Geotechnical Study

Consolidate/Expand Medical Procedures (CEMP)
VA Mather Healthcare Services

Mather, Sacramento County, California

January 2, 2014
#2012-065G

Rutherford + Chekene
55 Second Street, Suite 600
San Francisco, CA 94105

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R+C RUTHERFORD + CHEKENE

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Mr. Donald Luu
MEI Architects
239 9th Street, Suite 201
San Francisco, CA 94103

2012-065G

Subject: **GEOTECHNICAL STUDY**
CONSOLIDATE/EXPAND MEDICAL SERVICES (CEMP)
VA MATHER HEALTHCARE SERVICES
MATHER, SACRAMENTO COUNTY, CALIFORNIA

Dear Mr. Luu:

We are pleased to transmit herewith our report covering the subject geotechnical study. We are also sending you an electronic copy of the report via e-mail.

This report summarizes the findings of the study, which was performed by our office.

If there are questions regarding any aspects of this investigation, please contact us. We greatly appreciate the opportunity to be of service to you on this project.

Sincerely,

RUTHERFORD + CHEKENE

Laurel Jiang, G.E.
Senior Associate

Gyimah Kasali, Ph.D., G.E.
Executive Principal

cc: Patrick Ryan, R+C

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

SECTION 1
SITE AND PROJECT INFORMATION

INTRODUCTION

General

This report summarizes the findings and recommendations from our geotechnical study for the Consolidate/Expanded Medical Procedures (CEMP) building, which is part of the Consolidate Outpatient Surgical Specialties (COSS) project. The building when completed will be part of VA Mather Healthcare Services complex in Mather, California. Our study has addressed the particular geologic hazards and geotechnical issues pertaining to the site.

Purpose

The purpose of this study was to 1) evaluate the potential geologic hazards at the site, and 2) develop conclusions regarding geologic hazards as well as the recommendations for mitigating the identified major hazards, and 3) develop detailed recommendations and criteria needed for design.

Site Descriptions

The project site is located in the existing parking lot. The site location is shown in Figure 1, Site Vicinity Map, Figure 2, Site Location Map, and Figure 3, Site and Boring Location Plan. The site has the following coordinates: 38.572065 North and 121.297587 West.

Description of Proposed Project

The proposed project involves the construction of a new approximately 16,000 square foot, two-story building with a finished floor elevation of 92.12 feet.

The proposed structure will house the VA's digestive diseases unit. The ground floor is primarily for patient services and includes the main lobby, pre-operation and recovery, and seven procedure rooms as well as the necessary support spaces. The second floor consists of a patient education classroom, six exam rooms, one procedure room, and staff offices. The staff lounge, located on the second floor with the staff offices, opens out to an employee-only roof deck.

Site Elevations

We based the site elevations in this report on an undated topographic survey, provided by the VA. We noted that the datum on which the elevations in the survey are based is unknown at the time of our report preparation.

Previous Geotechnical Investigations

In preparing this report, we have referenced exploratory boring logs from the previous geotechnical investigation for the Consolidate Outpatient Surgical Specialty (COSS) Clinic, which is to the immediate north of the CEMP site. The COSS Clinic investigation was performed by Sanders & Associates Geostructural Engineering (SAGE) in 2012.

We used the boring log data referenced above to adequately characterize the subsurface conditions on the site.

Limitations

This study addresses the geological and geotechnical issues deemed relevant to the CEMP project only as described above. General conclusions and recommendations presented herein are valid only when applied to the projects as described above. No attempt should be made to extend or extrapolate these conclusions and recommendations to other areas or designs without review and written authorization by this office. Anyone relying on this report for other projects or designs, without appropriate review by our office, does so at his/her own risk. The following limitations also apply to the project:

1. This report has been prepared for the exclusive use of the VA and its consultants for specific application to the CEMP project as described herein. In the event that there are any changes in ownership, nature, or design of the project, the conclusions and recommendations contained in this report shall not be considered valid unless 1) the project changes are reviewed by Rutherford + Chekene and 2) the conclusions and recommendations presented in this report are modified or verified in writing.

2. The discussions, conclusions, and recommendations contained in this report are based in part upon the data obtained from previous exploratory borings performed as part of the previous geotechnical study for the adjacent COSS Clinic project. The nature and extent of variations between the borings may not become evident until construction. If variations are discovered, it will be necessary to re-evaluate the recommendations of this report.

3. This report should not be part of the contract documents for the proposed project described herein. Instead, it should be used as a guide to prepare specifications that are part of the contract documents. This report is provided for informational purposes only.

4. We cannot be responsible for the impacts of any changes in geotechnical or geologic standards, practices, or regulations subsequent to the performance of our services if we are not consulted subsequent to the changes.

5. We can neither vouch for the accuracy of information supplied by others, nor accept the consequences for someone using segregated portions of this report without prior consultation with our office.

6. The opinions set forth in this report are not based upon an examination of the location or condition of utility lines or other subsurface structures on the property. Those

performing the construction must assume any risks arising from the location or condition of such lines.

The limitations with respect to hazardous materials are:

1. Rutherford + Chekene assumes no responsibility for the management of contaminated or hazardous materials that may be found on the site.

2. Rutherford + Chekene has not performed a Phase 2 investigation to determine the presence of contaminated or hazardous materials on the project site. The Owner must provide the results of such investigation, if it has been performed.

3. The Construction Contractor is responsible for ensuring that personnel within the work area are protected from hazardous materials. If hazardous materials are discovered, the Contractor must immediately notify the Owner and cease work until conditions can be maintained in accordance with all applicable regulations.

Review of Design Documents

We should be provided the opportunity to perform a general review of the final design drawings and specifications, prepared by members of the design team. We will review the document for their conformance to and proper application of our geotechnical recommendations. Our review will be brief in nature, limited to the earthwork and foundation aspects of the project, and will not involve any calculations or checking of plan completeness. If we are not given the opportunity to make this recommended review, we can assume no responsibility for misinterpretation of our recommendations.

Organization of Report

This report has been organized into two parts as follows:

Section 1 – Site and Project Information

Section 2 – Site Conditions and Geologic Hazard Evaluation

Section 3 – Mitigation of Identified Site Hazards

Section 4 – Design Recommendations

Section 5 – Construction Observation

Section 6 – References and Appendices

SECTION 2
SITE CONDITIONS AND GEOLOGIC HAZARD EVALUATION

SUBSURFACE CONDITIONS

Regional and Local Geologic Setting

This site is within the Great Valley geomorphic province of Northern California. This province is characterized by thick, flat-lying continental and marine deposits.

Sediments beneath the site are mapped as Middle Pleistocene Riverbank formation. The Riverbank formation unconformably overlies Pliocene-Pleistocene Turlock formation. The Riverbank formation includes alluvium consisting of minor clay, silt, and sand with occasional lenses of sand and gravel. The Turlock formation includes somewhat coarser-grained alluvium consisting of sand, silt, and gravel with occasional lenses of floodplain clay.

Soil Conditions

Based on the earth materials encountered in the borings from the COSS Clinic site, the earth materials, which were encountered (to the maximum depth of exploration of about 15.7 feet), are alluvial deposits. The earth materials encountered, from highest to lowest elevation, are as follows:

1. *Red Brown/Dark Brown, Stiff to Very Stiff Sandy Clay.* This layer was encountered in all the four borings at the COSS Clinic site and was found to be about 3 to 4 feet thick. SAGE classified this top layer as top soil at boring locations B1 and B2.

2. *Red Brown, Very Stiff to Hard Sandy Clay/ dense to Very Dense Clayey Sand.* This layer was encountered in the middle part of the COSS site and was found to be about 4 to 6 feet thick. Boring B4 was terminated in this layer, hence, the thickness of this layer at B4 is not known.

3. *Tan Brown, Very Dense, Clayey Gravel with Sand*. This layer was encountered in the three deepest borings at the site. Since this layer was encountered at the bottom of the deepest borings, its thickness is not known.

The consistency of the clay-rich layers typically ranged from stiff to hard, while that of the sandy/gravelly layers typically ranged from medium to very dense. In general, sampler blow counts indicated that the sand/gravel layers become denser with depth. Note that these stratigraphic descriptions are necessarily general. Within each described strata, substantial variation in clay, silt, sand and gravel content is expected across the site.

Groundwater Conditions

According to SAGE's report, groundwater was not encountered during the field exploration at the COSS Clinic site. Compilation of ground water data from nearby wells by California

Department of Water Resources (DWR) indicates that the groundwater table in the vicinity of the VA is located at an approximate elevation of 10 feet MSL.

Based on the preceding discussion, we recommend that the design groundwater depth should be considered to be 10 feet MSL.

SEISMIC AND GEOLOGIC HAZARDS

General

We have considered a number of potential geologic hazards that could affect the site. The potential for occurrence of each identified hazard is rated qualitatively on a scale of increasing probability: negligible, low, moderate, high.

Table 1 shows a summary of the results of the geologic hazards evaluation, which is discussed below.

Table 1
Summary of Potential Geologic Hazards

Possible Geologic Hazard	Potential for Occurrence at the Site
Strong Ground Shaking:	High
Seismically Induced Ground Displacement or Failure:	
Liquefaction	Low
Lateral Spreading Impacts	Low
Compaction Settlement Impacts	Low
Slope Instability	Low
Fault Rupture	Low
Non Seismic Ground Displacement or Failure:	
Landslide	Low
Subsidence due to Subsurface Fluid Extraction	Low
Expansive Soil Effects	Low
Soil Collapse	Low
Flooding Inundation:	
Storm-induced Flooding	Low
Flooding Induced by Reservoir Failure	Low
Tsunamis and Seiches	
Tsunami-induced Inundation	Negligible
Seiche-induced Inundation	Low
Erosion	Low
Soil Corrosivity	Low to Moderate
Other Potential Hazards	
Naturally Occurring Asbestos	Negligible
Compressible Soil Hazard	Low
Volcanic Hazards	Negligible

Strong Ground Shaking

The site has and will experience ground shaking during a major earthquake on one of the active faults in Northern California. We estimate that the site may experience low to moderate ground shaking, based on the Safety Element of the Sacramento General Plan. The intensity of the earthquake ground motion at the site will depend on the characteristics of the generating fault, the distance to the earthquake epicenter, the magnitude and duration of the earthquake, and specific site geologic conditions.

Based on the preceding, we judge the potential for strong ground shaking on the site to be high.

Seismically Induced Ground Displacement or Failure

Strong ground shaking caused by large earthquakes can induce ground failure such as liquefaction, compaction settlement, and slope movement. A site's susceptibility to these hazards relates to the site topography, soil conditions, and/or depth to groundwater.

Liquefaction is a phenomenon whereby sediments temporarily lose their shear strength and collapse. This is caused by earthquake-induced cyclic loading that leads to the generation of high pore water pressures within the sediments. The requisite conditions for liquefaction to occur are: 1) the presence of loose, cohesionless, granular soil, 2) the existence of a high groundwater table, and 3) moderate to high potential for strong ground shaking. Liquefaction can result in loss of foundation support, failures due to lateral spreading, and differential settlement of affected soils.

Based on mapping of the site soils (as shown in the Safety Element of the Sacramento General Plan), the depth to groundwater, the density of the granular materials, and the fines contents of these soils, we judge the potential hazard for liquefaction to be low.

Lateral spreading occurs when a layer liquefies at depth and causes horizontal movement or displacement of the overburden mass toward a free face such as a stream bank or excavation, or toward an open body of water. There is no free face or open body of water on the site that could increase the potential for lateral spreading. Based on the absence of a free face and a low potential for liquefaction, we judge that the potential for lateral spreading is low.

Compaction settlement, or seismic densification, occurs when loose granular soils above the water table increase in density due to earthquake shaking. The soil densification can result in differential settlement because of variations in soil composition, thickness and initial density. Because the subsurface soils at the referenced boring locations are primarily sandy clay and medium dense to very dense clayey sand, compaction settlement is likely to be low. We therefore judge the potential for compaction settlement impacts on the proposed project to be low.

The overall ground surface slope at the site and surrounding areas is nearly level, we therefore judge the potential for seismic-induced slope instability on the site to be low.

Fault Rupture

The State of California adopted the Alquist-Priolo Special Studies Zone Act of 1972, which regulates development near active faults for the purpose of mitigating the hazard of surface fault rupture to structures for human occupancy. Faults are considered to be “active” if they display evidence of movement within Holocene time (the last 11,000 years), and “potentially active” if they display evidence of movement within Quaternary time (i.e., within the last 1.6 million years). In accordance with the policies promulgated by the Alquist-Priolo Act, the California Division of Mines and Geology (CDMG), now known as California Geological Survey, CGS, established Special Studies Zones along faults or segments of faults that are judged to be "sufficiently active and well-defined as to constitute a potential hazard to structures from surface faulting or fault creep". Movement along an active fault that intersects the ground surface can result in permanent ground displacements, which may severely damage structures. The most common method of mitigating the hazard of surface fault rupture is to avoid active fault traces. Construction of structures for human occupancy in the Special Studies Zones is therefore not permitted until a site-specific evaluation of surface fault rupture and fault creep has been performed and the findings indicate that a specific site does not lie on or across an active fault trace.

The project site is not located within a State or County fault zone, and no known active or potentially faults traverse the proposed project footprint. Based on the preceding, we judge the potential for surface rupture at the project site to be low.

Non-seismic Ground Failure

Potential geologic hazards in the site vicinity associated with ground failure that are not caused by earthquakes include landslides, subsidence, and expansive and collapsible soil. The flat ground surface gradient in the site vicinity and lack of steep cuts or fills on the site indicates the site is generally not susceptible to slope instability. Subsidence typically occurs as a result of subsurface fluid extraction (e.g., groundwater, petroleum) or compression of soft, geologically youthful sediments. Subsidence from petroleum withdrawal is implausible given that no oil or gas resources are known to exist in the vicinity of the site.

Expansive soil is clayey soil that will shrink or swell significantly with changes in moisture content, often causing damage to structures. The liquid limit and plasticity index values gathered by SAGE during their geotechnical investigation of the COSS Clinic site suggest that the surficial site soils have a low to medium shrink/swell capacity. We therefore judge the potential for expansive soil effects to be low.

Soil collapse is the densification of sediments resulting from significant increases in their moisture content, typically resulting from water sources such as poor drainage, irrigation, or leaking pipes. This phenomenon is more prevalent in semi-arid and arid climates. Soils beneath the site are judged to have a low susceptibility to collapse because of their relatively dense or stiff condition.

Based on the preceding discussion, we judge the potential for non seismic ground failure on the site to be low.

Flood Inundation

Based on FEMA maps and on the Safety Element of the Sacramento General Plan, flood hazards at the site are judged to be low.

Tsunamis and Seiches

Tsunamis are transient long-period sea waves generated by submarine earthquakes or volcanic eruptions that rapidly displace large volumes of water. Based on the site's distance from the ocean, tsunami hazards at the site are judged to be negligible.

Seiches are large waves within enclosed bodies of water such as lakes or reservoirs and result from violent earthquake shaking. No enclosed water bodies are located near the site; however, the site can potentially experience flooding if a seiche overtops any one of a number of dams east of Sacramento. Even so, the Safety Element of the Sacramento General Plan concluded that the potential for flooding as a result of a seiche is low.

Erosion

The site is presently covered by existing structures, parking areas, and landscaping. Assuming these areas remain covered with hardscape or landscape, we judge the potential for substantial erosion at the site to be low.

Soil Corrosivity

The results of previous corrosivity test performed on sample taken from a depth of one to four feet at borehole B2 indicated that the corrosion potential of sulfate to cement was low. However, information on the general corrosion potential of the site soils on utility lines were not available. Based on the lack of available information and the fact that the upper site soils consisted of fine-grained materials, we judge the potential for soil corrosivity to be low to moderate.

Conclusions

Based on the results of the geologic hazard evaluation, we developed the following conclusions regarding the potential impacts of the two identified primary hazards (strong ground shaking and corrosivity) on the proposed project:

Ground Shaking: Strong ground shaking should be expected at the site during a major earthquake in keeping with the seismicity of the area. Ground shaking will induce lateral forces in new structures.

Soil Corrosivity: The site soils have a low to moderate potential to be corrosive. Soil corrosivity can lead to the corrosion of buried iron, steel, cast iron, ductile iron, galvanized steel, and dielectric coated steel or iron.

SECTION 3
MITIGATION OF IDENTIFIED SITE HAZARDS

MITIGATION OF IDENTIFIED HAZARDS

General

In the following subsections we discuss mitigation options for the two groups of geologic hazards that were identified as having moderate to high likelihood of occurrence – ground shaking and soil corrosivity.

Ground Shaking

General: The primary approach to mitigating the potential impacts of ground shaking on the proposed building is to design the building in accordance with the current seismic design code. We have therefore developed recommendations for seismic design parameters per the 2009 International Building Code (IBC) and VA's seismic design requirements. The seismic design parameters are presented in the section titled "Design Recommendations" in Section 4.

Soil Corrosivity

We recommend that all buried iron, steel, cast iron, ductile iron, galvanized steel, and dielectric coated steel or iron should be protected against corrosion depending on the critical nature of the utility line. All underground metallic pressure piping such as ductile iron firewater pipelines should also be protected against corrosion.

We recommend that provisions be made in the contract documents to ensure that adequate cover is provided for reinforcement in both shallow and deep foundations in accordance with ACI requirements.

Detailed Recommendations

Detailed recommendations regarding foundation, earthwork, and other pertinent geotechnical issues will be presented in Section 4 Design Recommendations.

SECTION 4
DESIGN RECOMMENDATIONS

DESIGN RECOMMENDATIONS

Seismic Design Requirements

General: The primary approach to mitigating the potential impacts of ground shaking on the proposed building is to design the building in accordance with the current seismic design code. We have therefore developed recommendations for seismic design parameters per the 2009 International Building Code (IBC).

Site Coordinates: As previously noted, the project site has the following coordinates: 37.434311 degrees North and 122.174284 degrees West.

Site Class: Based on the subsurface information that we have gathered, we conclude that the site class is D.

Seismic Design Parameters: Seismic design parameters are typically established using mapped spectral acceleration values from USGS. We are required, however to use the seismic design criteria contained in the Department of Veterans Affairs Seismic Design Requirements document, H18-8, dated February 2011. The seismic design parameters are presented in Table 2.

Table 2
Seismic Design Parameters

Site Class	**D**	
Mapped Spectral Response Acceleration Parameters	S_S (From 0.2 sec Mapped Spectral Accelerations)	0.464
	S_1 (From 1.0 sec. Mapped Spectral Accelerations)	0.214
Site Coefficients	F_a (From Table 11.4-1 of ASCE/SEI 7-05)	1.43
	F_v (From Table 11.4-2 of ASCE/SEI 7-05)	1.97
Adjusted MCE Spectral Acceleration Parameters	$S_{MS} = F_a S_S$	0.664
	$S_{M1} = F_v S_1$	0.422
Design Spectral Acceleration Parameters	$S_{DS} = 2/3 S_{MS}$	0.442
	$S_{D1} = 2/3 S_{D1}$	0.281

Foundation Conditions

Based on the topographic survey provided by the VA, which shows the site elevation to be about 92 feet, we anticipate that the proposed building will be supported on shallow foundations bearing in the upper layer of medium stiff to stiff sandy clay.

Recommendations Relating to Foundations

Bearing Pressures: The new structure can be supported on a shallow foundation that is designed using the allowable bearing pressures in Table 3.

Table 3
Recommended Bearing Pressures

Loading Conditions	Bearing Pressure (ksf)
Dead + Live Loads	3.0
Dead + Live + Seismic Loads	4.0
Ultimate Load	6.0

Footings designed in accordance with the allowable bearing pressures in Table 3 should have a minimum width of 24 inches, and the bottoms of the footings should be embedded at least 24 inches below the lowest adjacent rough grade.

Lateral Loads: Lateral loads applied to a footing may be resisted by 1) friction at the base of the footing and 2) passive pressure against the side of the footing or mat foundation that is perpendicular to the applied force. These components of resistance may be assumed to act together at the limit state, and so may be added to estimate the total resistance available.

1. Friction at the Base of Footing

   The horizontal frictional resistance, F_{base}, at the interface of the soil and a footing may be taken as:

   $$F_{base} = f_s \text{ x Actual Dead Load Pressure (psf)}$$

   where, f_s is the friction coefficient at the interface of the soil and the footing. f_s should be assumed to be 0.4.

2. Passive Pressure Against the Side of the Footing

   For design purposes, a passive pressure perpendicular to the side of the footing can be taken as zero pressure (beginning at the lowest adjacent grade) and increasing as an equivalent fluid pressure of 2000 pounds per cubic foot. The top one foot of passive pressure should be disregarded where the footing or mat foundation is not confined by a slab. To obtain the ultimate passive soil pressure, the allowable value should be multiplied by 1.5.

Settlement: Total and differential settlements induced by the dead load pressures under the new footing are expected to be about a quarter of an inch.

Footing Construction: To assure that the passive and frictional resistances are developed from all footings and grade beams, they should be cast directly against native soil.

The following measures are recommended to minimize potential detrimental impacts of footing excavations on foundation performance:

1. Footing excavations should not be left open for a long time period, especially during the rainy season, and water should not be introduced into the excavations. The intent of this recommendation is to avoid the softening of the bearing soil by water, as well as the introduction of soft materials into the bottoms of excavations by erosion. If necessary, the excavations should be covered to minimize ponding or infiltration of rainwater.

2. If footing construction occurs between the beginning of October and the end of April, a two-inch thick lean concrete layer should be placed at the bottom of the footing excavations after suitable bearing conditions have been established. This lean concrete layer would ensure that the bearing conditions are maintained, provide a firm bearing surface for the footing reinforcement cage, and ensure adequate concrete cover on the bottom reinforcing bars. Also, any loose materials that accumulate in the excavation can be easily removed using air-blowing techniques. This approach can also be adopted by the Contractor if he chooses, even if foundation construction occurs outside of the given time period.

We should be given the opportunity to observe the bearing conditions prior to the placement of reinforcement and immediately before concrete placement. Remedial work should be performed, if necessary, until the bearing conditions are deemed to be satisfactory by our field representative. Remedial work is likely to involve the removal of loose materials and compaction of the exposed foundation subgrade.

Slabs-on-Grade

General: We anticipate that the floor slab for the proposed building will consist of a slab-on-grade. The slab-on-grade will bear on engineered fill.

We assume that the building floor will not be subjected to forklift or other traffic loads. Under that assumption, it is estimated that the slab would be exerting a surcharge pressure of 100 – 150 pounds per square foot on the subgrade.

Building Floor Slabs: We understand that the design requirements of the new floor slabs are to 1) support live loads due to equipment and building occupants, estimated to be 100 to 150 psf, 2) prevent dampness and efflorescence in the floor, and 3) provide a nominal drainage blanket to give minimal protection against artificial intrusion of water (i.e., a leaking pipe). To fulfill the above objectives, we recommend that the slab-on-grade section consist of the following components:

1. Reinforced concrete slab of minimum five-inch thickness.

2. Impervious membrane (vapor barrier) of good quality to prevent moisture vapor penetration into the slab, with resulting condensation, wetness and efflorescence. The vapor barrier must have all of the following qualities:

   a. Permeance of less than 0.1 Perms per ASTM F 1249 or ASTM E 96.

   b. Maintain permeance of less than 0.1 Perms after mandatory conditioning tests per ASTM E 154 Sections 8, 11, 12, and 13.

   c. ASTM E 1745 Class A.

   The vapor barrier must be installed in accordance with the manufacturer's instructions and ASTM E 1643-04. Arrangement should be made for field review of the installation by the manufacturer's representative at the beginning of the installation phase. All penetrations must be sealed per the manufacturer's instructions.

3. A minimum 4-inch thick granular base (underlying the vapor barrier) to serve as capillary break. Where the slab is underlain by a mat foundation, the thickness of the granular base can be increased to allow for the installation of plumbing within this layer.

   The granular base material for slab-on-grade not subjected to traffic loads should consist of lean angular gravel or crushed rock free from adobe, vegetable matter or other deleterious substances and conforming to the following gradation requirements:

US Series Sieve Size	**Percentage Passing Sieve (Dry Weight Composition)**
3/4-inch	100
No. 4	0-5

   Each lift of the granular base material must be compacted with a vibro-plate until there is no further consolidation.

   For floor with covering, the above requirements must be met in addition to requirements relating to water/cement ratio for the concrete mix, concrete curing method, and those recommended by the floor covering manufacturer in order to minimize the potential for floor covering failure.

Other Slabs-on-Grade: Concrete slabs-on-grade for below-grade structures, such as elevator or utility pits, may serve the dual role of acting as a foundation as well as a floor element. If the slab serves as a foundation, neither a granular base course nor a vapor barrier would be required and the thickness of the slab should be based on criteria for designing a mat foundation.

Structures with slabs-on-grade exposed to the atmosphere may not require the elements necessary to prevent dampness and efflorescence. The Architect should make a determination on which of these below-grade structures should be provided with the elements required to prevent dampness and efflorescence.

All slabs-on-grade should be supported on a subgrade prepared according to the recommendations presented in subsequent sections.

EARTHWORK AND PAVEMENTS

Demolition

Existing structures and pavements within the footprints of proposed site improvements should be demolished. In particular, foundations of buildings-to-be-demolished should be removed so that they do not interfere with the construction of the proposed building. Debris resulting from demolition should be hauled away from the site.

Pavements

General: We anticipate that asphalt concrete, concrete, and pervious concrete paving could be required for all new entry driveways and parking areas. This paving section is based on the procedures contained in the Caltrans Highway Design Manual, dated November 2, 2012, using a Traffic Index, TI = 7.0 for the driveways and TI = 5.0 for the parking area. Selection of this design traffic parameter was based on assumed use and not on a detailed equivalent wheel load analysis or traffic study.

Asphalt Concrete Paving: For flexible paving design, the R-value, which represents the ability of the subsurface material to resist lateral deformation when acted upon by a vertical load, is estimated based on the soil classification rather on the laboratory test results. Our recommendations for flexible asphalt concrete paving are presented in Table 4.

Pervious and Concrete Pavements: The pervious pavement design was based on the highway design manual procedures for standard concrete pavement design, except that a treated permeable base material is specified instead of aggregate base. The concrete pavement design is based on the determination that the site is classified as falling in the "Inland Valley" region, based on the California Highway Design Manual's classification of California Pavement Climate regions. The site soil is classified as Type II subgrade soil. We estimated the section thickness, which is in Table 4, based on the assumption that curbs will be installed to provide lateral support for the pavement sections.

Pavement Drainage: Our observations of pavement performance indicate that there is a strong correlation between poor pavement drainage conditions and the amount of pavement failures (potholes, settlement bowls, alligator cracks, etc.) observed. For this reason, we recommend that new pavement sections should be adequately drained by providing swales, culverts, subdrains, as deemed necessary.

Table 4
Recommended Pavement Sections

Proposed Use	Assumed Traffic Index	Asphalt Concrete Pavement		Pervious and Concrete Pavement		
		Asphalt Pavement Section (inches)	Aggregate Base (inches)	Pervious and Concrete Pavement Section (inches)	Aggregate Base (inches)	Treated Permeable Base (inches)
Parking Areas	5	2	10	9	12	12
Driveways	7	2.5	16	9	12	16
	7	3	13	-	-	-

We note that though the various pavement sections for driveways might be technically equivalent, the section with the largest thickness of asphalt concrete for the assumed traffic index of 7 may be preferred, hence, selected for design and implementation.

Sidewalk: For slabs-on-grade subjected to pedestrian traffic only, a minimum four-inch thick nominally reinforced concrete slab on prepared subgrade should be adequate.

Subgrade-All Paving Types: The subgrade for all paving types should consist of existing non-organic site soils (after stripping) scarified to a depth of six inches, moisture-conditioned, and recompacted to a minimum 95 percent relative compaction (based on ASTM Test Method D1557).

Miscellaneous: For the rigid (pervious) pavements, the designer should refer to AASHTO, ACI and other pavement design documents regarding requirements for concrete strength, jointing, etc.

It should be noted that the pavement sections described above will not be able to accommodate construction traffic. The Contractor should be aware of this and should sequence the construction in such a way that new pavement sections are not subjected to construction traffic.

Existing Street Pavement: Where adjacent street paving is breached and need to be replaced, the pavement section thickness and other requirements imposed by the City for breaching such street paving should be met.

Site Preparation

General: Except for areas of the site where it is specifically prohibited, the site should be cleared of all obstructions, including pavements, buried utility lines and conduits, trees and other vegetation, and deleterious materials. Holes resulting from the removal of trees, underground structures, or improvements that extend below the planned finish grades should be cleared thoroughly. If the holes do not extend below the bearing elevation of footings they should be backfilled with suitable material compacted to the requirements described in "Engineered Fill and Backfill Placement", otherwise they should be backfilled with flowable compacting fill.

Stripping: In the areas of new improvements where there is vegetation, the site should be completely stripped of grass and other organic material to a minimum depth of six to 12 inches below the existing grade. Concrete, wood, and other debris should be hauled off the site. Stripping should extend at least 5 feet beyond the edge of the proposed improvements. The resulting exposed soils after stripping should be reviewed by the Geotechnical Engineer before subsequent construction is performed.

Unless the stripped materials are considered suitable for landscaping purposes, they should be hauled off the site.

Excavation and Slopes

Conventional excavation and earthwork equipment should be satisfactory for mass grading, foundation excavations, and utility trenching on this site.

During the excavation operations, temporary cut slopes should be used, where feasible, to prevent movement of materials exposed on the excavation walls. A temporary slope gradient of 1:1 (horizontal: vertical) or flatter should be used.

Permanent cut and fill slopes, if any, should not exceed a gradient of 2:1 in order to ensure stability, encourage plant growth, and minimize erosion. To provide erosion protection, permanent slopes should be initially stabilized with straw plugs and then planted with native plants, grasses, and shrubs consistent with the approved landscaping plan.

The Contractor should be aware that slope height, slope inclination, and excavation depths (including utility trench excavations) should 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.

Subgrade Stabilization

Subgrade stabilization may be required outside the building pad area during grading because of 1) wet or soft conditions and/or 2) unstable or pumping subgrade. These conditions may occur at the site due to saturated soil or inclement weather conditions during construction. Where the aforementioned conditions occur, the existing soil should be excavated to a minimum depth of 12 inches. The overexcavated area should then be stabilized with geotextile fabric as described below. If stabilization is required, we recommend that MIRAFI 500X or approved equal should be used. The stabilization should meet the following requirements:

1. The fabric should be laid loosely on a smooth, fairly level surface; folds and wrinkles in the fabric should be avoided.

2. Adjacent rolls of fabric should overlap a minimum of 24 inches.

3. During fill placement, a 9 to 12-inch lift of uncompacted fill should be placed over the fabric before compaction is commenced. Subsequent lifts of fill should then be placed per the requirements described under "Engineered Fill and Backfill Placement".

4. The fabric should be stored away and protected per the recommendations of the manufacturer.

Alternatively, the subgrade could be stabilized using lime treatment if the soil materials are amenable to such treatment.

Subgrade Preparation

Unless otherwise stated in this report, any exposed subgrade that will receive fill should be prepared by scarifying to a depth of six inches and moisture-conditioning to a moisture content of about two percent above optimum moisture content or as directed by the Geotechnical Engineer. The moisture-conditioned material should then be compacted to at least 90 percent relative compaction (based on ASTM Test Method D 1557). The moisture condition should be maintained until subsequent fill is placed.

Directly under concrete walkways and pavement sections, the exposed subgrade should be scarified to a depth of six inches, moisture-conditioned as described above, and compacted to at least 95 percent relative compaction. In cases where the slab or pavement section will bear on engineered fill, the top six inches of the fill should be compacted to a minimum 95 percent relative compaction.

Engineered Fill and Backfill Placement

General: In areas designated to receive fill, the subgrade-to-receive-fill should be prepared as described under “Subgrade Stabilization” and “Subgrade Preparation”. Approved fill material should then be placed in lifts not exceeding eight inches in uncompacted thickness, moisture-conditioned to a moisture content of about two percent above the optimum moisture content of the material, and compacted to at least 90 percent relative compaction (ASTM D 1557). Moisture-conditioning to the specified level is critical to minimizing the potential impacts of hydrocompression.

In areas to be overlain by a slab-on-grade or footing, each lift should be compacted, at a moisture content of 2-percent above optimum, to a minimum relative compaction of 95 percent in the uppermost six inches of all fill and backfill, and a minimum 95 percent at other depths.

In addition to being compacted to the required relative compaction, the engineered fill should also be stable, i.e., not exhibit “pumping” behavior. Ponding or jetting should not be used to densify fill or backfill.

Flowable Compacting Fill

In some cases where backfilling is required (e.g. in utility trenches), flowable compacting fill can be used in lieu of soil backfill, if approved by the Geotechnical Engineer.

Flowable compacting fill (also known as "Controlled Low-Strength Material") should be a flowable and self-compacting mixture of Portland cement, fly ash, fine aggregates, water and entrained air; conforming to ACI 229R. The mix shall have the following properties:

1. Minimum Compressive Strength: 25 psi at 1 day; 300 psi at 28 days. Strength shall not exceed 500 psi at 90 days.

2. Slump: Eight inches minimum to ten inches maximum, when tested in accordance with ASTM C 143.

Fill and Backfill Materials

Imported Fill: If imported material is required for fill and backfill, the imported material must be granular soil, free of organic matter, which does not exhibit excessive shrinkage or swelling behavior when subjected to changes in water content. Imported fill should be free of construction debris. The material should classify as SP, SC or SW under the Unified Soil Classification System. The material should conform to the following:

1. Be thoroughly compacted without excessive voids.

2. Meet the following plasticity requirements:

    a. Maximum Plasticity Index of 6 (ASTM D 4318).

    b. Maximum Liquid Limit of 25 (ASTM D 4318).

3. Meet minimum R-value of 35 when tested using California Test 301 (at exudation pressure of 400 psi), with a maximum expansion pressure of 100 psf.

The Contractor should provide written certification from a licensed environmental professional stating that the imported fill materials are free of hazardous and/or deleterious contaminants.

Selective Stockpiling of Site-Derived Fill Materials: During the excavation operations, the Geotechnical Engineer should be given the opportunity to identify native soils to be selectively stockpiled for use as fill or backfill. Site-derived fill materials contaminated by concrete and other debris or containing fat clay should be considered as unsuitable fill materials. We note that because of their predominantly silty and/or clayey nature, moisture-conditioning of site-derived fill materials is likely to be difficult if earthwork operations are performed during the rainy season.

Aggregate Base and Permeable Base Materials

Where aggregate base material or permeable base is specified, the furnished material should meet the requirements of Class 2 Aggregate Base and Treated Permeable Base as described in the California Department of Transportation (Caltrans) Standard Specifications. Aggregate base and permeable base materials should consist of virgin rock aggregates only from an established quarry, unless certification can be provided that any proposed recycled materials are free of hazardous and/or deleterious contaminants. The Contractor should provide written certification from a licensed environmental professional stating that the recycled materials are free of hazardous and/or deleterious contaminants.

Drain Rock and Filter Fabric

Drain rock, if required, should consist of Class 2 Permeable Material, meeting gradation and other requirements contained in the California Standard Specifications. Alternatively, three-quarter-inch crushed rock encapsulated in filter fabric (Mirafi 140N, or approved equivalent) can be used instead of Class 2 Permeable Material. The Contractor should provide written certification and back-up data to the Owner and the Geotechnical Engineer stating that the propose drain rock materials meet all the requirements of Caltrans Class 2 Permeable Material. If the Contractor intends to use recycled Class 2 Permeable Material, the same written certification requirement stated above for recycled Class 2 Aggregate Base must be assumed to apply.

Underground Utilities

Set-Back Distance Requirement: Existing buried utility lines should be re-routed around the proposed excavation areas. New and re-routed buried utility lines should be spaced away from the nearest foundation edge such that the horizontal distance between the edge of the foundation and the nearest edge of utility trench backfill is at least three times the depth of the foundation embedment. The requirement is intended to maintain a zone of soil around the foundation to enable full development of passive pressures.

Bedding and Backfill Materials: Bedding and backfill material requirements should be specified by the Civil Engineer based on the type of pipe proposed. Trench backfill should be compacted to 90 percent relative compaction. Where a trench is overlain by pavement, the upper 6 inches of the backfill should be compacted to 95% relative compaction.

Surface Drainage

Finished grading for surface drainage should be designed to direct surface runoff away from the new buildings toward discharge facilities. Ponding of surface water should not be allowed adjacent to the new buildings. Downspouts and gutters should be provided, and water from downspouts should be directed through unperforated pipes to storm drains. Alternatively, drainage culverts may be used to direct water from downspouts to storm drains.

Winter Construction

If earthwork operations are performed during the winter or the rainy season, long delays may result from the Contractor's inability to properly moisture-condition the mostly silty and/or clayey site soils to achieve the required relative compaction. Also, water-logged or boggy conditions that will limit movement of construction equipment or lead to the equipment being stuck could occur during winter construction. In either case, lime treatment could be considered to make the site soils workable and compactable. Please refer to the discussion under the subheading "Subgrade Stabilization" for additional mitigation measures.

Once the subgrade soils have been properly compacted, a six-inch layer of Caltrans Class 2 Aggregate Base can be placed over the subgrade as a cap to maintain suitable working conditions, if necessary. Alternatively, the Contractor may choose to lime-treat the surface soils.

Provisions should be made to dewater any excavations and to minimize the flow of surface runoff into the excavations if earthwork is performed during the rainy season.

We must note that the moisture content shown on the boring logs for the native soils reflects the moisture conditions at the time of the field exploration. The moisture content of those materials should be expected to be much higher if earthwork is performed during the winter or rainy season.

Impact of Site Conditions on Construction

Although this investigation was performed primarily for design purposes, a brief discussion of the impact of the site conditions on construction is presented for information purposes only. The discussion must not be considered as a presentation of every possible impact of site conditions on construction.

Utility Lines: The Contractor should be aware that a number of utility lines traverse the site prior to the demolition phase. The Contractor should take necessary precautions, prior to and during earthwork operations, to prevent damage to any of the old utility lines that might still be active. Utility lines to be left and abandoned in place should be properly grouted and capped.

Demolition: In areas of proposed site improvements, the Contractor should completely remove any subsurface structures. The Contractor should review design drawings (or as-built drawings, if they exist) of the structures that were demolished to familiarize himself/herself with the depths and locations of all buried and underground elements to be removed.

Subsurface Conditions Shown in Profiles: The Contractor should be aware that the actual conditions will not be known until the soils are excavated. The Contractor should therefore perform his own interpretation of the boring log data and should avoid optimistic interpretation of the logs as a basis for his/her soils-related bid.

New Pavements: The Contractor should be aware that new pavement sections are not designed for construction traffic, and he/she should sequence the construction in such a way that new pavement sections are not subjected to construction traffic.

Dust, Noise, and Vibration Control: Dust, noise and vibration control may be necessary to minimize the impact of construction activities on nearby buildings.

SECTION 5
CONSTRUCTION OBSERVATION

CONSTRUCTION OBSERVATION

Summary

Since our recommendations are based on the interpretation of available subsurface information, and actual subsurface conditions may not be known fully until the construction phase, it is necessary that Rutherford + Chekene be retained to provide continuous geotechnical engineering services during construction of the excavation and foundation phases of the project. This will allow us to 1) make necessary modifications to our recommendations should actual subsurface conditions differ substantially from the conditions anticipated prior to the start of construction and 2) observe that the Contractor's work conforms to the geotechnical aspects of the construction documents.

Our construction observation services will include (but will not necessarily be limited to) engineering observation of the following:

1. Meet with the Construction Manager, the Architect/Engineer, Contractor, and Earthwork Subcontractor on the site at critical points during site preparation, excavation, foundation, and backfilling operations to coordinate our observation services with the work.

2. Review submittals on earthwork materials and respond to RFIs.

3. Review any proposed earthwork materials, both on-site and imported, to determine their acceptability. Our review will include review of the results of all laboratory testing required to evaluate conformance with the specifications and to establish any necessary reference standards.

4. Provide observation during construction on an intermittent basis, as required, to establish conformance with the specifications and the proper execution of our geotechnical recommendations. Interact with personnel of testing laboratory that will perform field density testing. Review all test results, and provide recommendations for remedial work, if necessary.

5. Observe bearing conditions in footing excavations, prior to placement of reinforcing and again immediately prior to the placement of concrete.

6. Prepare a report summarizing our observations upon completion of construction.

SECTION 6
REFERENCES AND APPENDICES

REFERENCES

The following reports and publications were used for information in the course of this investigation:

1. American Society of Civil Engineers, (2005), *Minimum Design Loads for Buildings and Structures, ASCE Standard, (ASCE/SEI 7-05)*.

2. Boulanger, R.W. and Idriss, I.M., (2007), *Evaluation of Cyclic Softening in Silts and Clays*, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 133, No. 6, ASCE, June.

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4. Bray, J.D., and Sancio, R.B., (2006), *Assessment of the Liquefaction Susceptibility of Fine-Grained Soils*, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 132, No. 9, ASCE, September.

5. California Division of Mines and Geology, (1997), *Fault Rupture Hazard Zones in California*, Special Publication 42.

6. California Division of Mines and Geology, (2008), *Guidelines for Evaluating and Mitigating Seismic Hazards in California,* Special Publication 117.

7. Cetin, O.K., Seed, R.B., Kiureghian, A., Tokimatsu, K., Harder, L.F., Kayen, R.E., and Moss, R.S., (2006), *Standard Penetration Test-Based Probabilistic and Deterministic Assessment of Seismic Soil Liquefaction Potential*, Journal of Geotechnical and Geoenvironmental Engineering, Vol. 130, No. 6, ASCE, June.

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12. International Conference of Building Officials (ICBO), (1998), *Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada*.

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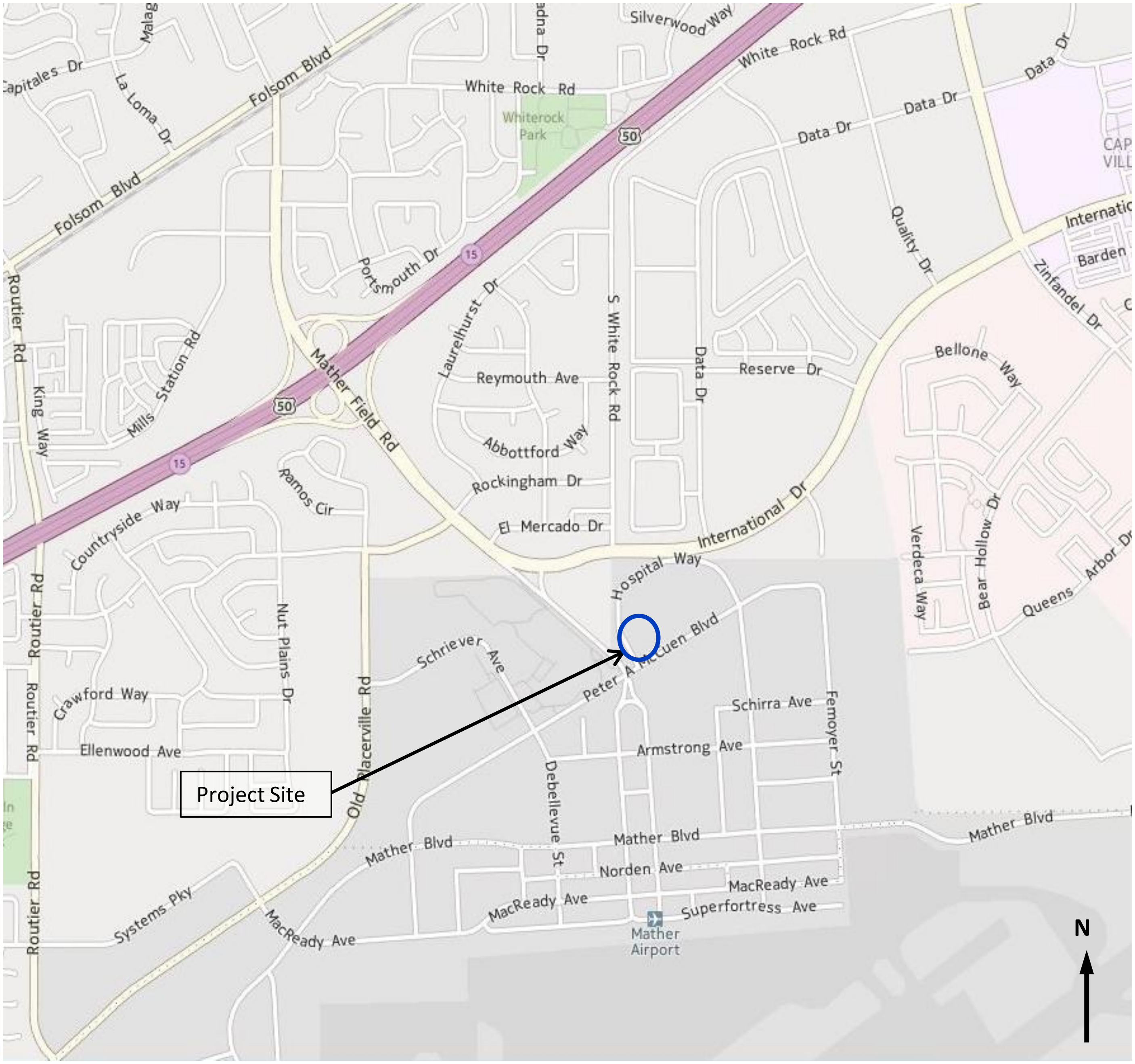
15. Sanders & Associates Geostructural Engineering, (SAGE), (2012), Final *Geotechnical Investigation Report, Consolidated outpatient Surgical Specialty, Veteran Affairs Medical Center, Mather, California*, #10-024.00, 11 July.

16. Working Group on California Earthquake Probabilities, (2007), *Earthquake The Uniform California Earthquake Rupture Forecast, Version 2 (UCERF 2)*, USGS Open-File Report 2007-1437.

APPENDIX A

Figures for This Report



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Site Vicinity Map
Consolidate/Expand Medical Procedures (CEMP)
VA Mather Healthcare Service
Mather, California

JOB NUMBER	DATE	FIGURE	PAGE
2012-065G	1/2/2014	1	A1

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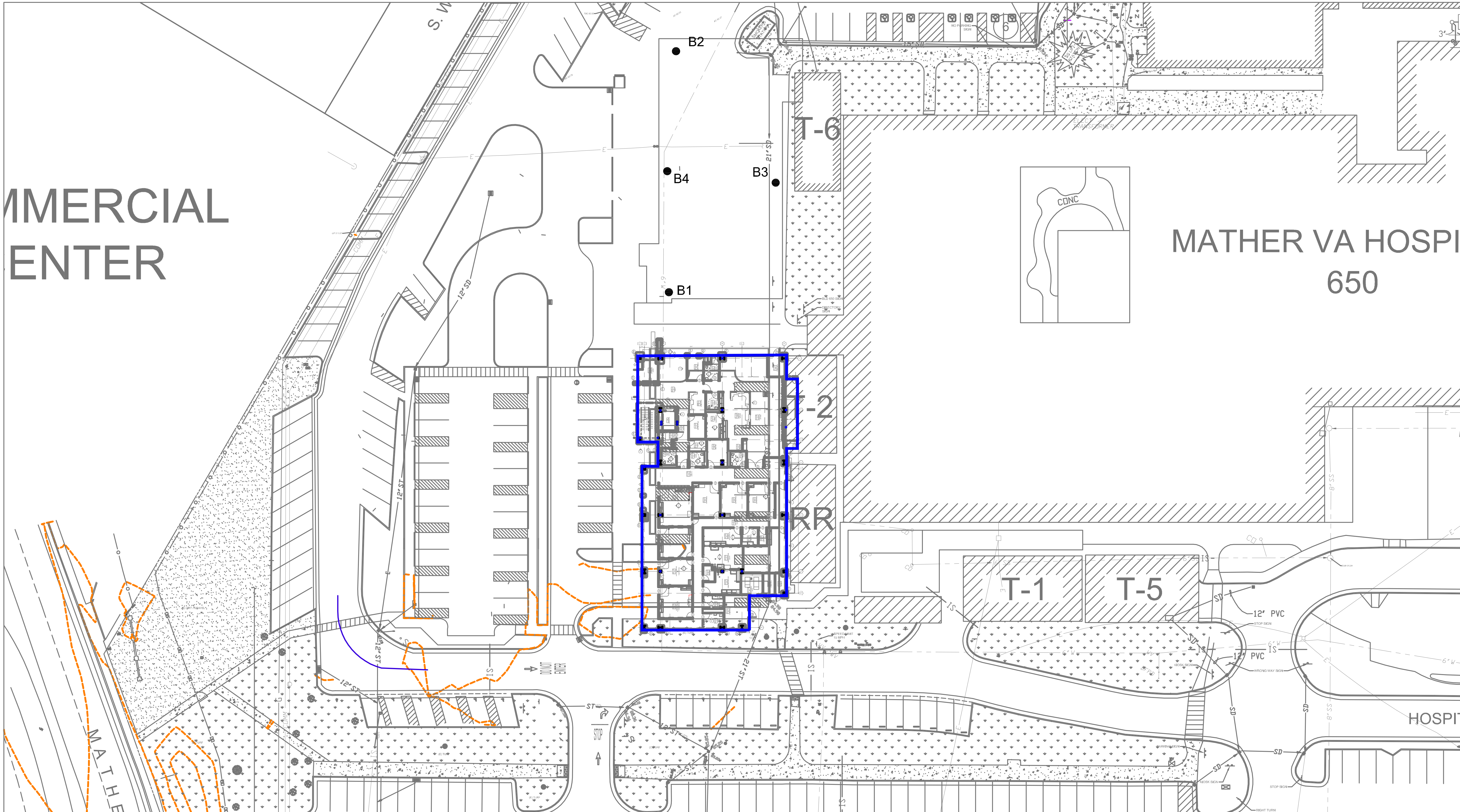
Site Location Map
Consolidate/Expand Medical Procedures (CEMP)
VA Mather Healthcare Service
Mather, California

JOB NUMBER	DATE	FIGURE	PAGE
2012-065G	1/2/2014	2	A2



Legend

Proposed building footprint

B1 Approximate location of boreholes by SAGE (2012)

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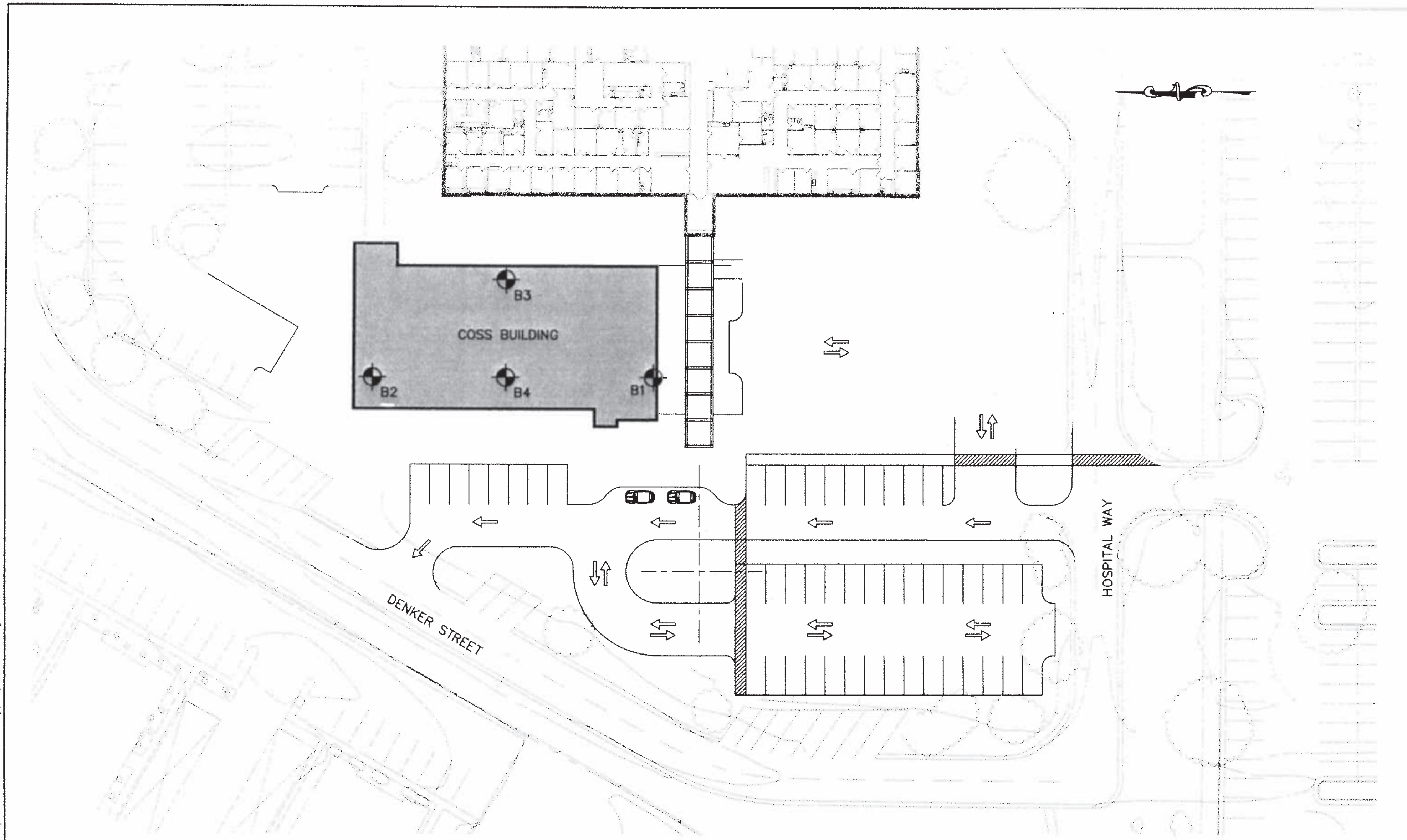
Consolidate/Expand Medical Procedures (CEMP)
VA Mather Healthcare Service
Mather, California

JOB No.: 2012-065G	DATE: 01/02/2014	FIGURE: 3	PAGE: A3

APPENDIX B

Boring Logs from Previous Investigation



BASE MAP REFERENCE:

SITE PLAN PHASE 1, VA MATHER COSS, BY HDR, DATED 12/16/10

LEGEND

APPROXIMATE BORING LOCATION BY SAGE, JUNE 18, 2012

0 1"
REFERENCE SCALE

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SITE PLAN VA COSS CLINIC MATHER SACRAMENTO COUNTY CALIFORNIA	FIGURE 2 2 of 2
DATE: 07/11/12 FILE: 10-024.00-FIG SCALE: 1" = 40'	JOB NO. 10-024.00

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > No. 200 sieve size)	Gravels (More than half of coarse fraction > No. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction > No. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine-Grained Soils (more than half of soil < No. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		PT	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No.4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

TYPES OF STRENGTH TESTS

PP	Pocket Penetrometer
TV	Field Torvane
LVS	Laboratory Vane Shear
UC	Unconfined Compression
TXUU	Triaxial, unconsolidated, undrained
DS	Direct Shear

▽ Unstabllized (initial) groundwater level

▼ Stabilized groundwater level

SAMPLER TYPE

C — Core barrel

O — Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube

PT — Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube

ST — Shelby tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

CC — CME Continuous Sample Tube System sampler advanced with hollow stem auger

BULK — Disturbed grab sample

CA — California split-barrel sampler with 2.5-inch outside diameter and 1.93-inch inside diameter

MCA — Modified California split-barrel sampler with 3.0-inch outside diameter and 2.5-inch inside diameter

SPT — Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter

Sampling attempted without recovery

NOTE:
Shaded portion of sampler symbol represents portion of sample recovered

Examples:

MCA SPT CC } Portion recovered

VA COSS CLINIC

MATHER SACRAMENTO COUNTY CALIFORNIA

SOIL CLASSIFICATION CHART

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Project No. 10-024.00

Date 07/11/12

Figure A-1

PROJECT: VA COSS Clinic, Mather, California	LOG OF BORING B1 — Sheet 1 of 1
BORING LOCATION: See Figure 2	DRILLING SUBCONTRACTOR: Taber Drilling, Inc.
DATE STARTED: 6/18/2012 — DATE FINISHED: 6/18/2012	DRILL RIG: Track-mounted CME-55
LOGGED BY: C. Smith	DRILLING METHOD: 4-inch solid-flight auger
ELEVATION (FT): 92.0 — DATUM: Design Drawing C-101	
GW DEPTH (FT): N/A — GW DATE: N/A	HAMMER TYPE: Automatic
CASING NOTES: N/A	HAMMER WT (LBS): 140 — HAMMER DROP (IN): 30
BACKFILL MATERIAL: Soil Cuttings	SAMPLERS: MCA, SPT

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY LL	PLASTICITY PI
0–4.5				CL	SANDY CLAY (CL) medium brown to dark red brown, grey brown, medium stiff to stiff, moist, contains rootlets, fine sand and pebbles; some organic odor. Sieve: See Appendix B (TOP SOIL)								
1	91.0												
2	90.0	SPT	10					62.0				21	12
					becomes very stiff; pebbles continued; maganese oxide in areas (dark grey).								
3	89.0	MCA	18										
4	88.0												
5	87.0			SC/CL	CLAYEY SAND TO SANDY CLAY (SC/CL) tan brown, very dense to very hard, dry to damp, contains gravel and abundant calcium carbonate coatings, gravel well rounded up to 1" in size.								
6	86.0	SPT	67										
7	85.0												
8	84.0	MCA	85										
9	83.0												
10	82.0			GC	CLAYEY GRAVEL WITH SAND (GC) tan brown, dense to very dense, dry, driller added water to promote easier drilling. Matrix ranging between clayey sand (SC) and sandy clay (CL) with variable gravel. Cementation increasing. Sieve: See Appendix B.			25.0					
11	81.0	SPT	58										
12	80.0												
13	79.0												
14	78.0												
15	77.0	MCA	47/5"		dark gray to gray matrix, refusal at 15.7'								
16	76.0												
17	75.0												
18	74.0												
19	73.0												

Boring terminated at a depth of 15.7 feet below existing ground surface.
Blow counts for the MCA sampler were converted to SPT values using a conversion factor of 0.65. Blow counts were then corrected to SPT N60 values using a conversion factor of 1.45 (auto-hammer efficiency of 87% provided by Taber).

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Project No: 10-024.00
Figure: A-2

PROJECT: VA COSS Clinic, Mather, California		**LOG OF BORING B2**	Sheet 1 of 1
BORING LOCATION: See Figure 2		**DRILLING SUBCONTRACTOR:** Taber Drilling, Inc.	
DATE STARTED: 6/18/2012	**DATE FINISHED:** 6/18/2012	**DRILL RIG:** Track-mounted CME-55	
LOGGED BY: C. Smith		**DRILLING METHOD:** 4-inch solid-flight auger	
ELEVATION (FT): 92.0	**DATUM:** Design Drawing C-101		
GW DEPTH (FT): N/A	**GW DATE:** N/A	**HAMMER TYPE:** Automatic	
CASING NOTES: N/A		**HAMMER WT (LBS):** 140	**HAMMER DROP (IN):** 30
BACKFILL MATERIAL: Soil Cuttings		**SAMPLERS:** MCA, SPT	

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY LL	PLASTICITY PI
				CL	SANDY CLAY (CL) dark brown, olive grey brown, and red brown, stiff to very stiff (increasing with depth), moist, contains rootlets, fine sand, and some organic odor, contains some well rounded gravel up to 1.25". TOP SOIL								
1	91.0												
2	90.0	SPT	12		Sieve: See Appendix B			66.0				23	12
3	89.0	MCA	14		Direct Shear: See Appendix B	18.5	109						
4	88.0			SC/CL	CLAYEY SAND TO SANDY CLAY (SC/CL) tan brown, very dense to very hard, dry to damp, contains gravel up to 1.5" in size. Matrix varies from clayey sand (SC) to sandy clay (CL). Some clay coatings and clayey zones on and between clasts. Gravel well rounded.								
5	87.0												
6	86.0	SPT	81					63.0					
7	85.0				driller added water to boring								
8	84.0	MCA	57										
9	83.0												
10	82.0			GC	CLAYEY GRAVEL WITH SAND (GC) tan brown, very dense, dry								
11	81.0	SPT	118										
12	80.0												
13	79.0												
14	78.0												
15	77.0												
16	76.0												
17	75.0												
18	74.0												
19	73.0												

Boring terminated at a depth of 13.0 feet below existing ground surface.
Blow counts for the MCA sampler were converted to SPT values using a conversion factor of 0.65. Blow counts were then corrected to SPT N60 values using a conversion factor of 1.45 (auto-hammer efficiency of 87% provided by Taber).

SANDERS & ASSOCIATES GEOSTRUCTURAL ENGINEERING
sage
INTEGRATING EARTH & STRUCTURE

Project No: 10-024.00
Figure: A-3

PROJECT:	VA COSS Clinic Mather, California	LOG OF BORING B3	Sheet 1 of 1
BORING LOCATION: See Figure 2		DRILLING SUBCONTRACTOR: Taber Drilling, Inc.	
DATE STARTED: 6/18/2012	DATE FINISHED: 6/18/2012	DRILL RIG: Track-mounted CME-55	
LOGGED BY: C. Smith		DRILLING METHOD: 4-inch solid-flight auger	
ELEVATION (FT): 92.0	DATUM: Design Drawing C-101		
GW DEPTH (FT): N/A	GW DATE: N/A	HAMMER TYPE: Automatic	
CASING NOTES: N/A		HAMMER WT (LBS): 140	HAMMER DROP (IN): 30
BACKFILL MATERIAL: Soil Cuttings		SAMPLERS: MCA, SPT	

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY LL	PLASTICITY PI
0				CL	SANDY CLAY (CL) red brown, hard, damp, minor fill at surface (~0.2'), contains glass fragments.								
1	91.0												
2	90.0	SPT	52		Sieve: See Appendix B			61.0				19	9
3	89.0	MCA	44	SC/CL	CLAYEY SAND TO SANDY CLAY (SC/CL) red brown, dense to very dense, hard to very hard, damp to dry, contains some interspersed pebbles/gravel								
4	88.0												
5	87.0				increasing coarsness with depth								
6	86.0	SPT	86										
7	85.0			GC	CLAYEY GRAVEL WITH SAND (GC) tan, very dense, dry, gravel to 1.5" in size, rounded, cemented. water added to boring to ease drilling								
8	84.0	MCA	47/5"										
9	83.0												
10	82.0	SPT	47/5"										
11	81.0				gravel wedged in shoe								
12	80.0												
13	79.0												
14	78.0												
15	77.0												
16	76.0												
17	75.0												
18	74.0												
19	73.0												

Boring terminated at a depth of 12.1 feet below existing ground surface.
Blow counts for the MCA sampler were converted to SPT values using a conversion factor of 0.65. Blow counts were then corrected to SPT N60 values using a conversion factor of 1.45 (auto-hammer efficiency of 87% provided by Taber).

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Figure: A-4

PROJECT: VA COSS Clinic, Mather, California

LOG OF BORING B4

Sheet 1 of 1

BORING LOCATION: See Figure 2	**DRILLING SUBCONTRACTOR:** Taber Drilling, Inc.
DATE STARTED: 6/18/2012 **DATE FINISHED:** 6/18/2012	**DRILL RIG:** Track-mounted CME-55
LOGGED BY: C. Smith	**DRILLING METHOD:** 4-inch solid-flight auger
ELEVATION (FT): 92.0 **DATUM:** Design Drawing C-101	
GW DEPTH (FT): N/A **GW DATE:** N/A	**HAMMER TYPE:** Automatic
CASING NOTES: N/A	**HAMMER WT (LBS):** 140 **HAMMER DROP (IN):** 30
BACKFILL MATERIAL: Soil Cuttings	**SAMPLERS:** MCA, SPT

DEPTH (FT)	ELEV. (FT)	SAMPLE TYPE	SAMPLE	SPT N60 VALUE	LITHOLOGY	DESCRIPTION	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	FINES (%)	TYPE of TEST	UNCONFINED STRENGTH (tsf)	SHEAR STRENGTH (ksf)	PLASTICITY LL	PLASTICITY PI
0–4.5	92.0–87.5				CL	SANDY CLAY (CL) red brown, hard, damp to moist, contains some gravel and pebbles. Some zones with fine sand interspersed. Abundant rootlets and olive brown areas in upper 4.5'.								
1	91.0													
2	90.0	SPT		30										
3	89.0	MCA		22										
4	88.0													
4.5–9.0	87.5–83.0				SC/CL	CLAYEY SAND TO SANDY CLAY (SC/CL) reddish tan brown, medium dense to very dense, very stiff to very hard, damp to dry, contains gravel up to 1.5" in size. Some clay pockets around and in between weathered clasts. Matrix contains areas of increased sand content.								
5	87.0													
6	86.0	SPT		26										
7	85.0													
8	84.0	MCA		64										
9	83.0													
10	82.0													
11	81.0													
12	80.0													
13	79.0													
14	78.0													
15	77.0													
16	76.0													
17	75.0													
18	74.0													
19	73.0													

Boring terminated at a depth of 9.0 feet below existing ground surface.
Blow counts for the MCA sampler were converted to SPT values using a conversion factor of 0.65. Blow counts were then corrected to SPT N60 values using a conversion factor of 1.45 (auto-hammer efficiency of 87% provided by Taber).

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Figure: A-5

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