
APPENDIX E1

GEOTECHNICAL REPORT

**GEOTECHNICAL ENGINEERING STUDY
SAN ANDREAS DEVELOPMENT
236 - 300 EAST SAINT CHARLES STREET
APNS: 042-030-014-000 & 042-031-017-000
SAN ANDREAS, CALIFORNIA**

Prepared for
**Stephanie Mielbye
Vice President of Development
RK Hospitality Development
PO Box 2267
Davenport, Florida 33836
857.210.5315**

Prepared by
**Condor Earth
188 Frank West Circle, Suite I
Stockton, CA 95206
209.234.0518**

**September 15, 2022
Condor Project No. 8897**

**Copyright © 2022, Condor Earth
All Rights Reserved**



TABLE OF CONTENTS

1.0	INTRODUCTION.....	1
2.0	PURPOSE AND SCOPE.....	1
3.0	SITE DESCRIPTION.....	1
4.0	GEOLOGIC HAZARDS AND SEISMIC SETTING.....	2
4.1	REGIONAL GEOLOGY	2
4.2	SITE GEOLOGY	2
4.3	FAULTING AND REGIONAL SEISMICITY	2
4.4	HISTORICAL TUNNELS AND WELLS.....	2
5.0	SUBSURFACE CONDITIONS	3
5.1	TEST PIT EXPLORATION	3
5.2	EARTH MATERIALS	4
5.3	LOCAL GROUNDWATER CONDITIONS.....	5
6.0	SEISMIC CONSIDERATIONS	5
6.1	SEISMIC DESIGN PARAMETERS.....	5
6.2	LIQUEFACTION POTENTIAL	5
7.0	CONCLUSIONS AND RECOMMENDATIONS.....	5
7.1	GENERAL	5
7.2	GRADING AND EARTHWORK RECOMMENDATIONS	6
7.2.1	Clearing, Grubbing, and Well Closure.....	6
7.2.2	Subgrade Preparation	7
7.2.3	Engineered Fill Materials.....	7
7.2.4	Engineered Fill Placement	7
7.2.5	Excavations	8
7.3	UNDERGROUND UTILITY TRENCHES	8
7.4	SURFACE DRAINAGE CONTROL.....	8
8.0	FOUNDATION RECOMMENDATIONS	8
8.1	GENERAL FOUNDATION RECOMMENDATIONS	8
8.2	SPREAD FOOTING FOUNDATIONS	9
8.3	LATERAL RESISTANCE	9
9.0	SLABS-ON-GRADE.....	9
9.1	SUBGRADE SUPPORT FOR SLABS-ON-GRADE	9
9.2	GUIDELINES FOR CONCRETE SLABS-ON-GRADE	10
10.0	RETAINING WALLS	10
10.1	LATERAL EARTH PRESSURES	10
10.2	WALL DRAINAGE	11
11.0	CORROSION POTENTIAL	12
12.0	PAVEMENTS	12
13.0	ADDITIONAL SERVICES.....	14
14.0	LIMITATIONS.....	14



APPENDICES

APPENDIX A – FIGURES

- Figure 1 – Vicinity Map
- Figure 2 – Site Map with Test Pit Locations
- Figure 3 – Geologic Map
- Figure 4 – Regional Fault Map
- Figure 5 – Typical Fill Slope Over Sloping Ground Surface
- Figure 6 – Retaining Wall Drainage

APPENDIX B

- Logs of Test Pits

APPENDIX C

- Laboratory Test Results

APPENDIX D

- U.S. Seismic Design Maps

APPENDIX E

- Site Photographs

APPENDIX F

- Construction Standards



**GEOTECHNICAL ENGINEERING STUDY
SAN ANDREAS DEVELOPMENT
236 - 300 EAST SAINT CHARLES STREET
APNS: 042-030-014-000 & 042-031-017-000
SAN ANDREAS, CALIFORNIA**

1.0 INTRODUCTION

This report includes the results of a Geotechnical Engineering Study (GES) for RK Hospitality Development planned improvements at 236 - 300 East Saint Charles Street (APNs: 042-030-014-000 and 042-031-017-000) in San Andreas, Calaveras County, California. We understand that the proposed improvements will consist of a hotel and restaurant (Phase 1), and residential development (Phase 2). In addition, significant roadway and parking areas will be graded for retail, hotel, and residential parking. Condor Earth (Condor) performed this study and prepared this report at the request of Stephanie Mielbye, Vice President of Development to meet the requirements of 2019 California Building Code (CBC) for Geotechnical Engineering Studies and our proposal dated June 14, 2022.

2.0 PURPOSE AND SCOPE

This GES was performed to 1) explore and evaluate the subsurface soil conditions at the site 2) identify geotechnical or geologic conditions that might impact design and construction; 3) provide geotechnical recommendations to mitigate geotechnical constraints; and 4) provide grading recommendations, foundation design parameters, and geotechnical criteria for design of the proposed improvements. Condor completed the following work for this GES:

1. Reviewed available maps and documents relevant to the site geology, seismic setting, and geotechnical conditions.
2. Performed field exploration excavating test pits at fourteen locations.
3. Analyzed the findings from the field exploration and developed geotechnical recommendations for:
 - a) General earthwork, including subgrade preparation, temporary excavations, excavation difficulty and stability, permanent slopes, trench backfill, import fill, compaction criteria, and general alternatives to remediate wet/soft soil conditions if encountered.;
 - b) 2019 CBC site-specific ground motion hazard
 - c) Geologic hazards including faulting, and liquefaction potential and associated total and differential settlements.
 - d) Allowable bearing pressures for new foundations
 - e) Lateral earth pressures for design of retaining wall and buried systems, including seismic soil loading.
4. Prepared this written report summarizing our findings, conclusions and geotechnical recommendations.

3.0 SITE DESCRIPTION

The site is on the southwest side of Saint Charles Street (California State Highway 49) in downtown San Andreas and bound to the northwest by El Dorado Savings Bank, to the southeast by a residence, and a cemetery to the southwest. The general location of the site is shown on the Figure 1 – Vicinity Map, and Figure 2 – Site Map with Test Pit Locations, Appendix A.



The project will occur on two vacant parcels (APNs: 042-030-014-000 & 042-031-017-000) in the central Sierra Nevada Mountains at an elevation ranging from 1,140 feet above mean sea level (msl) near the cemetery down to 1,037 feet near Saint Charles Steet. Past grading has resulted in near-vertical cuts near the top of the site and several relatively flat areas about mid-slope height. Deleterious material is present on slopes and flat areas locally. Overall, the site slopes northeast at about 20 percent.

No evidence of surface water run-on or run-off was noted. The site is sparsely populated with live oak, valley oak and lesser digger pine trees. Native grasses cover most of the ground surface.

4.0 GEOLOGIC HAZARDS AND SEISMIC SETTING

4.1 REGIONAL GEOLOGY

The project site lies within the Sierra Nevada Geomorphic Province of California. The basement rock in much of Calaveras County consists of steeply dipping metamorphic rock of Paleozoic and Mesozoic age that has been intruded by the Mesozoic granitic plutons of the Sierra Nevada Batholith. Locally, the basement rock is nonconformably overlain by the eroded remnants of younger Tertiary age continental volcanic and sedimentary rock. Tectonic uplift and westward tilting of the Sierra Nevada range began during the late Cenozoic in response to a change in regional plate-boundary motions. Much of the Tertiary rock overlying the basement rock was eroded as uplift of the range progressed. The Sierra Nevada range was further eroded during the last two million years by several episodes of glaciation that exposed the basement rock throughout the higher elevations and generated extensive sedimentary deposits in the Great Central Valley to the west. The geologic processes of tectonic uplift and erosion continue to act on the Sierra Nevada Mountains.

4.2 SITE GEOLOGY

The geologic map, *Geologic Map of the San Andreas Quadrangle, Calaveras County, California*, (Clark, 1963) and the regional geologic map Sacramento Quadrangle, 1:250:000 series (Wagoner, 1981) indicates that the site is underlain by the Tertiary Mehrten Formation. We classified the site material as andesitic conglomerate and sandstone of the Mehrten Formation.

The east extent of the Foothills Fault Zone is located approximately 0.6 miles southwest of the site and forms the boundary between the underlying Calaveras Complex and the Jurassic metasediments and metavolcanic rocks to the west. The geologic distribution of surface deposits in the vicinity of the site is shown on Figure 3 – Geologic Map, Appendix A.

4.3 FAULTING AND REGIONAL SEISMICITY

The site is in a moderately seismic region of California's Central Sierra Nevada Mountains. The locations of significant faults relative to the site are shown on Figure 4 – California Regional Fault Map, Appendix A. As shown, there are no significant faults in the immediate vicinity of the project and ground rupture is not a significant hazard to the project.

4.4 HISTORICAL TUNNELS AND WELLS

The 2003 site investigation at the adjacent El Dorado Savings Bank site revealed two tunnels in the basement of a former building on that property; one trended S20E, was approximately four feet high, three feet wide and 90 feet long and terminated about 15 below the ground surface in the sidewall of a 4-foot diameter water well. The well was approximately 68 feet deep with water at about 63 feet. This water well was outside the parcel boundary of the El dorado Savings Bank project and no other investigation of the well was performed as the location was not a concern during construction of the bank. The second tunnel trended N27W, was two feet wide, three feet high and terminated after about 12 feet.



In 2005, during site grading for the bank project, a large diameter borehole was unearthed after demolition of a second building on the parcel. Visual inspection from the ground surface of the borehole revealed near vertical sidewalls with no evidence of significant caving. No deleterious material, obstructions, or horizontal passages (tunnels or drifts) were observed in the borehole. The borehole was approximately 3.5 feet in diameter, approximately 53 feet deep, and exposed geologic materials similar to those encountered during this and the bank investigations which are andesitic conglomerate and sandstone of the Mehrten Formation. No resistant bedrock was observed in the borehole and no groundwater, pumps or plumbing were present. No other information pertaining the purpose of the tunnels, the borehole, or historical mining at the site was available at the time of our reporting for the bank. Condor provided El Dorado Savings Bank recommendations dated June 13, 2005, for closure of the two tunnels and one large-diameter borehole.

During field work at 236 - 300 East Saint Charles Street, Condor located a 4-foot diameter water well within the footprint of the planned RK Hospitality Development improvements as shown on Figure 2. The well ground surface elevation is approximately 1,060 feet. The well is currently covered with rotten timbers; a pressure tank is adjacent to the well, and a pipe from the tank runs down into the well. These features are covered by a large shrub growing next to the well. The well depth and presence of water was not investigated because of potentially unsafe surface conditions. A light shown down the well did not illuminate the well bottom nor any tunnels or drifts. Assuming this is the same water well discovered at the end of a 90-foot long tunnel trending S20E described above, Condor has shown the approximate tunnel location on Figure 2. Based on the estimated well ground surface elevation of 1,060 feet, the tunnel crown is approximately 1,045 feet. The planned restaurant floor elevation in the project drawings is 1,050 feet. A photo of the well is provided in Appendix E.

A second large-diameter borehole was identified within the footprint of the planned improvements at 236 - 300 East Saint Charles Street partially beneath the existing concrete paved driveway accessing the site from Saint Charles Street as shown on Figure 2. This borehole is backfilled to within 3 feet of the ground surface. However, the quality of the backfill (i.e., dirt, rock, cement, or concrete) was not investigated. The water well, respective tunnel, and abandoned large-diameter borehole locations are shown on Figure 2. A photo of the well is provided in Appendix E.

While the exact nature of tunnel is unclear in a historic context, it is now known that the mapped geology of the site is composed of a geological unit that does not contain minable materials that would yield gold. The tunnel may have an exploration tunnel associated with historical prospecting without the benefit of current geological mapping. Because we know the unit does not contain minable gold, the tunnel would have been abandoned (stopped without further exploration). It is also unclear why the vertical shaft is significantly deeper than the top of tunnel (15 feet below grade). It is unknown whether the shaft was originally intended for exploration or water well purposes. If an historic exploration shaft hit groundwater, exploration would have terminated. If the shaft could have been used for water production, it could have been subsequently repurposed.

5.0 SUBSURFACE CONDITIONS

5.1 TEST PIT EXPLORATION

On July 18th and 19th, 2022, a Condor geologist oversaw the excavation of fourteen test pits at the site by DRM Construction using a bobcat E50 rubber track hoe equipped with a 24-inch-wide claw bucket. Test pits were excavated to confirm our field observations and total depths ranged from 4 feet to about 11 feet, the maximum reach of the equipment. Excavations terminated prior to the maximum reach of the equipment typically showed no change with depth and were in very hard ground requiring significant effort to excavate.



The subsurface materials were classified according to the Unified Soil Classification System and applicable rock classification system. The test pits encountered natural soils underlain by sandstone and coarse light brown, red sandy lean clay of the early Pliocene to Miocene Mehrten Formation¹. No hard bedrock was encountered. The contacts shown on the test pit logs are approximated based on field observations and measurements. The actual boundaries between different materials may be gradual and soil conditions may vary between the test pit locations. Representative samples of the materials were collected for further review and testing in our laboratory. Each test pit was backfilled with the excavated material and rubber tire rolled for compaction.

Disturbed 2.5 OD stainless steel liner samples were collected by hand from test pit sidewalls using a 5-pound sledgehammer and wood 2x4. All test pits were backfilled with excavated material, loosely compacted with the excavation equipment, and the ground surface graded to near original conditions. The test pit locations are shown in Figure 2, Appendix A. Detailed test pit logs are presented in Appendix B, and laboratory test results are presented in Appendix C.

5.2 EARTH MATERIALS

The natural soils encountered at the site include about four inches of duff underlain by one to four feet of residual soil depending on the locations of past grading activities. The residual soil blankets the site and generally classified as grayish red, slightly moist, very stiff to hard, sandy lean clay (CL). The sandy lean clay has a low to moderate plasticity and a laboratory test yielded a plasticity index (PI) of 15. The residual soil is considered to have a very low to low expansion potential due to the sand and gravel content and moderate plasticity. An R-Value test yielded a result of 24.

The residual soil is in sharp contact with underlying sandstone or andesitic conglomerate, depending on the location. Moving upslope from near St. Charles Street, sandstone is present from near street level to an approximate elevation of 1,055 feet; conglomerate from 1,055 to 1,073; and sandstone from 1,073 to at least the southwest property boundary. These elevations are based on pace and compass field methods and are approximate only. Elevations shown on test pit logs are based on drawing provided to Condor by others². The approximate horizontal delineation of the sandstone and conglomerate is shown in Figure 2, along with the location of the two shafts (wells) and tunnel location.

The sandstone is dark olive gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. Classified as a soil, the material is dense to very dense, silty sand (SM). Vertical cuts are present in the sandstone near the southwest property boundary but the length of time these cuts have been free-standing is not known.

The conglomerate has low hardness and is very weak rock. Classified as soil, the material is slightly moist, very dense, silty gravel with sand (GM). The gravel and cobbles consist mostly of sub-rounded clasts ranging in size from ¾ to 6-inches.

No hard bedrock was encountered that would necessitate blasting based on local excavation practices by experienced contractors in similar ground.

The materials as described in the test pit logs provided in Appendix B.

¹ Holland, P.J., and Delattre, M.P., Preliminary Geologic Map of the San Andreas 7.5' Quadrangle, Calaveras County, California, V1.0, California Geologic Survey

² San Andreas Development, Stewart Romberger Kite, Architects Inc., RK Hospitality Development - Mercury Ranch LP, drawing SK-04, May 18, 2022



5.3 LOCAL GROUNDWATER CONDITIONS

No groundwater was encountered in any of the test pits excavated at the site. Seasonal groundwater is likely to occur as perched water where permeable soils overlie less permeable material. Saturated soil conditions should be expected in most areas during winter and spring months.

As discussed in Section 2.0, there has been historic groundwater recorded at a depth of 63 feet. It is likely that the groundwater was present in a water bearing layer in the past and could be present in the future during years of higher rainfall or higher local groundwater. We understand that there are currently no plans to excavate the site to a deep depth that might encounter groundwater near this historic depth.

6.0 SEISMIC CONSIDERATIONS

6.1 SEISMIC DESIGN PARAMETERS

Probabilistic values of ground motion corresponding to various levels of seismic hazards are available on-line from professional organizations using the USGS data to retrieve the seismic design data and present the findings in a report format. The USGS uses a probabilistic model to estimate ground motions corresponding to various levels of seismic hazard. Site soils were classified using the procedures specified in the 2019 CBC, which utilizes ASCE 7-16.

Based on our field observations, results of laboratory analyses, and the anticipated presence of engineered fill beneath structures, we recommend the site be assigned Site Class D, Stiff Soil, for seismic characterization. The results of the general seismic analysis using the 2019 CBC for Site Class D (stiff soil) are summarized below and provided in Appendix D. The recommended values for design of the proposed structures are:

Risk Catégorie	II
Site Class:	D
Seismic Coefficient, S_s :	0.359g
Seismic Coefficient, S_1 :	0.189g
Site Coefficient, F_a :	1.513
Site Coefficient, F_v :	2.222
Adjusted Seismic Coefficient, S_{MS} :	0.543g
Adjusted Seismic Coefficient, S_{M1} :	0.42
Design Parameter, S_{DS} :	0.362g
Design Parameter, S_{D1} :	0.28
Peak Ground Acceleration, PGA	0.151g

g = acceleration due to gravity

6.2 LIQUEFACTION POTENTIAL

No potentially liquefiable deposits were identified, and groundwater is not anticipated within 50 feet of the ground surface; therefore, the risk from liquefaction is considered non-existent.

7.0 CONCLUSIONS AND RECOMMENDATIONS

7.1 GENERAL

Based on our findings, it is our professional opinion that the site is suitable from a geotechnical standpoint for construction of the proposed improvements provided the geotechnical recommendations contained herein are incorporated into the project design and construction. The primary geotechnical considerations are:



- The presence of historic vertical shafts and tunnels as discussed in Section 4.4. When properly closed, we view these two shaft locations and the mapped tunnel as very low risk for the use of the proposed parking and driveway areas. However, the locations should be avoided for structures. As such, the locations should be accurately surveyed to confirm they are not located within or close proximity to proposed build footprints. Additional discussion is provided in later sections for proper closure.
- The potential to encounter variable ground conditions below the residual soil layer. This includes sandstone and conglomerate (containing large amounts of cobbles) as described in Sections 4.2 and 5.3.

Specific conclusions and recommendations addressing these geotechnical considerations, as well as general recommendations regarding the geotechnical aspects of design and construction, are presented in the following sections.

7.2 GRADING AND EARTHWORK RECOMMENDATIONS

All grading and site work should be performed in accordance with the 2019 CBC, Title 24, Chapter 33 (Safeguards During Construction Construction), Appendix J (Grading), Chapter 17 (Special Inspections and Tests), and Chapter 18 (Soils and Foundations), and with the recommendations of the Geotechnical Engineer of Record during construction. Where the recommendations of this report and the cited sections of Title 24 are in conflict, the owner should request clarification from the Geotechnical Engineer of Record. The recommendations of this report should not be waived without the consent of the Geotechnical Engineer of Record for the project. Recommendations for additional work and construction monitoring are contained in later sections of this report.

Fill construction on existing slopes steeper than 5:1 (Horizontal to Vertical) should be constructed in accordance with Figure 5.

7.2.1 Clearing, Grubbing, and Well Closure

At the time of our field investigation, the site was covered with moderate vegetation, including trees. Areas proposed to receive buildings, pavements, and other permanent structural improvements should commence with the removal of root systems, vegetation and the stripping of organic soil where present. All roots greater than ½-inch diameter shall be removed by either mechanical means or by hand during grading. Removal of vegetation should extend a minimum of 5 feet beyond the limits of the proposed improvements (including buildings, hardscapes, and paving). Removal of any organic matter to a depth of at least 1 to 2 inches may be required. Any organic-laden material free from debris may be stockpiled for later use in non-structural areas where approved by the owner, but such material should not be used for engineered fill.

Buried objects are known to exist onsite in areas described in Section 4.4. Site specific closure recommendations should be provided for the two known wells after they are confirmed to be outside building footprints. Preliminary, it is anticipated that closure will include backfill with granular rock and capped with a concrete cover.

Other buried objects or remnants from the past site use may become known during site preparation. If encountered, buried objects should be removed and disposed of offsite. Underground pipes should be removed within the limits of construction, and portions abandoned in-place should be plugged with cement grout to prevent migration of soil and/or water. All excavations resulting from removal activities should be cleaned of loose or disturbed material and dish-shaped with sides sloped 3H:IV or flatter, to permit access of compaction equipment. These excavations should be backfilled with engineered fill.



7.2.2 Subgrade Preparation

In areas to support improvements or engineer fill, the exposed subgrade should be scarified to a depth of 6 inches, uniformly moisture conditioned, and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density. Native subgrade soils or native weathered bedrock should be uniformly moisture conditioned to between 2 and 4 percentage points above the optimum moisture content. Field density tests should be taken to verify compaction of the prepared subgrade in these areas.

The depth of scarification should be confirmed at the time of grading by the Geotechnical Engineer. Areas of loose top soil that exceeds 6 inches may require removal of soil prior to scarification.

7.2.3 Engineered Fill Materials

Engineered fill used for the project should be either 1) select import engineered fill, or 2) general on-site soils with less than 3 percent organic content. Areas with high percentage of gravel- and cobble-sized rock may require processing such as screening or blending to provide fill that is compatible with sufficient fines.

Select import engineered fill should be inorganic, have an R-value of at least 30, a liquid limit less than 30, and a plastic index less than 7. In addition, select import engineered fill should meet the following particle-size gradation:

Sieve Opening	Percent Passing, by Dry Weight
4-inch square	100
3/4-inch square	70 minimum
U.S. No. 4	60 minimum
U.S. No. 200	50 maximum

Fill material that does not meet the above criteria should be tested under the direction of the Geotechnical Engineer of Record to determine if it has engineering properties equivalent to, or better than, the existing site materials. Samples of any proposed imported fill material should be submitted to the Laboratory of Record for testing and approved by the Geotechnical Engineer of Record prior to being brought to the site. General on-site engineered fill should be inorganic, contain no rocks greater than 4-inches in least dimension, and be free of deleterious materials. Soils containing more than 3 percent by weight of organic material should be considered organic. Our subsurface data and laboratory test data indicate that the near-surface native soil encountered in the borings generally meets the criteria for import engineered fill.

7.2.4 Engineered Fill Placement

Engineered fill should be placed in a series of horizontal layers not exceeding 8 inches in loose thickness, uniformly moisture-conditioned, and compacted to achieve a minimum relative compaction of 90 percent of the ASTM D1557 maximum dry density. Fill soils composed of sands, silty sands, and non-plastic silts should be uniformly moisture conditioned to between 1 and 3 percentage points above the optimum moisture content. Additional fill lifts should not be placed if the previous lift did not meet the required relative compaction or if soil conditions are not stable. The upper 12 inches of pavement subgrades should be compacted to at least 95 percent relative compaction by the CAL 216 test procedure.



7.2.5 Excavations

Excavations will encounter native residual soils and weathered bedrock materials. These materials can be excavated with conventional earthmoving equipment in most cases. Areas consisting of cuts 2 to 3 feet below existing grade may be difficult to excavate with a conventional backhoe and may require specialty equipment. We anticipate that temporary excavations less than 5 feet deep and a minimum of 3 feet above groundwater or seeps may be cut as steep as 1½H:1V (horizontal to vertical). Deeper cuts should be considered on a case-by-case basis due to variable conditions. All open cuts should be in compliance with applicable Occupational Safety Health Administration (OSHA) regulations (California Construction Safety Orders, Title 8) and should be monitored for evidence of incipient instability. The final inclination of both permanent cut and permanent fill slopes should be made no steeper than 2H:1V.

7.3 UNDERGROUND UTILITY TRENCHES

Unless concrete bedding is required around utilities, pipe bedding should consist of sand with a sand equivalent of at least 30 or the pipe manufacturer's requirements, or permitting agency standards, whichever is more restrictive. The pipe bedding should extend from 6 inches below the invert of the pipe to 1 foot above the crown of the pipe. The pipe bedding material should be compacted to a minimum of 90 percent relative compaction or the manufacturer's recommendations if more stringent.

Trench backfill above the pipe bedding zone should be placed in the same manner as required in Section 7.2.4, Engineered Fill Placement. Native onsite soils may be used as backfill in trenches above the pipe bedding. Utility trench backfill should be placed in layers not exceeding a loose lift thickness of 8 inches, uniformly moisture conditioned, and compacted to a minimum of 90 percent relative compaction.

Compaction criteria for trench backfill above the bedding zone may be decreased to 85 percent relative compaction in landscape areas that are at least 5 feet beyond structural improvements, except in areas overlain by pavements, sidewalks, or other hardscapes. In landscape areas overlain by pavements, sidewalks, or other hardscapes, we recommend that the trench backfill be compacted to a minimum of 90 percent relative compaction.

7.4 SURFACE DRAINAGE CONTROL

Surface drainage should be planned to prevent ponding and to enable water to drain away from building foundations, slabs, edges of pavements, and retaining walls toward suitable collection or discharge facilities. A positive surface drainage of at least 5 percent should be provided within 10 feet of all building foundations. Elsewhere, positive surface drainage of at least 2 percent is recommended to allow for rapid removal of surface water. Pavements should also be designed with minimum gradients of about 2 percent in their principal direction of drainage, unless drainage reaches are short. Roof drainage systems should be planned to direct rainwater away from foundations, existing fill, and slopes. A detailed drainage plan is outside the scope of this report but should be included in the preparation of the grading plans for the project.

8.0 FOUNDATION RECOMMENDATIONS

8.1 GENERAL FOUNDATION RECOMMENDATIONS

The foundation improvements should be designed and constructed in accordance with the 2019 CBC, Title 24, Chapter 17 (Structural Tests and Special Inspections), Chapter 18 (Soil and Foundations), and all other sections applicable to the proposed structural improvements. Further evaluation of the project site should be conducted to provide specific foundation recommendations not addressed in this report.



8.2 SPREAD FOOTING FOUNDATIONS

The proposed construction may be supported on shallow, reinforced concrete spread footings founded on engineered fill or native ground in cut that is a minimum of 2 feet below original native grade. Continuous and isolated spread footings should have minimum widths of 12 and 24 inches, respectively. Footings should be embedded at least 18 inches below the lowest final adjacent subgrade. Footings supported on engineered fill and native ground may be designed using a net allowable bearing pressure of 2,500 pounds per square foot (psf) for dead plus sustained live loading. A one-third increase in the allowable bearing pressures may be applied when considering short-term loading due to wind or seismic forces.

Total settlement of the foundation will vary depending on the plan dimensions of the foundation, the actual load supported, and the settlement of the existing fill at depth. Based on the assumed foundation dimensions and loads, we estimate maximum total and differential foundation settlements should be on the order of 1 ½ inches and ¾ inch or less, respectively. We recommend that foundations be designed to accommodate the estimated differential settlement over a distance of 50 feet without the loss of structural integrity.

Footings adjacent to descending slopes should be deepened as required to provide a maximum horizontal distance of 15 feet between the edge of the footing and the face of the descending slope.

Prior to placing steel or concrete, footing excavations should be cleaned of all debris, loose or soft soil, and water. All footing excavations should be observed by the project Geotechnical Engineer just prior to placing steel or concrete to confirm the recommendations contained herein are implemented during construction.

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

8.3 LATERAL RESISTANCE

Resistance to lateral loads (including those due to wind or seismic forces) may be determined using the friction between the bottom of concrete foundations and the underlying soil and the passive soil pressure acting against the vertical face of the footings. These two modes of resistance can be combined.

For planning purposes only, we anticipate that sliding resistance to lateral forces may be calculated using a coefficient of friction of 0.3. We anticipate that passive resistance pressure available in the engineered fill may be calculated using an allowable equivalent fluid weight of 300 pounds per cubic foot (pcf), assuming that the ground adjacent the foundation is level. This allowable value includes a reduction factor of 1.5 to limit the foundation movement required to mobilize the ultimate passive resistance. Passive resistance contributed by soils within 1 foot of the ground surface should be neglected unless the ground is covered and confined by a slab-on-grade or pavement. To mobilize passive pressure, gaps between the footing and adjacent ground should be completely backfilled using engineered fill, concrete, or lean cement sand slurry with a 28-day unconfined compressive strength of at least 500 psi.

9.0 SLABS-ON-GRADE

9.1 SUBGRADE SUPPORT FOR SLABS-ON-GRADE

Concrete floor slabs should be supported on ground prepared as discussed in Section 7.0. Because slab-on-grade is generally less tolerant to differential settlement, we recommend that slab-on-grade be limited to exterior areas where feasible. Where this is not feasible, we recommend that the slab-on-grade not be structurally tied to perimeter footings.



9.2 GUIDELINES FOR CONCRETE SLABS-ON-GRADE

Condor does not consider itself an expert on the control of slab cracking or prevention of vapor transmission through concrete slabs. The following recommendations are provided based on current practice in the industry in similar ground. The designer of record should provide final details on plans based on their past experience, coupled with our recommendations.

Where dampness of floor slabs is to be minimized, the slabs should be constructed on a minimum 4-inch-thick layer of capillary break material covered with a high quality vapor retarder. The capillary break material should be free-draining, clean gravel or rock such as No. 4 by ¾-inch pea gravel or permeable aggregate complying with Caltrans Standard Specifications, Section 68, Class 1, Type B.

A 2-inch-thick protective cover (blotter) of clean sand may be placed over the vapor retarder to aid in concrete curing. However, the designer of record of the slab-on-grade may omit the blotter at their discretion when concrete with a water-cement ratio of 0.45 or less is specified. Current ACI recommendations include elimination of the blotter. The vapor retarder should have a minimum thickness of 15 mils, a permeance as tested before and after mandatory conditioning (ASTM E 1745, Section 7.1.2 – 7.1.5) of less than 0.01 perms [grains/(ft² hr inHg)], and comply with the ASTM E 1745 Class A requirements. A two-layer vapor retarder with the equivalent or greater thickness may be used as an alternative. Vapor retarders having these properties are commonly referred to as “vapor barriers.” The vapor retarder should be constructed in accordance with ASTM E 1643-18a using material which meets ASTM E 1745-17.

Slab surfaces to receive moisture sensitive floor coverings should have considerations for maximum vapor emission levels. Most floor coverings require a 3 or 5 pound emission levels for a warranted installation. Emission levels may be controlled by the use of a sub-slab vapor barrier meeting ASTM E 1745 Class A, ASTM E 154-93 resistance to puncture of not less than 3000 grams and ASTM E 154-93 tensile strength after soaking of not less than 55.5 (MD/TD) average.

Slabs should be cast using concrete with a maximum slump of 4 inches or less. Excessive water content is the major cause of concrete cracking. To reduce concrete shrinkage, a water reducing agent or plasticizer may be utilized in the concrete to increase slump while maintaining an appropriate water/cement ration. Hot reinforcing steel should be cooled prior to concrete placement to help prevent concrete shrinkage at the bar location. Where there is potential for moisture accumulation under the slab, special consideration should be given to allow gravity drainage of any water that could migrate into the subgrade of the slab or rock cushion.

The final design floor slab thickness and reinforcement should be provided by the project Structural Engineer. Where a structural engineer is not providing a floor slab design, the following may be used.

Exterior concrete slabs (i.e., sidewalks, concrete aprons, concrete driveways, etc.,) may be constructed directly over subgrade prepared as discussed in Section 7.2. when covered with 4 inches of clean rock, aggregate base, or other granular material. Exterior slabs-on-grade should be a minimum of 4 inches in thickness. All exterior slabs should be reinforced or jointed and scored to limit cracking from shrinkage.

10.0 RETAINING WALLS

10.1 LATERAL EARTH PRESSURES

The following geotechnical criteria may be used for preliminary design of earth-retaining structures constructed on site. Active earth pressures may be used for design of unrestrained retaining walls where the top of the wall is free to translate or rotate. To develop active earth pressures, the walls should be capable of deflecting by at least 0.004H (where H is the height of the wall). At-rest earth pressures should be used for design of



retaining walls where the wall top is restrained such that the deflections required for development of active soil pressures cannot occur or are undesirable. Cantilever walls retaining engineered fill may be designed for active or at-rest lateral earth pressures for various backfill slopes using the following equivalent fluid unit weights. The lateral earth pressures presented in the table below assume that the unit weight of the soil is 100 pounds pcf, the soils internal angle of friction is 30 degrees, based upon laboratory testing of the soil samples, and that the wall backfill is drained (no hydrostatic forces acting on the wall), and no traffic or other surcharge loads are applied within a distance of one-half the wall height.

Equivalent Fluid Unit Weight (pcf)

Backfill Slope	Active Conditions	At-Rest Conditions
Level	35	60
3H:1V	45	75
2H:1V	55	90

The lateral earth pressures should be applied to a plane extending vertically upward from the base of the heel of the retaining wall to the ground surface. Lateral pressures for backfill slopes other than those given above can be estimated by interpolation.

Where the wall backfill will be subject to traffic loading within a distance of $H/2$ (where H is the wall height) from the top of the wall, the wall should be designed to resist an additional uniform lateral pressure of 65 psf applied to the back of yielding walls (active conditions), or 110 psf applied to the back of non-yielding walls (at-rest conditions). The surcharge load should extend from the top of the wall down to 10-feet below the top of wall. Surcharge loads imposed by greater loads or unusual loads within a distance of H of the back of the wall should be considered on a case-by-case basis.

Retaining walls should be designed to resist additional seismic earth pressures due to earthquake loading for walls that exceed 10 feet. The additional seismic pressure increment may be calculated using an inverted equivalent fluid pressure of 10 pcf. The seismic increment should be a pressure that increases linearly from the base of the wall to the top of the wall as an inverted, triangular distribution. The resultant force of the seismic increment should act at a distance of $0.6H$ (where H is the height of the wall) above the base of the wall. Under the combined effects of static and dynamic loading, a factor of safety of 1.1 against sliding or overturning is acceptable. Use of the seismic increment assumes that sufficient wall deformation will occur during seismic loading to develop active earth pressure conditions.

10.2 WALL DRAINAGE

The above lateral earth pressures are based on fully drained conditions. For these conditions, we recommend that the retaining wall backfill be free-draining and provisions are made to collect and dispose of excess water away from the wall. A typical retaining wall detail is provided in Figure 6, Appendix A. Wall drainage may be provided by either a minimum 1-foot wide layer of clean drain rock/gravel enclosed by geosynthetic filter fabric or by prefabricated drainage panels (such as Miradrain, Enkadrain, or an equivalent substitute) installed per the manufacturer's recommendations. In either case, drainage should be collected by perforated pipes and directed to a sump, storm drain, weep holes, or other suitable location for disposal. The drain rock should conform to Class One, Type B permeable material as specified in Section 68 of the California Department of Transportation (Caltrans) Standard Specifications, current edition. A typical 1-inch x No. 4 concrete coarse aggregate mix approximates this specification. A clean pea-gravel is also acceptable. The geosynthetic filter fabric should conform to the requirement in Section 88, "Engineering Fabrics" of the Caltrans Standard Specifications, current edition. A 4-inch diameter perforated pipe at least Schedule 40 PVC, or similar, should be placed "holes down" near the bottom of the section of permeable



material and directed to discharge by gravity to a suitable outlet. The upper 18 inches of engineered backfill above the wall drainage should consist of native material, concrete, asphaltic concrete, or similar backfill to reduce surface drainage into the wall drainage system.

11.0 CORROSION POTENTIAL

A chemical test was performed on a sample of near surface soil anticipated to be in contact with the site improvements. The test result yielded a pH of 6.4, chloride ion concentration reflects none detected, sulfate ion concentrations reflects non detected, and soil redox potentials are 310-mV.

Resistivity test results of 2,600 ohms-centimeter indicate that the soil is mildly corrosive. A commonly accepted correlation between soil resistivity and corrosivity towards ferrous metals is provided in the following table developed by the National Association of Corrosion engineers (NACE).

Soil Resistivity	Corrosivity
Less than 500 ohm-cm	Very corrosive
500 to 1,000 ohm-cm	Corrosive
1,000 to 2,000 ohm-cm	Moderately corrosive
2,000 to 10,000 ohm-cm	Mildly corrosive
Over 10,000 ohm-cm	Progressively less corrosive

Appendix C contains the results of the corrosivity tests performed, as well as a brief evaluation letter by our laboratory subcontractor. The brief evaluation provides general recommendations regarding protecting buried metals. If warranted, a corrosion expert should be consulted to develop specific recommendations.

12.0 PAVEMENTS

The near-surface soils across the site range from the red, sandy lean clay residual soil to silty sand and silty gravel of the Mehrten Formation. A sample was tested to determine the R-value of the red, sandy lean clay and silty sand and yielded R-values of 24 (red, sand clay) and 77 (silty sand). Because of the large variation in the R-values, the pavement design for each material are provided below. Based on the provided values, it appears that it would be advantageous to remove the red, sand clay where present at subgrade and replace with the silty sand, where possible. Preliminary pavement sections³ are presented below based on a Caltrans R-value of 20 and 50, current Caltrans design procedures, and traffic indices ranging from 4.5 to 7.0. The R-Value of the subgrade materials should be tested during grading to confirm the assumed R-Value used in the design. The traffic index (TI) is a measure of traffic wheel loading frequency and intensity of anticipated traffic. For comparison, TI's of between 4 and 5 are often suitable for design of automobile parking areas, whereas TI's of between 5 and 6 are commonly used for design of fire truck access lanes and areas subject to channelized flow with light delivery trucks. Traffic indices assumed above should be reviewed by the project Owner, Architect, and/or Civil Engineer to evaluate their suitability for this project. Pavement sections for other traffic loading should be designed on a case-by-case basis. The use of rigid concrete pavement is favored where trash pick-up or truck traffic necessitates short radius maneuvering and/or heavy metal bin movement on rollers.

³ Caltrans design procedures for asphalt concrete pavements provide sections in units of inches, rounded up to the nearest 1/2-inch. Sections provided above include no Gravel Equivalent Safety Factor (per County Engineers Association and the League of California Cities criteria). If a Gravel Equivalent Safety Factor is required, the pavement sections should be reevaluated.



RECOMMENDED PAVEMENT SECTIONS ON COMPACTED SILTY GRAVEL TO SILTY SAND

R-Value	Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	R-Value 50 Minimum Subgrade Thickness (inches)
R = 50	4.0	2.0	4.0	24
	5.0	2.5	4.0	24
	6.0	3.0	5.0	24
	7.0	4.0	5.0	24

RECOMMENDED PAVEMENT SECTIONS ON COMPACTED RED, SANDY CLAY NATIVE SOIL

R-Value	Traffic Index	Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	R-Value 50 Subgrade (inches)
R = 20	4.0	2.0	7.0	0
	5.0	2.5	8.5	0
	6.0	3.0	10.5	0
	7.0	4.0	12.0	0

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

- The pavement subgrade soils in the upper 12 inches below the finished subgrade elevation, should be compacted as engineered fill to achieve a minimum relative compaction of 95 percent of the CAL 216 maximum wet density.
- All trenches backfill for culverts, utilities and pipes underlying paved areas should be properly placed and compacted to at least 90 percent relative compaction (ASTM D1557) within 1 foot of finished subgrade elevation. The upper 12 inches of trench backfill should be compacted to at least 95 percent relative compaction (CAL 216).
- The subgrade soils should be in a stable, non-pumping condition at the time the aggregate base material is placed and compacted.
- Aggregate base materials should meet current Caltrans specifications for Class 2 aggregate and be compacted as engineered fill to at least 95 percent relative compaction.
- Asphalt paving materials and placement methods should meet current Caltrans specifications for asphalt concrete.
- Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become continuously wet.
- All concrete curbs separating pavement and landscaped areas should extend at least 2 inches into the subgrade and below the bottom of the adjacent aggregate base to provide a barrier against lateral migration of landscape water or runoff into the pavement section. For better performance, we recommend that subdrains be considered along edges of roads where there are slopes and especially swales that descend towards pavement.
- Periodic maintenance should be performed to repair degraded areas and seal cracks with appropriate filler.



The regulatory jurisdiction may have additional minimum standards in addition to those provided above. Due to grading operations, the actual pavement subgrade materials may vary significantly from those assumed for the pavement sections presented above. Following site grading activities, we recommend that a representative subgrade sample be obtained, and R-value testing be performed. If the results of the R-value testing vary significantly from those assumed, the pavement sections presented above will need to be revised.

Portland Cement Concrete pavements may be constructed directly on weathered bedrock or engineered fill. All Portland Cement Concrete pavements should have a minimum compressive strength of 3,000 pounds per square inch (psi) and should contain entrained air to resist freeze damage. The thickness of the pavement should equal the thickness of the AB listed in the above table for the supporting soil.

13.0 ADDITIONAL SERVICES

The geotechnical recommendations and design criteria in this report are sensitive to the location, design details, and any special requirements of the new construction. Condor should review the geotechnical elements of project grading, foundation plans and specifications prior to construction bidding to check that the intent of our recommendations have been incorporated into these project documents. If Condor does not review the geotechnical elements of the plans and specifications, the reviewing geotechnical engineer or qualified professional civil engineer should thoroughly review this report and concur with its conclusions and recommendations or provide alternative recommendations.

Because surface and subsurface conditions vary across the site, geotechnical recommendations used as a basis for construction contracting are sensitive to the possible need for adjustment in the field. The adjustments are dependent upon conditions revealed during construction that could previously only be assumed based upon site exploration. Since the intent of the recommendations given in this report are best understood by a Condor representative, we recommend that field observations and testing during earthwork and construction be performed by Condor. If Condor does not provide the field observations and testing, the Geotechnical Engineer of Record should thoroughly review this report and concur with its conclusions and recommendations or provide alternative recommendations.

A representative of the Geotechnical Engineer of Record or a qualified professional civil engineer should be on-site to observe and advise during site preparation, grading and earthwork, paving, and construction of foundations and slabs-on-grade. These observations should be supplemented with periodic density and compaction testing of subgrade and engineered fills to evaluate conformance with the recommendations contained in this report. It is important that foundation excavations be checked after cleaning and immediately prior to concrete placement to verify their suitability.

14.0 LIMITATIONS

The geotechnical conclusions and recommendations presented in this report are based on our findings during field investigations, and are intended for planning, design, and construction of the proposed improvements. These conclusions and recommendations may be invalid if:

- the design assumptions change;
- the report is used for another site and/or project;
- the encountered soil or groundwater conditions are different than those anticipated in this report;
- the recommendations contained in this report are not followed; or
- any other change is implemented that materially alters the project.



This report was prepared in accordance with the generally accepted standards of geotechnical engineering practice existing in Contra Costa County at the time it was written. No other warranty, expressed or implied, is made. It is the owner's responsibility to see that all parties to the project, including the designer, contractors, subcontractors, etc., are made aware of this report in its entirety.

The analyses and recommendations submitted herein are based upon the data obtained during our soil boring and test pit investigation at locations shown on Figure 2. Subsurface exploration of any site is necessarily confined to selected locations and conditions may, and often do, vary between and around these locations. Should varied conditions come to light during construction on the project site, additional exploration, testing, or analysis may be required. Any person concerned with this project who observes conditions or features of the site or its surrounding areas that are different from those described in this report, should report them immediately to Condor for evaluation.

It should be noted that changes in the standards of practice in the field of geotechnical engineering, changes in site conditions (such as new excavations or fills), new agency regulations, or modifications to the proposed project are grounds for this report to be professionally reviewed. In light of this, there is a practical limit to the usefulness of this report without critical professional review. It is suggested that 2 years be considered a reasonable time for the usefulness of this report.

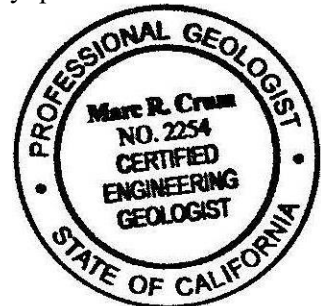
We trust this report provides the information required at this time. Please call with any questions.

Respectfully submitted,
CONDOR EARTH



A handwritten signature in blue ink, appearing to read "Ronald L. Skaggs".

Ronald L. Skaggs
Geotechnical Engineer (CA #2295)
Vice President, Engineering Services



A handwritten signature in black ink, appearing to read "Marc R. Crum".

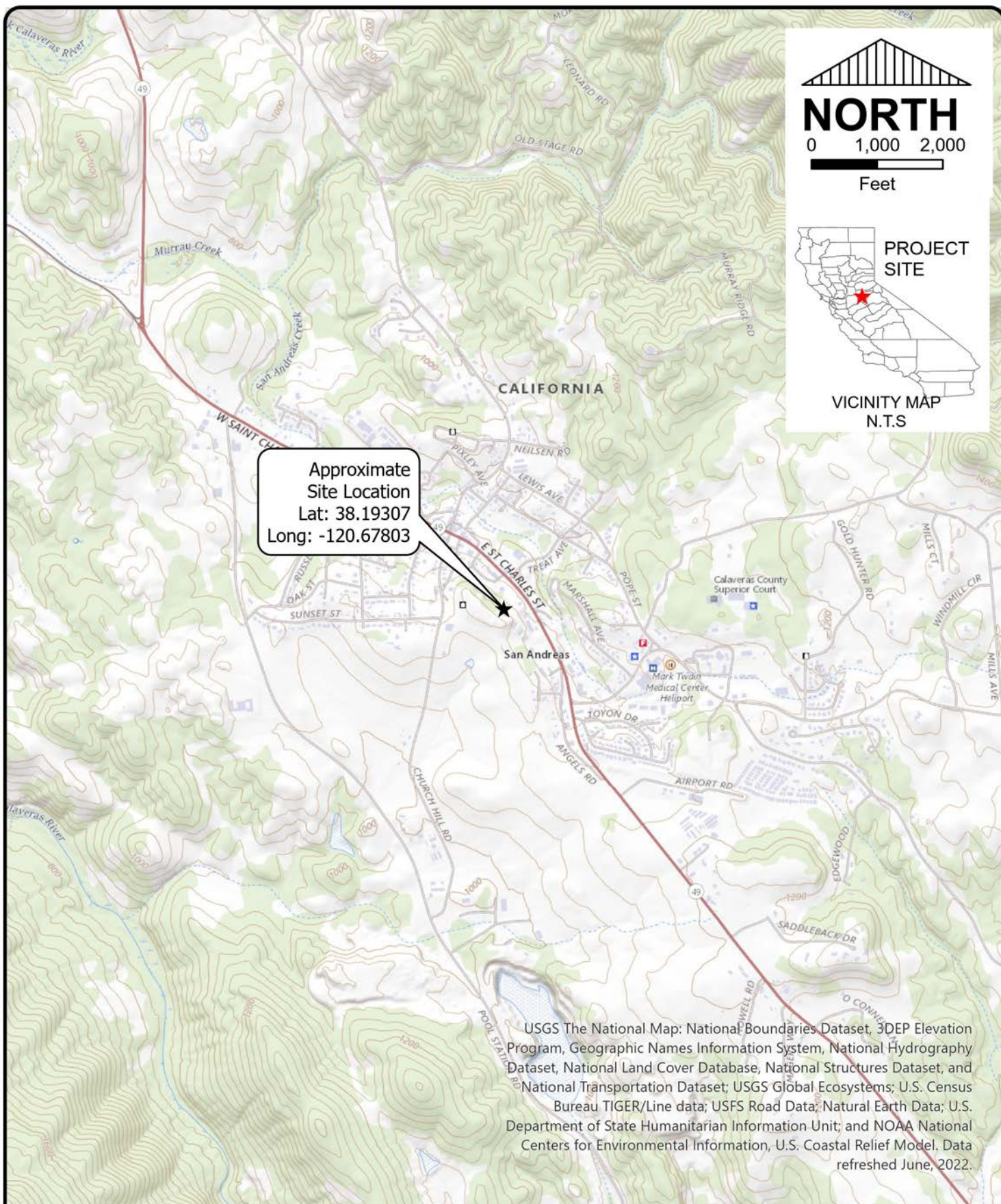
Marc R. Crum
Certified Engineering Geologist (CA #2254)

X:\Project\8000_prj\8897 RK Hospitality Development\Reports\FR 20220915 GES.docx

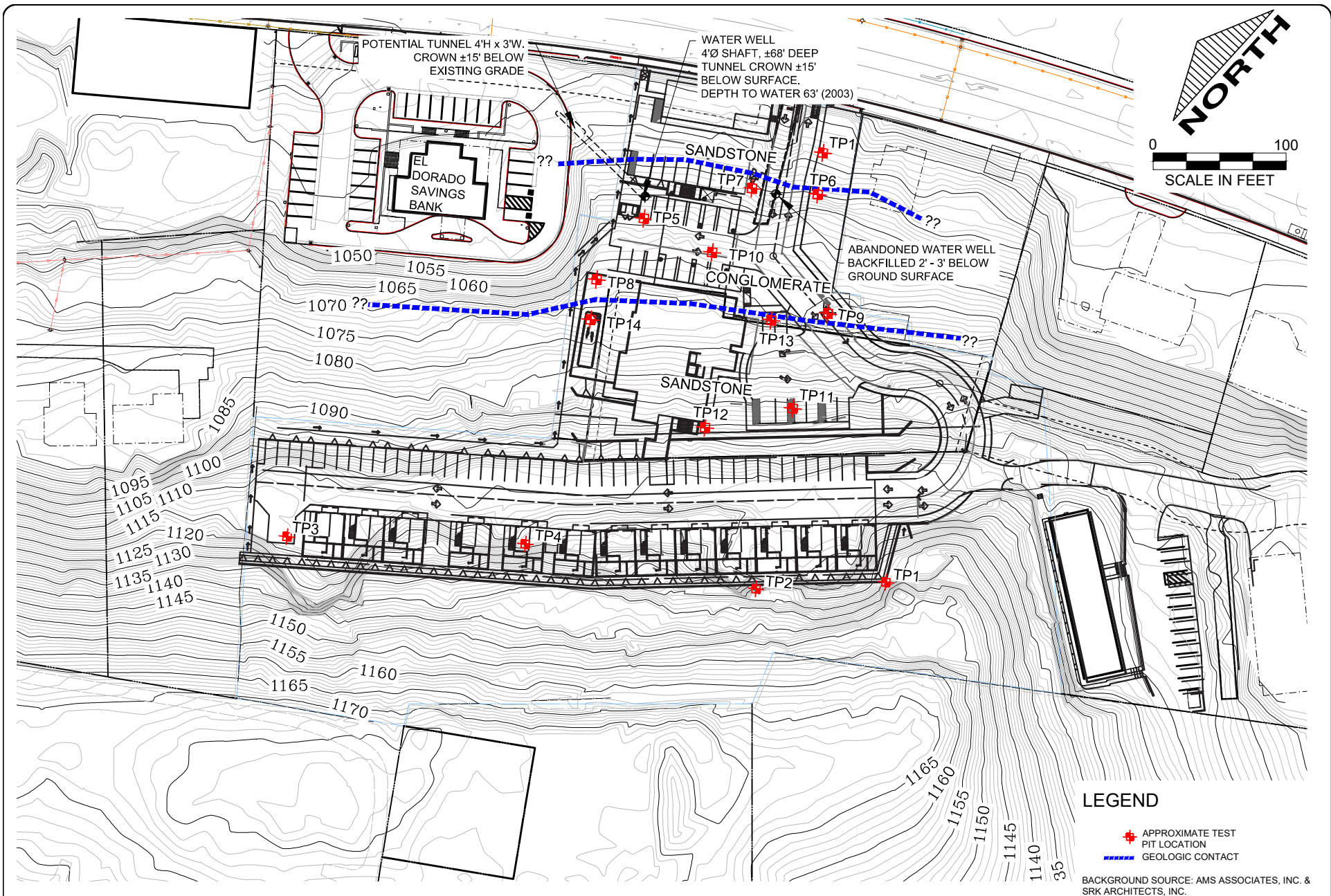


APPENDIX A
Figures

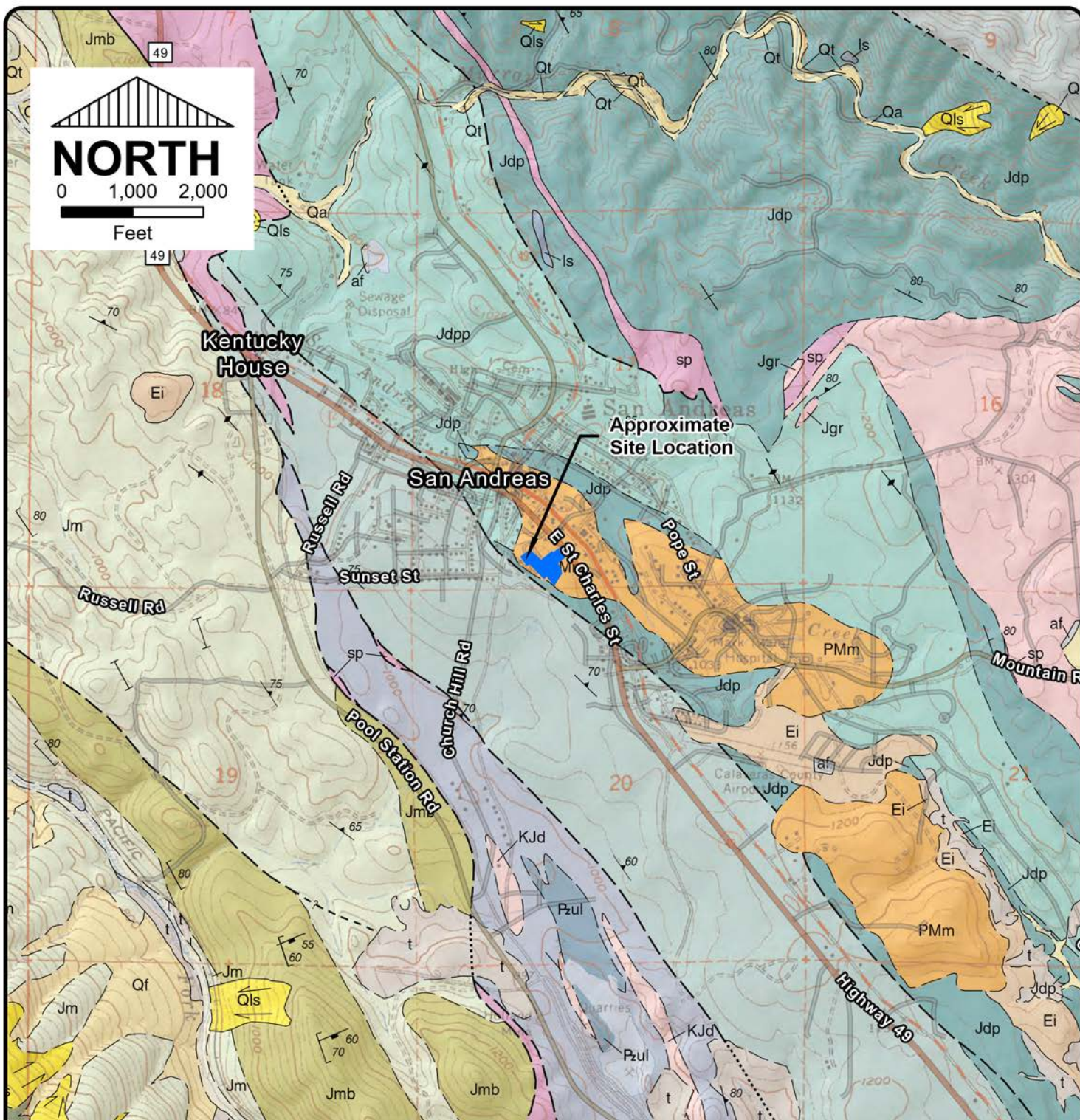




 CONDOR EARTH 21663 Brian Lane P.O. Box 3905 Sonora, CA 95370 (209) 532-0361 fax (209) 532-0773 www.condorearth.com	Job No. 8897 Date 08 Aug 2022 Scale AS SHOWN Drawn JW Chk'd LA	VICINITY MAP RK HOSPITALITY DEVELOPMENT 236 - 300 EAST SAINT CHARLES STREET SAN ANDREAS, CALIFORNIA	FIGURE 1 8897_GES.aprx
---	--	---	---



F2_8897	FIGURE 2		CONDOR EARTH		Job No. 8897		SITE MAP WITH TEST PIT LOCATIONS RK HOSPITALITY DEVELOPMENT 236-300 EAST SAINT CHARLES STREET SAN ANDREAS, CALIFORNIA			
			21663 Brian Lane P.O. Box 3905 Sonora, CA 95370 (209) 532-0361		Date 18 August 2022					
			fax(209) 532-0773 www.condorearth.com		Scale AS SHOWN					
			Drawn MT		Chk'd MC					



LEGEND

	APPROXIMATE SITE BOUNDARY		Jdp	Phyllite		Jdpv	Green Schist
	PMm	Mehrten Formation		Jdpp	Pyroclastic Rocks		

Source:
California Geological Survey, Preliminary Map of the San
Andreas 7.5' Quadrangle, Peter J. Holland, and Marc P.
Delattre, 2017



CONDOR EARTH

21663 Brian Lane
P.O. Box 3905
Sonoma, CA 95370
(209) 532-0361
fax (209) 532-0773
www.condorearth.com

Job No.

8897

Date

08 Aug 2022

Scale

AS SHOWN

Drawn

JW

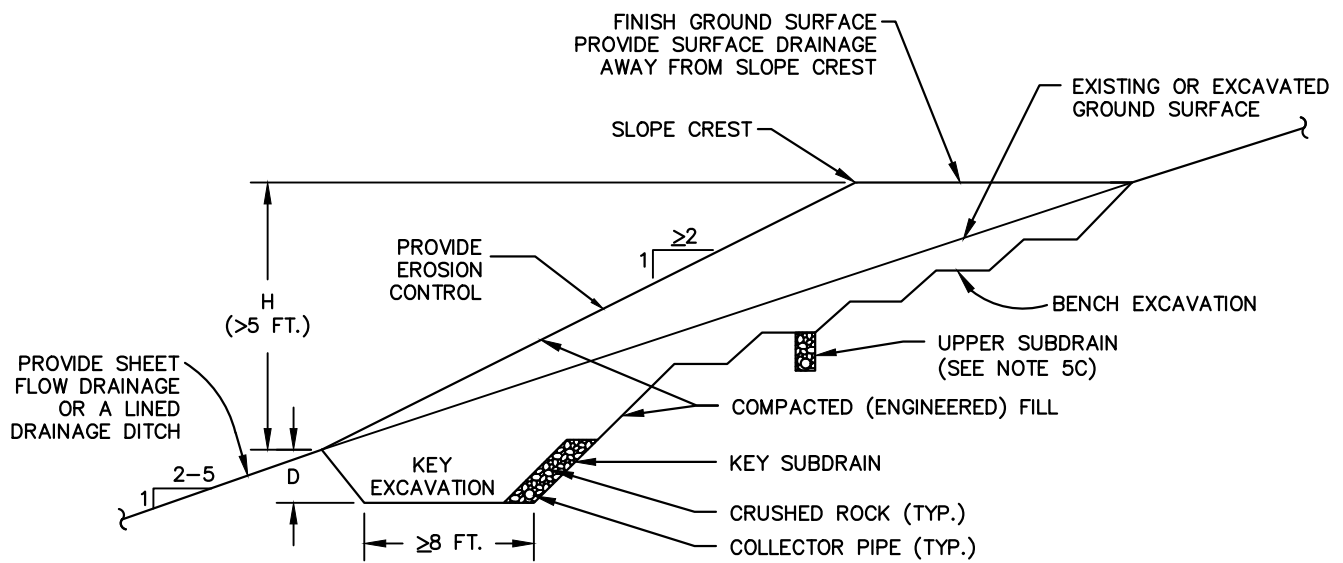
Chk'd

LA

GEOLOGIC MAP
RK HOSPITALITY DEVELOPMENT
236 - 300 EAST SAINT CHARLES STREET
SAN ANDREAS, CALIFORNIA

FIGURE
3

8897_GES.aprx



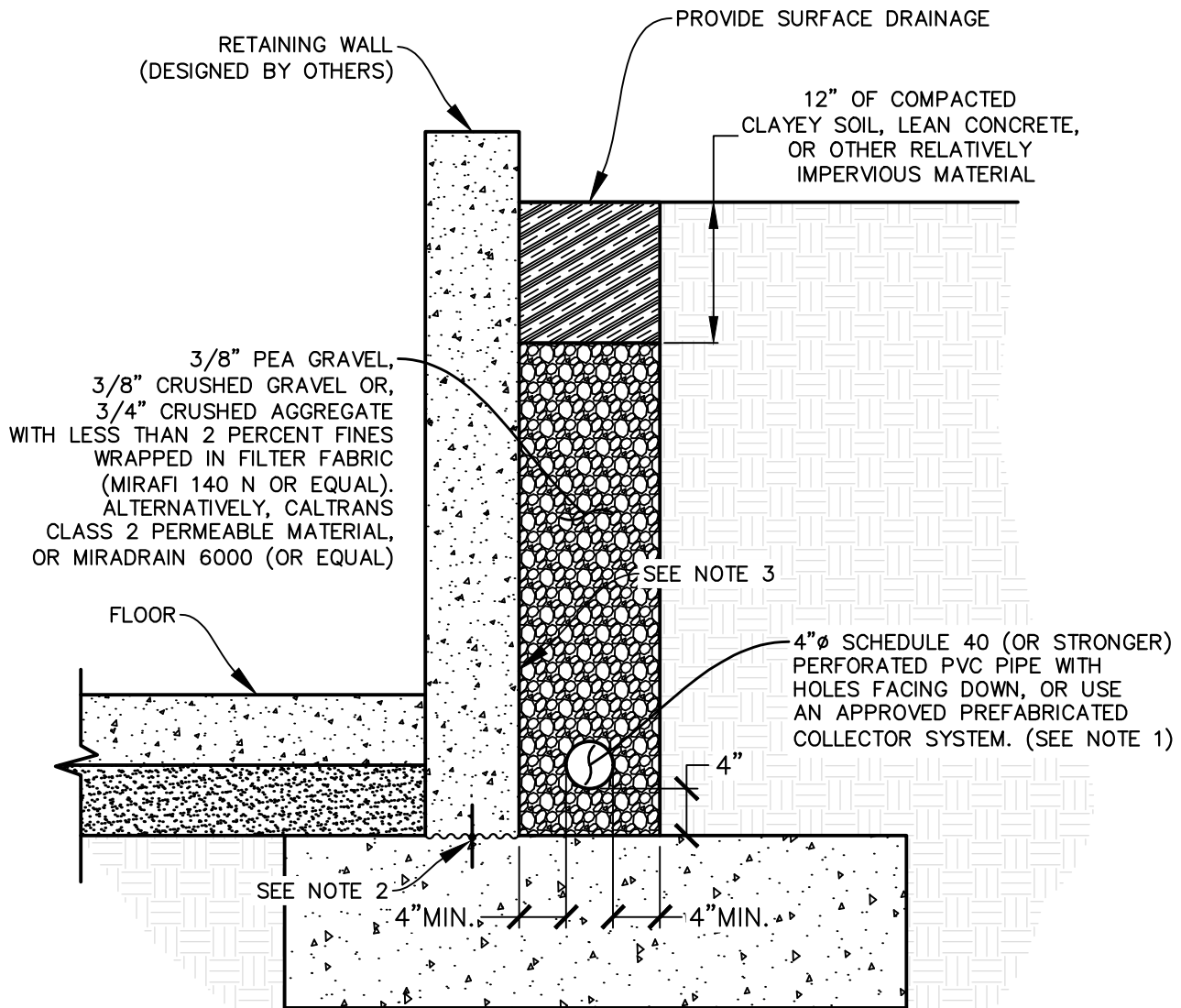
NOTES:

1. EXCAVATE CUT SLOPES BELOW FILL SLOPES PRIOR TO CONSTRUCTING FILL SLOPE.
2. STRIP VEGETATION ON EXISTING GROUND SURFACE BENEATH FILL.
3. $D \geq 2$ FEET.
4. GEOTECHNICAL ENGINEER IN FIELD TO DETERMINE KEY AND BENCH EXCAVATION DEPTH AND WIDTH.
5. A. SUBDRAINS:
 PIPE: SDR-35, SCHEDULE 40, OR STRONGER. PERFORATIONS FACING DOWN. PERFORATED COLLECTOR PIPES DRAIN TO TIGHTLINE DISCHARGE PIPE. DISCHARGE PIPES DRAIN TO STORM DRAIN OR DAYLIGHT. DIAMETER = 4 or 6 INCHES. ENGINEER IN FIELD TO DETERMINE ACTUAL DIAMETER AND LOCATIONS OF DISCHARGE PIPES. CAP UPSTREAM ENDS OR INSTALL CLEANOUTS, AS DETERMINED BY GEOTECHNICAL ENGINEER IN FIELD. JUNCTION ANGLE AT CLEANOUTS, DISCHARGE PIPES, AND OTHER JUNCTIONS $\leq 45^\circ$ AND DIRECT SUCH THAT CLEANOUT EQUIPMENT CAN ACCESS ALL PIPES FROM UPSTREAM ENDS. INSTALL RODENT SCREENS AT DAYLIGHT.
 B. CRUSHED ROCK:
 CLASS 2 PERMEABLE MATERIAL (CALTRANS SPECIFICATION) OR OPEN-GRADED ROCK WITH $< 2\%$ FINES COMPLETELY WRAPPED IN FILTER FABRIC: $\geq 15\%$ OPEN AREA, EQUIVALENT OPENING SIZE = 40-70. PLACE AT LEAST 4 INCHES OF CRUSHED ROCK BENEATH COLLECTOR PIPE. GEOTECHNICAL ENGINEER IN FIELD TO DETERMINE THICKNESS OF ROCK PLACED ABOVE PIPE.
 C. GEOTECHNICAL ENGINEER IN FIELD TO DETERMINE LOCATIONS OF UPPER SUBDRAINS ABOVE KEY SUBDRAIN.
6. COMPACT FILL TO AT LEAST 90% COMPACTION AS PER ASTM 1557, UNLESS OTHERWISE SPECIFIED. GEOTECHNICAL ENGINEER TO APPROVE FILL MATERIAL.

DISCLAIMER: THIS MAP REPRESENTS FEATURES FOR ILLUSTRATION PURPOSES ONLY. IT IS NOT A LEGAL SURVEY OR CONSTRUCTION DOCUMENT AND IS NOT INTENDED FOR USE IN DETERMINING BOUNDARIES OR DIMENSIONS. ANY USE OF THIS MAP FOR PURPOSES OTHER THAN FOR APPROXIMATE LOCATION OF FEATURES IS DONE SO AT THE USER'S RISK AND WITHOUT THE CONSENT OF CONDOR EARTH.

 CONDOR EARTH 21663 Brian Lane P.O. Box 3905 Sonora, CA 95370 (209) 532-0361 fax(209) 532-0773 www.condorearth.com	Job No.		TYPICAL FILL SLOPE OVER SLOPING GROUND SURFACE RK HOSPITALITY DEVELOPMENT 236-300 EAST SAINT CHARLES STREET SAN ANDREAS, CALIFORNIA	FIGURE 5
	Date			
	Scale			
	Drawn KGM	Chk'd ASK		
FILL SLOPE				

FILL SLOPE



NOTES:

1. SLOPE PIPE OR PREFABRICATED COLLECTOR SYSTEM AT LEAST 2% TO DRAIN. PLACE PIPE OR COLLECTOR BELOW ADJACENT INTERIOR FLOORS.
2. PROVIDE WATER STOP OR EQUIVALENT DETAIL FOR BUILDING WALLS AT CONSTRUCTION JOINTS.
3. PROVIDE APPROVED WATERPROOFING ON BUILDING WALLS.
4. WATERPROOFING AND DRAINAGE PRODUCTS TO BE INSTALLED PER MANUFACTURER'S RECOMMENDATIONS.
5. PROVIDE CLEANOUTS AT EACH UPSTREAM END OF PIPES AND AS PER ENGINEER IN FIELD.
6. JUNCTION ANGLES IN PIPES SHALL BE $\leq 45^\circ$ AND DIRECTED SO CLEANOUT EQUIPMENT CAN ACCESS ALL PIPES FROM UPSTREAM ENDS.
7. PROVIDE RODENT SCREENS AND EROSION PROTECTION AT DISCHARGE.

DISCLAIMER: THIS MAP REPRESENTS FEATURES FOR ILLUSTRATION PURPOSES ONLY. IT IS NOT A LEGAL SURVEY OR CONSTRUCTION DOCUMENT AND IS NOT INTENDED FOR USE IN DETERMINING BOUNDARIES OR DIMENSIONS. ANY USE OF THIS MAP FOR PURPOSES OTHER THAN FOR APPROXIMATE LOCATION OF FEATURES IS DONE SO AT THE USER'S RISK AND WITHOUT THE CONSENT OF CONDOR EARTH.



CONDOR EARTH

21663 Brian Lane
P.O. Box 3905
Sonora, CA 95370
(209) 532-0361
fax(209) 532-0773
www.condorearth.com

Job No.

8897

Date

Scale

AS SHOWN

Drawn

KGM

Chk'd

ASK

RETAINING WALL DRAINAGE
RK HOSPITALITY DEVELOPMENT
236-300 EAST SAINT CHARLES
STREET SAN ANDREAS,
CALIFORNIA

FIGURE
6

RETAINING WALL DRAINAGE

APPENDIX B
Logs of Test Pits



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 1
Total Depth: 7 feet
Date Excavated: 07/18/22
Elevation: 1,135', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-2'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite Trace roots at sharp contact with:
2'-7'	SM	MEHRTEN FORMATION: SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense

Notes: Test pit excavated in near-vertical cut and relatively flat area at toe created by past grading. No excavation refusal, no groundwater encountered, bulk sample collected from 3'-4', disturbed liner sample from 4'. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 2
Total Depth: 10 feet
Date Excavated: 07/18/22
Elevation: 1,135', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-2'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite Sharp contact with:
2'-10'	SM	MEHRTEN FORMATION: SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense

Notes: Test pit excavated previously graded area. No excavation refusal, no groundwater encountered.
Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 3
Total Depth: 11 feet
Date Excavated: 07/18/22
Elevation: 1,120', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-3'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite Sharp contact with:
3'-11'	SM	<u>MEHRTEN FORMATION:</u> SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense

Notes: Test pit excavated previously graded area at toe of near-vertical cut. No excavation refusal, no groundwater encountered. Disturbed liner sample collected from 4'. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 4
Total Depth: 7 feet
Date Excavated: 07/18/22
Elevation: 1,130', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-2'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite Trace roots at sharp contact with:
2'-7'	SM	MEHRTEN FORMATION: SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense

Notes: Test pit excavated near toe of native slope in previously graded area. No excavation refusal, no groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 5
Total Depth: 6.5 feet
Date Excavated: 07/18/22
Elevation: 1,060', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-0.75'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite sharp contact with:
0.75'-6.5'	GM	<u>MEHRTEN FORMATION:</u> sub-rounded cobble conglomerate SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles.

Notes: Test pit excavated on apparent native slope to practical refusal. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 6
Total Depth: 2.7 feet
Date Excavated: 07/18/22
Elevation: 1,055', Topo
Logged by: M. Crum

DEPTH	USCS	DESCRIPTION
0'-2.7'	GM	MEHRTEN FORMATION: sub-rounded cobble conglomerate SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles.

Notes: Test pit excavated on apparent native slope to practical refusal. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 7
Total Depth: 9 feet
Date Excavated: 07/18/22
Elevation: 1,055', Topo
Logged by: M. Crum

DEPTH	USCS	DESCRIPTION
0'-2'	GM	MEHRTEN FORMATION: sub-rounded cobble conglomerate SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles. Sharp contact with:
2'-9'	SM	SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense

Notes: Test pit excavated on apparent native slope to practical refusal at location about 20 west of existing concrete driveway. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 8
Total Depth: 5.5 feet
Date Excavated: 07/18/22
Elevation: 1,070', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-1.3'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite sharp contact with:
1.3'-5.5'	GM	MEHRTEN FORMATION: sub-rounded cobble conglomerate SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles.

Notes: Test pit excavated on apparent native slope to practical refusal. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 9
Total Depth: 5 feet
Date Excavated: 07/18/22
Elevation: 1,070', Topo
Logged by: M. Crum

DEPTH	USCS	DESCRIPTION
-------	------	-------------

0'-5'	GM	MEHRTEN FORMATION: sub-rounded cobble conglomerate SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles.
-------	----	--

Notes: Test pit excavated to practical refusal. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 10
Total Depth: 4 feet
Date Excavated: 07/18/22
Elevation: 1,065', Topo
Logged by: M. Crum

DEPTH	USCS	DESCRIPTION
-------	------	-------------

0'-4'	GM	MEHRTEN FORMATION: sub-rounded cobble conglomerate SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles.
-------	----	--

Notes: Test pit excavated to practical refusal. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 11
Total Depth: 11 feet
Date Excavated: 07/18/22
Elevation: 1,095', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-4'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite, abundant roots Sharp contact with:
4'-11'	SM	MEHRTEN FORMATION: SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense

Notes: Test pit excavated on apparent native slope. Bulk sample from 0-3', disturbed liner sample at 3'. No excavation refusal, no groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 12
Total Depth: 11 feet
Date Excavated: 07/19/22
Elevation: 1,100', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-3'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite, abundant roots Sharp contact with:
3'-11'	SM	MEHRTEN FORMATION: SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense

Notes: Test pit excavated on apparent native slope. No excavation refusal, no groundwater encountered.
Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• **Engineering** • **Geotechnical** • **Environmental** • **Mapping** •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 13
Total Depth: 9 feet
Date Excavated: 07/19/22
Elevation: 1,080', Topo
Logged by: M. Crum

DEPTH	USCS	DESCRIPTION
0'-7'	SM	<u>MEHRTEN FORMATION:</u> SANDSTONE: dark greenish gray, weakly lithified, extremely weak, soft rock with horizontal bedding locally. SOIL CLASSIFICATION: Silty Sand, slightly moist, dense to very dense Grades to:
7'-9'	GM	CONGLOMERATE: sub-rounded cobbles SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles

Notes: Test pit excavated on apparent native slope to practical refusal south of existing concrete driveway. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



CONDOR EARTH

188 Frank West Circle, Suite I, Stockton, CA 95206
21663 Brian Lane, PO Box 3905, Sonora, CA 95370
1739 Ashby Road, Suite B, Merced, CA 95347

(209) 234-0518 FAX (209) 234-0538
(209) 532-0361 FAX (209) 532-0773
(209) 388-9601 FAX (209) 388-1778

• Engineering • Geotechnical • Environmental • Mapping •

TEST PIT LOG

Project No: 8897 – San Andreas Development
Client: RK Hospitality Development
Project Location: San Andreas, California
Test Pit Location: 236 - 300 East Saint Charles Street
Equipment: Bobcat E50 mini-excavator with 2' claw bucket

Test Pit No: TP – 14
Total Depth: 6 feet
Date Excavated: 07/19/22
Elevation: 1,075', Topo
Logged by: M. Crum



DEPTH	USCS	DESCRIPTION
0-4'	CL	RESIDUAL SOIL: Sandy Lean Clay, grayish red, slightly moist, very stiff to hard (4.5TSF), fine to medium sand generally medium. Mineralogy: rhyolite, andesite, quartz, biotite, muscovite sharp contact with:
4'-6'	GM	MEHRTEN FORMATION: sub-rounded cobble conglomerate SOIL CLASSIFICATION: Silty Gravel with Sand, slightly moist, dense to very dense, clasts generally andesite, rhyolite and less tuff. ¾" pebbles to 6" cobbles.

Notes: Test pit excavated on apparent native slope to practical refusal. No groundwater encountered. Test pit backfilled with excavated material and loosely compacted.



UNIFIED SOIL CLASSIFICATION SYSTEM

Division		Group Symbol	Group Name
Coarse-Grained Soils (more than 50 percent retained or the No. 200 sieve)	Gravel (% gravel > % sand)	GW	Well-graded Gravel (with Sand)
		GW-GM	Well-graded Gravel with Silt (and Sand)
		GW-GC	Well-graded Gravel with Clay (and Sand)
		GP	Poorly graded Gravel (with Sand)
		GP-GM	Poorly graded Gravel with Silt (and Sand)
		GP-GC	Poorly graded Gravel with Clay (and Sand)
		GM	Silty Gravel (with Sand)
		GC	Clayey Gravel (with Sand)
	Sand (% sand ≥ % gravel)	SW	Well-graded Sand (with Gravel)
		SW-SM	Well-graded Sand with Silt (and Gravel)
		SW-SC	Well-graded Sand with Clay (and Gravel)
		SP	Poorly graded Sand (with Gravel)
		SP-SM	Poorly graded Sand with Silt (and Gravel)
		SP-SC	Poorly graded Sand with Clay (and Gravel)
		SM	Silty Sand (with Gravel)
		SC	Clayey Sand (with Gravel)
Fine-Grained Soils (50 percent or more passing the No. 200 sieve)	Silt or Clay LL < 50	ML	Silt (with Sand or Gravel), Sandy Silt (with Gravel), Gravelly Silt (with Sand)
		CL-ML	Silty Clay (with Sand or Gravel), Sandy Silty Clay (with Gravel), Gravelly Silty Clay (with Sand)
		CL	Lean Clay (with Sand or Gravel), Sandy lean Clay (with Gravel), Gravelly lean Clay (with Sand)
		OL	Organic Clay (with Sand or Gravel), Sandy organic Clay (with Gravel), Gravelly organic Clay (with Sand), organic Silt (with Sand or Gravel), Sandy organic Silt (with Gravel), Gravelly organic Silt (with Sand)
	Silt or Clay LL ≥ 50	MH	Elastic Silt (with Sand or Gravel), Sandy elastic Silt (with Gravel), Gravelly elastic Silt (with Sand)
		CH	Fat Clay (with Sand or Gravel), Sandy fat Clay (with Gravel), Gravelly fat Clay (with Sand)
		OH	Organic Clay (with Sand or Gravel), Sandy organic Clay (with Gravel), Gravelly organic Clay (with Sand), organic Silt (with Sand or Gravel), Sandy organic Silt (with Gravel), Gravelly organic Silt (with Sand)
Highly Organic Soils		PT	Peat and other highly organic soils

Note: Percentages are by dry weight. Soil classifications based on some criteria that are not shown. Group Name items in parentheses may or may not apply, depending on percent of sand or gravel.

Coarse Grained Soil Definitions	
Fraction	Particle Dimension or U.S. Standard Sieve Size/No.
Boulders	Above 12"
Cobbles	12" to 3"
Gravel - coarse - fine	3" to 3/4" 3/4" to No. 4
Sand - coarse - medium - fine	No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200



Split-barrel, 3-inch O.D., 2.43-inch I.D.



Split-barrel, 2.5-inch O.D., 1.93-inch I.D.



Standard Penetration Test (SPT), 2.0-inch O.D., 1.375-inch I.D.



Shelby Tube



Disturbed sample



No recovery



Groundwater level during drilling



Subsequent groundwater level

Note: O.D. = outside diameter I.D. = inside diameter



CONDOR EARTH TECHNOLOGIES, INC.

LOG LEGEND AND SOIL CLASSIFICATION

WEATHERING

Severely Weathered – minerals decomposed to soil, but rock fabric and structure are preserved.

Highly Weathered – abundant fractures coated with oxides, carbonates, sulphates, mud, etc., thorough discoloration, rock disintegration, mineral decomposition.

Moderately Weathered – some fracture coating, moderate or localized discoloration, little to no effect on cementation, slight mineral decomposition.

Slightly Weathered – a few stained fractures, slight discoloration, little or no effect on cementation, no mineral decomposition.

Fresh – unaffected by weathering agents; no appreciable change with depth.

FRACTURE, JOINT, OR SHEAR SPACING

(Spacing in Inches)

Very little fractured	Greater than 48
Occasionally fractured	12 to 48
Moderately fractured	6 to 12
Closely fractured	1.25 to 6
Intensely fractured	0.5 to 1.25
Crushed	Less than 0.5

THICKNESS OF SEDIMENTARY ROCK BEDS

(Thickness in Inches)

Very thickly bedded	Greater than 72
Thickly bedded	24 to 72
Medium bedded	8 to 24
Thinly bedded	2.5 to 8
Very thinly bedded	0.75 to 2.5
Laminated	0.25 to 0.75
Thinly laminated	Less than 0.25

FRACTURE OR LAYER SEPARATION

(Thickness of Separations in Millimeters)

Very tight	< 0.1 mm
Tight	0.1 – 0.5 mm
Moderately open	0.5 – 2.5 mm
Open	2.5 – 10 mm
Very wide	> 10 mm

FRACTURE OR LAYER ROUGHNESS

Very Rough - Non-continuous, Hard joint rock wall

Slightly Rough - Hard joint rock wall

Slightly Rough and Soft - Soft joint rock wall

Slickensided - Open and continuous with gouge

Soft Gouge - Open and continuous with soft gouge

STRUCTURE

Intact/Massive – intact rock specimens with few widely spaced discontinuities.

Blocky – well interlocked, undisturbed rock mass, consisting of cubical blocks formed by three intersecting joint sets.

Very blocky – interlocked, partially disturbed, with multi-faceted angular blocks formed by 4 or more joint sets.

Disturbed/Seamy – folded with angular blocks, formed by many intersecting joint sets, persistence of bedding planes or schistosity.

Disintegrated – poorly interlocked, heavily broken, mix of angular and rounded rock pieces.

Laminated/Sheared – lack of blockiness due to close spacing of shear planes.

STRENGTH

Plastic or very low strength.

Friable – crumbles easily by rubbing with fingers.

Weak – an unfractured specimen of such material will crumble under light hammer blows.

Moderately strong – specimen will withstand a few heavy hammer blows before breaking.

Strong – specimen will withstand a few heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

Very strong – specimen will resist heavy ringing hammer blows and will yield with difficulty only dust and small flying fragments.

HARDNESS

Soft – reserved for plastic material alone.

Low hardness – can be gouged deeply or carved easily with a knife blade.

Moderately hard – can be readily scratched by a knife blade; scratch leaves a heavy trace of dust and is readily visibly after the powder has been blown away.

Hard – can be scratched with difficulty; scratch produced a little powder and is often faintly visible.

Very hard – cannot be scratched with knife blade; leaves a metallic streak.

GROUND WATER

Dry

Damp

Wet

Dripping

Flowing



CONDOR EARTH TECHNOLOGIES, INC.

ROCK PROPERTIES

APPENDIX C
Laboratory Test Results





CONDOR EARTH
 188 Frank West Circle, Suite I
 Stockton CA 95206
 Phone 209.234.0518
 FAX 209.234.0538
 www.condorearth.com

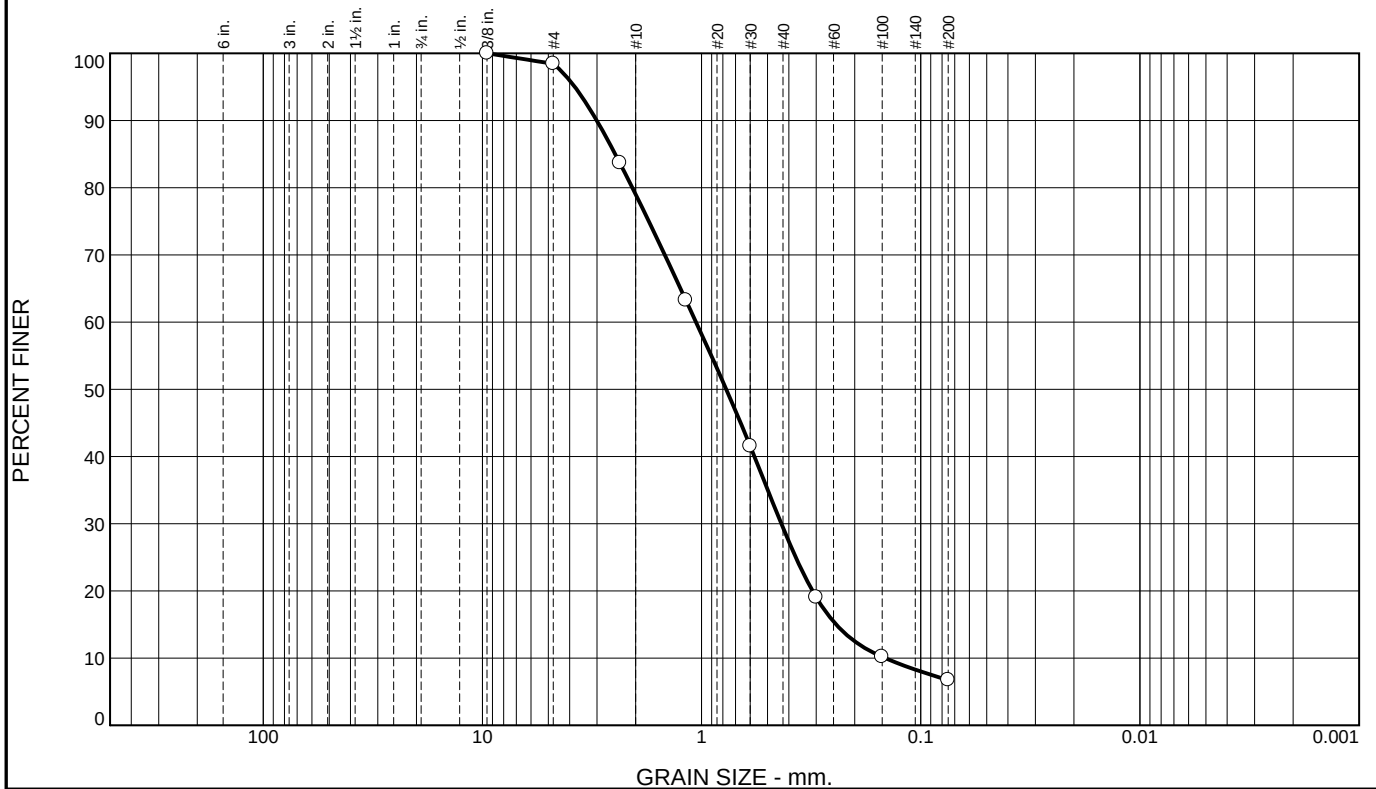
Project #: 8897
Client: RK Hospitality Development
Project: Geotechnical Engineering Study-San Andreas Development
Test Date: 7/25/2022
Tested by: E. Carrasco

Natural Dry Density/Unit Weight								
Sample #	TP-1	TP-3	TP-11					
Date	7/25/2022	7/25/2022	7/25/2022					
Depth (ft)	4'	4'	3'					
Sleeve Diam. (in)	2.45	2.45	2.45					
Sleeve Area (sq in)	4.7	4.7	4.7					
Sample Length (in)	5.81	5.57	2.1					
Volume (cu.in)	27.3	26.2	9.9					
Volume(cu ft)	0.016	0.015	0.006					
Gross wt (grms)	860.7	850.5	562.8					
Tare wt (grms)	316.8	311.1	316.1					
Soil wt (grms)	543.9	539.4	246.7					
Soil wt (lbs)	1.2	1.2	0.5					
Wet density (pcf)	75.9	78.5	95.2					
Dry Density(pcf)	63.6	62.0	80.9					

Notes: Stiff Dark Stiff Dark Stiff Light
 Olive Gray Olive Gray Brown
 Silty Sand Silty Sand Silty Clay

Moisture Content								
Tare #	C	B	F					
Wet wt & Tare (grms)	860.7	850.5	562.8					
Dry wt & Tare (grms)	772.5	737.3	525.7					
Wt of Water (grms)	88.2	113.2	37.1					
Wt of Tare (grms)	316.8	311.1	316.1					
Wt dry Soil (grms)	455.7	426.2	209.6					
Moisture Content %	19.4	26.6	17.7					

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.6	19.4	49.6	22.7	6.7	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8"	100.0		
#4	98.4		
#8	83.7		
#16	63.3		
#30	41.6		
#50	19.1		
#100	10.2		
#200	6.7		

* (no specification provided)

Material Description
Dark Olive Gray Poorly Graded Sand with Silt

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 3.0087 D₈₅= 2.4782 D₆₀= 1.0607
 D₅₀= 0.7718 D₃₀= 0.4326 D₁₅= 0.2435
 D₁₀= 0.1453 C_u= 7.30 C_c= 1.21

Classification
 USCS= AASHTO=

Remarks
 F.M.=2.84

Location: TP-1
Sample Number: SA-1 (RV-1) Depth: 3'-4'

Date: 7/25/2022

**CONDOR
EARTH TECHNOLOGIES, INC.
Stockton, California**

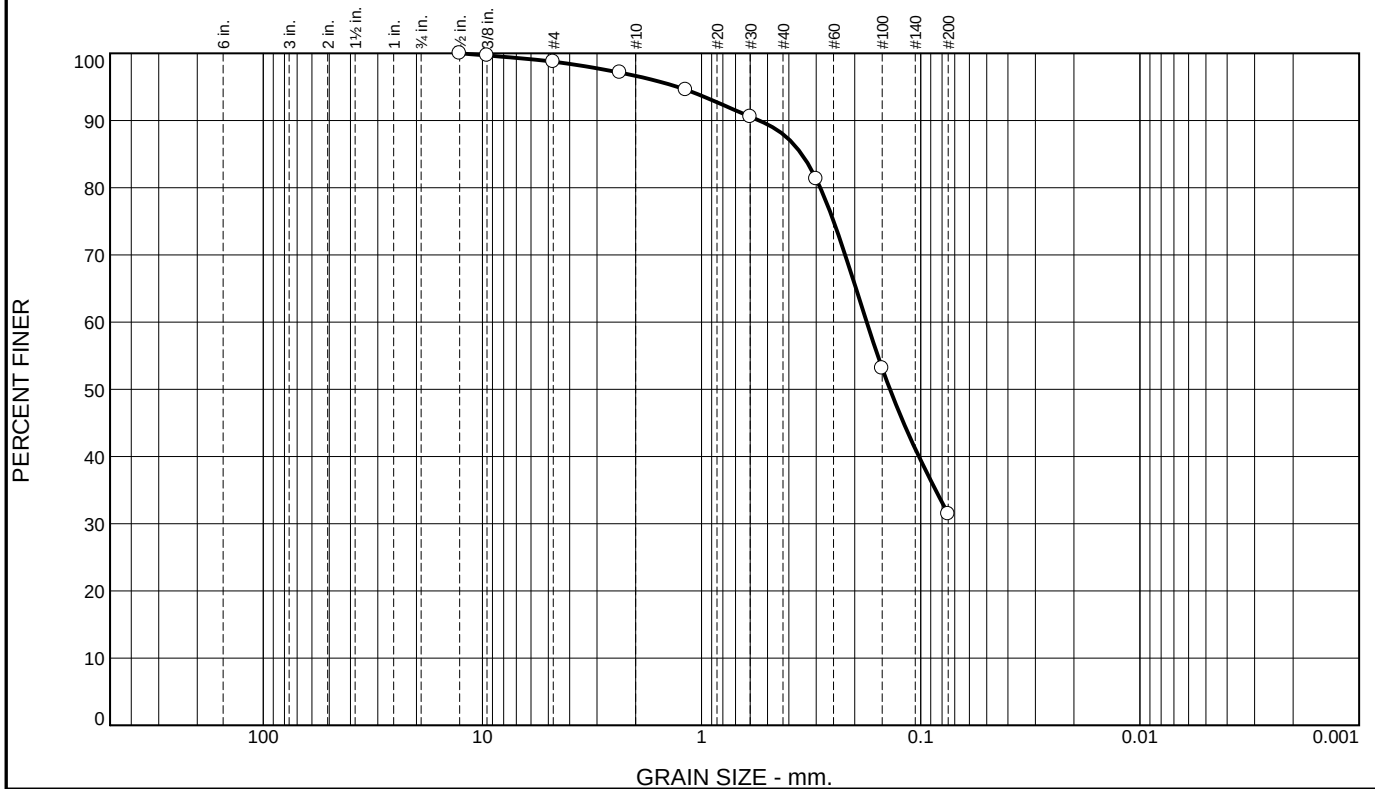
Client: RK Hospitality Development
Project: Geotechnical Engineering Study- San Andreas Development

Project No: 8897

Figure

Tested By: E. Carrasco Checked By: R. Skaggs

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	1.3	2.1	8.6	56.6	31.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1/2"	100.0		
3/8"	99.7		
#4	98.7		
#8	97.1		
#16	94.6		
#30	90.6		
#50	81.3		
#100	53.1		
#200	31.4		

* (no specification provided)

Material Description
Yellowish Light Brown Silty Sand

Atterberg Limits
 PL= LL= PI=

Coefficients
 D₉₀= 0.5462 D₈₅= 0.3495 D₆₀= 0.1764
 D₅₀= 0.1383 D₃₀= D₁₅=
 D₁₀= C_u= C_c=

Classification
 USCS= AASHTO=

Remarks
 F.M.=0.85

Location: TP-7

Sample Number: SA-2

Depth: 4'-6"

Date: 7/29/2022

**CONDOR
EARTH TECHNOLOGIES, INC.
Stockton, California**

Client: RK Hospitality Development

Project: Geotechnical Engineering Study- San Andreas Development

Project No: 8897

Figure

Tested By: E. Carrasco

Checked By: R. Skaggs

Dashed line indicates the approximate upper limit boundary for natural soils

CH or OH

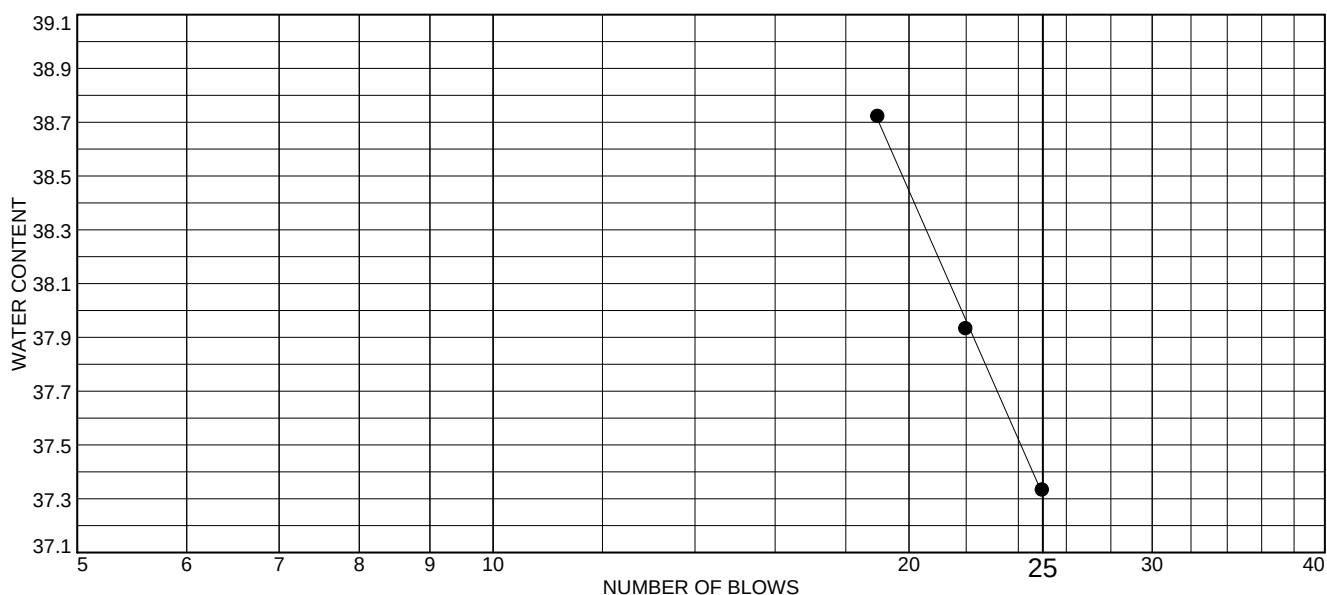
CL or OL

ML or OL

MH or OH

PLASTICITY INDEX

LIQUID LIMIT



Tested By: E. Carrasco **Checked By:** R. Skaggs

Figure



CONDOR EARTH TECHNOLOGIES, INC.

21663 Brian Lane, P.O. Box 3905, Sonora, CA 95370 (209) 532-0361/0773(f)

188 Frank West Circle Suite I, Stockton, CA 95206 (209) 234-0518/0538(f)

17857 High School Road, Jamestown, CA 95327 (209) 984-4593/4596(f)

www.condorearth.com

Resistance "R" Value Test Report (California Test 301)

CET Job: 8897

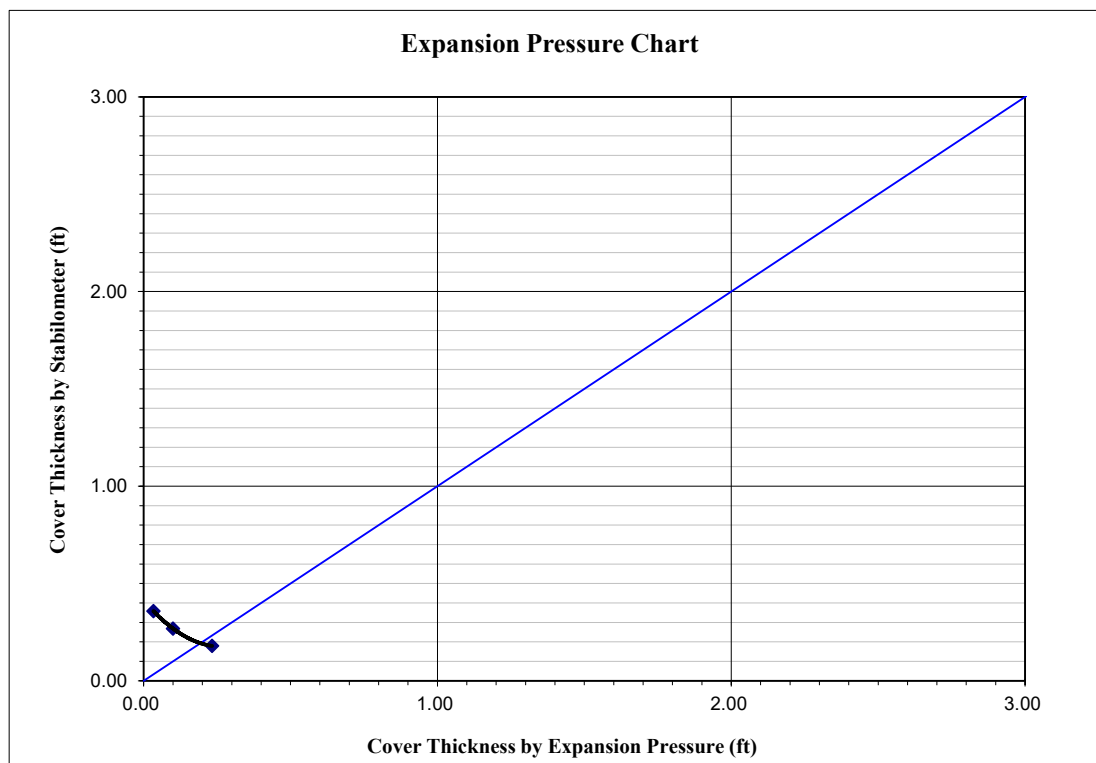
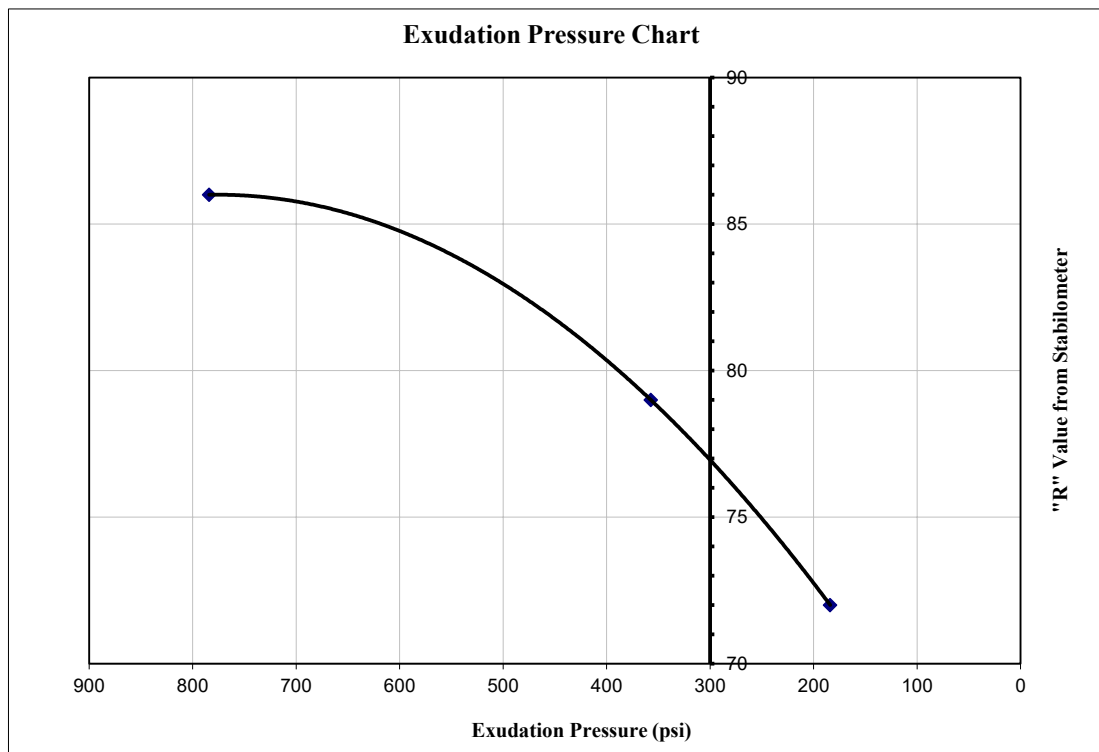
Client: **RK Hospitality Development**
Project: **Geotechnical Engineering Study- San Andreas Development**

Sample ID : **RV-1 (SA-1)**
Soil Description: **Dark Olive Gray Poorly Graded Sand with Silt**
Date Received: **July 22, 2022**
Tested by: **E. Carrasco**
Sample Source: **TP-1**
Depth of Sample: **3'-4'**

Specimen Number	1	2	3	4
Exudation Pressure (psi)	183.9	357.3	784.1	-
Expansion Pressure (psf)	4.3	13.0	30.3	0.0
Resistance Value, "R"	72.0	79.0	86.0	-
Moisture Content at Test (%)	32.1	30.4	29.5	-
Dry Density at Test (pcf)	84.9	85.8	86.0	-
Initial Moisture Content (%)	21.1			
R-Value by Exudation Pressure =	77.0	Assumed/Given TI = 4.0		
R-Value by Expansion Pressure =	84.4			
R-Value Design =	77.0			

CET Job: 8897

RV-1 (SA-1)





CONDOR EARTH TECHNOLOGIES, INC.

21663 Brian Lane, P.O. Box 3905, Sonoma, CA 95370 (209) 532-0361/0773(f)

188 Frank West Circle Suite I, Stockton, CA 95206 (209) 234-0518/0538(f)

17857 High School Road, Jamestown, CA 95327 (209) 984-4593/4596(f)

www.condorearth.com

Resistance "R" Value Test Report (California Test 301)

CET Job: 8897

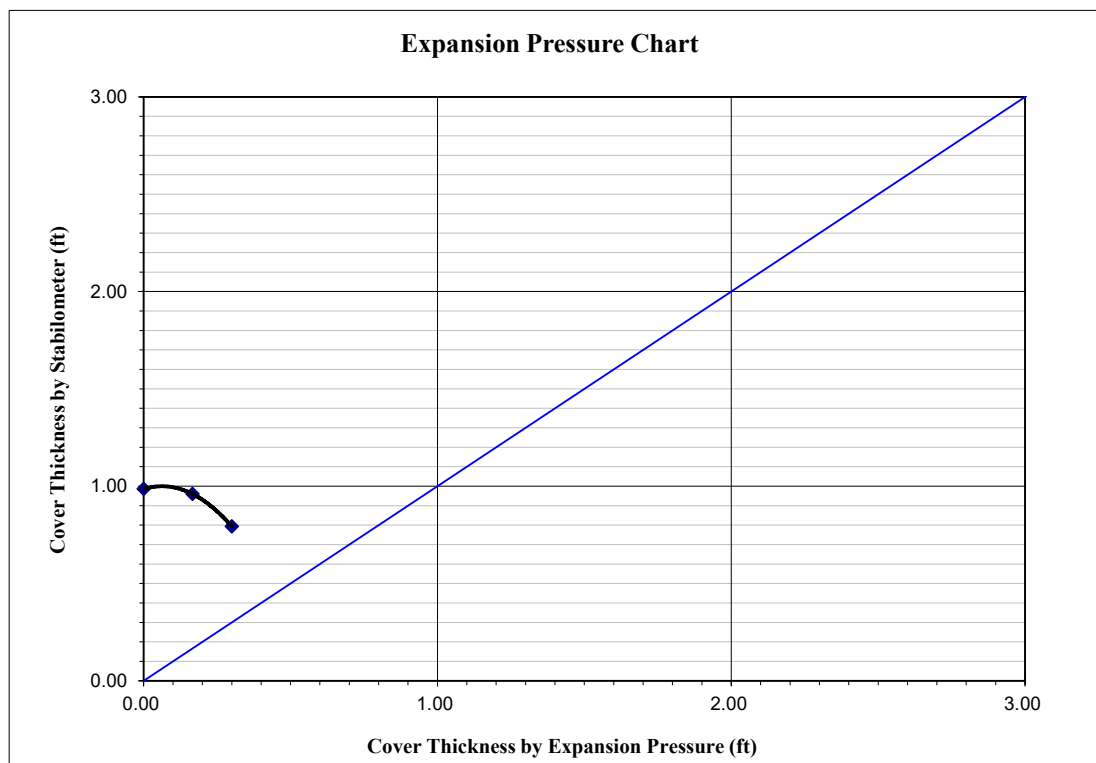
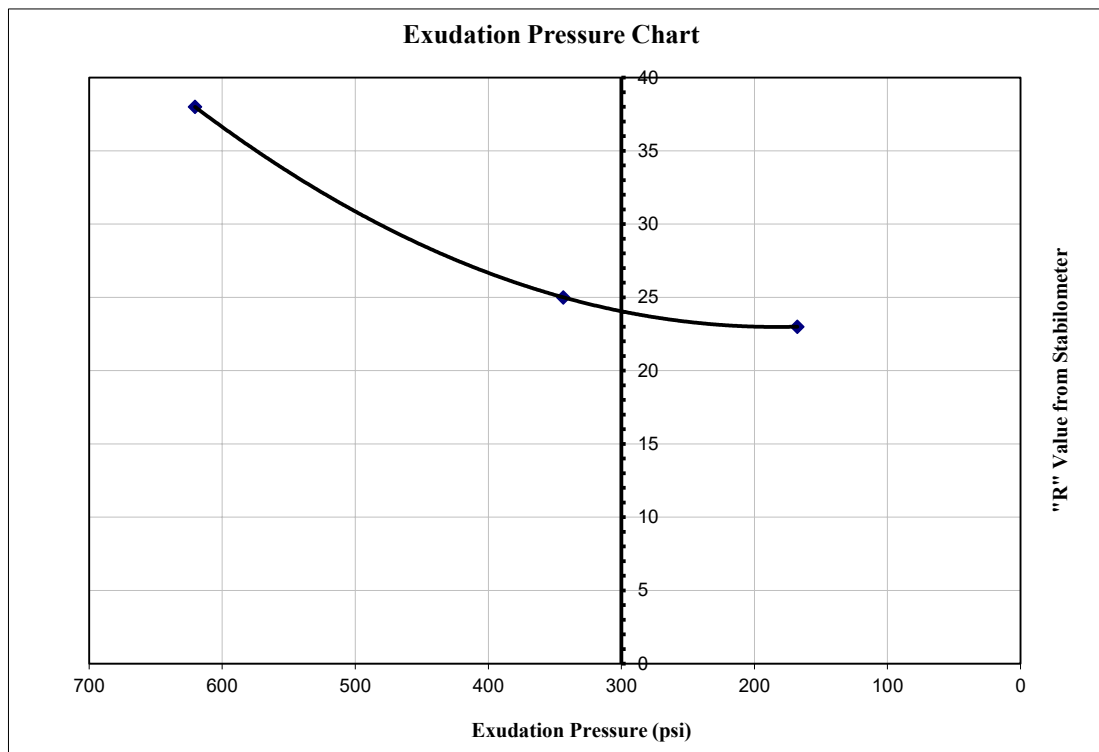
Client: **RK Hospitality Development**
Project: **Geotechnical Engineering Study- San Andreas Development**

Sample ID : **RV-2 (PI-1)**
Soil Description: **Light Brown Red Sandy Lean Clay**
Date Received: **July 22, 2022**
Tested by: **E. Carrasco**
Sample Source: **TP-11**
Depth of Sample: **0-3"**

Specimen Number	1	2	3	4
Exudation Pressure (psi)	620.4	167.7	343.6	-
Expansion Pressure (psf)	39.0	0.0	21.7	0.0
Resistance Value, "R"	38.0	23.0	25.0	-
Moisture Content at Test (%)	20.4	23.4	21.9	-
Dry Density at Test (pcf)	105.2	98.4	102.8	-
Initial Moisture Content (%)	9.0			
R-Value by Exudation Pressure =	24.0			
R-Value by Expansion Pressure =	100.0	Assumed/Given TI = 4.0		
R-Value Design =	24.0			

CET Job: 8897

RV-2 (PI-1)



4 August, 2022

Job No. 2207041

Cust. No. 12257

Ms. Laura Arista
Condor Earth Technologies, Inc.
188 Frank West Circle, Suite I
Stockton, CA 95206

Subject: Project No.: 8897
Project Name: RK Hospitality Development, San Andreas
Corrosivity Analysis – ASTM Test Methods

Dear Ms. Arista:

Pursuant to your request, CERCO Analytical has analyzed the soil sample submitted on July 29, 2022. Based on the analytical results, this brief corrosivity evaluation is enclosed for your consideration.

Based upon the resistivity measurement, this sample is classified as "moderately corrosive". All buried iron, steel, cast iron, ductile iron, galvanized steel and dielectric coated steel or iron should be properly protected against corrosion depending upon the critical nature of the structure. All buried metallic pressure piping such as ductile iron firewater pipelines should be protected against corrosion.

The chloride ion concentration reflects none detected with a reporting limit of 15 mg/kg.

The sulfate ion concentration reflects none detected with a reporting limit of 15 mg/kg.

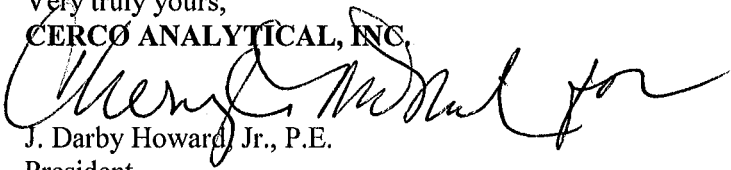
The pH of the soil is 6.40, which does not present corrosion problems for buried iron, steel, mortar-coated steel and reinforced concrete structures.

The redox potential is 310-mV and is indicative of potentially "slightly corrosive" soils resulting from anaerobic soil conditions.

This corrosivity evaluation is based on general corrosion engineering standards and is non-specific in nature. For specific long-term corrosion control design recommendations or consultation, please call *JDH Corrosion Consultants, Inc.* at (925) 927-6630.

We appreciate the opportunity of working with you on this project. If you have any questions, or if you require further information, please do not hesitate to contact us.

Very truly yours,

CERCO ANALYTICAL, INC.
J. Darby Howard, Jr., P.E.
President

JDH/jdl
Enclosure

Client: Condor Earth Technologies, Inc.
 Client's Project No.: 8897
 Client's Project Name: RK Hospitality Development, San Andreas
 Date Sampled: 18-Jul-22
 Date Received: 29-Jul-22
 Matrix: Soil
 Authorization: Signed Chain of Custody

Date of Report: 4-Aug-2022

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Conductivity (umhos/cm)*	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
2207041-001	TP-11 @ 3' MD	310	6.40	-	2,600	-	N.D.	N.D.

Method:	ASTM D1498	ASTM D4972	ASTM D1125M	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	10	-	50	15	15
Date Analyzed:	2-Aug-2022	2-Aug-2022	-	2-Aug-2022	-	3-Aug-2022	3-Aug-2022


 Sherri Moore
 Chemist

* Results Reported on "As Received" Basis
 N.D. - None Detected

Page of

 CERCO
analytical[illegible]

APPENDIX D
USGS Seismic Design Parameters





RK Hospitality, San Andreas

Latitude, Longitude: 38.19307, -120.67803



Date	8/18/2022, 3:54:10 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.359	MCE_R ground motion. (for 0.2 second period)
S_1	0.189	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.543	Site-modified spectral acceleration value
S_{M1}	0.42	Site-modified spectral acceleration value
S_{DS}	0.362	Numeric seismic design value at 0.2 second SA
S_{D1}	0.28	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1.513	Site amplification factor at 0.2 second
F_v	2.222	Site amplification factor at 1.0 second
PGA	0.151	MCE_G peak ground acceleration
F_{PGA}	1.498	Site amplification factor at PGA
PGA_M	0.226	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
S_{sRT}	0.359	Probabilistic risk-targeted ground motion. (0.2 second)
S_{sUH}	0.37	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
S_{sD}	1.5	Factored deterministic acceleration value. (0.2 second)
S_{1RT}	0.189	Probabilistic risk-targeted ground motion. (1.0 second)
S_{1UH}	0.197	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S_{1D}	0.6	Factored deterministic acceleration value. (1.0 second)
$PGAd$	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.151	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.971	Mapped value of the risk coefficient at short periods

Type	Value	Description
C _{R1}	0.958	Mapped value of the risk coefficient at a period of 1 s
C _V	0.939	Vertical coefficient

DISCLAIMER

While the information presented on this website is believed to be correct, SEAOC / OSHPD and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in this web application should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. SEAOC / OSHPD do not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the seismic data provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the search results of this website.

APPENDIX E
Site Photos - North & South Wells



North Well



South Well



APPENDIX F
Construction Standards





Designation: E1643 – 18a

Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs¹

This standard is issued under the fixed designation E1643; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers procedures for selecting, designing, installing, and inspecting flexible, prefabricated sheet membranes in contact with earth or granular fill used as vapor retarders under concrete slabs.

1.2 Conditions subject to frost and either heave or hydrostatic pressure, or both, are beyond the scope of this practice. Vapor retarders are not intended to provide a waterproofing function.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[E1745 Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs](#)
[E1993/E1993M Specification for Bituminous Water Vapor](#)

¹ This practice is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.21 on Serviceability.

Current edition approved Feb. 15, 2018. Published February 2018. Originally approved in 1994. Last previous edition approved in 2018 as E1643-18. DOI: 10.1520/E1643-18A.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs](#)

[F710 Practice for Preparing Concrete Floors to Receive Resilient Flooring](#)

2.2 *Other Standard:*³

[ACI 302.2R-06 Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials](#)

3. Significance and Use

3.1 Vapor retarders provide a method of limiting water vapor transmission and capillary transport of water upward through concrete slabs on grade, which can adversely affect floor finishes and interior humidity levels.

3.2 Adverse impacts include adhesion loss, warping, peeling, and unacceptable appearance of resilient flooring; deterioration of adhesives, ripping or separation of seams, and air bubbles or efflorescence beneath seamed, continuous flooring; damage to flat electrical cable systems, buckling of carpet and carpet tiles, offensive odors, growth of fungi, and undesired increases to interior humidity levels.

4. Manufacturer's Recommendations

4.1 Where inconsistencies occur between this practice and the manufacturer's instructions, conform to the manufacturer's instructions for installation of vapor retarder.

5. Material, Design, and Construction

5.1 See ACI 302.2R-06 for material, design, and construction recommendations.

5.2 See Specifications [E1745](#) and [E1993/E1993M](#) for vapor retarder specifications.

5.3 *Vapor Retarder Material Selection*—The following criteria should be considered when selecting a vapor retarder material.

5.3.1 Local building code and regulatory requirements.

5.3.1.1 Comply with local building code and regulatory requirements as a minimum consideration.

³ Available from American Concrete Institute (ACI), 38800 Country Club Dr., Farmington Hills, MI 48331-3439, <http://www.concrete.org>.

5.3.2 The water-vapor permeance of the vapor retarder material.

5.3.2.1 The water vapor permeance of the vapor retarder material shall be at such a rate so that adverse impacts to floor finishes and coatings do not occur

5.3.2.2 Refer to **X1.6** for discussion on water vapor transmission rate of vapor retarder.

5.3.2.3 The perm rating determined under these criteria shall supersede that in references **5.2** should this value be less than required under references in **5.2**.

5.3.3 The types and amounts of deleterious compounds in the soil on the building site.

5.3.3.1 Review building site soil analyses for deleterious materials and compounds and select a vapor retarder material that will withstand exposure to such deleterious materials or compounds.

5.3.4 The tensile strength and puncture resistance of the vapor retarder material.

5.3.4.1 Select a vapor retarder material capable of withstanding potential construction site damage.

5.3.5 The type of base material on which the vapor retarder is to be installed.

5.3.5.1 Select vapor retarder material capable of withstanding tear or puncture damage due to the type, gradation, and texture of the base material to be installed below the material. Prepare base material to minimize risk of puncture, for example, by rolling or compacting.

5.3.6 The expected exposure of the vapor retarder to ultra-violet rays.

5.3.6.1 Assess expected exposure of the vapor retarder material to ultra violet rays and select a material capable of withstanding such exposure and maintain its capability to perform its intended function.

6. Placement

6.1 Level and compact base material.

6.2 Install vapor retarder material with the longest dimension parallel with the direction of concrete pour.

6.3 Face laps away from the expected direction of the concrete pour whenever possible.

6.4 Extend vapor retarder over footings and seal to foundation wall, grade beam, or slab at an elevation consistent with the top of the slab or terminate at impediments such as water stops or dowels. Seal around penetrations such as utilities and columns in order to create a monolithic membrane between the surface of the slab and moisture sources below the slab as well as at the slab perimeter.

6.5 Lap joints minimum 6 in. (150 mm), or as instructed by the manufacturer, and seal laps in accordance with the manufacturer's recommendations.

6.6 Extend vapor retarder over the tops of pile caps and grade beams to a distance acceptable to the structural engineer and terminate as recommended by the manufacturer.

7. Protection

7.1 Take precautions to protect vapor retarder from damage during installation of reinforcing steel, utilities and concrete.

7.2 Use reinforcing bar supports with base sections that minimize the potential for puncture of the vapor retarder.

7.3 Avoid use of stakes driven through the vapor retarder.

7.4 Refer to ACI 302.2R-06 for discussion of aggregate for protection of vapor retarder, including the risks of installing aggregate fill above a vapor retarder that can act as a reservoir for water.

8. Inspection and Repair

8.1 Inspect and mark all areas of damage and insufficient installation of the vapor retarder sufficiently in advance of concrete placement such that deficiencies may be corrected before concrete is placed.

8.2 Repair damaged areas prior to concrete placement with vapor retarder material lapped and sealed minimum of 6 in. (150 mm) beyond damaged area or as instructed by manufacturer.

9. Keywords

9.1 concrete slabs; vapor; vapor retarder

APPENDIX

(Nonmandatory Information)

X1. PRE-DESIGN CONSIDERATIONS

X1.1 Planning and Organization of Construction—To avoid ambiguities, redundancies, conflicts, and omissions, plan the organization and coordination of drawings and specifications so that graphic, dimensional, and descriptive information on subgrade, granular base, vapor retarder, and protection course, if any, appears in only one place. Since the relationship of the subgrade (pad) elevation (usually shown on grading plans) to the rest of the building finish floor elevations and finished site grades is a function of the depth of the granular

base and protection course, these dimensions should be shown in only one place. For graphic depictions and dimensions of the granular base and the protection course, the architectural drawings are preferred, but structural drawings are sometimes used. Specifications for sub-base conditions should be in the grading section. Specifications for base, vapor retarder, and protection course should be in the section on concrete, but there are advocates of a separate section in Division 7 for the vapor retarder system. Examination and testing of surface

conditions should be in appropriate finish sections.

X1.2 Scheduling—Determine if slab drying will be on the critical path for schedule occupancy. If so, plan measures to reduce drying times, mitigate moisture, or select floor finish materials not subject to damage by moisture.

X1.3 Geotechnical—Ensure that the geotechnical survey includes comprehensive and reliable information on subsurface water table levels and the hydrology of geological strata as well as historical data on surface flooding and hydrology. The survey should also include a list of compounds and concentration levels that are deleterious to plastic materials. The geotechnical study should consider not only the past but also the projected change from ongoing or anticipated development patterns. Soils with comparably higher clay contents are particularly troublesome because the relatively high capillary action within the clay allows moisture to rise under the slab.

X1.4 Civil—Ensure that site topographic surveys and grading plans accurately and comprehensively establish surface drainage characteristics for the site and surrounding areas.

X1.5 Landscape and Irrigation—Most traditional geotechnical studies do not take into account the post-construction change in ground moisture conditions due to introduced planting and irrigation which is a major problem. For example, in California coastal areas, the average annual rainfall is about 18 in. (457 mm). Turf irrigation amounting to 1.3 in. (33 mm) of water per week over the normal seven-month dry season will increase this to nearly 60 in. (1524 mm) with almost no runoff. It is not enough to assume that irrigation will simply duplicate natural conditions encountered during the wet season. The landscape architect, geotechnical engineer, and civil engineer should closely coordinate design recommendations to avoid moisture problems introduced or exacerbated by landscape planting and irrigation. Once a project is completed, effective irrigation management is instrumental not only in water conservation but also in avoiding potential building-related moisture problems.

X1.6 Water Vapor Permeance of Vapor Retarder—In order to prevent moisture damage to the slab on grade, floor covering systems and floor coating systems the water vapor permeance of the vapor retarder material shall be such that accumulation of moisture in the slab through the vapor retarder material does not occur. The vapor pressures of the below grade environment and the interior environment shall be calculated and analyzed. For humidity sensitive interior environments, calculate the

effect of vapor diffusion through the vapor retarder, slab on grade and, if applicable, the floor covering or coating on the interior humidity levels. Select a vapor retarder material with a water vapor permeance rating that will maintain interior humidity levels within specified tolerances. The water vapor permeance of flooring material or coating shall be obtained, if available. Calculate the amount of moisture entering the slab through the vapor retarder material. Calculate the amount of moisture that can diffuse through the flooring material. Insure that the water vapor permeance of the vapor retarder material does not allow accumulation of moisture within the slab due to water vapor permeance of the flooring material. Analyze soil temperatures with regard to heat flux through the slab on grade as well as interior temperature and RH levels. Determine if conditions exist for a dew point within the slab. If such conditions can potentially exist, analyze the amount of moisture accumulation within the slab versus the drying potential of the slab through its top surface, and if applicable, through the floor covering system to determine if prolonged and detrimental wetting of the slab will occur. If so, incorporate measures to eliminate conditions for a dew point to occur. One such measure is installing an insulation layer directly below the slab and vapor retarder.

X1.7 Moisture Entrapment Due to Rainfall or Ground Water Intrusion—Moisture entrapment can occur beneath slabs when the vapor retarder is placed below a fill course or vapor retarder protection layer, and the fill material takes on water from rainfall, saw-cutting, curing, cleaning or other sources. If a fill course or vapor retarder protection layer is used, the extent of moisture entrapment can be reduced by scheduling concrete placements before rainfall and by sealing any entry points for water in the completed slab. If a fill course or vapor retarder protection layer is used, the vapor retarder must be turned up at the perimeter of the slab to protect the fill course from lateral entrance of moisture.

X1.8 Ensure there is no water accumulation on top of the vapor retarder prior to placing of concrete.

X1.9 Moisture Conditions of Slab—Following placement of the concrete and acclimatization of the building, comply with Practice **F710** and floor covering manufacturer's recommendations for any specified tests for moisture emissions from or moisture content of the slab on grade. Review written report(s) on test results prior to the installation of the floor covering or coating installation. Obtain written approval of acceptable slab conditions from the floor covering manufacturer and project design professional. See also ACI 302.2R–06.

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>



Designation: E1745 – 17

Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs¹

This standard is issued under the fixed designation E1745; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers flexible, preformed sheet membrane materials to be used as vapor retarders in contact with soil or granular fill under concrete slabs.

1.1.1 This specification does not cover bituminous vapor retarders. See Specification E1993/E1993M for information on bituminous vapor retarders.

1.2 The specified tests are conducted on new materials and materials that have been conditioned or exposed to simulate potential service conditions.

1.3 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:²

C168 Terminology Relating to Thermal Insulation

D828 Test Method for Tensile Properties of Paper and Paperboard Using Constant-Rate-of-Elongation Apparatus

D882 Test Method for Tensile Properties of Thin Plastic Sheeting

D1709 Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method

E96/E96M Test Methods for Water Vapor Transmission of Materials

E154/E154M Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

E631 Terminology of Building Constructions

E1643 Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

E1993/E1993M Specification for Bituminous Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs

F1249 Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

3. Terminology

3.1 *Definitions*—For definitions of terms used in this specification, see Terminologies C168 and E631.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *perm, n*—the time rate of water vapor migration through a material or a construction of one grain per hour, square foot, inch of mercury pressure difference.

3.2.1.1 *Discussion*—If a specification states that a one perm limit is required, the same flow rate will be obtained from the following relationships:

$$\begin{aligned} 1 \text{ perm} &= 1 \text{ grain/h} \cdot \text{ft}^2 \text{ in.} \cdot \text{Hg (inch-pound)} \\ &= 57.2 \cdot 10^{-12} \text{ kg}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2) \text{ (SI fundamental units)} \\ &= 57.2 \text{ ng}/(\text{Pa} \cdot \text{s} \cdot \text{m}^2) \text{ (SI frequently used)} \\ &= 0.66 \text{ g}/24 \text{ h} \cdot \text{m}^2 \cdot \text{mm Hg (SI has been used but is now obsolete)} \end{aligned}$$

3.2.2 *vapor retarder, n*—(formerly vapor barrier) a material or construction that impedes the transmission of water vapor under specified conditions.

3.2.3 *water vapor permeability, n*—a property of material which is water vapor permeance through unit thickness. Since materials that provide resistance to vapor flow are never used in unit thickness, the preferred evaluation of both materials and constructions is the permeance.

3.2.4 *water-vapor permeance, n*—the time rate of water vapor flow through unit area of the known thickness of a flat material or a construction normal to two specific parallel surfaces induced by unit vapor pressure difference between the two surfaces under specific temperature and humidity conditions. See *perm*.

¹ This specification is under the jurisdiction of ASTM Committee E06 on Performance of Buildings and is the direct responsibility of Subcommittee E06.21 on Serviceability.

Current edition approved May 1, 2017. Published May 2017. Originally approved in 1996. Last previous edition approved in 2011 as E1745-11. DOI: 10.1520/E1745-17.

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

4. Classification

4.1 Materials shall be specified to conform to one of these three classes: A, B, or C, or specific requirements shall be specified in one or more of the properties listed in **Table 1**.

5. Specifying Information

5.1 Specifications for materials shall include the following:

5.1.1 This specification number.

5.1.2 Class A, B, or C, or alternatively, specific performance requirements for each of the properties listed in **Table 1**.

5.1.3 Performance requirements, if any, for special conditions (see **7.4**).

5.1.4 Execution or installation requirements with reference to Practice **E1643**.

6. Lap Sealing

6.1 The producer shall provide instructions for lap sealing, including minimum width of lap, method of sealing, and either supply or specify suitable products for lap sealing.

7. Properties

7.1 *Permeance*—Material shall conform to the requirements listed in **Table 1** under the following conditions: when tested in accordance with Test Methods **E154/E154M**, Section 7 (based on Test Methods **E96/E96M**), or Test Method **F1249**, test temperature shall be 73.4 °F (23 °C) and test humidity shall be $50 \pm 2\%$.

7.1.1 *Permeance of New Material*—No conditioning.

7.1.2 *Permeance after Wetting, Drying, and Soaking*—Refer to Test Methods **E154/E154M**, Section 8.

7.1.3 *Permeance after Heat Conditioning*—Refer to Test Methods **E154/E154M**, Section 11.

7.1.4 *Permeance after Low Temperature Conditioning*—Refer to Test Methods **E154/E154M**, Section 12.

7.1.5 *Permeance after Soil Organism Exposure*—Refer to Test Methods **E154/E154M**, Section 13.

7.2 *Tensile Strength of New Material*—Refer to Test Methods **E154/E154M**, Section 9. (The apparatus shall be that described in either Test Methods **D828** or **D882**.)

7.3 *Resistance to Puncture of New Material*—Refer to Test Methods **D1709**, Test Method B.

7.4 *Special Conditions*—When specifically required by the buyer, due to special conditions which dictate properties of fire resistivity, prolonged exposure to sunlight, or resistance to deterioration from hydrocarbons, the material shall conform to the following:

7.4.1 *Flame Spread*³—Refer to Test Methods **E154/E154M**, Section 16, as follows:

Class A	0–25
Class B	26–75
Class C	76–200

7.4.2 *Permeance after Soil Poison Petroleum Vehicle Exposure*—Refer to Test Methods **E154/E154M**, Section 14 (based on Test Methods **E96/E96M**), or Test Method **F1249**. Conform to permeance requirements in **Table 1**.

7.4.3 *Permeance after Exposure to Ultraviolet Light*—Refer to Test Methods **E154/E154M**, Section 15. Conform to permeance requirements in **Table 1**.

8. Sampling

8.1 For each complete set of tests, obtain all samples from a single production roll of material. Samples shall be representative of the material being sold to the end user.

9. Certification

9.1 When specified in the purchase order or contract, the purchaser shall be furnished with certification that samples representing each lot have been either tested or inspected as directed in this specification and that requirements have been met.

9.2 Upon the request of the purchaser in the contract or order, the certification of an independent third party (testing laboratory) indicating conformance to the requirements of this specification may be considered.

³ The classes and values shown are distinct from the performance classes listed in **Table 1**.

TABLE 1 Properties for Specified Performance Classes^A

	Class A		Class B		Class C	
	IP Units	SI Units	IP Units	SI Units	IP Units	SI Units
Water vapor permeance (Test Methods E154/E154M , Section 7, or Test Method F1249), max	0.1 perms (0.1 gr/[h·ft ² ·in.·Hg])	(6 ng/[s·m ² ·Pa])	0.1 perms (0.1 gr/[h·ft ² ·in.·Hg])	(6 ng/[s·m ² ·Pa])	0.1 perms (0.1 gr/[h·ft ² ·in.·Hg])	(6 ng/[s·m ² ·Pa])
Tensile strength (Test Methods E154/E154M , Section 9), ^B min	45.0 lbf/in.	7.9 kN/m	30.0 lbf/in.	5.3 kN/m	13.6 lbf/in.	2.4 kN/m
Puncture resistance (Test Methods D1709 , Test Method B), min	no inch-pound equivalent used	2200 g	no inch-pound equivalent used	1700 g	no inch-pound equivalent used	475 g

^A Refer to Practice **E1643** for assessing suitability of use based on reported perm rating of material.

^B Tensile strength per unit width for the total sample thickness is used instead of tensile strength per unit area because vapor retarder materials are never used in unit thickness.

9.3 When specified in the purchase order or contract, the producer or supplier shall furnish a summary of the test procedures listed in **Table 1**, providing for each test the laboratory that performed or witnessed the test, the date of the most recent test, and the test results.

9.4 When specified in the purchase order or contract, the producer or supplier shall furnish copies of the laboratory reports for each of the tests listed in **Table 1**.

10. Keywords

10.1 concrete; concrete slab; floor; plastic; vapor retarder

ASTM International takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, are entirely their own responsibility.

This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM International Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, at the address shown below.

This standard is copyrighted by ASTM International, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA 19428-2959, United States. Individual reprints (single or multiple copies) of this standard may be obtained by contacting ASTM at the above address or at 610-832-9585 (phone), 610-832-9555 (fax), or service@astm.org (e-mail); or through the ASTM website (www.astm.org). Permission rights to photocopy the standard may also be secured from the Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923, Tel: (978) 646-2600; <http://www.copyright.com/>