sieve Size	**Percent Passing**		
3 inch	100	D6913	202
¾-inch	70-100	D6913	202
No. 200	15-70	D6913	202
Plasticity			
Liquid Limit	**Plasticity Index**		
<35	<12	D4318	204
Organic Content			
No visible organics		---	---
Expansion Potential			---
20 or less		D4829	---
Soluble Sulfates			
Less than 2,000 ppm		---	417
Soluble Chloride			
Less than 300 ppm		---	422
Resistivity			
Greater than 2,000 ohm-cm		---	643

1 American Society for Testing and Materials Standards (latest edition)
2 State of California, Department of Transportation, Standard Test Methods (latest edition)

All imported fill materials to be used for engineered fill should be sampled and tested by Kleinfelder prior to being transported to the site.

5.2.5.3 *Compaction Criteria*

On-site or imported soils that meet the criteria outlined in Table 5-1 above that are to be used for engineered fill should be uniformly moisture conditioned to between 1 to 4 percentage points above the optimum moisture content, placed in horizontal lifts less than about 8 inches in loose thickness, and compacted to at least 90 percent relative compaction. The required moisture content at the time of compaction is dependent on the plasticity and expansion characteristics of the fill and would be assessed at the time of grading.

5.2.6 Anticipated Excavation Conditions

5.2.6.1 *General*

It should be understood that this report does not represent a study of the excavatibility of the subsurface materials that may be encountered within the limits of the proposed project. The contractor should independently evaluate the condition of the subsurface materials in order to select the appropriate excavation equipment and techniques. Furthermore, the contractor should be aware of past development and activities at the site and the potential presence of abandoned utility lines, wells, and/or foundations that may be encountered. Excavation and removal of these features, if encountered, will require special consideration by the contractor.

5.2.6.2 *Shallow Trenches*

The near-surface materials encountered in the borings consisted mostly of clayey soils with varying amounts of sands. These materials can be excavated with conventional backhoes or track-mounted excavators. The trench side walls within the clay materials are expected to stand near vertical for short periods of time but may tend to ravel as the material dries out or if groundwater seepage is present. Granular materials (sands and gravels) may cave/ravel and trench sidewalls should be sloped. Groundwater was not encountered in our borings within anticipated trench excavation depths and is not anticipated to be a concern to grading/excavation operations.

Section 5.2.7 presents further recommendations regarding temporary excavations and should be followed.

5.2.7 Temporary Excavations

5.2.7.1 *General*

All excavations should comply with applicable local, state, and federal safety regulations including the current Occupational Safety & Health Administration (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the responsibility of the Contractor, who is responsible for the means, methods, and sequencing of construction operations. Kleinfelder is providing the information below solely as a service to the client. Under no circumstances should the information provided be interpreted to mean that Kleinfelder is assuming responsibility for construction site safety or the Contractor's activities. Such responsibility is not being implied and should not be inferred.

5.2.7.2 *Excavation and Slopes*

Excavated slope height, slope inclination, or excavation depths (including utility trench and wet well excavations) should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

5.2.8 Wet Weather Considerations

Should construction be performed during or subsequent to wet weather, near-surface site soils may be significantly above the optimum moisture content. These conditions could hamper equipment maneuverability and efforts to compact site soils to the recommended compaction criteria. Disking to aerate, chemical treatment, replacement with drier material, stabilization with a geotextile fabric or geogrid, or other methods may be required to mitigate the effects of excessive soil moisture and facilitate earthwork and construction operations. If needed, Kleinfelder can provide supplemental recommendations for soil stabilization during construction.

If construction is to proceed during the winter and spring months, one way to reduce the exposure of the building pad and potential repairs is to leave the subgrade at least 1 foot above the proposed subgrade elevation, cutting it down immediately before placing the capillary break and floor slabs. Any cut areas should be proof rolled at the discretion of the Geotechnical Engineer to identify whether undercutting of any remaining wet/unstable soils is required. Cut soils can be placed in landscape areas or disced and aerated (dried) during dry weather for placement in pavement, future pad, or other areas.

5.2.9 Trench Backfill

All trench backfill should be placed and compacted in accordance with recommendations provided for engineered fill (see Section 5.2.5). Mechanical compaction is recommended.

It should be noted that the native clayey material may require significant effort to achieve compaction within narrow trenches. If granular import is used for backfill, a native clay soil or lean concrete slurry dike should be provided in the upper 4 feet where the trenches cross beneath the perimeter of the structures. This dike is intended to minimize the lateral migration of subsurface water into clay soil under the building. In addition, the native clay soil should be placed within the upper 2 feet of trenches exposed to surface water.

5.2.10 Pipe Bedding and Pipe Zone Backfill Placement

Pipe bedding and pipe zone backfill materials for pipelines should meet manufacturer's recommendations for material type, gradation and thickness. If used, clean crushed rock bedding and initial backfill materials should be overlain by a non-woven filter fabric (see Section 5.2.11, Filter Fabric Envelope) to prevent migration of fines into the voids in the material.

Bedding materials should be compacted to a firm and unyielding condition prior to placement of pipes. Initial backfill materials placed around the pipe zone should be placed in a manner to eliminate voids beneath the pipe. Clean crushed rock should be suitable for this use. If used, clean crushed rock materials should be placed in lifts less than 2 feet in loose thickness and be compacted using vibratory plate equipment until it is firm and unyielding. It is recommended that placement of the bedding and pipe zone backfill material be observed by a representative of the geotechnical engineer during construction to verify proper placement and compaction.

Consideration could be given to the use of cementitious slurry mixtures such as lean concrete, Controlled Low Strength Material (CLSM) or Controlled Density Fill (CDF) for bedding and initial backfill around the pipes. In general, we recommend cementitious slurry mixtures have a 28-day compressive strength between 50 and 200 psi.

5.2.11 Filter Fabric Envelope

To reduce the potential for migration of the trench backfill soil into the voids in crushed rock bedding and initial backfill, a non-woven filter fabric should be placed between backfill soils and the underlying crushed rock. Filter fabric should be laid-out and overlapped according to the manufacturer's recommendations. Recommended minimum filter fabric specifications are presented in Table 5-2.

Table 5-2
Recommended Filter Fabric Specifications

Property	Requirement	Test Method
Apparent Opening Size (AOS)	#70 U.S. Standard Sieve Size	ASTM D4751
Grab Tensile/Elongation	120 lbs./50%	ASTM D4632
Puncture Strength	70 lb. Minimum, Average Roll Value	ASTM D4833

Geotextiles such as Mirafi 140N and similar products should meet the above specifications.

5.3 2016 CBC SEISMIC DESIGN PARAMETERS

The parameters provided below are based on the 2019 CBC. The 2019 CBC is based on the 2018 International Building Code (IBC) and ASCE 7-16. For a 2019 CBC based design, the estimated Maximum Considered Earthquake (MCE) mapped spectral accelerations for 0.2 second and 1 second periods (S_S and S_1), associated soil amplification factor (Fa), and mapped peak ground acceleration (PGA) are presented in Table 1 below. Corresponding site modified (S_{MS}) and design (S_{DS}) spectral accelerations, PGA modification coefficient (F_{PGA}), PGA_M, risk coefficients (C_{RS} and C_{R1}), and long-period transition period (T_L) are also presented in the table below. Presented values were estimated using Section 1613.3 of the 2019 California Building Code (CBC), chapters 11 and 22 of ASCE 7-16, and the Structural Engineers Association of

California (SEAOC) and California Office of Statewide Health Planning and Development (OSHPD) U.S. seismic design maps[1].

Table 5-3
Ground Motion Parameters Based on 2016 CBC

Parameter	Value	Reference
S_S	0.738g	2016 CBC Section 1613.3.1
S_1	0.287g	2016 CBC Section 1613.3.1
Site Class	D	2016 CBC Section 1613.3.2
F_a	1.209	2016 CBC Table 1613.3.3(1)
F_v	N/A	2016 CBC Table 1613.3.3(2)
PGA	0.308g	ASCE 7-10 Figure 22-7
S_{MS}	0.893g	2016 CBC Section 1613.3.3
S_{M1}	N/A	2016 CBC Section 1613.3.3
S_{DS}	0.595g	2016 CBC Section 1613.3.4
S_{D1}	N/A	2016 CBC Section 1613.3.4
F_{PGA}	1.292	ASCE 7-10 Table 11.8-1
PGA_M	0.398g	ASCE 7-10 Section 11.8.3
C_{RS}	0.948	ASCE 7-10 Figure 22-17
C_{R1}	0.950	ASCE 7-10 Figure 22-18
T_L	12 seconds	ASCE 7-10 Figure 22-12

It should be noted that Section 11.4.8 of ASCE 7-16 requires a site-specific ground motion hazard analysis to be performed for Site Class D sites with S_1 values greater or equal to 0.2g unless structural design exceptions are taken. The subject site meets these criteria. If exceptions are taken, then a F_v value of 2.026 can be used only to calculate the T_s value.

5.4 LIQUEFACTION

Soil liquefaction is a condition where saturated, granular soils undergo a substantial loss of strength and deformation due to pore pressure increase resulting from cyclic stress application induced by earthquakes. In the process, the soil acquires mobility sufficient to permit both horizontal and vertical movements if the soil mass is not confined. Soils most susceptible to liquefaction are saturated, loose, clean, uniformly graded, and fine-grained sand deposits. If

[1] *https://seismicmaps.org/*

liquefaction occurs, foundations resting on or within the liquefiable layer may undergo settlements. This will result in reduction of foundation stiffness and capacities.

Based on the subsurface data obtained from our geotechnical investigation at the site, groundwater at the site is anticipated to be at depths of about 19 to 34 feet below site grade. As a result, liquefaction potential at the site is considered low. Additionally, should liquefaction occur below these, the presence of non-liquefiable soils in the upper 19 to 34 feet will likely act as a bridge, thereby mitigating liquefaction settlement at the ground surface. Accordingly, liquefaction settlement should not be considered a significant concern for project design.

5.5 STRUCTURE FOUNDATION DESIGN

5.5.1 Allowable Bearing Pressure

The structures may be supported by shallow spread foundations constructed of reinforced concrete. Due to presence of potentially expansive near surface soils, the footings should be founded at least 24 inches below adjacent finished subgrade. In addition, perimeter continuous foundations would serve as a horizontal moisture break, reducing the potential for seasonal or man-made wetting and drying below the structure. Accordingly, continuous foundations should extend the entire perimeter of the structure, including door openings. Continuous footings should have a minimum width of 12 inches. Isolated footings should have a minimum width of 24 inches.

We anticipate much of the site will be underlain by fill soils composed of variable soil types and relative densities/consistencies. These materials can be weak and moderately compressible. In areas where spread foundations rest within these soils, it is our professional opinion that fills soils should be overexcavated to firm soils as identified by the geotechnical engineer and replaced with compacted engineered fill (see Section 5.2.3). The zone of engineered fill should extend laterally a distance equal to at least 3 feet or one-half the footing width, whichever is greater, outside the perimeter of the footing on all sides. By overexcavating the foundation and replacing with engineered fill, a net allowable bearing pressure of 3,000 psf for dead plus sustained live loading for spread foundations could be used.

The allowable bearing pressure provided above is a net value. Therefore, the weight of the foundation that extends below grade may be neglected when computing dead loads. The allowable bearing pressure applies to dead plus live loads, includes a calculated factor of safety of at least 3, and may be increased by one-third for short-term loading due to wind or seismic forces. A modulus of subgrade reaction (for a 1 ft. by 1 ft. foundation) of 150 pci may be used for footing design for foundation subgrade prepared as presented above. This modulus may need to be modified accordingly to reflect differences in foundation size and shape. The net allowable bearing pressure can be increased by one third for all loads including wind and seismic loads.

To maintain the desired support, foundations adjacent to utility trenches or other existing foundations should be deepened so that their bearing surfaces are below an imaginary plane having an inclination of 1.5H:1V (horizontal to vertical), extending upward from the bottom edge of the adjacent foundations or utility trenches.

5.5.2 Lateral Load Resistance

Lateral loads may be resisted by a combination of friction between the foundation bottoms and the supporting subgrade, and by passive resistance acting against the vertical faces of the foundations. An allowable coefficient of sliding friction of 0.30 between the foundation and the supporting subgrade may be used for design. For allowable passive resistance, an equivalent fluid weight of 350 pcf acting against the side of the foundation may be used. This value generally corresponds to a lateral deflection of less than about ½-inch. Passive resistance in the upper 12 inches of soil should be neglected unless the area in front of the footing is protected from disturbance by concrete or pavement. The allowable friction coefficient and passive resistance may be used concurrently.

5.5.3 Settlement

Total settlement of an individual foundation will vary depending on the plan dimensions of the foundation and the actual load supported as well as the ground conditions. Based on anticipated foundation dimensions and loads, we estimate maximum total settlement of foundations designed and constructed in accordance with the preceding recommendations to be on the order of ¾-inch or less. Differential settlement between similarly loaded, adjacent footings is estimated to be about half the total settlement.

5.5.4 Construction Considerations

Prior to placing steel or concrete, foundation excavations should be cleaned of any debris, disturbed soil or water. All foundation excavations should be observed by a representative of Kleinfelder just prior to placing steel and concrete. The purpose of these observations is to check that the bearing soils actually encountered in the foundation excavations are similar to those assumed in analysis and to verify the recommendations contained herein are implemented during construction. Should soft/loose soils be observed at the base of foundation excavations, the soils should be overexcavated to firm materials and the excavations backfilled with engineered fill.

The structural engineer should evaluate footing configurations and reinforcement requirements to account for loading, shrinkage, and temperature stresses. As a minimum, continuous footings should be reinforced with at least two No. 4 reinforcement bars, one top and one bottom, to provide structural continuity and permit spanning of local subgrade irregularities.

5.6 CONCRETE SLAB-ON-GRADE FLOOR SYSTEMS

5.6.1 General

Based on the soil conditions at the site, we anticipate the near surface soils after mass grading will consist of clayey and silty sand but also sandy lean clay, fat clay, and clayey silt. Based on our data and experience, the clay materials can exhibit significant expansion characteristics. This subsurface condition is common within the project area and poses a risk for post-construction heave and cracking of concrete slabs. The terms expansion or expansive soil generally apply to any soil that has a potential for swelling or heaving with seasonal or man-made increases in moisture content. When reference is made to swell or heave potential, it should be recognized that there also exists a potential for shrinking or settlement to occur due to decreases in soil moisture content or drying of the soil.

We understand that the proposed structures will employ floor slabs with interior and exterior bearing wall footings. Given this system, several approaches can be taken to improve/modify the subgrade soil conditions and reduce the potential for post-construction heave. The most cost-effective approaches (using non-expansive fill and lime stabilization of expansive soils) are discussed in the following subsection. These approaches have been used successfully in the project area. If there are questions regarding other potential subgrade improvement alternatives, risks, and life cycle costs, our firm can be consulted to provide additional recommendations.

5.6.2 Subgrade Preparation

Based on the anticipated/assumed project details, the clay most susceptible to expansion can partially be replaced with non-expansive soil or be stabilized with lime (lime treated). In addition, a non-expansive fill pad or lime treated soil pad tends to provide some resistance to up-lift forces by increasing the dead load imposed on the underlying clay and often produces a more uniform heave pattern with less differential movement if the underlying clay were to swell. These alternatives are discussed below.

5.6.2.1 *Non-Expansive Fill*

This alternative involves the removal of the clay materials directly below the floor slab and replacement with non-expansive fill. This procedure consists of placing at least 12 inches of non-expansive fill directly below the proposed floor slab system. The non-expansive fill should be moisture conditioned to a moisture content ranging from 1 to 4 percentage points above its optimum moisture content and compacted to at least 90 percent relative compaction. Specific requirements for import fill are presented in Section 5.2.5.2. The non-expansive soil pad can be prepared by removing and replacing the existing clay materials, raising the building pad above existing site grade, or a combination of both. A capillary break or other slab support system placed directly below the floor slab should not replace, in whole or part, the non-expansive fill layer. The zone of non-expansive soil should extend laterally at least 5 feet outside the perimeter of the structure. Prior to placement of the non-expansive fill, the exposed subgrade soil to a minimum depth of 12 inches should be uniformly moisture conditioned to a moisture content ranging from 2 to 4 percentage points above the optimum moisture content and compacted to at least 88 percent relative compaction and not greater than 95 percent relative compaction, unless approved by the geotechnical engineer. The moisture content of the subgrade soil should be maintained until placement of the non-expansive fill. A representative from our firm should perform a field check of the soil moisture content and relative compaction prior to placement of the non-expansive fill.

5.6.2.2 *Lime Treatment*

The second option is to improve/stabilize the subgrade conditions by mixing the clay materials with lime (lime treatment). This procedure reduces the plasticity/expansion characteristics of the treated clay and has been utilized on other development projects in the site area. Furthermore, the lime provides an added benefit in that it also acts as a cementing agent, increasing the strength and decreasing the flexibility of the subgrade soil. Accordingly, floor slabs supporting concentrated loads exhibit less deflection and tend to perform better overall. During or following rainfall, lime-treated soil also tends to remain reasonably stable, thus providing a firm, accessible working platform for construction. It should be noted that lime increases the pH of the soil and does not promote plant growth. Accordingly, treatment should not be performed in landscape areas, or the lime-treated soils should be completely removed and replaced prior to planting.

A disadvantage of lime stabilized subgrade beneath building pads is possible disruption during the placement of underground utility lines. If numerous underground lines are placed after treatment, the benefit of lime stabilization is reduced, and the first option (non-expansive fill) would be recommended. As an option, utility trenches excavated through the lime treated pad can be backfilled within the lime treated section with a control density fill or low strength material with a minimum compressive strength of 200 psi.

The lime treatment procedure consists of mixing the upper 18 inches of subgrade soils within the proposed floor slab area with high calcium quick lime and compacting the soil as engineered fill to 90 percent relative compaction. The zone of lime-treated soil should extend laterally at least 5 feet beyond the perimeter of the proposed structure. Based on previous lime treatment evaluations in the general project area, it would be reasonable for estimating purposes to assume an application rate of 4 percent high calcium quick lime by dry weight of soil with a dry unit weight of 115 pcf.

The lime quality and spreading, mixing, and compacting operations should conform to Section 24 of the Caltrans Standard Specifications, latest edition. At least two to three days prior to spreading or mixing the lime, the moisture content of the underlying, untreated subgrade soil should be checked. If the soil moisture content is found to be dry of optimum, the soil moisture content should be raised using liberal sprinkling, flooding or another suitable method.

Following lime treatment, the treated soil should be properly cured by continual sprinkling with water to keep the surface damp, combined with light rolling to keep the surface knitted together. The subgrade soils should be covered with at least two inches of Class 2 aggregate base within two to three days of lime treatment in an effort to reduce drying. Periodic sprinkling is still required to keep the surface damp. As an alternative, the treated soil could be cured as discussed in Section 24 of the Caltrans Standard Specifications.

Although lime treatment has performed well for hundreds of developments in the general project area, isolated problems have occasionally occurred due to a lack of quality control during construction, swelling if the underlying, untreated subgrade is dry, and/or inadequate curing following lime treatment. Accordingly, these factors are considered critically important. Prior to earthwork operations, our firm should review the lime contractor's proposed treatment procedures. Laboratory tests should be performed at least two weeks prior to earthwork operation in order to assess or revise the required lime application rate. Also, a representative from our firm should be on-site during treatment operations to document spreading, mixing and compaction operations and provide supplemental/revised recommendations, if warranted, based on the soil conditions observed.

5.6.3 Capillary Break

Groundwater should not rise near surface and adversely impact the structural performance of the floor slabs. In areas where the floor slabs will be covered with moisture-sensitive flooring, it has been common practice and industry standard in the project area to place a capillary break consisting of at least 4 inches of free draining crushed gravel on the finished subgrade soil that, in turn, is overlain by a flexible sheet membrane, such as Stego Wrap™, Moistop Plus™, or an equivalent meeting the requirements of ASTM E1745, that serves as a water and/or moisture vapor retarder. The crushed gravel should be graded so that 100 percent passes the 1-inch sieve and less than 5 percent passes the No. 4 sieve. Care should be taken to properly place, lap, and seal the membrane in accordance with the manufacturer's recommendations to provide a vapor tight barrier. Tears and punctures in the membrane should be completely repaired prior to placement of concrete. Until recently, the local practice and ACI standard has been to place a 1- to 2-inch-thick layer of relatively dry, fine- to medium-grained "clean" sand over the membrane to promote uniform curing of concrete and to protect the membrane. ACI has now revised their standard, and this layer of sand is no longer recommended. To compensate, a lower water cement ratio and improved curing methods are suggested. If the design engineer still prefers to specify a sand cushion, we suggest that the moisture content of the sand not exceed 4 percent by dry weight. If the sand becomes overly wet, it should be removed and replaced with suitable sand. The capillary break should not replace in whole or in part the Subgrade Preparation recommendations discussed in Section 5.6.2.

Over the past few years, problems with wet, curled, and loose floor coverings have become an issue. Accordingly, prior to placement of floor coverings, moisture emissions through the concrete and the pH and relative humidity of the concrete should meet the manufacturer's recommendations and requirements. A guide for preparing concrete floors that will receive moisture-sensitive floor covering is presented in ASTM F 710. Since Kleinfelder is not a floor moisture proofing consultant or expert, it is our professional opinion that these standards should be incorporated into the project design and construction unless otherwise revised by a qualified specialist with local knowledge of slab moisture protection systems, flooring design, and other potential components that may be influenced by moisture and/or moisture vapor.

In equipment storage and other similar areas where the floor slabs are not covered with floor coverings or support moisture-sensitive equipment, it is common to replace the gravel and capillary break with at least 4 inches of Class 2 aggregate base that is compacted to at least 95 percent relative compaction. If the lime treatment option is selected for floor slab support this aggregate base layer will likely already be present in order to help cure the underlying lime treated soil. The aggregate base also provides added support for concentrated and/or storage loads and less deflection at the slab joints caused by forklift or other equipment traffic. The moisture-proofing specialist and structural engineer should approve this slab support prior to final design and construction.

5.6.4 Additional Considerations

A modulus of subgrade reaction of 150 pci may be used for concrete slabs on grade bearing on subgrade prepared as discussed in Section 5.6.2. The project structural engineer should provide the final design floor slab thickness and reinforcement requirements. Care should be taken to place, consolidate, and cure concrete in accordance with American Concrete Institute (ACI) standards and criteria.

Within the project area, the subgrade improvement alternatives discussed in Section 5.6.2 have performed well in reducing the potential for post-construction heave to within generally accepted or tolerable levels. These approaches are contingent upon our assumption that drainage criteria discussed in Section 5.10 will be implemented during and following construction. Poor drainage, inadequate landscaping, and leaking pipelines can still potentially trigger some isolated slab heave as the moisture content of the native clay increases. The degree and risk of potential heaving varies depending on the quality control followed during construction. If the preference is to provide a performance standard higher than currently assumed for the proposed project, the level of subgrade preparation should be increased and/or the floor slab should be stiffened by thickening the slab and/or reinforcing it with steel bars. Kleinfelder can provide revised recommendations to increase the performance standard, upon request.

5.7 EXTERIOR CONCRETE

Per our discussion in Section 5.6.1, the near-surface soil underlying the site consists of clay that can exhibit significant shrink-swell (expansion) characteristics, thus posing a risk for post-construction movement and cracking of exterior flatwork. In order to reduce this risk, the subgrade soil conditions in all areas to support exterior concrete flatwork, i.e., sidewalks and the like, should be prepared per the recommendations presented in Section 5.6.2.

As an alternative to non-expansive fill and lime treatment, the upper 18 inches of subgrade soils could be uniformly moisture conditioned to a moisture content ranging from 2 to 4 percentage points above the optimum moisture content and compacted to at least 88 percent relative compaction and not greater than 95 percent relative compaction, unless approved by the Geotechnical Engineer. If there will be a delay in construction, it is not necessary to achieve the elevated moisture content of 2 to 4 percentage points above the optimum moisture content since the soils will likely dry out during the delay. Instead, a moisture content near optimum can be considered for the scarification process. Prior to placement of concrete, the subgrade soil should be wetted or pre-soaked in order to uniformly raise the moisture content of the scarified/compacted subgrade soil to at least 3 percentage points above its optimum moisture content or at least 1 percent above its plastic limit, whichever is more, to a depth of 18 inches. Pre-soaking is usually performed using liberal sprinkling, flooding, or other suitable method. Since pre-soaking softens and weakens the affected clay, this procedure is not suitable in flatwork areas that will support traffic. A representative from Kleinfelder should perform a field check of the soil moisture content and consistency within 48 hours of the concrete placement. This approach is typically the least costly procedure with the greater risk for future cracking and maintenance. We note that presoaking can take several weeks depending on the initial condition of the clay subgrade. If more rapid construction is required, deep ripping followed by flooding can achieve the desired elevated moisture content with depth. Additional criteria regarding general earthwork are presented in Section 5.2.

In some cases, isolated “edge” cracking or heaving forms along the outside portions of exterior flatwork because of seasonal or man-made wetting and drying of the subgrade soil. This potential can be reduced by placing lateral cutoffs, i.e., inverted curbs, heavy plastic membranes, or manufactured composite drains, along the outside edges of the flatwork. The lateral cutoffs typically extend vertically 12 to 18 inches into the subgrade soils. Another approach is to strengthen or stiffen the flatwork by increasing the thickness of the concrete and/or reinforcing the flatwork with steel bars rather than wire mesh. Kleinfelder can provide additional recommendations addressing these approaches upon request.

If tripping hazards are a concern, smooth dowels should be provided at all joints to reduce differential displacement. The dowels should be at least 24 inches in length, greased or sleeved at one end, and spaced at a maximum lateral spacing of 18 inches. Furthermore, flatwork, including planter boxes, should not be attached to the proposed buildings or other structures. The flatwork should be allowed to “float” with the changes in volume of the soil.

The near-surface soil conditions do not necessarily warrant the placement of aggregate base below flatwork from a geotechnical standpoint. Flatwork, however, tends to perform better during and following construction with less maintenance if it is underlain by a layer Class 2 aggregate base. The aggregate base serves to provide a firm/uniform surface directly below the flatwork where surcharge stresses are highest. As a result, we have found that flatwork supported on aggregate base tends to experience less stress cracking and movement or deflection at joints. If considered, the aggregate base should have a thickness of at least 4 inches and be compacted to at least 90 percent relative compaction. In areas where concrete flatwork will support construction equipment, trash collection areas, and/or vehicle traffic, we suggest that the aggregate base be increased to a thickness of 8 inches and be compacted to at least 95 percent relative compaction.

5.8 ASPHALT CONCRETE PAVEMENTS

5.8.1 Subgrade Preparation

5.8.1.1 *Existing Subgrade*

Per our discussion in Section 5.6.1, the near-surface soil encountered consisted of undocumented fills containing potentially expansive clay that poses a potential risk for post-construction heave and cracking of pavements. In order to reduce this risk and improve the service life of the pavement, the subgrade soils in pavement areas should be thoroughly scarified or ripped to a minimum depth of 12 inches below the finished subgrade elevation and uniformly moisture conditioned to a moisture content ranging from 2 to 4 percent above the optimum moisture content. Depending on the condition of the exposed soils deeper over-excavation may be required. During or following moisture conditioning, the upper 6 inches of subgrade soil should be compacted as engineered fill to at least 95 percent relative compaction. The underlying 6 inches of moisture conditioned subgrade soil should be compacted to at least 90 percent relative compaction. The subgrade soil should be in a stable, non-pumping condition at the time aggregate base materials are placed and compacted. The moisture content of the soils should be maintained until placement of the aggregate base by liberal sprinkling with water or other suitable method. If there will be a delay between placing the aggregate base and asphalt concrete, the aggregate base should also be periodically sprinkled or wetted to prevent drying of the underlying subgrade soil. A representative from our firm should perform a field check of the soil moisture content and relative compaction prior to placement of aggregate base.

5.8.1.2 *Lime Treated Subgrade*

In lieu of supporting pavement directly on expansive clay, the subgrade soil can be stabilized by mixing it with lime (lime treatment). For areas where pavement subgrades will be lime treated, we recommend the upper 12 to 18 inches of the subgrade below pavements be treated with 4 percent high calcium quick lime by dry weight (assumed as 115 pcf). Lime treatment is commonly used to stabilize near surface expansive soils under concrete building slabs and pavements for many developments in the project area. The treatment area should extend beyond the proposed improvements a horizontal distance of at least 2 feet. Final lime percentage should be determined during construction in consultation with Kleinfelder. The lime quality and spreading, mixing, and compacting operations should conform to Section 24 of the Caltrans Standard Specifications, latest edition. Following lime treatment, the treated soil should be properly cured by continual sprinkling with water to keep the surface damp, combined with light rolling to keep the surface knitted together. The subgrade soils should be covered with Class 2 aggregate base within two to three days of lime treatment in an effort to reduce drying. Periodic sprinkling is still required to keep the surface damp. As an alternative, the treated soil could be cured as discussed in Section 24 of the Caltrans Standard Specifications. The upper 12 inches of lime-treated subgrade soil should be compacted to at least 95 percent relative compaction. Lime treated subgrade soil below a minimum depth of 12 inches should be compacted to at least 90 percent relative compaction. The lime treatment should be designed to meet a minimum unconfined compressive strength of 200 pounds per square inch at 28-day cure based on the California Test 373. The zone of lime-treated soil should extend laterally at least 2 feet beyond the perimeter of the pavements.

Prior to earthwork operations, our firm should review the lime contractor’s proposed treatment procedures. Laboratory tests should be performed at least two weeks prior to earthwork operation in order to assess or revise the required cement application rate.

5.8.2 Pavement Sections

The results of laboratory tests completed for previous studies in the project area indicate that the near surface "fat" and "lean" clay (medium to highly plastic) subgrade soil should exhibit poor support characteristics for pavements as represented by an R-values typically in the range of 5 or less. Pavement sections (determined in units of inches rounded up to the nearest ½-inch) are presented below based on a Caltrans minimum R-value of 5, current Caltrans design procedures, TI's ranging from 5 to 9, and our assumption that Caltrans construction tolerances are acceptable. The pavement sections include a Gravel Equivalent Safety Factor of 0.20 per Caltrans highway design criteria. The project owner and/or civil engineer should review the pavement sections and evaluate the suitable TIs for this project[2].

Table 5-4

Asphalt Concrete Pavement Sections – Existing Soil Subgrade

Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
5	3½	9
6	3½	13
7	4	15½
8	5	17½
9	5½	20½

Historically in the project area, we've found it's more economical to increase the lime treated subgrade section thickness and reduce the overall pavement section (asphalt concrete and aggregate base) thickness. The following lime-treated pavement sections are based on our experience and the following criteria:

- A minimum lime-treated soil compressive strength of 200 psi.
- Gravel equivalency factor for the lime-treated soil of 1.1.
- Minimum depth of lime-treated soil will be 12 inches.
- Maximum depth of lime-treated soil will be 18 inches.

[2]The traffic index (TI) is a measure of traffic wheel loading frequency and intensity of anticipated traffic. For comparison, TI's of between 4 and 5 are often suitable for design of automobile parking areas, TI's of between 5 and 6 are commonly used for design of fire truck access lanes and areas subject to channelized flow with light delivery trucks, and TI's greater than 6 are common for design of pavements supporting light to moderate bus and truck traffic.

It is typically difficult to achieve the required minimum compaction near the bottom of thick, lime-treated sections. Furthermore, the native soils underlying the lime-treated section are not compacted. To compensate for these factors, 3 inches of lime-treated soil has been added to the calculated pavement section. However, the soils beneath the planned lime-treatment section should be at above optimum moisture content prior to lime treating.

Table 5-5

Asphalt Concrete Pavement Sections –Lime Treated Subgrade

Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Lime-Treated Soil (inches)
5	3½	4	12 (minimum)
6	3½	4	14
7	4	4	15
8	5	4	17
9	5½	5½	18

The pavement sections provided above are contingent on the following recommendations being implemented during and following construction.

- All trench backfills, including utility and sprinkler lines, should be properly placed and adequately compacted at above optimum moisture content to provide a stable subgrade. All backfill within the pavement areas should be completed prior to lime treating the pavement subgrade.
- Lime-treated subgrade should be kept moist by periodic watering until aggregate base is placed if it will be placed within three days. If aggregate base will not be placed within three days, a sealing compound should be placed on the lime-treated subgrade.
- Aggregate base material should conform to the specifications stated in Section 26 of the Caltrans Standard Specifications and be compacted as engineered fill to at least 95 percent relative compaction.
- Asphalt paving materials and placement methods should conform to Section 39 of the Caltrans Standard Specifications, latest edition.
- Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become wet. Pavement sections should be isolated from intrusion of water at all locations where pavements are adjacent to irrigated landscaping or areas that may pond water. For long-term

performance, pavement edge drains should be placed to collect water and to convey it to a storm drain or other drainage facility. As an alternative, but one that tends to be less effective, edge barriers, such as concrete curbs, polyethylene membranes and the like, should be placed that extend a minimum of 4 inches below the aggregate base and into the subgrade soil. Additional details regarding these systems can be provided upon request.

- Periodic maintenance should be performed to repair degraded areas and seal cracks with appropriate filler.

5.9 BIOSWALE OR STORMWATER DRAINAGE/TREATMENT CONSTRUCTION

If bio-infiltration swales/basins or stormwater drainage/treatment construction are considered adjacent to proposed parking lots or exterior flatwork, mitigative measures should be considered in design and construction to reduce potential impacts to flatwork or pavements. Exterior flatwork, concrete curbs, and pavements located directly adjacent to bioswales/stormwater drainage areas may be susceptible to settlement or lateral movement, depending on the configuration of the bioswale/stormwater drainage and the setback between the improvements and edge of the swale/drainage. To reduce the potential for distress to these improvements due to vertical or lateral movement, the following options should be considered in design:

- Improvements should be setback from the vertical edge of a bioswale/drainage area such that there is at least 1 foot of horizontal distance between the edge of improvements and the top edge of the bioswale/drainage area excavation for every 1 foot of vertical bioswale depth, or
- Concrete curbs for pavements, or lateral restraint for exterior flatwork, located directly adjacent to a vertical bioswale cut should be designed to resist lateral earth pressures or concrete curbs or edge restraint should be adequately keyed into the native soil or engineered fill to reduce the potential for rotation or lateral movement of the curbs. If curbs are already underlain by lime treated soil that extends 2 feet beyond the curb, we recommend that the edge of lime treated soil be buried within the swale rather than removed.

Additionally, if trenches are proposed for placement within or near bioswales, Kleinfelder should be made aware so that we may review and provide guidance regarding compaction criteria for trenches.

5.10 SITE DRAINAGE

Foundation and slab performance depends greatly on how well runoff water drains from the site. Accordingly, positive drainage should be provided away from building pad and pavement areas toward appropriate drop inlets or other surface drainage devices without ponding. In general, we recommend consideration be given to providing at least 1 to 2 percent slope away from structure foundations or access ways for drainage. The drainage should be maintained both during construction and over the life span of the project. Roof drainage should be installed with appropriate downspout extensions out falling on splash blocks so that water is directed a minimum of 5 feet horizontally away from the structures or be connected to the storm drain system for the development.

A number of post-construction landscape practices beyond the control of the design engineers can occur to cause distress to pavements founded on expansive clay. Potential man-made water sources, such as buried pipelines, drains and the like, should be periodically tested and/or examined for signs of leakage or damage. Any such leakage or damage should be promptly repaired.

6 ADDITIONAL SERVICES

6.1 PLANS AND SPECIFICATIONS REVIEW

Kleinfelder should conduct a general review of plans and specifications to evaluate that the earthwork and foundation recommendations presented in this report have been properly interpreted and implemented during design. In the event Kleinfelder is not retained to perform this recommended review, no responsibility for misinterpretation of the recommendations by Kleinfelder is accepted.

6.2 CONSTRUCTION OBSERVATION AND TESTING

It is recommended that all earthwork and foundation construction be monitored by a representative from Kleinfelder, including site preparation, placement of all engineered fill and trench backfill, construction of slab and pavement subgrade, and all foundation excavations. The purpose of these services is to observe the soil conditions encountered during construction, evaluate the applicability of the recommendations presented in this report to the soil conditions encountered, and recommend appropriate changes in design or construction procedures if conditions differ from those described herein.

7 LIMITATIONS

This report presents information for planning, permitting, design, and construction of the proposed New City Hall Site Improvements Project located at 501 and 509 West Weber Avenue in Stockton, California. Recommendations contained in this report are based on materials encountered in the recently completed hand auger borings and DCPs as well as review of previous borings performed at the site, geologic interpretation based on published articles and geotechnical data, and our present knowledge of the proposed construction.

It is possible that soil conditions could vary between and beyond the points explored. If the scope of the proposed construction, including the proposed location, changes from that described in this report, we should be notified immediately in order that a review may be made, and any supplemental recommendations provided.

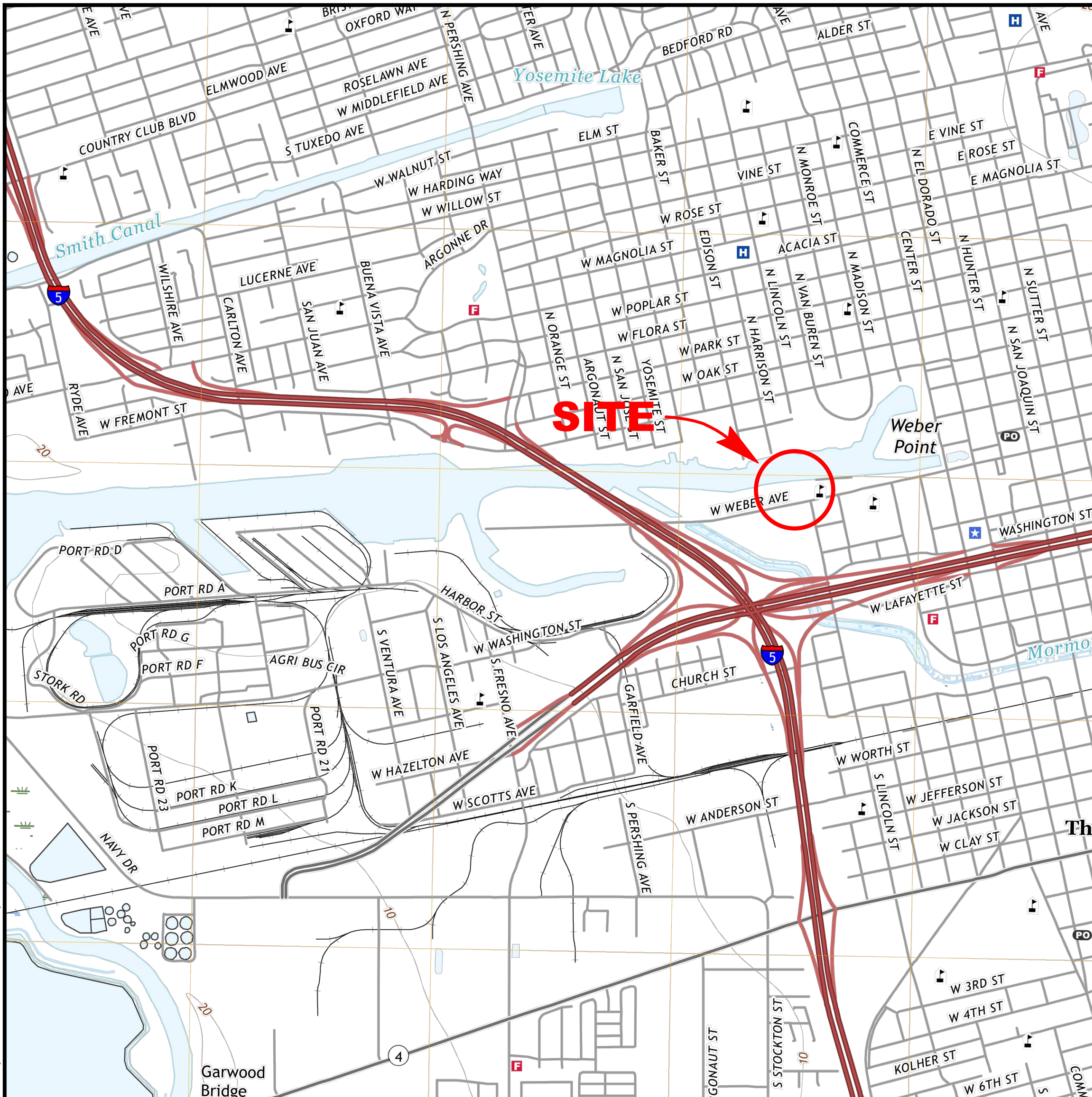
We have prepared this report in accordance with the generally accepted geotechnical engineering practice as it exists in the site area at the time of our investigation. No warranty expressed or implied is made.

This report may be used only by the client and only for the purposes stated, within a reasonable time from its issuance. Land use, site conditions (both on-site and off-site) or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from any liability resulting from the use of this report by any unauthorized party.

FIGURES

LIST OF ATTACHMENTS

The following figures are attached.



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SCALE: 1" = 2000' SCALE IN FEET

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REFERENCE:
West Stockton, Ca. Quadrangle California 7.5-Minute Series

PLOTTED: 18 Jun 2021, 12:27pm, GGomez LAYOUT: FIGURE 1 CAD FILE: W:\2022\20220839 - City of Stockton New City Hall\PLANS\

ATTACHED IMAGES:
ATTACHED XREFS:
OFFICE_NAME

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PROJECT NO. 20220839	**SITE VICINITY MAP**	FIGURE
DRAWN: 6/15/2021		**1**
DRAWN BY: GG		
CHECKED BY: AG	Proposed New City Hall Site Improvements 501 & West Weber Avenue Stockton, California	
FILE NAME: STO21D043.CAD		

PLOTTED: 18 Jun 2021, 12:27pm, GGomez LAYOUT: FIGURE 2 CAD FILE: W:\2022\20220839 - City of Stockton New City Hall\PLANS\

Denotes Numbers & Approximate Locations of Hand Borings Drilled & DCP's Performed For This Investigation

Denotes Numbers & Approximate Locations of Hand Borings Drilled as Part of 1980 Investigation

N

0 75 150

SCALE: 1" = 75' SCALE IN FEET

ATTACHED IMAGES:
ATTACHED XREFS:
OFFICE_NAME

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PROJECT NO. 20220839	EXPLORATION LOCATION MAP	FIGURE	
DRAWN: 6/15/2021		2	
DRAWN BY: GG			
CHECKED BY: AG	Proposed New City Hall Site Improvements 501 & West Weber Avenue Stockton, California		
FILE NAME: STO21D043.CAD			

APPENDIX A
LOGS OF EXPLORATIONS FROM CURRENT INVESTIGATION

LIST OF ATTACHMENTS

The following figures are attached and complete this appendix.

SAMPLE/SAMPLER TYPE GRAPHICS

BAG SAMPLE

GROUND WATER GRAPHICS

WATER LEVEL (level where first observed)

WATER LEVEL (level after exploration completion)

WATER LEVEL (additional levels after exploration)

OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu≥4 and 1≤Cc≤3	**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/ or 1>Cc>3	**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu≥4 and 1≤Cc≤3	**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/ or 1>Cc>3	**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES		**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
				GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (Half or more of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3	**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/ or 1>Cc>3	**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu≥6 and 1≤Cc≤3	**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/ or 1>Cc>3	**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES		**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
				SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (Half or more of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit 50 or greater)	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

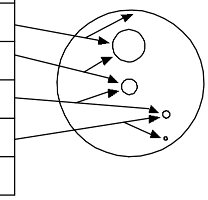
NOTE: USE MATERIAL DESCRIPTION ON THE LOG TO DEFINE A GRAPHIC THAT MAY NOT BE PROVIDED ON THIS LEGEND.

KLEINFELDER
Bright People. Right Solutions.

PROJECT NO.: 20220839.001A		GRAPHICS KEY	FIGURE
DRAWN BY:	GG	Proposed New City Hall Site Improvements 501 & 509 West Weber Avenue Stockton, California	A-1
CHECKED BY:	AG		
DATE:	6/15/2021		

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

Term of Use	AMOUNT	
	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N_{60} (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25 ≤ PP <0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5 ≤ PP <1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1 ≤ PP <2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2 ≤ PP <4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4 ≤ PP	>8000	Thumbnail will not indent soil.

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

PLASTICITY

DESCRIPTION	LL		PI
Non-Plastic	NP	Either the LL or the PI (or both) may be used to describe the soil plasticity. The ranges of numbers shown here do not imply that the LL ranges correlate with the PI ranges for all soils.	NP
Low	< 30		< 15
Medium	30 - 50		15 - 25
High	> 50		> 25

LL is from Casagrande, 1948. PI is from Holtz , 1959.

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

KLEINFELDER
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PROJECT NO.: 20220839.001A		SOIL DESCRIPTION KEY	FIGURE
DRAWN BY:	GG	Proposed New City Hall Site Improvements 501 & 509 West Weber Avenue Stockton, California	A-2
CHECKED BY:	AG		
DATE:	6/15/2021		

Date Begin - End:	6/14/2021	**Drilling Company:**	Confluence		**BORING LOG HA-1**
Logged By:	AG	**Drill Crew:**	Ricky & Richard		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger		
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger		
Weather:	Sunny	**Exploration Diameter:**	3 in. O.D.		

FIELD EXPLORATION							LABORATORY RESULTS							
Depth (feet)	Graphical Log	Surface Condition: Asphalt Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		4" Asphalt												
		Silty SAND (SM): yellowish brown, trace gravel, FILL												
		Clayey SAND (SC): medium plasticity, yellowish brown, wet, loose, FILL	1								50			PID Reading: 0.0 ppm
		Grades more sandy, trace gravel, loose to medium dense, low to medium plasticity	2					17.6						PID Reading: 0.1 ppm
5		**Fat CLAY (CH)**: high plasticity, reddish brown, wet, soft to medium stiff	3											PID Reading: 0.1 ppm
		Stiff	4											
10														
15														

The boring was terminated because of refusal (↑) at approximately 7.5 ft. below ground surface. The boring was backfilled with neat cement grout on June 14, 2021.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:

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PROJECT NO.: 20220839.001A		BORING LOG HA-1	FIGURE
DRAWN BY:	GG	Proposed New City Hall Site Improvements 501 & 509 West Weber Avenue Stockton, California	A-3
CHECKED BY:	AG		
DATE:	6/15/2021		PAGE: 1 of 1

Date Begin - End:	6/14/2021	**Drilling Company:**	Confluence	**BORING LOG HA-2**
Logged By:	AG	**Drill Crew:**	Ricky & Richard	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger	
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger	
Weather:	Sunny	**Exploration Diameter:**	3 in. O.D.	

Depth (feet)	Graphical Log	FIELD EXPLORATION Surface Condition: Asphalt Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	LABORATORY RESULTS USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		2" Asphalt												
		7" Aggregate Base												

The boring was terminated because of refusal (↑) at approximately 1 ft. below ground surface on cobbles. The boring was backfilled with neat cement grout on June 14, 2021.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:

5

10

15

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PROJECT NO.: 20220839.001A		BORING LOG HA-2	FIGURE
DRAWN BY:	GG	Proposed New City Hall Site Improvements 501 & 509 West Weber Avenue Stockton, California	A-4
CHECKED BY:	AG		
DATE:	6/15/2021		PAGE: 1 of 1

Date Begin - End:	6/14/2021	**Drilling Company:**	Confluence	**BORING LOG HA-3**
Logged By:	AG	**Drill Crew:**	Ricky & Richard	
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger	
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger	
Weather:	Sunny	**Exploration Diameter:**	3 in. O.D.	

Depth (feet)	Graphical Log	FIELD EXPLORATION: Surface Condition: Asphalt / Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	LABORATORY RESULTS: USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		3" Asphalt												
		8" Aggregate Base												
		Sandy Lean CLAY (CL): medium plasticity, olive brown to olive gray, moist, medium stiff to very stiff	1					18.4						PID Reading: 0.1 ppm
		Grades less sandy, very stiff	2								69			PID Reading: 0.3 ppm
5		**Silty SAND (SM)**: non-plastic, olive brown/olive gray, moist, medium dense, FILL	3											PID Reading: 0.7 ppm
10														
15														

The boring was terminated at approximately 5.5 ft. below ground surface. The boring was backfilled with neat cement grout on June 14, 2021.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20220839.001A	BORING LOG HA-3	FIGURE
	DRAWN BY: GG	Proposed New City Hall Site Improvements 501 & 509 West Weber Avenue Stockton, California	A-5
	CHECKED BY: AG		
	DATE: 6/15/2021		PAGE: 1 of 1

BORING LOG HA-4

Date Begin - End:	6/14/2021	**Drilling Company:**	Confluence
Logged By:	AG	**Drill Crew:**	Ricky & Richard
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger
Weather:	Sunny	**Exploration Diameter:**	3 in. O.D.

Surface Condition: Asphalt

Depth (feet)	Graphical Log	Lithologic Description (FIELD EXPLORATION)	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol (LABORATORY RESULTS)	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		7" Asphalt												
		5" Aggregate Base												
		Fat CLAY (CH): high plasticity, brown, moist, stiff, FILL	1					26.2				61	44	PID Reading: 0.0 ppm
		Silty SAND (SM): fine-grained, moist, medium dense, FILL												
			2								17			PID Reading: 0.0 ppm
		Fat CLAY (CH): high plasticity, dark brown, moist, stiff												
5		Very stiff	3					28.9						PID Reading: 0.0 ppm
			4											PID Reading: 2.0 ppm
10														
15														

The boring was terminated at approximately 8.5 ft. below ground surface. The boring was backfilled with neat cement grout on June 14, 2021.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.

GENERAL NOTES:

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PROJECT NO.: 20220839.001A		BORING LOG HA-4	FIGURE A-6
DRAWN BY:	GG	Proposed New City Hall Site Improvements 501 & 509 West Weber Avenue Stockton, California	
CHECKED BY:	AG		
DATE:	6/15/2021		PAGE: 1 of 1

BORING LOG HA-5

Date Begin - End:	6/14/2021	**Drilling Company:**	Confluence
Logged By:	AG	**Drill Crew:**	Ricky & Richard
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Hand Auger
Plunge:	-90 degrees	**Drilling Method:**	Hand Auger
Weather:	Sunny	**Exploration Diameter:**	3 in. O.D.

FIELD EXPLORATION							LABORATORY RESULTS							
Depth (feet)	Graphical Log	Surface Condition: Asphalt Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		3" Asphalt												
		7" Aggregate Base												
		Clayey SILT (CL-ML): low to medium plasticity, gray, moist, very stiff to hard, FILL	1					15.7						PID Reading: 0.1 ppm
		Very stiff	2									25	5	PID Reading: 0.0 ppm
5		**Sandy Lean CLAY (CL)**: medium plasticity, gray, moist, stiff, FILL	3								62			PID Reading: 0.0 ppm

The boring was terminated at approximately 6 ft. below ground surface. The boring was backfilled with neat cement grout on June 14, 2021.

GROUNDWATER LEVEL INFORMATION:
Groundwater was not observed during drilling or after completion.
GENERAL NOTES:

10

15

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PROJECT NO.: 20220839.001A		BORING LOG HA-5	FIGURE
DRAWN BY:	GG	Proposed New City Hall Site Improvements 501 & 509 West Weber Avenue Stockton, California	A-7
CHECKED BY:	AG		
DATE:	6/15/2021		PAGE: 1 of 1

WILDCAT DYNAMIC CONE LOG

Kleinfelder
2001 Arch-Airport Road
Stockton, CA 95206

PROJECT NUMBER: 20220839
DATE STARTED: 06-14-2021
DATE COMPLETED: 06-14-2021

HOLE #: DCP-1
CREW: Confluence
PROJECT: New City Hall
ADDRESS: Weber Ave and Lincoln St
LOCATION: Stockton CA

SURFACE ELEVATION:
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	TESTED CONSISTENCY CLAY
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	14	62.2	•••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 1 ft	9	40.0	••••••••••	11	MEDIUM DENSE	STIFF
-	7	31.1	••••••••	8	LOOSE	MEDIUM STIFF
-	6	26.6	••••••	7	LOOSE	MEDIUM STIFF
- 2 ft	6	26.6	••••••	7	LOOSE	MEDIUM STIFF
-	8	35.5	•••••••••	10	LOOSE	STIFF
-	6	26.6	••••••	7	LOOSE	MEDIUM STIFF
- 3 ft	10	44.4	•••••••••••	12	MEDIUM DENSE	STIFF
- 1 m	8	35.5	•••••••••	10	LOOSE	STIFF
-	7	27.0	••••••	7	LOOSE	MEDIUM STIFF
- 4 ft	4	15.4	•••	4	VERY LOOSE	SOFT
-	4	15.4	•••	4	VERY LOOSE	SOFT
-	3	11.6	••	3	VERY LOOSE	SOFT
- 5 ft	4	15.4	•••	4	VERY LOOSE	SOFT
-	5	19.3	••••	5	LOOSE	MEDIUM STIFF
-	10	38.6	•••••••••	11	MEDIUM DENSE	STIFF
- 6 ft	11	42.5	••••••••••	12	MEDIUM DENSE	STIFF
-	10	38.6	•••••••••	11	MEDIUM DENSE	STIFF
- 2 m	10	38.6	•••••••••	11	MEDIUM DENSE	STIFF
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT.XLS

WILDCAT DYNAMIC CONE LOG

Kleinfelder
2001 Arch-Airport Road
Stockton, CA 95206

PROJECT NUMBER: 20220839
DATE STARTED: 06-14-2021
DATE COMPLETED: 06-14-2021

HOLE #: DCP-3
CREW: Confluence
PROJECT: New City Hall
ADDRESS: Weber Ave and Lincoln St
LOCATION: Stockton CA

SURFACE ELEVATION:
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	TESTED CONSISTENCY CLAY
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	0	0.0		0	VERY LOOSE	VERY SOFT
-	7	31.1	••••••••	8	LOOSE	MEDIUM STIFF
-	18	79.9	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
- 2 ft	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	15	66.6	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 3 ft	13	57.7	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 1 m	15	66.6	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	16	61.8	•••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 4 ft	17	65.6	••••••••••••••••	18	MEDIUM DENSE	VERY STIFF
-	16	61.8	•••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	11	42.5	••••••••••	12	MEDIUM DENSE	STIFF
- 5 ft	15	57.9	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	19	73.3	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT.XLS

WILDCAT DYNAMIC CONE LOG

Kleinfelder
2001 Arch-Airport Road
Stockton, CA 95206

PROJECT NUMBER: 20220839
DATE STARTED: 06-14-2021
DATE COMPLETED: 06-14-2021

HOLE #: DCP-4
CREW: Confluence
PROJECT: New City Hall
ADDRESS: Weber Ave and Lincoln St
LOCATION: Stockton CA

SURFACE ELEVATION:
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	TESTED CONSISTENCY CLAY
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	0	0.0		0	VERY LOOSE	VERY SOFT
-	3	13.3	•••	3	VERY LOOSE	SOFT
-	9	40.0	••••••••••	11	MEDIUM DENSE	STIFF
- 2 ft	13	57.7	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
-	14	62.2	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	13	57.7	••••••••••••••	16	MEDIUM DENSE	VERY STIFF
- 3 ft	14	62.2	••••••••••••••••	17	MEDIUM DENSE	VERY STIFF
- 1 m	11	48.8	••••••••••••	13	MEDIUM DENSE	STIFF
-	9	34.7	••••••••	9	LOOSE	STIFF
- 4 ft	9	34.7	••••••••	9	LOOSE	STIFF
-	10	38.6	•••••••••	11	MEDIUM DENSE	STIFF
-	12	46.3	•••••••••••	13	MEDIUM DENSE	STIFF
- 5 ft	14	54.0	•••••••••••••	15	MEDIUM DENSE	STIFF
-	16	61.8	•••••••••••••••	17	MEDIUM DENSE	VERY STIFF
-	18	69.5	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 6 ft	21	81.1	••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
-	21	81.1	••••••••••••••••••••	23	MEDIUM DENSE	VERY STIFF
- 2 m	24	92.6	•••••••••••••••••••••••	-	MEDIUM DENSE	VERY STIFF
- 7 ft	23	78.7	••••••••••••••••••••	22	MEDIUM DENSE	VERY STIFF
-	33	112.9	•••••••••••••••••••••••••••••	-	DENSE	HARD
-	32	109.4	••••••••••••••••••••••••••••	-	DENSE	HARD
- 8 ft	38	130.0	•••••••••••••••••••••••••••••••••	-	DENSE	HARD
-	36	123.1	•••••••••••••••••••••••••••••••	-	DENSE	HARD
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT.XLS

WILDCAT DYNAMIC CONE LOG

Kleinfelder
2001 Arch-Airport Road
Stockton, CA 95206

PROJECT NUMBER: 20220839
DATE STARTED: 06-14-2021
DATE COMPLETED: 06-14-2021

HOLE #: DCP-5
CREW: Confluence
PROJECT: New City Hall
ADDRESS: Weber Ave and Lincoln St
LOCATION: Stockton CA

SURFACE ELEVATION:
WATER ON COMPLETION: N/A
HAMMER WEIGHT: 35 lbs.
CONE AREA: 10 sq. cm

DEPTH	BLOWS PER 10 cm	RESISTANCE Kg/cm²	GRAPH OF CONE RESISTANCE 0 50 100 150	N'	TESTED CONSISTENCY SAND & SILT	TESTED CONSISTENCY CLAY
-	0	0.0		0	VERY LOOSE	VERY SOFT
-	0	0.0		0	VERY LOOSE	VERY SOFT
- 1 ft	26	115.4	•••••••••••••••••••••••••••••	-	DENSE	HARD
-	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
-	17	75.5	•••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 2 ft	15	66.6	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	15	66.6	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	16	71.0	••••••••••••••••••	20	MEDIUM DENSE	VERY STIFF
- 3 ft	17	75.5	•••••••••••••••••••	21	MEDIUM DENSE	VERY STIFF
- 1 m	15	66.6	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
-	18	69.5	•••••••••••••••••	19	MEDIUM DENSE	VERY STIFF
- 4 ft	10	38.6	•••••••••	11	MEDIUM DENSE	STIFF
-	11	42.5	••••••••••	12	MEDIUM DENSE	STIFF
-	14	54.0	•••••••••••••	15	MEDIUM DENSE	STIFF
- 5 ft	10	38.6	•••••••••	11	MEDIUM DENSE	STIFF
-	12	46.3	•••••••••••	13	MEDIUM DENSE	STIFF
-						
- 6 ft						
-						
- 2 m						
- 7 ft						
-						
-						
- 8 ft						
-						
-						
- 9 ft						
-						
-						
- 3 m 10 ft						
-						
-						
-						
- 11 ft						
-						
-						
- 12 ft						
-						
-						
- 4 m 13 ft						

WILDCAT.XLS

APPENDIX B
LABORATORY TESTING RESULTS FROM CURRENT INVESTIGATION

LIST OF ATTACHMENTS

The following figures are attached and complete this appendix.

Exploration ID	Depth (ft.)	Sample No.	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
						Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
HA-1	1.0	1						50				
HA-1	3.0	2		17.6								
HA-3	1.0	1		18.4								
HA-3	3.0	2						69				
HA-4	1.0	1		26.2					61	17	44	
HA-4	3.0	2						17				
HA-4	5.0	3		28.9								
HA-5	1.0	1		15.7								
HA-5	3.0	2							25	20	5	
HA-5	5.0	3						62				

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic
NA = Not Available

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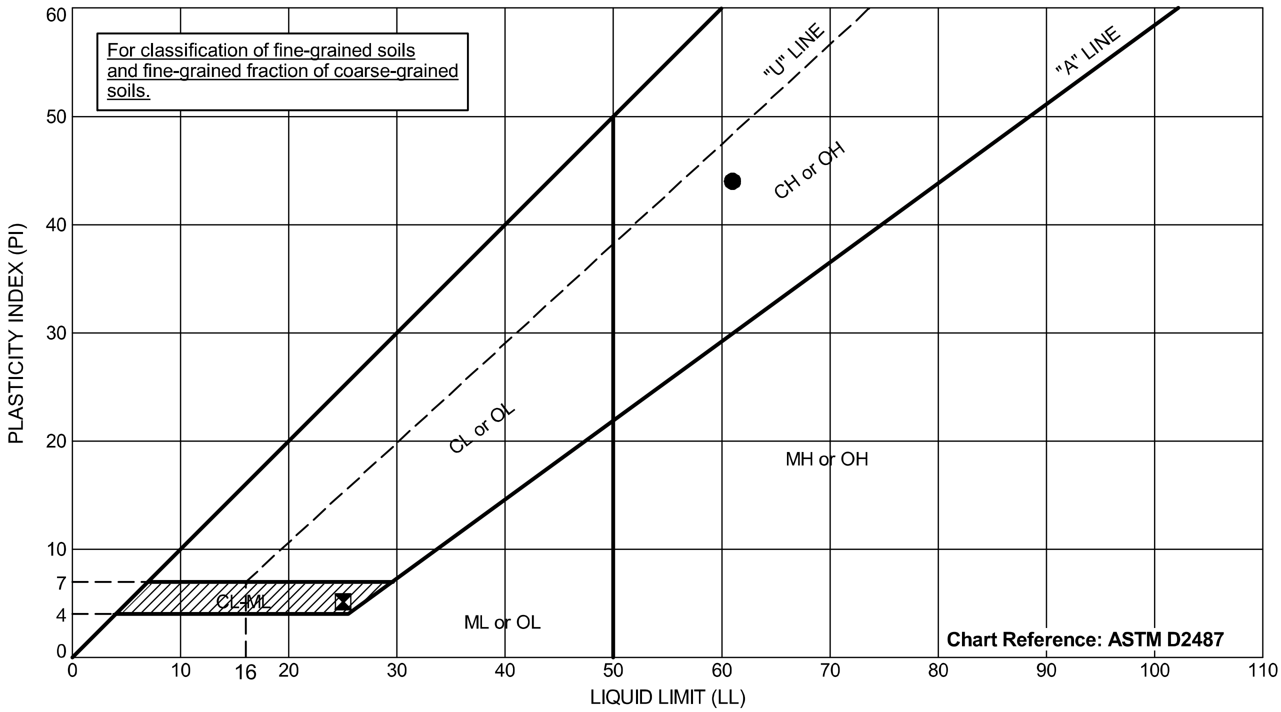
PROJECT NO.: 20220839.001A
DRAWN BY: GG
CHECKED BY: AG
DATE: 6/15/2021

LABORATORY TEST RESULT SUMMARY

Proposed New City Hall Site Improvements
501 & 509 West Weber Avenue
Stockton, California

FIGURE
B-1



Exploration ID		Depth (ft.)	Sample Description	Passing #200	LL	PL	PI
●	HA-4	1		NM	61	17	44
⧗	HA-5	3		NM	25	20	5

Testing performed in general accordance with ASTM D4318.
NP = Nonplastic
NM = Not Measured

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PROJECT NO.: 20220839.001A

DRAWN BY: GG

CHECKED BY: AG

DATE: 6/15/2021

ATTERBERG LIMITS

Proposed New City Hall Site Improvements
501 & 509 West Weber Avenue
Stockton, California

FIGURE

B-2

APPENDIX C
LOGS OF EXPLORATIONS FROM PREVIOUS INVESTIGATION

BORING 1

Depth In Feet	Dry Density Lbs./Cu. Ft.	Moisture Content % Dry Weight	Blow Count *
2	105	19	12
5	91	31	12
10			52
15	99	23	31
20	100		13
25			16
30	106	22	36
35			20
40			24
45	107	21	35/6"
50			31

Description

- ML Brown Very Fine Sandy Silt.
- CL Mottled Brown Silty Clay. (Stiff)
- ML Mottled Brown Clayey Silt. (Stiff)
- CL Mottled Brown Silty Clay. (Stiff)
- Mottled Brown Silty Clay with Very Fine Sand. (Hard)

FILL

- CL Mottled Tan-Brown Silty Very Fine Sandy Clay. (Sluff) (Very Stiff)
- ML Mottled Gray-Brown Very Fine Sandy Silt. (Hard)
- Ground Water Encountered at 19 Feet.
- SM Mottled Brown Silty Clayey Very Fine Sand. (Medium-Dense)
- SM Blue-Grey Slightly Silty Sand. (Medium-Dense)
- CL Blue-Grey Very Fine Sandy Clay. (Hard)
- ML Blue-Grey Very Fine Sandy Silt with Clay. (Very Stiff)
- CL Blue-Grey Silty Clay with Very Fine Sand. (Very Stiff)
- ML Blue-Grey Very Fine Sandy Silt with Clay. (Hard)

BORING TERMINATED AT 51.5-FOOT DEPTH

NOTES:
1. Boring Drilled on 10-17-79.
2. No Caving Noted.
3. Ground Water Encountered at 19 Feet During Drilling.

BORING 5

Depth In Feet	Dry Density Lbs./Cu. Ft.	Moisture Content % Dry Weight	Blow Count *
10	120	14	45
15	100	25	14
20	97	23	27
25			23
30	96	27	16

Description

- ML/CL Tan-Brown Very Clayey Silt with Fine Sand and Silty Clay.

FILL

- ML Mottled Grey-Brown Very Fine Sandy Silt with Clay.
- SM Grey-Brown Silty Fine Sand. (Partially Cemented, Hard)
- CL Mottled Grey-Brown Very Fine Sandy Clay with Silt. (Stiff)
- SM/ML Mottled Grey Fine Sandy Silt and Very Silty Fine Sand with Clay.
- CL Blue-Grey Silty Very Fine Sandy Clay. (Very Stiff)
- Ground Water Encountered at 27 Feet.

BORING TERMINATED AT 31.5-FOOT DEPTH.

NOTES:
1. Boring Drilled on 12-27-79.
2. No Caving Noted.
3. Ground Water Encountered at 27 Feet During Drilling.

BORING 6

Depth In Feet	Dry Density Lbs./Cu. Ft.	Moisture Content % Dry Weight	Blow Count

Description

- ML/CL Tan-Brown Very Clayey Silt and Silty Sand.

FILL

Concrete Slab at 5 Feet.

BORING TERMINATED AT 5.0-FOOT DEPTH

NOTES:
1. Boring Drilled on 12-26-79.
2. No Caving Noted.
3. No Ground Water Encountered.

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LOGS OF BORINGS 1, 5, 6
PROPOSED OFFICE BUILDINGS
WEST END REDEVELOPMENT PROJECT
STOCKTON, CALIFORNIA

DRAWN BY:	SRD	DATE:	3-3-80
CHECKED BY:	RTH	DATE:	3-3-80

PROJECT NO. S-2094-10 PLATE NO. III

BORING 2

Dry Density Lbs./Cu. Ft.	Moisture Content % Dry Weight	Blow Count *
104	20	36
93	30	18
95	28	22
102	24	22
101	25	21
		20
		29
		15

Depth In Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55

Description:

- ML Mottled Brown Very Fine Sandy Silt with Clay. (FILL)
- CL Mottled Brown Silty Clay. (FILL)
- CL Mottled Tan Silty Clay with Minor Gravel.
- Mottled Tan Silty Clay with Minor Gravel and Grey Silt Lenses.
- ML Orange-Brown Clayey Silt with Very Fine Sand. (Hard)
- CL Mottled Grey-Brown Very Silty Clay with Very Fine Sand. (Very Stiff)
- Ground Water Encountered at 23 Feet.
- ML Mottled Grey Very Clayey Silt with Very Fine Sand. (Very Stiff)
- SM Blue-Grey Silty Fine Sand. (Medium-Dense)
- CL Blue-Grey Very Silty Very Fine Sandy Clay. (Very Stiff)
- SM Blue-Grey Very Clayey Fine Sand with Pea Gravel. (Very Stiff)
- ML Blue-Grey Very Fine Sandy Silt with Clay and Pea Gravel.

BORING TERMINATED AT 51.5-FOOT DEPTH

NOTES:

1. Boring Drilled on 10-18-79.
2. No Caving Noted.
3. Ground Water Encountered at 23 Feet During Drilling.

BORING 3

Dry Density Lbs./Cu. Ft.	Moisture Content % Dry Weight	Blow Count *
		4
88	33	35/6"
103	23	21
113	17	27
101	24	30
		12
101	26	14
104	23	26
105		15
97	29	19
		15

Depth In Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55

Description:

- SM Brown Silty Fine Sand. (FILL)
- CL Mottled Brown Silty Clay with Very Fine Sand and Cemented Layers of Silt. (Hard)
- CL Mottled Grey-Brown Silty Clay. (Partially Cemented, Very Stiff)
- ML Mottled Grey Very Fine to Fine Sandy Silt. (Very Stiff)
- ML Mottled Brown Very Clayey Silt. (Very Stiff)
- CL Grey Very Silty Clay.
- CL Mottled Brown Very Silty Clay. (Stiff)
- Ground Water Encountered at 27 Feet.
- ML Blue-Grey Very Fine Sandy Silt with Clay. (Stiff)
- CL Blue-Grey Very Silty Clay. (Stiff)
- (Grades to Very Stiff)
- SM Blue-Grey Silty Fine Sand with Clay. (Dense)
- ML Blue-Grey Very Fine Sandy Silt with Clay. (Very Stiff)
- SM Blue-Grey Silty Fine Sand. (Dense)

BORING TERMINATED AT 51.5-FOOT DEPTH

NOTES:

1. Boring Drilled on 10-18-79.
2. No Caving Noted.
3. Ground Water Encountered at 27 Feet During Drilling.

BORING 4

Dry Density Lbs./Cu. Ft.	Moisture Content % Dry Weight	Blow Count *
		14
93	29	11
93	19	14
98	25	22
101		29
88	27	40
		24
111	19	35
		26
104	23	26
		29

Depth In Feet: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55

Description:

- CL Mottled Brown-Black Silty Clay with Organics. (Stiff) (FILL)
- ML Brown Very Clayey Silt.
- ML Mottled Brown-Grey Silt with Very Fine Sand. (Hard)
- CL Blue-Grey Very Silty Clay. (Very Stiff)
- ML Blue-Grey Very Clayey Silt with Very Fine Sand.
- SM Grey-Brown Very Silty Very Fine Sand.
- ML Blue-Grey Very Fine Sandy Silt with Clay. (Hard)
- SM Blue-Grey Silty Very Fine to Fine Sand. (Medium-Dense)
- Ground Water Encountered at 34 Feet.
- ML Blue-Grey Very Clayey Silt with Very Fine Sand.
- SM Blue-Grey Slightly Silty Fine Sand with Coarse Sands. (Medium-Dense)
- ML Blue-Grey Very Clayey Silt.
- SM Blue-Grey Silty Fine Sand. (Medium-Dense)
- CL Grades to Silty Very Fine Sand.
- ML Blue-Grey Clayey Sandy Silt. (Very Stiff)

BORING TERMINATED AT 51.5-FOOT DEPTH

NOTES:

1. Boring Drilled on 10-22-79.
2. No Caving Noted.
3. Ground Water Encountered at 34 Feet During Drilling.

J. H. KLEINFELDER & ASSOCIATES
GEOTECHNICAL CONSULTANTS — ENGINEERING LABORATORIES

LOGS OF BORINGS 2, 3, 4
PROPOSED OFFICE BUILDINGS
WEST END REDEVELOPMENT PROJECT
STOCKTON, CALIFORNIA

DRAWN BY:	SRD	DATE:	3-3-80
CHECKED BY:	RTH	DATE:	3-3-80

PROJECT NO. -2094-10 | PLATE NO. IV

J. H. KLEINFELDER AND ASSOCIATES
CONSULTING ENGINEERS

SUMMARY OF LABORATORY TESTS

PROJECT NO. S-2094-10

DATE 2-28-80

PROJECT and LOCATION West End Redevelopment-Stockton

PLATE NO. V

BORING NO.	SAMPLE Depth & NO.	DRY UNIT WEIGHT P.C.F.	MOISTURE CONTENT % OF DRY WT.	GRADING ANALYSES — SIEVE SIZE - PERCENT PASSING						HYDROMETER ANALYSIS			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH P.S.F.
										SILT SIZE	CLAY SIZE	COLLOIDS	L. L.	P. I.	
1	2-1	105	19												
1	5-1	91	31												
1	15-1	99	23												3,489
1	20-1	100	25												
1	30-1	106	22												
1	45-1	107	21												
2	15-2	104	20												
2	20-1	93	30												
2	25-2	95	28												1,916
2	30-1	102	24												
2	35-1	101	25												987
3	7-2	88	33												
3	12-1	103	23												
3	15-1	113	17												

J. H. KLEINFELDER AND ASSOCIATES
CONSULTING ENGINEERS

SUMMARY OF LABORATORY TESTS

PROJECT NO. S-2094-10 DATE 2-28-80

PROJECT and LOCATION West End Redevelopment-Stockton

PLATE NO. V

BORING NO.	SAMPLE Depth & NO.	DRY UNIT WEIGHT P.C.F.	MOISTURE CONTENT % OF DRY WT.	GRADING ANALYSES SIEVE SIZE - PERCENT PASSING						HYDROMETER ANALYSIS			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH P.S.F.
										SILT SIZE	CLAY SIZE	COLLOIDS	L.L.	P.I.	
3	20-2	101	24												2,698
3	30-2	101	26												1,355
3	35-1	104	23												
3	40-1	105	18												
3	45-1	97	29												
4	5-1	93	29												2,176
4	10-1	93	19												
4	15-1	98	25												
4	20-1	101	18												
4	25-1	88	27												
4	35-1	111	19												2,888
4	45-2	104	23												
5	10-1	120	14												8,269
5	15-1	100	25												

J. H. KLEINFELDER AND ASSOCIATES
CONSULTING ENGINEERS

SUMMARY OF LABORATORY TESTS

PROJECT NO. S-2094-10

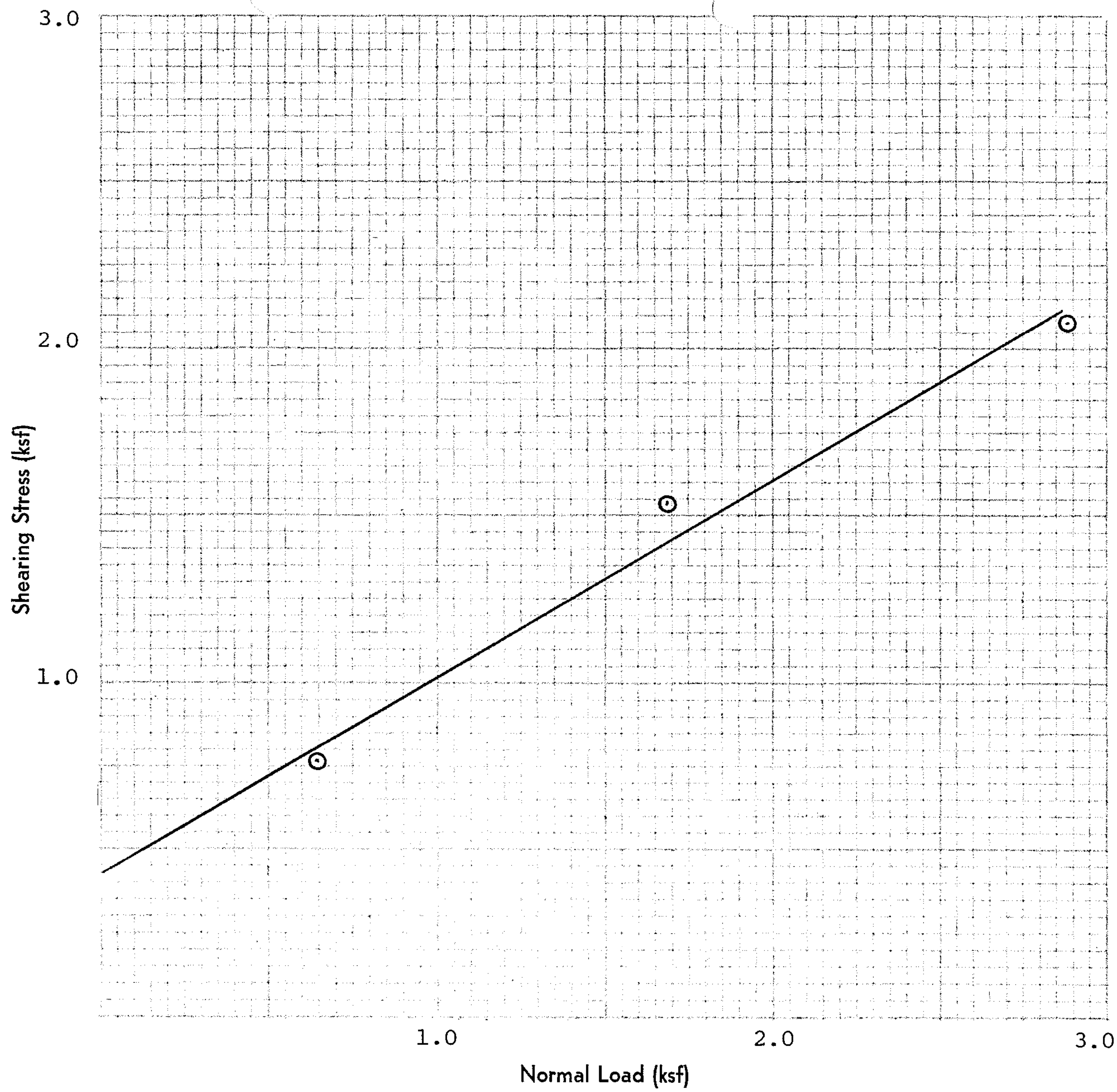
DATE 2-28-80

PROJECT and LOCATION West End Redevelopment-Stockton

Page 3 of 3

PLATE NO. V

BORING NO.	SAMPLE Depth & NO.	DRY UNIT WEIGHT P.C.F.	MOISTURE CONTENT % OF DRY WT.	GRADING ANALYSES SIEVE SIZE - PERCENT PASSING						HYDROMETER ANALYSIS			ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH P.S.F.
										SILT SIZE	CLAY SIZE	COLLOIDS	L. L.	P. I.	
5	20-1	97	23												
5	30-1	96	27												1,441



Boring No. 1	Initial Dry Density-pcf 100
Depth 20 Feet	Initial Water Content-% 25
Sample Description Brown Clayey Silty Sand	Cohesion-ksf 0.45
Special Loading Conditions	Angle of Internal Friction Ø= 29°

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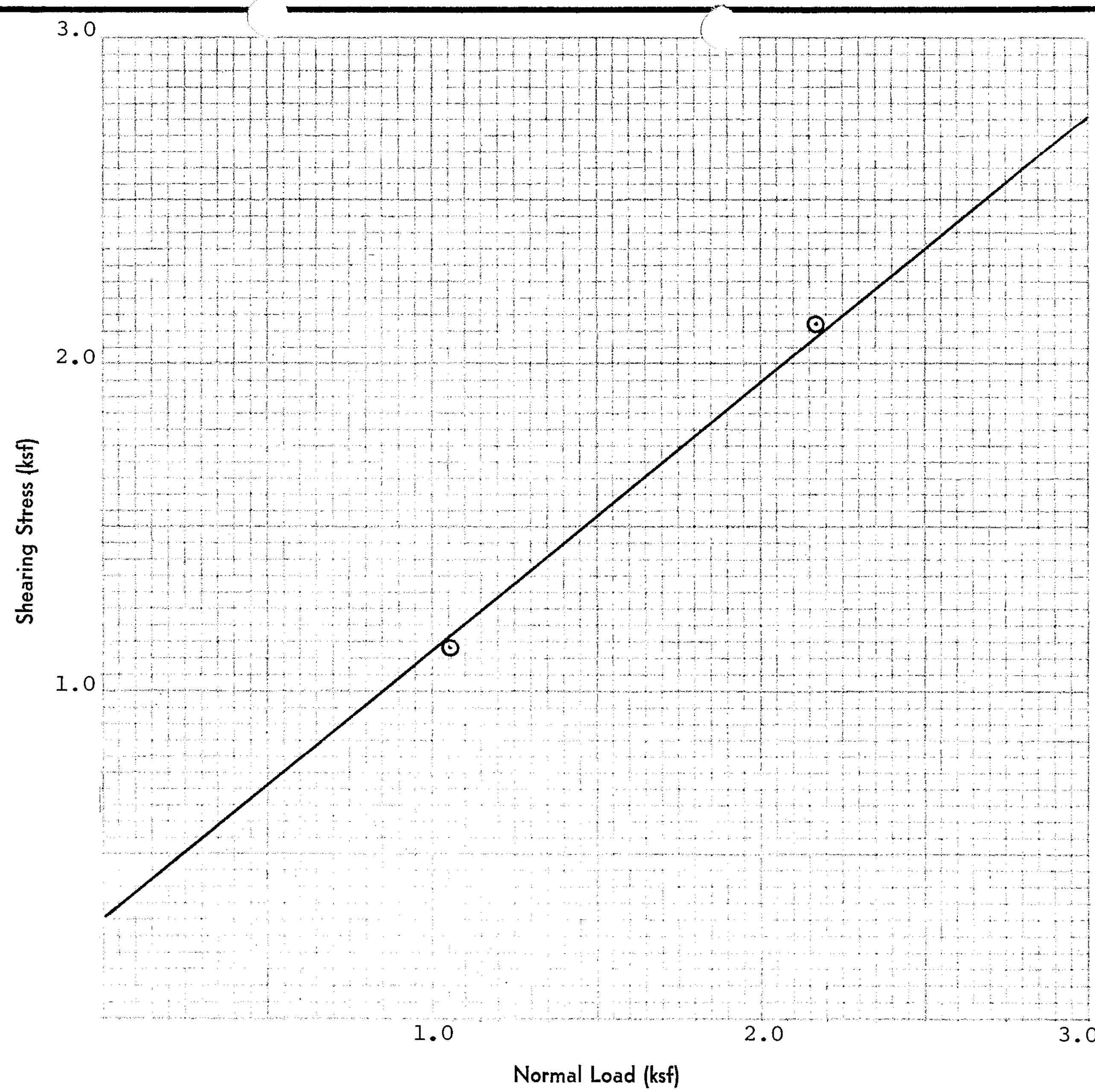
WEST END REDEVELOPMENT
STOCKTON, CALIFORNIA

PREPARED BY:	DATE:	DIRECT SHEAR TEST	
CHECKED BY: RTH	DATE: 2-28-80	PROJECT NO. S-2094-10	PLATE NO. VI



Boring No.	3	Initial Dry Density-pcf	105
Depth	40 Feet	Initial Water Content-%	18
Sample Description	Grey Silty Sand	Cohesion-ksf	0.35
		Angle of Internal Friction Ø=	39°
Special Loading Conditions			

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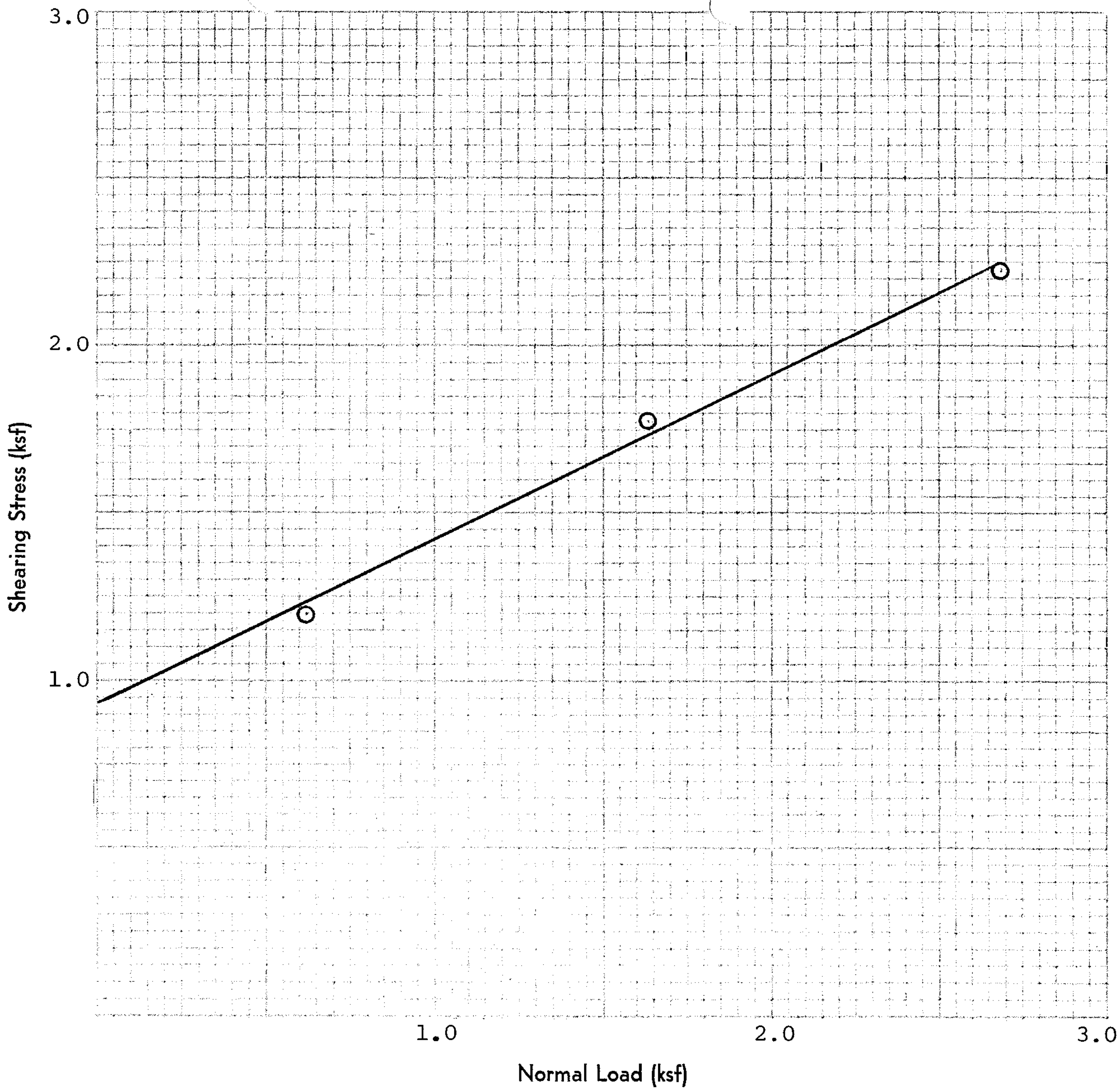
WEST END REDEVELOPMENT
STOCKTON, CALIFORNIA

PREPARED BY:	DATE:	DIRECT SHEAR TEST	
CHECKED BY: RTH	DATE: 2-28-80	PROJECT NO. S-2094-10	PLATE NO. VII



Boring No. 4 Initial Dry Density-pcf 101

Depth 20 Feet Initial Water Content-% 18

Sample Description Tan Silty Fine Sand Cohesion-ksf 0.92

Special Loading Conditions

Angle of Internal Friction Ø= 27°

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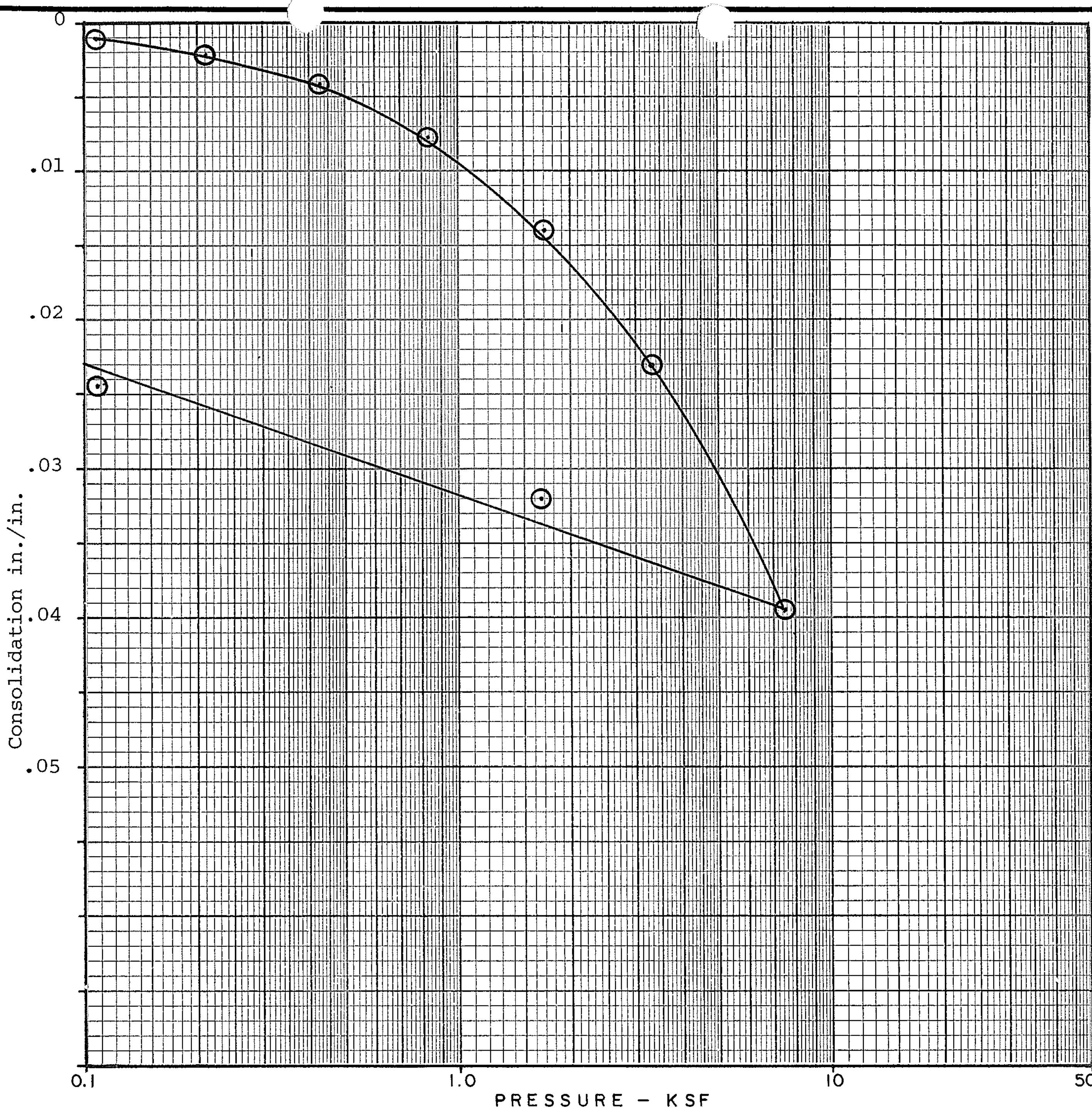
WEST END REDEVELOPMENT

STOCKTON, CALIFORNIA

PREPARED BY:	DATE:	DIRECT SHEAR TEST
CHECKED BY: RTH	DATE: 2-28-80	PROJECT NO. S-2094-10 / PLATE NO. VIII



BORING NO. 1

DEPTH 10 Feet

SAMPLE DESCRIPTION Grey Brown Silty Clay

SPECIFIC GRAVITY

OVERBURDEN PRESSURE

PRECONSOLIDATION PRESSURE 1,400 psf+

COMPRESSION INDEX, C_c 0.043

RECOMPRESSION INDEX, C_r 0.008

	INITIAL	FINAL
DRY DENSITY - PCF	91	95
WATER CONTENT - %	30	--
VOID RATIO		
DEGREE OF SATURATION, %		
SAMPLE HEIGHT - INCHES	1	0.96

Normally Consolidated

J. H. KLEINFELDER & ASSOCIATES

GEOTECHNICAL CONSULTANTS — ENGINEERING LABORATORIES

WEST END REDEVELOPMENT

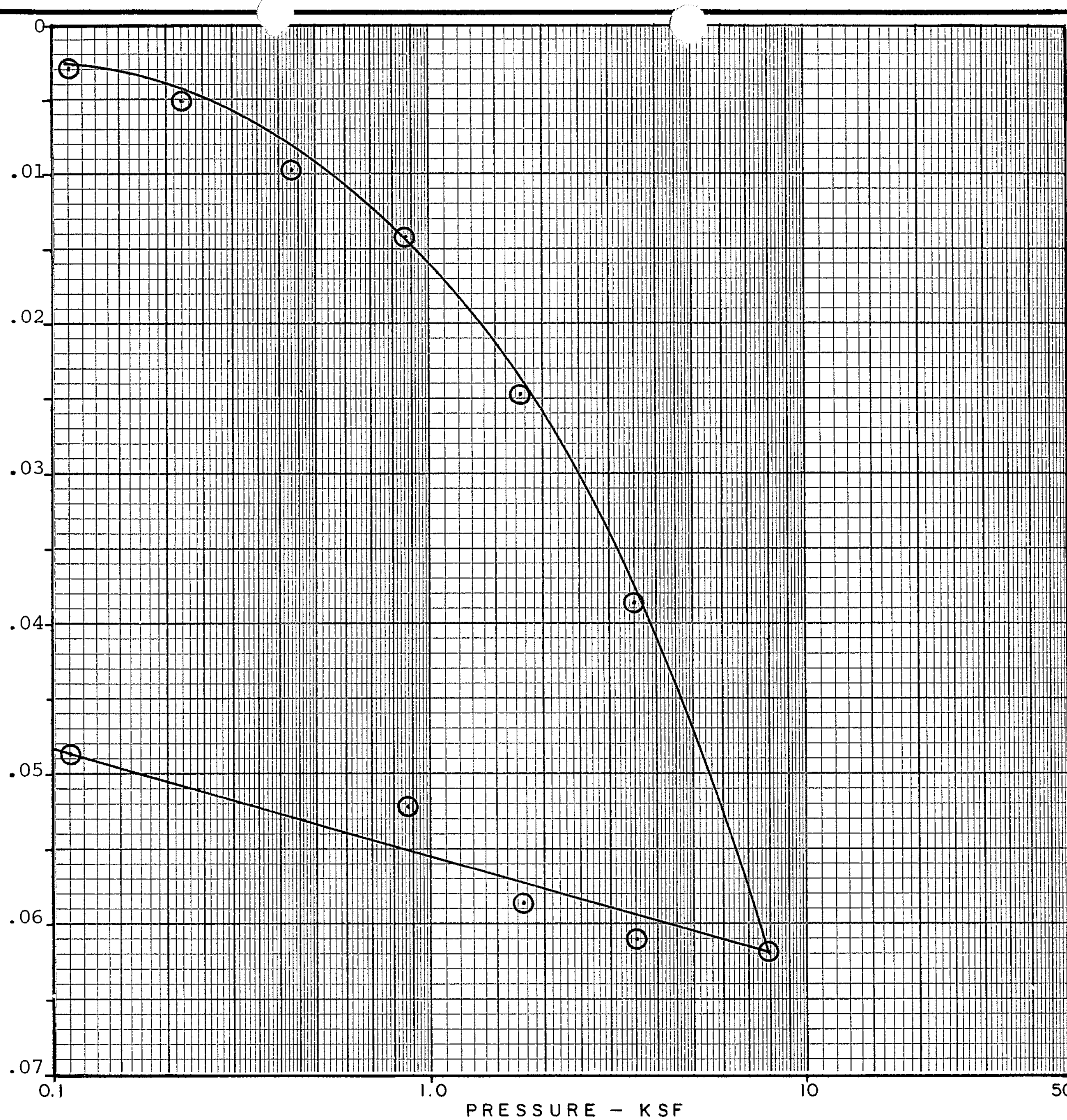
STOCKTON, CALIFORNIA

PREPARED BY: DATE:

CHECKED BY: RTH DATE: 2-28-80

CONSOLIDATION TEST DATA

PROJECT NO. S-2094-10 PLATE NO. IX



BORING NO. 5

DEPTH 15 Feet

SAMPLE DESCRIPTION Brown Very Fine Sandy Clay

SPECIFIC GRAVITY

OVERBURDEN PRESSURE 1,800 psf±

PRECONSOLIDATION PRESSURE

COMPRESSION INDEX, C_c 0.062

RECOMPRESSION INDEX, C_r 0.006

	INITIAL	FINAL
DRY DENSITY – PCF	100	107
WATER CONTENT – %	25	23
VOID RATIO		
DEGREE OF SATURATION, %		
SAMPLE HEIGHT – INCHES	1	0.94

Normally Consolidated

J. H. KLEINFELDER & ASSOCIATES

GEOTECHNICAL CONSULTANTS — ENGINEERING LABORATORIES

WEST END REDEVELOPMENT

STOCKTON, CALIFORNIA

PREPARED BY:		DATE:	
CHECKED BY:	RTH	DATE:	2-28-80

CONSOLIDATION TEST DATA

PROJECT NO. S-2094-10 PLATE NO. X

APPENDIX D
GBA INFORMATION SHEET

Important Information about This

Geotechnical-Engineering Report

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

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

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

Understand the Geotechnical-Engineering Services Provided for this Report

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

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

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

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

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

Do <u>not</u> rely on this report if your geotechnical engineer prepared it:

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

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

Read this Report in Full

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

You Need to Inform Your Geotechnical Engineer About Change

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

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

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

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

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

This Report's Recommendations Are Confirmation-Dependent

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

This Report Could Be Misinterpreted

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

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

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

Give Constructors a Complete Report and Guidance

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

Read Responsibility Provisions Closely

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

Geoenvironmental Concerns Are Not Covered

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

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

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

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