# Proposed Desert Valley Hospital Addition

## Geotechnical Engineering Report – Revision 02

## Victorville, California

June 17, 2024 | Terracon Project No. CB225235

**Prepared for:**

Prime Healthcare Management, Inc.
Geotechnical Engineering
Ontario, CA 91761

HCAI Facility #: 12763
BLD-01046 - Main Hospital Building – BLDG 01 (Existing)
BLD-07204 – ED Addition - BLDG 07 (Building Addition)
Project Name: PRIME HEALTHCARE - DESERT VALLEY HOSPITAL - ED & MED-SURG BUILDING ADDITION
HCAI Project #: G241116-36-00



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June 17, 2024

Prime Healthcare Management, Inc.
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Ontario, CA 91761

Attn: Mr. Robert T. Escareno
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Re: Geotechnical Engineering Report – Revision 02
Proposed Desert Valley Hospital Addition
16850 Bear Valley Road
Victorville, California
Terracon Project No. CB225235

Dear Mr. Escareno:

We have completed the Geotechnical Engineering services for the above referenced project. This study was performed in general accordance with a Task Order dated December 22, 2022 under MSA dated April 20, 2020 and supplement dated February 24, 2024. This report compiles the data and findings of subsurface explorations completed in January 2023 (Emergency Addition) and March 2024 (Service Yard) and provides geotechnical recommendations concerning earthwork and the design and construction of foundations, floor slabs and pavements for the proposed project.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report or if we may be of further service, please contact us.

Sincerely,

**Terracon**

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# Attachments

## Exploration and Testing Procedures
## Site Location and Exploration Plans
## Exploration and Laboratory Results
## Supporting Information

**Note:** This report was originally delivered in a web-based format. **Blue Bold** text in the report indicates a referenced section heading. The PDF version also includes hyperlinks which direct the reader to that section and clicking on the Terracon logo will bring you back to this page. For more interactive features, please view your project online at **client.terracon.com**.

Refer to each individual Attachment for a listing of contents.

# Report Summary

| Topic [1] | Overview Statement [2] |
|---|---|
| **Project Description** | Project plans include an Emergency Addition with approximate footprint measuring 39,280 square feet, one-story CUP central service building and service yard with a combined footprint measuring approximately 17,500 square feet enclosed with a CMU wall. The Emergency Room addition is planned at the east side of an existing 2-story stucco medical office building. The service yard will contain a cooling tower, water tank, chiller room, electrical service room, and emergency power electrical room. Associated improvements include surface parking, a pad-mounted oxygen bulk tank storage area, and an emergency water tank (underground). |
| **Geotechnical Characterization** | Fill – Fill materials were encountered at the site to an approximate depth ranging between 2½ and 6 feet below existing site grades (bgs). The fill materials consisted of medium dense to very dense sand with varying amounts of clay and gravel.<br><br>Native – Native soils at the site generally consisted of very loose to very dense sand with varying amounts of silt, clay, and gravel with minor interbedded layers of very stiff to hard sandy silt.<br><br>Groundwater was not observed during our exploration |
| **Earthwork** | Remove existing fill materials were observed within human occupied structures.<br><br>At-grade structures – We recommend that the proposed at-grade structures be supported on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 5 feet below existing grades, or to the depth of undocumented fill, whichever is greatest. Engineered fill placed beneath the entire footprint of the at-grade structures should extend horizontally a minimum distance of 3 feet beyond the outside edge of perimeter footings.<br><br>Below grade structures – Buried tanks may be supported on a minimum of 1 foot of engineered fill. Furthermore, excavations for buried tanks should be overexcavated 2 feet horizontally to provide |

| Topic [1] | Overview Statement [2] |
|---|---|
| | adequate access around the excavation for underground storage tanks construction.<br><br>Exterior slabs and pavements – Subgrade soils beneath exterior slabs and pavements should be scarified, moisture conditioned, and compacted to a minimum depth of 12 inches below the proposed pavement section.<br><br>General Site Grading – Exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of 10 inches, moisture conditioned, and compacted per the compaction requirements in this report. |
| **Shallow Foundations** | At-grade Structures – 2,500 psf<br>Buried Tanks – 3,500 psf<br>Expected settlements: < 1-inch total, < 1/2-inch differential |
| **Below-Grade Structures** | Buried tanks are anticipated on site. |
| **Pavements** | With subgrade prepared as noted in **Earthwork**.<br>Flexible Pavement:<br>■ Auto Parking Areas – 3" HMA over 9" Class II AB<br>■ Drive Lanes – 5" HMA over 7" Class II AB<br>■ Truck Delivery Areas – 5" HMA over 13" Class II AB<br>Rigid Pavements<br>■ Light Duty – 5" PCC over 4" Class II AB<br>■ Medium Duty – 6" PCC over 4" Class II AB<br>■ Heavy Duty – 7.5" PCC over 4" Class II AB |
| **General Comments** | This section contains important information about the limitations of this geotechnical engineering report. |

1. If the reader is reviewing this report as a pdf, the topics above can be used to access the appropriate section of the report by simply clicking on the topic itself.
2. This summary is for convenience only. It should be used in conjunction with the entire report for design purposes.

# Introduction

This report presents the results of our subsurface exploration and geotechnical engineering services performed for the proposed Hospital Addition project to be located at 16850 Bear Valley Road in Victorville, San Bernardino County, California. Subsurface exploration was performed for the Hospital Addition and Service Yard in January 2023 and March 2024, respectively. Additionally, allowable soil bearing capacities for design of shallow foundations for new tanks and various appurtenant improvements related to the hospital addition are provided in this report. The purpose of these services is to provide information and geotechnical engineering recommendations relative to:

- Subsurface soil conditions
- Groundwater conditions
- 2022 California Building Code (CBC) seismic design parameters
- Geological Hazards Evaluation per CGS Note 48
- Site-specific ground motion hazard analysis
- Site-specific seismic design parameters
- Liquefaction/settlement analysis
- Subgrade preparation/earthwork recommendations
- Foundation design and concrete slabs-on-grade
- Pavement section
- Infiltration and drainage

The geotechnical engineering Scope of Services for the Emergency Addition (January 2023) included the advancement of eleven test borings to depths ranging from approximately 5 to 51½ feet below existing site grades, percolation testing, laboratory testing, and preparation of this report. Eight test borings were advanced in the area of the Service Yard project (March 2024) to depths ranging from approximately 5 to 51½ feet below existing site grades and laboratory testing of samples recovered from these borings was performed. The boring logs are attached and keyed to the drilling dates.

Drawings showing the site and boring locations are shown on the **Site Location** and **Exploration Plan**, respectively. The results of the laboratory testing performed on soil samples obtained from the site during our field exploration are included on the boring logs or as separate graphs in the **Exploration Results** section.

# Site Conditions

The following description of site conditions is derived from our site visit in association with the field exploration and our review of publicly available geologic and topographic maps.

| Item | Description |
|---|---|
| **Parcel Information** | The project is located at 16850 Bear Valley Road in Victorville, California. The project consists of an Emergency Addition building planned on the east side of the existing hospital complex, service yard to the east, and associated improvements. The footprint (per plans provided to us) of the new building is approximately 39,280 square feet and service yard area is approximately 17,500 square feet. Coordinates at the center of the proposed structure are:<br>■ Latitude 34.4717° N / Longitude 117.2973° W (approximate)<br>See **Site Location** |
| **Existing Improvements** | The northern portion of the site includes asphalt-paved parking. The remainder is a vacant lot. |
| **Current Ground Cover** | Asphalt-paved parking, trees, shrubs, concrete flatwork, and open ground. |
| **Existing Topography** | The site is relatively flat with approximately elevations ranging from 3,035 to 3,040 feet and generally slopes down towards the southeast. |

# Project Description

Our initial understanding of the project was provided in our proposal and was discussed during project planning. A period of collaboration has transpired since the project was initiated, and our final understanding of the project conditions is as follows:

| Item | Description |
|---|---|
| **Documents/Plans Provided** | Scope for Geotechnical Report by IMEG file dated 12/20/2022<br>Civil Scope for Geotechnical Report by IMEG file dated 12/20/2022<br>Topographic Survey dated October 2022 (6 sheets)<br>Topographic Survey with proposed infiltration test locations file dated 12/01/2022 (1 sheet)<br>Desert Valley Hospital – Phase 1 structural drawings dated 11/20/1992 (16 sheets)<br>Overall Site Plan – Proposed – Plumbing by IMEG, dated 12/22/2023 with annotations (1 sheet)<br>Service Yard Foundation Plan by IMEG dated 12/22/2023 (2 sheets)<br>Overall Campus Site Plan – dated 11/29/2023 (7 sheets) |

| Item | Description |
|---|---|
| **Investigations** | We performed a geotechnical investigation for the proposed Emergency Addition to be located west of the subject site. Additionally, we performed a geotechnical investigation for the proposed service yard area to be located west of the subject site. |
| **Proposed Development** | Project plans include an Emergency Addition with an approximate footprint measuring 39,280 square feet and service yard area with a one-story CUP central service building with combined footprint measuring approximately 17,500 square feet enclosed with a CMU wall. The existing hospital building is described as a two-story stucco building. We assume a similar configuration for the planned Emergency Addition. The service yard will contain a cooling tower and water tank. Associated improvements included surface parking, a pad-mounted oxygen bulk tank storage area, and an emergency water tank (underground).<br><br>Additional improvements addressed in this report include two 20,000-gallon emergency waste tanks to be located north of the existing hospital, selected foundation elements at the east end of the existing hospital building.<br><br>We understand that the proposed construction is subject to HCAI review and will also be reviewed by the California Geological Survey (CGS). |
| **Building Construction** | Construction of the Emergency Addition will be steel moment frame with a slab on grade, using spread footings or a mat foundation. Construction of the service yard area building is planned as fully grouted CMU special shear wall with metal deck roof, slab on grade, using spread footings. |
| **Finished Floor Elevation** | Unknown, assumed to be similar to existing grade. |
| **Structural Loads (assumed)** | ▪ Columns: 100 - 200 kips<br>▪ Walls: 2 to 4 kips per linear foot (klf)<br>▪ Slabs: 150 pounds per square foot (psf) |
| **Grading Requirements** | Up to 2 to 5 feet of cut and fill may be required to develop final grade, excluding remedial grading. Permanent slopes are not anticipated. |
| **Below Grade Structures** | Underground tanks and utility runs. |
| **Infiltration Systems** | An on-site stormwater retention/infiltration system is planned; therefore, we have included infiltration testing in this current scope of work and report. |

| Item | Description |
|---|---|
| **Free-Standing Retaining Wall** | Not anticipated |
| **Pavements** | Paved driveway and parking will be constructed on site.<br>We assume both rigid (concrete) and flexible (asphalt) pavement sections should be considered. Please confirm this assumption.<br><br>Anticipated traffic indices (TIs) are as follows for asphalt pavement:<br><br>■ Auto Parking Areas: TI=5.0<br>■ Drive Lanes TI=5.5<br>■ Truck Delivery Areas: TI=7.0<br>■ The pavement design period is 20 years.<br><br>Anticipated average daily truck traffic (ADTT) is as follows for concrete pavement:<br><br>■ Light Duty: ADTT=1 (Category A)<br>■ Medium Duty: ADTT=25 (Category B)<br>■ Heavy Duty: ADTT=700 (Category C) |

# Geotechnical Characterization

## Site Geology

The site is located in the Mojave Desert on an alluvial plain formed along the northern flank of the San Bernardino Mountains. The Mojave River is approximately 2.4 miles east of the site. The Mojave Desert Province is an interior region characterized by isolated mountains and hills separated by broad alluvial plains. Playa lakes are common in the lower basins and faults trend east-west and northwest to southeast.

Based on geologic mapping by Dibblee and Minch (2008), the site is underlain by older alluvium. As encountered in our site explorations, these materials include interlayered mixtures of silt, sand, and gravel. A **Geologic Map** is attached.

## Subsurface Profile

We have developed a general characterization of the subsurface soil and groundwater conditions based upon our review of the data and our understanding of the geologic setting and planned construction.

The geotechnical characterization forms the basis of our geotechnical calculations and evaluation of site preparation, foundation options and pavement options. As noted in

**General Comments**, the characterization is based upon widely spaced exploration points across the site, and variations are likely.

Surface cover consisted of earthen cover and asphalt concrete. Asphalt concrete, where encountered, was approximately 1.5 to 2.5-inch-thick layer of asphalt concrete overlying a 4 to 6-inch thick layer of aggregate base course as encountered in initial borings B-1, B-3, and B-7 (January 2023), and additional boring N-1 (March 2024). Previous borings B-1 and B-2 by C.H.J., Inc. were reviewed as part of our subsurface characterization (C.H.J., Inc., 1994).

Fill materials were encountered at the site to an approximate depth ranging between 2½ and 6 feet below existing site grades (bgs). The fill materials consisted of medium dense to very dense sand with varying amounts of clay and gravel. Documentation of prior grading operations, including fill placement, was not available. As such, the fill materials are considered undocumented. Terracon should be notified if documentation becomes available as the recommendations in this report may be modified.

Native soils at the site generally consisted of very loose to very dense sand with varying amounts of silt, clay, and gravel with minor interbedded layers of very stiff to hard sandy silt.

Conditions observed at each exploration point are indicated on the individual logs. The individual logs can be found in the **Exploration Results**. **Cross Section A A'** and **Cross Section B B'** illustrating the subsurface conditions relative to planned improvements are attached.

## Laboratory Test Results

Laboratory tests were conducted on selected soil samples and the test results are presented in the **Exploration Results** section and on the boring logs. Atterberg limit test results indicate that the on-site soils generally are non-plastic. An R-value test conducted on near-surface bulk samples resulted in an R-value of 11. Consolidation test results are discussed in the following section.

## Hydroconsolidation

To evaluate the potential deformation that may be caused by the addition of water to subsurface soils, hydroconsolidation testing was performed on a total of five selected, representative relatively undisturbed samples. The results are provided in the **Exploration Results** section. The test results for two samples, from the 2023 investigation in the Emergency addition area indicate a collapse potential of 0.4, and 1.2 percent for B-1 (2023) at 5 feet, and B-8 (2023) at 5 feet, respectively. The soil sample was saturated under an axial pressure of 2,000 psf. The test results for three samples from the 2024 Service Yard investigation indicate a collapse potential of 4.1, 2.8, and 1.4

percent for N-3 (2024) at 2.5 feet, N-3 (2024) at 5 feet, and N-5 (2024) at 2.5 feet, respectively. The soil sample was saturated under an axial pressure of 2,000 psf. In our opinion, the collapse result for N-3 (2024) at 2.5 feet is affected by sample disturbance. Remedial grading is anticipated to mitigate the potential effects of hydroconsolidation.

### Groundwater Conditions

The following table summarizes groundwater depth information for a well located near the site.

| Well No. | Reference Point Elevation (feet) | Date of Measurement | Depth to Water (feet) | Distance to Site | Direction |
|---|---|---|---|---|---|
| **05N04W34N001S** | 3003 | 8/1/1992 | 239 | 1440 feet | NE |
| | | 3/1/2006 | 250 | | |
| | | 2/2/2011 | 240 | | |
| | | 5/12/2014 | 252 | | |

Groundwater was not encountered within the maximum 51½ foot depth of borings drilled for the project. These observations represent groundwater conditions at the time of the field exploration and may not be indicative of other times, or at other locations.

The borings were advanced using continuous flight auger drilling techniques that allow short-term groundwater observations to be made while drilling.

Groundwater level fluctuations can occur due to seasonal variations in the amount of rainfall, runoff, and other factors not evident at the time the borings were performed. We do not anticipate groundwater to impact construction.

# Geologic Hazards

## Liquefaction and Lateral Spreading

According to the County of San Bernardino (2010), the site is not located within an area identified as having a liquefaction potential. Historic groundwater levels are not within 50 feet of the ground surface; therefore, liquefaction is not anticipated. Lateral spreading is also not anticipated. A more detailed discussion (including dry seismic settlement analysis) is provided in the **Liquefaction and Seismic Settlement** section of this report.

## Regional Faulting

The tectonics of the Southern California area are dominated by the interaction of the North American and Pacific tectonic plates, which are sliding past each other in transform motion. Although some of the motion may be accommodated by rotation of crustal blocks such as the western Transverse Ranges (Dickinson, 1996), the San Andreas fault zone represents the major surface expression of the tectonic boundary and accommodates a significant portion of the slip between the Pacific and North American plates. Some of the slip is accommodated by other northwest-trending strike-slip faults that are related to the San Andreas system, such as the San Jacinto and Elsinore faults. The Mojave Desert region contains a portion of the Eastern California Shear Zone, a system of northwest-southeast trending faults that extend across the eastern Mojave region. Active faults in this zone include the Helendale-South Lockhart, Lenwood-Lockhart, and Johnson Valley faults. Several of the ECSZ faults ruptured during the Landers earthquake in 1992, forming a broad zone of surface rupture distributed across multiple fault strands. The Hector Mine earthquake of 1999 similarly ruptured along several mapped fault strands. A **Regional Fault Map** is attached.

**North Frontal Fault Zone:** The North Frontal fault zone of the San Bernardino Mountains is located approximately 11 kilometers southeast of the site. The North frontal zone is an east-west trending fault system made up of a number of separate structural elements, each of which accommodates range-front uplift/deformation. This fault zone is characterized by a broad, complex zone of discontinuous, generally south-dipping thrust, reverse, and, locally, strike-slip faults with latest Pleistocene to Holocene offset. The western section includes the Ord Mountains fault zone which is the closest element of the zone to the site. Additional elements in the Western section include the Ocotillo Ridge fold, Sky High Ranch fault, and White Mountains Thrust. The Ord Mountains section is included in a State-designated fault hazard zone.

**Helendale Fault:** The northwest-striking Helendale-South Lockhart fault zone, located approximately 22 kilometers northeast of the site, is the westernmost of a series of sub-parallel right-lateral strike-slip faults in the central Mojave Desert, and is part of the eastern California shear zone. The Helendale-South Lockhart fault zone extends from its presumed junction with the Lockhart fault zone near Highway 395 to about 15 km northwest of Highway 15. The Helendale fault trends along the southwest side of the Sidewinder Mountains, through the Lucerne Valley and into the northern San Bernardino Mountains.

**San Andreas Fault Zone:** The San Andreas fault zone (SAFZ), a prominent geologic feature of California, traverses the Cajon Pass region and northern flank of the San Gabriel Mountains approximately 26 kilometers southwest of the site. The San Andreas fault is characterized by youthful fault scarps, aligned vegetation, topographic troughs, springs and offset drainage channels.

The greater San Andreas fault system is composed of multiple named segments extending through California that are postulated to rupture singly or together with other segments. The SAFZ is capable of producing magnitude 7.5 to 8 earthquakes under multi-segment rupture scenarios. The ShakeOut Scenario (USGS, 2008) is a study aimed at identifying the physical, social and economic effects of a major earthquake in southern California and preparing Californians before such an event occurs. The scenario earthquake selected for ShakeOut is a magnitude 7.8 event on the southern SAFZ, postulated to generate similar events on average every 150 years. Lateral slip for the scenario event is estimated as 9 to 30 feet. Fault rupture and strong ground shaking from the SAFZ present hazards to be mitigated for developments in the southern California region. Southwestward decrease in slip rates along the SAFZ northwest of its junction with the San Jacinto fault zone is suggested in studies by McGill and others (2021) and attests to the complexity of fault systems in southern California.

**Cucamonga Fault :** The southern margin of the San Gabriel Mountains is coincident with a series of east-west trending, predominantly reverse and thrust faults known as the Transverse Ranges frontal fault system. The San Fernando fault of this system ruptured during the 1971 magnitude 6.7 San Fernando earthquake. The Cucamonga fault of this system is located at the base of the San Gabriel Mountains, approximately 35 kilometers southwest of the site. Evidence of recent activity on this fault includes fresh scarps, sag ponds and disrupted Holocene alluvium (Dutcher and Garrett, 1963; Yerkes, 1985; Morton and Yerkes, 1987).

## Fault Rupture Potential

The site is not located within an Alquist-Priolo Earthquake Fault Zone (APZ) designated by the State of California for active faults (Hart, 1999). The closest APZ boundary, designated for the North Frontal fault zone, is located approximately 6.8 miles southeast of the site. Known faults or fault-related features are not located within the site; therefore, the potential for fault rupture within the site is considered low.

## Historical Earthquakes

A search of the USGS earthquake catalog for earthquakes of magnitude 4.5 or greater within 150 kilometers of the site returned 340 results including 4 events of magnitude 7 or greater, 19 events of magnitude 6 to 6.9, 104 events of magnitude 5 to 6 and 248 events of magnitude 4.5 to 5. A **Regional Seismicity Map** based on these data is attached.

The following table summarizes selected earthquakes recorded in the site region.

| Event ID | Date | Magnitude | Distance (km) | Direction |
|---|---|---|---|---|
| NW of San Bernardino | 12-8-1812 | 7.5 | 34 | WSW |

| | | | | |
|---|---|---|---|---|
| Palmdale | 1-16-1857 | 6.3 | 68 | W |
| Devore area | 12-16-1858 | 6.0 | 31 | S |
| NW of San Bernardino | 7-30-1894 | 6.2 | 34 | SW |
| Cajon Pass area | 7-22-1899 | 6.4 | 29 | SW |
| Barstow Heights | 7-16-1916 | 4.5 | 37 | NE |
| SSE of Fort Irwin | 4-10-1947 | 6.5 | 88 | NE |
| Tehachapi | 7-21-1952 | 7.3 | 165 | W |
| Sylmar | 2-9-1971 | 6.6 | 99 | W |
| Landers | 6-28-1992 | 7.3 | 85 | ESE |
| Big Bear | 6-28-1992 | 6.4 | 53 | SE |
| Northridge | 1-17-1994 | 6.7 | 115 | WSW |
| Hector Mine | 10-16-1999 | 7.1 | 96 | E |
| ENE Running Springs | 10-19-1999 | 5.6 | 35 | SE |
| Searles Valley | 7-6-2019 | 7.1 | 145 | N |

Mitigation of seismic shaking hazard includes design and construction of buildings and improvements according to applicable codes. The following section provides seismic design information specific to this project site.

## Tsunamis, Inundation, and Seiche and Flooding Potential

The site is not located within a 100-year flood zone or 500-year flood zone (FEMA, 2016). No evidence of recent significant flooding of the site was observed during the geologic field reconnaissance or on the aerial photographs reviewed. An evaluation of the storm-induced flood potential of the site falls under the purview of others.

The site is not located within a potential inundation zone for seismically-induced dam/reservoir failure (County of San Bernardino General Plan, 2010).

The site is not located in a coastal area. No large water storage facilities are known to exist within the area of the site. Therefore, the potential for seismically-induced flooding due to seiche or tsunami to affect the site is considered very low.

## Subsidence Potential

The site is not within an area of defined subsidence hazard. Structures susceptible to subsidence include gravity sewers, surface drainage and storm drains. The proposed development is unlikely to be significantly affected should subsidence occur.

### Erosion Potential

Most of the subject site will be covered with structures or flatwork. Erosion by wind and water is not considered to be a hazard at the site.

### Slope Stability and Landslide Potential

The site is not located in an area identified as having a potential for landslides. The site is relatively flat and level, and significant natural or manmade slopes are not located within the project boundaries. Therefore, the potential for landsliding is considered very low.

### Additional Geohazards

The site is underlain by granular, non-expansive soils. Expansive soils and associated effects are not anticipated within the site area.

Hazardous materials including methane gas, hydrogen-sulfide gas, or tar seeps are not present in the site area.

The site lies within an Environmental Protection Agency (EPA) Zone 2 Radon area. Zone 2 Radon areas contain between 2 and 4 pCi/L of predicted average indoor radon. The site is within an area of unknown radon potential according the CGS indoor radon maps. Due to the low anticipated radon levels at the site, we do not consider naturally occurring radon gas to be a hazard at the site.

Rock formations with the potential for naturally-occurring asbestos are not mapped in the vicinity of the project site. Therefore, the potential for naturally-occurring asbestos to affect the site is considered very low.

Oil or gas wells are not mapped near the site (CalGEM, 2023). The closest well, located approximately 7.3 kilometers southwest of the site, is listed as being abandoned. We do not consider oil- and gas-related hazards to be potential hazards at the site.

## Seismic Considerations

The site is located adjacent to a proposed that included development of site-specific ground motions. Seismic design information based on the project location is provided below.

The seismic design parameters, according to the ASCE 7-16 are provided in the following section based on the **site-specific method** of Section 21.2. A shear wave velocity value of $Vs_{30}$ = 260 meters/second, consistent with the Site Class 'D' condition and based on

blow counts measured in site borings, was applied. The site-specific $Vs_{30}$ value was used in deterministic models and the 'D' category was applied in probabilistic spectral values using the USGS Hazard Tool. Basin factors $Z_{1.0}$ = 60 meters and $Z_{2.5}$ = 220 meters were derived from data compiled by Graves (2011) for CDMG seismic station 23321 located in a similar geologic setting approximately 3.7 kilometers southwest of the site. The site does not lie above a deep structural basin.

Subsurface explorations at this site were extended to a maximum depth of 51½ feet. The site properties to a profile depth of 100 feet (30 meters) were extrapolated based on our experience and knowledge of geologic conditions of the general area. The seismic design parameters are summarized in the following table according to **site-specific method** of ASCE 7-16, Chapter 21.

| Description | Value |
|---|---|
| **Site Classification** [1] | D |
| **Site Latitude** | 34.4717 |
| **Site Longitude** | -117.2973 |
| **Mapped Spectral Acceleration Parameters** [2] | $S_S$ = 1.251 and $S_1$ = 0.482 |
| **Site Coefficients** | $F_a$ = 1.0[2] and $F_v$ = 1.82[3] |
| **Site-specific Spectral Response Acceleration Parameters** [4] | $SM_S$ = 1.47 and $SM_1$ = 0.963 |
| **Site-specific Design Spectral Acceleration Parameters** [4] | $SD_S$ = 0.98 and $SD_1$ = 0.642 |
| **Site-specific Peak Ground Acceleration** [4] | 0.538g |
| **De-aggregated Modal Magnitude** [5] | 7.9 |

1. Seismic site classification in general accordance with ASCE 7-16, Chapter 20.
2. These values were obtained using online seismic design tools provided by Structural Engineers Association of California - 'https://www.seaoc.org/page/seismicdesignmaptool.
3. ASCE 7-16 11.4.4
4. Site-specific values based on ASCE 7-16, 21.4 and 21.5.
5. USGS Unified Hazard Tool https://earthquake.usgs.gov/hazards/interactive.

## Site-Specific Ground Motions

The site-specific response spectra in tabular and graphic forms and a discussion of methodology are included in this section.

**Deterministic Spectrum:** Deterministic MCE spectra based on scenario events on nearby faults and consistent with the Next Generation West 2 (NGA-West 2) attenuation relations (GMPEs) used for the 2014 USGS seismic source models were calculated. Basin factors were applied as defined for each GMPE. The fault properties used are summarized in the

following table and are consistent with deterministic scenario values presented in BSSC (2015) https://earthquake.usgs.gov/scenarios/catalog/bssc2014.

| Fault | Magnitude | Distance (km) | Direction | Type |
|---|---|---|---|---|
| North Frontal | 7.2 | 11 | SE | reverse |
| Helendale | 7.4 | 22 | NE | Strike slip |
| San Andreas | 8.2 | 26 | SW | Strike slip |
| Cucamonga | 6.9 | 35 | SW | reverse |

We evaluated the deterministic spectral values from scenario fault sources that resulted in the highest amplitude at any spectral period and compiled them for the deterministic spectrum. The resulting deterministic spectrum is controlled by the North Frontal fault at periods from PGA to 2.0 seconds and the San Andreas fault at periods from 3 to 5 seconds.

The equally-weighted spectral values from the attenuation relations of Abrahamson and others (ASK 2014), Boore and others (BSSA 2014), Campbell and Borzognia (CB 2014) and Chiou and Youngs (CY 2014) were used for the deterministic MCE spectra. The MCE spectrum represents 84$^{th}$-percentile, 5-percent-damped spectral response acceleration in the direction of maximum horizontal response (maximum rotated) for each spectral period. Maximum rotated values were obtained using the scaling factors of Shahi and Baker (2014). The deterministic $MCE_R$ spectrum and associated spectra are attached in tabular and graphic forms.

**Probabilistic $MCE_R$ Spectrum:**_An $MCE_R$ spectrum was developed as a probabilistic spectrum using site class D values obtained with the USGS Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/) web-based software application consistent with the Next Generation West 2 (NGA-West 2) attenuation relations (GMPEs). The equally-weighted spectral values from the attenuation relations of Abrahamson and others (ASK 2014), Boore and others (BSSA 2014), Campbell and Borzognia (CB 2014) and Chiou and Youngs (CY 2014) were used for the probabilistic spectrum. Basin factors were applied as defined for each GMPE. The values so obtained were scaled from geomean to maximum rotated values using the factors of Shahi and Baker (2014). Gridded seismic sources are included in the probabilistic model. The probabilistic MCE spectrum was converted to a risk-targeted spectrum ($MCE_R$) using the USGS Risk Targeted Ground Motion Calculator tool (https://code.usgs.gov/ghsc/hazdev/earthquake-rtgm-calculator).

**Site-Specific $MCE_R$ Spectrum:** The lesser of the spectral values at any period from the deterministic $MCE_R$ and probabilistic $MCE_R$ spectra form the site-specific $MCE_R$ spectrum per ASCE 7-16 21.2.3. For the subject site, the deterministic spectrum controls the design spectrum at all periods.

**Design Spectrum:** A design response spectrum was determined according to the procedure outlined in ASCE 7-16, Section 21.3, and is equal to two-thirds of the response spectral accelerations of the site-specific $MCE_R$. The design spectrum is limited by a 'floor'

at 80 percent of spectral acceleration determined according to ASCE 7-16, Section 11.4.6. For this site, the 'floor' condition was applied for period from 1 to 5 seconds. The recommended site-specific design response spectrum is attached in tabular and graphic forms.

### Peak Ground Acceleration (PGA)

According to ASCE 7-16, Section 11.4.8, the site-specific geometric mean ($MCE_G$) PGA used for evaluation of soil effects is based on the lesser of the site-specific deterministic and probabilistic PGA values with an adjustment to 80% of the code value if needed. The following table summarizes the PGA values considered for the project.

| Site-Specific PGA Values | |
|---|---|
| **Code-Based Geometric Mean PGA** | 0.55g |
| **80 Percent of Code-Based PGA** | 0.44g |
| **Probabilistic Geometric Mean PGA** | 0.69g |
| **Deterministic Geometric Mean PGA** | 0.54g |
| **Recommended Site-Specific PGA** | 0.54g |

For the site-specific ($MCE_G$) PGA, the deterministic value is the lesser of the probabilistic and deterministic values and is greater than 80 percent of the code-based geometric mean PGA value. Therefore, we recommended a site-specific PGA value of 0.54g for evaluation of soil effects such as liquefaction or seismic settlement.

## Liquefaction and Seismic Settlement

**Liquefaction:** Liquefaction is a mode of ground failure that results from the generation of high pore-water pressures during earthquake ground shaking, causing loss of shear strength, and is typically a hazard where loose sandy soils exist below groundwater. San Bernardino County has designated certain areas as potential liquefaction hazard zones. These are areas considered at a risk of liquefaction-related ground failure during a seismic event, based upon mapped surficial deposits and the presence of a relatively shallow water table.

The subsurface materials at the site generally consisted of very loose to very dense sand with varying amounts of silt, clay, and gravel with minor interbedded layers of very stiff to hard sandy silt. Groundwater seepage was not observed within the maximum depths of exploration during or at the completion of drilling and has historically been greater than 100 feet bgs.

According to the County of San Bernardino (2010), the site is not located within an area identified as having a liquefaction potential. Historic groundwater levels are not within 50 feet of the ground surface; therefore, liquefaction is not anticipated. Based on the low relief across the site and lack of free-face slope conditions, lateral spreading is also not anticipated.

**Seismic Settlement:** To determine the amount of seismic settlement (dry sand), we utilized the software "LiquefyPro" by CivilTech Software, seismic settlement was estimated using the soil profile from 2023 exploratory borings B-1 (2023) and B-4 (2023), and 2024 exploratory boring N-2 (2024). A Peak Ground Acceleration (PGA) of 0.54g and the de-aggregated mode magnitude of 7.9 were utilized as input into the liquefaction analysis program. Settlement analysis used the Tokimatsu/Seed method and the fines percentage were corrected for liquefaction using the Idriss/Seed method.

We performed a seismic settlement analysis to determine the dry seismic settlement using data from 2023 exploratory borings B-1 (2023) and B-4 (2023), and 2024 exploratory boring N-2 (2024). Based on data from these borings, seismically induced settlement (dry sand) is estimated to be less than 1 inch. Differential seismic settlement is estimated to be on the order of 2/3 of total seismic settlement over a distance of 40 feet.

# Corrosivity

The table below lists the results of laboratory soluble sulfate, sulfides, soluble chloride, electrical resistivity (as received and saturated), redox potential, and pH testing. The values may be used to estimate potential corrosive characteristics of the on-site soils with respect to contact with the various underground materials which will be used for project construction.

**Corrosivity Test Results Summary**

| Boring | Sample Depth (feet) | Soil Description | Soluble Sulfate (%) | Sulfides (mg/Kg) | Soluble Chloride (%) | Redox potential (mV) | As Received Electrical Resistivity (Ω-cm) | Saturated Minimum Resistivity (Ω-cm) | pH |
|---|---|---|---|---|---|---|---|---|---|
| B-3 (2023) | 0-5 | Silty Sand | 0.022 | Nil | 23 | +732 | 29,100 | 2,813 | 9.37 |
| N-3 (2024) | 0-5 | Silty Sand with Gravel | 0.0231 | Nil | 172 | +733 | 12,610 | 4,171 | 7.75 |

Results of soluble sulfate testing indicate samples of the on-site soils tested possess negligible sulfate concentrations when classified in accordance with Table 19.3.1.1 of the ACI Design Manual. Concrete should be designed in accordance with the exposure class S0 provisions of the ACI Design Manual, Section 318, Chapter 19.

Imported fill materials may have significantly different properties than the site materials noted above and should be evaluated if expected to be in contact with metals used for construction. Consultation with a NACE certified corrosion professional is recommended for buried metals on the site.

For protection against corrosion to buried metals, Terracon recommends that an experienced corrosion engineer be retained to design a suitable corrosion protection system for underground metal structures or components.

If corrosion of buried metal is critical, it should be protected using a non-corrosive backfill, wrapping, coating, sacrificial anodes, or a combination of these methods, as designed by a qualified corrosion engineer.

# Geotechnical Overview

The site appears suitable for the proposed construction based upon geotechnical conditions encountered in the test borings, provided that the recommendations provided in this report are implemented in the design and construction phases of this project.

Geotechnical engineering recommendations for foundation systems and other earth connected phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing, engineering analyses, and our current understanding of the proposed project.

Potentially compressible soils, which show significant tendency for hydro-compaction when elevated in moisture content, will require particular attention in the design and construction. Hydro-compactive soils, sometimes referred to as collapsible soils, are capable of supporting typical building loads at natural moisture contents. These same materials however, may undergo volume decrease, including settlement and consolidation, when subjected to increases in moisture content under constant load.

Based on the geotechnical engineering analyses, subsurface exploration, and laboratory test results, we recommend that the proposed structures be supported on a spread footing foundation system. Due to the potential for hydro-compaction in the near surface soils, spread footings bearing on engineered fill are recommended for support of the proposed structures. Engineered fill should extend to a minimum depth of 2 feet below the bottom of foundations, or 5 feet below existing grades, or to the depth of undocumented fill, whichever is greatest. Grading for the proposed structures should incorporate the limits of the structures plus a lateral distance of 3 feet beyond the outside edge of perimeter footings.

Estimated movements described in this report are based on effective drainage for the life of the structure and cannot be relied upon if effective drainage is not maintained. Exposed

ground, extending at least 10 feet from the perimeter, should be sloped a minimum of 5% away from the building to provide positive drainage away from the structure. Grades around the structure should be periodically inspected and adjusted as part of the structure's maintenance program.

The **General Comments** section provides an understanding of the report limitations.

# Earthwork

The following recommendations include site preparation, excavation, subgrade preparation and placement of engineered fills on the project. The recommendations presented for design and construction of earth supported elements including foundations, slabs, and pavements are contingent upon following the recommendations outlined in this section.

Earthwork on the project should be observed and evaluated by Terracon. The evaluation of earthwork should include observation and testing of engineered fill, subgrade preparation, foundation bearing soils, and other geotechnical conditions exposed during the construction of the project.

An on-site, pre-job meeting with the owner, the contractor and the Geotechnical Engineer should occur prior to all grading-related operations. Observation, testing, documentation, and reporting of the grading operation should be performed by the Geotechnical Engineer of Record. A final compaction report should be issued by the Geotechnical Engineer of Record at the completion of the grading operation. Interim reports may be issued according to project requirements. Operations undertaken at the site without the Geotechnical Engineer present may result in exclusions of affected areas from compaction reports for the project.

Grading of the subject site should be performed, at a minimum, in accordance with these recommendations and with applicable portions of the current version of CBC. The following recommendations are presented for your assistance in establishing proper grading criteria.

## Site Preparation

Strip and remove existing vegetation, debris, pavements and other deleterious materials from proposed building and pavement areas. Exposed surfaces should be free of mounds and depressions which could prevent uniform compaction. The site should be initially graded to create a relatively level surface to receive fill and provide for a relatively uniform thickness of fill beneath proposed building structures.

All materials derived from the demolition of existing improvements or pavements should be removed from the site and not be allowed for use as on-site fill, unless processed in accordance with the fill requirements included in this report.

As noted in **Geotechnical Characterization**, borings from the 2024 explorations N-2 (2024), N-3 (2024), N-4 (2024) and N-7 (2024) in the proposed Service Yard area encountered fill to depths ranging from about 2.5 to 6 feet. This depth should not be considered exact due to the similarity of lithology, color, and densities of the graded materials and native soils. Furthermore, we have no records to indicate the degree of control, and consequently, the fill is considered unreliable for support of foundation loads. Structures that are classified as "occupied structures" in accordance with California Code of Regulations Section 3601 should not be constructed on undocumented fill. We recommend that all fill soils be removed within the proposed building area and the excavation thoroughly cleaned prior to backfill placement and/or construction. If such documentation exists, Terracon should be notified and the recommendations in this report may be appropriately modified. Fill was not identified in the area of the proposed Emergency Addition; however, the recommendations for minimum depth of remedial grading (see Subgrade Preparation) also apply.

Existing utility lines were noted across the site. However, although no evidence of other underground facilities such as septic tanks, cesspools, and basements, was observed during the site reconnaissance, such features could be encountered during construction. If unexpected fills, utilities, or underground facilities are encountered, such features should be removed and the excavation thoroughly cleaned prior to backfill placement and/or construction.

## Subgrade Preparation

Due to the potential for hydro-compaction in the near surface soils, foundations and floor slabs should be supported on engineered fill extending to a minimum depth of 2 feet below the bottom of foundations, or 5 feet below existing grades, or to the depth of undocumented fill, whichever is greatest. Engineered fill placed beneath the entire footprint of the at-grade structures should extend horizontally a minimum distance of 3 feet beyond the outside edge of perimeter footings.

Buried tanks may be supported on a minimum of 1 foot of engineered fill. Furthermore, excavations for buried tanks should be overexcited 2 feet horizontally to provide adequate access around the excavation for underground storage tanks construction.

Subgrade soils beneath exterior slabs and pavements should be scarified, moisture conditioned, and compacted to a minimum depth of 12 inches below the proposed pavement section, or 18 inches below the existing grade, whichever is deeper. Support of pavements on or above existing fill materials is discussed in this report. However, even with the recommended construction testing services, there is an inherent risk for the

owner that compressible fill or unsuitable material within or buried by the fill will not be discovered. This risk of unforeseen conditions cannot be eliminated without completely removing the existing fill but can be reduced by performing additional testing and evaluation.

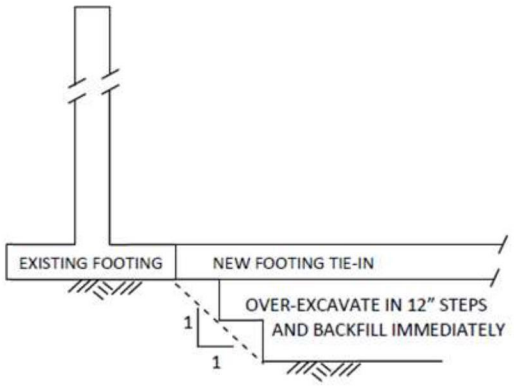
Exposed areas which will receive fill, once properly cleared and benched where necessary, should be scarified to a minimum depth of 10 inches, moisture conditioned, and compacted per the compaction requirements in this report. Compacted fill soils should then be placed to the design grades, and the moisture content and compaction of soils should be maintained until slab, pavement, or proposed improvements are constructed.

Based upon the subsurface conditions determined from the geotechnical exploration, subgrade soils exposed during construction are anticipated to be relatively workable. However, the workability of the subgrade may be affected by precipitation, repetitive construction traffic or other factors. If unworkable conditions develop, workability may be improved by scarifying and drying.

## Excavation

We anticipate that excavations for the proposed construction can be accomplished with conventional earthmoving equipment. The bottom of excavations should be thoroughly cleaned of loose soils and disturbed materials prior to backfill placement and/or construction.

If new foundations are constructed adjacent to the existing foundations, there is a risk that the bearing material could become undermined and/or overstressed due to overlapping stresses. Provisions should be made during construction to prevent undermining or disturbing the soils supporting the existing foundations. Excavations should not extend below an imaginary 1H:1V inclined plane projecting below the bottom edge of any adjacent existing foundations as shown in the figure to the right.




Onsite soils may include layers of cohesionless sandy soils. Such soils have the tendency to cave and slough during excavations. Therefore, formwork may be needed for foundation excavations. Based on the relatively flat-lying site surface and planned development, significant temporary cut slopes are not expected during the proposed construction. For purposes of construction, the soils encountered in our explorations are considered type "C" materials. Accordingly, temporary slopes in near surface native soil should conform to applicable standards as outlined by Cal/OSHA for construction excavations

(https://www.dir.ca.gov/title8/1541_1a.html). On-site soils shall be sloped at a minimum of 1.5H:1V. Benching is not permitted.

We recommend that the excavations for underground storage tanks be over-excavated by about 2 feet horizontally to provide adequate access around the excavation for underground storage tanks construction. The walls of the proposed excavation should be shored or sloped in conformance with OSHA excavation and trench safety standards. If any excavation is extended to a depth of more than 20 feet, it will be necessary to have the side slopes designed by a professional engineer.

Soils from the excavation should not be stockpiled higher than six 6 feet or within ten 10 feet of the edge of an open trench. Construction of open cuts adjacent to existing structures, including underground pipes, is not recommended within a 1½H:1V plane extending beyond and down from the perimeter of the structure. Cuts that are proposed within five 5 feet of light standards, other utilities, underground structures, and pavement should be provided with temporary shoring.

It may be necessary for the contractor to retain a geotechnical engineer to monitor the soils exposed in all excavations and provide engineering services for slopes. This will provide an opportunity to monitor the soils encountered and to modify the excavation slopes as necessary. It also offers an opportunity to verify the stability of the excavation slopes during construction.

Individual contractors are responsible for designing and constructing stable, temporary excavations. Excavations should be sloped or shored in the interest of safety following local, and federal regulations, including current OSHA excavation and trench safety standards.

## Fill Material Types

All fill materials should be inorganic soils free of vegetation, debris, and fragments larger than three inches in size. Pea gravel or other similar non-cementitious, poorly-graded materials should not be used as fill or backfill without the prior approval of the geotechnical engineer.

Clean on-site soils or approved imported materials may be used as fill material for the following:

- general site grading
- foundation areas
- interior floor slab areas
- foundation backfill
- pavement areas
- exterior slab areas

If imported soils are used as fill materials to raise grades, these soils should conform to low volume change materials and should conform to the following requirements:

| Gradation | Percent Finer by Weight (ASTM C 136) |
|---|---|
| 3" | 100 |
| No. 4 Sieve | 50 - 100 |
| No. 200 Sieve | 20 - 50 |

- Liquid Limit ..... 30 (max)
- Plasticity Index ..... 15 (max)
- Maximum Expansive Index* ..... 20 (max)

*ASTM D 4829

The contractor shall notify the Geotechnical Engineer of import sources sufficiently ahead of their use so that the sources can be observed and approved as to the physical characteristic of the import material. For all import material, the contractor shall also submit current verified reports from a recognized analytical laboratory indicating that the import has a "not applicable" (Class S0) potential for sulfate attack based upon current ACI criteria. The reports shall be accompanied by a written statement from the contractor that the laboratory test results are representative of all import material that will be brought to the job.

Engineered fill should be placed and compacted in horizontal lifts, using equipment and procedures that will produce recommended moisture contents and densities throughout the lift. Fill lifts should not exceed 10 inches loose thickness.

## Fill Placement and Compaction Requirements

| Material Type and Location | Per the Modified Proctor Test (ASTM D 1557) | | |
|---|---|---|---|
| | Minimum Compaction Requirement (%) | Range of Moisture Contents for Compaction Above Optimum | |
| | | Minimum | Maximum |
| **On-site soils and/or low volume change imported fill:** | | | |
| **Beneath foundations:** | 90 | -2% | +3% |
| **Beneath interior slabs:** | 90 | -2% | +3% |
| **Miscellaneous backfill:** | 90 | -2% | +3% |
| **Beneath pavements:** | 95 | -2% | +3% |
| **Utility Trenches*:** | 90 | -2% | +3% |
| **Bottom of excavation receiving fill:** | 90 | -2% | +3% |
| **Aggregate base (beneath pavements):** | 95 | -2% | +3% |

* Upper 12 inches should be compacted to 95% within pavement and structural areas. Low-volume change imported soils should be used in structural areas.

## Utility Trench Backfill

We anticipate that the on-site soils will provide suitable support for underground utilities and piping that may be installed. Any soft and/or unsuitable material encountered at the bottom of excavations should be removed and be replaced with an adequate bedding material. A non-expansive granular material with a sand equivalent greater than 30 is recommended for bedding and shading of utilities, unless otherwise allowed by the utility manufacturer.

On-site materials are considered suitable for backfill of utility and pipe trenches from one foot above the top of the pipe to the final ground surface, provided the material is free of organic matter and deleterious substances.

Trench backfill should be mechanically placed and compacted as discussed earlier in this report. Compaction of initial lifts should be accomplished with hand-operated tampers or other lightweight compactors. Where trenches are placed beneath slabs or footings, the backfill should satisfy the gradation and expansion index requirements of engineered fill discussed in this report. Flooding or jetting for placement and compaction of backfill is not recommended.

## Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Infiltration of water into utility trenches or foundation excavations should be prevented during construction. Planters and other surface features which could retain water in areas adjacent to the building or pavements should be sealed or eliminated. In areas where sidewalks or paving do not immediately adjoin the structure, we recommend that protective slopes be provided with a minimum grade of approximately 5 percent for at least 10 feet from perimeter walls. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to reduce the possibility of moisture infiltration.

Roof drainage should discharge into splash blocks or extensions when the ground surface beneath such features is not protected by exterior slabs or paving. Sprinkler systems and landscaped irrigation should not be installed within 5 feet of foundation walls.

## Exterior Slab Design and Construction

Exterior slabs-on-grade, exterior architectural features, and utilities founded on, or in backfill may experience some movement due to the volume change of the backfill. To reduce the potential for damage caused by movement, we recommend:

- minimizing moisture increases in the backfill;
- controlling moisture-density during placement of backfill;
- using designs which allow vertical movement between the exterior features and adjoining structural elements;
- placing effective control joints on relatively close centers.

## Earthwork Construction Considerations

Shallow excavations for the proposed structures are anticipated to be accomplished with conventional construction equipment. Upon completion of filling and grading, care should be taken to maintain the subgrade water content prior to construction of grade-supported improvements such as floor slabs and pavements. Construction traffic over the completed subgrades should be avoided. The site should also be graded to prevent ponding of surface water on the prepared subgrades or in excavations. Water collecting over or adjacent to construction areas should be removed. If the subgrade freezes, desiccates, saturates, or is disturbed, the affected material should be removed, or the materials should be scarified, moisture conditioned, and recompacted prior to floor slab construction.

As a minimum, excavations should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local and/or state regulations.

Construction site safety is the sole responsibility of the contractor who controls the means, methods, and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean Terracon is assuming responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Excavations or other activities resulting in ground disturbance have the potential to affect adjoining properties and structures. Our scope of services does not include review of available final grading information or consider potential temporary grading performed by the contractor for potential effects such as ground movement beyond the project limits. A preconstruction/precondition survey may be conducted to document nearby property/infrastructure prior to any site development activity. Excavation or ground disturbance activities adjacent or near property lines may be monitored or instrumented for potential ground movements that could negatively affect adjoining property and/or structures.

## Construction Observation and Testing

The geotechnical engineer should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation, proof-rolling, placement and compaction of controlled compacted fills, backfilling of excavations to the completed subgrade.

The exposed subgrade and each lift of compacted fill should be tested, evaluated, and reworked as necessary until approved by the Geotechnical Engineer prior to placement of additional lifts. Each lift of fill should be tested for density and water content at a frequency of at least one test for every 2,500 square feet of compacted fill in the building areas and 5,000 square feet in pavement areas. One density and water content test for every 50 linear feet of compacted utility trench backfill. This testing frequency criteria may be adjusted during construction as specified by the geotechnical engineer of record.

In areas of foundation excavations, the bearing subgrade should be evaluated under the direction of the Geotechnical Engineer. In the event that unanticipated conditions are encountered, the Geotechnical Engineer should prescribe mitigation options.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

In addition to the documentation of the essential parameters necessary for construction, the continuation of the Geotechnical Engineer into the construction phase of the project provides the continuity to maintain the Geotechnical Engineer's evaluation of subsurface conditions, including assessing variations and associated design changes.

# Shallow Foundations

If the site has been prepared in accordance with the requirements noted in **Earthwork**, the following design parameters are applicable for shallow foundations.

| Item | Description |
|---|---|
| **Foundation Support** | At-grade Structures – Engineered fill extending 2 feet below the bottom of foundations, or 5 feet below existing grades, or to the depth of undocumented fill whichever is greatest.<br>Buried Tanks – Engineered fill extending 1 foot below the bottom of tanks |
| **Net Allowable Bearing pressure [1, 2] (On-site soils or structural fill)** | At-grade Structures – 2,500 psf<br>Buried Tanks – 3,500 psf |

| | |
|---|---|
| **Minimum Foundation Dimensions** | Columns: 24 inches wide<br>Continuous: 18 inches wide |
| **Minimum Footing Depth** | 24" below finish grade |
| **Increments of Net Allowable Bearing Pressure** | 400 psf for each additional foot of width<br>800 psf for each additional foot of depth<br>(Maximum Net Allowable Bearing Pressure not to exceed 3,500 psf) |
| **Ultimate Passive Resistance** [4] | 400 pcf |
| **Ultimate Coefficient of Sliding Friction** [5] | 0.32 |
| **Estimated Total Static Settlement from Structural Loads** [2] | about 1 inch |
| **Estimated Differential Settlement** [2, 6] | About 1/2 of total settlement |

1. The maximum net allowable bearing pressure is the pressure in excess of the minimum surrounding overburden pressure at the footing base elevation. An appropriate factor of safety has been applied.
2. Values provided are for maximum loads noted in **Project Description**. The foundation settlement will depend upon the variations within the subsurface soil profile, the structural loading conditions, the embedment depth of the footings, the thickness of compacted fill, and the quality of the earthwork operations. The above settlement estimates have assumed that the maximum footing size is 6 feet for column footings and 3 feet for continuous footings.
3. Unsuitable or soft soils should be over-excavated and replaced per the recommendations presented in the **Earthwork**.
4. Use of passive earth pressures requires the footing forms be removed and compacted structural fill be placed against the vertical footing face. A factor of safety of 2.0 is recommended. Passive pressure and sliding friction may be combined to resist sliding provided the passive pressure is reduced by 50 percent. Ultimate passive resistance should be capped at 4,000 psf.
5. Can be used to compute sliding resistance where foundations are placed on suitable soil/materials. Should be neglected for foundations subject to net uplift conditions. A factor of safety of 1.5 is recommended.
6. Differential settlements are as measured over a span of 40 feet.

Differential settlement between the new and existing foundations is expected to approach the magnitude of the total settlement of the new footings. The structural engineer should account for the anticipated differential settlement between new and existing footings in the design of the improvements. Care should be taken during excavation adjacent to existing foundations, to avoid disturbing existing foundation bearing soils.

New footings should bear at or near the bearing elevation of immediately adjacent existing foundations. If this depth varies from the minimum footing depth required herein, Terracon should be notified to adjust our recommendations as needed. Depending upon their locations and current loads on the existing footings, footings for the wall and/or columns could cause settlement of adjacent walls. To reduce this concern and risk, clear distances at least equal to the new footing widths should be maintained between the new footings and footings supporting the existing building. In the event such clearance is not feasible, overlapping stresses should be considered for both existing and new foundations.

We understand existing foundations may support additional load from the improvements. It is likely additional loads on the existing foundations could cause other building settlements to occur. The structural capacity of existing foundations should be evaluated by a licensed structural engineer, where increases in loading are planned.

## Design Parameters – Existing Foundations

Per the design team request, we have verified the bearing capacity for the shallow foundations for the existing hospital by performing settlement analysis for the soil profile obtained from a boring located near the southeast portion of the existing hospital building. Based on the settlement analysis with a maximum total tolerance of 1 inch, a bearing capacity of 2,500 psf may be used for a maximum foundation width of 12 feet.

Based on collaboration with the structural engineer, we analyzed the potential settlement for the existing foundations under the additional loading only and overlapping stresses from the planned new foundations in close proximity. The location of and the loading on the new foundations and additional loading on existing foundations was provided by the structural engineer. The settlement of the existing foundations under the new loading and the adjacent new foundations is estimated to be less than 0.5 inches. Differential settlement is estimated to be less than 0.25 inches. Terracon has no information on settlement movements that have occurred during the lifetime of the existing foundations.

## Design Parameters – Overturning and Uplift Loads

Shallow foundations subjected to overturning loads should be proportioned such that the resultant eccentricity is maintained in the center-third of the foundation (e.g., $e < b/6$, where b is the foundation width). This requirement is intended to keep the entire foundation area in compression during the extreme lateral/overturning load event. Foundation oversizing may be required to satisfy this condition.

Uplift resistance of spread footings can be developed from the effective weight of the footing and the overlying soils with consideration to the CBC basic load combinations.

| Item | Description |
|---|---|
| **Soil Effective Unit Weight** | 125 pcf |
| **Soil weight included in uplift resistance** | Soil included within the prism extending up from the top perimeter of the footing at an angle of 20 degrees from vertical to ground surface |

### Foundation Construction Considerations

As noted in **Earthwork**, the footing excavations should be evaluated under the direction of the Geotechnical Engineer. The base of all foundation excavations should be free of water and loose soil, prior to placing concrete. Concrete should be placed soon after excavating to reduce bearing soil disturbance. Care should be taken to prevent wetting or drying of the bearing materials during construction. Excessively wet or dry material or any loose/disturbed material in the bottom of the footing excavations should be removed/reconditioned before foundation concrete is placed.

To ensure foundations have adequate support, special care should be taken when footings are located adjacent to trenches. The bottom of such footings should be at least 1 foot below an imaginary plane with an inclination of 1.5 horizontal to 1.0 vertical extending upward from the nearest edge of adjacent trenches.

## Floor Slabs

Design parameters for floor slabs assume the requirements for **Earthwork** have been followed. Specific attention should be given to positive drainage away from the structure and positive drainage of the aggregate base beneath the floor slab.

### Floor Slab Design Parameters

| DESCRIPTION | RECOMMENDATION |
|---|---|
| **Interior floor system** | Slab-on-grade concrete |
| **Floor slab support** | Engineered fill extending 3 feet below the bottom of foundations, or 5 feet below existing grades, whichever is greater. |
| **Subbase** | Minimum 4-inches of Aggregate Base |
| **Modulus of subgrade reaction** | 180 pounds per square inch per inch (psi/in) (The modulus was obtained based on estimates obtained from NAVFAC 7.1 design charts). This value is for a small loaded area (1 |

| | |
|---|---|
| | Sq. ft or less) such as for forklift wheel loads or point loads and should be adjusted for larger loaded areas. |

The use of a vapor retarder should be considered beneath concrete slabs on grade covered with wood, tile, carpet, or other moisture sensitive or impervious coverings, or when the slab will support equipment sensitive to moisture. When conditions warrant the use of a vapor retarder, the slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder.

Saw-cut control joints should be placed in the slab to help control the location and extent of cracking. For additional recommendations refer to the ACI Design Manual. Joints or cracks should be sealed with a water-proof, non-extruding compressible compound specifically recommended for heavy duty concrete pavement and wet environments.

Where floor slabs are tied to perimeter walls or turn-down slabs to meet structural or other construction objectives, our experience indicates differential movement between the walls and slabs will likely be observed in adjacent slab expansion joints or floor slab cracks beyond the length of the structural dowels. The Structural Engineer should account for potential differential settlement through use of sufficient control joints, appropriate reinforcing, or other means.

### Floor Slab Construction Considerations

Finished subgrade, within and for at least 10 feet beyond the floor slab, should be protected from traffic, rutting, or other disturbance and maintained in a relatively moist condition until floor slabs are constructed. If the subgrade should become damaged or desiccated prior to construction of floor slabs, the affected material should be removed, and structural fill should be added to replace the resulting excavation. Final conditioning of the finished subgrade should be performed immediately prior to placement of the floor slab support course.

The Geotechnical Engineer should observe the condition of the floor slab subgrades immediately prior to placement of the floor slab support course, reinforcing steel, and concrete. Attention should be paid to high traffic areas that were rutted and disturbed earlier, and to areas where backfilled trenches are located.

## Below-Grade Structures

We understand an underground storage tank is planned north of the proposed service yard. Additional underground tanks are planned north of the existing hospital building. Recommendations pertaining to design and construction of the underground storage tanks is provided in the **Earthwork** section of this report.

# Lateral Earth Pressures

For engineered fill comprised of on-site soils or imported low volume change materials above any free water surface, recommended equivalent fluid pressures for unrestrained foundation elements are:

| ITEM | VALUE[a, b] |
|---|---|
| **Active Case** | 39 psf/ft |
| **Passive Case** | 400 psf/ft |
| **At-Rest Case** | 59 psf/ft |
| **Lateral Surcharge** | 0.31 * S where S is the vertical surcharge load |
| **Coefficient of Friction** | 0.32 |

[a]Note: The values are based on engineered fill materials used as backfill.
[b]Note: Uniform, horizontal backfill, compacted to at least 90% of the ASTM D 1557 maximum dry density, rendering a maximum unit weight of 125 pcf.

The lateral earth pressures herein do not include any factor of safety and are not applicable for submerged soils/hydrostatic loading. Additional recommendations may be necessary if such conditions are to be included in the design. Fill against foundation walls should be compacted to densities specified in the Earthwork section of this report. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors.

The design of the shored excavation should be performed by an engineer knowledgeable and experienced with the on-site soil conditions. The contractor should be aware that slope height, slope inclination or excavation depths should in no case exceed those specified in local, state or federal safety regulations, e.g. OSHA Health and Safety Standards for Excavation, 29 CFR Part 1926, or successor regulations. Such regulations are strictly enforced and, if not followed, the owner or the contractor could be liable for substantial penalties.

The design shoring systems should consider surcharge loads imposed by the foundations. In addition, the design should take into consideration new footing loads and anticipated vehicular loads in the vicinity of the proposed temporary excavation. In general, surcharge loads should be considered where they are located within a horizontal distance behind the excavation equal to the height of the excavation.

Surcharge loads acting at the top of the excavation should be applied to the wall over the backfill as a uniform pressure over the entire wall height and should be added to the static earth pressures. Surcharge stresses due to point loads, line loads, and those of limited extent, such as compaction equipment, should be evaluated using elastic theory.

For the design of braced shoring, we recommend such shoring be designed using a rectangular-shaped distribution of lateral earth pressure of 26H (in psf) (H is the total

height of the braced excavation). This pressure does not consider the effects of surcharge from foundations or vehicles.

# Pavements

## General Pavement Comments

Pavement designs are provided for the traffic conditions and pavement life conditions as noted in **Project Description** and in the following sections of this report. A critical aspect of pavement performance is site preparation. Pavement designs noted in this section must be applied to the site which has been prepared as recommended in the **Earthwork** section.

## Pavement Design Parameters

Design of asphalt concrete (AC) pavements is based on the procedures outlined in the Caltrans "Highway Design Manual for Safety Roadside Rest Areas" (Caltrans, 2016). Design of Portland cement concrete (PCC) pavements are based upon American Concrete Institute (ACI) 330R-08; "Guide for Design and Construction of Concrete Parking Lots."

A laboratory testing R-value of 11 was used for the AC pavement design. A modulus of rupture of 600 psi and modulus of subgrade reaction of 50 psi/in was used for pavement concrete. The structural sections are predicated upon proper compaction of the utility trench backfills and the subgrade soils as prescribed by in **Earthwork**, with the upper 12 inches of subgrade soils and all aggregate base material brought to a minimum relative compaction of 95 percent in accordance with ASTM D 1557 prior to paving. The aggregate base should meet Caltrans requirements for Class 2 base.

The pavement designs were based upon the results of preliminary sampling and testing and should be verified by additional sampling and testing (specifically R-value testing) during construction when the actual subgrade soils are exposed. Additionally, the preliminary sections provided are minimums based on procedures previously referenced. The project civil engineer should confirm minimum Traffic Indices and sections required by local agencies or jurisdictions if applicable.

## Pavement Section Thicknesses

The following table provides options for AC and PCC Sections:

| Asphalt Concrete Design | | |
|---|---|---|
| **Usage** | **Assumed Traffic Index** | **Recommended Structural Section** |
| Auto Parking Areas | 5.0 | 3" HMA[1]/9" Class 2 AB[2] |
| Drive lanes | 5.5 | 3" HMA[1]/11" Class 2 AB[2] |
| Truck Delivery Areas | 7.0 | 4" HMA[1]/14" Class 2 AB[2] |

1. HMA = hot mix asphalt
2. AB = aggregate base

| Portland Cement Concrete Design | | | |
|---|---|---|---|
| Layer | **Thickness (inches)** | | |
| | **Light Duty[1]** | **Medium Duty[2]** | **Heavy Duty[3]** |
| PCC | 5.0 | 6.0 | 7.5 |
| Aggregate Base[4] | 4.0 | 4.0 | 4.0 |

1. Car Parking and Access Lanes, Average Daily Truck Traffic (ADTT) = 1 (Category A).
2. Truck Parking Areas, Multiple Units, ADTT = 25 (Category B)
3. In areas of anticipated heavy traffic, fire trucks, delivery trucks, or concentrated loads (e.g., dumpster pads), and areas with repeated turning or maneuvering of heavy vehicles, ADTT = 700 (Category C).
4. Aggregate base is not required. Compacted on-site material is considered competent.

Recommended structural sections were calculated based on assumed TIs and our preliminary sampling and testing.

Terracon does not practice traffic engineering. We recommend that the project civil engineer or traffic engineer verify that the TIs and ADTT traffic indices used are appropriate for this project.

Areas for parking of heavy vehicles, concentrated turn areas, and start/stop maneuvers could require thicker pavement sections. Edge restraints (i.e. concrete curbs or aggregate shoulders) should be planned along curves and areas of maneuvering vehicles. A maintenance program including surface sealing, joint cleaning and sealing, and timely repair of cracks and deteriorated areas will increase the pavement's service life. As an option, thicker sections could be constructed to decrease future maintenance.

Concrete for rigid pavements should have a minimum 28-day compressive strength of 4,000 psi, and be placed with a maximum slump of 4 inches. Although not required for structural support, a minimum 4-inchthick base course layer is recommended to help

reduce potential for slab curl, shrinkage cracking, and subgrade pumping through joints. Proper joint spacing will also be required to prevent excessive slab curling and shrinkage cracking. Joints should be sealed to prevent entry of foreign material and doweled where necessary for load transfer.

Where practical, we recommend early-entry cutting of crack-control joints in PCC pavements. Cutting of the concrete in its "green" state typically reduces the potential for micro-cracking of the pavements prior to the crack control joints being formed, compared to cutting the joints after the concrete has fully set. Micro-cracking of pavements may lead to crack formation in locations other than the sawed joints, and/or reduction of fatigue life of the pavement.

Openings in pavements, such as decorative landscaped areas, are sources for water infiltration into surrounding pavement systems. Water can collect in the islands and migrate into the surrounding subgrade soils thereby degrading support of the pavement. This is especially applicable for islands with raised concrete curbs, irrigated foliage, and low permeability near-surface soils. The civil design for the pavements with these conditions should include features to restrict or collect and discharge excess water from the islands. Examples of features are edge drains connected to the storm water collection system, longitudinal subdrains, or other suitable outlets and impermeable barriers preventing lateral migration of water such as a cutoff wall installed to a depth below the pavement structure.

Dishing in parking lots surfaced with ACC is usually observed in frequently-used parking stalls (such as near the front of buildings), and occurs under the wheel footprint in these stalls. The use of higher-grade asphalt cement, or surfacing these areas with PCC, should be considered. The dishing is exacerbated by factors such as irrigated islands or planter areas, sheet surface drainage to the front of structures, and placing the ACC directly on a compacted clay subgrade.

PCC pavement details for joint spacing, joint reinforcement, and joint sealing should be prepared in accordance with ACI 330 and ACI 325. PCC pavements should be provided with mechanically reinforced joints (doweled or keyed) in accordance with ACI 330.

## Pavement Drainage

Pavements should be sloped to provide rapid drainage of surface water. Water allowed to pond on or adjacent to the pavements could saturate the subgrade and contribute to premature pavement deterioration. In addition, the pavement subgrade should be graded to provide positive drainage within the granular base section. Appropriate sub-drainage or connection to a suitable daylight outlet should be provided to remove water from the granular subbase.

## Pavement Maintenance

The pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be anticipated. Therefore, preventive maintenance should be planned and provided for through an on-going pavement management program. Maintenance activities are intended to slow the rate of pavement deterioration and to preserve the pavement investment. Maintenance consists of both localized maintenance (e.g., crack and joint sealing and patching) and global maintenance (e.g., surface sealing). Preventive maintenance is usually the priority when implementing a pavement maintenance program. Additional engineering observation is recommended to determine the type and extent of a cost-effective program. Even with periodic maintenance, some movements and related cracking may still occur and repairs may be required.

Pavement performance is affected by its surroundings. In addition to providing preventive maintenance, the civil engineer should consider the following recommendations in the design and layout of pavements:

- Final grade adjacent to paved areas should slope down from the edges at a minimum 2 percent.
- Subgrade and pavement surfaces should have a minimum 2 percent slope to promote proper surface drainage.
- Install below pavement drainage systems surrounding areas anticipated for frequent wetting.
- Install joint sealant and seal cracks immediately.
- Seal all landscaped areas in or adjacent to pavements to reduce moisture migration to subgrade soils.
- Place compacted, low permeability backfill against the exterior side of curb and gutter.
- Place curb, gutter and/or sidewalk directly on clay subgrade soils rather than on unbound granular base course materials.

# Storm Water Management

Three in-situ infiltration tests (falling head borehole permeability) were performed at approximate depths of 5 and 10 feet bgs. The objective of the infiltration testing is to provide infiltration rates for designing the proposed infiltration system. A 2-inch thick, 3/8-inch gravel layer was placed in the bottom of each boring after the borings were drilled to investigate the soil profile.

Three-inch diameter perforated pipes were installed on top of the gravel layer. Gravel was used to backfill between the perforated pipes and the boring sidewall. The borings were then filled with water for a pre-soak period.

At the beginning of each test, the pipes were refilled with water and readings were taken at periodic time intervals as the water level dropped. The soil at the percolation test locations was classified in the field using a visual/manual procedure. The infiltration velocity is presented as the infiltration rate and is summarized in the following table. The infiltration rates provided do not include safety factors.

**Infiltration Test Results**

| Test Location | Boring Depth (ft.) | Test Depth Range (ft.) | Soil Type | Percolation Rate (in./hr.) | Correlated Infiltration Rate (in./hr.) |
|---|---|---|---|---|---|
| P-1 | 5 | 0 to 5 | SM | 37.0 | 1.5 |
| P-2 | 5 | 0 to 5 | SM | 67.8 | 3.4 |
| P-3 | 10 | 5 to 10 | SW-SM | 316.0 | 16.8 |

The above infiltration rates determined by the shallow percolation test method are based on field test results utilizing clear water. Infiltration rates can be affected by silt buildup, debris, degree of soil saturation, site variability and other factors. The rate obtained at specific location and depth is representative of the location and depth tested and may not be representative of the entire site. Application of an appropriate safety factor is prudent to account for subsoil inconsistencies, possible compaction related to site grading, and potential silting of the percolating soils, depending on the application.

The design engineer should also check with the local agency for the limitation of the infiltration rate allowed in the design. If the maximum allowable design infiltration rate is lower than the above recommended rate, the maximum allowable design infiltration rate should be used. The designer of the basins should also consider other possible site variability in the design.

The percolation test was performed with clear water, whereas the storm water will likely not be clear, but may contain organics, fines, and grease/oil. The presence of these deleterious materials will tend to decrease the rate that water percolates from the infiltration systems. Design of the storm water infiltration systems should account for the presence of these materials and should incorporate structures/devices to remove these deleterious materials.

Based on the soils encountered in our borings, we expect the percolation rates of the soils could be different than measured in the field due to variations in fines and gravel

content. The design elevation and size of the proposed infiltration system should account for this expected variability in infiltration rates.

Infiltration testing should be performed after construction of the infiltration system to verify the design infiltration rates. It should be noted that siltation and vegetation growth along with other factors may affect the infiltration rates of the infiltration areas. The actual infiltration rate may vary from the values reported here. Infiltration systems should be located at least 10 feet from any existing or proposed foundation system.

# General Comments

Our analysis and opinions are based upon our understanding of the project, the geotechnical conditions in the area, and the data obtained from our site exploration. Variations will occur between exploration point locations or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. Terracon should be retained as the Geotechnical Engineer, where noted in this report, to provide observation and testing services during pertinent construction phases. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our Scope of Services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the sole benefit and exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices with no third-party beneficiaries intended. Any third-party access to services or correspondence is solely for information purposes to support the services provided by Terracon to our client. Reliance upon the services and any work product is limited to our client and is not intended for third parties. Any use or reliance of the provided information by third parties is done solely at their own risk. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly effect excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for specific purposes to obtain the specific level of detail necessary for costing. Site safety and cost estimating including excavation

support and dewatering requirements/design are the responsibility of others. Construction and site development have the potential to affect adjacent properties. Such impacts can include damages due to vibration, modification of groundwater/surface water flow during construction, foundation movement due to undermining or subsidence from excavation, as well as noise or air quality concerns. Evaluation of these items on nearby properties are commonly associated with contractor means and methods and are not addressed in this report. The owner and contractor should consider a preconstruction/precondition survey of surrounding development. If changes in the nature, design, or location of the project are planned, our conclusions and recommendations shall not be considered valid unless we review the changes and either verify or modify our conclusions in writing.

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## Aerial Imagery Examined

Google Earth, 2023, web-based software application, aerial imagery dated May 28, 1994; June 4, 2003; November 13, 2003; December 31, 2004; December 31, 2005; May 24, 2009; March 21, 2013; January 1, 2015; September 4, 2016; June 13, 2017; August 25, 2018; May 30, 2022.

Fairchild Imagery Collection (UCSB Library), black and white aerial photograph no. AXL 6W-27, dated June 23, 1959.

Fairchild Imagery Collection (UCSB Library), black and white aerial photograph no. AXL 3JJ-149 dated May 28, 1968.

# Attachments

# Exploration and Testing Procedures

## Field Exploration

Terracon conducted eleven soil-testing borings. These borings were planned to the following extended depths below existing grades.

| Boring | Boring Depth (feet) [1] | Location |
|---|---|---|
| **B-1 and B-4** | 51 ½ | Planned building footprint |
| **B-2 and B-3** | 31 ½ | Planned building footprint |
| **B-5 to B-8** | 26 ½ | Planned building footprint |
| **P-1 to P-3** | 5 and 10 | Infiltration system |

1. **Below ground surface.**

Terracon conducted an additional eight soil-testing borings. These borings were planned to the following extended depths below existing grades.

| Boring | Boring Depth (feet) [1] | Location |
|---|---|---|
| **N-1** | 26½ | Proposed tank |
| **N-2** | 51½ | Planned Service Yard footprint |
| **N-3 and N-4** | 36½ | Planned Service Yard footprint |
| **N-5** | 26½ | Proposed tank |
| **N-6, N-7, N-8** | 5 | Parking areas |

2. **Below ground surface.**

**Boring Layout and Elevations:** Terracon personnel provided the boring layout using handheld GPS equipment (estimated horizontal accuracy of about ±10 feet) and referencing existing site features. Approximate ground surface elevations were obtained by interpolation were estimated using Google Earth. If elevations and a more precise boring layout are desired, we recommend borings be surveyed.

**Subsurface Exploration Procedures:** We advance the borings with a truck-mounted drill rig using 8-inch-diameter hollow-stem augers. Both a standard penetration test (SPT) sampler (2-inch outer diameter and 1-3/8-inch inner diameter) and a modified California ring-lined sampler (3-inch outer diameter and 2-3/8-inch inner diameter) are utilized in our investigation. The penetration resistance is recorded on the boring logs as the number of hammer blows used to advance the sampler in 6-inch increments (or less if noted). The samplers are driven with an automatic hammer that drops a 140-pound weight 30 inches for each blow. After the required seating, samplers are advanced up to 18 inches, providing up to three sets of blowcounts at

each sampling interval. The sampling depths, penetration distances, and other sampling information are recorded on the field boring logs. The recorded blows are raw numbers without any corrections for hammer type (automatic vs. manual cathead) or sampler size (ring sampler vs. SPT sampler). Relatively undisturbed and bulk samples of the soils encountered are placed in sealed containers and returned to the laboratory for testing and evaluation.

We observe and record groundwater levels during drilling and sampling. For safety purposes, all borings are backfilled with auger cuttings after their completion.

Our exploration team prepares field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs are prepared from the field logs. The final boring logs represent the Geotechnical Engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in our laboratory.

## Laboratory Testing

The project engineer reviewed the field data and assigned laboratory tests to understand the engineering properties of the various soil strata, as necessary, for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods were applied because of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed

- Moisture Content
- Dry Unit Weight
- Particle size distribution (gradation) of soils using sieve analysis
- Hydroconsolidation test
- Modified Proctor
- Plasticity Index
- R value
- Corrosion suite

The laboratory testing program often includes examination of soil samples by an engineer. Based on the results of our field and laboratory programs, we described and classified the soil samples in accordance with the Unified Soil Classification System.

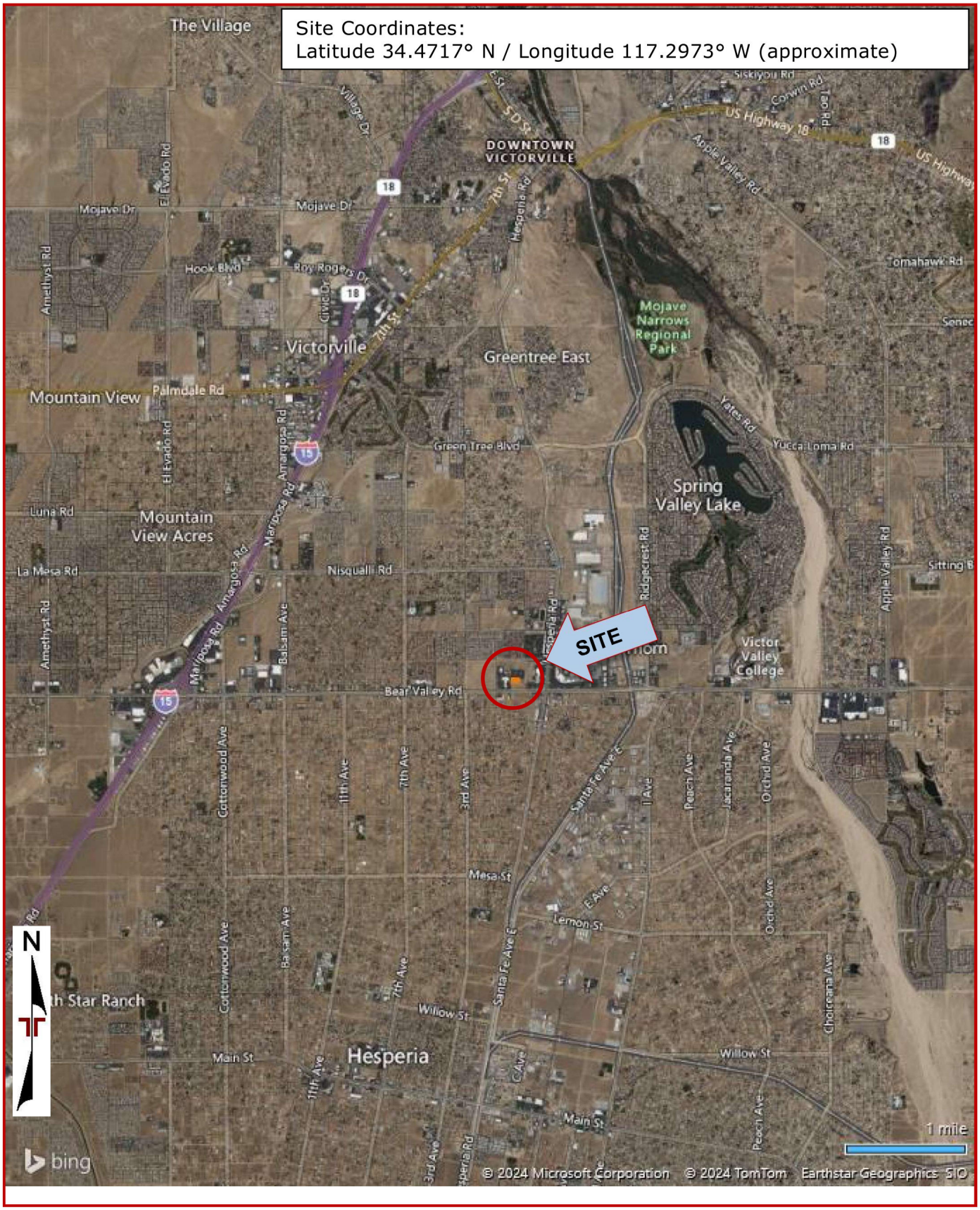
# Site Location and Exploration Plans

**Contents:**

Site Location Plan
Exploration Plan
Cross Section
Geologic Map
Regional Fault Map
Regional Seismicity Map

Note: All attachments are one page unless noted above.

## Site Location



## Exploration Plan

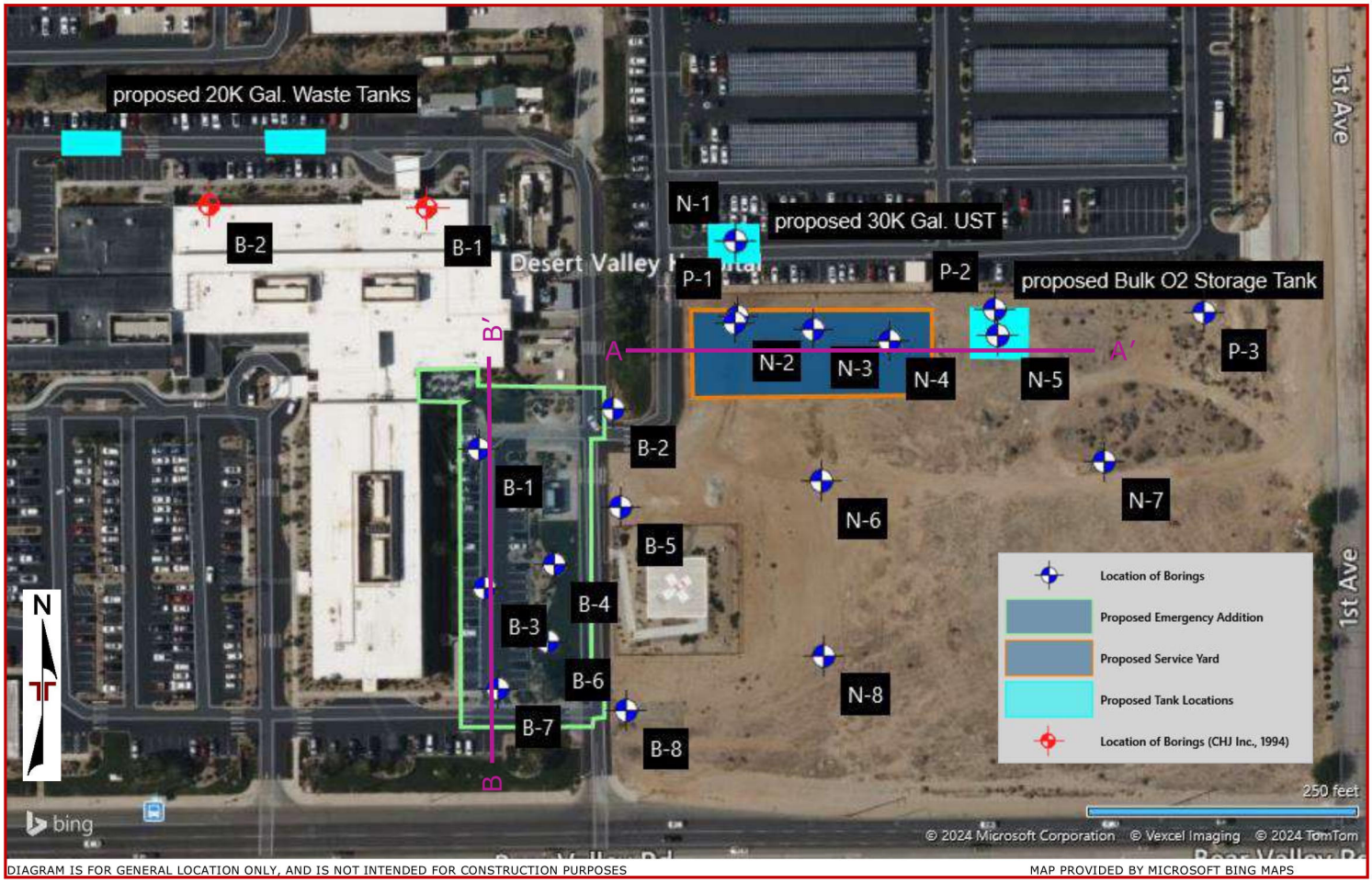
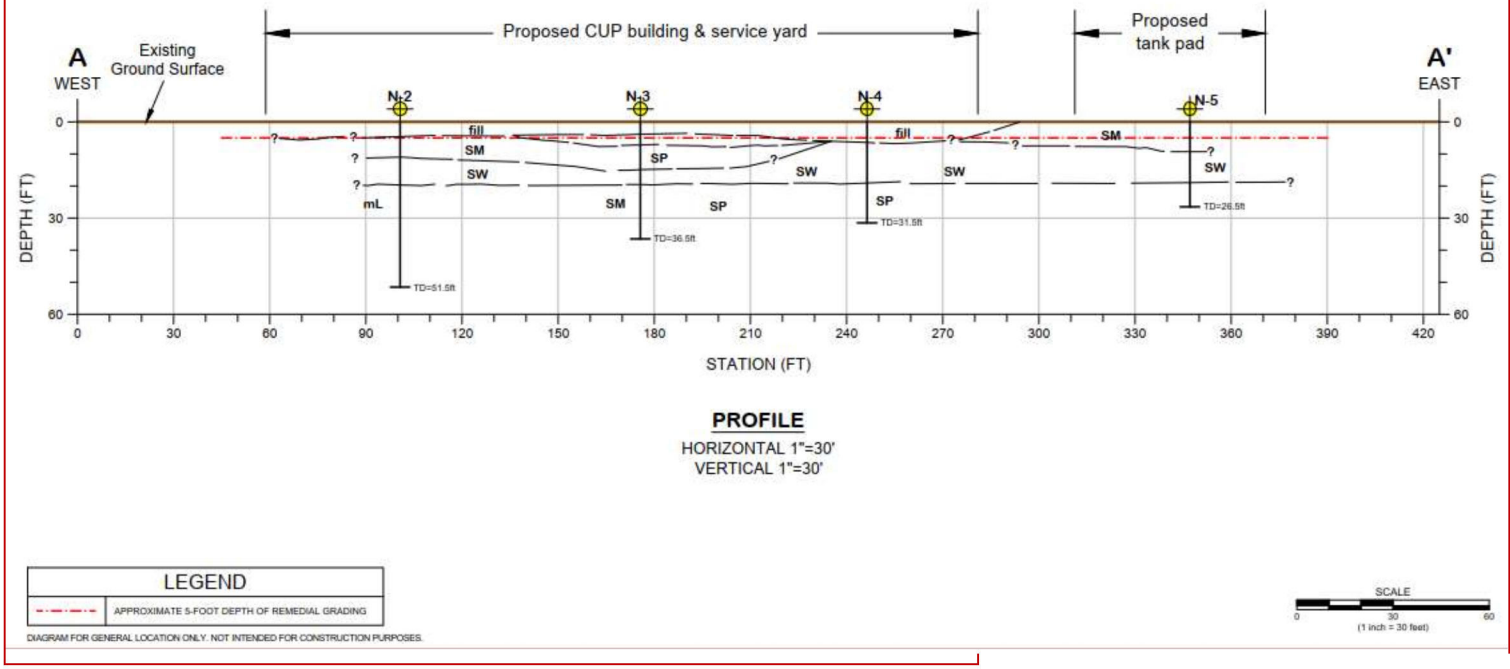



DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

MAP PROVIDED BY MICROSOFT BING MAPS

## Cross Section A A'



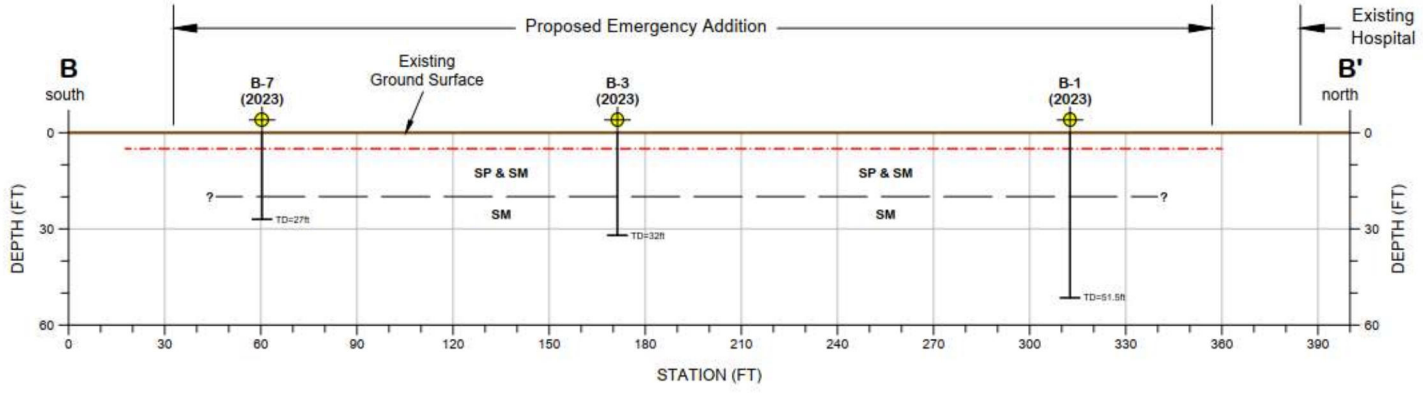

**PROFILE**
HORIZONTAL 1"=30'
VERTICAL 1"=30'

| LEGEND | |
|---|---|
| | APPROXIMATE 5-FOOT DEPTH OF REMEDIAL GRADING |

DIAGRAM FOR GENERAL LOCATION ONLY. NOT INTENDED FOR CONSTRUCTION PURPOSES.

SCALE
0 30 60
(1 inch = 30 feet)

## Cross Section B B'



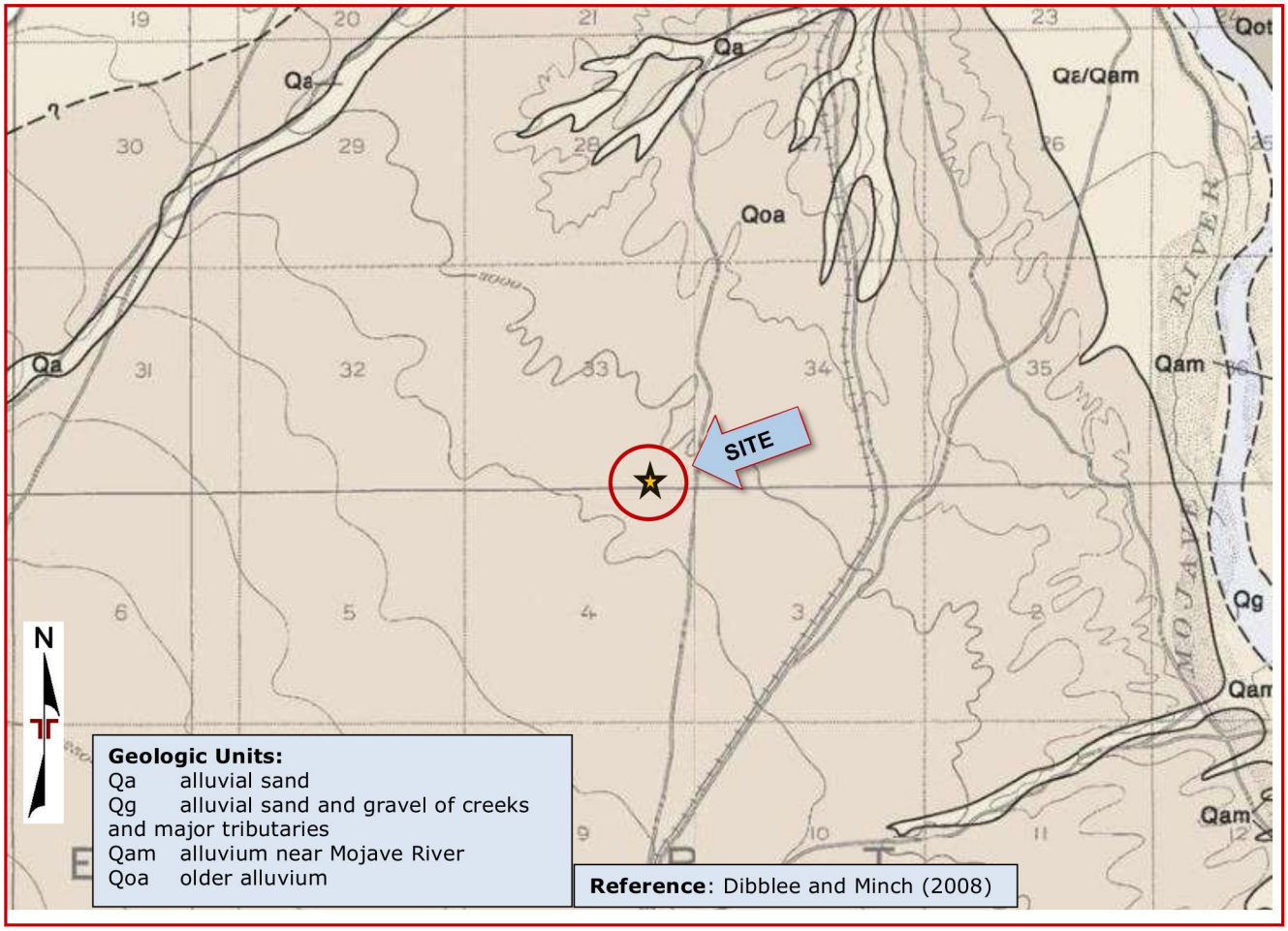

**PROFILE**
HORIZONTAL 1"=30'
VERTICAL 1"=30'

| LEGEND | |
|---|---|
| -·-·-·- | APPROXIMATE 5-FOOT DEPTH OF REMEDIAL GRADING |

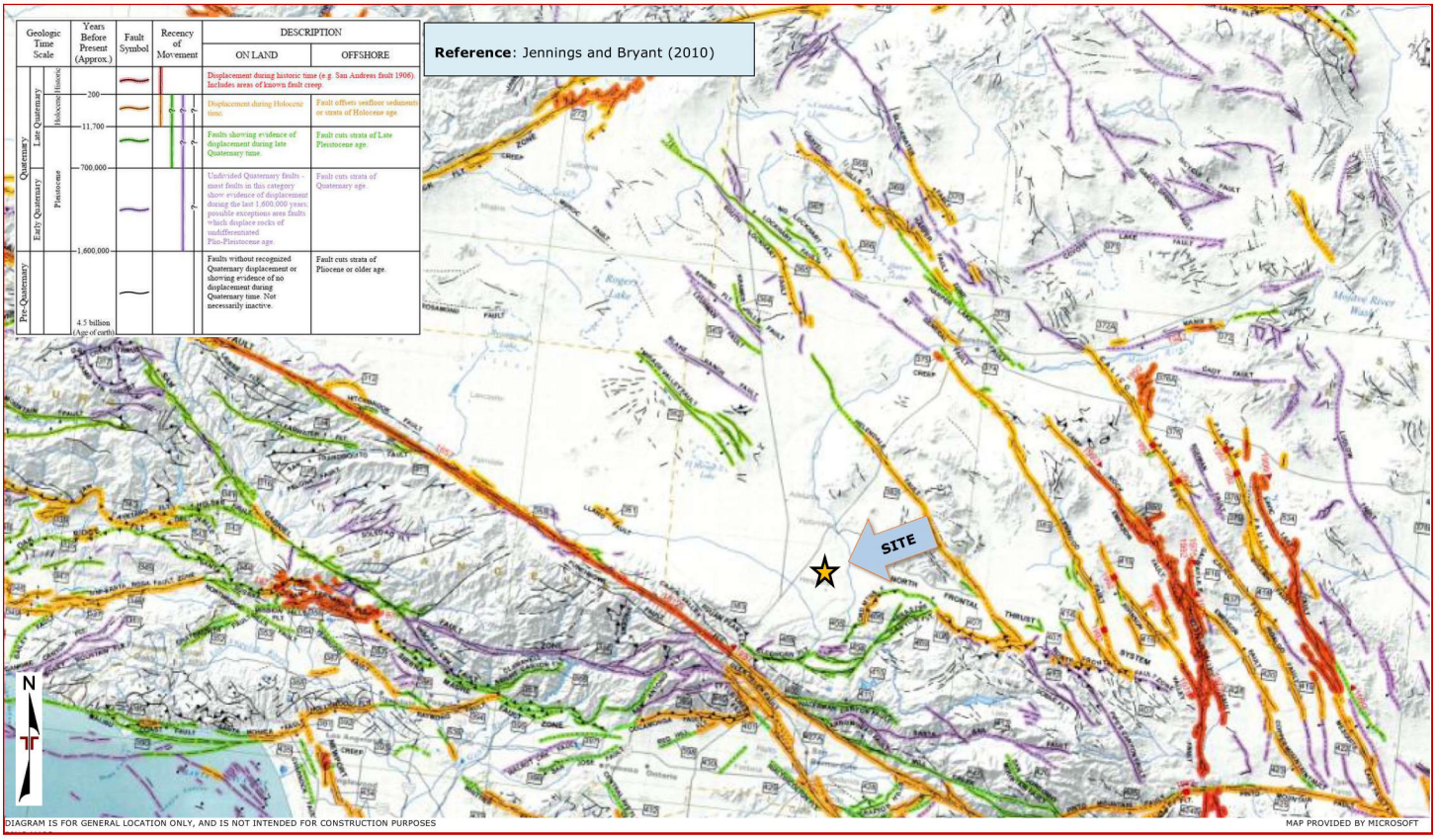
DIAGRAM FOR GENERAL LOCATION ONLY. NOT INTENDED FOR CONSTRUCTION PURPOSES.

SCALE
0 30 60
(1 inch = 30 feet)

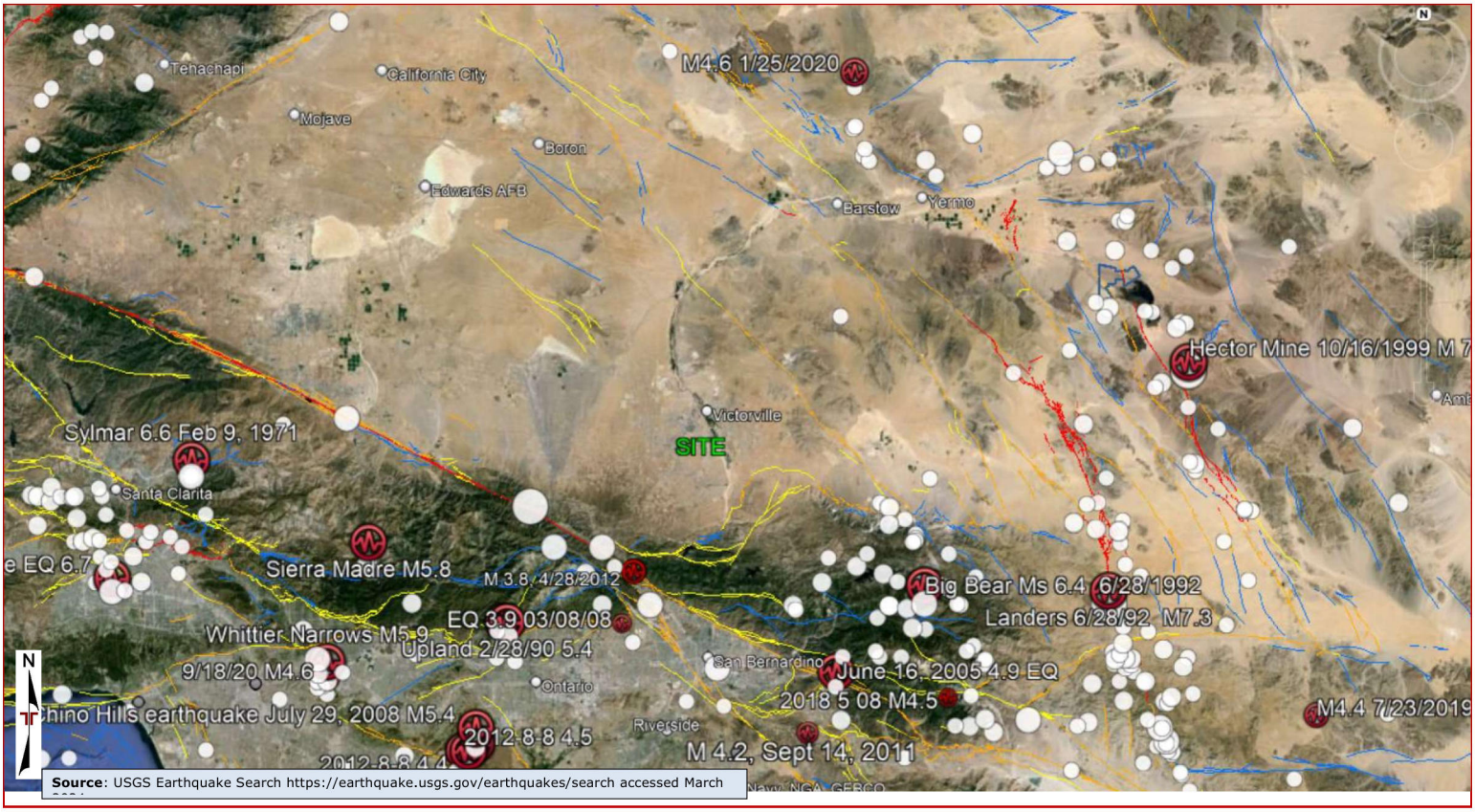
## Geologic Map



## Regional Fault Map



## Regional Seismicity Map




**Source**: USGS Earthquake Search https://earthquake.usgs.gov/earthquakes/search accessed March

# Exploration and Laboratory Results

**Contents:**

2023 INVESTIGATION
- Boring Logs B-1 through P-3 (2023)
- Consolidation (2)
- Moisture Density Relationship
- Grain Size Distribution
- Results of Corrosion Analysis
- Percolation Test Data (3)
- Liquefaction/Settlement Analysis (2)

2024 INVESTIGATION
- Boring Logs N-1 through N-8 (2024)
- Atterberg Limits
- Grain Size Distribution
- Consolidation (2)
- R-Value
- Results of Corrosion Analysis
- Moisture Content (on logs)

Note: All attachments are one page unless noted above.

# 2023 Investigation

# BORING LOG NO. B-1



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.472° Longitude: -117.2974°

| DEPTH | GRAPHIC LOG | | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.2 | | **ASPHALT**, 2" thickness | | | | | | | | |
| 0.7 | | **AGGREGATE BASE COURSE**, 6" thickness | | | | | | | | |
| | | **POORLY GRADED SAND (SP)**, trace silt, brown | | | | | | | | |
| 5.0 | | | 5 | | | | | | | |
| | | **SILTY SAND (SM)**, light brown, medium dense | | | | 16-17-13 | 12 | 102 | | 33 |
| | | loose | | | | 5-6-11 | 14 | 108 | | |
| 10.0 | | | 10 | | | | | | | |
| | | **POORLY GRADED SAND WITH SILT (SP-SM)**, light brown, medium dense | | | | 11-17-27 | 4 | 116 | | |
| | | | 15 | | | 5-10-9 N=19 | | | | 6 |
| 20.0 | | | 20 | | | | | | | |
| | | **SILTY SAND (SM)**, brown, dense | | | | 5-12-18 N=30 | | | | |
| | | medium dense | 25 | | | 6-7-9 N=16 | | | | 29 |
| | | medium dense | 30 | | | 8-13-16 N=29 | | | | |
| | | | 35 | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-1



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.472° Longitude: -117.2974°

| GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | **SILTY SAND (SM)**, brown, dense *(continued)* medium dense | | | | 7-10-16 N=26 | | | | |
| | | 40 | | | 9-18-31 N=49 | | | | 29 |
| | | 45 | | | 16-17-21 N=38 | | | | |
| | | 50 | | | 12-19-20 N=39 | | | | |
| | 51.5 ***Boring Terminated at 51.5 Feet*** | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-2



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4721° Longitude: -117.297°

| DEPTH | GRAPHIC LOG | | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | | **SILTY SAND (SM)**, brown, dense | | | | | | | |
| | | | | | | 8 | 125 | | |
| 5 | | reddish brown | | | 16-34-50 | 6 | 110 | | 28 |
| | | brown | | | 13-25-39 | 15 | 109 | | |
| 10 | | | | | 16-21-26 | 1 | 119 | | 12 |
| 10.0 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, light brown, medium dense | | | | | | | |
| 15 | | | | | 7-11-14 N=25 | | | | |
| 20 | | | | | 7-9-11 N=20 | | | | |
| 25.0 | | **SILTY SAND (SM)**, brown, medium dense | | | | | | | |
| 25 | | | | | 5-8-15 N=23 | | | | 35 |
| 30 | | | | | 3-6-9 N=15 | | | | |
| 31.5 | | ***Boring Terminated at 31.5 Feet*** | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-3



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4716° Longitude: -117.2974°

| DEPTH | GRAPHIC LOG | | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.1 | | **ASPHALT**, approximately 1.5" thick | | | | | | | | |
| 0.6 | | **AGGREGATE BASE COURSE**, approximately 6" thick | | | | | | | | |
| | | **SILTY SAND (SM)**, brown<br>very dense | | | | 6-50/6" | | | | |
| | | dense | 5 | | | 27-33-30 | 4 | 122 | | |
| 7.5 | | **POORLY GRADED SAND (SP)**, trace silt, reddish brown, medium dense | | | | 11-18-21 | 8 | 125 | | |
| 10.0 | | **SILTY SAND (SM)**, brown, medium dense | 10 | | | 12-20-29 | 9 | 120 | | 31 |
| 15.0 | | **POORLY GRADED SAND (SP)**, trace silt, tan, medium dense | 15 | | | 7-11-13<br>N=24 | | | | |
| 20.0 | | **SILTY SAND (SM)**, brown, medium dense | 20 | | | 5-6-11<br>N=17 | | | | |
| | | dense | 25 | | | 10-14-18<br>N=32 | | | | 26 |
| | | dense | 30 | | | 10-15-19<br>N=34 | | | | |
| 31.5 | | ***Boring Terminated at 31.5 Feet*** | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-4



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4717° Longitude: -117.2972°

| DEPTH | GRAPHIC LOG | | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | | **SILTY SAND (SM)**, brown, medium dense | | | | | | | |
| | | | | | 20-16-26 | 8 | 113 | | 31 |
| 5 | | reddish brown, dense | | | 25-32-36 | 6 | 130 | | 23 |
| | | brown, medium dense | | | 16-16-14 | 24 | 101 | | |
| 10.0 | | | | | | | | | |
| 10 | | **POORLY GRADED SAND WITH SILT (SP-SM)**, reddish brown, loose, soft | | | 7-6-8 | | | | 7 |
| 15 | | dense | | | 13-15-15 N=30 | | | | |
| 20.0 | | | | | | | | | |
| 20 | | **SILTY SAND (SM)**, brown, medium dense | | | 7-8-9 N=17 | | | | 21 |
| 25 | | | | | 3-5-8 N=13 | | | | |
| 30.0 | | | | | | | | | |
| 30 | | **POORLY GRADED SAND (SP)**, trace silt, brown, medium dense | | | 3-12-12 N=24 | | | | |
| 35.0 | | | | | | | | | |
| 35 | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-4



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4717° Longitude: -117.2972°

| DEPTH | GRAPHIC LOG | | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | | **WELL GRADED SAND WITH SILT (SW-SM)**, tan, dense | | | 10-20-27 N=47 | | | | 11 |
| 40.0 | | | | | | | | | |
| 40 | | **SANDY SILT (ML)**, brown, stiff | | | 3-5-9 N=14 | | | | |
| 45 | | very stiff | | | 4-7-11 N=18 | | | | 68 |
| 50.0 | | | | | | | | | |
| 50 | | **POORLY GRADED SAND (SP)**, trace silt, brown, medium dense | | | 13-11-15 N=26 | | | | |
| 51.5 | | ***Boring Terminated at 51.5 Feet*** | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-5



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4718° Longitude: -117.297°

| DEPTH | GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **POORLY GRADED SAND WITH SILT (SP-SM)**, reddish brown, medium dense | | | | | | | | | |
| | | 5 | | | 6-14-19 | 4 | 111 | | |
| | | | | | 12-21-21 | 2 | 114 | | |
| trace gravel | | 10 | | | 10-18-30 | 1 | 116 | | |
| dense | | 15 | | | 9-15-16 N=31 | | | | 7 |
| 20.0 | | | | | | | | | |
| **SILTY SAND (SM)**, brown, medium dense | | 20 | | | 8-8-8 N=16 | | | | |
| 26.5 | | 25 | | | 8-12-13 N=25 | | | | |
| ***Boring Terminated at 26.5 Feet*** | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-6



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4715° Longitude: -117.2972°

| DEPTH | GRAPHIC LOG | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| **SILTY SAND (SM)**, trace gravel, brown, dense | | | | | 14-37-50/6" | | | | |
| 5.0 | | 5 | | | 15-18-20 | | | | |
| **POORLY GRADED SAND WITH SILT (SP-SM)**, brown, medium dense | | | | | 5-8-9 | | | | |
| trace silt and gravel, loose | | 10 | | | 6-8-11 | | | | |
| | | 15 | | | 9-11-13 N=24 | | | | |
| 20.0 | | 20 | | | 8-12-9 N=21 | | | | |
| **SILTY SAND (SM)**, trace gravel, brown, medium dense | | | | | | | | | |
| 26.5 | | 25 | | | 5-7-9 N=16 | | | | |
| ***Boring Terminated at 26.5 Feet*** | | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 02-06-2023 | Boring Completed: 02-06-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-7



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4714° Longitude: -117.2973°

| DEPTH | GRAPHIC LOG | | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|---|
| 0.2 | | **ASPHALT**, approximately 1.5" thick | | | | | | | | |
| 0.7 | | **AGGREGATE BASE COURSE**, approximately 6" thick | | | | | | | | |
| 2.5 | | **SILTY SAND (SM)**, brown | | | | | | | | |
| | | **POORLY GRADED SAND (SP)**, reddish brown, medium dense | | | | 7-17-20 | 5 | 117 | | |
| | | | 5 | | | 7-14-19 | 10 | 108 | | |
| | | | | | | 5-12-17 | 1 | 111 | | |
| | | | 10 | | | 13-17-24 | 4 | 104 | | |
| | | loose | 15 | | | 6-8-7 | | | | |
| 20.0 | | **SILTY SAND (SM)**, brown, loose | 20 | | | 4-6-8 | | | | 44 |
| | | medium dense | 25 | | | 8-11-11 | | | | |
| 26.5 | | ***Boring Terminated at 26.5 Feet*** | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. B-8



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4713° Longitude: -117.2969°

| DEPTH | GRAPHIC LOG | DESCRIPTION | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | | **POORLY GRADED SAND WITH SILT (SP-SM)**, trace gravel, light brown, medium dense | | | | | | | |
| | | | | | 8-13-17 | 1 | | | 8 |
| 5 | | tan | | | 9-11-16 | 2 | | | |
| | | | | | 10-18-23 | 1 | | | |
| 10 | | | | | 13-21-29 | 2 | 109 | | 7 |
| 15 | | | | | 8-10-15 | | | | |
| 20 | | 20.0 **SILTY SAND (SM)**, brown, medium dense | | | 7-10-14 | | | | 24 |
| 25 | | 25.0 **CLAYEY SAND (SC)**, dark brown, medium dense 26.5 | | | 6-11-15 | | | | |
| | | ***Boring Terminated at 26.5 Feet*** | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Elevations were interpolated from a topographic site plan.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. P-1



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4723° Longitude: -117.2966°

| GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | **SILTY SAND (SM)**, light brown | | | | | | | | 25 |
| | 5.0 | 5 | | | | | | | |
| | ***Boring Terminated at 5 Feet*** | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. P-2



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4723° Longitude: -117.2958°

| GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | **SILTY SAND (SM)**, light brown | | | | | | | | |
| | 5.0 | 5 | | | | | | | |
| | ***Boring Terminated at 5 Feet*** | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

# BORING LOG NO. P-3



**PROJECT:** Desert Valley Hospital Addition

**CLIENT:** Prime Healthcare Management Inc
Ontario, CA

**SITE:** 16850 Bear Valley Rd
Victorville, CA

LOCATION See Exploration Plan

Latitude: 34.4723° Longitude: -117.2952°

| GRAPHIC LOG | DEPTH | DEPTH (Ft.) | WATER LEVEL OBSERVATIONS | SAMPLE TYPE | FIELD TEST RESULTS | WATER CONTENT (%) | DRY UNIT WEIGHT (pcf) | ATTERBERG LIMITS LL-PL-PI | PERCENT FINES |
|---|---|---|---|---|---|---|---|---|---|
| | **WELL GRADED SAND WITH SILT (SW-SM)**, reddish brown | 5 | | | | | | | 7 |
| | 10.0 | 10 | | | | | | | |
| | ***Boring Terminated at 10 Feet*** | | | | | | | | |

Stratification lines are approximate. In-situ, the transition may be gradual.

Hammer Type: Automatic

Advancement Method:
8-inch Hollow Stem Auger

Abandonment Method:
Boring backfilled with auger cuttings upon completion.

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

Notes:

**WATER LEVEL OBSERVATIONS**

*No free water observed*

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

Boring Started: 01-12-2023 | Boring Completed: 01-12-2023

Drill Rig: CME 75 | Driller: 2R Drilling

Project No.: CB225235

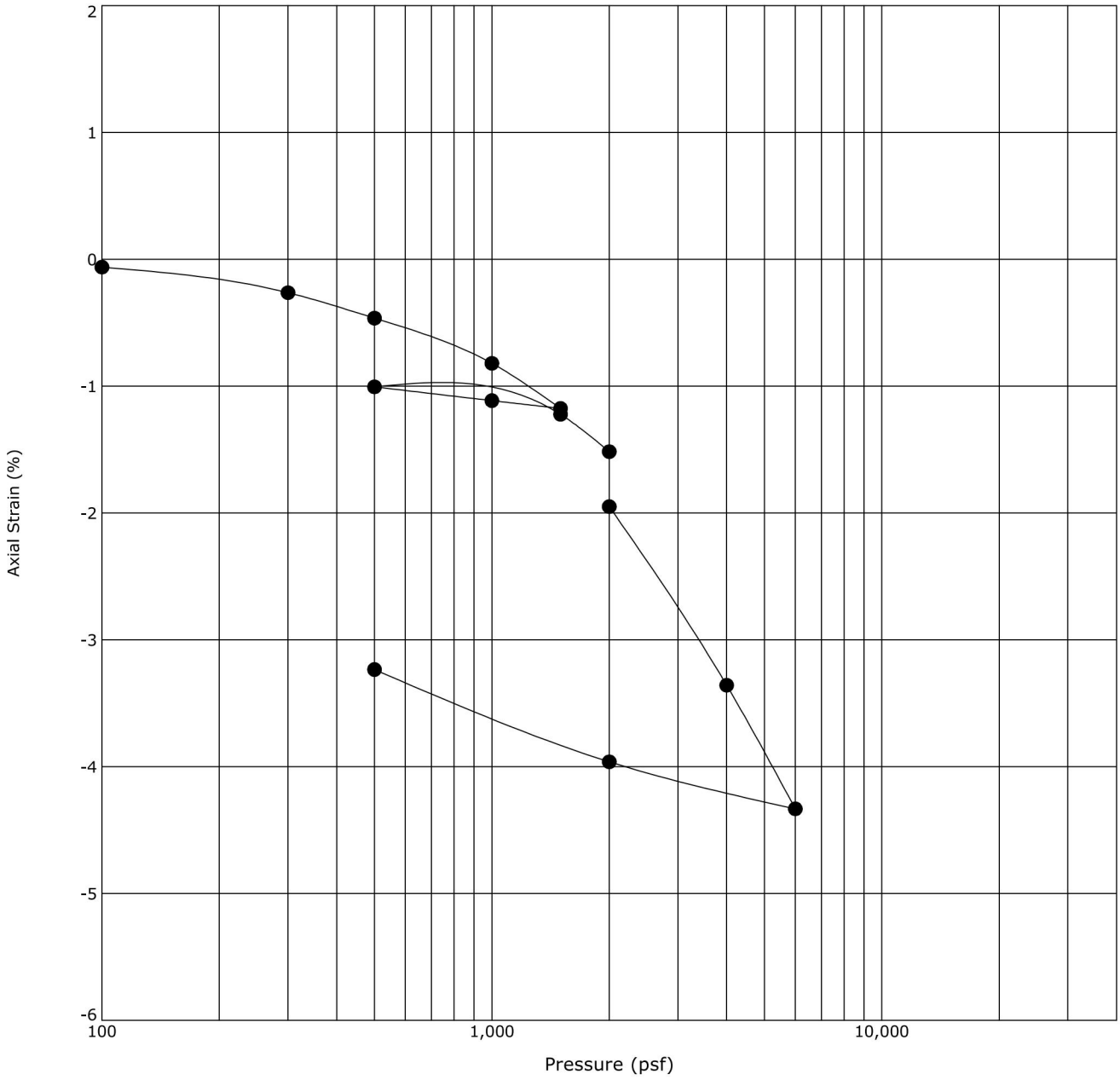
THIS BORING LOG IS NOT VALID IF SEPARATED FROM ORIGINAL REPORT. GEO SMART LOG-NO WELL CB225235 DESERT VALLEY HOS.GPJ TERRACON_DATATEMPLATE.GDT 3/1/23

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

1355 E Cooley Dr, Ste C
Colton, CA

# Swell Consolidation Test

## ASTM D2435




| Boring ID | | Depth (Ft) | Description | USCS | $\gamma_d$(pcf) | WC (%) |
|---|---|---|---|---|---|---|
| ● | B-1 | 5 - 6.5 | | | 102 | 12.1 |

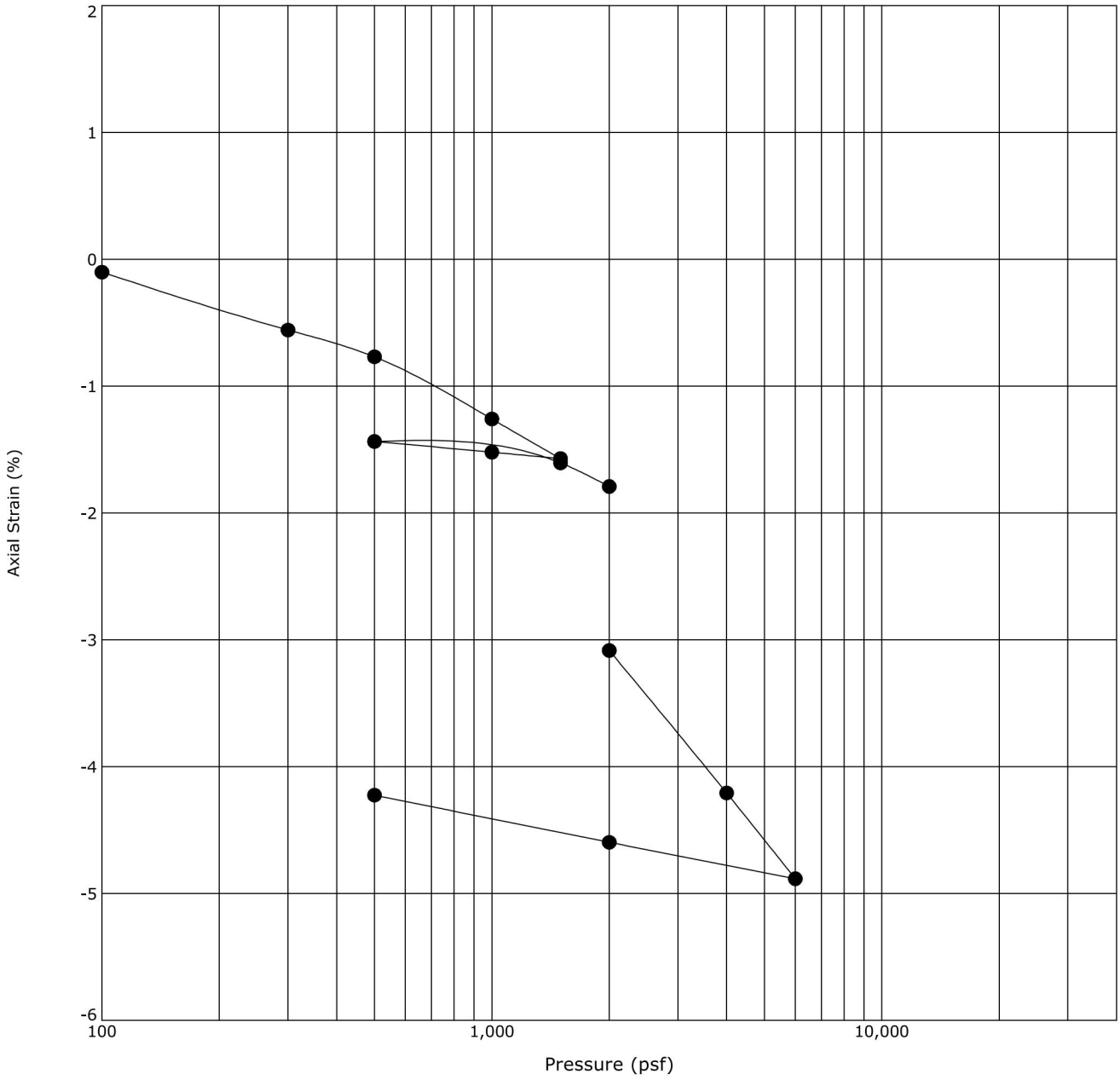
Notes:

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

1355 E Cooley Dr, Ste C
Colton, CA

# Swell Consolidation Test

## ASTM D2435




| Boring ID | | Depth (Ft) | Description | USCS | $\gamma_d$(pcf) | WC (%) |
|---|---|---|---|---|---|---|
| ● | B-8 | 5 - 6.5 | | | | 1.6 |

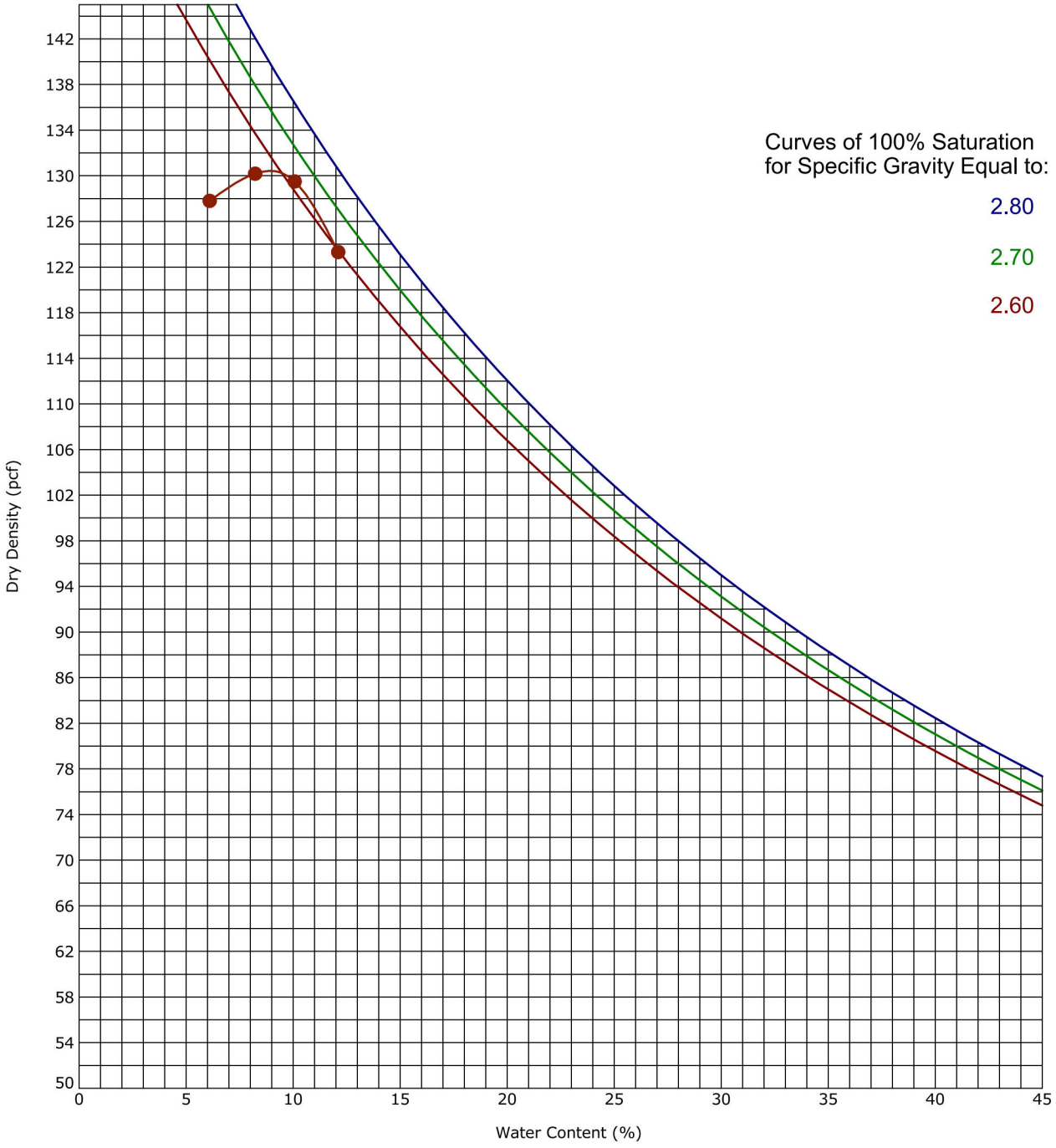
Notes:

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

# Moisture-Density Relationship

## ASTM D1557-Method D




| Boring ID | Depth (Ft) | Description of Materials |
|---|---|---|
| B-1 | 0 - 5 | POORLY GRADED SAND |

| Fines (%) | Fraction > mm size | LL | PL | PI | Test Method | Maximum Dry Density (pcf) | Optimum Water Content (%) |
|---|---|---|---|---|---|---|---|
| | 0.0 | | | | ASTM D1557-Method D | 130.4 | 8.9 |

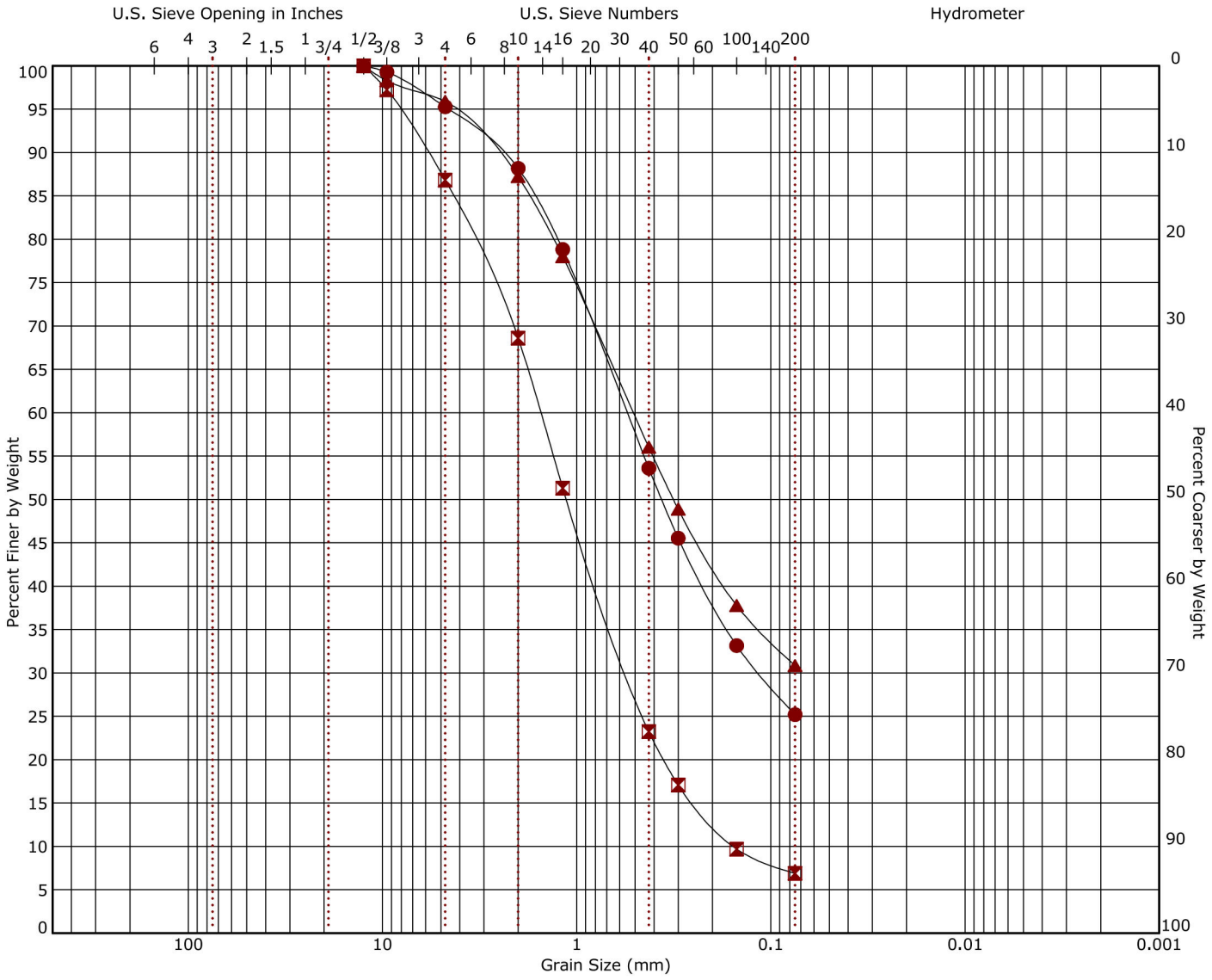
Laboratory tests are not valid if separated from original report.

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr, Ste C
Colton, CA

# Grain Size Distribution

## ASTM D422 / ASTM C136




| Cobbles | Gravel | | Sand | | | Silt or Clay |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

| Boring ID | | Depth (Ft) | USCS Classification | USCS | AASHTO | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|---|---|
| ● | P-1 | 0 - 5 | SILTY SAND | SM | | | | | | |
| ⊠ | P-3 | 5 - 10 | WELL GRADED SAND WITH SILT | SW-SM | | | | | 1.24 | 9.97 |
| ▲ | B-4 | 0 - 5 | SILTY SAND | SM | | | | | | |

| Boring ID | | Depth (Ft) | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Cobbles | %Gravel | %Sand | %Fines | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | P-1 | 0 - 5 | 12.5 | 0.551 | 0.114 | | 0.0 | 4.7 | 70.1 | 25.2 | | |
| ⊠ | P-3 | 5 - 10 | 12.5 | 1.539 | 0.544 | 0.154 | 0.0 | 13.2 | 79.9 | 6.9 | | |
| ▲ | B-4 | 0 - 5 | 12.5 | 0.511 | | | 0.0 | 4.1 | 65.1 | 30.8 | | |

Laboratory tests are not valid if separated from original report.

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

**Client**
Prime Healthcare Management Inc

**Project**
Desert Valley Hospital Addition

**Sample Submitted By:** Terracon (CB) **Date Received:** 1/24/2023 **Lab No.: 23-0069**

# Results of Corrosion Analysis

| | |
|---|---|
| **Sample Number** | -- |
| **Sample Location** | B-3 |
| **Sample Depth (ft.)** | 0.0-5.0 |
| pH Analysis, ASTM G 51 | 9.37 |
| Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg) | 22 |
| Sulfides, AWWA 4500-S D, (mg/kg) | Nil |
| Chlorides, ASTM D 512, (mg/kg) | 23 |
| Red-Ox, ASTM G 200, (mV) | +732 |
| Total Salts, AWWA 2540, (mg/kg) | 327 |
| As-Received Resistivity, ASTM G 57, (ohm-cm) | 29100 |
| Resistivity, ASTM G 57, (ohm-cm) | 2813 |

**Analyzed By:**
Nathan Campo
Engineering Technician II

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

Job No.: CB225235

# PERCOLATION TEST DATA

BORING NUMBER: P-1
LOT No:
TRACT No:

CLIENT: Prime Healthcare Management Inc.
PROJECT: Desert Valley Hospital Addition

DATE OF DRILLING: January 13, 2023
DATE OF PRESOAK: January 13, 2023
DATE OF TEST: January 13, 2023
TESTED BY:

DEPTH BEFORE (ft.): 5.0
DEPTH AFTER (ft.): 5.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

| Time Interval (min.) | Total Elapsed Time (min.) | Initial Water Level (in.) | Final Water Level (in.) | Change in Water Level (in.) | Initial Hole Depth (in.) | Final Hole Depth (in.) | Percolation Rate (in/hr) | Infiltration rate (Porchet Method) (in/hr) |
|---|---|---|---|---|---|---|---|---|
| 15 | 15 | 2.5 | 22.0 | 19.5 | 60.0 | 60.0 | 78.0 | 3.14 |
| 15 | 30 | 4.0 | 13.0 | 9.0 | 60.0 | 60.0 | 36.0 | 1.35 |
| 10 | 40 | 9.0 | 17.0 | 8.0 | 60.0 | 60.0 | 48.0 | 1.96 |
| 10 | 50 | 9.0 | 15.0 | 6.0 | 60.0 | 60.0 | 36.0 | 1.44 |
| 10 | 60 | 9.0 | 15.0 | 6.0 | 60.0 | 60.0 | 36.0 | 1.44 |
| 10 | 70 | 9.0 | 15.5 | 6.5 | 60.0 | 60.0 | 39.0 | 1.57 |
| 10 | 80 | 9.0 | 15.0 | 6.0 | 60.0 | 60.0 | 36.0 | 1.44 |
| | | | | Average of last 3 readings: | | | 37.00 | 1.48 |

Job No.: CB225235

# PERCOLATION TEST DATA

BORING NUMBER: P-2
LOT No:
TRACT No:

CLIENT: Prime Healthcare Management Inc.
PROJECT: Desert Valley Hospital Addition

DATE OF DRILLING: January 13, 2023
DATE OF PRESOAK: January 13, 2023
DATE OF TEST: January 13, 2023
TESTED BY:

DEPTH BEFORE (ft.): 5.0
DEPTH AFTER (ft.): 5.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

| Time Interval (min.) | Total Elapsed Time (min.) | Initial Water Level (in.) | Final Water Level (in.) | Change in Water Level (in.) | Initial Hole Depth (in.) | Final Hole Depth (in.) | Percolation Rate (in/hr) | Infiltration rate (Porchet Method) (in/hr) |
|---|---|---|---|---|---|---|---|---|
| 10 | 10 | 21.0 | 60.0 | 39.0 | 60.0 | 60.0 | 234.0 | 21.77 |
| 3 | 13 | 23.0 | 30.8 | 7.8 | 60.0 | 60.0 | 155.0 | 8.83 |
| 10 | 23 | 16.0 | 36.0 | 20.0 | 60.0 | 60.0 | 120.0 | 6.67 |
| 10 | 33 | 16.0 | 30.0 | 14.0 | 60.0 | 60.0 | 84.0 | 4.31 |
| 10 | 43 | 17.0 | 29.0 | 12.0 | 60.0 | 60.0 | 72.0 | 3.69 |
| 10 | 53 | 17.0 | 28.0 | 11.0 | 60.0 | 60.0 | 66.0 | 3.34 |
| 10 | 63 | 17.0 | 29.0 | 12.0 | 60.0 | 60.0 | 72.0 | 3.69 |
| 11 | 64 | 16.0 | 28.0 | 12.0 | 60.0 | 60.0 | 65.5 | 3.27 |
| | | | | Average of last 3 readings: | | | 67.82 | 3.44 |

Job No.: CB225235

# PERCOLATION TEST DATA

BORING NUMBER: P-3
LOT No:
TRACT No:

CLIENT: Prime Healthcare Management Inc.
PROJECT: Desert Valley Hospital Addition

DATE OF DRILLING: January 13, 2023
DATE OF PRESOAK: January 13, 2023
DATE OF TEST: January 13, 2023
TESTED BY:

DEPTH BEFORE (ft.): 10.0
DEPTH AFTER (ft.): 10.0
PVC PIPE DIA. (in.): 3.0
PERC HOLE DIA. (in.): 8.0

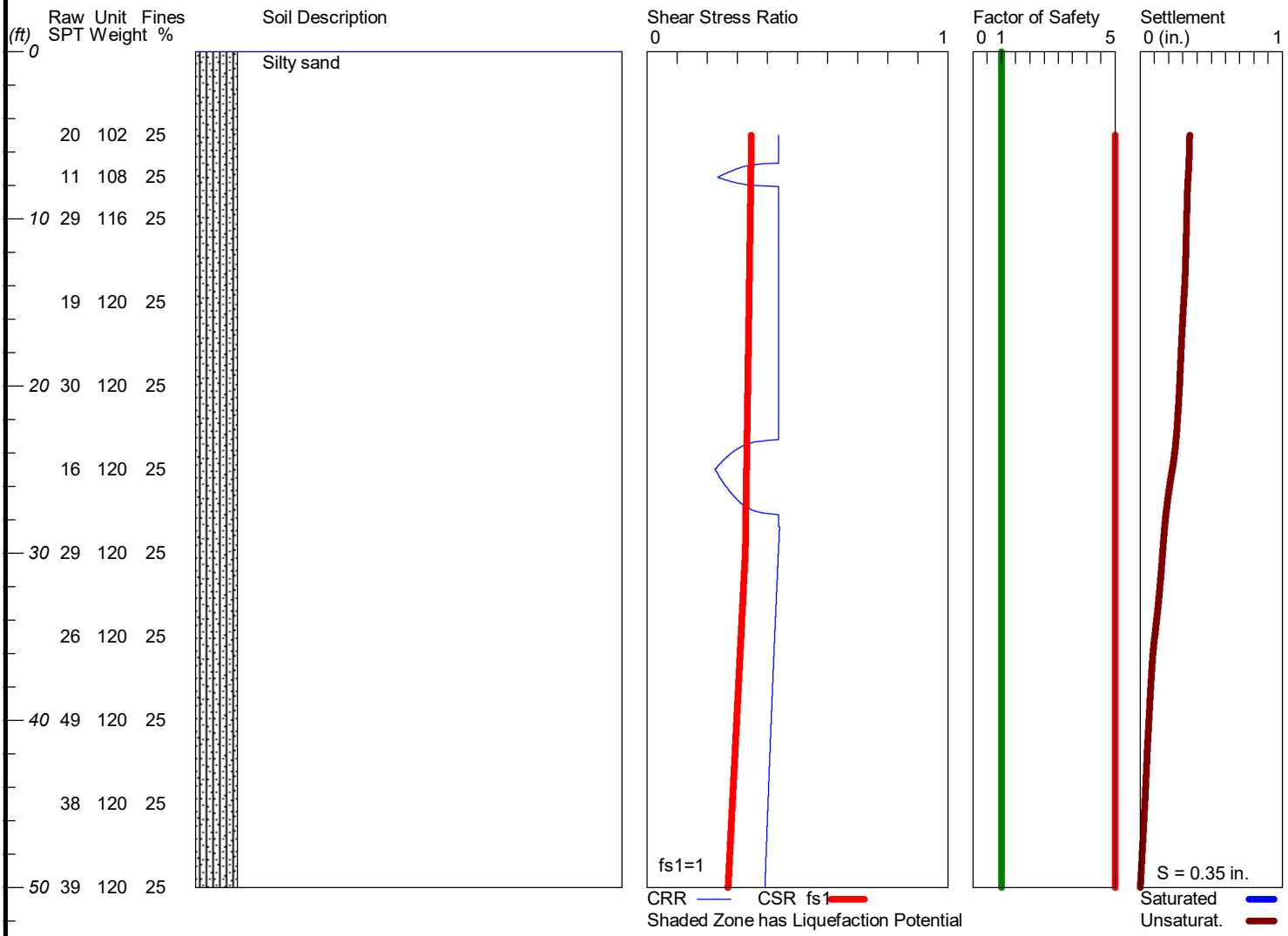
| Time Interval (min.) | Total Elapsed Time (min.) | Initial Water Level (in.) | Final Water Level (in.) | Change in Water Level (in.) | Initial Hole Depth (in.) | Final Hole Depth (in.) | Percolation Rate (in/hr) | Infiltration rate (Porchet Method) (in/hr) |
|---|---|---|---|---|---|---|---|---|
| 3 | 3 | 58.0 | 94.0 | 36.0 | 120.0 | 120.0 | 720.0 | 31.30 |
| 2 | 5 | 64.0 | 106.0 | 42.0 | 120.0 | 120.0 | 1260.0 | 68.11 |
| 10 | 15 | 58.0 | 113.0 | 55.0 | 120.0 | 120.0 | 330.0 | 18.08 |
| 10 | 25 | 58.0 | 112.0 | 54.0 | 120.0 | 120.0 | 324.0 | 17.51 |
| 10 | 35 | 58.0 | 112.0 | 54.0 | 120.0 | 120.0 | 324.0 | 17.51 |
| 10 | 45 | 58.0 | 110.0 | 52.0 | 120.0 | 120.0 | 312.0 | 16.42 |
| 10 | 55 | 58.0 | 111.0 | 53.0 | 120.0 | 120.0 | 318.0 | 16.96 |
| 10 | 62 | 58.0 | 111.0 | 53.0 | 120.0 | 120.0 | 318.0 | 16.96 |
| | | | | Average of last 3 readings: | | | 316.00 | 16.78 |

# LIQUEFACTION ANALYSIS

## Desert Valley Hospital Addition

***Hole No.=B-1  Water Depth=100 ft***

***Magnitude=7.9***
***Acceleration=0.54g***



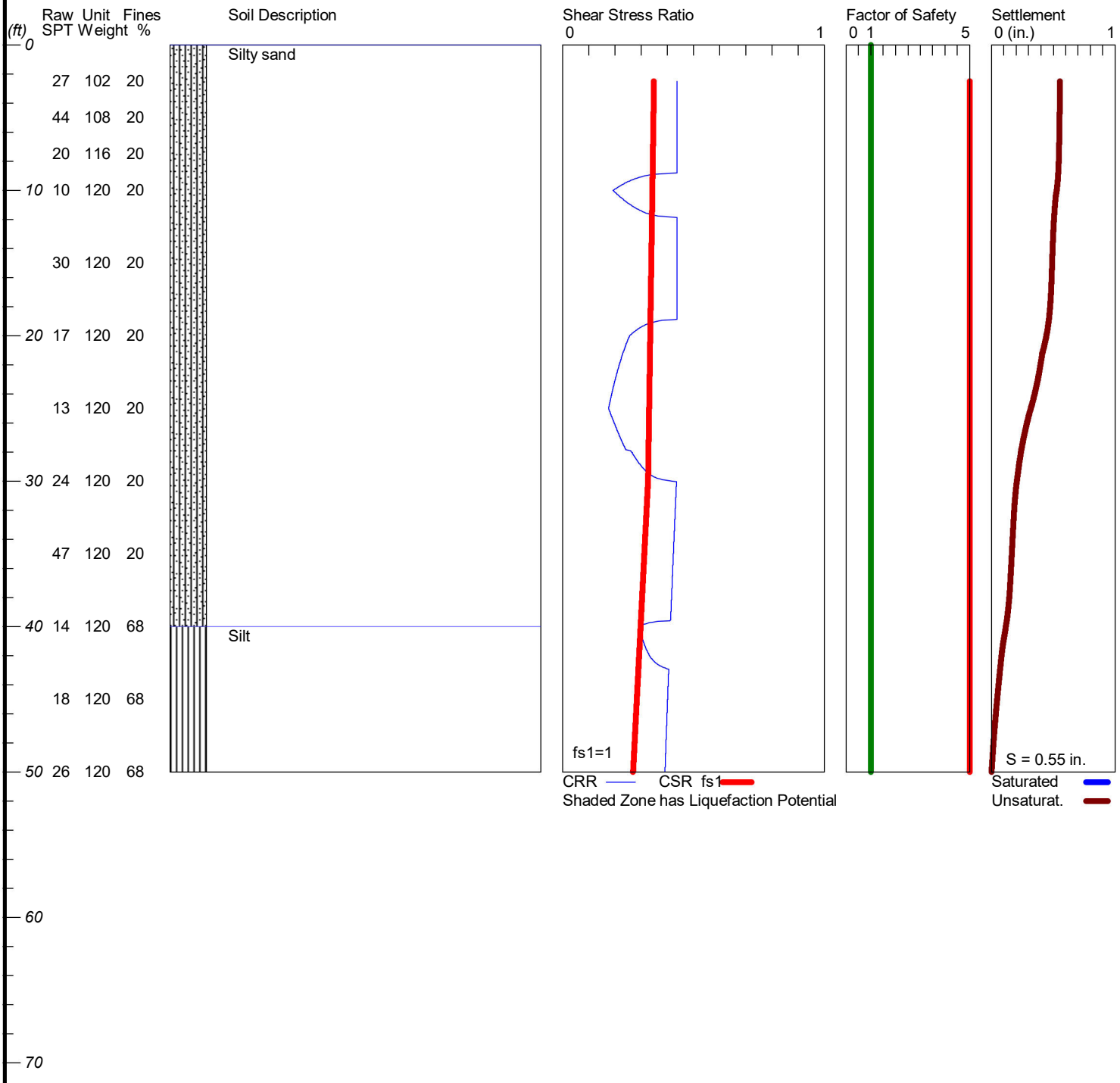

LiquefyPro CivilTech Software USA www.civiltech.com

# LIQUEFACTION ANALYSIS

## Desert Valley Hospital Addition

***Hole No.=B-4  Water Depth=100 ft***

***Magnitude=7.9***
***Acceleration=0.54g***




LiquefyPro CivilTech Software USA www.civiltech.com

# 2024 Investigation

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-1

Location: See Exploration Plan

Latitude: 34.4723° Longitude: -117.2966°

| Depth (Ft.) | Elevation.: 3032 (Ft.) | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|
| 0.2 | **ASPHALT**, 2.5" 3031.79 | | | | | |
| 0.5 | **AGGREGATE BASE COURSE**, 4.1" 3031.46 | | | | | |
| | **SILTY SAND (SM)**, trace clay, fine to coarse grained, brown<br>medium dense<br>fine grained | 12-17-18 | 5.6 | 117 | NP | 23 |
| | | 7-23-34 | 10.9 | 119 | | |
| 7.0 | 3025 | | | | | |
| | **WELL GRADED SAND WITH GRAVEL (SW)**, fine to coarse grained, yellowish brown<br>loose | 7-8-10 | 10.0 | 101 | | |
| 9.0 | 3023 | | | | | |
| | **POORLY GRADED SAND (SP)**, fine grained, yellow<br>medium dense | 5-12-15 | 6.4 | 107 | | |
| | | 4-5-8<br>N=13 | | | | |
| 19.0 | 3013 | | | | | |
| | **SILTY CLAYEY SAND (SC-SM)**, fine grained, olive<br>very dense | 7-19-33<br>N=52 | | | | 45 |
| 24.0 | 3008 | | | | | |
| | **POORLY GRADED SAND (SP)**, fine grained, yellow<br>medium dense | 6-12-15<br>N=27 | | | | |
| 26.5 | 3005.5 | | | | | |
| | ***Boring Terminated at 26.5 Feet*** | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-19-2024

**Boring Completed**
03-19-2024

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-2

Location: See Exploration Plan

Latitude: 34.4723° Longitude: -117.2966°

Depth (Ft.) Elevation.: 3033 (Ft.)

| Graphic Log | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **FILL - SILTY SAND WITH GRAVEL (SM)**, with clay, gravel up to 1", fine to coarse grained, brown<br>medium dense | | | | 7-16-33 | 6.1 | 121 | | |
| 4.0 3029 | | | | | | | | |
| **SILTY SAND (SM)**, fine grained, yellow<br>medium dense | 5 | | | 7-14-14 | 8.8 | 98 | | |
| dense | | | | 16-25-36 | 7.1 | 109 | | |
| 9.0 3024 | | | | | | | | |
| **WELL GRADED SAND WITH GRAVEL (SW)**, up to 1", fine to coarse grained, yellowish brown<br>medium dense | 10 | | | 14-27-28 | 4.0 | 108 | | |
| | 15 | | | 6-6-8<br>N=14 | | | | |
| 19.0 3014 | | | | | | | | |
| **SANDY SILT (ML)**, with clay, fine grained, olive brown<br>very stiff | 20 | | | 4-6-10<br>N=16 | | | | 50 |
| 24.0 3009 | | | | | | | | |
| **POORLY GRADED SAND (SP)**, fine grained, yellow<br>medium dense | 25 | | | 5-9-12<br>N=21 | | | | |
| 29.0 3004 | | | | | | | | |
| **SILTY SAND (SM)**, fine grained, yellow | 30 | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-19-2024

**Boring Completed**
03-19-2024

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-2

Location: See Exploration Plan

Latitude: 34.4723° Longitude: -117.2966°

Depth (Ft.) Elevation.: 3033 (Ft.)

| Graphic Log | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|
| | **SILTY SAND (SM)**, fine grained, yellow *(continued)*<br>medium dense | | | 7-12-16<br>N=28 | | | | |
| | 34.0 2999 | | | | | | | |
| | **WELL GRADED SAND (SW)**, with few gravel up to 1/2", fine to coarse grained, brown<br>medium dense | | | 8-10-12<br>N=22 | | | | |
| | 35 | | | | | | | |
| | 39.0 2994 | | | | | | | |
| | **SANDY SILT (ML)**, fine grained, olive<br>very stiff | | | 8-11-15<br>N=26 | | | | 53 |
| | 40 | | | | | | | |
| | 44.0 2989 | | | | | | | |
| | **SILTY SAND (SM)**, fine to medium grained, olive brown<br>medium dense | | | 6-12-16<br>N=28 | | | | |
| | 45 | | | | | | | |
| | fine grained<br>dense | | | 11-15-22<br>N=37 | | | | |
| | 50 | | | | | | | |
| | 51.5 2981.5 | | | | | | | |
| | ***Boring Terminated at 51.5 Feet*** | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-19-2024

**Boring Completed**
03-19-2024

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-3

Location: See Exploration Plan

Latitude: 34.4723° Longitude: -117.2964°

Depth (Ft.) Elevation.: 3035 (Ft.)

| Depth (Ft.) | Elevation | Description | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|
| 0 | | **FILL - SILTY SAND WITH GRAVEL (SM)**, up to 1", fine to coarse grained, brown | | | | | |
| 2.5 | 3032.5 | | | | | | |
| | | **WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, up to 1", fine to coarse grained, yellow, medium dense | 7-11-16 | 3.4 | 109 | | |
| 6.0 | 3029 | | 6-9-12 | 3.9 | 102 | | |
| | | **POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, yellow<br>medium dense | 9-16-16 | 7.9 | 94 | | |
| 14.0 | 3021 | | 8-10-25 | 6.3 | 95 | | |
| | | **WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, fine to coarse grained, yellow<br>medium dense | 4-8-8<br>N=16 | | | | |
| 19.0 | 3016 | | | | | | |
| | | **SILTY SAND (SM)**, fine grained, yellow<br>medium dense | 7-9-15<br>N=24 | | | | |
| | | | 7-11-13<br>N=24 | | | | |
| 29.0 | 3006 | | | | | | |
| | | **POORLY GRADED SAND (SP)**, fine to medium grained, yellow | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-19-2024

**Boring Completed**
03-19-2024

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-3

| Graphic Log | Location: See Exploration Plan<br>Latitude: 34.4723° Longitude: -117.2964°<br>Depth (Ft.) Elevation.: 3035 (Ft.) | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| | **POORLY GRADED SAND (SP)**, fine to medium grained, yellow<br>*(continued)*<br>medium dense<br>34.0 3001 | | | | 12-12-13<br>N=25 | | | | |
| | **SANDY SILT (ML)**, fine grained, olive yellow<br>hard<br>36.5 2998.5 | 35 | | | 9-19-28<br>N=47 | | | | 62 |
| | ***Boring Terminated at 36.5 Feet*** | | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-19-2024

**Boring Completed**
03-19-2024

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-4

Location: See Exploration Plan

Latitude: 34.4722° Longitude: -117.2961°

Depth (Ft.) Elevation.: 3036 (Ft.)

| Graphic Log | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|
| **FILL - SILTY SAND (SM)**, trace gravel up to 1", fine to coarse grained, brown<br>very dense | 0 | | | | | | | |
| | | | | 20-50/5" | 5.2 | 116 | | 22 |
| | 5 | | | 45-50/5" | 5.1 | 105 | | |
| 6.0 3030 | | | | | | | | |
| **WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, up to 1", fine to coarse grained, brown<br>medium dense | | | | 23-27-25 | 3.0 | 109 | | |
| | 10 | | | 13-15-20 | 4.6 | 108 | | |
| yellowish brown, no silt | | | | 5-6-6<br>N=12 | | | | |
| 19.0 3017 | 15 | | | | | | | |
| **POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, brown<br>medium dense | 20 | | | 4-8-10<br>N=18 | | | | |
| 24.0 3012 | | | | | | | | |
| **SILTY SAND (SM)**, fine to coarse grained, brown<br>medium dense | 25 | | | 6-12-14<br>N=26 | | | | |
| 29.0 3007 | | | | | | | | |
| **POORLY GRADED SAND (SP)**, fine grained, yellow | 30 | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-19-2024

**Boring Completed**
03-19-2024

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-4

| Graphic Log | Location: See Exploration Plan<br>Latitude: 34.4722° Longitude: -117.2961°<br>Depth (Ft.) Elevation.: 3036 (Ft.) | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| | **POORLY GRADED SAND (SP)**, fine grained, yellow *(continued)*<br>medium dense | | | | 7-12-14<br>N=26 | | | | |
| | 34.0 3002 | | | | | | | | |
| | **SANDY SILT (ML)**, fine grained, light olive gray<br>very stiff | 35 | | | 8-13-17<br>N=30 | | | | |
| | 36.5 2999.5 | | | | | | | | |
| | ***Boring Terminated at 36.5 Feet*** | | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-19-2024

**Boring Completed**
03-19-2024

Desert Valley Hospital Addition
16850 Bear Valley Rd | Victorville, CA
Terracon Project No. CB225235

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1355 E Cooley Dr
Colton, CA

# Boring Log No. N-5

Location: See Exploration Plan

Latitude: 34.4723° Longitude: -117.2958°

Depth (Ft.) Elevation.: 3036 (Ft.)

| Graphic Log | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|
| | **SILTY SAND WITH GRAVEL (SM)**, up to 2", fine to coarse grained, brown | | | | | | | |
| | very loose | | | 2-3-3 | 5.1 | 108 | NP | |
| | with clay | | | | | | | |
| | loose | | | 5-7-10 | 8.3 | 93 | | |
| | 9.0 3027 | | | 5-9-7 | 7.4 | 98 | | |
| | **WELL GRADED SAND WITH GRAVEL (SW)**, with few gravels up to 1/2", fine to coarse grained, yellowish gray | | | | | | | |
| | loose | | | 4-5-7 | 1.3 | 101 | | |
| | medium dense | | | 11-12-10 N=22 | | | | |
| | 19.0 3017 | | | | | | | |
| | **POORLY GRADED SAND WITH SILT (SP-SM)**, fine grained, yellow | | | | | | | |
| | medium dense | | | 5-9-11 N=20 | | | | |
| | dense | | | 8-14-22 N=36 | | | | |
| | 26.5 3009.5 | | | | | | | |
| | ***Boring Terminated at 26.5 Feet*** | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-20-2024

**Boring Completed**
03-20-2024

Desert Valley Hospital Addition
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Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-6

| Graphic Log | Location: See Exploration Plan<br>Latitude: 34.4719° Longitude: -117.2963°<br>Depth (Ft.) Elevation.: 3038 (Ft.) | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| | **SILTY SAND WITH GRAVEL (SM)**, up to 1", fine to coarse grained, brown<br>medium dense | | | | 9-13-20 | 2.0 | 108 | NP | 25 |
| | 5.0 3033<br>***Boring Terminated at 5 Feet*** | 5 | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).
See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-20-2024

**Boring Completed**
03-20-2024

Desert Valley Hospital Addition
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Terracon Project No. CB225235

Terracon
1355 E Cooley Dr
Colton, CA

# Boring Log No. N-7

| Graphic Log | Location: See Exploration Plan<br>Latitude: 34.4719° Longitude: -117.2955°<br>Depth (Ft.) Elevation.: 3034 (Ft.) | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| | **FILL - SILTY SAND WITH GRAVEL (SM)**, up to 1", fine to coarse grained, brown<br>3.0 3031 | | | | | | | | |
| | **WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, up to 1", fine to coarse grained, brown, medium dense<br>5.0 3029 | | | | 6-12-16 | 5.8 | 112 | | |
| | ***Boring Terminated at 5 Feet*** | 5 | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-20-2024

**Boring Completed**
03-20-2024

Desert Valley Hospital Addition
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Terracon Project No. CB225235

1355 E Cooley Dr
Colton, CA

# Boring Log No. N-8

| Graphic Log | Location: See Exploration Plan<br>Latitude: 34.4714° Longitude: -117.2963°<br>Depth (Ft.) Elevation.: 3041 (Ft.) | Depth (Ft.) | Water Level Observations | Sample Type | Field Test Results | Water Content (%) | Dry Unit Weight (pcf) | Atterberg Limits LL-PL-PI | Percent Fines |
|---|---|---|---|---|---|---|---|---|---|
| | **WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)**, up to 1", fine to coarse grained, reddish brown | | | | | | | | |
| | dense | | | | 35-37-42 | 2.1 | 108 | | |
| | 5.0 3036 | 5 | | | | | | | |
| | ***Boring Terminated at 5 Feet*** | | | | | | | | |

See Exploration and Testing Procedures for a description of field and laboratory procedures used and additional data (If any).

See Supporting Information for explanation of symbols and abbreviations.

**Water Level Observations**
No groundwater encountered

**Drill Rig**
CME 75

**Hammer Type**
Automatic

**Driller**
2R Drilling

**Notes**

**Advancement Method**
Hollow stem auger

**Abandonment Method**
Boring backfilled with auger cuttings upon completion.

**Logged by**
GA

**Boring Started**
03-20-2024

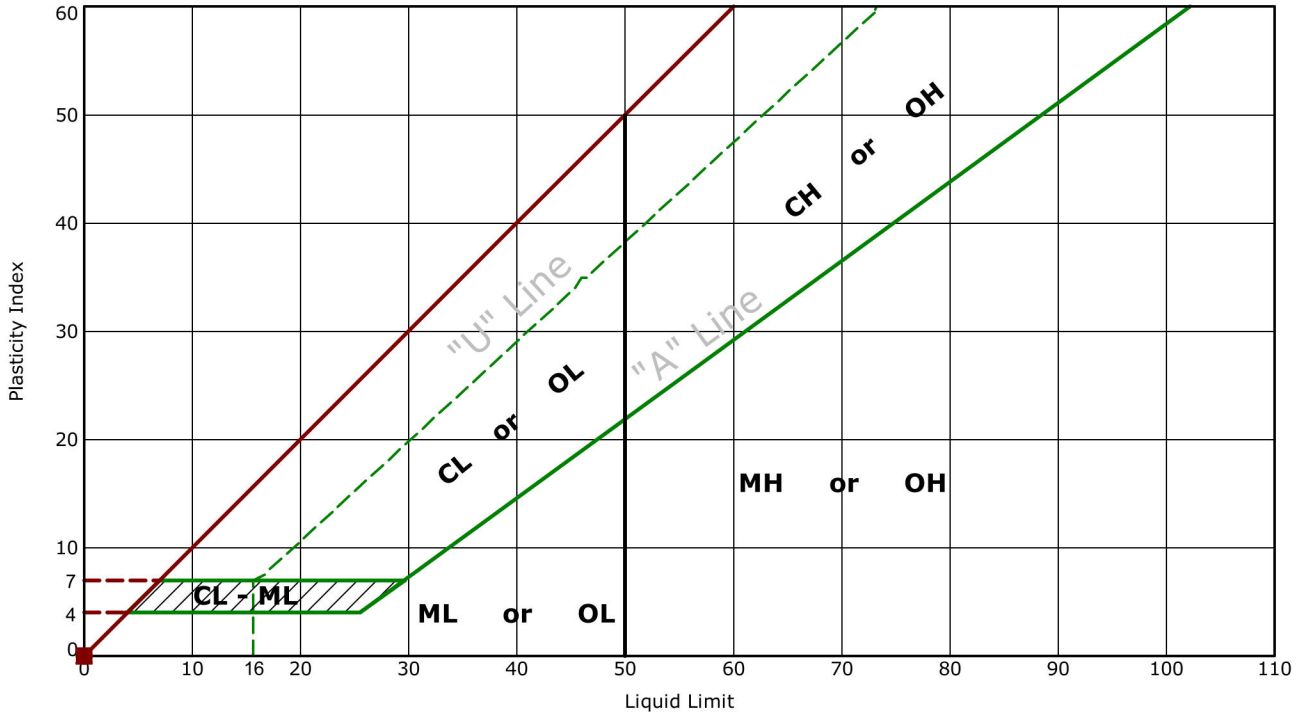
**Boring Completed**
03-20-2024

Desert Valley Hospital Addition
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Terracon Project No. CB225235

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Colton, CA

# Atterberg Limit Results

## ASTM D4318



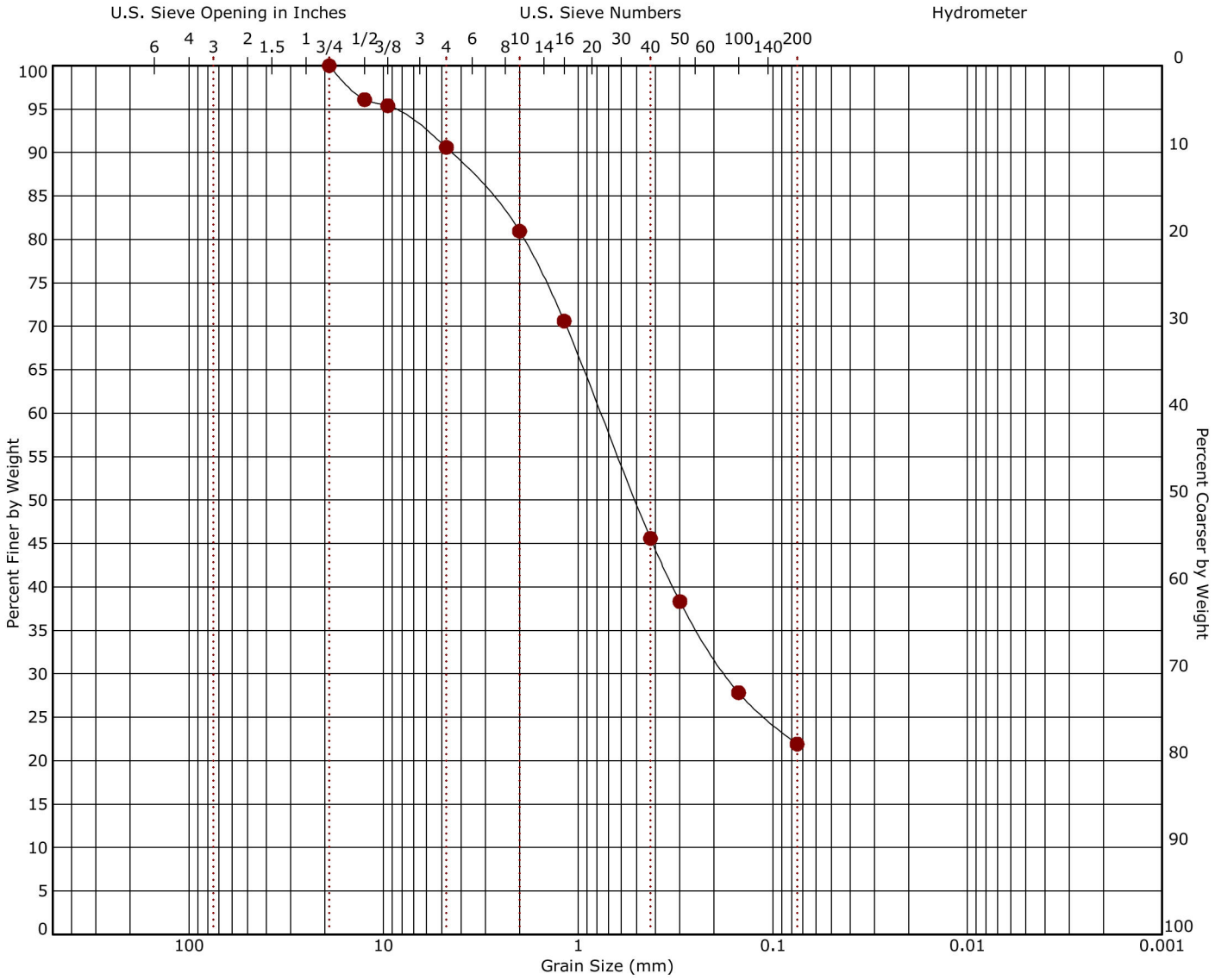

| | Boring ID | Depth (Ft) | LL | PL | PI | Fines | USCS | Description |
|---|---|---|---|---|---|---|---|---|
| ● | N-1 | 1 - 6 | NP | NP | NP | 23.3 | SM | SILTY SAND |
| ⊠ | N-5 | 0 - 5 | NP | NP | NP | | SM | SILTY SAND with GRAVEL |
| ▲ | N-6 | 0 - 5 | NP | NP | NP | 25.4 | SM | SILTY SAND with GRAVEL |

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Terracon Project No. CB225235

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Colton, CA

# Grain Size Distribution

## ASTM D422 / ASTM C136 / AASHTO T27




| Cobbles | Gravel | | Sand | | | Silt or Clay |
|---|---|---|---|---|---|---|
| | coarse | fine | coarse | medium | fine | |

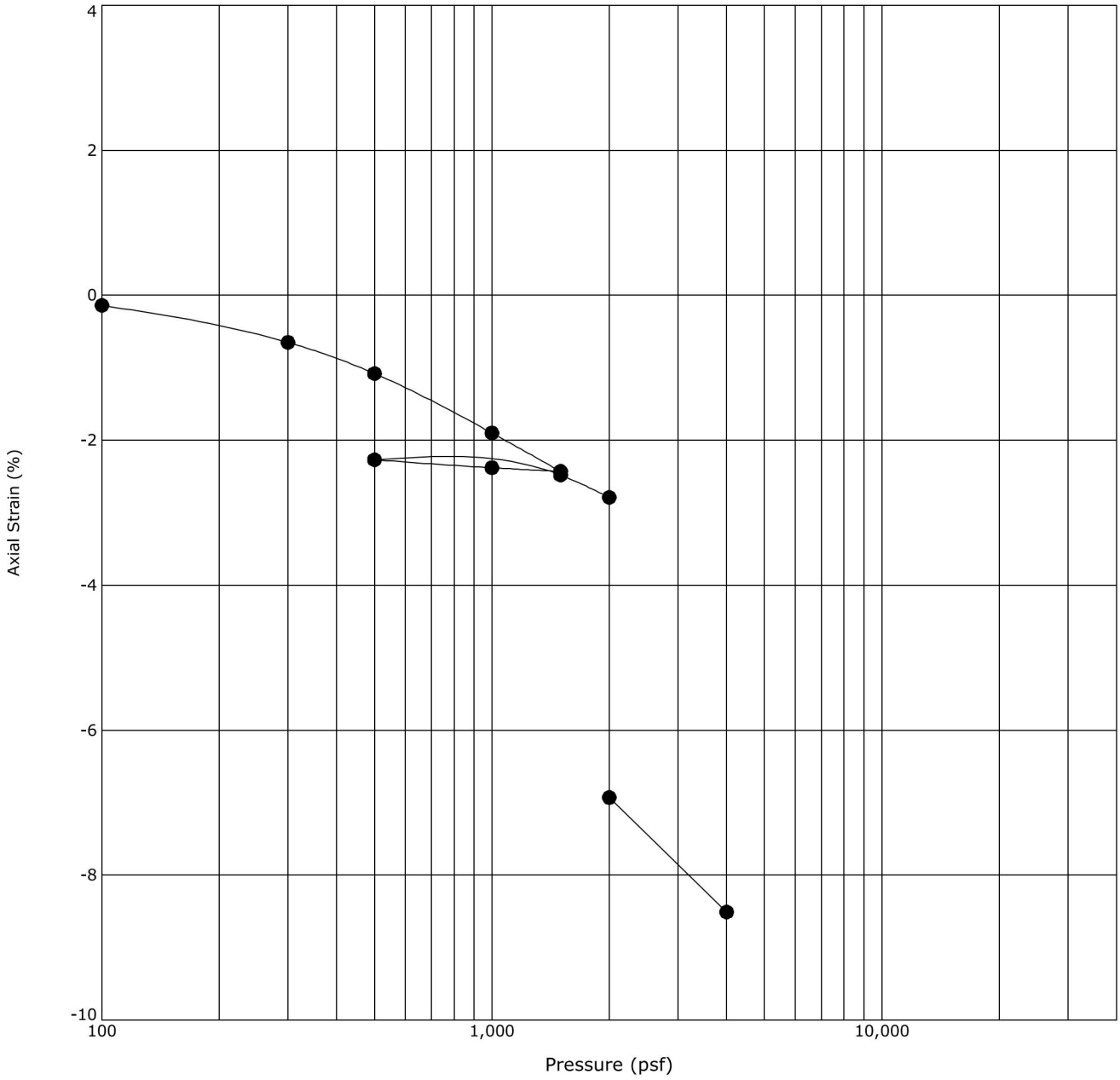
| Boring ID | Depth (Ft) | Description | USCS | LL | PL | PI | Cc | Cu |
|---|---|---|---|---|---|---|---|---|
| ● N-4 | 0 - 5 | SILTY SAND | SM | | | | | |

| Boring ID | Depth (Ft) | $D_{100}$ | $D_{60}$ | $D_{30}$ | $D_{10}$ | %Cobbles | %Gravel | %Sand | %Fines | %Silt | %Clay |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ● **N-4** | 0 - 5 | 19 | 0.765 | 0.173 | | 0.0 | 9.4 | 68.7 | 21.9 | | |

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# One-Dimensional Swell or Collapse

## ASTM D4546



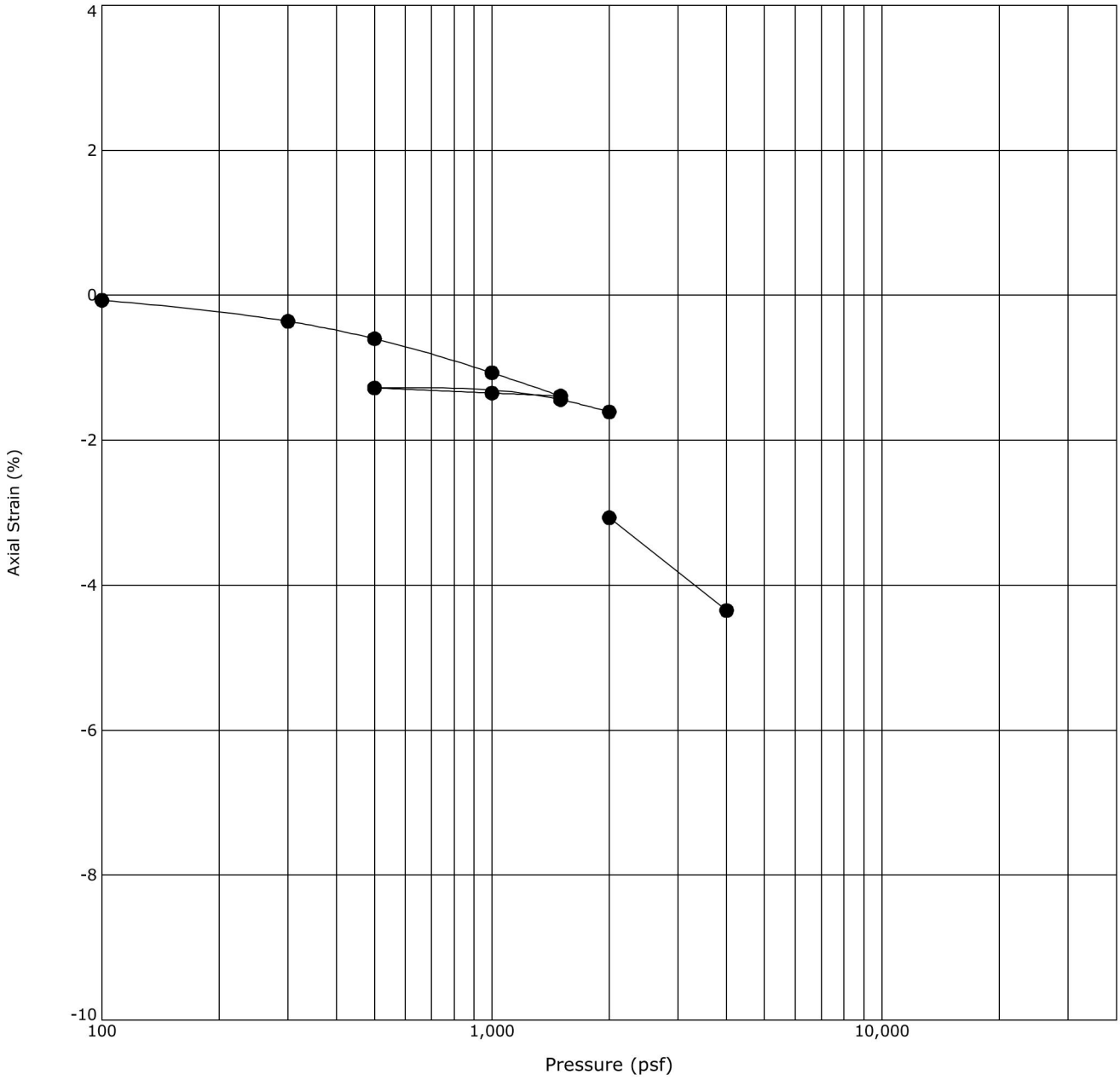

| Boring ID | | Depth (Ft) | Description | USCS | $\gamma_d$(pcf) | WC (%) |
|---|---|---|---|---|---|---|
| ● | N-3 | 2.5 - 4 | WELL GRADED SAND with SILT AND GRAVEL | SW-SM | 109 | 3.4 |

Notes: Water added at 2,000 psf

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Colton, CA

# One-Dimensional Swell or Collapse

## ASTM D4546




| Boring ID | | Depth (Ft) | Description | USCS | $\gamma_d$(pcf) | WC (%) |
|---|---|---|---|---|---|---|
| ● | N-5 | 2.5 - 4 | SILTY SAND with GRAVEL | SM | 108 | 5.1 |

Notes: Water added at 2,000 psf

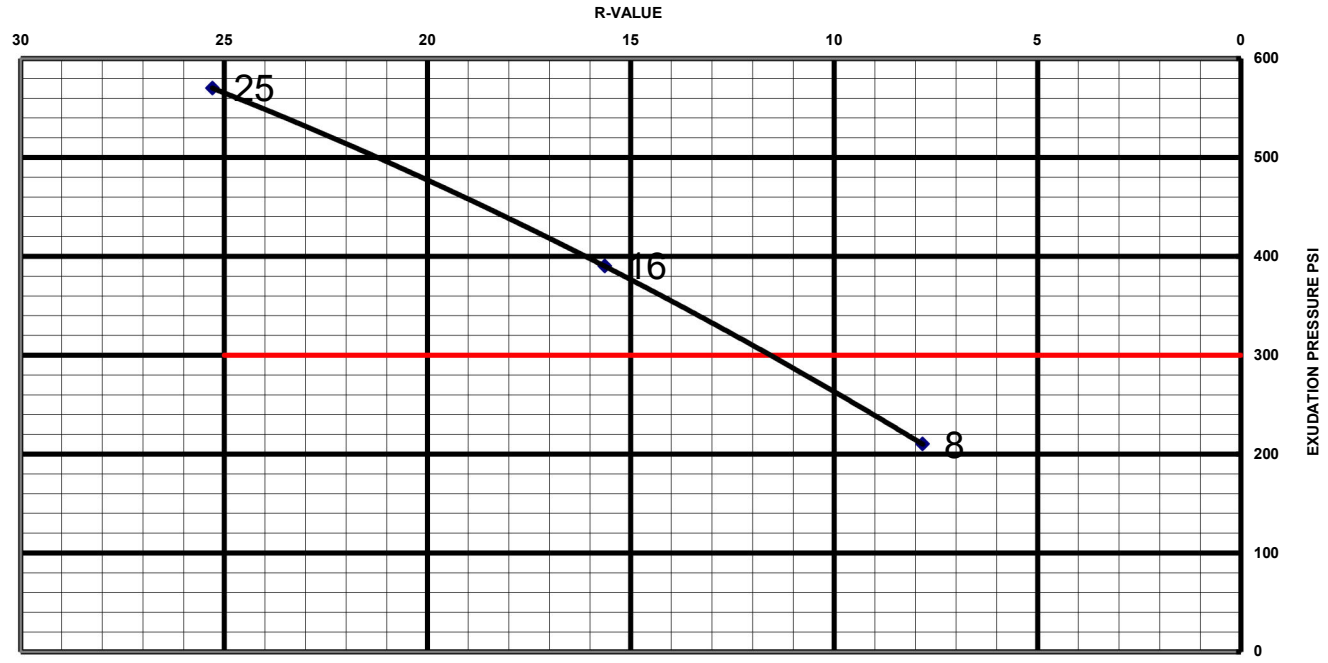
Job No. CB225235
Date. 4/9/2024

**LABORATORY RECORD OF TESTS MADE ON BASE, SUBBASE, AND BASEMENT SOILS**

**CLIENT:** **Prime Healthcare Management Inc.**
**PROJECT LOCATION:** **Desert Valley Hospital Addition**
**R-VALUE # :** **N -7A**
**T.I. :**

| | A | B | C | D |
|---|---|---|---|---|
| COMPACTOR AIR PRESSURE P.S.I. | 50 | 125 | 200 | |
| INITIAL MOISTURE % | 7.1 | 7.1 | 7.1 | |
| WATER ADDED, ML | 60 | 50 | 40 | |
| WATER ADDED % | 5.6 | 4.7 | 3.7 | |
| MOISTURE AT COMPACTION % | 12.7 | 11.8 | 10.8 | |
| HEIGHT OF BRIQUETTE | 2.54 | 2.51 | 2.47 | |
| WET WEIGHT OF BRIQUETTE | 1150 | 1151 | 1156 | |
| DENSITY LB. PER CU.FT. | 121.7 | 124.3 | 128.0 | |
| STABILOMETER PH AT 1000 LBS. | 54 | 47 | 42 | |
| 2000 LBS. | 136 | 118 | 102 | |
| DISPLACEMENT | 5.20 | 4.80 | 4.20 | |
| R-VALUE | 8 | 16 | 25 | |
| EXUDATION PRESSURE | 210 | 390 | 570 | |
| THICK. INDICATED BY STAB. | 0.00 | 0.00 | 0.00 | |
| EXPANSION PRESSURE | 0 | 18 | 29 | |
| THICK. INDICATED BY E.P. | 0.00 | 0.60 | 0.97 | |

**EXUDATION CHART**




**R-Value:** **11**

750 Pilot Road, Suite F
Las Vegas, Nevada 89119
(702) 597-9393

**Client**
Prime Healthcare Management Inc

**Project**
Desert Valley Hospital Addition (CIP#0121023)

**Sample Submitted By:** Terracon (CB) **Date Received:** 4/4/2024 **Lab No.: 24-0124**

## Results of Corrosion Analysis

| | |
|---|---|
| **Sample Number** | N-3A |
| **Sample Location** | N-3 |
| **Sample Depth (ft.)** | 0.0-5.0 |
| pH Analysis, ASTM G51 | 7.75 |
| Water Soluble Sulfate (SO4), ASTM C 1580 (mg/kg) | 231 |
| Sulfides, AWWA 4500-S D, (mg/Kg) | Nil |
| Chlorides, ASTM D512, (mg/kg) | 172 |
| Red-Ox, ASTM G200, (mV) | +733 |
| Total Salts, AWWA 2540, (mg/Kg) | 271 |
| As-Received Resitivity, ASTM G-57, (ohm-cm) | 12610 |
| Saturated Minimum Resistivity, ASTM G-57, (ohm·cm) | 4171 |

**Analyzed By** N. Campo
Nathan Campo
Laboratory Coordinator

The tests were performed in general accordance with applicable ASTM and AWWA test methods. This report is exclusively for the use of the client indicated above and shall not be reproduced except in full without the written consent of our company. Test results transmitted herein are only applicable to the actual samples tested at the location(s) referenced and are not necessarily indicative of the properties of other apparently similar or identical materials.

# Supporting Information

**Contents:**

General Notes
Unified Soil Classification System
Analysis of Seismic Settlement (4 pages)
Response Spectra (3 pages)

Note: All attachments are one page unless noted above.

# GENERAL NOTES

Terracon GeoReport

## DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

**SAMPLING**


Auger


Shelby Tube


Split Spoon


Rock Core


Macro Core


Modified California Ring Sampler


Grab Sample


No Recovery


Modified Dames & Moore Ring Sampler

**WATER LEVEL**


Water Initially Encountered


Water Level After a Specified Period of Time


Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

**FIELD TESTS**

| | |
|---|---|
| (HP) | Hand Penetrometer |
| (T) | Torvane |
| (b/f) | Standard Penetration Test (blows per foot) |
| N | N value |
| (PID) | Photo-Ionization Detector |
| (OVA) | Organic Vapor Analyzer |
| (WOH) | Weight of Hammer |

## DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

## LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

**STRENGTH TERMS**

| RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts. | | | CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance | | | |
|---|---|---|---|---|---|---|
| **Descriptive Term (Density)** | **Standard Penetration or N-Value Blows/Ft.** | **Ring Sampler Blows/Ft.** | **Descriptive Term (Consistency)** | **Unconfined Compressive Strength, Qu, psf** | **Standard Penetration or N-Value Blows/Ft.** | **Ring Sampler Blows/Ft.** |
| Very Loose | 0 - 3 | 0 - 6 | Very Soft | less than 500 | 0 - 1 | < 3 |
| Loose | 4 - 9 | 7 - 18 | Soft | 500 to 1,000 | 2 - 4 | 3 - 4 |
| Medium Dense | 10 - 29 | 19 - 58 | Medium-Stiff | 1,000 to 2,000 | 4 - 8 | 5 - 9 |
| Dense | 30 - 50 | 59 - 98 | Stiff | 2,000 to 4,000 | 8 - 15 | 10 - 18 |
| Very Dense | > 50 | ≥ 99 | Very Stiff | 4,000 to 8,000 | 15 - 30 | 19 - 42 |
| | | | Hard | > 8,000 | > 30 | > 42 |

### RELATIVE PROPORTIONS OF SAND AND GRAVEL

| Descriptive Term(s) of other constituents | Percent of Dry Weight |
|---|---|
| Trace | < 15 |
| With | 15 - 29 |
| Modifier | > 30 |

### GRAIN SIZE TERMINOLOGY

| Major Component of Sample | Particle Size |
|---|---|
| Boulders | Over 12 in. (300 mm) |
| Cobbles | 12 in. to 3 in. (300mm to 75mm) |
| Gravel | 3 in. to #4 sieve (75mm to 4.75 mm) |
| Sand | #4 to #200 sieve (4.75mm to 0.075mm |
| Silt or Clay | Passing #200 sieve (0.075mm) |

### RELATIVE PROPORTIONS OF FINES

| Descriptive Term(s) of other constituents | Percent of Dry Weight |
|---|---|
| Trace | < 5 |
| With | 5 - 12 |
| Modifier | > 12 |

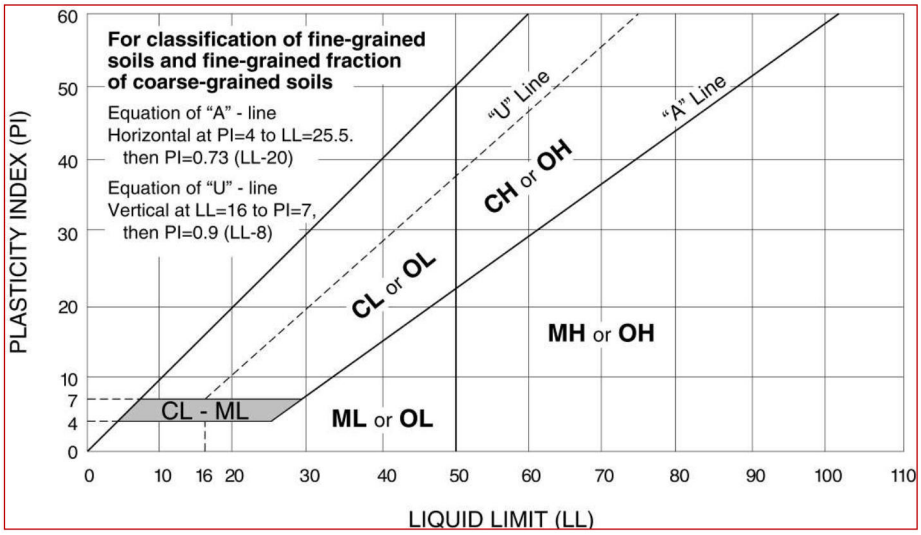
### PLASTICITY DESCRIPTION

| Term | Plasticity Index |
|---|---|
| Non-plastic | 0 |
| Low | 1 - 10 |
| Medium | 11 - 30 |
| High | > 30 |

# Unified Soil Classification System

| Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A] | | | | Soil Classification | |
|---|---|---|---|---|---|
| | | | | Group Symbol | Group Name [B] |
| **Coarse-Grained Soils:** More than 50% retained on No. 200 sieve | **Gravels:** More than 50% of coarse fraction retained on No. 4 sieve | **Clean Gravels:** Less than 5% fines [C] | Cu≥4 and 1≤Cc≤3 [E] | GW | Well-graded gravel [F] |
| | | | Cu<4 and/or [Cc<1 or Cc>3.0] [E] | GP | Poorly graded gravel [F] |
| | | **Gravels with Fines:** More than 12% fines [C] | Fines classify as ML or MH | GM | Silty gravel [F, G, H] |
| | | | Fines classify as CL or CH | GC | Clayey gravel [F, G, H] |
| | **Sands:** 50% or more of coarse fraction passes No. 4 sieve | **Clean Sands:** Less than 5% fines [D] | Cu≥6 and 1≤Cc≤3 [E] | SW | Well-graded sand [I] |
| | | | Cu<6 and/or [Cc<1 or Cc>3.0] [E] | SP | Poorly graded sand [I] |
| | | **Sands with Fines:** More than 12% fines [D] | Fines classify as ML or MH | SM | Silty sand [G, H, I] |
| | | | Fines classify as CL or CH | SC | Clayey sand [G, H, I] |
| **Fine-Grained Soils:** 50% or more passes the No. 200 sieve | **Silts and Clays:** Liquid limit less than 50 | **Inorganic:** | PI > 7 and plots above "A" line [J] | CL | Lean clay [K, L, M] |
| | | | PI < 4 or plots below "A" line [J] | ML | Silt [K, L, M] |
| | | **Organic:** | $\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$ | OL | Organic clay [K, L, M, N] |
| | | | | | Organic silt [K, L, M, O] |
| | **Silts and Clays:** Liquid limit 50 or more | **Inorganic:** | PI plots on or above "A" line | CH | Fat clay [K, L, M] |
| | | | PI plots below "A" line | MH | Elastic silt [K, L, M] |
| | | **Organic:** | $\frac{LL\ oven\ dried}{LL\ not\ dried} < 0.75$ | OH | Organic clay [K, L, M, P] |
| | | | | | Organic silt [K, L, M, Q] |
| **Highly organic soils:** | Primarily organic matter, dark in color, and organic odor | | | PT | Peat |

[A] Based on the material passing the 3-inch (75-mm) sieve.
[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.
[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay.
[E] $Cu = D_{60}/D_{10}$ $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$
[F] If soil contains ≥ 15% sand, add "with sand" to group name.
[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
[H] If fines are organic, add "with organic fines" to group name.
[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.
[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.
[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.
[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.
[N] PI ≥ 4 and plots on or above "A" line.
[O] PI < 4 or plots below "A" line.
[P] PI plots on or above "A" line.
[Q] PI plots below "A" line.

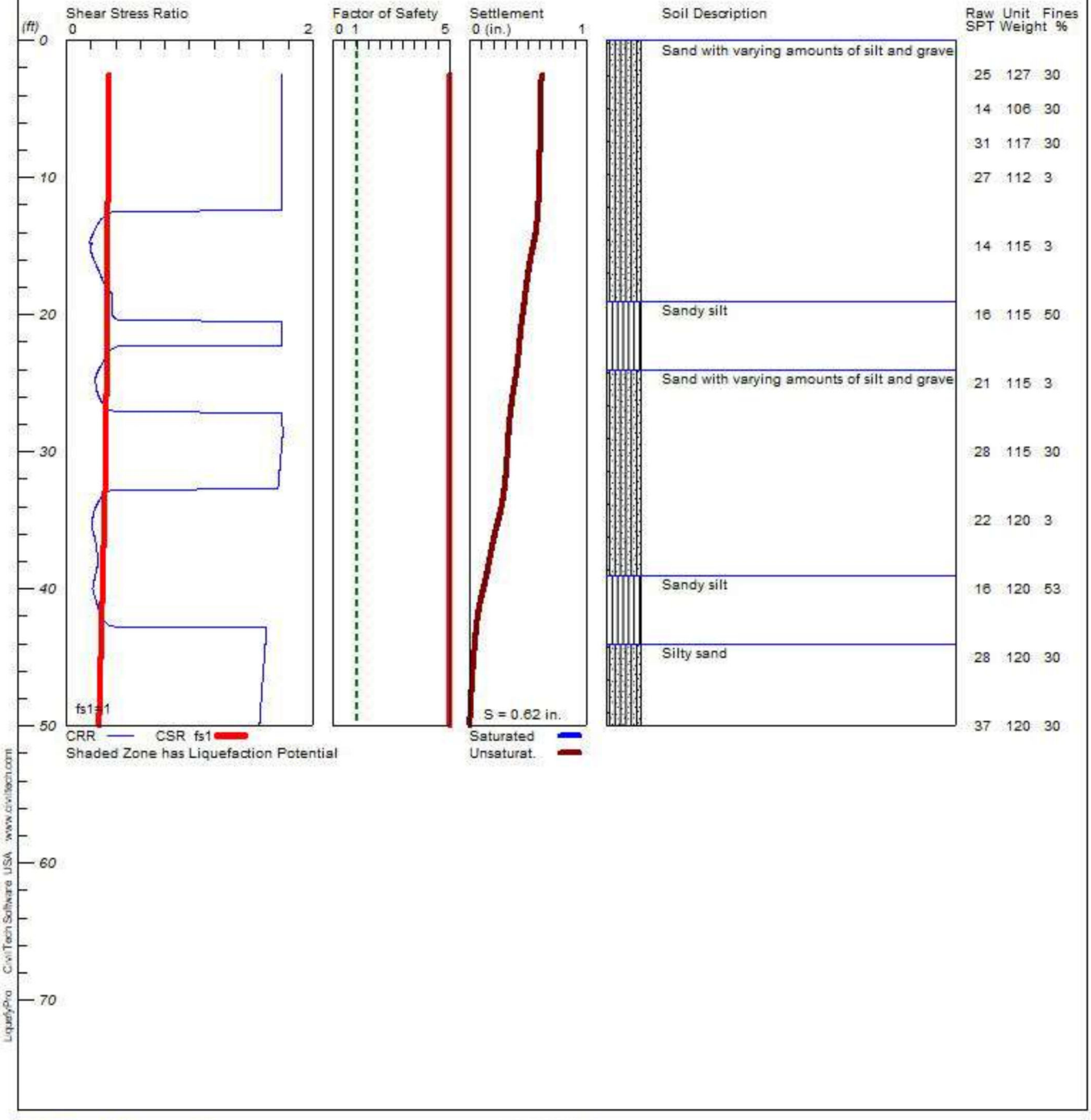


# LIQUEFACTION ANALYSIS

## Desert Valley Hospital Addition

***Hole No.=*** N-2 ***Water Depth=100 ft*** ***Surface Elev.=3033***

***Magnitude=7.9***
***Acceleration=0.54g***




**CivilTech Corporation** **CB225235**

LIQUEFACTION ANALYSIS SUMMARY
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Input File Name: C:\Users\vvnguyen\OneDrive - Terracon Consultants Inc\Desktop\Liquefaction\LiquefyPro\CB225235 Desert Valley\B-2.liq
Title: Desert Valley Hospital Addition
Subtitle: CB225235

Surface Elev.=3033
Hole No.=N-2
Depth of Hole= 50.00 ft
Water Table during Earthquake= 100.00 ft
Water Table during In-Situ Testing= 100.00 ft
Max. Acceleration= 0.54 g
Earthquake Magnitude= 7.90

Input Data:
Surface Elev.=3033
Hole No.=N-2
Depth of Hole=50.00 ft
Water Table during Earthquake= 100.00 ft
Water Table during In-Situ Testing= 100.00 ft
Max. Acceleration=0.54 g
Earthquake Magnitude=7.90
No-Liquefiable Soils: Based on Analysis

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Tokimatsu/Seed
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.42
7. Borehole Diameter, Cb= 1
8. Sampling Method, Cs= 1
9. User request factor of safety (apply to CSR) , User= 1
Plot one CSR curve (fs1=1)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

| Depth ft | SPT | gamma pcf | Fines % |
|---|---|---|---|
| 2.50 | 25.00 | 127.00 | 30.00 |
| 5.00 | 14.00 | 106.00 | 30.00 |
| 7.50 | 31.00 | 117.00 | 30.00 |
| 10.00 | 27.00 | 112.00 | 3.00 |
| 15.00 | 14.00 | 115.00 | 3.00 |
| 20.00 | 16.00 | 115.00 | 50.00 |
| 25.00 | 21.00 | 115.00 | 3.00 |
| 30.00 | 28.00 | 115.00 | 30.00 |
| 35.00 | 22.00 | 120.00 | 3.00 |
| 40.00 | 16.00 | 120.00 | 53.00 |
| 45.00 | 28.00 | 120.00 | 30.00 |
| 50.00 | 37.00 | 120.00 | 30.00 |

Output Results:
Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.62 in.
Total Settlement of Saturated and Unsaturated Sands=0.62 in.
Differential Settlement=0.309 to 0.407 in.

| Depth ft | CRRm | CSRfs | F.S. | S_sat. in. | S_dry in. | S_all in. |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.50 | 1.75 | 0.35 | 5.00 | 0.00 | 0.62 | 0.62 |
| 3.00 | 1.75 | 0.35 | 5.00 | 0.00 | 0.62 | 0.62 |
| 3.50 | 1.75 | 0.35 | 5.00 | 0.00 | 0.62 | 0.62 |
| 4.00 | 1.75 | 0.35 | 5.00 | 0.00 | 0.61 | 0.61 |
| 4.50 | 1.75 | 0.35 | 5.00 | 0.00 | 0.61 | 0.61 |
| 5.00 | 1.75 | 0.35 | 5.00 | 0.00 | 0.61 | 0.61 |
| 5.50 | 1.75 | 0.35 | 5.00 | 0.00 | 0.61 | 0.61 |
| 6.00 | 1.75 | 0.35 | 5.00 | 0.00 | 0.61 | 0.61 |
| 6.50 | 1.75 | 0.35 | 5.00 | 0.00 | 0.61 | 0.61 |
| 7.00 | 1.75 | 0.35 | 5.00 | 0.00 | 0.61 | 0.61 |
| 7.50 | 1.75 | 0.34 | 5.00 | 0.00 | 0.61 | 0.61 |
| 8.00 | 1.75 | 0.34 | 5.00 | 0.00 | 0.60 | 0.60 |
| 8.50 | 1.75 | 0.34 | 5.00 | 0.00 | 0.60 | 0.60 |
| 9.00 | 1.75 | 0.34 | 5.00 | 0.00 | 0.60 | 0.60 |
| 9.50 | 1.75 | 0.34 | 5.00 | 0.00 | 0.60 | 0.60 |
| 10.00 | 1.75 | 0.34 | 5.00 | 0.00 | 0.60 | 0.60 |
| 10.50 | 1.75 | 0.34 | 5.00 | 0.00 | 0.60 | 0.60 |
| 11.00 | 1.75 | 0.34 | 5.00 | 0.00 | 0.60 | 0.60 |
| 11.50 | 1.75 | 0.34 | 5.00 | 0.00 | 0.59 | 0.59 |
| 12.00 | 1.75 | 0.34 | 5.00 | 0.00 | 0.59 | 0.59 |
| 12.50 | 0.38 | 0.34 | 5.00 | 0.00 | 0.59 | 0.59 |
| 13.00 | 0.29 | 0.34 | 5.00 | 0.00 | 0.58 | 0.58 |
| 13.50 | 0.25 | 0.34 | 5.00 | 0.00 | 0.58 | 0.58 |
| 14.00 | 0.22 | 0.34 | 5.00 | 0.00 | 0.57 | 0.57 |
| 14.50 | 0.20 | 0.34 | 5.00 | 0.00 | 0.56 | 0.56 |
| 15.00 | 0.20 | 0.34 | 5.00 | 0.00 | 0.54 | 0.54 |
| 15.50 | 0.20 | 0.34 | 5.00 | 0.00 | 0.53 | 0.53 |
| 16.00 | 0.22 | 0.34 | 5.00 | 0.00 | 0.52 | 0.52 |
| 16.50 | 0.25 | 0.34 | 5.00 | 0.00 | 0.51 | 0.51 |
| 17.00 | 0.27 | 0.34 | 5.00 | 0.00 | 0.50 | 0.50 |
| 17.50 | 0.29 | 0.34 | 5.00 | 0.00 | 0.49 | 0.49 |
| 18.00 | 0.32 | 0.34 | 5.00 | 0.00 | 0.49 | 0.49 |
| 18.50 | 0.37 | 0.34 | 5.00 | 0.00 | 0.48 | 0.48 |
| 19.00 | 0.37 | 0.34 | 5.00 | 0.00 | 0.47 | 0.47 |
| 19.50 | 0.37 | 0.34 | 5.00 | 0.00 | 0.46 | 0.46 |
| 20.00 | 0.37 | 0.33 | 5.00 | 0.00 | 0.46 | 0.46 |
| 20.50 | 1.75 | 0.33 | 5.00 | 0.00 | 0.45 | 0.45 |
| 21.00 | 1.75 | 0.33 | 5.00 | 0.00 | 0.44 | 0.44 |
| 21.50 | 1.75 | 0.33 | 5.00 | 0.00 | 0.43 | 0.43 |
| 22.00 | 1.75 | 0.33 | 5.00 | 0.00 | 0.43 | 0.43 |
| 22.50 | 0.37 | 0.33 | 5.00 | 0.00 | 0.42 | 0.42 |
| 23.00 | 0.32 | 0.33 | 5.00 | 0.00 | 0.42 | 0.42 |
| 23.50 | 0.29 | 0.33 | 5.00 | 0.00 | 0.41 | 0.41 |
| 24.00 | 0.26 | 0.33 | 5.00 | 0.00 | 0.40 | 0.40 |
| 24.50 | 0.24 | 0.33 | 5.00 | 0.00 | 0.40 | 0.40 |
| 25.00 | 0.24 | 0.33 | 5.00 | 0.00 | 0.39 | 0.39 |
| 25.50 | 0.25 | 0.33 | 5.00 | 0.00 | 0.38 | 0.38 |
| 26.00 | 0.26 | 0.33 | 5.00 | 0.00 | 0.37 | 0.37 |
| 26.50 | 0.30 | 0.33 | 5.00 | 0.00 | 0.36 | 0.36 |
| 27.00 | 0.36 | 0.33 | 5.00 | 0.00 | 0.35 | 0.35 |
| 27.50 | 1.75 | 0.33 | 5.00 | 0.00 | 0.35 | 0.35 |
| 28.00 | 1.75 | 0.33 | 5.00 | 0.00 | 0.34 | 0.34 |
| 28.50 | 1.76 | 0.33 | 5.00 | 0.00 | 0.34 | 0.34 |
| 29.00 | 1.75 | 0.33 | 5.00 | 0.00 | 0.33 | 0.33 |
| 29.50 | 1.75 | 0.33 | 5.00 | 0.00 | 0.33 | 0.33 |
| 30.00 | 1.74 | 0.33 | 5.00 | 0.00 | 0.32 | 0.32 |
| 30.50 | 1.74 | 0.32 | 5.00 | 0.00 | 0.32 | 0.32 |
| 31.00 | 1.73 | 0.32 | 5.00 | 0.00 | 0.32 | 0.32 |
| 31.50 | 1.73 | 0.32 | 5.00 | 0.00 | 0.31 | 0.31 |
| 32.00 | 1.72 | 0.32 | 5.00 | 0.00 | 0.31 | 0.31 |
| 32.50 | 1.72 | 0.32 | 5.00 | 0.00 | 0.30 | 0.30 |
| 33.00 | 0.32 | 0.32 | 5.00 | 0.00 | 0.29 | 0.29 |
| 33.50 | 0.27 | 0.32 | 5.00 | 0.00 | 0.28 | 0.28 |
| 34.00 | 0.24 | 0.31 | 5.00 | 0.00 | 0.27 | 0.27 |
| 34.50 | 0.22 | 0.31 | 5.00 | 0.00 | 0.26 | 0.26 |
| 35.00 | 0.21 | 0.31 | 5.00 | 0.00 | 0.25 | 0.25 |
| 35.50 | 0.21 | 0.31 | 5.00 | 0.00 | 0.23 | 0.23 |
| 36.00 | 0.22 | 0.31 | 5.00 | 0.00 | 0.22 | 0.22 |
| 36.50 | 0.24 | 0.31 | 5.00 | 0.00 | 0.20 | 0.20 |
| 37.00 | 0.24 | 0.31 | 5.00 | 0.00 | 0.19 | 0.19 |
| 37.50 | 0.25 | 0.30 | 5.00 | 0.00 | 0.18 | 0.18 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 38.00 | 0.25 | 0.30 | 5.00 | 0.00 | 0.17 | 0.17 |
| 38.50 | 0.25 | 0.30 | 5.00 | 0.00 | 0.16 | 0.16 |
| 39.00 | 0.23 | 0.30 | 5.00 | 0.00 | 0.14 | 0.14 |
| 39.50 | 0.22 | 0.30 | 5.00 | 0.00 | 0.13 | 0.13 |
| 40.00 | 0.21 | 0.30 | 5.00 | 0.00 | 0.12 | 0.12 |
| 40.50 | 0.23 | 0.30 | 5.00 | 0.00 | 0.10 | 0.10 |
| 41.00 | 0.24 | 0.29 | 5.00 | 0.00 | 0.09 | 0.09 |
| 41.50 | 0.26 | 0.29 | 5.00 | 0.00 | 0.08 | 0.08 |
| 42.00 | 0.29 | 0.29 | 5.00 | 0.00 | 0.07 | 0.07 |
| 42.50 | 0.33 | 0.29 | 5.00 | 0.00 | 0.06 | 0.06 |
| 43.00 | 1.62 | 0.29 | 5.00 | 0.00 | 0.06 | 0.06 |
| 43.50 | 1.62 | 0.29 | 5.00 | 0.00 | 0.05 | 0.05 |
| 44.00 | 1.61 | 0.29 | 5.00 | 0.00 | 0.04 | 0.04 |
| 44.50 | 1.61 | 0.28 | 5.00 | 0.00 | 0.04 | 0.04 |
| 45.00 | 1.61 | 0.28 | 5.00 | 0.00 | 0.04 | 0.04 |
| 45.50 | 1.60 | 0.28 | 5.00 | 0.00 | 0.03 | 0.03 |
| 46.00 | 1.60 | 0.28 | 5.00 | 0.00 | 0.03 | 0.03 |
| 46.50 | 1.59 | 0.28 | 5.00 | 0.00 | 0.02 | 0.02 |
| 47.00 | 1.59 | 0.28 | 5.00 | 0.00 | 0.02 | 0.02 |
| 47.50 | 1.59 | 0.28 | 5.00 | 0.00 | 0.02 | 0.02 |
| 48.00 | 1.58 | 0.27 | 5.00 | 0.00 | 0.01 | 0.01 |
| 48.50 | 1.58 | 0.27 | 5.00 | 0.00 | 0.01 | 0.01 |
| 49.00 | 1.57 | 0.27 | 5.00 | 0.00 | 0.01 | 0.01 |
| 49.50 | 1.57 | 0.27 | 5.00 | 0.00 | 0.00 | 0.00 |
| 50.00 | 1.57 | 0.27 | 5.00 | 0.00 | 0.00 | 0.00 |

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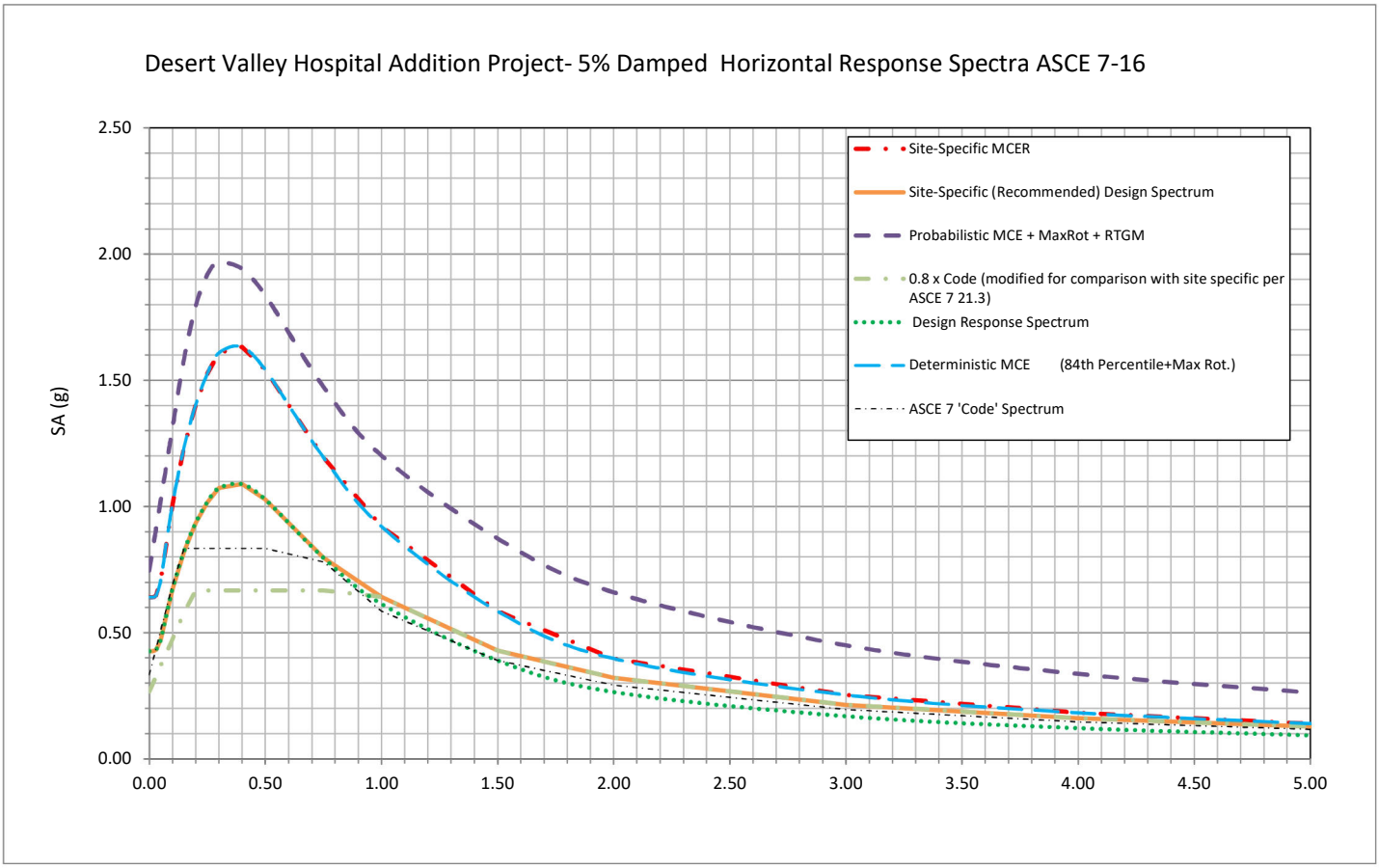
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5,  CRR is limited to 2,  CSR is limited to 2)

Units:  Unit: qc, fs, Stress or Pressure = atm (1.0581tsf); Unit Weight = pcf; Depth = ft; Settlement = in.

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1 atm (atmosphere) = 1 tsf (ton/ft2)

| | |
|---|---|
| CRRm | Cyclic resistance ratio from soils |
| CSRsf | Cyclic stress ratio induced by a given earthquake (with user request factor of safety) |
| F.S. | Factor of Safety against liquefaction, F.S.=CRRm/CSRsf |
| S_sat | Settlement from saturated sands |
| S_dry | Settlement from Unsaturated Sands |
| S_all | Total Settlement from Saturated and Unsaturated Sands |
| NoLiq | No-Liquefy Soils |


Desert Valley Hospital Addition Project- 5% Damped Horizontal Response Spectra ASCE 7-16
SA (g)
2.50
2.00
1.50
1.00
0.50
0.00
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
Site-Specific MCER
Site-Specific (Recommended) Design Spectrum
Probabilistic MCE + MaxRot + RTGM
0.8 x Code (modified for comparison with site specific per ASCE 7 21.3)
Design Response Spectrum
Deterministic MCE (84th Percentile+Max Rot.)
ASCE 7 'Code' Spectrum

| Desert Valley Hospital Addition Project - Site-Specific Response Spectra ASCE 7-16 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Period (sec)** | **Deterministic MCE (84th Percentile+Max Rot.)** | **Probabilistic MCE + MaxRot + RTGM** | **Site-Specific $MCE_R$** | **0.8 x Code (modified for comparison with site specific per ASCE 7 21.3)** | **Design Response Spectrum** | **Site-Specific (Recommended) Design Spectrum** | **ASCE 7 'Code' Spectrum** |
| 0.000 | 0.640 | 0.746 | 0.640 | 0.267 | 0.427 | 0.427 | 0.334 |
| 0.010 | 0.641 | 0.803 | 0.641 | 0.288 | 0.427 | 0.427 | 0.369 |
| 0.020 | 0.641 | 0.859 | 0.641 | 0.308 | 0.427 | 0.427 | 0.405 |
| 0.030 | 0.648 | 0.916 | 0.648 | 0.329 | 0.432 | 0.432 | 0.441 |
| 0.050 | 0.711 | 1.029 | 0.711 | 0.371 | 0.474 | 0.474 | 0.512 |
| 0.075 | 0.864 | 1.171 | 0.864 | 0.423 | 0.576 | 0.576 | 0.601 |
| 0.100 | 1.010 | 1.313 | 1.010 | 0.475 | 0.673 | 0.673 | 0.690 |
| 0.150 | 1.235 | 1.585 | 1.235 | 0.579 | 0.823 | 0.823 | 0.834 |
| 0.200 | 1.403 | 1.794 | 1.403 | 0.667 | 0.935 | 0.935 | 0.834 |
| 0.250 | 1.526 | 1.919 | 1.526 | 0.667 | 1.017 | 1.017 | 0.834 |
| 0.300 | 1.609 | 1.965 | 1.609 | 0.667 | 1.073 | 1.073 | 0.834 |
| 0.400 | 1.633 | 1.941 | 1.633 | 0.667 | 1.088 | 1.088 | 0.834 |
| 0.500 | 1.541 | 1.836 | 1.541 | 0.667 | 1.027 | 1.027 | 0.834 |
| 0.750 | 1.195 | 1.474 | 1.195 | 0.667 | 0.797 | 0.797 | 0.780 |
| 1.000 | 0.921 | 1.202 | 0.921 | 0.642 | 0.614 | 0.642 | 0.585 |
| 1.500 | 0.585 | 0.873 | 0.585 | 0.428 | 0.390 | 0.428 | 0.390 |
| 2.000 | 0.397 | 0.660 | 0.397 | 0.321 | 0.265 | 0.321 | 0.293 |
| 3.000 | 0.253 | 0.450 | 0.253 | 0.214 | 0.169 | 0.214 | 0.195 |
| 4.000 | 0.183 | 0.336 | 0.183 | 0.161 | 0.122 | 0.161 | 0.146 |
| 5.000 | 0.140 | 0.262 | 0.140 | 0.128 | 0.093 | 0.128 | 0.117 |

# Shahi & Baker (2014) Coefficients

| Period | $Sa_{RotD100}/Sa_{RotD50}$ |
|---|---|
| 0.01 | 1.19 |
| 0.02 | 1.19 |
| 0.03 | 1.19 |
| 0.04 | 1.19 |
| 0.05 | 1.19 |
| 0.075 | 1.19 |
| 0.10 | 1.19 |
| 0.15 | 1.20 |
| 0.20 | 1.21 |
| 0.25 | 1.22 |
| 0.30 | 1.22 |
| 0.40 | 1.23 |
| 0.50 | 1.23 |
| 0.75 | 1.24 |
| 1.00 | 1.24 |
| 1.50 | 1.24 |
| 2.00 | 1.24 |
| 3.00 | 1.25 |
| 4.00 | 1.26 |
| 5.00 | 1.26 |