Appendix D:
Geology and Soils Supporting Information

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GEOTECHNICAL AND INFILTRATION EVALUATION

FOR

PROPOSED SINGLE-FAMILY RESIDENTIAL DEVELOPMENT
ACACIA 57 PROJECT
TRACT 31651
PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PREPARED FOR

D.R. HORTON LOS ANGELES HOLDING COMPANY, INC.
2280 WARDLOW CIRCLE, SUITE 100
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PREPARED BY

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PROJECT NO. 2340-CR **JANUARY 12, 2021**

GEOTEK

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January 12, 2021
Project No. 2340-CR

D.R. Horton Los Angeles Holding Company, Inc.
2280 Wardlow Circle, Suite 100
Corona, California 92880

Attention: Mr. Ryan Woosley

Subject: Geotechnical and Infiltration Evaluation
Proposed Single-Family Residential Development
Acacia 57 Project
Tract 31651
Perris, Riverside County, California

Dear Mr. Woosley:

We are pleased to provide our geotechnical and infiltration report for proposed development at the subject property located in the city of Perris, Riverside County, California. This report presents a discussion of our evaluation and provides geotechnical and infiltration recommendations for earthwork, foundation design, and construction.

In our opinion, site development appears feasible from a geotechnical viewpoint provided that the recommendations presented in this report are incorporated into the design and construction phases of the project.

The opportunity to be of service is sincerely appreciated. If you have any questions, please do not hesitate to call our office.

Respectfully submitted,
GeoTek, Inc.

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1. PURPOSE AND SCOPE OF SERVICES

The purpose of this study was to evaluate the existing geotechnical conditions for the currently proposed development. Services provided for this study included the following:

- Research and review of readily available geologic data pertinent to the site,
- A site reconnaissance,
- Site exploration via eleven exploratory borings to depths between 5 and 51.5 feet across the site,
- Testing of four percolation test borings to estimate the infiltration rate of the subsoils within two basins proposed at the site,
- Collection of relatively undisturbed and bulk samples of the site soils for geotechnical and corrosion assessment,
- Review and evaluation of site seismicity,
- Engineering analyses, and;
- Compilation of this geotechnical and infiltration evaluation which presents our findings, conclusions, and recommendations for site development.

The intent of this report is to aid in the evaluation of the site for future proposed development from a geotechnical perspective. The professional opinions and geotechnical information contained in this report may need to be updated based upon our review of the final site development plans. Final site development plans should be provided to GeoTek for review when available.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

2.1 SITE DESCRIPTION

Tract 31651, also known as the Acacia 57 Project site, is a irregular-shaped property that is located south of East Nuevo Road and east of Wilson Avenue in the city of Perris, Riverside

County, California. The site consists of 12.16 acres of vacant land. At the time of our visit, the property had minor visible trash and some light to moderate vegetation. A stockpile of soil ranging from about 2-5.5 feet in height was located within the southern and central portions of the site.

The site has a generally flat terrain, with a gentle fall of about three feet to the north. Surface drainage is to the north. The site is bounded by East Nuevo Road and an apartment complex and commercial development to the north, Wilson Avenue with residential dwellings to the west, and single-family residences to the east and south.

The general location of the site is shown in Figure 1.

2.2 PROPOSED DEVELOPMENT

Based on the Construction Site Plan, prepared by Linville Civil Engineers Land Surveyors, Inc. and dated March 28, 2007, we understand that the property will be developed with 57 single-family homes and associated improvements. Associated improvements include two water quality basins, interior streets, underground utilities and hardscape as well as landscape improvements. The water quality basins are estimated to have depths on the order of five to seven feet. The residences planned for the subject lots will be one- to two-stories in height supported on conventional shallow footings and concrete floors and are expected to exert light to moderately foundation loads. Site grading will likely involve cuts and fills of less than five feet in order to reach design grades. Cuts and fill slopes are anticipated to be less than five feet in height at maximum gradients of 2:1 (h:v)

If site development differs from the information presented in this report, the recommendations should be subject to further review and evaluation by GeoTek. Final site development plans should be reviewed by GeoTek when they become available.

3. FIELD EXPLORATION, LABORATORY TESTING, CORROSION TESTING, AND PERCOLATION TESTING

3.1 FIELD EXPLORATION

GeoTek conducted a field exploration at the site on December 30, 2020 which consisted of excavating eleven exploratory borings across the property. The explorations were performed to depths between 5 and 51.5 feet below the existing ground surface. The approximate locations of these excavations are shown on Plate 1- Exploration Location Map. Logs of the excavations performed by GeoTek are included in Appendix A.

3.2 LABORATORY TESTING

Laboratory testing was performed on selected soil samples collected during our field exploration. The purpose of the laboratory testing was to confirm the field classification of the soil materials encountered and to evaluate the physical properties of the soils for use in the engineering design and analysis. Laboratory testing included in-situ dry density-moisture content, proctor, remolded direct shear, collapse, percent of soil passing No. 200 sieve, and expansion index, among other tests. Test results are presented in Appendix B.

3.3 CORROSION TESTING

GeoTek collected a total of ten samples across the site from approximately 0 to one foot below existing grade. The samples were taken to HDR Engineering to be evaluated for their corrosion potential. The locations of the samples obtained from the site are shown on the Exploration Location Map, Plate 1. Corrosion testing and report for the project are underway. These will be provided upon completion at a later date.

3.4 PERCOLATION TESTING

GeoTek utilized the percolation test procedure (Riverside County, 2011) in order to estimate the infiltration rate of the subsoils within the northeast and southeast corners of the site where two site basins are being proposed for construction.

The percolation test borings (Borings I-1 through I-4) were excavated with a hollow-stem auger drill rig within the future basin areas as shown on the Construction Site Plan, prepared by Linville Civil Engineers Land Surveyors Inc. The test borings were drilled to a depth of approximately seven feet in the northeast basin and approximately five feet in the southeast basin. The borings were approximately eight inches in diameter. A three-inch diameter perforated PVC pipe encapsulated in filter sock was inserted into each of the test holes. The annular space between the test hole sidewalls and PVC pipe was filled with gravel. Additionally, approximately two inches of gravel was placed at the bottom of the excavation below the PVC pipe.

Native alluvial materials typically consisting of sandy silt were encountered in our test holes. In addition to our test borings, Borings B-2 and B-4 were drilled to 21.5 and 18.5 feet, respectively, within the future basin areas to confirm the absence of impermeable materials or groundwater. All deep borings encountered alluvial materials of sandy and/or clayey silt and some silty sand. The logs of the borings are presented in Appendix A. The locations of the test borings and deep borings drilled within the basin areas are shown on Plate 1.

Subsequent to pre-soaking the test holes, percolation testing was performed in the lower 20 inches of each test hole by a representative from our firm. The percolation rates were converted to infiltration rates via the Porchet Method.

The infiltration rates, which do not include a factor of safety and were determined after the water levels had stabilized, are presented in the following table.

SUMMARY OF INFILTRATION FIELD RATES			
Area	Boring No.	Test Depth (ft)	Infiltration Field Rate (inches per hour)
Northeast Basin	I-1	7	1.8
	I-2	7	2.7
Southeast Basin	I-3	5	2.6
	I-4	5	2.1

Detailed infiltration/percolation test data and Porchet conversion calculations are presented in Appendix C.

Over the lifetime of the basin systems, the infiltration rates may be affected by silt build up and biological activities, as well as local variations in near surface soil conditions. A suitable factor of safety should be applied to the field rates to design the infiltration system.

It should be noted that the infiltration rates provided above were performed in relatively undisturbed native materials. Infiltration rates will vary and are mostly dependent on the underlying consistency of the site soils and relative density. Infiltration rates will be impacted by weight of equipment travelling over the soils, placement of engineered fill and other various factors. GeoTek assumes no responsibility or liability for the ultimate design or performance of the storm water management system.

4. GEOLOGIC AND SOILS CONDITIONS

4.1 REGIONAL SETTING

The property is situated in the Peninsular Ranges geomorphic province. The Peninsular Ranges province is one of the largest geomorphic units in western North America. Basically, it extends from the point of contact with the Transverse Ranges geomorphic province, southerly to the tip of Baja California. This province varies in width from about 30 to 100 miles. It is bounded on the west by the Pacific Ocean, on the south by the Gulf of California and on the east by the Colorado Desert Province.

The Peninsular Ranges are essentially a series of northwest-southeast oriented fault blocks. Several major fault zones are found in this province. The Elsinore Fault zone and the San Jacinto Fault zone trend northwest-southeast and are found near the middle of the province. The San Andreas Fault zone borders the northeasterly margin of the province.

More specific to the subject property, the site is located in an area geologically mapped to be underlain by alluvium (Dibblee, T.W. and Minch, J.A., 2003). The reviewed map indicates that the San Jacinto Fault is located 8.2 miles to the northeast of the site. No active faults are shown in the immediate site vicinity on the maps reviewed for the area.

4.2 SUBURFACE CONDITIONS

A brief description of the earth materials reported to be on the site encountered during our field investigation is presented in the following sections.

4.2.1 Undocumented Fill

Our exploration found that the southern and central portion of the site is covered by undocumented fill consisting of silty sand which was moist, brown and very dense. The fill was approximately 5.5 feet thick at the location explored. Based on field observations, the soils appear to shallow out around the perimeter of the soil stockpile.

4.2.2 Alluvium

Alluvium was encountered across the site and below the fill in our site excavations. The alluvium was composed of alternating units of silty sand, sandy silt, silt, and clayey silt which is various shades of brown, olive and gray in color, medium stiff to hard/loose to dense, and damp to very moist. Calcium carbonate deposits (i.e. caliche) were observed in significant concentrations within the upper 10 to 15 feet of the alluvium, decreasing in content below 10-15 feet. Various collapse tests conducted by our firm on the most critical (i.e. loosest) alluvial samples indicated that the upper 10-15 feet of the alluvium have moderate to severe potential for collapse.

Our test results showed that the site surficial soils have a "very low" expansion potential (EI ≈ 0-7).

Detailed logs of the site explorations are included in Appendix A. The locations of the site explorations are shown on the Exploration Location Map presented as Plate 1.

4.3 SURFACE WATER AND GROUNDWATER

4.3.1 Surface Water

Surface water on this site is the result of precipitation or surface run-off from surrounding areas. Overall surface drainage is generally to the north.

4.3.2 Groundwater

Our exploratory boring B-1 excavated to a maximum depth of 51.5 feet encountered perched groundwater at a depth of 39.5 feet below existing ground at the property.

The California Water Data Library (https://wdl.water.ca.gov/waterdatalibrary/) shows a groundwater well located approximately 3,000 feet northeast of east property line. Records of this well indicate that depth to groundwater in the region is greater than 50 feet.

4.4 FAULTING AND SEISMICITY

The geologic structure of the entire southern California area is dominated mainly by northwest-trending faults associated with the San Andreas system. The site is in a seismically active region. No active or potentially active fault is presently known to exist at this site nor is the site situated within an *"Alquist-Priolo"* Earthquake Fault Zone. The County of Riverside (https://countyofriverside.us/Residents/PropertyInformation.aspx) has designated the site area as "not in fault zone", "not in a fault line", having a "moderate" potential for liquefaction, and "susceptible to subsidence. The nearest zoned fault is the San Jacinto fault zone located approximately 8.2 miles to the northeast.

4.4.1 Seismic Design Parameters

The site is located at approximately 33.7994^0 Latitude and -117.2118^0 Longitude. Site spectral accelerations (S_a and S_1), for 0.2 and 1.0 second periods for a Class "D" site, was determined from the SEAOC/OSHPD web interface that utilizes the USGS web services and retrieves the seismic design data and presents that information in a report format. Using the ASCE 7-16 option on the SEAOC/OSHPD website results in the values for S_{M1} and S_{D1} reported as "null-See Section 11.4.8" (of ASCE 7-16). As noted in ASCE 7-16, Section 11.4.8, a site-specific ground motion procedure is recommended for Site Class D when the value S_1 exceeds 0.2. The value S_1 for the subject site exceeds 0.2.

For a site Class D, an exception to performing a site-specific ground motion analysis is allowed in ASCE 7-16 where S_1 exceeds 0.2 provided the value of the seismic response coefficient, Cs, is conservatively calculated by Eq 12.8-2 of ASCE 7-16 for values of $T \leq 1.5Ts$ and taken as equal to 1.5 times the value computed in accordance with either Eq. 12.8-3 for $T_L \geq T > 1.5Ts$ or Eq. 12.8-4 for $T > T_L$.

The results, based on the 2015 NEHRP and the 2019 CBC, are presented in the following table and we have assumed that the exception as allowed in ASCE 7-16 is applicable. If the exception is deemed not appropriate, a site-specific ground motion analysis will be required.

SITE SEISMIC PARAMETERS	
Mapped 0.2 sec Period Spectral Acceleration, S_S	1.47g
Mapped 1.0 sec Period Spectral Acceleration, S_1	0.548g
Site Coefficient for Site Class "D", F_a	1.0
Site Coefficient for Site Class "D", F_v	1.752
Maximum Considered Earthquake Spectral Response Acceleration for 0.2 Second, S_{MS}	1.47g
Maximum Considered Earthquake Spectral Response Acceleration for 1.0 Second, S_{M1}	0.96g
5% Damped Design Spectral Response Acceleration Parameter at 0.2 Second, S_{DS}	0.98g
5% Damped Design Spectral Response Acceleration Parameter at 1 second, S_{D1}	0.64g
Peak Ground Acceleration Adjusted for Site Class Effects, PGA_M	0.55g
Seismic Design Category	D

Final selection of the appropriate seismic design coefficients should be made by the project structural engineer based upon the local practices and ordinances, expected building response and desired level of conservatism.

4.5 LIQUEFACTION AND SEISMICALLY INDUCED SETTLEMENT

According to Riverside County, the site has "moderate" for liquefaction. However, groundwater records in the site vicinity show that regional groundwater is deeper than 50 feet. While a perched groundwater condition was encountered in boring B-1 at 39.5 feet, high blow counts in excess of 40 blows per foot were recorded below 40 feet in boring B-1. Thus, the potential for liquefaction at the site is considered to be nil.

Seismic settlement of unsaturated sandy soils at the property is also deemed to be negligible based on the relatively high blow counts and significant amounts of fines noted in several soil layers as well as the anticipated depths of soil recompaction (Section 5.2.2).

4.6 OTHER HAZARDS

Evidence of ancient landslides or slope instabilities at this site was not observed during our site reconnaissance. Furthermore, the site and surrounding areas is relatively flat. Thus, the potential for landslides is considered nil for design purposes.

The potential for secondary seismic hazard such as a tsunami and/or seiche is considered negligible due to site elevation and great distance to the ocean and/or an open body of water.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 GENERAL

The proposed development appears feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into design and construction.

The site contains undocumented fill and 10-15 of relatively loose/soft and collapsible alluvium. These materials are unsuitable for support of foundations and site improvements and thus should be entirely removed and replaced as engineered compacted fill. Upon the completion of the recommended remedial earthwork, standard project construction is anticipated.

5.2 EARTHWORK CONSIDERATIONS

Earthwork and grading should be performed in accordance with the applicable grading ordinances of the City of Perris/County of Riverside, the 2019 California Building Code (CBC), and recommendations contained in this report. The Grading Guidelines included in Appendix D outline general procedures and do not anticipate all site-specific situations. In the event of conflict, the recommendations presented in the text of this report should supersede those contained in Appendix D.

5.2.1 Site Clearing

The site should be cleared of existing vegetation, roots, and debris. These materials should be properly disposed of off-site.

The existing stockpiled soil on the southern and central portion of the site should also be removed. This material may be used as engineered fill.

5.2.2 Remedial Grading

Because for the potential for moderately severe soil collapse, all undocumented fill and the upper 10-15 feet of alluvium should be entirely removed across the site to expose competent alluvium. Competent alluvium is defined as relatively homogeneous and moist native soil with no noticeable adverse porosity and having none to trace amounts of caliche, with an in-place dry density of at least 85 percent of the maximum soil's dry density per ASTM D 1557.

The bottom of all removals should be scarified to a minimum depth of 12 inches, brought to above the optimum moisture content, and then recompacted to at least 90 percent of the soil's maximum dry density per ASTM D 1557. The bottoms of remedial excavations should be observed by a GeoTek representative prior to scarification.

Removals near property lines may require special procedures such as slot-cut, shoring, or other techniques. These will be evaluated when the final plans for the site are available. Additional recommendations will be provided at that time.

5.2.3 Excavation Characteristics

Excavation in the on-site soils is expected to be feasible utilizing heavy-duty grading equipment in good operating condition.

All temporary excavations for grading purposes and installation of underground utilities should be constructed in accordance with local and Cal-OSHA guidelines. Temporary vertical excavations within the on-site materials should be stable at four feet with a 1:1 (h:v) cut above.

Based on the soils encountered in our explorations and reported grading, we consider the soils to be categorized as OSHA Soil Type C. We recommend that temporary slopes greater than four feet in height not be constructed at inclinations steeper than 1:1 (h:v). Flatter inclinations may be needed depending on the field conditions. Temporary construction slopes should be periodically examined by a competent person, per OSHA requirements, to look of evidence of instability.

5.2.4 Engineered Fill

The onsite soils are considered suitable for reuse as engineered fill provided they are free from vegetation, debris, deleterious material, and hard lumps greater than six inches in maximum dimension.

Fill materials should be placed in horizontal lifts not exceeding 6 inches in loose thickness, moisture conditioned to at least the optimum moisture content, and compacted to a minimum relative compaction of 90 percent (ASTM D 1557).

Detailed recommendations pertaining to the placement of engineered fill are presented in Appendix D.

5.2.5 Slopes

Fill and cut slopes constructed at gradients of 2:1 (h:v) or flatter, in accordance with industry standards, are anticipated to be both grossly and surficially stable. Fill placed on slopes should be properly benched into competent soils per the geotechnical engineer. Cut slopes should be observed by a geotechnical engineer/engineering geologist to approve the exposed conditions upon excavation.

5.2.6 Trench Excavation and Backfill

Trench excavations should conform to Cal-OSHA regulations. The contractor should have a competent person, per OSHA requirements, on site during construction to observe conditions and to make the appropriate recommendations.

Utility trench backfill should be compacted to at least 90 percent relative compaction (ASTM D 1557). Compaction should be achieved with a mechanical compaction device. Jetting of trench backfill is not recommended. If soils to be used as backfill have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.2.7 Shrinkage and Subsidence

Several factors will impact earthwork balancing on the site, including shrinkage, subsidence, trench spoil from utilities and footing excavations, as well as the accuracy of topography.

Shrinkage is primarily dependent upon the degree of compactive effort achieved during construction. For planning purposes, a shrinkage factor of approximately 15 to 30 percent may be considered for the materials requiring recompaction. Subsidence of up to 0.2 feet may occur.

5.3 DESIGN RECOMMENDATIONS

5.3.1 Foundation Design Criteria

The site surficial soils possess "very low" ($0 \leq EI \leq 20$) expansion potential in accordance with ASTM D 4829, as noted by our soils data. However, verification testing should be performed after site remedial grading.

The foundation elements for the proposed structures should bear entirely in engineered fill soils and should be designed in accordance with the 2019 CBC.

A summary of our design recommendations for conventionally reinforced foundations is presented in the table below.

DESIGN PARAMETERS FOR CONVENTIONALLY REINFORCED SPREAD FOOTINGS	
Design Parameter	"Very Low" Expansion Potential (0≤EI≤20)
Foundation Depth or Minimum Perimeter Beam Depth (inches below lowest adjacent grade)	One-Story and Two-Story – 12
Minimum Foundation Width (Inches)*	One-Story and Two-Story – 12
Minimum Slab Thickness (actual)	4 inches
Minimum Slab Reinforcing	6" x 6" – W1.4/W1.4 welded wire fabric placed in middle of slab
Minimum Footing Reinforcement	Two No. 4 reinforcing bars, one top and one bottom
Effective Plasticity Index**	< 15
Presaturation of Subgrade Soil (Percent of Optimum)	Minimum 100% to a depth of 12 inches

*Code minimums per Table 1809.7 of the 2019 CBC should be complied with.
**Effective plasticity index to be verified at the completion of rough grading

An allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design of continuous footings 12 inches deep and 12 inches wide, and pad footings 24 inches square and 12 inches deep. This value may be increased by 400 psf for each additional 12 inches in depth and 100 psf for each additional 12 inches in width to a maximum value of 3,000 psf. Additionally, an increase of one-third may be applied when considering short-term live loads (e.g. seismic and wind loads).

The recommended allowable bearing capacity is based on a total post-construction static settlement of one-inch. Differential static settlement of up to 0.5-inch over a horizontal distance of 30 feet could result. Seismically induced settlement was estimated to be minimal.

The passive earth pressure may be computed as an equivalent fluid having a density of 200 psf per foot of depth, to a maximum earth pressure of 2,000 psf for footings founded in engineered fill. A coefficient of friction between engineered fill and concrete of 0.35 may be used with dead load forces. The upper one foot of soil below the adjacent grade should not be used in calculating passive pressure. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

A moisture and vapor retarding system should be placed below slabs-on-grade where moisture migration through the slab is undesirable. Guidelines for these systems are provided in the 2019 *California Green Building Standards Code (CALGreen)* Section 4.505.2, the 2019 CBC Section 1907.1, ACI 360R-10, and ACI 302.2R-06.

It should be realized that the effectiveness of the vapor retarding membrane can be adversely impacted as the result of construction related punctures (e.g. stake penetrations, tears, punctures from walking on the aggregate layer, etc.). These occurrences should be limited as much as possible during construction. Thicker membranes are generally more resistant to accidental puncture than thinner ones. Products specifically designed for use as moisture/vapor retarders may also be more puncture resistant. It is GeoTek's opinion that a minimum ten mil thick membrane with joints properly overlapped and sealed should be considered, unless otherwise specified by the slab design professional. Moisture and vapor retarding systems are intended to provide a certain level of resistance to vapor and moisture transmission through the concrete, but do not eliminate it. The acceptable level of moisture transmission through the slab is to a large extent based on the type of flooring used and atmospheric conditions.

Ultimately, the vapor retarding system should be comprised of suitable elements to limit migration of water and reduce transmission of water vapor through the slab to acceptable levels. The selected elements should have suitable properties (i.e. thickness, composition, strength, and permeance) to achieve the desired performance level. Consideration should be given to consulting with an individual possessing specific expertise in this area for additional evaluation.

5.3.2 Miscellaneous Foundation Recommendations

- To reduce moisture penetration beneath the slab on grade areas, utility trenches should be backfilled with engineered fill, lean concrete, or concrete slurry where they intercept the perimeter footing or thickened slab edge.
- Soils from the footing excavations should not be placed in the slab-on-grade areas unless properly compacted and tested. The excavations should be free of loose/sloughed materials and be neatly trimmed at the time of concrete placement.
- Under-slab utility trenches should be compacted to project specifications. Compaction should be achieved with a mechanical compaction device. If soils to be used as backfill have dried out, they should be thoroughly moisture conditioned prior to placement in trenches.

5.3.3 Foundation Setbacks

Minimum setbacks for all foundations should comply with the *2019 CBC* or City of Perris/County of Riverside requirements, whichever is more stringent. Improvements not conforming to these setbacks are subject to the increased likelihood of excessive lateral movements and/or differential settlements. If large enough, these movements can compromise the integrity of the improvements. The following recommendations are presented:

- The outside bottom edge of all footings should be set back a minimum of H/2 (where H is the slope height) from the face of any ascending slope. The setback should be at least 5 feet and need not to exceed 15 feet. Where a retaining wall is constructed at the toe of the slope, the height of the slope should be measured from top of the wall to the top of the slope.
- The outside bottom edge of all footings should be set back a minimum of H/3 from the face of any descending slope. The setback should be at least 5 feet and need not to exceed 40 feet.
- If pools are planned, pool setback should be one-half of the building footing setback.
- The bottom of any existing foundations for structures should be deepened so as to extend below a 1:1 projection upward from the bottom of the nearest excavation.
- The bottom of all footings for new structures near retaining walls should be deepened so as to extend below a 1:1 projection upward from the bottom inside edge of the wall foundation.

5.3.4 Retaining Wall Design and Construction

5.3.4.1 General Design Criteria

Recommendations presented in this report apply to typical masonry or concrete vertical retaining walls. These are typical design criteria and are not intended to supersede the design by the structural engineer.

Retaining wall foundations should be designed in accordance with Section 5.3.1 of this report. A minimum embedment of 12 inches into engineered compacted fill and a minimum footing width of 12 inches is recommended. Structural needs may govern and should be evaluated by the project structural engineer.

All earth retention structure plans, as applicable, should be reviewed by this office prior to finalization.

The backfill material placement for all earth retention structures should meet the requirement of Section 5.3.4.4 in this report.

In general, cantilever earth retention structures, which are designed to yield at least 0.001H, where H is equal to the height of the wall to the base of the footing, may be designed using the active condition. Rigid earth retention structures (including but not limited to rigid walls, and walls braced at top, such as typical basement walls) should be designed using the at-rest condition.

In addition to the design lateral forces due to retained earth, surcharges due to improvements, such as an adjacent building or traffic loading, should be considered in the design of the earth retention structures. Loads applied within a 1:1 (h:v) projection from the surcharge on the footing of the earth retention structure should be considered in the design.

Final selection of the appropriate design parameters should be made by the designer of the earth retention structures.

5.3.4.2 Cantilevered Walls

The recommendations presented below are for cantilevered retaining walls. Active earth pressure may be used for retaining wall design, provided the top of the wall is not restrained from minor deflections. An equivalent fluid pressure approach may be used to compute the horizontal pressure against the wall. Appropriate fluid unit weights are given below for specific slope gradients of the retained material. These do not include other superimposed loading conditions such as traffic, structures, seismic events, or adverse geologic conditions.

ACTIVE EARTH PRESSURES	
Surface Slope of Retained Materials (h:v)	Equivalent Fluid Pressure (pcf) Native Backfill*
Level	41
2:1	74

* The design pressures assume the backfill material has an expansion index less than or 20. Backfill zone includes area between the back of the wall and footing to a plane (1:1 h:v) up from the bottom of the wall foundation to the ground surface.

5.3.4.3 Restrained Retaining Walls

Retaining walls that will be restrained prior to placing and compacting backfill material, or that have reentrant or male corners, should be designed for an at-rest equivalent fluid pressure of 60 pcf, plus any applicable surcharge loading, for native backfill and level back slope condition. For areas of male or reentrant corners, the restrained wall design should extend a minimum distance of twice the height of the wall laterally from the corner, or a distance otherwise determined by the project structural engineer.

5.3.4.4 Retaining Wall Backfill and Drainage

Retaining wall backfill should consist of materials with expansion index (EI) ≤ 20 and free of deleterious and/or oversized materials. The wall backfill should also include a minimum one-foot wide section of ¾- to 1-inch clean crushed rock (or approved equivalent). The rock should be placed immediately adjacent to the back of wall and extend up from the back drain to within approximately 12 inches of finish grade. The upper 12 inches should consist of compacted onsite materials. Presence of other materials might necessitate revision to the parameters provided and modification of wall designs. The backfill materials should be placed in lifts no greater than 8-inches in thickness and compacted to a minimum of 90 percent relative compaction in accordance with ASTM Test Method D 1557. Proper surface drainage needs to be provided and maintained. Bracing of the walls during backfilling and compaction may also be necessary.

All earth retention structures should be provided with an adequate pipe and gravel back drain system to reduce the potential for hydrostatic pressure build up. As a minimum, backdrains should consist of a four-inch diameter perforated collector pipe (Schedule 40, SDR 35, or approved equivalent) embedded in a minimum of one cubic foot per lineal foot of ¾- to 1-inch clean crushed rock or equivalent, wrapped in filter fabric (Mirafi 140N or approved equivalent). The drain system should be connected to a suitable outlet, as determined by the civil engineer. Drain outlets should be maintained over the life of the project and should not be obstructed or plugged by adjacent improvements. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

Proper surface drainage needs to be provided and maintained. Water should not be allowed to pond behind retaining walls. Waterproofing of site walls should be performed where moisture migration through the wall is undesirable.

5.3.4.5 Other Design Considerations

- Retaining and garden wall foundation elements should be designed in accordance with building code setback requirements.
- Wall design should consider the additional surcharge loads from superjacent slopes and/or footings, where appropriate.
- No backfill should be placed against concrete until minimum design strengths are evident by compression tests of cylinders.
- The retaining wall footing excavations, backcuts, and backfill materials should be approved by the project geotechnical engineer or their authorized representative.

5.3.5 Pavement Design Considerations

Pavement design for proposed street improvements was conducted per Caltrans *Highway Design Manual* guidelines for flexible pavements. Based on Traffic Indices (TIs) generally associated with these types of improvements and based on an assumed design R-value of 20, the following preliminary sections were calculated:

PRELIMINARY PAVEMENT SECTIONS			
TI	R-Value	Thickness of Asphalt Concrete (inches)	Thickness of Aggregate Base (inches)
5.0	20	4*	6*
6.0	20	4	9

*Minimum section per D.R. Horton standards

Traffic Indices (TIs) used in our pavement design are considered a reasonable value for the proposed street areas and should provide a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance. Irrigation adjacent to pavements, without a deep curb or other cutoff to separate landscaping from the paving may result in premature pavement failure. Traffic parameters used for design were selected based upon engineering judgment and not upon information furnished to us such as an equivalent wheel load analysis or a traffic study.

The recommended pavement sections provided are intended as a minimum guideline and final selection of pavement cross section parameters should be made by the project civil engineer, based upon the local laws and ordinates, expected subgrade and pavement response, and desired level of conservatism. If thinner or highly variable pavement sections are constructed, increased maintenance and repair could be expected. Final pavement design should be checked by testing of soils exposed at subgrade (the upper 12 inches) after final grading has been completed.

Asphalt concrete and aggregate base should conform to current Caltrans Standard Specifications Section 39 and 26-1.02, respectively. As an alternative, asphalt concrete can conform to Section 203-6 of the current Standard Specifications for Public Work (Green Book). Crushed aggregate base or crushed miscellaneous base can conform to Section 200-2.2 and 200-2.4 of the Green Book, respectively. Pavement base should be compacted to at least 95 percent of the ASTM D1557 laboratory maximum dry density (modified proctor).

All pavement installation, including preparation and compaction of subgrade, compaction of base material, placement and rolling of asphaltic concrete, should be done in accordance with the City of Perris specifications, and under the observation and testing of GeoTek and a City Inspector where required. Jurisdictional minimum compaction requirements in excess of the aforementioned minimums may govern.

Deleterious material, excessive wet or dry pockets, oversized rock fragments, and other unsuitable yielding materials encountered during grading should be removed. Once existing compacted fill are brought to the proposed pavement subgrade elevations, the subgrade should be proof-rolled in order to check for a uniform and unyielding surface. The upper 12 inches of pavement subgrade soils should be scarified, moisture conditioned at or near optimum moisture content, and recompacted to at least 95 percent of the laboratory maximum dry density (ASTM D1557). If loose or yielding materials are encountered during construction, additional evaluation of these areas should be carried out by GeoTek. All pavement section changes should be properly transitioned.

5.3.6 Soil Corrosivity

A corrosion report is being prepared by our sub-consultant HDR based on various samples recently obtained across the site. The site corrosion report will be submitted upon its completion.

5.3.7 Concrete Construction

5.3.7.1 General

Concrete construction should follow the 2019 CBC and ACI guidelines regarding design, mix placement, and curing of the concrete. If desired, we could provide quality control testing of the concrete during construction.

5.3.7.2 Concrete Mix Design

The site-specific corrosion report which is being prepared will address if a particular concrete mix design in necessary for the site construction.

5.3.7.3 Concrete Flatwork

Exterior concrete flatwork (sidewalks, driveways, patios, etc.) should have a minimum thickness of four inches. No specific reinforcement is required due to the non-structural nature. However, the use of some reinforcement should be considered. Some shrinkage and cracking of the concrete should be anticipated as a result of typical mix designs and curing practices commonly utilized in residential construction.

"Very low" expansive subgrade soils below exterior concrete flatwork should be pre-saturated to at least 100 percent of optimum moisture content. Minimum depth of pre-saturation should be 12 inches.

Sidewalks and driveways may be under the jurisdiction of the governing agency. If so, jurisdictional design and construction criteria would apply, if more restrictive than the recommendations presented in this report.

All concrete installation, including preparation and compaction of subgrade, should be done in accordance with the City of Perris/County of Riverside specifications, and under the observation and testing of GeoTek and a City/County inspector, if necessary.

5.3.7.4 Concrete Performance

Concrete cracks should be expected. These cracks can vary from sizes that are essentially unnoticeable to more than 0.125-inch in width. Most cracks in concrete, while unsightly, do not significantly impact long-term performance. While it is possible to take measures (proper concrete mix, placement, curing, control joints, etc.) to reduce the extent and size of cracks that occur, some cracking will occur despite the best efforts to minimize it. Concrete can also undergo chemical processes that are dependent upon a wide range of variables, which are difficult, at best, to control. Concrete, while seemingly a stable material, is subject to internal expansion and contraction due to external changes over time.

One of the simplest means to control cracking is to provide weakened control joints for cracking to occur along. These do not prevent cracks from developing; they simply provide a relief point for the stresses that develop. These joints are a widely accepted means to control cracks but are not always effective. Control joints are more effective the more closely spaced they are. GeoTek suggests that control joints be placed in two orthogonal directions and located a distance apart approximately equal to 24 to 36 times the slab thickness.

5.4 POST CONSTRUCTION CONSIDERATIONS

5.4.1 Landscape Maintenance and Planting

Water has been shown to weaken the inherent strength of soil, and slope stability is significantly reduced by overly wet conditions. Positive surface drainage away from graded slopes should be maintained and only the amount of irrigation necessary to sustain plant life should be provided for planted slopes. Controlling surface drainage and runoff and maintaining a suitable vegetation cover can minimize erosion. Plants selected for landscaping should be lightweight, deep-rooted types that require little water and are capable of surviving the prevailing climate.

Overwatering should be avoided. Care should be taken when adding soil amendments to avoid excessive watering. An abatement program to control ground-burrowing rodents should be implemented and maintained. This is critical as burrowing rodents can decrease the long-term performance of slopes.

It is common for planting to be placed adjacent to structures in planter or lawn areas. This will result in the introduction of water into the ground adjacent to the foundation. This type of landscaping should be avoided.

5.4.2 Drainage

The need to maintain proper surface drainage and subsurface systems cannot be overly emphasized. Positive site drainage should be maintained at all times. Drainage should not flow uncontrolled down any descending slope. Water should be directed away from foundations and not allowed to pond or seep into the ground adjacent to the footings. Roof leaders and downspouts should discharge onto paved surfaces sloping away from the structure or into a closed pipe system which outfalls to the street gutter pan or directly to the storm drain system. Pad drainage should be directed toward approved areas and not be blocked by other improvements.

It is the owner's responsibility to maintain and clean drainage devices on or contiguous to their lot. In order to be effective, maintenance should be conducted on a regular and routine schedule and necessary corrections made prior to each rainy season.

5.5 PLAN REVIEW AND CONSTRUCTION OBSERVATIONS

We recommend that foundation plans for the site and relevant project specifications be reviewed by this office prior to construction to check for conformance with the recommendations of this report. We also recommend that GeoTek representatives be present during construction of foundation and other improvements to observe and document proper implementation of the geotechnical recommendations. The owner/developer should verify that GeoTek representatives perform at least the following duties:

- Observe site clearing and grubbing operations for proper removal of unsuitable materials.
- Observe and test bottom of removals prior to fill placement.
- Evaluate the suitability of onsite and import materials for fill placement and collect soil samples for laboratory testing where necessary.
- Observe the fill for uniformity during placement, including utility trenches.
- Perform field density testing of the fill materials.
- Observe and probe foundation excavations to confirm suitability of bearing materials.

If requested, a construction observation and compaction report can be provided by GeoTek, which can comply with the requirements of the governmental agencies having jurisdiction over the project.

6 INTENT

It is the intent of this report to aid in the design and construction of the proposed development. Implementation of the advice presented in this report is intended to reduce risk associated with construction projects. The professional opinions and geotechnical advice contained in this report are not intended to imply total performance of the project or guarantee that unusual or variable conditions will not be discovered during or after construction.

The scope of our report is limited to the boundaries of the subject property. This update does not and should in no way be construed to encompass any areas beyond the specific area of the proposed construction as indicated to us by our client. Further, no evaluation of any existing site improvements is included. The scope is based on our understanding of the project and the client's needs, our fee estimate (Proposal No. P-0202520-CR) date November 19, 2020 and geotechnical engineering standards normally used on similar projects in this locality at the present.

7 LIMITATIONS

Our findings are based on site conditions observed and the stated sources. Thus, our comments are professional opinions that are limited to the extent of the available data.

GeoTek has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report.

Since our recommendations are based on the site conditions observed and encountered, and laboratory testing, our conclusions and recommendations are professional opinions that are limited to the extent of the available data. Observations during construction are important to allow for any change in recommendations found to be warranted. These opinions have been derived in accordance with current standards of practice and no warranty of any kind is expressed or implied. Standards of care/practice are subject to change with time.

8 SELECTED REFERENCES

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_______, 2020, "Due Diligence Geotechnical Review, Acacia 57 Project, Tract 31651, SEC east Nuevo Road and Wilson Avenue, City of Perris, Riverside County, California," Project No. 2340-CR, dated February 17.

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Morton, D.M. and Matti, J.C., 2005, "Preliminary Geologic Map if the Perris 7.5' Quadrangle, Riverside County, California", US Geological Survey OF-2004-1455, scale 1:24,000.

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________, 2011, "Guidelines for Infiltration Testing".

1000 ft.
Scale

Modified from Google Earth Pro Aerial Imagery

D.R. Horton Los Angeles Holding Company, Inc.

Tract 31651, Acacia 57 Project
Perris, Riverside County, California

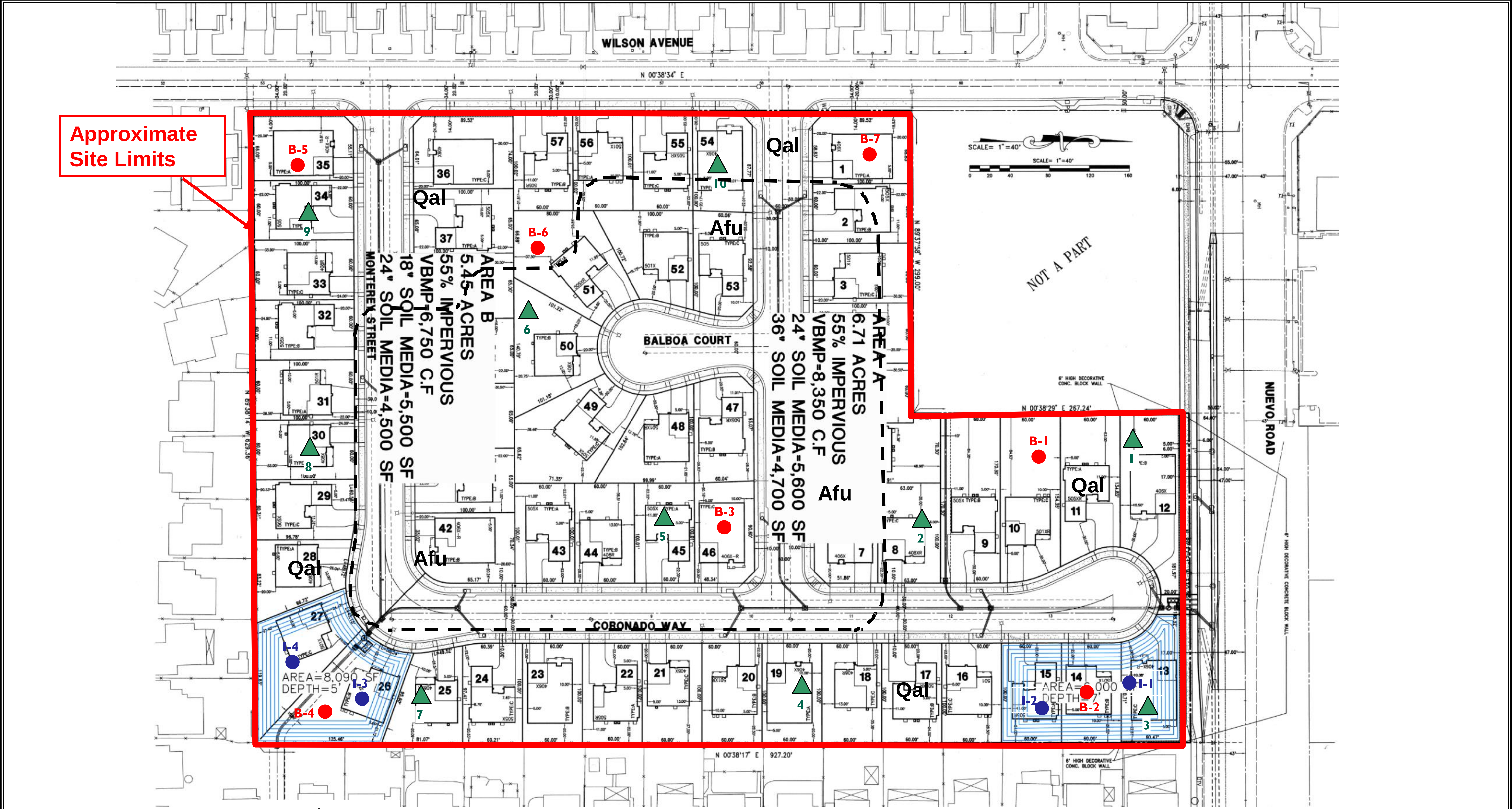
Project No. 2340-CR

NORTH

Figure 1

Site Location Map

GEOTEK



Legend
(Locations are approximate)

Geologic Units
Afu - Artificial Fill, Undocumented
Qal – Alluvium

B-7 - Exploratory Geotechnical Boring

I-4 - Infiltration Test Boring

10 - Corrosion Sample Location

- Geologic Contact

DR Horton Los Angeles Holding Company, Inc.

Tract 31651, Acacia 57 Project
Perris, Riverside County, California

Project No. 2340-CR

GEOTEK

Plate I

Exploration Location Map

APPENDIX A

LOGS OF EXPLORATORY BORINGS

Geotechnical and Infiltration Evaluation
Acacia 57 Project, Perris, California
Project No. 2340-CR

GEOTEK

A - FIELD TESTING AND SAMPLING PROCEDURES

The Modified Split-Barrel Sampler (Ring)
The ring sampler is driven into the ground in accordance with ASTM Test Method D 3550. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sampler is typically driven into the ground 12 or 18 inches with a 140-pound hammer free falling from a height of 30 inches. Blow counts are recorded for every 6 inches of penetration as indicated on the logs of borings. The samples are removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

Bulk Samples (Large)
These samples are normally large bags of earth materials over 20 pounds in weight collected from the field by means of hand digging or exploratory cuttings.

Bulk Samples (Small)
These are plastic bag samples which are normally airtight and contain less than five pounds in weight of earth materials collected from the field by means of hand digging or exploratory cuttings. These samples are primarily used for determining natural moisture content and classification indices.

B – BORING

The following abbreviations and symbols often appear in the classification and description of soil and rock on the logs of borings:

SOILS

USCS	Unified Soil Classification System
f-c	Fine to coarse
f-m	Fine to medium

GEOLOGIC

B: Attitudes	Bedding: strike/dip
J: Attitudes	Joint: strike/dip
C: Contact line	
………..	Dashed line denotes USCS material change
———	Solid Line denotes unit / formational change
━━━	Thick solid line denotes end of boring

(Additional denotations and symbols are provided on the logs of borings).

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: B-1 Sheet 1 of 2

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
	Large Bulk				**Topsoil**			EI
	Ring	8 8 10	R1	ML	Sandy Silt, pale brown, moist, very stiff, pores and pinhole pores	18.0	65.1	
					Alluvium			
5	Ring	10 13 32	R2	SM-ML	Silty f SAND/Sandy SILT, pale brown, moist, dense/hard, abundant caliche	22.7	69.3	HC
	Ring	15 21 19	R3		Same, disturbed sample	18.0	77.3	
10	Ring	9 14 17	R4	SM	Silty f SAND, light olive brown, moist, medium dense, less caliche stringers	23.7	85.3	
15	Ring	12 17 24	R6	SC	Clayey SAND, olive brown, moist, medium dense, trace caliche stringers	19.1	110.6	
20	Ring	7 11 12	S1	SM-ML	Silty f SAND/Sandy SILT, orangish brown, moist, medium dense/very stiff			
25	SPT	8 12 12	S2		Same, trace caliche and f gravel	18.8		
					Older Alluvium			
30	SPT	23 26 30	S3		Silty f-m SAND, dark orangish brown, moist, very dense	11.1		SA

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: B-1 Sheet 2 of 2

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					Drilling slowed			
35	SPT	25 25 35	S3	SM	Silty f-c SAND, dark reddish brown, very moist, very dense, trace f gravel	11.4		
		▽			Groundwater at 39.5 feet			
40	SPT	12 17 25	S4		Same, wet	12.8		SA
45	SPT	20 25 30	S5	SM	F-c SAND,orangish brown, wet, very dense, slightly friable	11.8		
#								
50	SPT	20 30 36	S6		Same, trace f gravel	15.3		SA
					BORING TERMINATED AT 51.5 FEET			
					Groundwater encountered at 39.5 feet Boring backfilled with soil cuttings			

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: B-2

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Alluvium			
	Ring	37 50/3	R1	ML	Sandy SILT, pale grayish brown, moist, hard, cemented, caliche	23.5	70.9	
5	Ring	11 19 20	R2		Same	27.7	62.6	
	Ring	6 10 18	R3		Offwhite, sightly moist, very stiff, abundant caliche	38.7	70.7	HC
10								
	Ring	7 18 27	R4	ML	Clayey SILT, olive brown, orangish brown, moist to very moist, hard, trace caliche stringers	15.9	114.0	
15	Ring	17 30 29	R5		Same	14.7	119.2	
20	Ring	18 42 50/4	R6	SM	Silty f SAND, dark orangish brown, very moist, very dense	10.1	124.7	
					BORING TERMINATED AT 21.5 FEET			
					No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test

SR = Sulfate/Resisitivity Test | SH = Shear Test | HC= Consolidation | MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT: D. R. Horton | **DRILLER:** 2R Drilling Inc. | **LOGGED BY:** KM
PROJECT NAME: Acacia 57 Project | **DRILL METHOD:** Hollow stem Auger | **OPERATOR:** Jerry
PROJECT NO.: 2340-CR | **HAMMER:** 140lbs/30in. | **RIG TYPE:** CME-75
LOCATION: See Exploration Location Map | **DATE:** 12/30/2020

BORING NO.: B-3

Depth (ft)	Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Water Content (%)	Dry Density (pcf)	Others
					Undocumented Fill			MD
		50/4	R1	SM	Silty f SAND, brown, damp, very dense, trace roots, no caliche	4.6	121.9	
5		33	R2		Same			
		23 20		ML	**Alluvium** Sandy SILT, grayish brown, moist, hard, high caliche content	34.2	60.7	
10		7 10 15	R3		Same, very stiff, high caliche content	23.2	71.9	HC
		5 7 9	R4	ML	Clayey SILT, olive brown, moist, stiff, trace caliche stringers	22.5	79.7	HC
15								
		13 29 50/4.5	R5	SM	Silty f-m SAND, orangish brown, olive, moist, very dense, mottled, trace caliche stringers	12.1	123.8	
20								
					BORING TERMINATED AT 21.5 FEET No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits | EI = Expansion Index | SA = Sieve Analysis | RV = R-Value Test
SR = Sulfate/Resisitivity Test | SH = Shear Test | HC= Consolidation | MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: B-4

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Alluvium			
	Ring	20 50/3	R1	ML	Sandy SILT, grayish brown, moist, hard, cemented, disturbed sample	19.5	68.5	
5	Ring	19 26 38	R2		Same, high caliche content	27.3	63.6	
	Ring	9 11 12	R3	ML	SILT, olive, moist, very stiff, moderately to high caliche content	27.2	81.8	
10								
	Ring	7 9 8	R4	ML	Clayey SILT, olive brown, offwhite, moist, stiff, abundant caliche	25.1	60.3	HC
15								
	Ring	12 30 38	R5	SM	Silty f-m SAND, olive brown, reddish brown, moist, very dense, trace caliche stringers	18.2	103.1	
					BORING TERMINATED AT 18.5 FEET			
					No groundwater encountered Boring backfilled with soil cuttings			
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits
EI = Expansion Index
SA = Sieve Analysis
RV = R-Value Test
SR = Sulfate/Resisitivity Test
SH = Shear Test
HC= Consolidation
MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: B-5

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
	Large Bulk				**Alluvium**			MD, EI, SH
	Ring	25 34 36	R1	ML	Sandy SILT, grayish brown, moist, hard, trace f-c gravel, cobble in sampler	9.4	102.5	
5	Ring	17 18 20	R2		Same, moist, abundant caliche	27.3	67.9	
	Ring	9 16 17	R3		Same, brownish gray, moist	20.4	69.8	
10	Ring	7 13 20	R4	ML	Clayey SILT, olive, grayish brown, moist, hard, moderately to low caliche content	25.3	88.5	
15	Ring	18 20 28	R5	SM-SC	Silty to Clayey f-m SAND, orangish brown, moist, dense, caliche stringers	8.5	126.0	
20	Ring	11 16 32	R6		Same	15.7	114.5	
					BORING TERMINATED AT 21.5 FEET			
					No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: B-6

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Alluvium			
	Ring	24 26 36	R1	ML	Sandy SILT, offwhite, moist, hard, abundant caliche	34.2	58.1	
5	Ring	17 28 23	R2		Same, cemented, pinhole pores locally Drilling slowed slightly, gravel and cobble size fragments in spoils	25.2	75.5	
	Ring	8 16 18	R3		Same, disturbed sample, high caliche content	32.7		
10	Ring	10 16 22	R4	ML	Clayey SILT, low caliche content, yellowish brown, moist, hard, pinhole pores locally	9.1	117.9	
15	Ring	6 8 12	R5	ML	SILT, reddish brown, very moist, very stiff	26.9	91.7	
20	Ring	24 28 28	R6	SM-ML	Silty to Clayey f-m SAND, reddish brown, moist, hard	9.4	126.8	
					BORING TERMINATED AT 21.5 FEET No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test; SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: B-7

Depth (ft)	SAMPLES: Sample Type	SAMPLES: Blows/ 6 in	SAMPLES: Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Laboratory Testing: Dry Density (pcf)	Laboratory Testing: Others
					Alluvium			
	Ring	18 25 50/4.5	R1	ML	Sandy SILT, grayish brown, moist, hard, cemented, abundant caliche	22.5	67.1	
5								
	Ring	6 9 11	R2		Same, offwhite, high caliche	36.3	53.1	
10	Ring	9 19 50/5.5	R3		Same, moist, offwhite, olive brown, predominantly caliche	23.1	89.1	
	Ring	23 38 39	R4	ML	Clayey SILT, grayish brown, offwhite, moist, hard	31.9	88.1	
15								
	Ring	16 18 20	R5	ML	Sandy SILT, olive brown, moist, hard, rootcasts	13.5	119.8	
20					**BORING TERMINATED AT 19.5 FEET** No groundwater encountered Boring backfilled with soil cuttings			
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:

AL = Atterberg Limits	EI = Expansion Index	SA = Sieve Analysis	RV = R-Value Test
SR = Sulfate/Resisitivity Test	SH = Shear Test	HC= Consolidation	MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: I-1

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					Alluvium			
				ML	Sandy SILT, grayish brown, dry to slightly moist, hard, caliche			
5								
					BORING TERMINATED AT 7 FEET			
					No groundwater encountered			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: I-2

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					Alluvium			
				ML	Sandy SILT, grayish brown, dry, hard, caliche			
5								
					BORING TERMINATED AT 7 FEET			
					No groundwater encountered			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits; EI = Expansion Index; SA = Sieve Analysis; RV = R-Value Test
SR = Sulfate/Resisitivity Test; SH = Shear Test; HC= Consolidation; MD = Maximum Density

GeoTek, Inc.
LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: I-3

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
				ML	**Alluvium** Sandy SILT, grayish brown, dry to slightly moist, hard			
5					**BORING TERMINATED AT 5 FEET** No groundwater encountered			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing: AL = Atterberg Limits EI = Expansion Index SA = Sieve Analysis RV = R-Value Test SR = Sulfate/Resisitivity Test SH = Shear Test HC= Consolidation MD = Maximum Density

GeoTek, Inc.

LOG OF EXPLORATORY BORING

CLIENT:	D. R. Horton	**DRILLER:**	2R Drilling Inc.	**LOGGED BY:**	KM
PROJECT NAME:	Acacia 57 Project	**DRILL METHOD:**	Hollow stem Auger	**OPERATOR:**	Jerry
PROJECT NO.:	2340-CR	**HAMMER:**	140lbs/30in.	**RIG TYPE:**	CME-75
LOCATION:	See Exploration Location Map			**DATE:**	12/30/2020

BORING NO.: I-4

Depth (ft)	SAMPLES: Sample Type	Blows/ 6 in	Sample Number	USCS Symbol	MATERIAL DESCRIPTION AND COMMENTS	Laboratory Testing: Water Content (%)	Dry Density (pcf)	Others
					Alluvium			
				ML	Sandy SILT, brownish gray, slightly moist, hard			
5					**BORING TERMINATED AT 5 FEET**			
					No groundwater encountered			
10								
15								
20								
25								
30								

LEGEND

Sample type: ---Ring ---SPT ---Small Bulk ---Large Bulk ---No Recovery ---Water Table

Lab testing:
AL = Atterberg Limits
EI = Expansion Index
SA = Sieve Analysis
RV = R-Value Test
SR = Sulfate/Resisitivity Test
SH = Shear Test
HC= Consolidation
MD = Maximum Density

APPENDIX B

LABORATORY TEST RESULTS

Geotechnical and Infiltration Evaluation

Acacia 57 Project, Perris, California

Project No. 2340-CR

GEOTEK

SUMMARY OF LABORATORY TESTING

In Situ Moisture Content and Unit Weight
The field moisture content was measured in the laboratory on selected samples collected during the field investigation. The field moisture content is determined as a percentage of the dry unit weight. The dry density was measured in the laboratory on selected ring samples. The results are shown on the logs of exploratory borings in Appendix A.

Moisture-Density Relationship
Laboratory testing was performed on two samples collected during the subsurface exploration. The laboratory maximum dry density and optimum moisture content for the soil types were determined in general accordance with test method ASTM Test Procedure D 1557. The results are included herein.

Direct Shear
Direct shear testing was performed on remolded samples of the surficial soils according to ASTM Test Method D 3080. The test results are presented herein.

Expansion Index
Expansion Index testing was performed on two soil samples collected from the site. Testing was performed in general accordance with ASTM Test Method D 4829. The test results are presented herein.

Percent Passing No. 200 Sieve
The amount of soil particles passing No. 200 Sieve was estimated in accordance with ASTM D 1140. The test results are presented herein.

Collapse
Collapse tests were conducted in accordance with ASTM D2435. The results of these tests are presented herein.

GEOTEK

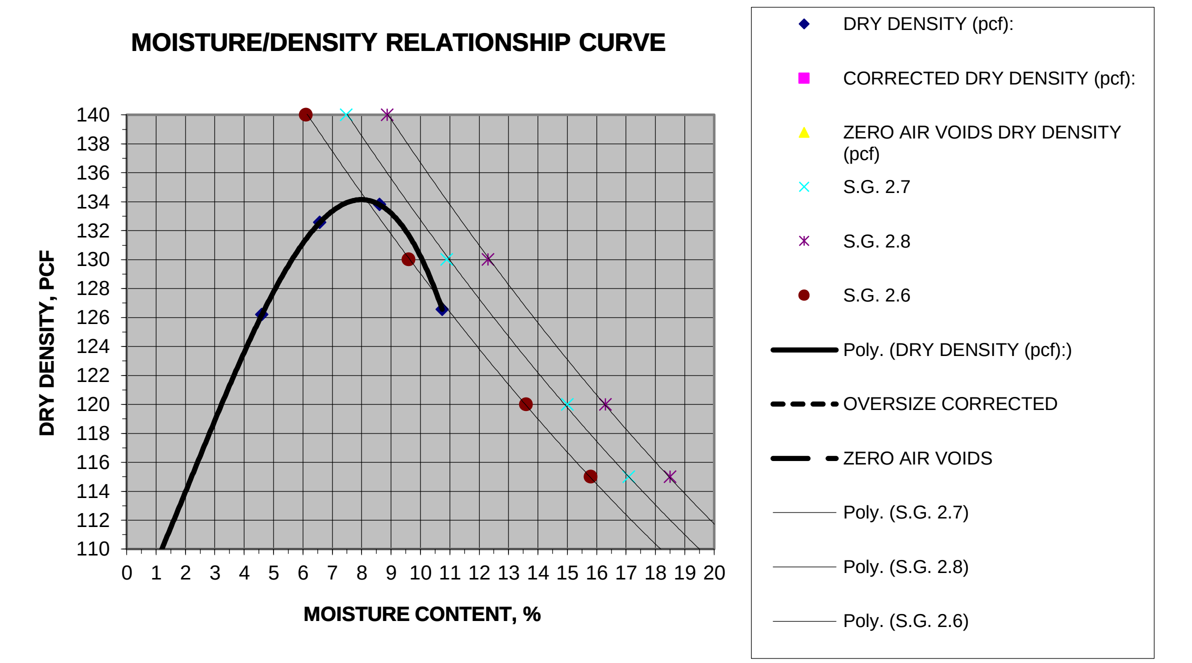
MOISTURE/DENSITY RELATIONSHIP

Client: DRH
Project: Acacia 57
Location: 0
Material Type: Silty Sand
Material Supplier: -
Material Source: -
Sample Location: B-3 @0-5'
-
Sampled By: Kyle
Received By: DI
Tested By: FS
Reviewed By: DA

Job No.: 2340-CR
Lab No.: Corona

Date Sampled: 1/4/2021
Date Received: 1/4/2021
Date Tested: 1/5/2021
Date Reviewed: 1/8/2021

Test Procedure: ASTM D1557 **Method:** A
Oversized Material (%): 0.0 **Correction Required:** ☐ yes ☒ no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	134.0	**@ Optimum Moisture, %**	8.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

Unified Soils Classification: ____________

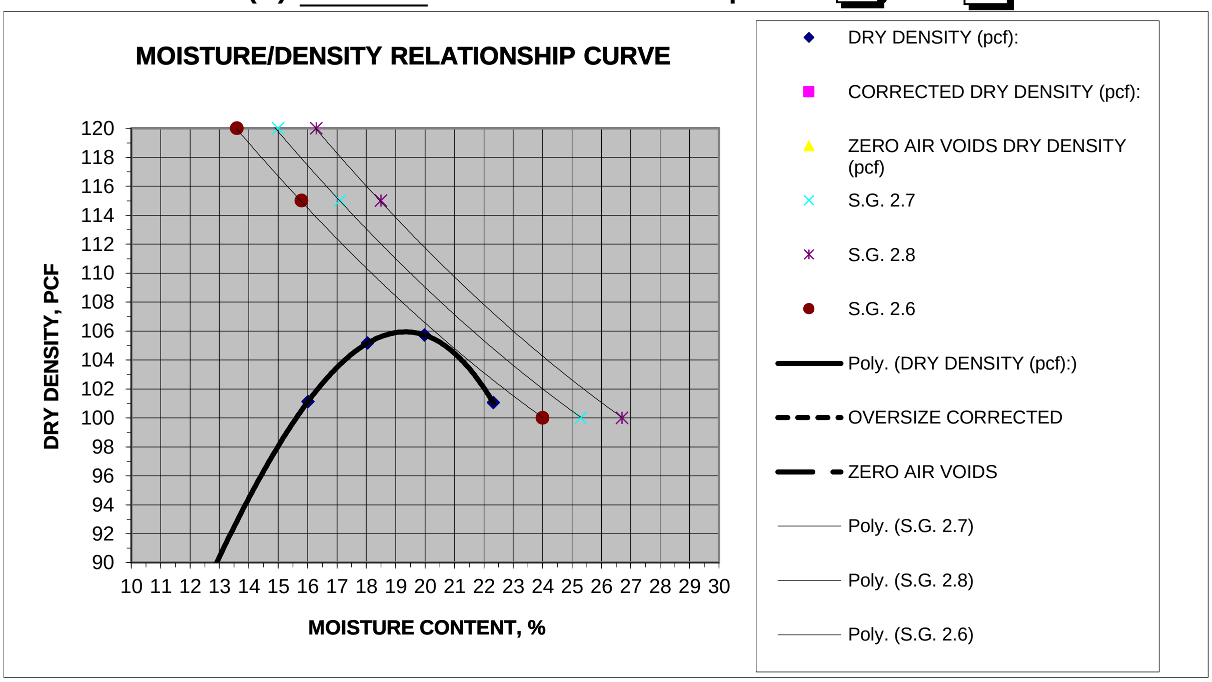
AASHTO Soils Classification: ____________

MOISTURE/DENSITY RELATIONSHIP

Client:	DRH	**Job No.:**	2340-CR
Project:	Acacia 57	**Lab No.:**	Corona
Location:	Perris		
Material Type:	Clay w/ silt		
Material Supplier:	-		
Material Source:	-		
Sample Location:	B-5 @0-5'		
	-		
Sampled By:	Kyle	**Date Sampled:**	1/4/2021
Received By:	DI	**Date Received:**	1/5/2021
Tested By:	FS	**Date Tested:**	1/5/2021
Reviewed By:	DA	**Date Reviewed:**	1/8/2021

Test Procedure: ASTM D1557 **Method:** A

Oversized Material (%): 0.0 **Correction Required:** [ ] yes [x] no



MOISTURE DENSITY RELATIONSHIP VALUES

Maximum Dry Density, pcf	106.0	**@ Optimum Moisture, %**	19.0
Corrected Maximum Dry Density, pcf		**@ Optimum Moisture, %**	

MATERIAL DESCRIPTION

Grain Size Distribution:

	% Gravel (retained on No. 4)
	% Sand (Passing No. 4, Retained on No. 200)
	% Silt and Clay (Passing No. 200)

Atterberg Limits:

	Liquid Limit, %
	Plastic Limit, %
	Plasticity Index, %

Classification:

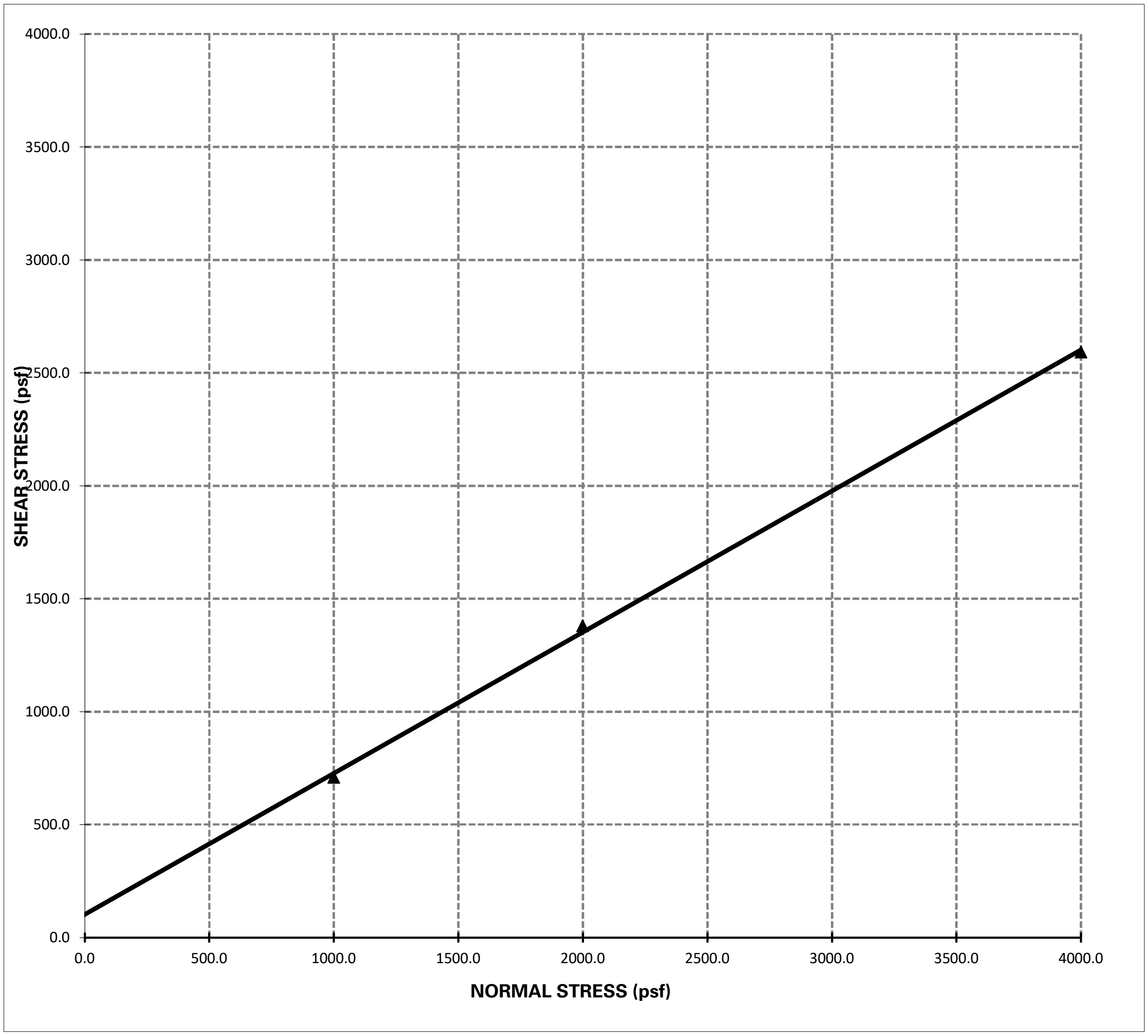
Unified Soils Classification: ________

AASHTO Soils Classification: ________

DIRECT SHEAR TEST

GEOTEK

Project Name:	Dr Horton	***Sample Location:***	B-5 @ 0-5 Feet
Project Number:	2340-CR	***Date Tested:***	1/5/2020



Shear Strength: $\Phi =$ **32.0** $^{\circ}$, **C = 102.00 psf**

Notes: 1 - The soil specimen used in the shear box was a ring sample remolded to approximately 90% relative compaction from a bulk sample collected during the field investigation.

2 - The above reflect direct shear strength at saturated conditions.

3 - The tests were run at a shear rate of 0.035 in/min.

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client:	Dr Horton	***Tested/ Checked By:***	GP Lab No Corona
Project Number:	2340CR	***Date Tested:***	1/12/2021
Project Location:	Acacia 57	***Sample Source:***	B-1 @ 0-5 ft
		Sample Description:	

Ring #:______ Ring Dia. : 4.01" Ring Ht. 1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	767.6
B	Weight of ring (gm)	366.2
C	Net weight of sample (gm)	**401.4**
D	Wet Density, lb / ft3 (C*0.3016)	**121.1**
E	Dry Density, lb / ft3 (D/1.F)	**110.5**

SATURATION DETERMINATION

F	Moisture Content, %	9.6
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**49.3**

READINGS

DATE	TIME	READING	
1/12/2021		0.7170	Initial
1/12/2021		0.7170	10 min/Dry
1/13/2021		0.7170	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
779.3	**12.5**

EXPANSION INDEX = 0

GEOTEK

EXPANSION INDEX TEST

(ASTM D4829)

Client: Dr Horton
Project Number: 2340CR
Project Location: Acacia 57

Tested/ Checked By: GP Lab No Corona
Date Tested: 1/12/2021
Sample Source: B-5 @ 0-5 ft
Sample Description:

Ring #:______ Ring Dia. : 4.01" Ring Ht. 1"

DENSITY DETERMINATION

A	Weight of compacted sample & ring (gm)	678.8
B	Weight of ring (gm)	366.6
C	Net weight of sample (gm)	**312.2**
D	Wet Density, lb / ft3 (C*0.3016)	**94.2**
E	Dry Density, lb / ft3 (D/1.F)	**76.8**

SATURATION DETERMINATION

F	Moisture Content, %	22.6
G	Specific Gravity, assumed	**2.70**
H	Unit Wt. of Water @ 20 °C, (pcf)	**62.4**
I	% Saturation	**51.1**

READINGS

DATE	TIME	READING	
1/12/2021	10am	0.3620	Initial
1/12/2021		0.3610	10 min/Dry
1/13/2021		0.3680	Final

FINAL MOISTURE

Final Weight of wet sample & tare	% Moisture
720.0	**35.8**

EXPANSION INDEX = 7

-200 WASH

Date:	1/11/2021		
W.O.:	2340-CR	sample ID	B-1
Client:	DR Horton	depth	30 feet
Project:	Acacia 57 Project Tract 31651, Perris		

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	151.4	64.7	29.9%	

Dry Weight 216.1

Soak Time 1440 Minutes

GEOTEK

-200 WASH

Date: 1/11/2021
W.O.: 2340-CR   sample ID B-1
Client: DR Horton   depth 40 feet
Project: Acacia 57 Project Tract 31651, Perris

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	166.5	36.4	17.9%	

Dry Weight 202.9

Soak Time 1440 Minutes

GEOTEK

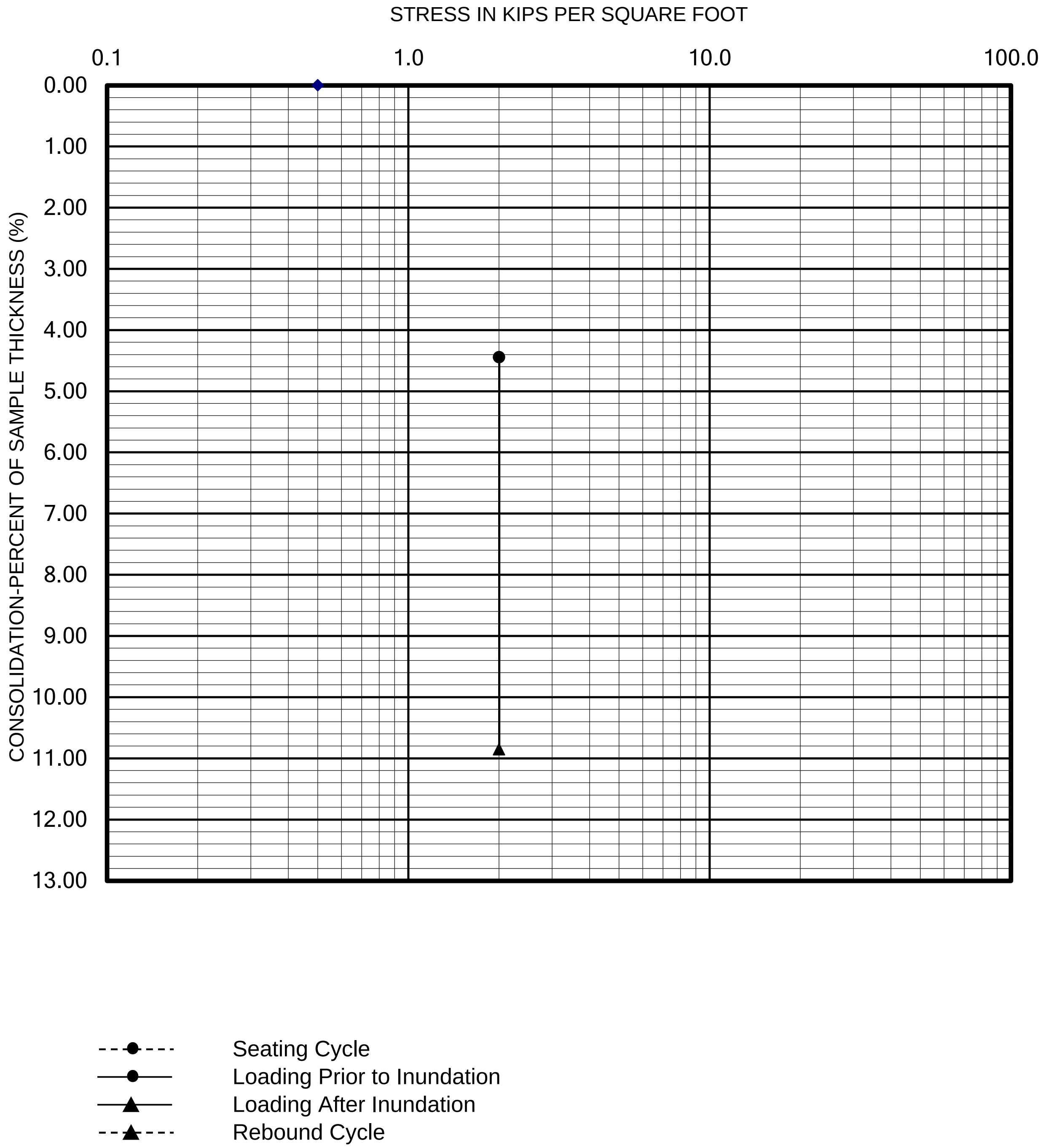
-200 WASH

Date: 1/11/2021
W.O.: 2340-CR sample ID B-1
Client: DR Horton depth 50 feet
Project: Acacia 57 Project Tract 31651, Perris

Sieve Size	Particle Diameter		Wt. Retained	Wt. Passing	% Passing	Specs
	in.	mm.				
#200	0.0029	0.074	167.3	48.6	22.5%	

Dry Weight 215.9

Soak Time 1440 Minutes



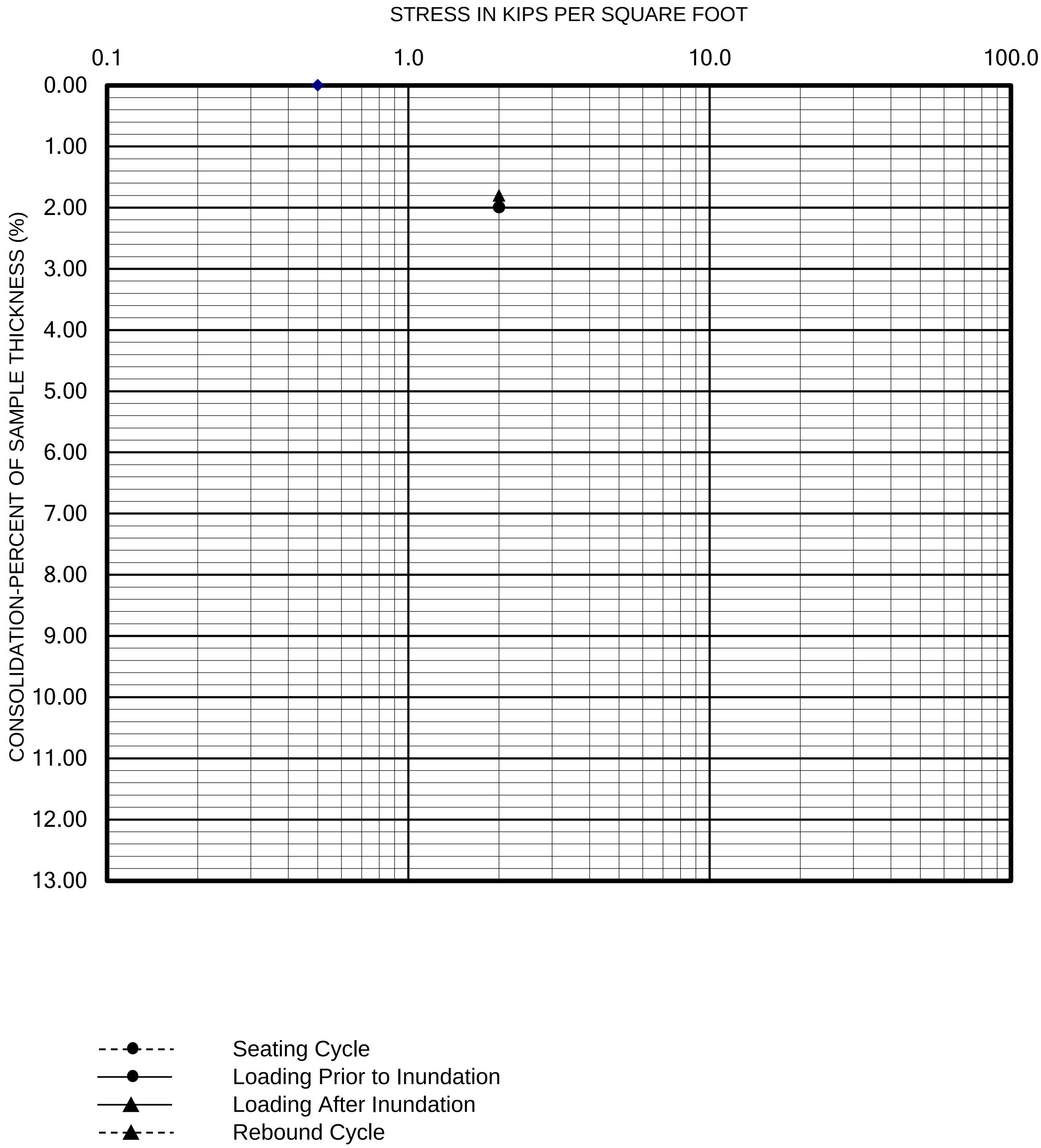
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-2 @ 8 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 2340-CR	1/6/2021



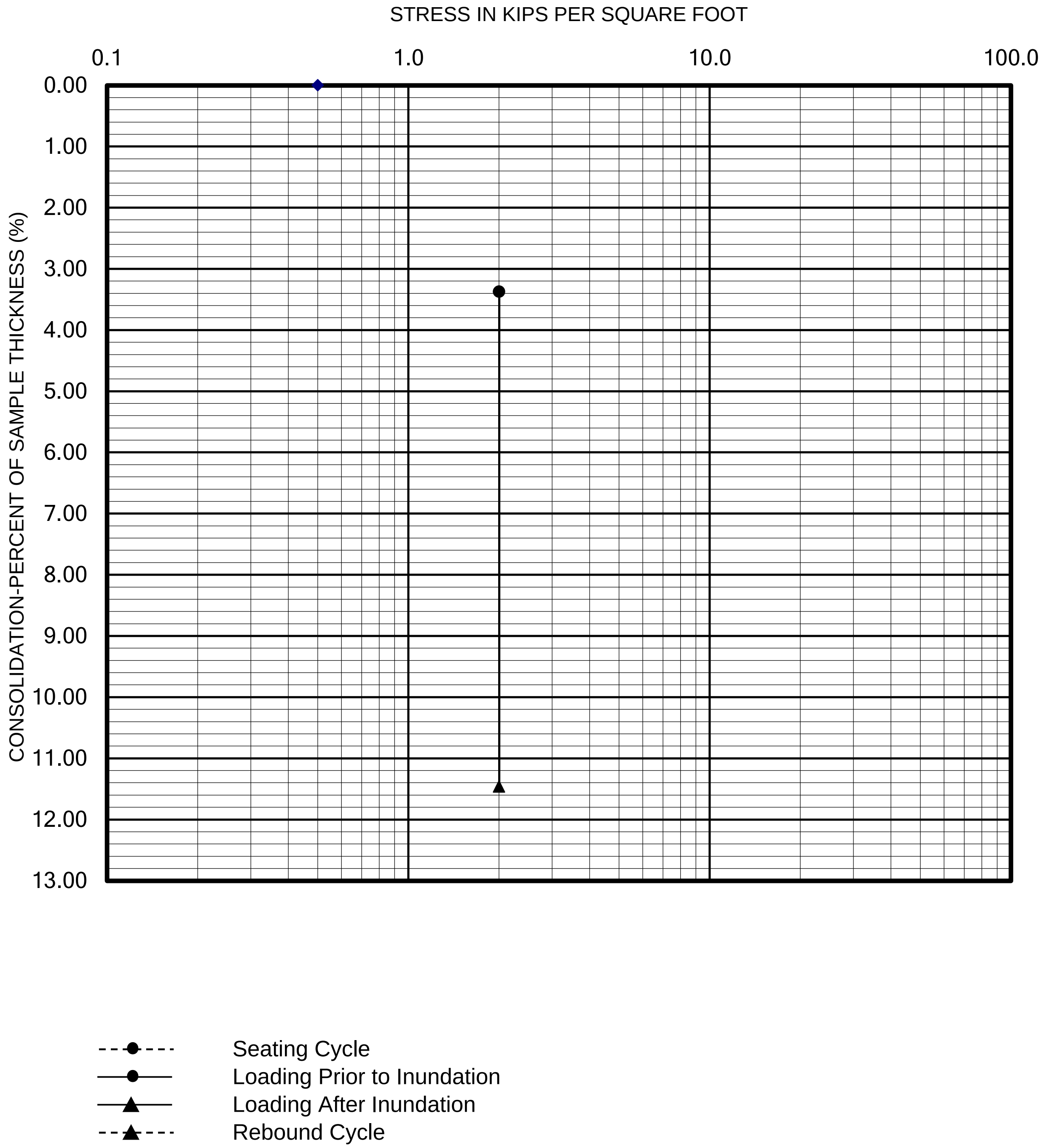
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-3 @ 9 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 2340-CR	Date: 1/6/21



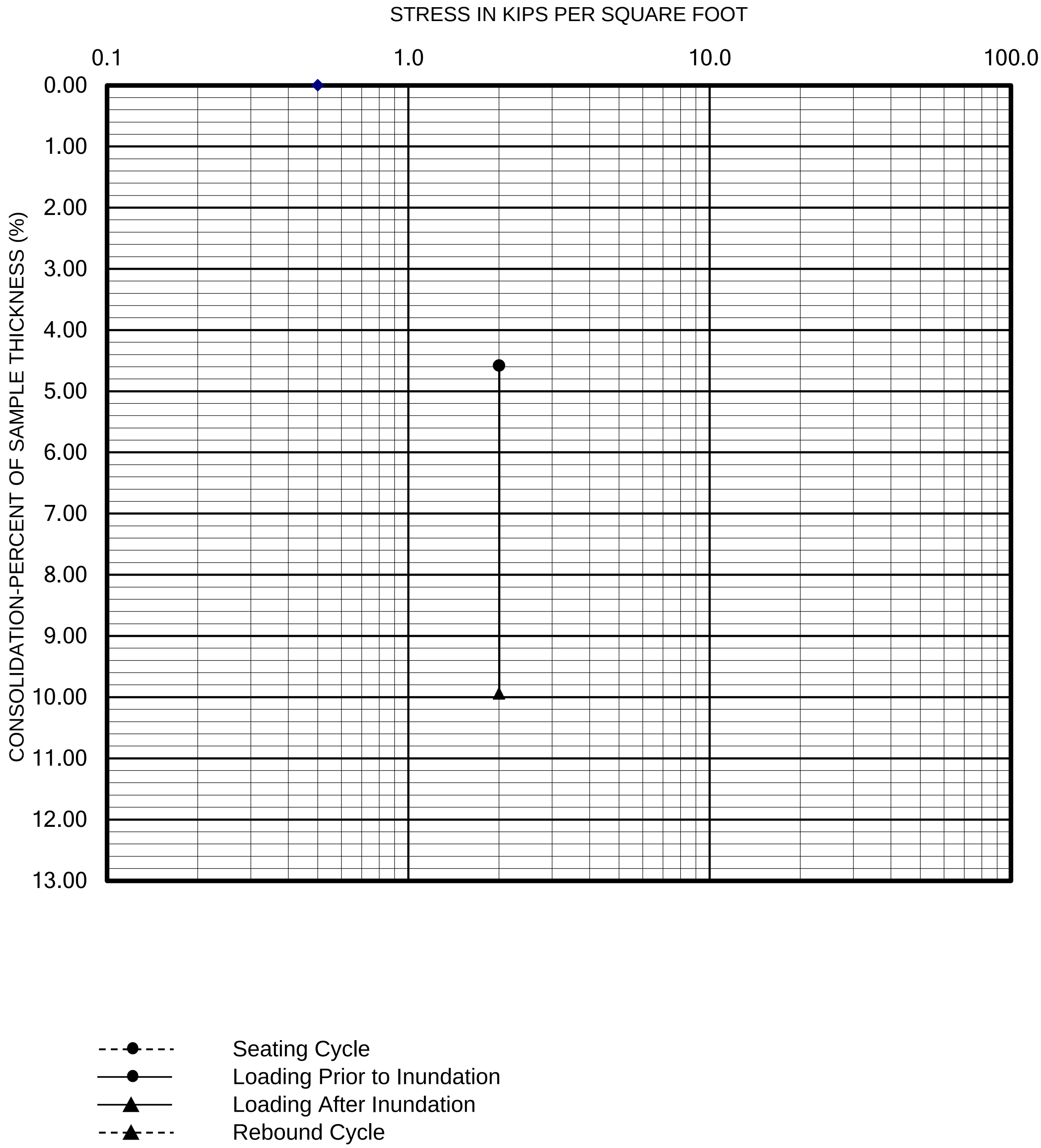
PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-3 @ 12 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 2340-CR	Date: 1/6/21



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4546

GEOTEK

COLLAPSE REPORT

Sample: B-4 @ 11 feet

CHECKED BY: DA	Lab: Corona
PROJECT NO.: 2340-CR	Date: 1/6/21

APPENDIX C

PERCOLATION/INFILTRATION TEST DATA

Geotechnical and Infiltration Evaluation

Acacia 57 Project, Perris, California

Project No. 2340-CR

GEOTEK

Client:	**D.R. Horton**
Project:	**Acacia 57, Perris**
Project No:	**2340-CR**
Date:	**1/11/2021**

Boring No. **I-1**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	10	min
Final Depth to Water, D_F =	67.0	in
Test Hole Radius, r =	4.0	in
Initial Depth to Water, D_O =	64.0	in
Total Test Hole Depth, D_T =	84.0	in

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	20.0	in
$H_F = D_T - D_F$ =	17.0	in
$\Delta H = \Delta D = H_O - H_F$ =	3.0	in
$H_{avg} = (H_O+H_F)/2$ =	18.5	in

I_t = 1.8 **Inches per Hour**

GEOTEK

Client:	**D.R. Horton**
Project:	**Acacia 57, Perris**
Project No:	**2340-CR**
Date:	**1/11/2021**

Boring No. **I-2**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	10	min
Final Depth to Water, D_F =	68.5	in
Test Hole Radius, r =	4.0	in
Initial Depth to Water, D_O =	64.0	in
Total Test Hole Depth, D_T =	84.0	in

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	20.0	in
$H_F = D_T - D_F$ =	15.5	in
$\Delta H = \Delta D = H_O - H_F$ =	4.5	in
Havg = $(H_O+H_F)/2$ =	17.8	in

I_t = 2.7 **Inches per Hour**

GEOTEK

Client:	**D.R. Horton**
Project:	**Acacia 57, Perris**
Project No:	**2340-CR**
Date:	**1/11/2021**

Boring No. **I-3**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	10	min
Final Depth to Water, D_F =	44.3	in
Test Hole Radius, r =	4.0	in
Initial Depth to Water, D_O =	40.0	in
Total Test Hole Depth, D_T =	60.0	in

Equation - $$I_t = \frac{\Delta H\,(60r)}{\Delta t\,(r+2H_{avg})}$$

$H_O = D_T - D_O$ =	20.0	in
$H_F = D_T - D_F$ =	15.8	in
$\Delta H = \Delta D = H_O - H_F$ =	4.3	in
$Havg = (H_O+H_F)/2$ =	17.9	in

I_t = 2.6 **Inches per Hour**

GEOTEK

Client:	**D.R. Horton**
Project:	**Acacia 57, Perris**
Project No:	**2340-CR**
Date:	**1/11/2021**

Boring No. **I-4**

Infiltration Rate (Porchet Method)

Time Interval, Δt =	10	min
Final Depth to Water, D_F =	43.5	in
Test Hole Radius, r =	4.0	in
Initial Depth to Water, D_O =	40.0	in
Total Test Hole Depth, D_T =	60.0	in

Equation - $I_t = \dfrac{\Delta H\ (60r)}{\Delta t\ (r+2H_{avg})}$

$H_O = D_T - D_O$ =	20.0	in
$H_F = D_T - D_F$ =	16.5	in
$\Delta H = \Delta D = H_O - H_F$ =	3.5	in
$Havg = (H_O+H_F)/2$ =	18.3	in

I_t = 2.1 **Inches per Hour**

GEOTEK

Percolation Test Data Sheet

Project: Acacia 57 Project Job No.: 2340-CR
Test Hole No.: I-1 Date Excavated: 12/30/20
Depth of Test Hole (ft): 7 Soil Description: ML
Percolation Test By: KRM Date: 12/31/20 Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Percolation Rate (min/inch)
8:40 AM 9:05 AM	25	25	20.00	12.50	7.50	3.33
9:06 AM 9:31 AM	25	51	20.00	12.50	7.50	3.33
9:32 AM 9:42 AM	10	62	20.00	17.00	3.00	3.33
9:43 AM 9:53 AM	10	73	20.00	16.75	3.25	3.08
9:54 AM 10:04 AM	10	84	20.00	17.00	3.00	3.33
10:05 AM 10:15 AM	10	95	20.00	17.00	3.00	3.33
10:17 AM 10:27 AM	10	107	20.00	17.00	3.00	3.33
10:28 AM 10:38 AM	10	118	20.00	17.00	3.00	3.33

Design Percolation Rate: **min/inch**

Percolation Test Data Sheet

Project: Acacia 57 Project | Job No.: 2340-CR

Test Hole No.: I-2 | Date Excavated: 12/30/20

Depth of Test Hole (ft): 7 | Soil Description: ML

Percolation Test By: KRM | Date: 12/31/20 | Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Percolation Rate (min/inch)
8:42 AM 9:07 AM	25	25	20.00	8.00	12.00	2.08
9:08 AM 9:33 AM	25	51	20.00	8.25	11.75	2.13
9:34 AM 9:44 AM	10	62	20.00	15.25	4.75	2.11
9:45 AM 9:55 AM	10	73	20.00	15.25	4.75	2.11
9:56 AM 10:06 AM	10	84	20.00	15.25	4.75	2.11
10:07 AM 10:17 AM	10	95	20.00	15.50	4.50	2.22
10:18 AM 10:28 AM	10	106	20.00	15.50	4.50	2.22
10:29 AM 10:39 AM	10	117	20.00	15.50	4.50	2.22

Design Percolation Rate: **min/inch**

Percolation Test Data Sheet

Project: Acacia 57 Project Job No.: 2340-CR

Test Hole No.: I-3 Date Excavated: 12/30/20

Depth of Test Hole (ft): 5 Soil Description: ML

Percolation Test By: KRM Date: 12/31/20 Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Percolation Rate (min/inch)
10:44 AM 11:09 AM	25	25	20.00	8.25	11.75	2.13
11:10 AM 11:35 AM	25	51	20.00	8.50	11.50	2.17
11:36 AM 11:46 AM	10	62	20.00	15.50	4.50	2.22
11:47 AM 11:57 AM	10	73	20.00	15.75	4.25	2.35
11:58 AM 12:08 PM	10	84	20.00	15.75	4.25	2.35
12:09 PM 12:19 PM	10	95	20.00	15.75	4.25	2.35
12:20 PM 12:30 PM	10	106	20.00	15.75	4.25	2.35
12:31 PM 12:41 PM	10	117	20.00	15.75	4.25	2.35

Design Percolation Rate: **min/inch**

Percolation Test Data Sheet

Project: Acacia 57 Project   Job No.: 2340-CR

Test Hole No.: I-4   Date Excavated: 12/30/20

Depth of Test Hole (ft): 5   Soil Description: ML

Percolation Test By: KRM   Date: 12/31/20   Presoak: Yes

Percolation Test Data

Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (inches)	Final Water Level (inches)	Δ in Water Level (inches)	Percolation Rate (min/inch)
11:46 AM 11:11 AM	25	25	20.00	11.00	9.00	2.78
11:12 AM 11:37 AM	25	51	20.00	11.50	8.50	2.94
11:38 AM 11:48 AM	10	62	20.00	16.50	3.50	2.86
11:49 AM 11:59 AM	10	73	20.00	16.50	3.50	2.86
12:00 AM 12:10 PM	10	84	20.00	16.50	3.50	2.86
12:11 PM 12:21 PM	10	95	20.00	16.50	3.50	2.86
12:22 PM 12:32 PM	10	106	20.00	16.50	3.50	2.86
12:33 PM 12:43 PM	10	117	20.00	16.50	3.50	2.86

Design Percolation Rate: **min/inch**

APPENDIX D

GENERAL GRADING GUIDELINES

GENERAL GRADING GUIDELINES

Guidelines presented herein are intended to address general construction procedures for earthwork construction. Specific situations and conditions often arise which cannot reasonably be discussed in general guidelines, when anticipated these are discussed in the text of the report. Often unanticipated conditions are encountered which may necessitate modification or changes to these guidelines. It is our hope that these will assist the contractor to more efficiently complete the project by providing a reasonable understanding of the procedures that would be expected during earthwork and the testing and observation used to evaluate those procedures.

General

Grading should be performed to at least the minimum requirements of governing agencies, Chapters 18 and 33 of the California Building Code, CBC (2019) and the guidelines presented below.

Preconstruction Meeting

A preconstruction meeting should be held prior to site earthwork. Any questions the contractor has regarding our recommendations, general site conditions, apparent discrepancies between reported and actual conditions and/or differences in procedures the contractor intends to use should be brought up at that meeting. The contractor (including the main onsite representative) should review our report and these guidelines in advance of the meeting. Any comments the contractor may have regarding these guidelines should be brought up at that meeting.

Grading Observation and Testing

1. Observation of the fill placement should be provided by our representative during grading. Verbal communication during the course of each day will be used to inform the contractor of test results. The contractor should receive a copy of the "Daily Field Report" indicating results of field density tests that day. If our representative does not provide the contractor with these reports, our office should be notified.
2. Testing and observation procedures are, by their nature, specific to the work or area observed and location of the tests taken, variability may occur in other locations. The contractor is responsible for the uniformity of the grading operations; our observations and test results are intended to evaluate the contractor's overall level of efforts during grading. The contractor's personnel are the only individuals participating in all aspect of site work. Compaction testing and observation should not be considered as relieving the contractor's responsibility to properly compact the fill.
3. Cleanouts, processed ground to receive fill, key excavations, and subdrains should be observed by our representative prior to placing any fill. It will be the contractor's responsibility to notify our representative or office when such areas are ready for observation.
4. Density tests may be made on the surface material to receive fill, as considered warranted by this firm.
5. In general, density tests would be made at maximum intervals of two feet of fill height or every 1,000 cubic yards of fill placed. Criteria will vary depending on soil conditions and size of the fill. More frequent testing may be performed. In any case, an adequate number of field density tests should be made to evaluate the required compaction and moisture content is generally being obtained.

6. Laboratory testing to support field test procedures will be performed, as considered warranted, based on conditions encountered (e.g. change of material sources, types, etc.) Every effort will be made to process samples in the laboratory as quickly as possible and in progress construction projects are our first priority. However, laboratory workloads may cause in delays and some soils may require a **minimum of 48 to 72 hours to complete test procedures**. Whenever possible, our representative(s) should be informed in advance of operational changes that might result in different source areas for materials.
7. Procedures for testing of fill slopes are as follows:
   a) Density tests should be taken periodically during grading on the flat surface of the fill, three to five feet horizontally from the face of the slope.
   b) If a method other than over building and cutting back to the compacted core is to be employed, slope compaction testing during construction should include testing the outer six inches to three feet in the slope face to determine if the required compaction is being achieved.
8. Finish grade testing of slopes and pad surfaces should be performed after construction is complete.

Site Clearing

1. All vegetation, and other deleterious materials, should be removed from the site. If material is not immediately removed from the site it should be stockpiled in a designated area(s) well outside of all current work areas and delineated with flagging or other means. Site clearing should be performed in advance of any grading in a specific area.
2. Efforts should be made by the contractor to remove all organic or other deleterious material from the fill, as even the most diligent efforts may result in the incorporation of some materials. This is especially important when grading is occurring near the natural grade. All equipment operators should be aware of these efforts. Laborers may be required as root pickers.
3. Nonorganic debris or concrete may be placed in deeper fill areas provided the procedures used are observed and found acceptable by our representative.

Treatment of Existing Ground

1. Following site clearing, all surficial deposits of alluvium and colluvium as well as weathered or creep effected bedrock, should be removed unless otherwise specifically indicated in the text of this report.
2. In some cases, removal may be recommended to a specified depth (e.g. flat sites where partial alluvial removals may be sufficient). The contractor should not exceed these depths unless directed otherwise by our representative.
3. Groundwater existing in alluvial areas may make excavation difficult. Deeper removals than indicated in the text of the report may be necessary due to saturation during winter months.
4. Subsequent to removals, the natural ground should be processed to a depth of six inches, moistened to near optimum moisture conditions and compacted to fill standards.
5. Exploratory back hoe or dozer trenches still remaining after site removal should be excavated and filled with compacted fill if they can be located.

Fill Placement

1. Unless otherwise indicated, all site soil and bedrock may be reused for compacted fill; however, some special processing or handling may be required (see text of report).

2. Material used in the compacting process should be evenly spread, moisture conditioned, processed, and compacted in thin lifts six (6) to eight (8) inches in compacted thickness to obtain a uniformly dense layer. The fill should be placed and compacted on a nearly horizontal plane, unless otherwise found acceptable by our representative.
3. If the moisture content or relative density varies from that recommended by this firm, the contractor should rework the fill until it is in accordance with the following:
   a) Moisture content of the fill should be at or above optimum moisture. Moisture should be evenly distributed without wet and dry pockets. Pre-watering of cut or removal areas should be considered in addition to watering during fill placement, particularly in clay or dry surficial soils. The ability of the contractor to obtain the proper moisture content will control production rates.
   b) Each six-inch layer should be compacted to at least 90 percent of the maximum dry density in compliance with the testing method specified by the controlling governmental agency. In most cases, the testing method is ASTM Test Designation D 1557.
4. Rock fragments less than eight inches in diameter may be utilized in the fill, provided:
   a) They are not placed in concentrated pockets;
   b) There is a sufficient percentage of fine-grained material to surround the rocks;
   c) The distribution of the rocks is observed by, and acceptable to, our representative.
5. Rocks exceeding eight (8) inches in diameter should be taken off site, broken into smaller fragments, or placed in accordance with recommendations of this firm in areas designated suitable for rock disposal. On projects where significant large quantities of oversized materials are anticipated, alternate guidelines for placement may be included. If significant oversize materials are encountered during construction, these guidelines should be requested.
6. In clay soil, dry or large chunks or blocks are common. If in excess of eight (8) inches minimum dimension, then they are considered as oversized. Sheepsfoot compactors or other suitable methods should be used to break up blocks. When dry, they should be moisture conditioned to provide a uniform condition with the surrounding fill.

Slope Construction

1. The contractor should obtain a minimum relative compaction of 90 percent out to the finished slope face of fill slopes. This may be achieved by either overbuilding the slope and cutting back to the compacted core, or by direct compaction of the slope face with suitable equipment.
2. Slopes trimmed to the compacted core should be overbuilt by at least three (3) feet with compaction efforts out to the edge of the false slope. Failure to properly compact the outer edge results in trimming not exposing the compacted core and additional compaction after trimming may be necessary.
3. If fill slopes are built "at grade" using direct compaction methods, then the slope construction should be performed so that a constant gradient is maintained throughout construction. Soil should not be "spilled" over the slope face nor should slopes be "pushed out" to obtain grades. Compaction equipment should compact each lift along the immediate top of slope. Slopes should be back rolled or otherwise compacted at approximately every 4 feet vertically as the slope is built.
4. Corners and bends in slopes should have special attention during construction as these are the most difficult areas to obtain proper compaction.
5. Cut slopes should be cut to the finished surface. Excessive undercutting and smoothing of the face with fill may necessitate stabilization.

UTILITY TRENCH CONSTRUCTION AND BACKFILL

Utility trench excavation and backfill is the contractors responsibility. The geotechnical consultant typically provides periodic observation and testing of these operations. While efforts are made to make sufficient observations and tests to verify that the contractors' methods and procedures are adequate to achieve proper compaction, it is typically impractical to observe all backfill procedures. As such, it is critical that the contractor use consistent backfill procedures.

Compaction methods vary for trench compaction and experience indicates many methods can be successful. However, procedures that "worked" on previous projects may or may not prove effective on a given site. The contractor(s) should outline the procedures proposed, so that we may discuss them **prior** to construction. We will offer comments based on our knowledge of site conditions and experience.

1. Utility trench backfill in slopes, structural areas, in streets and beneath flat work or hardscape should be brought to at least optimum moisture and compacted to at least 90 percent of the laboratory standard. Soil should be moisture conditioned prior to placing in the trench.
2. Flooding and jetting are not typically recommended or acceptable for native soils. Flooding or jetting may be used with select sand having a Sand Equivalent (SE) of 30 or higher. This is typically limited to the following uses:
   a) shallow (12 + inches) under slab interior trenches and,
   b) as bedding in pipe zone.

   The water should be allowed to dissipate prior to pouring slabs or completing trench compaction.
3. Care should be taken not to place soils at high moisture content within the upper three feet of the trench backfill in street areas, as overly wet soils may impact subgrade preparation. Moisture may be reduced to 2% below optimum moisture in areas to be paved within the upper three feet below sub grade.
4. Sand backfill should not be allowed in exterior trenches adjacent to and within an area extending below a 1:1 projection from the outside bottom edge of a footing, unless it is similar to the surrounding soil.
5. Trench compaction testing is generally at the discretion of the geotechnical consultant. Testing frequency will be based on trench depth and the contractors procedures. A probing rod would be used to assess the consistency of compaction between tested areas and untested areas. If zones are found that are considered less compact than other areas, this would be brought to the contractors attention.

JOB SAFETY

General

Personnel safety is a primary concern on all job sites. The following summaries are safety considerations for use by all our employees on multi-employer construction sites. On ground personnel are at highest risk of injury and possible fatality on grading construction projects. The company recognizes that construction activities will vary on each site and that job site safety is the contractor's responsibility. However, it is, imperative that all personnel be safety conscious to avoid accidents and potential injury.

In an effort to minimize risks associated with geotechnical testing and observation, the following precautions are to be implemented for the safety of our field personnel on grading and construction projects.

1. Safety Meetings: Our field personnel are directed to attend the contractor's regularly scheduled safety meetings.
2. Safety Vests: Safety vests are provided for and are to be worn by our personnel while on the job site.
3. Safety Flags: Safety flags are provided to our field technicians; one is to be affixed to the vehicle when on site, the other is to be placed atop the spoil pile on all test pits.

In the event that the contractor's representative observes any of our personnel not following the above, we request that it be brought to the attention of our office.

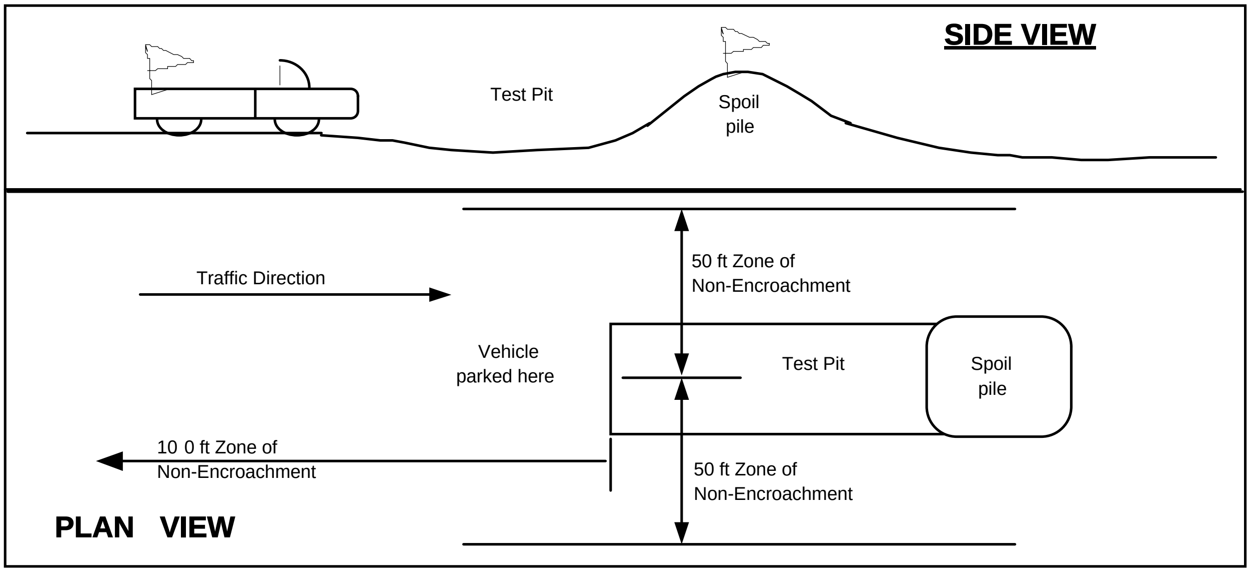
Test Pits Location, Orientation and Clearance

The technician is responsible for selecting test pit locations. The primary concern is the technician's safety. However, it is necessary to take sufficient tests at various locations to obtain a representative sampling of the fill. As such, efforts will be made to coordinate locations with the grading contractors authorized representatives (e.g. dump man, operator, supervisor, grade checker, etc.), and to select locations following or behind the established traffic pattern, preferably outside of current traffic. The contractors authorized representative should direct excavation of the pit and safety during the test period. Again, safety is the paramount concern.

Test pits should be excavated so that the spoil pile is placed away from oncoming traffic. The technician's vehicle is to be placed next to the test pit, opposite the spoil pile. This necessitates that the fill be maintained in a drivable condition. Alternatively, the contractor may opt to park a piece of equipment in front of test pits, particularly in small fill areas or those with limited access.

A zone of non-encroachment should be established for all test pits (see diagram below). No grading equipment should enter this zone during the test procedure. The zone should extend outward to the sides approximately 50 feet from the center of the test pit and 100 feet in the direction of traffic flow. This zone is established both for safety and to avoid excessive ground vibration, which typically decreases test results.

TEST PIT SAFETY PLAN



Slope Tests

When taking slope tests, the technician should park their vehicle directly above or below the test location on the slope. The contractor's representative should effectively keep all equipment at a safe operation distance (e.g. 50 feet) away from the slope during testing.

The technician is directed to withdraw from the active portion of the fill as soon as possible following testing. The technician's vehicle should be parked at the perimeter of the fill in a highly visible location.

Trench Safety

It is the contractor's responsibility to provide safe access into trenches where compaction testing is needed. Trenches for all utilities should be excavated in accordance with CAL-OSHA and any other applicable safety standards. Safe conditions will be required to enable compaction testing of the trench backfill.

All utility trench excavations in excess of 5 feet deep, which a person enters, are to be shored or laid back. Trench access should be provided in accordance with OSHA standards. Our personnel are directed not to enter any trench by being lowered or "riding down" on the equipment.

Our personnel are directed not to enter any excavation which;

1. is 5 feet or deeper unless shored or laid back,
2. exit points or ladders are not provided,
3. displays any evidence of instability, has any loose rock or other debris which could fall into the trench, or
4. displays any other evidence of any unsafe conditions regardless of depth.

If the contractor fails to provide safe access to trenches for compaction testing, our company policy requires that the soil technician withdraws and notifies their supervisor. The contractors representative will then be contacted in an effort to effect a solution. All backfill not tested due to safety concerns or other reasons is subject to reprocessing and/or removal.

Procedures

In the event that the technician's safety is jeopardized or compromised as a result of the contractor's failure to comply with any of the above, the technician is directed to inform both the developer's and contractor's representatives. If the condition is not rectified, the technician is required, by company policy, to immediately withdraw and notify their supervisor. The contractor's representative will then be contacted in an effort to effect a solution. No further testing will be performed until the situation is rectified. Any fill placed in the interim can be considered unacceptable and subject to reprocessing, recompaction or removal.

In the event that the soil technician does not comply with the above or other established safety guidelines, we request that the contractor bring this to technicians attention and notify our project manager or office. Effective communication and coordination between the contractors' representative and the field technician(s) is strongly encouraged in order to implement the above safety program and safety in general.

The safety procedures outlined above should be discussed at the contractor's safety meetings. This will serve to inform and remind equipment operators of these safety procedures particularly the zone of non-encroachment.

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