

**Geotechnical Investigation Report
Proposed Mental Health Clinic
Veterans Administration Medical Center
Northwest Corner of
E. Clinton Avenue and N. Angus Street
Fresno, California**

BSK ASSOCIATES

BSK G11-143-11F

Prepared For:

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January 5, 2012



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January 5, 2012

BSK G11-143-11F

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**SUBJECT: Geotechnical Investigation Report
Proposed Mental Health Clinic
Veterans Administration Medical Center
Northwest Corner of E. Clinton Avenue and N. Angus Street
Fresno, California**

Dear Mr. Blayney:

BSK Associates is pleased to submit our Geotechnical Investigation Report for the subject project. The geotechnical investigation, which included a field exploration, laboratory testing program, engineering analysis, and preparation of this report, was conducted in accordance with BSK Proposal GF10-4817 dated January 12, 2011 and authorized with a Letter of Agreement with Consultants dated December 20, 2011. The enclosed report provides geotechnical recommendations for use in preparation of plans and specifications for the subject project.

We appreciate the opportunity to assist you during the design phase of your project and look forward to continuing our relationship on this project through construction. If you have any questions regarding this report, please contact us.

Sincerely,
BSK ASSOCIATES

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**GEOTECHNICAL INVESTIGATION REPORT
PROPOSED MENTAL HEALTH CLINIC
VETERANS ADMINISTRATION MEDICAL CENTER
NORTHWEST CORNER OF
E. CLINTON AVENUE AND N. ANGUS STREET
FRESNO, CALIFORNIA**

1.0 INTRODUCTION

1.1 General

BSK Associates has conducted a geotechnical engineering investigation for the Proposed Mental Health Clinic Building for the Veterans Administration Medical Center (VAMC) on the northwest corner of E. Clinton Avenue and N. Angus Street in Fresno, California (Site). This report presents the results of our geotechnical investigation for the proposed Site. The location of the Site is shown on the Vicinity Map, Figure 1. The project layout and locations of our exploratory borings are shown on Figure 2, Boring Location Plan.

This investigation was performed for HMC Architects (HMC) in accordance with BSK Proposal GF10-4817 dated January 12, 2011 and authorized with a Letter of Agreement with Consultants dated December 20, 2011.

1.2 Project Description

Based on preliminary site plan prepared by HMC, the proposed building gross area will be 18,000 square feet with a ground floor foot print of 9,000 square foot. The proposed building will consist of a two-story, structural steel frame structure with a concrete slab-on-grade floor and shallow reinforced concrete footings and grade beam foundations. The foundation loads are anticipated to be 150 kips Dead Load (DL) and 75 kips Live Load (LL) for interior columns.

Based on preliminary topographic information provided by Blair Church and Flynn Consulting Engineers, multiple underground utilities cross the site.

In the event that significant changes occur in the design or location of the proposed building, this report's conclusions and recommendations will not be considered valid unless the changes are reviewed with BSK and the conclusions and recommendations are modified or verified in writing.

2.0 PURPOSE AND SCOPE OF SERVICES

The purpose of this geotechnical investigation is to provide geotechnical engineering recommendations for use by the project designers during preparation of the project plans and specifications. The scope of the investigation included a field exploration, laboratory testing, engineering analysis, and preparation of this report.

3.0 FIELD EXPLORATION

The field exploration was conducted on December 14 and December 15, 2011, under the oversight of a BSK Staff Engineer. Four (4) test borings were drilled to 25 feet below ground surface (bgs) within accessible areas adjacent to and within the proposed building area using a truck-mounted drill rig with a hollow stem auger. One (1) test boring was excavated within the building area to 10 feet bgs using a hand auger.

The approximate locations of the test borings are indicated on Figure 2, Boring Location Plan. Details of the field exploration and the boring logs are provided in Appendix A.

4.0 LABORATORY TESTING

Laboratory testing of selected samples was performed to evaluate their physical and engineering characteristics and properties. The testing program included: in-situ moisture and dry density; shear strength, collapse potential, and corrosion potential. The in-place moisture and dry density test results are presented on the boring logs in Appendix A. Descriptions of the test methods that were performed and test results are provided in Appendix B.

5.0 SITE CONDITIONS

The following sections address site description, surface and subsurface conditions, and groundwater conditions.

5.1 Site Description

The VAMC Campus is located in the southwest quarter of the northeast quarter of Section 27 of Township 13 South, Range 20 East, Mount Diablo Base and Meridian. The Site is located southeast of the main hospital building. The coordinates for the Site location are 36.7725° North Latitude and -119.7779° West Longitude. The Site is relatively flat with an approximate ground elevation of 309 feet (msl).

The Site currently supports two existing single-story, medical office buildings (Buildings 12 and 14), concrete sidewalks, and landscaping. A variety of large mature trees are located along the north and west side of Building 14. Existing trees are also located along the north and west side of Building 12. A masonry block wall with wrought iron fence extends along the back of the sidewalk and landscape strip on E. Clinton Avenue. Large mature trees are located along the E. Clinton Avenue landscape strip.

An existing single-story building (Building 13) and landscaped areas with a variety of young to mature trees is located along the north side of the Site. The east side of the Site is adjacent to N. Angus Avenue which is a neighborhood street with existing residential developments. The main parking lot of the hospital is on the west side of the Site.

5.2 Subsurface Conditions

Based on our soil boring data, the soils encountered at the Site are silty sand, sandy silt, and sand. The upper 2 feet consists of loose silty sand which is underlain by medium dense silty sand with intermittent zones of weak cementation. Medium dense silty sand was encountered

within the upper 10 to 15 feet bgs with the exception of Boring B-1 which encountered an isolated zone of loose silty sand from 5 to 8.5 feet bgs. The upper 10 to 15 feet of the soil profile has a relatively low moisture content ranging from 1.8 to 5.1 percent. Below 10 to 15 feet, the underlying alluvial deposits consist of medium dense, fine to coarse grained sand and silty sand with an isolated layer of hard sandy silt. Dense silty sand was encountered below 24 feet in Borings B-2 and B-4.

Groundwater was not encountered in the test borings at the time of the field exploration. Based on State of California Department of Water Resources records, the groundwater was indicated at a depth of approximately 75 feet below the existing ground surface. However, the possibility of the groundwater table rising to shallower depths and/or the presence of perched groundwater may occur due to landscape irrigation, seasonal effects, or other factors not evident at the time of the investigation.

The boring logs in Appendix A provide a more detailed description of the soils encountered in each boring, including the applicable Unified Soil Classification System symbol. The locations of the borings are shown on the Boring Location Plan, Figure 2.

5.3 Geologic Setting

The site is located in the southeastern portion of the San Joaquin Valley, a broad topographic and structural trough in Central California. The Valley is dominated by coalescing alluvial fans and flood plains derived from rivers and streams emanating from the Sierra Nevada and Coast Ranges bordering the valley. The structural floor of the Valley is asymmetrical, sloping westward to its greatest depth near the western margin of the Valley. The valley fill consists of a sequence of marine and overlying continental sediments, Jurassic to Holocene in age, that reach a thickness of as much as 28,000 feet on the southwest side of the Valley.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

Based upon the data collected during this investigation, and from a geotechnical engineering standpoint, it is our opinion that there are no soil conditions which would preclude or significantly impact the construction of the proposed improvements.

The near-surface soils in the proposed building area consists primarily of silty sand that may be considered to possess a very low expansion potential for design purposes. The soil profile within the upper 10 to 15 feet has a relatively low moisture content, however, based on our test results, the potential for hydro-collapse within the upper 10 to 15 feet is very low when inundated. The planned building may be supported on shallow reinforced concrete footings provided that the recommendations presented herein are incorporated in the design and construction of the project.

The upper 5 feet of the soil profile will be disturbed following the demolition and clearing process. The proposed building area will require the demolition and removal of two existing single-story medical office buildings (Buildings 12 and 14). The demolition of the existing buildings will require removal of building foundations and existing underground utilities which

may extend 2 to 5 feet bgs. Currently, the site has some mature trees which will require root removal which may extend to 4 feet bgs.

The site will require over-excavation and placement of a moisture conditioned engineered fill to construct a uniform, compacted building pad for the proposed building. An isolated zone of loose silty sand was encountered below 5 feet. The bottom of the over-excavated area must be reviewed by the Geotechnical Consultant prior to scarifying the exposed surface to evaluate the presence of loose zones and organics (roots) below 5 feet that may require additional localized over-excavation.

More detailed recommendations for earthwork construction at the project site are provided in Section 6.4 of this report.

6.2 Seismic Design Criteria - 2010 CBC / 2009 IBC

The site is located in an area of California with low to moderate regional seismicity. In general, the site will experience relatively low intensity ground motion, primarily from small earthquakes on nearby faults and large earthquakes on distance faults. The site is not located in an area with nearby faults capable of generating high intensity ground motion. The nearest major faults are segments of the Great Valley Fault (42 miles west) and the San Andreas Fault (75 miles west).

Based on our understanding of the geologic setting at the project site, the sampler blow counts and correlated Standard Penetration Test (SPT) "N" values from our soil borings, and in accordance with of the 2010 California Building Code (CBC), Table 1613.5.2 and 2009 International Building Code (IBC), Table 1613.5.2, the site can be classified as Site Class D.

Use of the 2010 California Building Code (CBC)/2009 International Building Code (IBC) seismic design criteria is considered appropriate and the following parameters should be considered applicable for the structural design of the planned improvements:

TABLE 1 2010 California Building Code (CBC) and 2009 International Building Code (IBC) Seismic Design Criteria			
Seismic Design Parameter	Value		Reference
MCE Mapped Spectral Acceleration (g)	$S_s = 0.51$	$S_1 = 0.22$	USGS Mapped Value
Amplification Factors (Site Class D)	$F_a = 1.40$	$F_v = 1.96$	Table 1613.5.3
Site Adjusted MCE Spectral Acceleration (g)	$S_{MS} = 0.71$	$S_{M1} = 0.44$	Equations 16-36, 37
Design Spectral Acceleration (g)	$S_{DS} = 0.47$	$S_{D1} = 0.29$	Equations 16-38, 39
Design Peak Ground Acceleration ($S_{DS}/2.5$) (g)	$PGA = 0.19$		CGS Note 48

As shown above, the mapped spectral acceleration parameter at 1-second period (S_1) is less than 0.75 and is greater than 0.20, therefore the site lies in Seismic Design Category D as specified in Section 1613.5.6 of the 2010 CBC/2009 IBC. Based on our subsurface exploration and our

knowledge of the geologic setting, there is no significant risk of ground rupture, liquefaction, or seismic settlement at the subject site during a design-level seismic event.

6.3 Soil Corrosivity

One soil sample was analyzed to evaluate the potential for concrete deterioration or steel corrosion due to attack by soluble salts in the on-site soils. Based on the test results, on-site, near-surface soils have a very low soluble sulfate and chloride content, a high resistivity, and are slightly alkaline. Thus, on-site soils are considered to have a low corrosion potential with respect to buried concrete and metal conduits. We recommend that Type II cement be used in the formulation of concrete and that buried reinforcing steel have a minimum concrete cover as required by the American Concrete Institute (ACI) Building Code Requirements for Structural Concrete, ACI 318-08, Chapter 7.7. Buried metal conduits must have a normal protective coating in accordance with the manufacturer's specifications. If more detailed recommendations for corrosion protection are desired, a corrosion specialist must be consulted.

6.4 Site Preparation and Earthwork Construction

The following procedures must be implemented during site preparation for the proposed site improvements. It should be noted that all references to maximum dry density, optimum moisture content, and relative compaction are based on ASTM D1557 (latest test revision) laboratory test procedures.

- 1) Within the area of the planned building and concrete flatwork improvements all trash, debris, and the near-surface soils containing vegetation, trees, roots, or other objectionable organic matter must be stripped to expose a clean soil surface. Stripping depth of 6 inches is expected. Some landscape trees will be removed during the clearing of the site. Tree roots must be grubbed out to a minimum depth of 4 feet below existing grade. As a minimum, roots should be removed until there is less than three percent organic material in the soil and no roots greater than ½-inch diameter are present. Organically rich materials resulting from stripping operations must be removed from the site and properly disposed. Although organic-rich strippings must not be used in engineered fill, they can be used in landscape areas at the discretion of the Architect.
- 2) Where existing utilities or underground tanks are present, they must be removed to a point at least 5 feet horizontally outside the proposed construction. Resultant cavities must be backfilled with engineered fill.
- 3) Following the required stripping and/or removal of underground and above-ground structures as indicated above, the exposed surface in the planned building area must be over-excavated to a depth of at least 5 feet below the stripped surface or to at least 1 foot below the bottom of footings, whichever is deepest. The over-excavation must extend at least 5 feet laterally outside of the building areas. *The exposed ground surface must be reviewed by the Geotechnical Engineer to evaluate if organically rich soil, loose, or soft zones are present that will require additional over excavation.*

- 4) After completing any required over excavation, the exposed subgrade must be scarified to a depth of 8 inches, moisture conditioned to within 2 percent of optimum moisture content and compacted to at least 92 percent of the maximum dry density.
- 5) Excavated soils, free of organic materials or deleterious substances, may be used as compacted engineered fill. Engineered fill must be placed in uniform layers not exceeding 8 inches in loose thickness, moisture conditioned to within 2 percent of optimum moisture content, and compacted to at least 92 percent relative compaction. The upper 12-inches of asphalt concrete or concrete pavement subgrade must be compacted to at least 95 percent relative compaction.
- 6) Import fill materials must be free from organic materials or deleterious substances. The project specifications must require the contractor to contact BSK for review of proposed import fill materials for conformance with these recommendations prior to importing to the Site, whether from on-site or off-site borrow areas. Imported fill soils must be non-hazardous and be derived from a single, consistent soil type source conforming to the following criteria:

Maximum Particle Size:	3"
Percent Passing #4 Sieve:	65% - 100%
Percent Passing #200 Sieve:	20 – 45
Plasticity Index:	less than 12
Low Corrosion Potential:	
Soluble Sulfates	< 1,500 mg/Kg
Soluble Chlorides	< 300 mg/Kg
Soil Resistivity	>3,000 ohm-cm

If at all possible, grading and paving operations should be scheduled as to avoid working during periods of inclement weather. Should these operations be performed during or shortly following periods of inclement weather, unstable soil conditions may result in the soils exhibiting a "pumping" condition. This condition is caused by excess moisture, in combination with compaction, resulting in saturation and zero air voids in the soils. If this condition occurs, the adverse soils will need to be over-excavated to the depth at which stable soils are encountered, and replaced with suitable soils compacted as engineered fill. Alternatively, the Contractor may proceed with grading operations after utilizing an alternative method of soil stabilization, which must be subject to review and approval by BSK prior to implementation.

Volume shrinkage of the existing soils due to compaction and removal of the existing trees and root structures is anticipated and should be considered by the Civil Engineer and Contractor.

6.5 Foundations

Provided that the site is prepared as recommended above, the proposed building may be supported on foundations bearing on engineered fill or compacted native soil. Footings must be designed with steel reinforcing as recommended by the Project Structural Engineer. Continuous wall footings must have a minimum width of 12-inches and isolated spread footings must have a minimum width of 24-inches. Foundations must extend a minimum depth of 24-inches below the lowest adjacent sub-grade surface. Footings constructed as recommended herein may be

designed for an allowable bearing pressure of 3,000 pounds per square foot (psf). This value applies to the dead load plus live load (DL + LL) condition, and may be increased by 1/3 for short duration wind or seismic loads.

For design purposes, maximum total foundation settlements should be less than one inch for the assumed maximum design loads (DL of 150 kips and LL of 75 kips). Differential settlements between adjacent similarly loaded (DL + LL) footings with equal area are anticipated to be less than one-quarter inch. Due to the granular nature of the foundation soils, the majority of the predicted settlement indicated above is expected to occur within a few months after the total building loads are applied.

6.6 Concrete Slabs-on-Grade

Concrete slab-on-grade floors must be a minimum of 4-inches thick and must be supported on a compacted subgrade prepared in accordance with Section 6.4. Existing on-site surface soils may be considered to have a very low expansion potential for design purposes. In order to regulate cracking of the slabs, full-depth construction joints or control joints must be provided at a maximum spacing of 10 feet in each direction along with steel reinforcement as recommended by the Project Structural Engineer. Control joints must have a minimum depth of one-quarter of the slab thickness. Due to the difficulty of installing and maintaining woven or welded wire mesh (WWM) in the middle of concrete slabs-on-grade during construction, it is recommended that any steel reinforcement used in concrete slabs-on-grade consist of steel rebar. Structural concrete slabs-on-grade may be designed using a modulus of subgrade reaction equal to 200 pci.

Interior concrete slabs must be successively underlain by: 1-½ inches of coarse, washed sand; a durable vapor barrier; and a smooth, compacted subgrade surface. The vapor barrier must meet the requirements of ASTM E 1745 Class A and have a water vapor transmission rate (WVTR) of less than or equal to 0.012 Perms as tested by ASTM E 96. Examples of acceptable vapor barrier products include: Stego Wrap (15-mil) Vapor Barrier by STEGO INDUSTRIES LLC; W.R. Meadows Premoulded Membrane with Plasmatic Core; and Zero-Perm by Alumiseal. Because of the importance of the vapor barrier, joints must be carefully spliced and taped. If migration of subgrade moisture through the slab is not a concern, then the vapor barrier and overlying sand may be deleted. The building subgrade must be kept in a moist condition until the vapor barrier or concrete slab is placed. BSK's representative must be called to the site to review soil and moisture conditions immediately prior to placing the vapor barrier or concrete slab.

As indicated in recent ACI Committee reports (see ACI 360R-06, Design of Slabs-on-Ground, dated October 2006 and ACI 302.1R-04, Guide for Concrete Floor and Slab Construction, dated June 2004), the sand layer between the vapor barrier and concrete floor slab may be omitted. This should reduce the amount of moisture that can be transmitted through the slab (especially if the sand layer becomes very moist or wet prior to placing the concrete); however, the risk of slab "curling" is much greater. The "curling" may result from a sharp contrast in moisture-drying conditions between the exposed slab surface and the surface in contact with the membrane. As recommended in the referenced ACI Committee reports, measures must be taken to reduce the risk of "curling" such as reducing the joint spacing, using a low shrinkage mix design, and reinforcing the concrete slab. The water:cement ratio of the concrete must not exceed 0.45. In

order to regulate cracking of the slab, we recommend that full depth construction joints and control joints be provided in each direction with slab thickness and steel reinforcing as recommended by the structural engineer.

Excessive landscape water or leaking utility lines could create elevated moisture conditions under concrete slabs, which could result in adverse moisture or mildew conditions in floor slabs or walls. Accordingly, care must be taken to avoid excess irrigation around the structures, as well as to periodically monitor for leaking utility lines. Likewise, positive surface drainage must be provided around the perimeter of the structures.

As indicated above, the control of the deleterious effects of moisture vapor transmission on flooring materials can be substantially improved by the use of a low porosity concrete. This can be achieved by specifying a low water:cement ratio (0.45 or less), 4,000 psi compressive strength at 28 days and a minimum of 7 days wet-curing.

6.7 Lateral Earth Pressures and Frictional Resistance

Provided that the site is prepared as recommended above, the following earth pressure parameters for footings may be used for design purposes. The parameters shown in Table 2 are for drained conditions of select engineered fill or undisturbed native soil.

TABLE 2 Recommended Lateral Earth Pressure (Drained Condition)	
Lateral Pressure Condition	Equivalent Fluid Pressure (pcf)
Active Pressure	34
At-Rest Pressure	53
Passive Pressure	420

Active pressure refers to walls that are free to rotate. At-rest pressure refers to walls that are restrained against rotation. The lateral earth pressures listed herein assume level backfill. The conventional equation for active, at-rest, and passive conditions, using soil bulk unit weights of 120 pcf are appropriate for the silty sand, above the groundwater because undrained conditions prevail in the soil mass.

A coefficient of friction of 0.4 may be used between soil sub-grade and the bottom of footings. The coefficient of friction and passive earth pressure values given above represent ultimate soil strength values. BSK recommends that a safety factor consistent with the design conditions be included in their usage. For stability against lateral sliding that is resisted solely by the passive earth pressure against footings or friction along the bottom of footings, a minimum safety factor of 1.5 is recommended. For stability against lateral sliding that is resisted by combined passive pressure and frictional resistance, a minimum safety factor of 2.0 is recommended. For lateral stability against seismic loading conditions, a minimum safety factor of 1.2 is recommended.

6.8 Excavation Stability

Soils encountered within the depth explored are generally soil Type C in accordance with OSHA (Occupational Safety and Health Administration). The slopes surrounding or along temporary excavations may be vertical for excavations that are less than five feet deep and exhibit no indication of potential caving. Excavations that are deeper than five feet, up to a maximum depth of 12 feet must be no steeper than 1.5H:1V (horizontal: vertical). Certified trench shields or boxes may also be used to protect workers during construction. Temporary excavations for the project construction should be left open for as short a time as possible and must be protected from water runoff. In addition, equipment and/or soil stockpiles must be maintained at least 10 feet away from the top of the excavations. Because of variability in soils, BSK must be afforded the opportunity to observe and document sloping and shoring conditions at the time of construction. Slope height, slope inclination, and excavation depths (including utility trench excavations) must in no case exceed those specified in local, state, or federal safety regulations, (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations).

6.9 Pipe Bedding and Envelope

Pipe bedding and envelope material must consist of relatively clean sand with a Sand Equivalent of at least 25 and with 100 percent passing the 3/8 inch sieve and less than 20 percent passing the #200 sieve. Based on the test borings that were performed for this investigation, it is likely that the soils excavated to install the proposed underground utilities will meet these requirements. As an alternative to using sand, the pipe bedding and envelope material may consist of Class 2 Aggregate Base or sand-cement slurry that contains 1.5 to 2.0 sacks of cement per yard of material and has a 4- to 6-inch slump.

Bedding and pipe envelope must be placed in loose thickness not exceeding twelve inches and compacted to at least 90 percent relative compaction as determined by ASTM Test Method D1557. Soil backfill moisture content during compaction must be maintained within two percent (2%) of optimum. Water jetting to attain compaction is not allowed. Class 2 Aggregate Base, when used for bedding or pipe envelope must be compacted to at least 92 percent relative compaction based on ASTM D1557.

6.10 Trench Backfill and Compaction

Processed on-site soils, which are free of organic material, are suitable for use as general trench backfill above the pipe envelope. Native soil with particles less than three inches in the greatest dimension may be incorporated into the backfill and compacted as specified above, providing they are properly mixed into a matrix of friable soils. The backfill must be placed in thin layers, not exceeding 12 inches in loose thickness, well blended and consistent texture, moisture conditioned to at least optimum moisture content, and compacted to at least 90 percent of the maximum dry density as determined by ASTM D1557. The uppermost 24 inches of trench backfill below pavement sections must be compacted to at least 95 percent of the maximum dry density and moisture content must be maintained within two percent (2%) of optimum in the trench backfill zone.

We recommend that trench backfill be tested for compliance with the recommended Relative Compaction and moisture conditions. Field density testing should conform to ASTM Test Methods D1556 or D6938. We recommend that field density tests be performed in the utility trench bedding, envelope and backfill for every vertical lift, at an approximate longitudinal spacing of not greater than 250 feet. Backfill that does not conform to the criteria specified in this section should be removed or reworked, as applicable over the trench length represented by the failing test so as to conform to BSK's recommendations.

6.11 SURFACE DRAINAGE CONTROL

The control of surface drainage within the proposed structure areas is an important design consideration. We recommend the following:

The control of surface drainage at the project site is an important design consideration. BSK recommends the following:

- Final grading around concrete or asphalt pavement must provide for positive and enduring drainage away from the buildings, and ponding of water must not be allowed around or near the buildings or on any of the paved surfaces. Paved surfaces next to the buildings must be at least a 2 percent gradient away from the building.
- Landscaping must be carefully planned to provide positive and enduring drainage away from the buildings, minimize irrigation of the area within 5 feet of the buildings, and prevent saturation of the soils immediately adjacent to or below the building areas. Unpaved landscape areas must be sloped with at least a 5 percent gradient away from the building for a distance of at least 10 feet.
- Irrigation water must be applied in amounts not exceeding those required to offset evaporation, sustain plant life, and maintain a relatively uniform moisture profile around the perimeter of, and below, site improvements.

7.0 PLANS AND SPECIFICATIONS REVIEW

BSK recommends that it be retained to review the draft plans and specifications for the project, with regard to foundations and earthwork, prior to their being finalized and issued for construction bidding.

8.0 CONSTRUCTION TESTING AND OBSERVATIONS

Geotechnical testing and observation during construction is a vital extension of this geotechnical investigation. BSK recommends that it be retained for those services. Field review during site preparation and grading allows for evaluation of the exposed soil conditions and confirmation or revision of the assumptions and extrapolations made in formulating the design parameters and recommendations. BSK's observations must be supplemented with periodic compaction tests to establish substantial conformance with these recommendations. BSK must also be called to the site to observe foundation excavations, prior to placement of reinforcing steel or concrete, in order to assess whether the actual bearing conditions are compatible with the conditions

anticipated during the preparation of this report. BSK must also be called to the site to observe placement of foundation and slab concrete.

If a firm other than BSK is retained for these services during construction, that firm must notify the owner, project designers, governmental building officials, and BSK that the firm has assumed the responsibility for all phases (i.e., both design and construction) of the project within the purview of the geotechnical engineer. Notification must indicate that the firm has reviewed this report and any subsequent addenda, and that it either agrees with BSK's conclusions and recommendations, or that it will provide independent recommendations.

9.0 LIMITATIONS

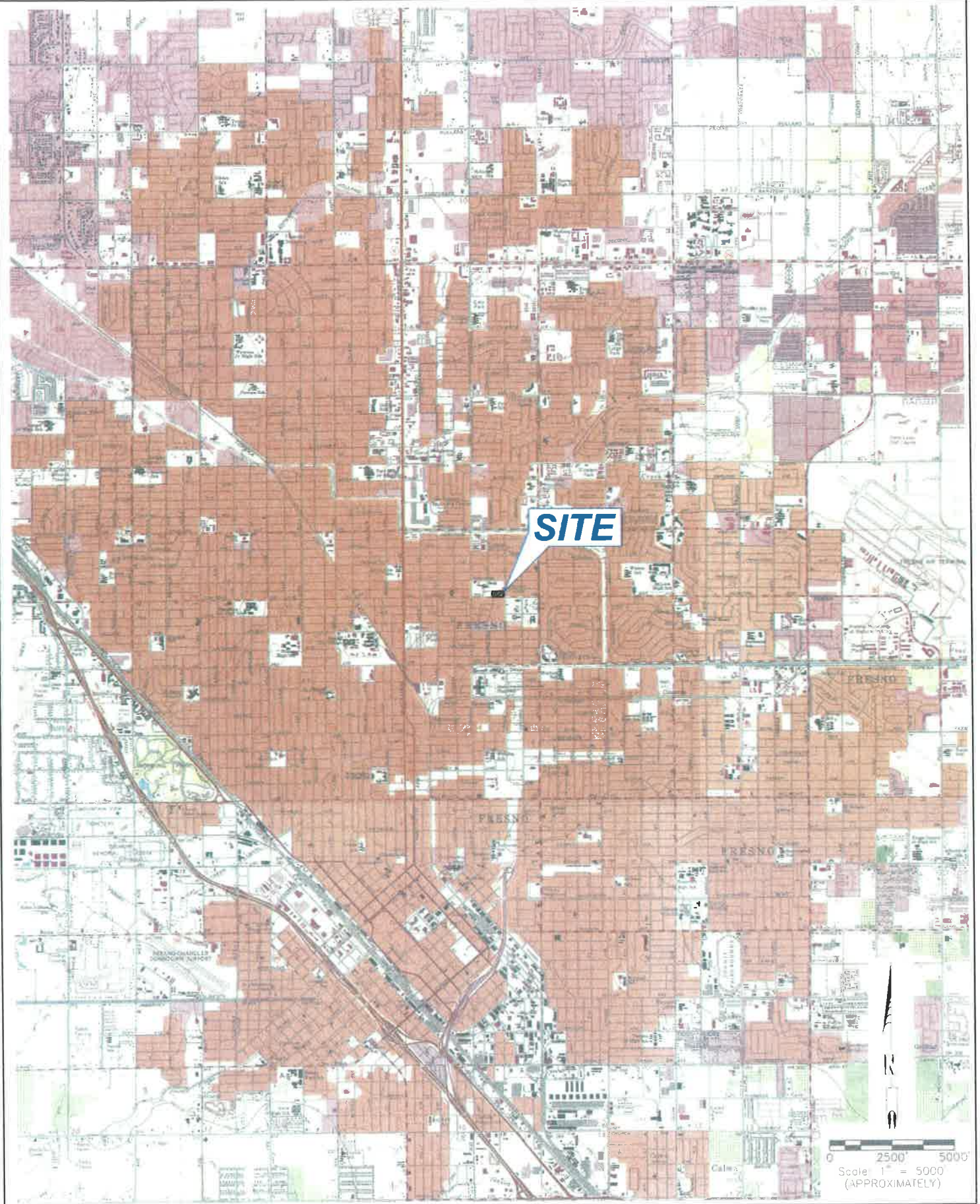
The analyses and recommendations submitted in this report are based upon the data obtained from the test borings performed at the locations shown on Figure 2. The report does not reflect variations which may occur between or beyond the borings. The nature and extent of such variations may not become evident until construction is initiated. If variations then appear, a re-evaluation of the recommendations of this report will be necessary after performing on-site observations during the excavation period and noting the characteristics of the variations.

The validity of the recommendations contained in this report is also dependent upon an adequate testing and observation program during the construction phase. BSK assumes no responsibility for construction compliance with the design concepts or recommendations unless it has been retained to perform the testing and observation services during construction as described above.

The findings of this report are valid as of the present. However, changes in the conditions of the site can occur with the passage of time, whether caused by natural processes or the work of man, on this property or adjacent property. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation, governmental policy or the broadening of knowledge.

BSK has prepared this report for the exclusive use of the Client and members of the project design team. The report has been prepared in accordance with generally accepted geotechnical engineering practices which existed in Fresno County at the time the report was written. No other warranties either express or implied are made as to the professional advice provided under the terms of BSK's agreement with Client and included in this report.

BSK ASSOCIATES



REFERENCE IMAGE: NATIONAL GEOGRAPHIC, TOPOI



VICINITY MAP

VMC Mental Health Building
NW Corner of E. Clinton Ave and N. Angus St.
Fresno, California

K:\2011\Jobs\11\G11-143-11F VAMC Mental Health Clinic\4817.GPJ VAMC Mental Health Bldg\A000\Boring Location Plan.dwg User:mlb001 Plotted: 05/20/12 1:59pm Last Save: Dec 27, 2011 11:56am

FRESNO STREET

HARVARD AVENUE

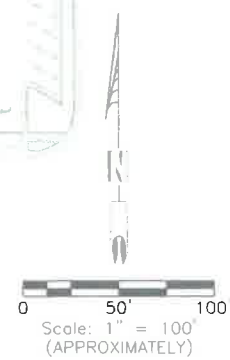
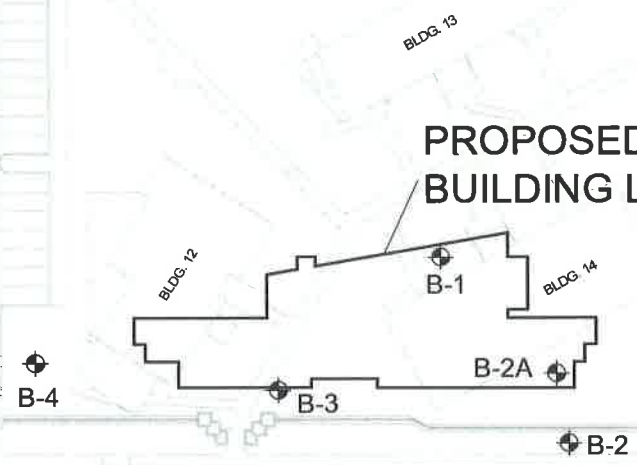
N. ANGUS STREET

E. CLINTON AVENUE

LEGEND:

⊕ APPROXIMATE BORING LOCATION

PROPOSED
BUILDING LAYOUT



BORING LOCATION PLAN

VAMC Mental Health Building
NW Corner of E. Clinton Ave. and N. Angus St.
Fresno, California

APPENDIX A

Field Exploration

APPENDIX A

Field Exploration

The field exploration was conducted on December 14 and December 15, 2008, under the oversight of a BSK Staff Engineer. Four (4) test borings were drilled to 25 feet below ground surface (bgs) within accessible areas adjacent to and within the proposed building area using a truck-mounted drill rig with hollow stem auger. One (1) other test boring was excavated to 10 feet bgs using a hand auger. The approximate locations of the test borings are indicated on Figure 2, Boring Location Plan.

The soil materials encountered in the test borings were visually classified in the field, and the Staff Engineer recorded logs during the drilling and sampling operations. Visual classification of the materials encountered in the test borings was made in general accordance with the Unified Soil Classification System (ASTM D 2487). A soil classification chart is presented herein. Boring logs are presented herein and should be consulted for more details concerning subsurface conditions. Stratification lines were approximated by the field staff based on observations made at the time of drilling, while the actual boundaries between different soil types may be gradual and soil conditions may vary at other locations.
















Subsurface samples were obtained at the successive depths shown on the boring logs by driving samplers which consisted of a 2.5-inch inside diameter (I.D.) California Sampler and a 1.4-inch I.D. Standard Penetration Test (SPT) Sampler. The samplers were driven 18 inches using a 140-pound hammer dropped from a height of 30 inches by means of either an automatic hammer or a down-hole "safety hammer". The number of blows required to drive the last 12 inches was recorded as the blow count (blows/foot) on the boring logs. The relatively undisturbed soil core samples were capped at both ends to preserve the samples at their natural moisture content. Soil samples were also obtained using the SPT Sampler (marked X in logs) lined with metal tubes or unlined in which case the samples were placed and sealed in polyethylene bags. At the completion of the field exploration, the test borings were backfilled with the excavated soil cuttings.

It should be noted that the use of terms such as "loose", "medium dense", "dense" or "very dense" to describe the consistency of a soil is based on sampler blow count and is not necessarily reflective of the in-place density or unit weight of the soils being sampled. The relationship between sampler blow count and consistency is provided in the following Tables A-1 and A-2 for coarse-grained (sandy and gravelly) soils and fine grained (silty and clayey) soils, respectively.

Table A-1: Consistency of Coarse-Grained Soil versus Sampler Blow Count		
Consistency	SPT Blow Count (#Blows / Foot)	2.5" I.D. California Sampler Blow Count (#Blows / Foot)
Very Loose	<4	<6
Loose	4 – 10	6 – 15
Medium Dense	10 – 30	15 – 45
Dense	30 – 50	45 – 80
Very Dense	>50	>80

Table A-2: Consistency of Fine-Grained Soil versus Sampler Blow Count		
Consistency	SPT Blow Count	2.5" I.D. Cal. Sampler Blow Count
Very Soft	<2	<3
Soft	2 – 4	3 – 6
Medium Stiff	4 – 8	6 – 12
Stiff	8 – 15	12 – 24
Very Stiff	15 – 30	24 – 45
Hard	>30	>45

* *Terzaghi and Peck, 1948*

MAJOR DIVISIONS				TYPICAL NAMES				
COARSE GRAINED SOILS More than Half >#200	GRAVELS MORE THAN HALF COURSE FRACTION IS LARGER THAN NO. 4 SIEVE	CLEAN GRAVELS WITH LITTLE OR NO FINES	GW		WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES			
			GP		POORLY GRADED GRAVELS, GRAVEL- SAND MIXTURES			
		GRAVELS WITH OVER 15% FINES	GM		SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES			
			GC		CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES			
	SANDS MORE THAN HALF COURSE FRACTION IS SMALLER THAN NO. 4 SIEVE	CLEAN SANDS WITH LITTLE OR NO FINES	SW		WELL GRADED SANDS, GRAVELLY SANDS			
			SP		POORLY GRADED SANDS, GRAVELLY SANDS			
		SANDS WITH OVER 15% FINES	SM		SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES			
			SC		CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES			
			FINE GRAIN SOILS More than Half <#200 sieve	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50		ML		INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY
						CL		INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
OL		ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY						
SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50		MH			INORGANIC SILTS , MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS			
		CH			INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS			
		OH			ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS			
HIGHLY ORGANIC SOILS				Pt		PEAT AND OTHER HIGHLY ORGANIC SOILS		

Notes:

Dual symbols are used to indicate borderline soil classifications. Blow counts represent the number of blows a 140-pound hammer falling 30 inches required to drive a sampler through the last 12 inches of an 18 inch penetration, unless otherwise noted. The lines separating strata on the logs represent approximate boundaries only. The actual transition may be gradual. No warranty is provided as to the continuity of soil strata between borings. Logs represent the soil section observed at the boring location on the date of drilling only.

	Modified California	RV	R-Value
	Standard Penetration Test (SPT)	SA	Sieve Analysis
	Split spoon	SW	Swell Test
	Pushed Shelby Tube	TC	Cyclic Triaxial
	Auger-Cuttings	TX	Unconsolidated Undrained Triaxial
	Grab Sample	TV	Torvane Shear
	Sample Attempt with No Recovery	UC	Unconfined Compression
CA	Chemical Analysis	(1.2)	(Shear Strength, ksf)
CN	Consolidation	WA	Wash Analysis
CP	Compaction	(20)	(with % Passing No. 200 Sieve)
DS	Direct Shear		Water Level at Time of Drilling
PM	Permeability		Water Level after Drilling (with date measured)
PP	Pocket Penetrometer		

SOIL CLASSIFICATION CHART AND KEY TO TEST DATA
Unified Soil Classification System

PLATE:



BSK & Associates
567 W Shaw ave
Fresno Ca 93704
Telephone: 559-497-2880
Fax: 559-497-2886

Project: VA Mental Health Building

Location: 2615 E. Clinton Ave., Fresno, CA 93703

Project No.: G11-143-11F

Logged By: K. Frank

Checked By: A. Love

Page 1 of 1

Boring: B-1

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Pocket Penetrometer (TSF)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
1			23						Silty SAND (SM) Light brown, fine to medium grained, moist, medium dense	
2										
3										
4										
5			10	108	3.9				...brown, fine to medium grained, moist, loose	
6										
7										
8			5							
9										
10			45	123	11.6				...increase in silt fines, trace of clay, dense	
11										
12										
13										
14										
15			26	117	4.5				SAND/Silty SAND (SP/SM) Red brown, fine to coarse grained, moist, medium dense	
16										
17										
18										
19										
20			23						SAND (SP) Light brown, fine to coarse grained, moist, medium dense	
21										
22										
23										
24										
25			20						...medium to coarse grained	
26									Boring completed at 25.5-feet bgs	
27									Groundwater not encountered	
28									Backfilled with soil cuttings	
29										
30										
31										
32										
33										
34										
35										

Drilling Contractor: Technicon Engineering Services
Drilling Method: CME 45
Drilling Equipment: Automatic Hammer w/HSA
Date Started: 12/15/11
Date Completed: 12/15/11

Surface Elevation:
Groundwater Depth: Not Encountered
Completion Depth: 25.5 Feet
Sample Method: 2.4-inch ID CA Mod & 1.5-inch ID SPT Split Spoon
Borehole Diameter: 6 inches

* See key sheet for symbols and abbreviations used above.

GEO G11-143-11F BORING LOGS GPJ GEOTECHNICAL 08.GDT 1/4/12

Boring: B-2

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Pocket Penetrometer (TSF)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
1			4						Silty SAND (SM) Brown, fine to medium grained, moist, loose, trace organics (roots and fertilizer)	Landscape strip near side walk along Clinton Avenue
2										
3										
4										
5										
6			50/6"						...orange brown, very dense, weak cementation, no visible organics	
7										
8										
9										
10										
11			29	123	5.1				...no cementation, fine to coarse grained, dense	
12										
13										
14										
15			50/6"	108	19.8				Sandy SILT (ML) Olive brown, fine grained sand, trace of pinhole voids, moist, hard	
16										
17										
18										
19										
20			50/6"						...decrease in pinhole voids, increase in fine grained sand	
21										
22										
23										
24										
25			51						Silty SAND (SM) Olive brown, fine grained, red-brown pinhole voids, moist, very dense	
26									Boring completed at 25.5-feet bgs	
27									Groundwater not encountered	
28									Backfilled with soil cuttings	
29										
30										
31										
32										
33										
34										
35										

Drilling Contractor: Technicon Engineering Services
Drilling Method: CME 45
Drilling Equipment: Automatic Hammer w/HSA
Date Started: 12/15/11
Date Completed: 12/15/11

Surface Elevation:
Groundwater Depth: Not Encountered
Completion Depth: 25.5 Feet
Sample Method: 2.4-inch ID CA Mod & 1.5-inch ID SPT Split Spoon
Borehole Diameter: 6 inches

* See key sheet for symbols and abbreviations used above.



BSK & Associates
567 W Shaw ave
Fresno Ca 93704
Telephone: 559-497-2880
Fax: 559-497-2886

Project: VA Mental Health Building

Location: 2615 E. Clinton Ave., Fresno, CA 93703

Project No.: G11-143-11F

Logged By: K. Frank

Checked By: A. Love

Page 1 of 1

Boring: B-2A

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Pocket Penetrometer (TSF)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
1									Silty SAND (SM) Red brown, fine to medium grained, moist	
2										
3										
4										
5										
6										
7										
8										
9										
10										
11								Boring completed at 10.0-feet bgs Groundwater not encountered Backfilled with soil cuttings		
12										
13										
14										
15										
16										
17										
18										
19										
20										
21										
22										
23										
24										
25										
26										
27										
28										
29										
30										
31										
32										
33										
34										
35										

Drilling Contractor: Technicon Engineering Services
Drilling Method: CME 45
Drilling Equipment: Automatic Hammer w/HSA
Date Started: 12/14/11
Date Completed: 12/14/11

Surface Elevation:
Groundwater Depth: Not Encountered
Completion Depth: 10 Feet
Sample Method: 2.4-inch ID CA Mod & 1.5-inch ID SPT Split Spoon
Borehole Diameter: 6 inches

* See key sheet for symbols and abbreviations used above.

GEO. G11.143.11F BORING LOGS.GPJ GEOTECHNICAL 08.GDT 1/5/12



BSK & Associates
567 W Shaw ave
Fresno Ca 93704
Telephone: 559-497-2880
Fax: 559-497-2886

Project: VA Mental Health Building

Location: 2615 E. Clinton Ave., Fresno, CA 93703

Project No.: G11-143-11F

Logged By: K. Frank

Checked By: A. Love

Boring: B-3

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Pocket Penetrometer (TSF)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
1			27	101	1.8				Silty SAND (SM) Brown, fine to medium grained, moist, medium dense	
2										
3										
4			28	124	3.0				...red brown, fine to coarse grained	
5										
6										
7										
8										
9										
10			47	121	3.1				SAND (SP) Red brown, fine to medium grained, trace of coarse grains, moist, dense	
11										
12										
13										
14			28						...medium dense	
15										
16										
17										
18										
19			16						...light brown, decrease in silt fines	
20										
21										
22										
23										
24			24							
25										
26									Boring completed at 25.5-feet bgs	
27									Groundwater not encountered	
28									Backfilled with soil cuttings	
29										
30										
31										
32										
33										
34										
35										

Drilling Contractor: Technicon Engineering Services
Drilling Method: CME 45
Drilling Equipment: Automatic Hammer w/HSA
Date Started: 12/15/11
Date Completed: 12/15/11

Surface Elevation:
Groundwater Depth: Not Encountered
Completion Depth: 25.5 Feet
Sample Method: 2.4-inch ID CA Mod & 1.5-inch ID SPT Split Spoon
Borehole Diameter: 6 inches

* See key sheet for symbols and abbreviations used above.



BSK & Associates
567 W Shaw ave
Fresno Ca 93704
Telephone: 559-497-2880
Fax: 559-497-2886

Project: VA Mental Health Building

Location: 2615 E. Clinton Ave., Fresno, CA 93703

Project No.: G11-143-11F

Logged By: K. Frank

Checked By: A. Love

Page 1 of 1

Boring: B-4

Depth (Feet)	Samples	Bulk Samples	Penetration Blows / Foot	In-Situ Dry Density (pcf)	In-Situ Moisture Content (%)	% Passing No. 200 Sieve	Pocket Penetrometer (TSF)	Graphic Log	MATERIAL DESCRIPTION	REMARKS
1			8	121	2.5				Silty SAND (SM) Red brown, fine to coarse grained, moist, loose at surface	Landscape area West of Bldg. 12
2										
3										
4										
5			32	117	2.2				...medium dense	
6										
7										
8										
9										
10			22	119	2.1				...red brown and black medium to coarse grained, decreasing silt fines	
11										
12										
13										
14										
15			26	108	2.8				SAND (SP) Red brown, fine to coarse grained, moist, medium dense	
16										
17										
18										
19			21						...light brown, decrease in silt fines	
20										
21										
22										
23										
24			70							
25									Silty SAND (SM) Olive brown, fine grained, moist, very dense	
26									Boring completed at 25.5-feet bgs	
27									Groundwater not encountered	
28									Backfilled with soil cuttings	
29										
30										
31										
32										
33										
34										
35										

Drilling Contractor: Technicon Engineering Services
Drilling Method: CME 45
Drilling Equipment: Automatic Hammer w/HSA
Date Started: 12/15/11
Date Completed: 12/15/11

Surface Elevation:
Groundwater Depth: Not Encountered
Completion Depth: 25.5 Feet
Sample Method: 2.4-inch ID CA Mod & 1.5-inch ID SPT Split Spoon
Borehole Diameter: 6 inches

* See key sheet for symbols and abbreviations used above.

GEO G11 143.11F BORING LOGS.GPJ GEOTECHNICAL 08.GDT 1/5/12

APPENDIX B

Laboratory Testing

APPENDIX B

Laboratory Testing

The results of laboratory testing performed in conjunction with this project are contained in this Appendix. The following laboratory tests were performed on representative samples in accordance with the latest applicable standards.

In-Situ Moisture and Density

The field moisture content and in-place dry density determinations were performed on relatively undisturbed samples obtained from the test borings. The field moisture content, as a percentage of dry weight of the soils, was determined by weighing the samples before and after oven drying in accordance with ASTM D2216 test procedures. Dry densities, in pounds per cubic foot, were also determined for undisturbed core samples in accordance with ASTM D 2937 test procedures. Test results are presented on the boring logs in Appendix A.

Consolidation Test

One consolidation test was performed on relatively undisturbed soil sample to evaluate compressibility characteristics. The test was performed in general accordance with ASTM D 2435. The sample was initially loaded under as-received moisture content, saturated, and incrementally loaded up to a maximum load of 16 ksf. The test results are presented on Figure B-1.

Direct Shear Test

Direct shear tests were performed on test specimens trimmed from a relatively undisturbed soil sample. The three-point shear test was performed in general accordance with ASTM Test Method D 3080. The test specimens, 2.42 inches in diameter and 1 inch in height, were subjected to shear along a plane at mid-height after allowing for pore pressure dissipation. The results of this test are presented on Figure B-2.

Soil Corrosivity Tests

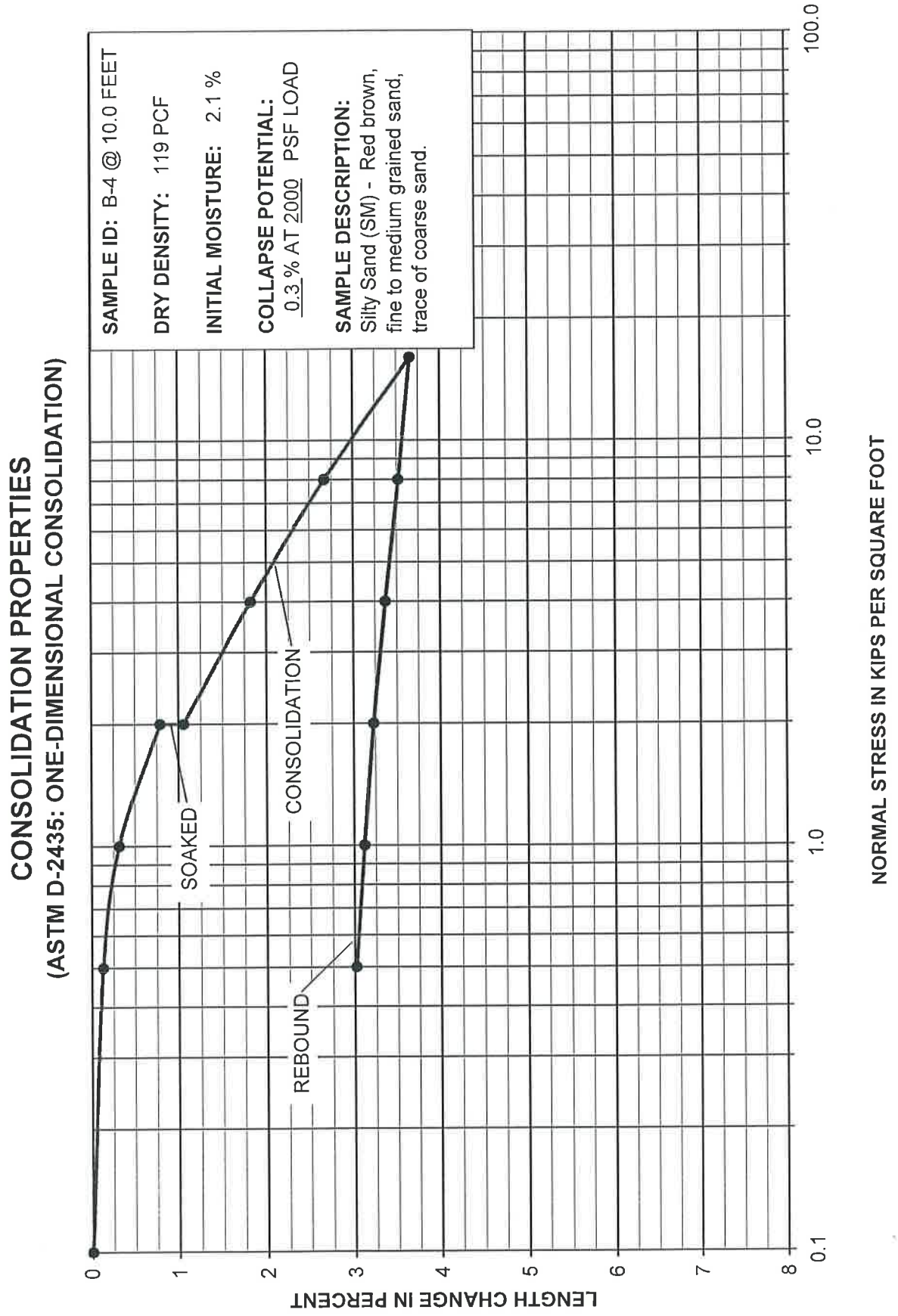
One soil sample was tested to evaluate the corrosion potential of the on-site soils. The test methods included: California Test Method 643 (for minimum resistivity) and EPA Test Methods 300.0 (for soluble sulfate and chlorides) and 9045C (for pH). The test results are summarized in the following table.

Location	Composite B-1 and B-3 at 1-5 feet
pH	7.7
Minimum Resistivity, ohm-cm	9,000
Sulfate, mg/Kg	12
Chloride, mg/Kg	8.8

BSK ASSOCIATES

JOB NUMBER: G11-146-11F
PROJECT: VMAC Mental Health Building, Fresno, CA

FIGURE B-1
Sample Date: 12/15/2011
Test Date: 12/27/2011

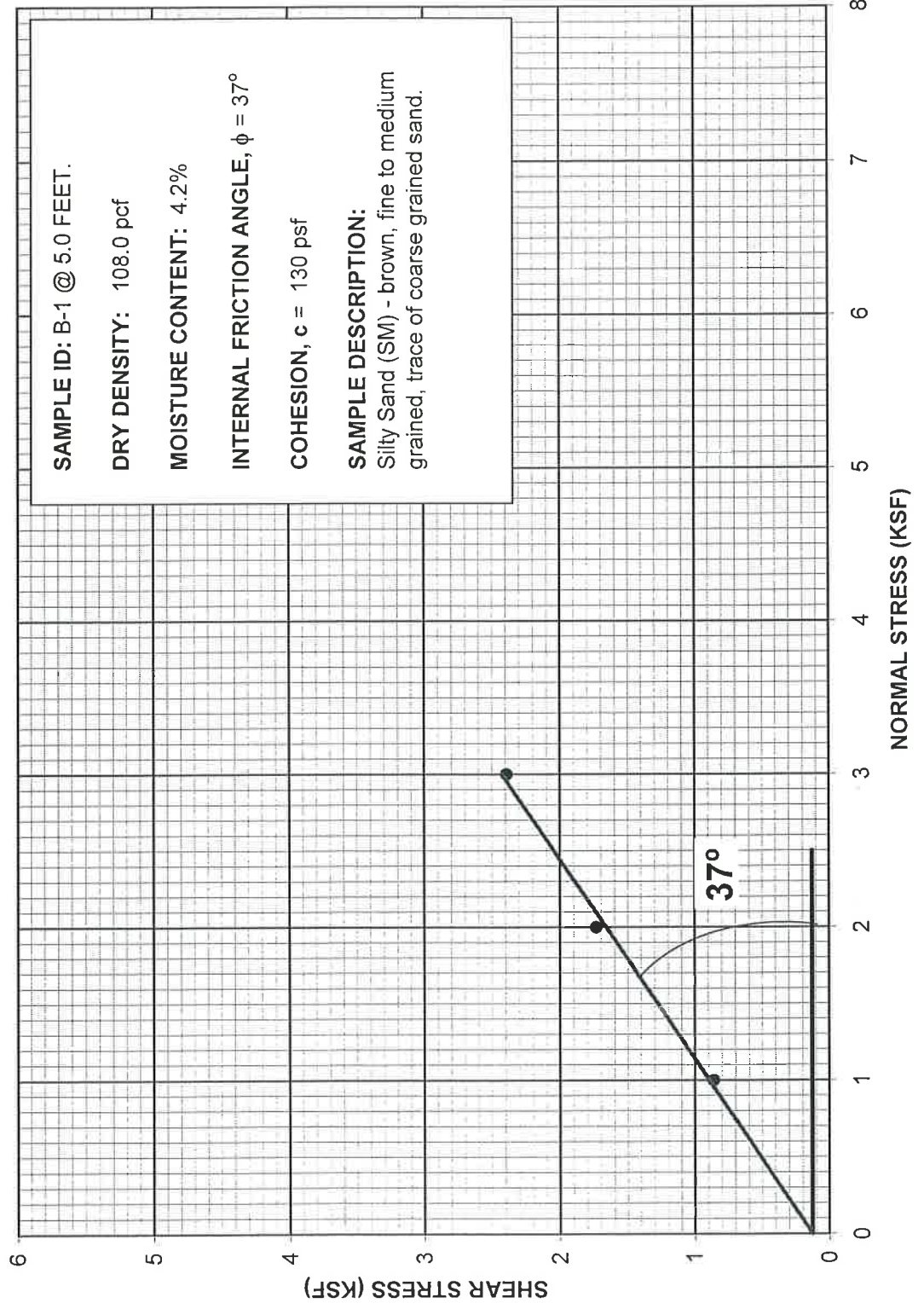


BSK ASSOCIATES

JOB NUMBER: G11-143-11F
PROJECT: VAMC Mental Health Building

FIGURE B-1
SAMPLE DATE: 12/15/2011
TEST DATE: 12/27/2011

SHEAR STRENGTH DIAGRAM (ASTM D-3080: DIRECT SHEAR TEST)





MINIMUM RESISTIVITY OF SOILS

1415 Tuolumne St.
Fresno, CA 93706
Ph: (559) 497-2868
Fax: (559) 485-6140

Caltrans Test Method 643

Project Name: VAMC Mental Health Report Date: 12/22/2011
Project Number: G11-143-11F Sample Date: 12/15/2011
Lab Tracking ID: F11-725 Test Date: 12/19/2011
Sample Location: B1@1-5'
Sample Description: Silty Sand, Olive Grey, Fine Grain
Sampled By: K.Frank Tested By: J.Frank

Soil temperature at minimum resistance = 23.5 °C

Total Moisture Added (ml)	Resistance Measured (ohms)	Resistivity (ohm-cm)
32	8,300	9960
36	8,200	9840
40	7,500	9000
44	7,800	9360
Minimum Resistivity at 15.5°C, Ohm-cm		9000

Remarks:

Reviewed by: 



Certificate of Analysis

Lloyd Suehiro
BSK Associates - Fresno
567 W Shaw, Suite B
Fresno, CA 93704

Report Issue Date: 12/23/2011 10:59
Received Date: 12/19/2011
Received Time: 12:15

Lab Sample ID: A1L1300-01
Sample Date: 12/15/2011 00:00
Sample Type: Other

Client Project: G11-143-11F - VAMC - Mental Health Clinic
Sampled by: Kenneth Frank
Matrix: Solid

Sample Description: B1@1-5' B3@ 1-5' Composite

General Chemistry

Analyte	Method	Result	RL	Units	RL Mult	Batch	Prepared	Analyzed	Qual
*Chloride, Cal Trans Extract	California Test 422	8.6	3.0	mg/kg	1	A114910	12/22/11	12/22/11	
*pH, Cal Trans Extract	California Test 643	7.7		pH Units	1	A114934	12/22/11	12/22/11	
*pH Temperature in °C		19.9							
*Sulfate as SO ₄ , Cal Trans Extract	California Test 417	12	6.0	mg/kg	1	A114910	12/22/11	12/22/11	