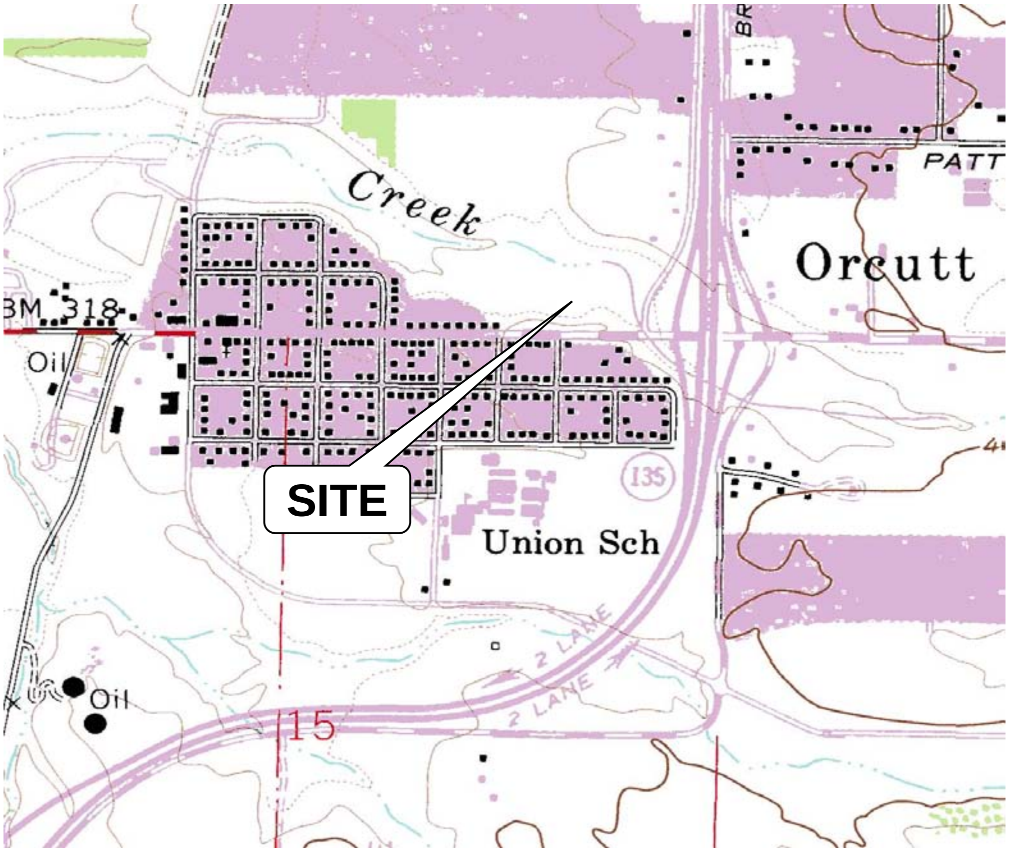
# GEOTECHNICAL INVESTIGATION
# OASIS CENTER MEETING FACILITY
# CLARK AVENUE & FOXENWOOD LANE
# ORCUTT, CALIFORNIA

May 16, 2016
PROJECT 16-7382



PREPARED BY:

GSI SOILS INC.
524 EAST CHAPEL STREET
SANTA MARIA, CA 93454
(805) 349-0140

PREPARED FOR:

OASIS CENTER
195 S. BROADWAY
SANTA MARIA, CA 93455

## TABLE OF CONTENTS

# GEOTECHNICAL INVESTIGATION
# OASIS CENTER MEETING FACILITY
# CLARK AVENUE & FOXENWOOD LANE
# ORCUTT, CALIFORNIA

## PROJECT 16-7382

## 1.0 INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed Oasis Center Meeting Facility to be located on East Clark Avenue in Orcutt, California. A site location map is presented in Figure 1.

The property is bounded by East Clark Avenue to the south, Foxenwood Lane to the east, Orcutt Creek to the north and vacant land to the west. The majority of the site is relatively level with an average elevation of approximately 330 feet above mean sea level MSL). Between the proposed building and East Clark Avenue the terrain rises from 330 feet above MSL to 365 feet above MSL with gradients of approximately 20 to 30 percent. At the time of our field investigation the majority of the site was covered with native grasses and weeds with trees to the north and south of the pad area.

It is our understanding that the structure will be wood or steel framed building with a concrete slab-on-grade floor. Footing loads for the building is presently unavailable. For the purpose of this report, loads on the order of 30 kips (columns) and 2.0 kips per lineal foot (continuous) have been estimated.

The project description is based on a site reconnaissance performed by a GSI Soils Inc., engineer and information provided by Vivek Harris (Architect). The plan provided forms the basis for the "Site Plan", Figure 2.

In the event that there is change in the nature, design or location of improvements, or if the assumed loads are not consistent with actual design loads, the conclusions and recommendations contained in this report should be reviewed and modified, if required. Evaluations of the soils for hydrocarbons or other chemical properties are beyond the scope of the investigation.

## 2.0 PURPOSE AND SCOPE

The purpose of this study was to explore and evaluate the surface and subsurface soil conditions at the site and to develop geotechnical information and design criteria for the proposed project. The scope of this study included the following items.

1. A review of available geotechnical data for this area of Orcutt.
2. A field study consisting of a site reconnaissance and an exploratory boring program to formulate a description of the subsurface conditions.
3. A laboratory testing program performed on representative soil samples collected during our field study.
4. Engineering analysis of the data gathered during our field study, laboratory testing, and literature review. Development of recommendations for site preparation and grading, and geotechnical design criteria for foundations, slab-on-grade construction, retaining walls, pavement design and underground facilities.
5. Preparation of this report summarizing our findings, conclusions, and recommendations regarding the geotechnical aspects of the project site.

## 3.0 SUBSURFACE SOIL CONDITIONS

The near surface soils encountered in our exploratory borings generally consisted of silty sands to a depth of 3 to 4 feet. These soils were encountered in a dry to slightly moist state and in a loose condition. Below the near surface soils, similar silty sands and sands with silt were found to a depth of 19 feet. These soils were encountered in a slightly moist state and in a medium dense to dense condition. Very stiff to hard sandy clay soils were encountered in boring B-1 at a depth of 19 feet extending to 23.5 feet below existing grade. Layers of sands, silts and silty sands were found below the sandy clays to termination of the boring at 50 feet below grade. These soils were generally encountered in a medium dense to very dense condition.

Free groundwater was encountered at a depth of 35 feet and is expected to rise to at least 30 feet below existing grades in wet winter years. In addition, very moist conditions should be expected in the upper 3 to 4 feet during wet winter months. A more detailed description of the soils encountered is presented graphically on the "Exploratory Boring Logs", ", B-1 through B-3, Appendix A. An explanation of the symbols and descriptions used on these logs are presented on the "Soil Classification Chart”.

The soil profile described above is generalized; therefore, the reader is advised to consult the boring logs (Appendix A) for soil conditions at specific locations. Care should be exercised in interpolating or extrapolating subsurface conditions between or beyond borings. On the boring logs we have indicated the soil type, moisture content, grain size, dry density, and the applicable Unified Soil Classification System Symbol.

The locations of our exploratory borings, shown on Site Plan, Figure 2, were approximately determined from features at the site. Hence, accuracy can be implied only to the degree that this method warrants. Surface elevations at boring locations were not determined.

## 4.0 SEISMIC CONSIDERATIONS

**4.1** The project site was positioned on the USGS Seismic Hazard Maps for a 2% probability of exceedance in 50 years to determine the maximum considered earthquake spectral response accelerations. The design seismic parameters are provided in the following table. A site class D (stiff soils) should be used for design of the structure.

| **SEISMIC PARAMETERS** | | | | | |
|---|---|---|---|---|---|
| **Mapped Value (g)** | | **Site Class D Adjusted Values (g)** | | **Design Value (g)** | |
| Seismic Parameter | Value (g) | Seismic Parameter | Value (g) | Seismic Parameter | Value (g) |
| $S_S$ | 1.064 | $S_{MS}$ | 1.143 | $S_{DS}$ | 0.762 |
| $S_1$ | 0.405 | $S_{M1}$ | 0.645 | $S_{D1}$ | 0.430 |
| Latitude, degrees, 34.86500<br>Longitude, degrees - 120.439800<br>Risk Category I/II/III | | | | | |

## 4.2 Liquefaction Analysis

Liquefaction is described as the sudden loss of soil shear strength due to a rapid increase of pore water pressures caused by cyclic loading from a seismic event. In simple terms it means that the soil acts more like a fluid than a solid in a liquefiable event. In order for liquefaction to occur, the following are generally needed; granular soils (sand, silty sand and sandy silt), groundwater and low density (very loose to medium dense) conditions. A liquefaction study was not part of our scope for this project, however, a preliminary opinion can be provided based on the results of our soil borings and experience in this area of Orcutt. Generally, silty sands and sands were encountered to a depth of 19 feet. Sandy clay soils were found below 19 feet with layers of sands, silts and silty sands from approximately 23 feet to 50 feet below grade. Groundwater was first encountered at 35 feet and is expected to rise to 30 feet or shallower in wet winter years. However, the relative high blow counts and the clay soils encountered would reduce the potential for surface express of liquefiable soils. As indicated on Figure 3 there is a relatively low potential for liquefaction to occur with total settlements are estimated to be on the order of +/- 1 inch and differential settlements estimated to be ½-inch over a distance of 20 feet.

## 4.3 Lateral Spreading

Due to the near level terrain and the high relative densities of the underlying soils, the potential for lateral displacements would in our opinion be low.

## 4.4 Slope Stability

The building pad area is located in near level terrain with no visual evidence of slope instability. To the south of the proposed building, slopes on the order of 3:1 (h:v) are present. There was no visual evidence of overall instability in these slopes although shallow instability could occur if over-saturated conditions were to occur. However, the potential for movement to influence the proposed construction would be low to negligible if the slopes are protected against erosion and no uncontrolled drainage occurs over the slopes.

### 4.5 Faulting

There are no active or potentially active faults in the direct vicinity of the proposed building. The nearest known fault (Casmalia Fault) is located to the south of the site. The site is not within a State of California Fault Hazards Zone (Alquist-Priolo). It is our opinion that there is a negligible potential for fault rupture to impact the proposed structure based on review of the published maps

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

1. The site is suitable for the proposed building provided the recommendations presented in this report are incorporated into the project plans and specifications.

2. All grading and foundation plans should be reviewed by GSI Soils Inc., hereinafter described as the Geotechnical Engineer, prior to contract bidding. This review should be performed to determine whether the recommendations contained within this report are incorporated into the project plans and specifications.

3. The Geotechnical Engineer should be notified at least two (2) working days before site clearing or grading operations commence, and should be present to observe the stripping of deleterious material and provide consultation to the Grading Contractor in the field.

4. Field observation and testing during the grading operations should be provided by the Geotechnical Engineer so that a decision can be formed regarding the adequacy of the site preparation, the acceptability of fill materials, and the extent to which the earthwork construction and the degree of compaction comply with the project geotechnical specifications. Any work related to grading performed without the full knowledge of, and under direct observation of the Geotechnical Engineer, may render the recommendations of this report invalid.

### 5.1 Clearing and Stripping

1. All surface and subsurface deleterious materials should be removed from the proposed building and pavement areas and disposed of off-site. This includes,

but is not limited to, existing structures and pavements, buried tanks and utility lines, loose fills, septic systems, debris, building materials, and any other surface and subsurface structures within proposed building areas. Voids left from site clearing, should be cleaned and backfilled as recommended for structural fill.

2. Once the site has been cleared, the exposed ground surface should be stripped to remove surface vegetation and organic soil. The surface may be disced, rather than stripped, if the organic content of the soil is not more than three percent by weight. If stripping is required, depths should be determined by a member of our staff in the field at the time of stripping. Strippings may be either disposed of off-site or stockpiled for future use in landscape areas if approved by the landscape architect.

## 5.2 Preparation of Building Pad

1. The intent of these recommendations is to remove all loose soils and undocumented fills and support the building footings on a uniform layer of compacted soil.

2. The building pad area should be overexcavated to a minimum depth of four (4) feet below existing grades or two (2) feet below the bottom of the deepest footing, whichever is greater. After approval of the excavation bottom by the geotechnical engineer the exposed surface should then be scarified to a depth of 12 inches, moisture conditioned to near optimum and compacted to at least ninety (90) percent of maximum dry density (ASTM D1557-02). The upper 48 inches of the pad should consist of native silty sands and sands or a suitable select non-expansive material (decomposed granite, Class II/III Base or equivalent), similar compacted to 90 percent. Fill and cut slopes should be constructed at a maximum slope of 3:1 (horizontal to vertical).

3. If fill soils are placed on slopes exceeding a 10 percent gradient, benching will be required. A keyway will be required if slopes exceed 20 percent. Keys and benches should be a minimum of 10 feet wide, with a minimum 2 percent

gradient back into the slope (see Figure 4). The need for subdrain or backdrain systems should be evaluated by a representative of GSI Soils during grading.

4. If loose or unstable soils are encountered at the bottom of the excavation, these areas should be excavated a further 18 inches and a layer of stabilization fabric (Mirafi HP370 or equivalent) and Class II/III Base placed prior to placing fill. The base should be compacted to 90% of ASTM D1557-02

5. In order to help minimize potential settlement problems associated with structures supported on a non-uniform thickness of compacted fill, the soils engineer should be consulted for specific site recommendations during grading. In general, all proposed construction should be supported by a uniform thickness of compacted soil.

6. The above grading is based on the strength characteristics of the materials under conditions of normal moisture that would result from rain water and do not take into consideration the additional activating forces applied by seepage from springs or subsurface water. Areas of observed seepage should be provided with subsurface drains to release the hydrostatic pressures.

7. The near-surface soils may become partially or completely saturated during the rainy season. Grading operations during this time period may be difficult since the saturated materials may not be compactable and they may not support construction equipment. Consideration should be given to the seasonal limit of the grading operations on the site.

8. All final grades should be provided with a positive drainage gradient away from foundations. Final grades should provide for rapid removal of surface water runoff. Ponding of water should not be allowed on building pads or adjacent to foundations.

## 5.3 Preparation of Paved Areas

1. Pavement areas should be scarified to a depth of 12 inches below existing grade or finished subgrade. The soil should then be wetted to slightly above optimum moisture content and compacted with heavy equipment such that the upper one (1) foot is at a minimum of 90 percent of maximum dry density.

2. The upper 9 inches of subgrade beneath all paved areas should be compacted to at least 95 percent relative compaction. Subgrade soils should not be allowed to dry out or have excessive construction traffic between the time of water conditioning and compaction, and the time of placement of the pavement structural section.

## 5.4 Structural Fill

1. On-site soils (silty sands, sands & sandy silts) free of organic and deleterious material are suitable for use as structural fill. Structural fill should not contain rocks larger than 3 inches in greatest dimension, and should have no more than 15 percent larger than 1.5 inches in greatest dimension.

2. Select import (decomposed granite and Class II/III Base) should be free of organic and other deleterious material and should be non-expansive with a plasticity index of 10 or less and a sand equivalent of at least 30. Before delivery to the site, a sample of the proposed import should be tested in our laboratory to determine its suitability for use as structural fill.

3. Structural fill using on-site inorganic soil or approved import should be placed in layers, each not exceeding eight inches in thickness before compaction. On-site inorganic or imported soil should be conditioned with water, or allowed to dry, to produce a soil water content at approximately optimum value, and should be compacted to at least 90 percent relative compaction based on ASTM D1557-02.

### 5.5 Foundations

1. Conventional continuous footings and spread footings may be used for support of the proposed building. All of the foundation materials should be competent after preparation in accordance with the grading section of this report.

2. The perimeter footings should be at least 15 inches wide and embedded a minimum of 24 inches below pad grade or below adjacent finished grade, whichever is lower. Spread footing should be a minimum of 18 inches square and 24 inches deep and tied to the perimeter footings with grade beams (min. 12" wide by 24" deep). The reinforcement for the footings should be designed by the structural engineer; however, a minimum of four (4) No. 5 rebar should be provided, two (2) on the top and two (2) on the bottom for continuous footings and grade beams. Dowels (#3 rebar @ 18" o.c.) should also be provided to tie the footings and grade beams to the slab.

3. An allowable dead plus live load bearing pressure of 2,000 psf may be used for design. A total settlement of less than 1-inch is anticipated with differential settlements being 50 percent of this value.

4. The above allowable pressures are for support of dead plus live loads and may be increased by one-third for short term wind and seismic loads.

5. Lateral forces on structures may be resisted by passive pressure acting against the sides of shallow footings and/or friction between the soil and the bottom of the footing. For resistance to lateral loads, a friction factor of 0.35 may be utilized for sliding resistance at the base of the spread footings in undisturbed native materials or engineered fill. A passive resistance of 350 pcf equivalent fluid weight may be used against the side of shallow footings. If friction and passive pressures are combined, the lesser value should be reduced by 33 percent.

### 5.6 Slab-On-Grade Construction

1. Concrete slabs-on-grade and flatwork should not be placed directly on unprepared loose fill materials. Preparation of subgrade to receive concrete slabs-on-grade and flatwork should be processed as discussed in the preceding sections of this report.

2. Concrete slabs-on-grade should be underlain by a minimum of 4 inches of clean free-draining material such as clean gravel or permeable aggregate complying with Caltrans Standard Specifications 68, Class I, Type A or Type B, to service as a cushion and a capillary break. A 15-mil Stego-type membrane should be placed between the cushion and the slab to provide an effective vapor barrier, and to minimize moisture condensation under the floor covering. All seams through the vapor barrier should be overlapped and sealed. Where pipes extend through the vapor barrier, the barrier should be sealed to the pipes. Tears or punctures in the moisture barrier should be completely repaired. It is suggested that a 2-inch thick sand layer be placed on top of the membrane to assist in the curing of the concrete. The sand should be lightly moistened prior to placing concrete.

3. Concrete slabs-on-grade should be a minimum of 4 inches thick and should be reinforced with No. 3 reinforcing bars placed at 18 inches on-center both ways at or slightly above the center of the structural section. Reinforcing bars should have a minimum clear cover of 1.5 inches, and hot bars should be cooled prior to placing concrete. The aforementioned reinforcement may be used for anticipated uniform floor loads not exceeding 100 psf. If floor loads greater than 100 psf are anticipated the slab should be evaluated by a structural engineer.

4. All slabs should be poured at a maximum slump of less than 5 inches. Excessive water content is the major cause of concrete cracking. For design of concrete floors, a modulus of subgrade reaction of k = 100 psi per inch would be applicable to on-site engineered fill soils.

## 5.7 Retaining Walls

1. Retaining walls should be designed to resist lateral pressures from adjacent soils and surcharge loads applied behind the walls.

| **Lateral Pressure and Condition (Compacted Fill)** | | **Equivalent Fluid Pressure, pcf** | |
|---|---|---|---|
| | | **Unrestrained Wall** | **Rigidly Supported Wall** |
| **Active Case, Drained** | **Level-native sand soils** | 40 | -- |
| | **Level-granular backfill** | 30 | -- |
| **At-Rest Case, Drained** | **Level-native sand soils** | -- | 60 |
| | **Level-granular backfill** | | 50 |
| **Passive Case, Drained** | **Level**<br>**2:1 Sloping Down** | 350<br>200 | -- |
| For sloping backfill add 1 pcf for every 2 deg. (Active case) and 1.5 pcf for every 2 deg. (At-rest case) | | | |

2. Isolated retaining wall foundations should extend a minimum depth of 24 inches below lowest adjacent grade. An allowable toe pressure of 2,200 psf is recommended for footings founded on 12 inches of compacted soil. A coefficient of friction of 0.35 may be used between subgrade soil and concrete footings. If friction and passive pressures are combined, the lesser value should be reduced by 33 percent.

3. For retaining walls greater than 6 feet, as measured from the top of the foundation, a seismic horizontal surcharge of $10H^2$ (pounds per linear foot of wall) may be assumed to act on retaining walls. The surcharge will act at a height of 0.6H above the wall base (where H is the height of the wall in feet). This surcharge force shall be added to an active design equivalent fluid pressure of 40 pounds per square foot of depth for the seismic condition

4. In addition to the lateral soil pressure given above, the retaining walls should be designed to support any design live load, such as from vehicle and construction

surcharges, etc., to be supported by the wall backfill. If construction vehicles are required to operate within 10 feet of a wall, supplemental pressures will be induced and should be taken into account through design.

5. The above-recommended pressures are based on the assumption that sufficient subsurface drainage will be provided behind the walls to prevent the build-up of hydrostatic pressure. To achieve this we recommend that a filter material be placed behind all proposed walls. The blanket of filter material should be a minimum of 12 inches thick and should extend from the bottom of the wall to within 12 inches of the ground surface. The top 12 inches should consist of water conditioned, compacted, native soil. A 4-inch diameter drain pipe should be installed near the bottom of the filter blanket with perforations facing down. The drain pipe should be underlain by at least 4 inches of filter type material. Adequate gradients should be provided to discharge water that collects behind the retaining wall to an adequately controlled discharge system with suitably projected outlets. The filter material should conform to Class I, Type B permeable material as specified in Section 68 of the California Department of Transportation Standard Specifications, current edition. A typical 1" x #4 concrete coarse aggregate mix approximates this specification.

6. For hydrostatic loading conditions (i.e. no free drainage behind retaining wall), an additional loading of 45 pcf equivalent fluid weight should be added to the above soil pressures. If it is necessary to design for submerged conditions, allowed bearing and passive pressures should be reduced by 33 percent. In addition, soil friction beneath the base of the foundations should be neglected.

7. Precautions should be taken to ensure that heavy compaction equipment is not used immediately adjacent to walls, so as to prevent movement of, the walls.

### 5.8 Pavement Design

1. The following table provides recommended pavement sections based on an R-Value of 40 for the near surface silty sand soils encountered at the site.

| RECOMMENDED MINIMUM ASPHALT CONCRETE PAVEMENT SECTIONS DESIGN THICKNESS | | |
|---|---|---|
| **T.I.** | **A.C.-in.** | **A.B.-in.** |
| 4.5 | 2.5 | 6.0 |
| 5.0 | 2.5 | 6.0 |
| 5.5 | 3.0 | 6.0 |
| 6.0 | 3.0 | 7.0 |
| 7.0 | 3.5 | 8.0 |

**T.I. =** **Traffic Index**
**A.C. =** **Asphaltic Concrete - must meet specifications for Caltrans Type B Asphalt Concrete**
**A.B. =** **Aggregate Base - must meet specifications for Caltrans Class II Aggregate Base (R-Value = minimum 78)**

2. R-value samples should be obtained and tested at the completion of rough grading and the pavement sections confirmed or revised. All sections should be crowned for good drainage. All asphalt pavement construction and materials used should conform with Sections 26 and 39 of the latest edition of the Standard Specifications, State of California, Department of Transportation. Aggregate bases and sub-bases should also be compacted to a minimum relative compaction of 95 percent based ASTM D1557-02.

3. Using the R-Value of 40, a Modulus of Rupture for concrete of 550 psi (based on a minimum strength of 3,500 psi) minimum pavement sections are presented in the following table for Traffic Indices (TI) of 4.5 to 7.0.

| RECOMMENDED MINIMUM CONCRETE PAVEMENT SECTIONS | | |
|---|---|---|
| **Traffic Index (T.I.)** | **Concrete inches (ft)** | **Caltrans Class II Aggregate Base inches* (ft)** |
| 4.5 | 5.5 (.46) | 4.0 (.33) |
| 5.0 | 6.0 (.50) | 4.0 (.33) |
| 6.0 | 6.5 (.54) | 6.0 (.50) |
| 7.0 | 7.0 (.58) | 6.0 (.50) |

4. Concrete pavement construction should generally comply with the requirements of Sections 40 and 90 of the latest edition of the Standard Specifications, State of California, Department of Transportation.

5. Recommendations for mix design; curing, joints and reinforcement should be as promulgated by the Portland Cement Association. Control and construction joints should be used to separate the pavements into approximately square shaped areas at a spacing of no more than 2.0 times the slab thickness in feet (i.e. 4" slab, joints at 8' o.c.) or 15 feet on-center, each way, whichever is less. A concrete shrinkage of approximately 1/16-inch per 10 feet of length should be anticipated and joints should be designed accordingly.

6. It is recommended that all joints in and adjacent to the PCC pavement be sealed to preclude entry of water into the soils underlying paved areas.

### 5.9 Underground Facilities Construction

1. The attention of contractors, particularly the underground contractors, should be drawn to the State of California Construction Safety Orders for "Excavations, Trenches, Earthwork". Trenches or excavations greater than 5 feet in depth should be shored or sloped back in accordance with OSHA Regulations prior to entry.

2. For purposes of this section of the report, bedding is defined as material placed in a trench up to 1 foot above a utility pipe and backfill is all material placed in the trench above the bedding. Unless concrete bedding is required around utility pipes, free-draining sand should be used as bedding. Sand proposed for use as bedding should be tested in our laboratory to verify its suitability and to measure its compaction characteristics. Sand bedding should be compacted by mechanical means to achieve at least 90 percent relative compaction based on ASTM Test D1557-02.

3. On-site inorganic soil, or approved import, may be used as utility trench backfill. Proper compaction of trench backfill will be necessary under and adjacent to structural fill, building foundations, concrete slabs and vehicle pavements. In these areas, backfill should be conditioned with water (or allowed to dry), to produce a soil water content of about 2 to 3 percent above the optimum value and placed in horizontal layers each not exceeding 8 inches in thickness before compaction. Each layer should be compacted to at least 90 percent relative compaction based on ASTM Test D1557-02. The top lift of trench backfill under vehicle pavements should be compacted to the requirements given in report section 5.3 for vehicle pavement subgrades. Trench walls must be kept moist prior to and during backfill placement.

### 5.10 Surface and Subsurface Drainage

1. Concentrated surface water runoff within or immediately adjacent to the site should be conveyed in pipes or in lined channels to discharge areas that are relatively level or that are adequately protected against erosion.

2. Water from roof downspouts should be conveyed in pipes that discharge in areas a safe distance away from structures. Surface drainage gradients should be planned to prevent ponding and promote drainage of surface water away from building foundations, edges of pavements and sidewalks. For soil areas we recommend that a minimum of five (5) percent gradient be maintained.

3. Careful attention should be paid to erosion protection of soil surfaces adjacent to the edges of roads, curbs and sidewalks, and in other areas where "hard" edges of structures may cause concentrated flow of surface water runoff. Erosion resistant matting such as Miramat, or other similar products, may be considered for lining drainage channels.

4. Subdrains should be placed in established drainage courses and potential seepage areas. The location of subdrains should be determined during grading. The subdrain outlet should extend into a suitable protected area or could be

connected to the proposed storm drain system. The outlet pipe should consist of an unperforated pipe the same diameter as the perforated pipe.

### 5.11 Temporary Excavations and Slopes

1. Conventional earth moving equipment should be adequate to excavate the soils at the site.

2. We recommend that temporary trench walls exceeding five (5) feet in depth be sloped at an inclination of 1½:1 (horizontal:vertical). However, during the rainy season, or where soft or loose sediments, or perched water conditions are found, slopes of 2:1 (horizontal:vertical) or less are more likely.

3. It should be noted that it is the *Contractor's* responsibility to maintain safe cut slopes based on actual field conditions and according to OSHA requirements. Temporary Slopes at gradients of 1½:1 should not be open for more than 2 to 3 days. In some geologic units, perched water may be present locally in the slope face. The stability of the slopes may be compromised somewhat where these conditions exist due to softening or piping of the saturated materials.

4. As noted previously, shallow perched ground water should be anticipated during the winter months and dewatering may be necessary for grading of the site. The *Contractor* should be responsible for proper design, installation, and operation of dewatering facilities during construction.

5. Where the excavation bottom is locally wet, soft and yielding, it is recommended that the bottom be stabilized prior to placement of fill. Methods such as the use of pit-run gravels and cobbles on the excavated bottom covered with a geotextile fabric such as Mirafi HP370 or placement of a Class II base material over a similar fabric could be used. The *Contractor* should be responsible for design and implementation of stabilization techniques.

6. Where the temporary trench slopes are inclined as described above, no shoring is required. However, where adjacent features may influence establishment of appropriate slopes, the *Contractor* may elect to use shoring. In no case should personnel enter trenches with vertical sidewalls greater than 5 feet deep without proper shoring. Design and installation of the shoring should be the responsibility of the *Contractor* and should be performed according to OSHA requirements.

7. Shoring should be designed to resist the lateral earth pressures provided, assuming no hydrostatic loads. If ground water is encountered the shoring should be designed for the required hydrostatic pressures.

## 5.12 Geotechnical Observation and Testing

1. Field exploration and site reconnaissance provides only a limited view of the geotechnical conditions of the site. Substantially more information will be revealed during the excavation and grading phases of the construction. Stripping & clearing of vegetation, overexcavation, scarification, fill and backfill placement and compaction should be reviewed by the geotechnical professional during construction.

2. Special inspection of grading should be provided in accordance with California Building Code Section 1705.6 and Table 1705.6. The special inspector should be under the direction of the engineer.

**CBC TABLE 1705.6 REQUIRED VERIFICATION AND INSPECTION OF SOILS**

| VERIFICATION AND INSPECTION TASK | CONTINUOUS DURING TASK LISTED | PERIODIC DURING TASK LISTED |
|---|---|---|
| 1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity | | X |
| 2. Verify excavations are extended to proper depth and have reached proper material | | X |
| 3. Perform classification and testing of compacted fill | | X |
| 4. Verify use of proper materials, densities and lift thicknesses during placement and compaction of compacted fill | X | |
| 5. Prior to placement of compacted fill, observe subgrade and verify that site has been prepared properly. | | X |
| | | |

3. The validity of the recommendations contained in this report are also dependent upon a prescribed testing and observation program. Our firm assumes no responsibility for construction compliance with these design concepts and recommendations unless we have been retained to perform on-site testing and review during all phases of site preparation, grading, and foundation/slab construction. The Geotechnical Engineer should be notified at least two (2) working days before site clearing or grading operations commence to develop a program of quality control.

## 6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. It should be noted that it is the responsibility of the owner or his/her representative to notify **GSI Soils Inc.** a minimum of 48 hours before any stripping, grading, or foundation excavations can commence at this site.

2. The recommendations of this report are based upon the assumption that the soil conditions do not deviate from those disclosed during our study. Should any variations or undesirable conditions be encountered during grading of the site **GSI Soils Inc,**, will provide supplemental recommendations as dictated by the field conditions.

3. This report is issued with the understanding that it is the responsibility of the owner or his/her representative to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project, and incorporated into the project plans and specifications. The owner or his/her representative is responsible to ensure that the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

4. As of the present date, the findings of this report are valid for the property studied. With the passage of time, changes in the conditions of a property can occur whether they be due to natural processes or to the works of man on this or adjacent properties. Legislation or the broadening of knowledge may result in

changes in applicable standards. Changes outside of our control may find this report to be invalid, wholly or partially. Therefore, this report should not be relied upon after a period of three (3) years without our review nor is it applicable for any properties other than those studied.

Thank you for the opportunity to have been of service in preparing this report. If you have any questions or require additional assistance, please feel free to contact the undersigned at (805) 349-0140.

Sincerely,
**GSI SOILS INC.**

R Church

Rick Armero
Project Manager

Ronald J. Church
GE #2184

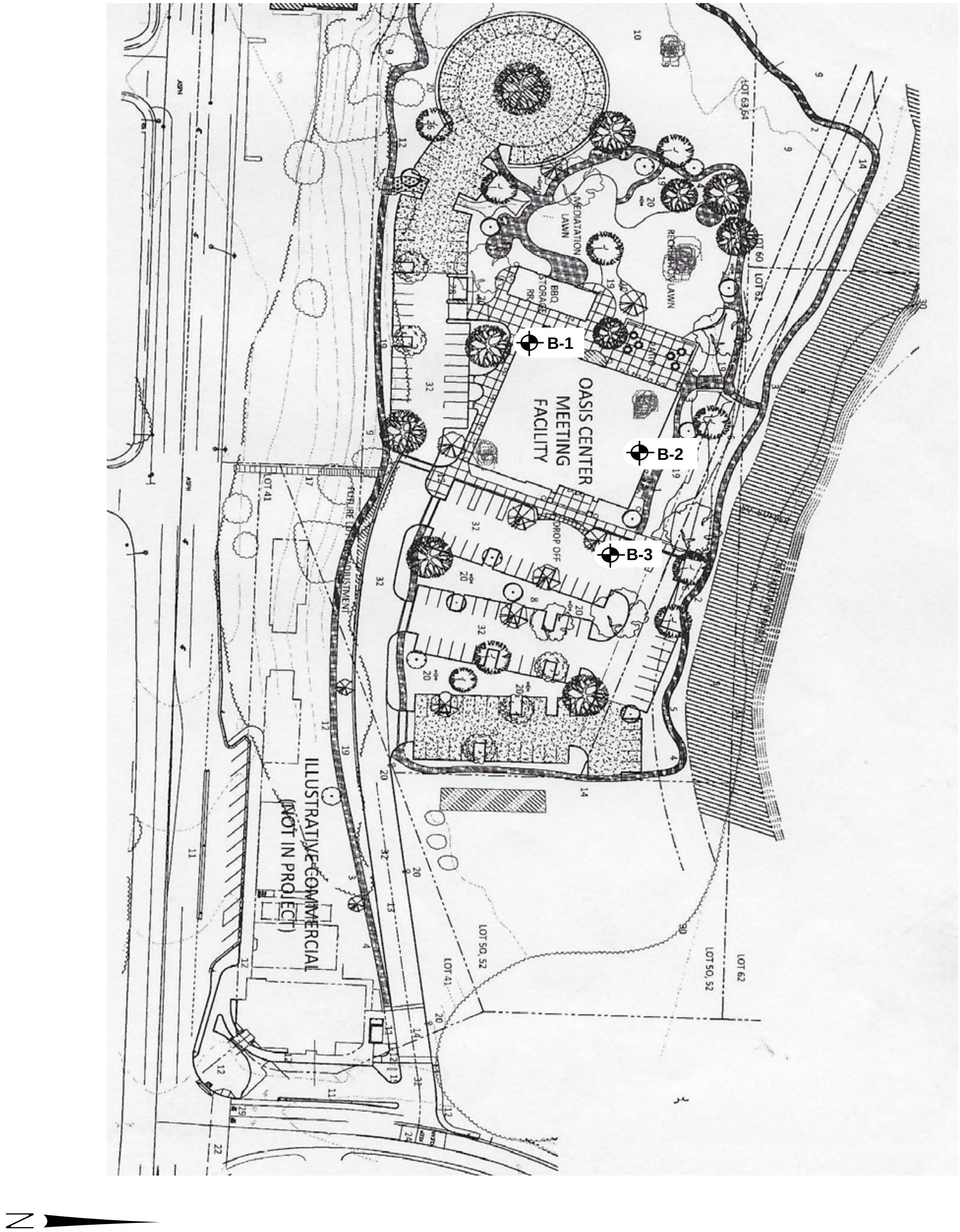
REGISTERED PROFESSIONAL ENGINEER
RONALD J. CHURCH
GE2184
GEOTECHNICAL
STATE OF CALIFORNIA

# FIGURES

GSI

SITE MAP
OASIS CENTER MEETING FACILITY
CLARK AVENUE & FOXENWOOD LANE
ORCUTT, CALIFORNIA

| Project No. | Figure No. |
|---|---|
| 16-7382 | 1 |



⊕ Boring Location

GSI

## SITE PLAN
## OASIS CENTER MEETING FACILITY
## CLARK AVENUE & FOXENWOOD LANE
## ORCUTT, CALIFORNIA

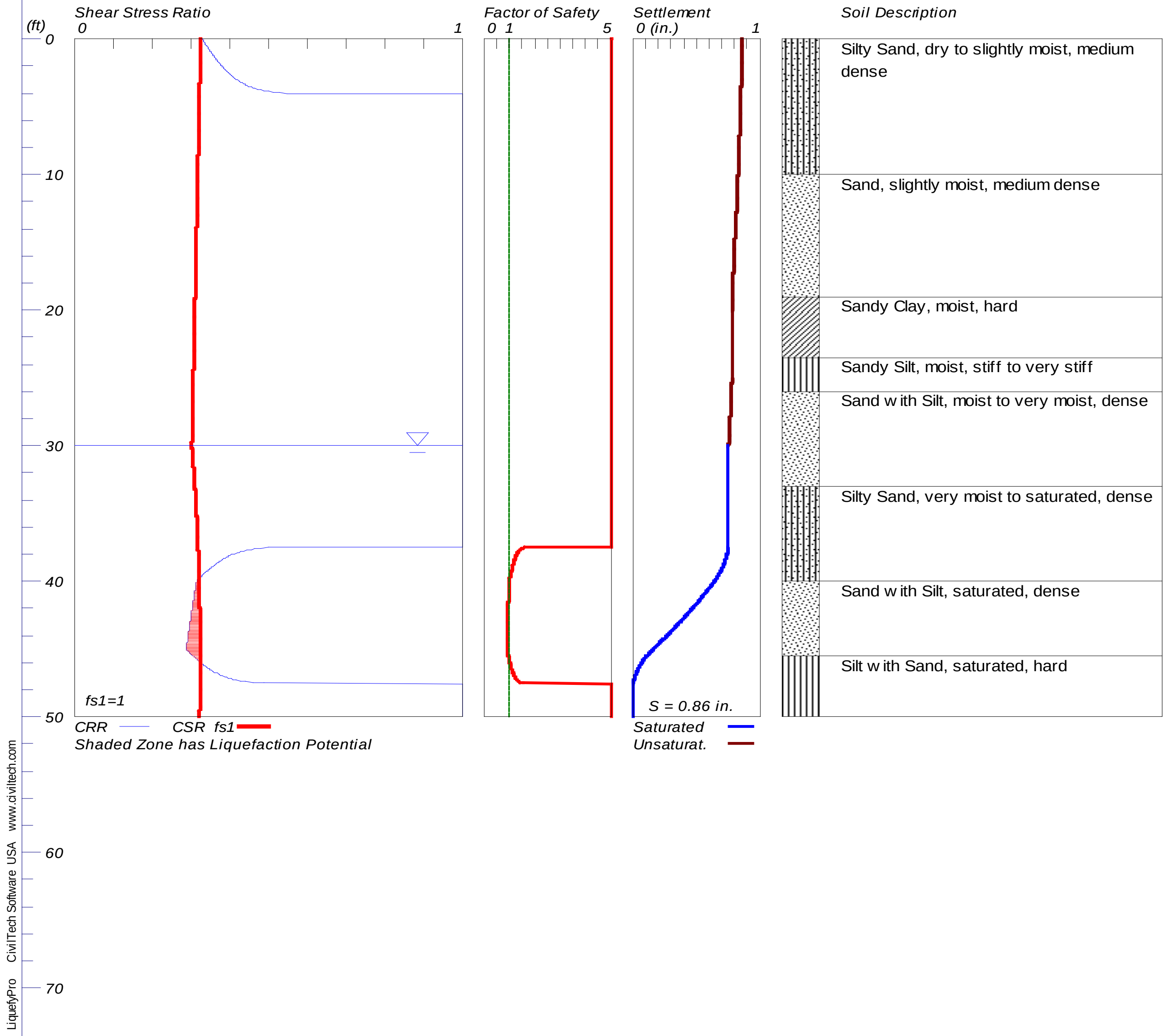
| Project No. | Figure No. |
|---|---|
| 16-7382 | 2 |

# LIQUEFACTION ANALYSIS

## OASIS CENTER

***Hole No.=B-1   Water Depth=30 ft   Surface Elev.=330***

***Magnitude=7.2***
***Acceleration=0.5g***



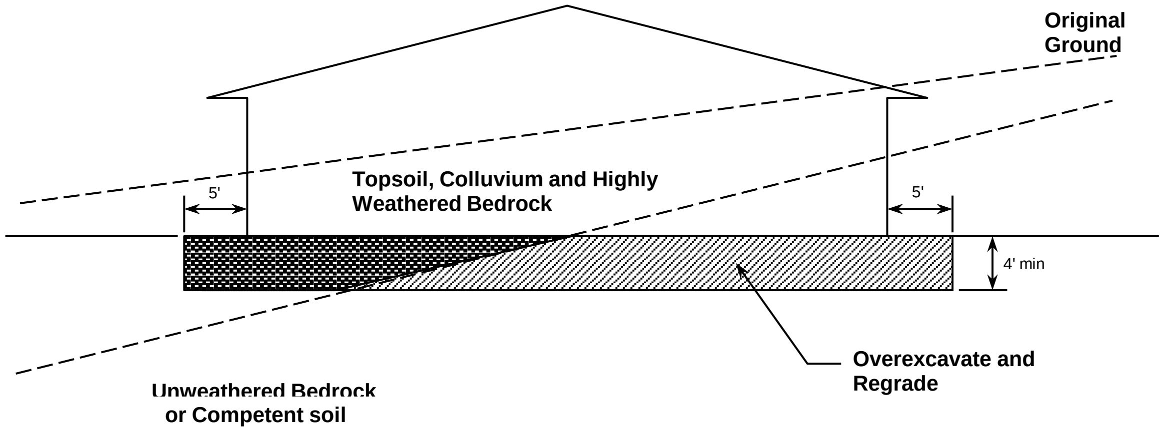
**CivilTech Corporation**   **16-7382**

**LIQUEFACTION ANALYSIS**
**OASIS CENTER MEETING FACILITY**
**CLARK AVENUE & FOXENWOOD LANE**
**ORCUTT, CALIFORNIA**

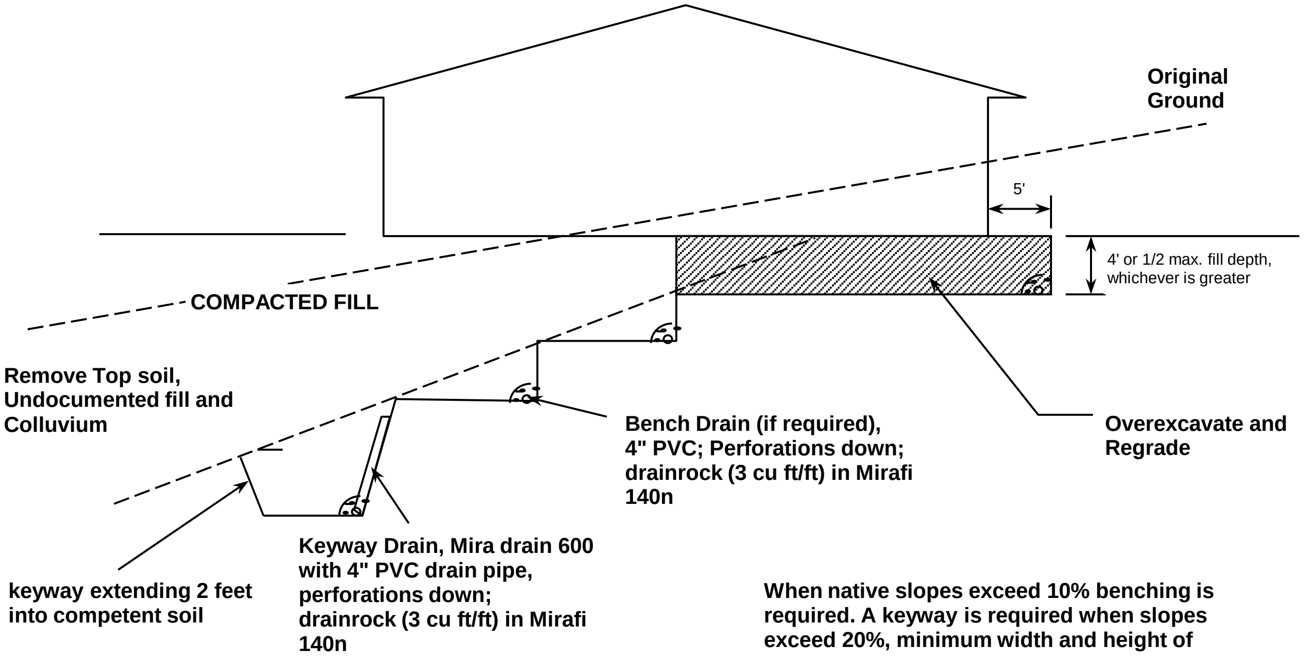
| Project No. | Figure No. |
|---|---|
| 16-7382 | 3 |

# GENERAL GRADING RECOMMENDATIONS

## CUT LOT



## CUT/FILL LOT TRANSITION



When native slopes exceed 10% benching is required. A keyway is required when slopes exceed 20%, minimum width and height of keyways and benches is 10 feet & 4 feet respectively.

| GSI | HILLSIDE GRADING | Project No. | Figure No. |
|---|---|---|---|
| | | 16-7382 | 4 |

# APPENDIX A

Field Investigation
Key to Boring Log
Boring Logs

# FIELD INVESTIGATION

## Test Hole Drilling

The field investigation was conducted on April 26, 2016. Three (3) exploratory borings were drilled at the approximate locations indicated on the Site Plan, Figure 2. The location of these borings was approximated in the field.

Undisturbed and bulk samples were obtained at various depths during test hole drilling. The undisturbed samples were obtained by driving a 2.4-inch inside diameter sampler into soils. Bulk samples were also obtained during drilling.

## Logs of Boring

A continuous log of soils, as encountered in the borings was recorded at the time of the field investigation, by a Staff Engineer. The Exploration Boring Logs are attached.

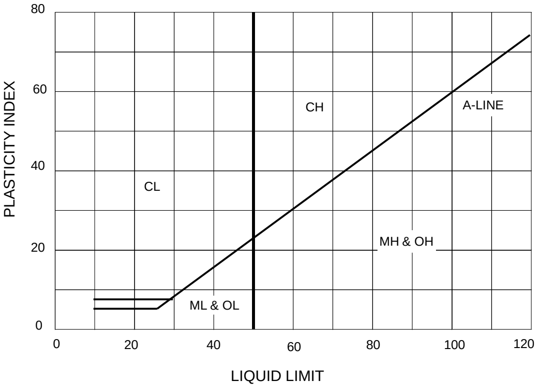
Locations and depth of sampling, in-situ soil dry densities and moisture contents are tabulated in the Boring Logs.

## UNIFIED SOIL CLASSIFICATION SYSTEMS

| MAJOR DIVISION | | | SYMBOLS | TYPICAL NAMES |
|---|---|---|---|---|
| COARSE GRAINED SOILS Over 50% > #200 sieve | GRAVELS Over 50% > #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 12% FINES | GM | SILTY GRAVELS, POORLY GRADED GRAVEL-SAND-SILT MIXTURES |
| | | | GC | CLAYEY GRAVELS, POORLY GRADED GRAVEL-SAND-CLAY MIXTURES |
| | SANDS Over 50% < #4 sieve | CLEAN SANDS WITH LITTLE OR NO FINES | SW | WELL GRADED SANDS, GRAVELLY SANDS |
| | | | SP | POORLY GRADED SANDS, GRAVELLY SANDS |
| | | SANDS WITH OVER 12% FINES | SM | SILTY SANDS, POORLY GRADED SAND-SILT MIXTURES |
| | | | SC | CLAYEY SANDS, POORLY GRADED SAND-CLAY MIXTURES |
| FINE GRAINED SOILS Over 50% < #200 sieve | SILTS AND CLAYS Liquid limit < 50 | | ML | INORGANIC SILTS, SILTY OR CLAYEY FINE SANDS, OR CLAYEY SILTS WITH SLIGHT PLASTICITY |
| | | | CL | INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS |
| | | | OL | ORGANIC CLAYS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY |
| | SILTS AND CLAYS Liquid limit > 50 | | MH | INORGANIC SILTS , MICACEOUS OR DIATOMACIOUS 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 CLAYS | | | Pt | PEAT AND OTHER HIGHLY ORGANIC SOILS |

## PLASTICITY CHART

USED FOR CLASSIFICATION OF FINE GRAINED SOILS



## SOIL GRAIN SIZE

U.S. STANDARD SIEVE

6" 3" 3/4" 4 10 40 200

| BOULDERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

150 75 19 4.75 2.0 0.425 0.075 0.002

SOIL GRAIN SIZE IN MILLIMETERS

## SAMPLE DRIVING RECORD

| BLOWS PER FOOT | DESCRIPTION |
|---|---|
| 25 | 25 BLOWS DROVE SAMPLER 12 INCHES, AFTER INITIAL 6 INCHES OF SEATING |
| 50/7" | 50 BLOWS DROVE SAMPLER 7 INCHES, AFTER INITIAL 6 INCHES OF SEATING |
| Ref/3" | 50 BLOWS DROVE SAMPLER 3 INCHES DURING OR AFTER INITIAL 6 INCHES OF SEATING |

NOTE: TO AVOID DAMAGE TO SAMPLING TOOLS, DRIVING IS LIMITED TO 50 BLOWS PER 6 INCHES DURING OR AFTER SEATING INTERVAL

## KEY TO TEST DATA

| | | | |
|---|---|---|---|
| B | Bag Sample | CONS | Consolidation (ASTM D2435) |
| ◫ | Drive, No Sample Collected | DS | Cons. Drained Direct Shear (ASTM D3080) |
| ⧄ | 2 1/2" O.D. Mod. California Sampler, Not Tested | PP | Pocket Penetrometer |
| ◪ | 2 1/2" O.D. Mod. California Sampler, Tested | GSD | Grain Size Distribution (ASTM D422) |
| ◼ | Standard Penetration Test | CP | Compaction Test (ASTM D1557) |
| ⧇ | Sample Attempted with No Recovery | EI | Expansion Index (ASTM D4829) |
| ▽ | Water Level at Time of Drilling | LL | Liquid Limit (in percent) |
| ▼ | Water Level after Drilling | PI | Plasticity Index |

RELATIVE DENSITY

| SANDS, GRAVELS, AND NON PLASTIC SILTS | BLOWS/FOOT |
|---|---|
| VERY LOOSE | 0 - 4 |
| LOOSE | 4 - 10 |
| MEDIUM DENSE | 10 - 30 |
| DENSE | 30 - 50 |
| VERY DENSE | OVER 50 |

RELATIVE DENSITY

| CLAYS AND PLASTIC SILTS | STRENGTH | BLOWS/FOOT |
|---|---|---|
| VERY SOFT | 0 - 1/4 | 0 - 2 |
| SOFT | 1/4 - 1/2 | 2 - 4 |
| FIRM | 1/2 - 1 | 4 - 8 |
| STIFF | 1 - 2 | 8 - 16 |
| VERY STIFF | 2 - 4 | 16 - 32 |
| HARD | OVER 4 | OVER 32 |

GSI

PROJECT NO.: 16-7382
DATE DRILLED: 4/26/2016

**SOIL CLASSIFICATION CHART AND BORING LOG LEGEND**

**OASIS CENTER MEETING FACILITY**
**ORCUTT, CALIFORNIA**

FIGURE NO.
**A-1**

LOGGED BY: **DG** DRILL RIG: **Simco 2400** BORING NO.: **B-1**

ELEVATION: **330'** BORING DIAMETER (INCH): **5** DATE DRILLED: **26 April 2016**

GROUNDWATER DEPTH (FT): **35.0**

| ELEVATION (FT) | DEPTH (FT) | GRAPHIC LOG | GEOTECHNICAL DESCRIPTION | SOIL TYPE | SAMPLE | CONV. SPT BLOW COUNT | WATER CONTENT (%) | DRY DENSITY (PCF) | LIQUID LIMIT | PLASIT. INDEX | UNC. COMP. STRENGTH (PSF) | COMMENTS AND ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silty Sand: dark yellowish brown, dry to slightly moist, fine to medium grained, some clay, loose | SM-SC | | | | | | | | |
| 329 | 1 | | | | | | | | | | | |
| 328 | 2 | | | | B | | 2.1 | | | | | |
| 327 | 3 | | slightly moist, medium dense | | ◢ | 15 | 4.2 | 103.2 | | | | |
| 326 | 4 | | | | | | | | | | | |
| 325 | 5 | | | | B | | 4.8 | | | | | |
| 324 | 6 | | | | | | | | | | | |
| 323 | 7 | | | | ‖ | 23 | 4.9 | | | | | |
| 322 | 8 | | | | | | | | | | | |
| 321 | 9 | | | | B | | | | | | | |
| 320 | 10 | | Sand: brown, slightly moist, fine to medium grained, some silt, trace clay, medium dense | SP-SC | | | | | | | | |
| 319 | 11 | | | | | | | | | | | |
| 318 | 12 | | | | B | | 2.8 | | | | | |
| 317 | 13 | | | | | | | | | | | |
| 316 | 14 | | | | ‖ | 28 | 4.5 | | | | | |
| 315 | 15 | | | | | | | | | | | |
| 314 | 16 | | some clay, moist | | | | | | | | | |
| 313 | 17 | | | | B | | 10.6 | | | | | |
| 312 | 18 | | | | | | | | | | | |
| 311 | 19 | | Sandy Clay: brown, moist, some silt, hard | CL | | | | | | | | |
| 310 | 20 | | | | ‖ | 47 | 12.7 | | | | | |

## EXPLORATORY BORING LOGS

GSI

**OASIS CENTER MEETING FACILITY**
**CLARK AVENUE & FOXENWOOD LANE**

| PROJECT NO. | DATE | FIGURE NO. |
|---|---|---|
| **16-7382** | **May-16** | **A-2** |

LOGGED BY: **DG** DRILL RIG: **Simco 2400** BORING NO.: **B-1** **(CONT.)**

ELEVATION: **330'** BORING DIAMETER (INCH): **5** DATE DRILLED: **26 April 2016**

GROUNDWATER DEPTH (FT): **35.0**

| ELEVATION (FT) | DEPTH (FT) | GRAPHIC LOG | GEOTECHNICAL DESCRIPTION | SOIL TYPE | SAMPLE | CONV. SPT BLOW COUNT | WATER CONTENT (%) | DRY DENSITY (PCF) | LIQUID LIMIT | PLASIT. INDEX | UNC. COMP. STRENGTH (PSF) | COMMENTS AND ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sandy Clay: brown, moist, trace silt, hard | CL | | | | | | | | |
| 309 | 21 | | | | | | | | | | | |
| 308 | 22 | | | | B | | 13.5 | | | | | |
| 307 | 23 | | | | | | | | | | | |
| 306 | 24 | | Sandy Silt: brown, moist, trace clay, stiff to very stiff | ML | | | | | | | | |
| 305 | 25 | | | | B | | | | | | | |
| 304 | 26 | | Sand with Silt: brown, moist to very moist, fine to medium grained, trace clay, dense | SP-SM | | | | | | | | |
| 303 | 27 | | | | | | | | | | | |
| 302 | 28 | | | | | | | | | | | |
| 301 | 29 | | | | ▮ | 38 | 11.7 | | | | | |
| 300 | 30 | | | | | | | | | | | |
| 299 | 31 | | | | | | | | | | | |
| 298 | 32 | | | | B | | | | | | | |
| 297 | 33 | | Silty Sand: brown, very moist to saturated, fine to medium grained, dense | SM | | | | | | | | |
| 296 | 34 | | | | | | | | | | | |
| 295 | 35 | | ▽<br>saturated | | | | | | | | | |
| 294 | 36 | | | | | | | | | | | |
| 293 | 37 | | | | B | | | | | | | |
| 292 | 38 | | | | | | | | | | | |
| 291 | 39 | | | | | | | | | | | |
| 290 | 40 | | | | | | | | | | | |

## EXPLORATORY BORING LOGS

GSI

**OASIS CENTER MEETING FACILITY**
**CLARK AVENUE & FOXENWOOD LANE**

| PROJECT NO. | DATE | FIGURE NO. |
|---|---|---|
| **16-7382** | **May-16** | **A-3** |

LOGGED BY: **DG** DRILL RIG: **Simco 2400** BORING NO.: **B-1 (CONT.)**

ELEVATION: **330'** BORING DIAMETER (INCH): **5** DATE DRILLED: **26 April 2016**

GROUNDWATER DEPTH (FT): **35.0**

| ELEVATION (FT) | DEPTH (FT) | GRAPHIC LOG | GEOTECHNICAL DESCRIPTION | SOIL TYPE | SAMPLE | CONV. SPT BLOW COUNT | WATER CONTENT (%) | DRY DENSITY (PCF) | LIQUID LIMIT | PLASIT. INDEX | UNC. COMP. STRENGTH (PSF) | COMMENTS AND ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sand with Silt: brown, saturated, trace clay, dense | SP-SM | | | | | | | | |
| 289 | 41 | | | | | | | | | | | |
| 288 | 42 | | | | | | | | | | | |
| 287 | 43 | | | | B | | | | | | | |
| 286 | 44 | | | | | | | | | | | |
| 285 | 45 | | | | | | | | | | | |
| 284 | 46 | | Silt with Sand: brown, saturated, trace clay, hard | ML-SM | | | | | | | | |
| 283 | 47 | | | | | | | | | | | |
| 282 | 48 | | | | B | | | | | | | |
| 281 | 49 | | | | | | | | | | | |
| 280 | 50 | | Boring terminated at 50 feet | | | | | | | | | |
| 279 | 51 | | | | | | | | | | | |
| 278 | 52 | | | | | | | | | | | |
| 277 | 53 | | | | | | | | | | | |
| 276 | 54 | | | | | | | | | | | |
| 275 | 55 | | | | | | | | | | | |
| 274 | 56 | | | | | | | | | | | |
| 273 | 57 | | | | | | | | | | | |
| 272 | 58 | | | | | | | | | | | |
| 271 | 59 | | | | | | | | | | | |
| 270 | 60 | | | | | | | | | | | |

## EXPLORATORY BORING LOGS

GSI

**OASIS CENTER MEETING FACILITY**
**CLARK AVENUE & FOXENWOOD LANE**

| PROJECT NO. | DATE | FIGURE NO. |
|---|---|---|
| **16-7382** | **May-16** | **A-4** |

LOGGED BY: **DG** DRILL RIG: **Simco 2400** BORING NO.: **B-2**

ELEVATION: **330'** BORING DIAMETER (INCH): **5** DATE DRILLED: **26 April 2016**

GROUNDWATER DEPTH (FT):

| ELEVATION (FT) | DEPTH (FT) | GRAPHIC LOG | GEOTECHNICAL DESCRIPTION | SOIL TYPE | SAMPLE | CONV. SPT BLOW COUNT | WATER CONTENT (%) | DRY DENSITY (PCF) | LIQUID LIMIT | PLASIT. INDEX | UNC. COMP. STRENGTH (PSF) | COMMENTS AND ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silty Sand: brown, slightly moist, fine to medium grained, loose | SM | | | | | | | | |
| 329 | 1 | | | | | | | | | | | |
| 328 | 2 | | | | B | | 3.2 | | | | | |
| 327 | 3 | | Silt with Sand: light brown, slightly moist, fine to medium grained, very stiff | ML-SM | ◢ | 30 | 3.3 | | | | | |
| 326 | 4 | | | | | | | | | | | |
| 325 | 5 | | | | B | | 3.5 | | | | | |
| 324 | 6 | | | | | | | | | | | |
| 323 | 7 | | | | | | | | | | | |
| 322 | 8 | | | | | | | | | | | |
| 321 | 9 | | hard | | ▮▮ | 37 | 4.3 | | | | | |
| 320 | 10 | | | | | | | | | | | |
| 319 | 11 | | Silty Sand: brown, moist, fine to medium grained, medium dense | ML | | | | | | | | |
| 318 | 12 | | | | | | | | | | | |
| 317 | 13 | | | | B | | 7.8 | | | | | |
| 316 | 14 | | | | | | | | | | | |
| 315 | 15 | | very dense | | ▮▮ | 51 | | | | | | |
| 314 | 16 | | Boring terminated at 16 feet | | | | | | | | | |
| 313 | 17 | | | | | | | | | | | |
| 312 | 18 | | | | | | | | | | | |
| 311 | 19 | | | | | | | | | | | |
| 310 | 20 | | | | | | | | | | | |

## EXPLORATORY BORING LOGS

## OASIS CENTER MEETING FACILITY
## CLARK AVENUE & FOXENWOOD LANE

| PROJECT NO. | DATE | FIGURE NO. |
|---|---|---|
| **16-7382** | **May-16** | **A-5** |

LOGGED BY: **DG** DRILL RIG: **Simco 2400** BORING NO.: **B-3**

ELEVATION: **330'** BORING DIAMETER (INCH): **5** DATE DRILLED: **26 April 2016**

GROUNDWATER DEPTH (FT):

| ELEVATION (FT) | DEPTH (FT) | GRAPHIC LOG | GEOTECHNICAL DESCRIPTION | SOIL TYPE | SAMPLE | CONV. SPT BLOW COUNT | WATER CONTENT (%) | DRY DENSITY (PCF) | LIQUID LIMIT | PLASIT. INDEX | UNC. COMP. STRENGTH (PSF) | COMMENTS AND ADDITIONAL TESTS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Silty Sand: brown, slightly moist, fine to medium grained, loose | SM | | | | | | | | |
| 329 | 1 | | | | | | | | | | | |
| 328 | 2 | | | | B | | 2.9 | | | | | |
| 327 | 3 | | | | | | | | | | | |
| 326 | 4 | | Silt with Sand: light brown, slightly moist, fine to medium grained, very stiff | ML-SM | | | | | | | | |
| 325 | 5 | | | | ▮ | 24 | 3.6 | | | | | |
| 324 | 6 | | | | | | | | | | | |
| 323 | 7 | | | | | | | | | | | |
| 322 | 8 | | | | | | | | | | | |
| 321 | 9 | | | | | | | | | | | |
| 320 | 10 | | hard | | ▮ | 45 | 5.8 | | | | | |
| 319 | 11 | | Boring terminated at 11 feet | | | | | | | | | |
| 318 | 12 | | | | | | | | | | | |
| 317 | 13 | | | | | | | | | | | |
| 316 | 14 | | | | | | | | | | | |
| 315 | 15 | | | | | | | | | | | |
| 314 | 16 | | | | | | | | | | | |
| 313 | 17 | | | | | | | | | | | |
| 312 | 18 | | | | | | | | | | | |
| 311 | 19 | | | | | | | | | | | |
| 310 | 20 | | | | | | | | | | | |

## EXPLORATORY BORING LOGS

GSI

**OASIS CENTER MEETING FACILITY**
**CLARK AVENUE & FOXENWOOD LANE**

| PROJECT NO. | DATE | FIGURE NO. |
|---|---|---|
| **16-7382** | **May-16** | **A-6** |

# APPENDIX B

Laboratory Testing
Moisture-Density Tests
Direct Shear Test
R-Value Test
Expansion Index Test

# LABORATORY TESTING

## Moisture-Density Tests

The field moisture content, as a percentage of the dry weight of the soil, was determined by weighing samples before and after oven drying. Dry densities, in pounds per cubic foot, were also determined for the undisturbed samples. Results of these determinations are shown in the Exploration Drill Hole Logs.

## Direct Shear Test

Direct shear tests were performed on undisturbed samples, to determine strength characteristics of the soil. The test specimens were soaked prior to testing. Results of the shear strength tests are attached.

## Resistance (R) Value Test

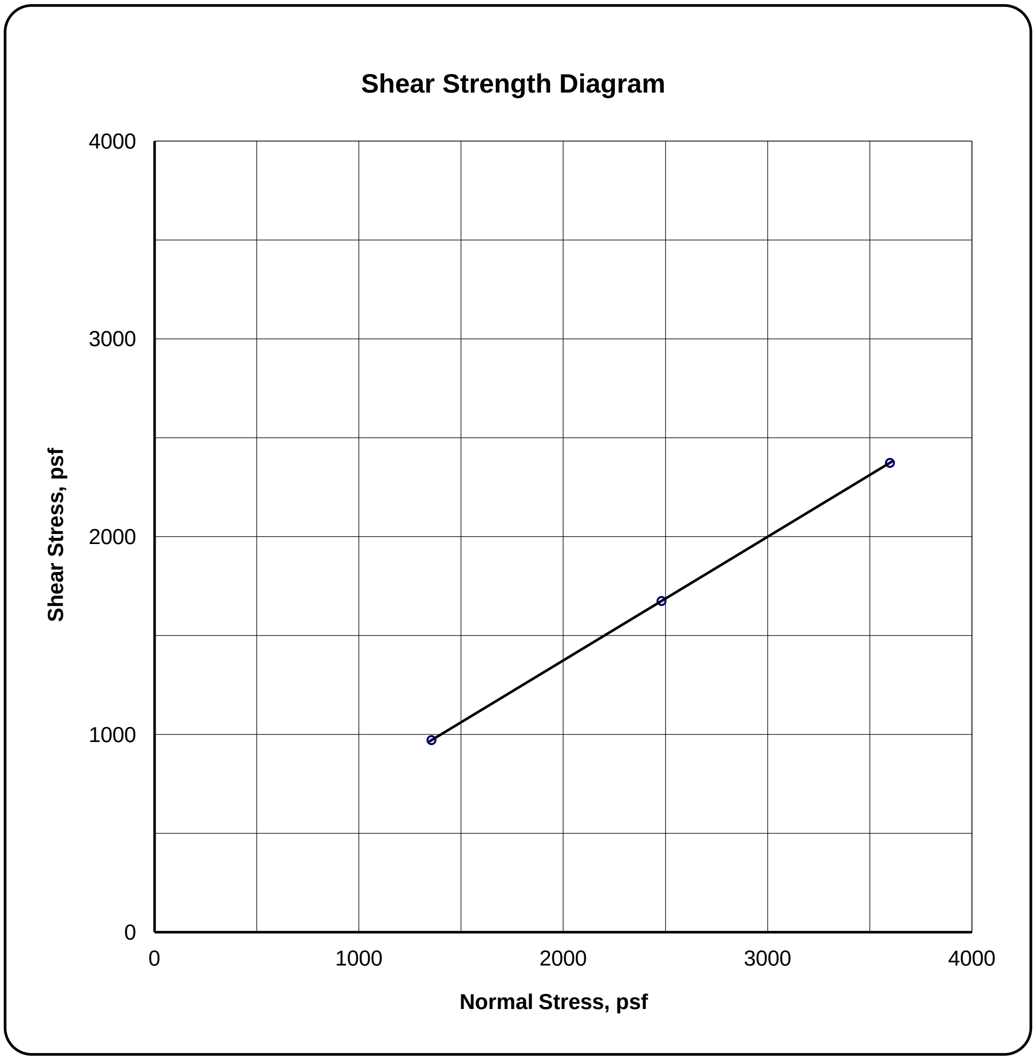
An R-Value test was estimated based on seive analysis and plasticity on a bulk sample obtained from boring B-1. The results of the tests indicate that the soils have an R-Value greater than 40.

## Expansion Index Tests

An expansion index of 0 was obtained for the surface silty sands encountered in boring B-1. The test procedure was performed in accordance with ASTM D4829 – Standard Test Method for Expansion Index of Soils.

# DIRECT SHEAR TEST

ASTM D3080-11 (Modified for unconsolidated-undrained conditions)



| | | | |
|---|---|---|---|
| Project: | OASIS CENTER MEETING FACILITY | Project No. | 16-7382 |
| Sample Location: | B-1 @ 3 Feet | Initial Dry Density (pcf) | 103.2 |
| Soil Description: | **Silty Sand** | Initial Moisture (%) | 4.2 |
| Sample Type: | ○ Remolded<br>● Ring | **Peak Shear Angle**<br>**Cohesion (psf)** | **32**<br>**125** |