ARAGÓN GEOTECHNICAL, INC.
Consultants in the Earth & Material Sciences

PRELIMINARY GEOTECHNICAL INVESTIGATION
"RIDER STREET AT REDLANDS AVENUE" PROJECT
CITY OF PERRIS, RIVERSIDE COUNTY, CALIFORNIA

FOR
FIRST INDUSTRIAL REALTY TRUST, INC.
898 N. PACIFIC COAST HWY., SUITE 175
EL SEGUNDO, CALIFORNIA 90245

PROJECT NO. 4534-SFI
AUGUST 9, 2019

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August 9, 2019
Project No. 4534-SFI

First Industrial Realty Trust, Inc.
898 N. Pacific Coast Highway, Suite 175
El Segundo, California 90245

Attention: Mr. Matt Pioli

Subject: Preliminary Geotechnical Investigation Report
Proposed "Rider Street at Redlands Avenue" Light Industrial Project
City of Perris, Riverside County, California.

Mr. Pioli:

In accordance with our proposal dated June 10, 2019 and your authorization, Aragón Geotechnical Inc. (AGI) has completed preliminary geotechnical and geological assessments for the above-referenced project. The attached report presents in detail the findings, opinions, and recommendations developed as a result of surface inspections, subsurface exploration and field tests, laboratory testing, and quantitative analyses. Our scope included an infiltration feasibility study for stormwater BMPs, but excluded environmental research and materials testing for contaminants in soil, groundwater, or air at the site. Infiltration-related findings have been presented in a separate report for the civil designer's use in formulating a required water quality management plan.

Subsurface site characterization was based on eleven exploratory borings arrayed within the proposed construction area. Drilled intervals encountered massive Pleistocene-age alluvial strata comprising sandy silt, silt, clayey silt, and clayey sand as majority classifications within 50 feet of existing grades. A veneer of younger, sometimes low-density silty sand alluvium blanketed almost all of the building site. Mapped floodplain areas in the northeastern project area lacked the silty sand layer. The surficial materials have been loosened by former agricultural tilling, burrowing fauna, and seasonal shrink-swell phenomena. Site soils were classified compressible within 5 to 7 feet of existing grades. AGI did not find evidence for pre-existing fill. Saturated soils were encountered in two borings starting at depths of about 37 feet and 45 feet. Although a static phreatic surface was not measurable in either hole, these depths were consistent with known groundwater depths within a half-mile radius.

Geologic constraints to development will require inclusion of structural measures to mitigate the high likelihood of strong earthquake ground motions at the site. However, risks from other natural hazards including liquefaction, surface fault rupture, excessive settlement, gross instability or landsliding, seiching, induced flooding, and tsunami appear to range from extremely low to zero.

Findings indicate the site should be suitable for a large warehouse-type structure from a geotechnical viewpoint. AGI recommends that loose and porous shallow-depth alluvium be removed and replaced as compacted engineered fill for adequate support of new fills, structures, and new pavements. Acceptable remedial grading "bottoms" below the building outline will generally average between 5 and 7 feet below existing surfaces, deepening slightly toward the north and northeast. All site soils should be acceptable for reuse in compacted fills. AGI guidance is recommended to institute limited selective grading to place non-expansive soils near pad subgrades to the maximum extent feasible.

It is AGI's preliminary conclusion that properly designed and constructed conventional shallow footings should provide adequate building support. Overexcavation is recommended when or if needed to supply at least 36 inches of engineered fill below all shallow spread and continuous footings. On-and off-site pavement areas should be partly stripped and partly processed-in-place to create recompacted depths of approximately 36 inches. Paved areas in cuts deeper than two feet should require only soil processing in place.

In addition to foundation design guidelines, including preliminary recommended design values for both vertical and lateral loads, this report presents recommendations for site earthwork, prescriptive code values for use in seismic groundshaking mitigation, concrete mix designs, and construction observation. It is recommended that grading and foundation plan reviews be performed by AGI prior to construction.

Thank you very much for this opportunity to be of service. Please do not hesitate to call our Riverside office if you should have any questions.

Very truly yours,
Aragón Geotechnical Inc.

Mark G. Doerschlag, CEG 1752
Engineering Geologist

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Geotechnical Engineer, G.E. No. 2994

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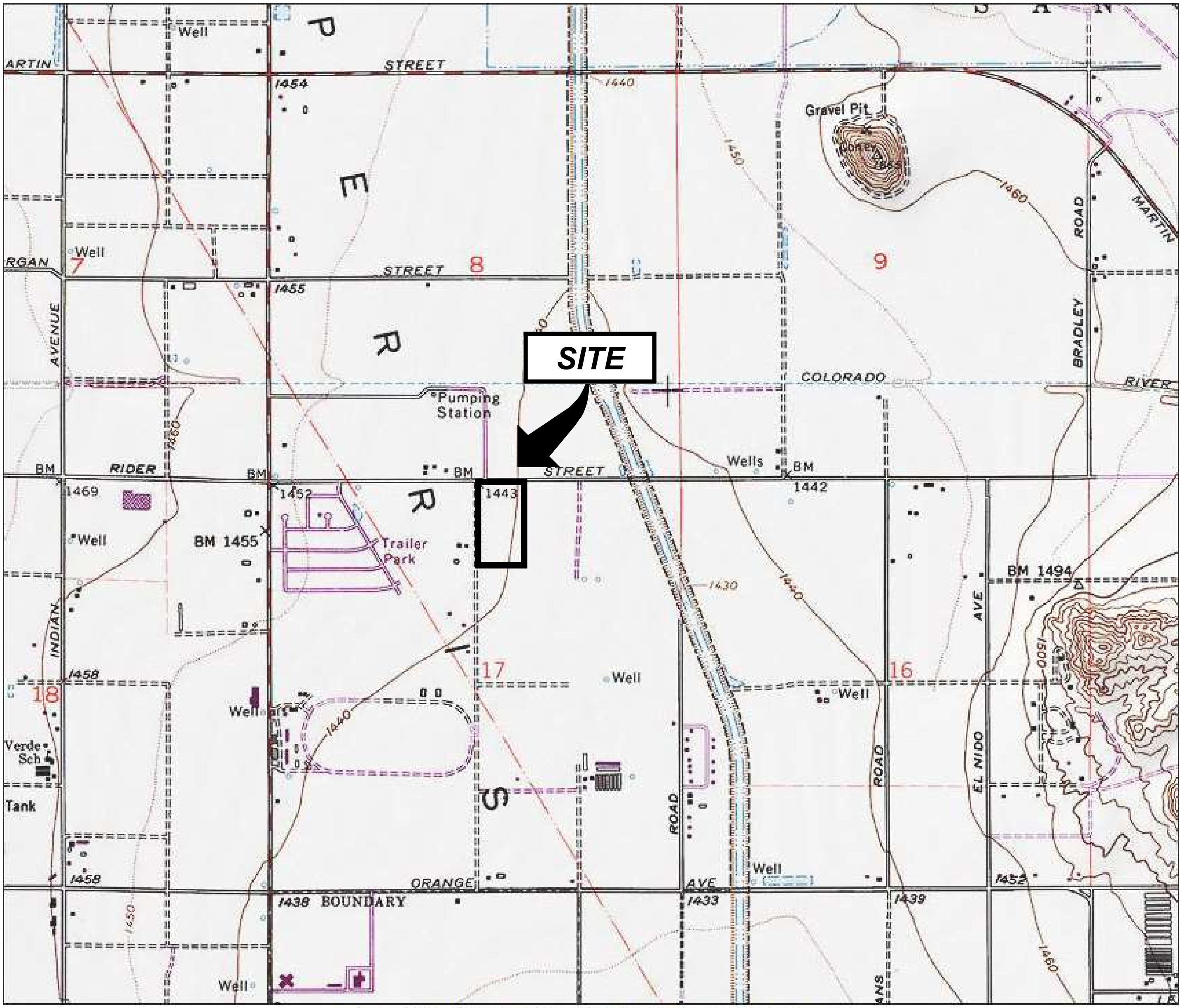
1.0 INTRODUCTION

This report presents the results of preliminary soils engineering and geologic evaluations conducted by Aragón Geotechnical, Inc. (AGI) for a proposed logistics warehouse or light manufacturing facility situated southeast of the intersection of Rider Street at Redlands Avenue, Perris, California. The rectangular project site comprises 5 contiguous land parcels (APN 300-210-001 through 300-210-005) and totals 16.26 gross acres. Map coordinates at the northeast project corner are 33.83002°N x 117.21524°W (this coordinate point was selected for seismological analyses based on closest site-to-source distance). Situs per the Public Lands Survey System places the project in the NE¼ of Section 17, Township 4 South, Range 3 West (San Bernardino Baseline and Meridian). The accompanying Site Location Map, Figure 1, depicts the general location of the project on a 1:24,000-scale topographic quadrangle map. Although out-of-date with respect to the rapid urbanization of the surrounding Perris Valley area, the older map series was selected for better depictions of ground slope and drainage patterns.

The primary objectives of our investigation were to determine the nature and engineering properties of the subsurface materials underlying the project area, in order to assess site suitability for the building and to provide *preliminary* foundation design, grading, and construction recommendations. Accordingly, our scope included reconnaissance of the 5 parcels and surrounding acreage, aerial photo interpretation, geologic literature research, subsurface exploration, recovery of representative soil samples, laboratory soils testing, and geotechnical analyses. Authorized services included field tests to characterize water infiltration potential at a pair of prospective water-quality basin sites. An infiltration feasibility report has been issued by AGI under separate cover for the design civil engineer’s use in formulating a required water quality management plan.

Geological assessments focused on risks posed by active earthquake faults, strong ground motion, liquefaction or other secondary seismic hazards, and groundwater. These were evaluated using published resources and site-specific qualitative analyses, plus conclusions drawn from field findings and local case-history experience. However, environmental research, Phase I or Phase II environmental site assessments, monitoring well construction, or contaminant testing of air, soil, or groundwater found in the site were beyond the scope of this geotechnical investigation.



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Reference: U. S. Geological Survey 7½-Minute Series Topographic Map, Perris Quadrangle (1979).

AGI

SITE LOCATION MAP

RIDER ST. AT REDLANDS AVE SITE, PERRIS, RIVERSIDE COUNTY, CA.

PROJECT NO. 4534-SFI	DATE: 8/9/19	**FIGURE 1**

2.0 PROPOSED CONSTRUCTION

A conceptual site development plan originating from the Irvine firm of RGA Office of Architectural Design was referenced for property information and borehole locality selection. The scaled drawing (Scheme 01) lacked elevation contours but included the planned envelope of an approximately rectangular 338,110-square-foot industrial building more or less centered in the site. Clearance-under-beam dimensions and finish floor elevations have not been specified. Two office areas, potentially with mezzanine levels, are planned in the northwestern and southwestern building corners. Truck dock doors would be situated on the east side of the structure. Based on regional practices, AGI anticipated that the structural system would feature concrete tilt-up walls with parapet heights of possibly 45 to 60 feet, supported by perimeter shallow foundations. Engineered roof trusses would rest on isolated interior steel columns. Moderate foundation loads would be predicted for walls and columns. Basements or other subterranean construction were not shown on the drawing and would be unlikely. Jurisdiction for development entitlements will be exercised by the City of Perris.

Surrounding the building, concrete paving is expected in truck areas while lighter-duty asphalt sections could be substituted in automobile driveways and stalls. Limited areas for collection, treatment, and disposal of stormwater runoff may exist next to Redlands Avenue and in a pair of prospective BMP basins near the eastern project-area corners. Live sewer, water, and gas utilities exist in street rights-of-way next to the property, and would presumably connect with the new building via buried service laterals.

Future grading would probably be a cut-and-fill operation. We suspect that grading could involve soil imports to help raise industrial floor elevations above general terrain elevations and for flood protection. Raw cut-and-fill quantities can be expected to increase based on ground preparation measures we can foresee for the building pad. Neither earthen slopes nor retaining walls are shown on conceptual plans, but in our view are unlikely to be needed on the very flat site.

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

Subsurface geotechnical site characterization comprising 11 exploratory soil borings was completed by AGI on July 8 and 9, 2019. Four out of five individual properties featured existing structures, landscaping, greenhouses, and storage yards that created some access impediments. However, enough gaps and vacant lot areas were present to allow creation of a well-spaced soil boring array. AGI-selected drill sites were cleared of utility interference issues by notification to the 811 DigAlert service in advance of AGI's work. Soil borings were preferentially sited to explore possible "least-favorable" locations identified from aerial photos and other geological resources, while also meeting a goal of spanning the building envelope to gauge the degree of geotechnical site variability. Soil boring locations and depths were not fixed, however, and were modified by AGI's field geologist where appropriate to obtain data concerning: (1) Soil material classifications, water contents, in-place densities, and settlement potential in light of local geological interpretations; (2) Presence or absence of groundwater; (3) Continuity of layers or units across the property; and (4) Unit geological origins and a derivation of site "stiffness" for earthquake engineering purposes.

The soil borings were drilled with a truck-mounted hollow-stem auger rig capable of driving and retrieving soil sample barrels. Borehole termination depths ranged from 11.5 to 51.5 feet. None of the borings encountered bedrock or were halted by machine refusal. As expected, all borings encountered deep sediments that were amenable to drive-tube sampling, performed at 2-foot to 5-foot depth increments. At shallow depths where soil bearing capacity and settlement potential would be the main items of concern, relatively undisturbed soil samples were recovered by driving a 3.0-inch-diameter "California modified" split-barrel sampler lined with brass rings. Deeper horizons in most borings included Standard Penetration Tests (SPTs) conducted using an unlined 2.0-inch O.D. split-barrel spoon. All sampler driving was done using rods and a mechanically actuated automatic 140-pound hammer free-falling 30 inches. Bulk samples of auger cuttings representative of shallow native materials found near the northern and southern ends of the proposed building were bagged. All geotechnical samples were brought to AGI's Riverside laboratory for assigned soils testing.

Drill cuttings and each discrete sample were visually/manually examined and classified according to the Unified Soil Classification System, and observations made concerning relative density, constituent grain size, visible macro-porosity, plasticity, and past or present groundwater conditions. Continuous logs of the subsurface conditions encountered were recorded by a senior Engineering Geologist, and the results are presented on the Field

Boring Logs in Appendix A. The approximate locations of the borehole explorations are illustrated on the Geotechnical Map (Plate No. 1 foldout), located at the back of this report.

"Undisturbed" samples were tested for dry density and water content. One-dimensional consolidation tests were conducted on selected barrel samples in order to evaluate settlement or collapse potential. Collapsible soils undergo rapid, irreversible compression when brought close to saturation while also subjected to loads such as from buildings or fill. The recovered bulk soil samples were evaluated for index and engineering properties such as shear strength, compaction criteria, expansion potential, and corrosivity characteristics. Discussions of the laboratory test standards used and the test results are presented in Appendix B.

4.0 SITE GEOTECHNICAL CONDITIONS

4.1 Previous Site Uses

AGI's scope included limited historical research to ascertain changes to surficial conditions through time, and address known or possible geotechnical impacts to project design or construction. Stereoscopic aerial photographs archived at the Riverside County Flood Control and Water Conservation District headquarters in Riverside, California, were interpreted for evidence of past structures, land use, and for geological assessments of active faulting potential and geomorphic history. Older monoscopic pictures were downloaded from the U.C. Santa Barbara Aerial Collections web application. Finally, the on-line version of the U.S. Geological Survey Historical Map Collection was accessed for digital scans of topographic quadrangle sheets pre-dating the referenced base map used for Figure 1. Reviewed historical sources are listed under "References" at the end of this report.

For decades beginning before 1938 and up until at least the mid-1970's, the site was a single agricultural field used for dry-farmed grain crops and irrigated alfalfa. Buildings were not present within the project limits. A 12-foot-tall concrete irrigation standpipe (still present today) was located in the far northwest site corner next to a large eucalyptus tree. There were no confirmed past uses for stock raising, poultry ranching, feedlot, or dairying operations.

By 1980 the first subdivided lot ("Reyez property") in the northeast corner had been split from the field and improved with a small mobile home. The rest of the lot was barren. This property over the years acquired additional outbuildings, stored vehicles and equipment, a covered patio, and fairly lush landscaping near the home. An animal pen was installed near the middle of the property. Turkey pens were situated along the southern property line. These were removed more than 10 year ago, however, according to the owner.

Lots fronting onto a then-unimproved dirt Redlands Avenue were developed between 1980 and 1990 with manufactured housing and one commercial site ("Lopez property"). The latter is a plastering business with several shop buildings, storage containers, a storage yard for scaffolding, and a large inventory of EPS architectural foam shapes. Redlands Avenue does not appear to have been completed as a improved paved street until 2007-2009.

4.2 Surface Conditions

Project limits are defined by Rider Street to the north, Redlands Avenue on the west side, a vacant field to the south, and a mix of rural-residential and commercial lots to the east. Chain-link or simple barbed-wire fences demarcate private property boundaries. None of the constituent parcels seem to have experienced grading or dumping of fill soils. Mobile homes or pre-engineered buildings and some mature trees are present on APNs 300-210-002 through 300-210-005. To date, AGI has not seen any evidence for private wells in the project area. Water mains are present in the neighboring streets. Since the 1980s, vacant APN 300-210-001 in the northwest quadrant has been periodically disced for weed abatement.

The project area features a very low-gradient slope of under a half-percent toward the east-southeast according to Riverside County Flood Control contour maps. Relief within the 16-acre site is estimated to be only about 3 feet. Very soft and disturbed soil surfaces dominate the recently cleared APN 300-210-001. The remaining parcels have variously firm native-soil or crushed-rock surfaces. It appears that most incident rainfall is absorbed by unpaved and disturbed surface horizons, although excess water runoff can move unimpeded as sheetflow through the individual lots eastward toward ultimate interception by improved Wilson Avenue.

4.3 Subsurface Conditions

AGI soil borings penetrated vertically heterogeneous alluvial soil sequences that could be grouped into three general packages:

(1) A surficial zone dominated by silty sand (Unified Soil Classification System classification SM) with subordinate sandy silt (ML). The zone ranged between 8 and 10 feet thick in borings near the southern project limits. The middle and northern segments of the building envelope had from ~2 to 5 feet of silty sand. The unit was completely absent from the northeast corner area. Surficial soils have been "churned" by burrowing fauna and consistently exhibited visible porosity to depths of 5 to 5½ feet. Mild to moderate soil cementation was noted near 3-foot depths. The surficial silty sand horizons tended to have low *in situ* density and sometimes low penetration resistance for sampling tools. Logged ring sampler penetration resistance ranged from 12 to 66 blows per foot.

(2) An intermediate-depth interval of alluvial deposits composed mostly of fine-grained soil classifications of sandy silt, clayey silt, and silty clay (USCS ML and CL). These deposits were typically very stiff or hard, non-plastic, and frequently shot through with abundant whitish-colored calcium carbonate as interstitial cement, fracture linings, or laminar precipitates. Where weathered near ground surfaces, fine-grained soils exhibited poor cohesion and soft, punky textures judged to be highly compressible. Deeper horizons *not* subject to weathering were cohesive and proven to have low compressibility in laboratory tests.

(3) Sequences dominated by coarse-grained soil classifications of clayey sand (SC) and subordinate silty sand (SM) at depths beyond 35 to 37 feet. Logged relative densities ranged from medium dense to very dense. Almost all recovered samples appeared massive, i.e., without distinct stratification, although sample variability implied soil coarse-fine proportions changed over spans of feet.

Laboratory tests corroborated field logs of slightly variable but mostly low clay content in the surficial zone. Near-surface soils collected from the approximate southeast building corner produced an expansion index of only 2 (categorically "very low" expansion potential), while a blended sand + silt sample from the northwest building corner produced an expansion index of 20 ("low" potential). Surficial sandy materials were also characterized by high achievable maximum dry density on the order of 134 pounds per cubic foot based on modified Proctor methods.

The deeper silty and clayey sequences were interpreted to be far older than the surficial horizons. Pedogenic alteration and concentration of whitish-colored calcium carbonate as interstitial cement, fracture fillings, and laminar hardpans was sometimes more than 10 feet thick. Consolidation tests showed that clay-bearing fine-grained soil types that have been subjected to subaerial weathering and moisture changes may be prone to collapse when saturated under load, even where not described as porous. Vesicular textures and pinhole voids are reliable indicators for detecting collapsible soils in the Inland area. However, testing also demonstrated that soils deeper than 5 to 7 feet, i.e., beyond typical active shrink-swell depths, should normally have very low compressibility. The contact between surficial silty sand zones and hardpan soils was usually fairly abrupt and typical of an erosional surface. Section 5.2 (Local Geologic Conditions) and the drill logs in Appendix A contain considerable additional descriptions and interpretations of soil conditions in the project area.

4.4 Groundwater

Very slow groundwater inflows were observed in two exploratory borings. Saturated or near-saturated soils were logged beginning at approximately 37 feet deep near the southern building limits. Wet conditions started near 45 feet deep in the north end of the proposed structure. Neither soil boring produced a measurable water pool. Nonetheless, the observed seepage was consistent with our knowledge of the Perris area and groundwater data from nearby properties. Shallower soil samples were not mottled with iron oxide staining, a telltale effect of episodic high groundwater. All other soil borings remained dry.

The project site is within the West San Jacinto groundwater subbasin. According to many years of monitoring well records reviewed through the State CASGEM website, groundwater within a radius of about a half-mile from the property has had minimum measured depths of about 40 feet east of the site, and 57 to 81 feet to the west. The hydrogeologic regime is complex due to the heterogeneity of the alluvial basin fill, substantial erosional relief of the buried bedrock surfaces under the southern Perris

Valley, and municipal groundwater pumping. The seepage zones would be best interpreted as perched water horizons. Close by is the Perris Valley Drain, un unlined flood control channel located a few hundred yards to the east. The channel represents a seasonal line of basin recharge. There has also been a historic tendency for groundwater levels to rise across the valley. Rising water levels are attributed to changing land uses in the Perris Plain vicinity, such as the cessation of formerly widespread agricultural pumping and introduction of irrigated suburban tracts.

Under current and predicted future conditions, *we judge that groundwater should remain at or below the minimum-detected 37-foot depth*. Shallower unsaturated soils tend to be cemented and/or fine-grained, and will not readily transmit seasonal rainfall as local recharge. Groundwater should not influence building design or construction. Any open excavation or shaft deeper than ~37 feet, however, could encounter saturated ground and water inflows. Future fluctuations in water surface elevations are possible, however, due to variations in precipitation, temperature, consumptive uses, or surrounding land use changes which were not present at the time observations were made.

5.0 ENGINEERING GEOLOGIC ANALYSES

5.1 Regional Geologic Setting

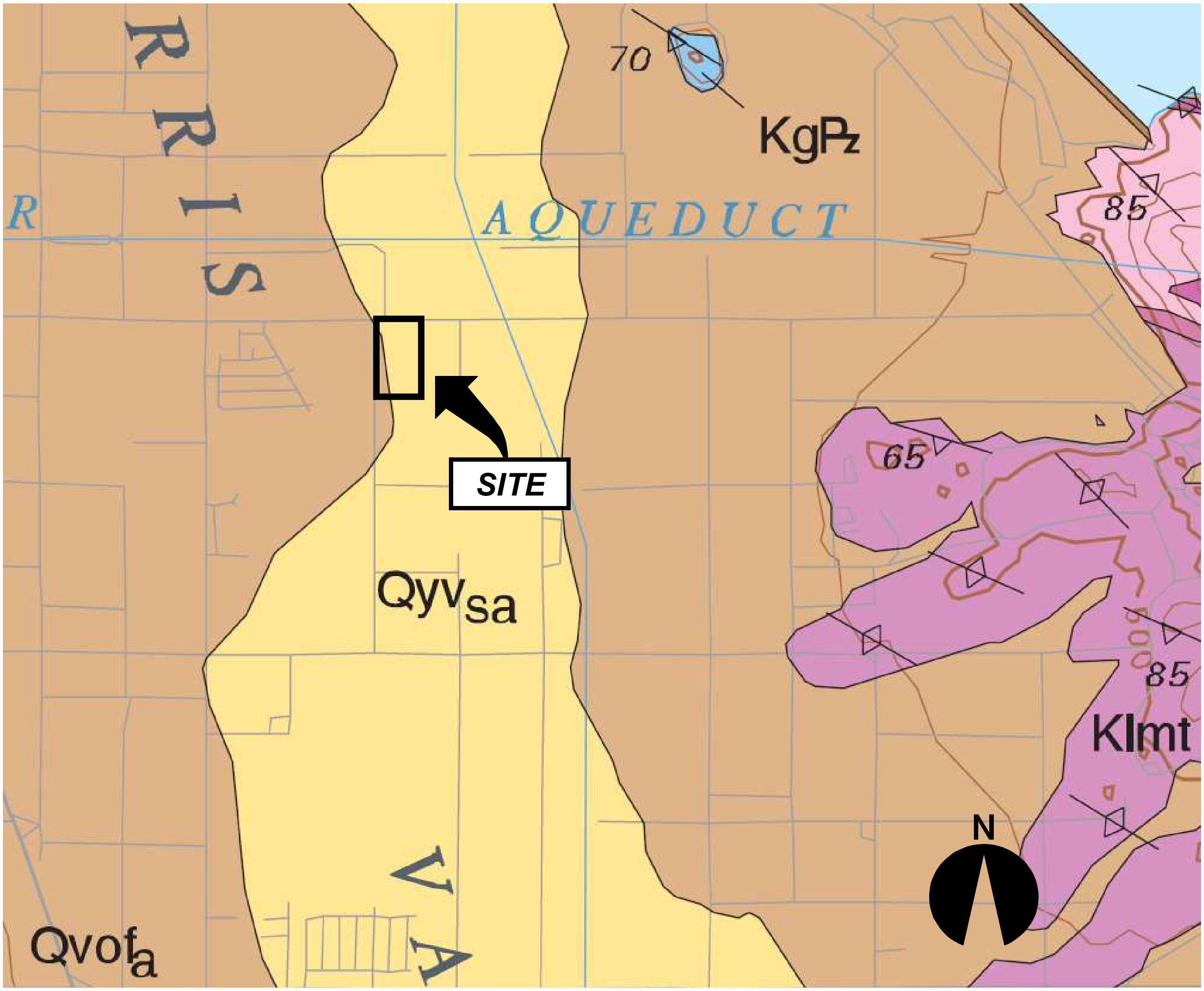
All of western Riverside County lies within the Peninsular Ranges Physiographic Province, one of 11 continental provinces recognized in California. The physiographic provinces are topographic-geologic groupings of convenience based primarily on landforms, characteristic lithologies, and late Cenozoic structural and geomorphic history. The Peninsular Ranges encompass southwestern California west of the Imperial-Coachella Valley trough and south of the escarpments of the San Gabriel and San Bernardino Mountains. Most of the province lies outside of California, where it comprises much of the Baja California Peninsula. The province is characterized by youthful, steeply sloped, northwest-trending elongated ranges and intervening valleys.

Structurally, the Peninsular Ranges province in California is composed of a number of relatively stable, elongated crustal blocks bounded by active faults of the San Andreas transform system. Although some folding, minor faulting, and random seismic activity can be found within the blocks, intense structural deformation and large earthquakes are mostly limited to the block margins. Exceptions are most notable approaching the Los Angeles Basin, where compressive stress gives rise to increasing degrees of vertical offset along the transform faults and a change in deformation style that includes young folds and active thrust ramps. Perris is located in the central portion of the Perris tectonic block, the longest sides of which are bounded by the San Jacinto fault zone to the northeast and the Elsinore and Chino fault systems to the southwest.

The Peninsular Ranges structural blocks are dominated by the presence of intrusive granitic rock types similar to those in the Sierra Nevada, although the province additionally contains a diverse array of metamorphic, sedimentary, and extrusive volcanic rocks. In general, the metamorphic rocks represent the highly altered host rocks for the episodic emplacement of Mesozoic-age granitic masses of varying composition. Parts of the province include thick sequences of younger marine and non-marine clastic sedimentary rocks of Mesozoic and Tertiary age, ranging from claystones to conglomerate. Pre-Quaternary sedimentary rocks are conspicuously absent from most of the Perris Block, however, which is dominated by crystalline basement materials.

5.2 Local Geologic Conditions

Bounded by sometimes bold mountainous terrain to the east and west, the Perris Plain is entirely underlain by massive to crudely bedded alluvium. Morton and Miller (2006) assign an early to middle Pleistocene age for very old alluvium (unit $Qvof_a$, Figure 2) that composes the majority of the topographical valley floor. The map exhibit also delineates a ribbon-like zone of younger Quaternary alluvium that follows the valley axis and supposedly underlies most of the site. Data from Rider Street and other nearby projects show that younger deposits actually tend to be very thin or absent in valley floodplain areas such as the eastern portions of the project. AGI interprets surficial silty sand in the site to be representative of younger (but probably still pre-Holocene age) alluvium derived from elevated granitic bedrock terrain west of the Interstate 215 freeway. These deposits thicken westward. The regional map is erroneous. The Perris Plain is considered part of the “Paloma” depositional surface



Selected vicinity units:

0 0.5 1.0 mi.

Qyv_{sa}	Young sandy axial-valley alluvial deposits (Holocene and late Pleistocene)
$Qvof_{a}$	Very old sandy alluvial-fan deposits (middle to early Pleistocene)
KgPz Klmt	Granitic and mixed intrusive/metamorphic basement rocks composed of tonalite, granodiorite, and banded gneiss (Cretaceous and older)

Reference: Modified after Morton and Miller (2006). Scale is approximate.

VICINITY GEOLOGIC MAP

RIDER ST. AT REDLANDS AVE. SITE, PERRIS, RIVERSIDE COUNTY, CA.

PROJECT NO. 4534-SFI	DATE: 8/9/19	**FIGURE 2**

of Woodford et al. (1971), typified by fairly strongly developed illuvial clay and calcic horizons atop the older parent materials. The drilling logs hint that the deeper soils grossly describe a fining-up sequence within 35 to 40 feet of existing grade.

The alluvium conceals several deep erosional channels carved into granitic basement bedrock that can be considered tributaries to an ancestral San Jacinto River. The maximum depth of the $Qvof_a$ unit at the warehouse site is not known with certainty, but based on water well data is inferred to be at least 400 feet. Bedrock contour maps suggest the site is actually over a bedrock valley that angles northeast towards Lake Perris. Granitic bedrock consisting of weakly foliated quartz diorite (Lakeview Mountains tonalite) rises to the surface only about 1¼ miles east of the project site.

5.3 Slope Stability

The almost zero-relief site was found to be free of natural features associated with gross instability of slopes. The property is also distant from mountainous slopes surrounding Perris Valley. We judge landslide risks to be nil.

5.4 Flooding

AGI reviews of Riverside County GIS maps suggested that about 0.5 acres in the far northeast site corner might be in “100-year” floodplain zones close to the Perris Valley Drain. However, according to the official revised (2014) FEMA Flood Insurance Rate Map for the site and vicinity, “100-year” flood volumes should remain closer to the - Perris Valley Drain channel (Figure 3). We suspect the County GIS map is out-of-date.

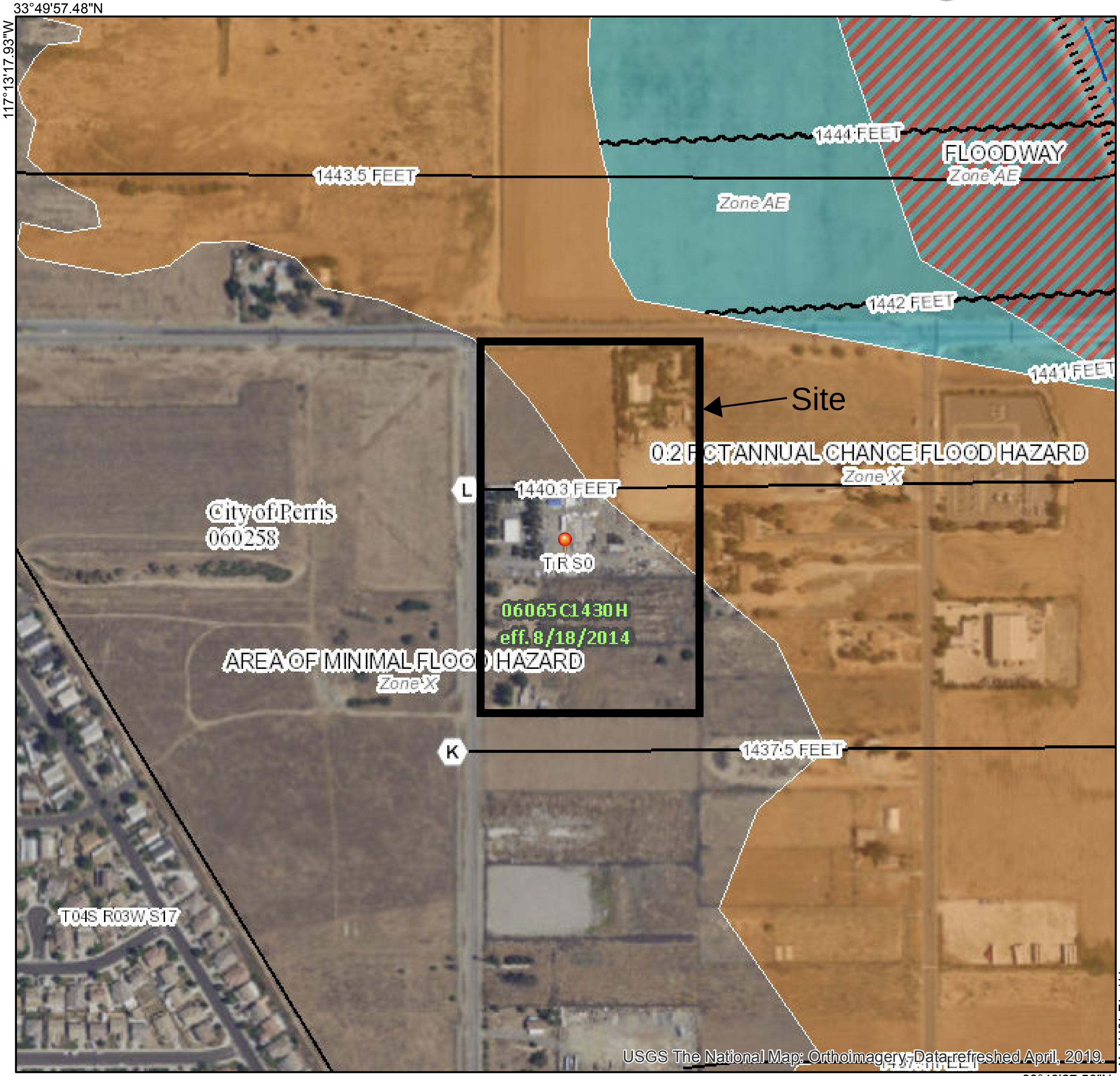
Per the referenced susceptibility map, certain northeastern-area terrain is zoned for 0.2 percent chance per annum for flood hazard, i.e., “500-year” floodplain. There are normally few restrictions for non-critical facilities developed in 500-year risk management zones, although an owner’s election to protect against flooding by raising the building floor can be considered. We suspect that the maximum 500-year flood depth in the project is under a foot. Maximum water depth would be at the northeast corner.

National Flood Hazard Layer FIRMette

FEMA

33°49'57.48"N

117°13'17.93"W



117°12'40.47"W

33°49'27.59"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/8/2019 at 2:07:00 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Figure 3

5.5 Faulting and Regional Seismicity

The project is situated in region of active and potentially active faults, as is all of metropolitan Southern California. Active faults present several potential risks to structures and people. Hazards associated with active faults include strong earthquake ground shaking, soil densification and liquefaction, mass wasting (landsliding), and surface rupture along active fault traces. Generally, the following four factors are the principal determinants of seismic risk at a given location:

- Distance to seismogenically capable faults.
- The maximum or "characteristic" magnitude earthquake for a capable fault.
- Seismic recurrence interval, in turn related to tectonic slip rates.
- Nature of earth materials underlying the site.

5.5.1 Fault Rupture Potential

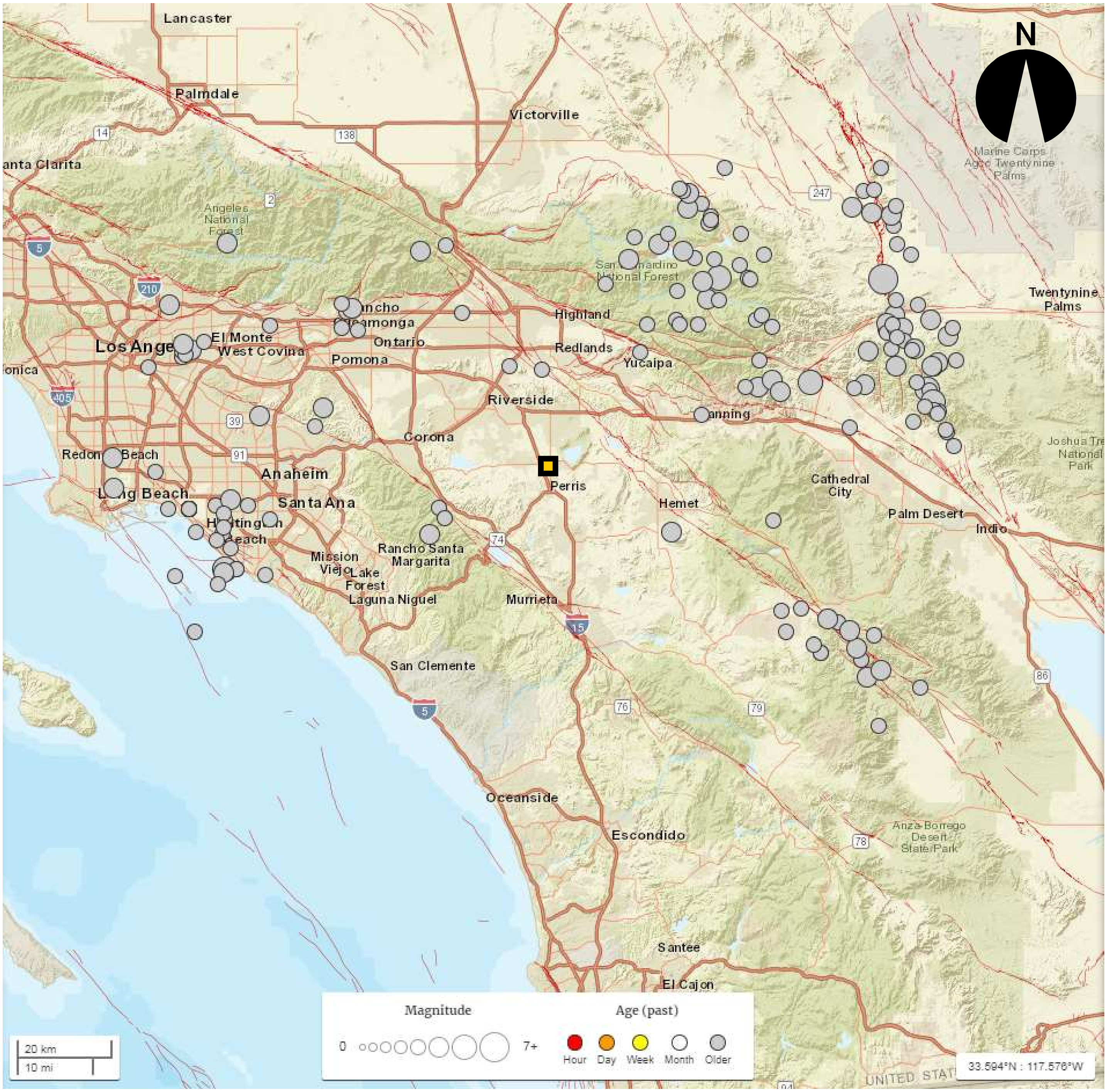
Surface rupture presents a primary or direct potential hazard to structures built across an active fault trace. Reviews of official maps delineating State of California Earthquake Fault Zones and Riverside County Fault Hazard Management zones indicated the project site is not located in a zone of required investigation for active faulting. The closest known active regional fault traces are associated with the San Jacinto Fault east of Moreno Valley, about 8.8 miles away at closest approach. Aerial photographic interpretations did not suggest visible lineaments or manifestations of fault topography related to active fault traces on or adjacent to the site. Accordingly, chances for direct surface fault rupture affecting the project are judged to be extremely low.

5.5.2 Strong Motion Potential

All Southern California construction is considered to be at high risk of experiencing strong ground motion during a structure's design life. In addition to the previously mentioned San Jacinto fault zone, the San Andreas Fault can be considered a potentially significant sources of lower-frequency and longer-duration shaking at the project. Other, more-distant regional faults are very unlikely to cause shaking as intense as that caused by rupture of one of the two listed faults. Probabilistic risk models for the Perris-Moreno Valley area fundamentally assign the highest seismic risks from large characteristic seismic events along the San Jacinto fault system. The mode-magnitude event for peak ground acceleration at a 2% in 50-year exceedance risk is a multi-segment M_w8.1 earthquake on the San Jacinto fault (U.S. Geological Survey, 2019b; dynamic conterminous U.S. 2014 model).

The searchable ANSS Comprehensive Earthquake Catalog indicates about 176 events of local magnitude M4.5 or greater have occurred within 100 kilometers of the project since instrumented recordings started in 1932 (Figure 4, next page). Clusters of epicenters are associated with the 1992 Landers and triggered Big Bear Lake events. These and other notable historical earthquakes in southern California over the last 30 years (e.g., Northridge, Hector Mine) were far away. They produced estimated peak ground accelerations well under 0.20g in the City of Perris area. Interestingly, earthquakes larger than the selected M4.5 intensity threshold have been rare along the northern San Jacinto fault and the San Andreas fault, even though both have among the fastest slip rates and shortest mean recurrence intervals among all California faults.

San Jacinto Fault: The San Jacinto fault constitutes a set of *en-échelon* or right- and left-stepping fault segments stretching from near Cajon Pass to the Imperial Valley region. The primary sense of slip along the zone is right-lateral, although many individual fault segments show evidence of at least several thousand feet of vertical displacement. The San Jacinto fault zone has been very active, producing possibly eight historical earthquakes of local magnitude 6.0 or greater. The communities of Hemet and San Jacinto were heavily damaged in 1918 and again in 1923 from events on the San Jacinto Fault. Pre-instrumental interpreted magnitudes for these events were M_L6.8 and M_L6.3, respectively. The historical record suggests each discrete segment *usually* reacts to tectonic stress more or less independently from the others, and to have its own characteristic large earthquake with differing maximum magnitude potential and recurrence interval. Researchers and code development authorities now model the fault with potential for multi-segment rupture, however, with consequent increases in calculated risk to structures.



Reference: U. S. Geological Survey (2019c) real-time earthquake epicenter map. Plotted are 176 epicenters of instrument-recorded events from 1932 to present (8/9/19) of local magnitude M4.5 or greater within a radius of ~62 miles (100 kilometers) of the site. Location accuracy varies. The site is indicated by the gold square. The red lines indicate the approximate surface traces of Quaternary active faults. The selected magnitude corresponds to a threshold intensity value where light damage potential begins. These events are also generally widely felt by persons. Notable Southern California historical events with epicenters just beyond the selected search radius would include the Northridge earthquake [San Fernando Valley], and the Hector Mine event in the Mojave Desert north of Yucca Valley.

AGI	**SIGNIFICANT EVENT EPICENTER EXHIBIT**		
	RIDER ST. AT REDLANDS AVE. SITE, PERRIS, RIVERSIDE COUNTY, CA.		
	PROJECT NO. 4534-SFI	DATE: 8/9/19	**FIGURE 4**

San Andreas Fault: For most of its over-550-mile length, the San Andreas Fault can be clearly defined as a narrow, discrete zone of predominantly right-lateral shear. The southern terminus is close to the eastern shore of the Salton Sea, where it joins a crustal spreading center marked by the Brawley Seismic Zone. To the northwest, a major interruption of the otherwise relatively simple slip model for the San Andreas fault is centered in the San Gorgonio Pass region. Here, structural complexity resulting from a 15-kilometer left step in the fault zone has created (or reactivated) a myriad of separate faults spanning a zone 5 to 7 kilometers wide (Matti, et al., 1985; Sieh and Yule, 1997; 1998). Continuing research is refining speculation that propagation of ruptures from other portions of the San Andreas Fault might not be impeded through the Pass region. New data suggest the San Bernardino and Coachella Valley segments of the fault may experience concurrent rupture roughly once out of every three to four events. Multi-segment cascade rupture is currently considered in all 2008 and later State of California seismic hazard models (Petersen, 2008; Working Group, 2013), and has been adopted as a scenario event for emergency response training such as the annual ShakeOut drill.

Source characteristics for the two regional active fault zones with the highest contributions to site risks are listed in the following table. Fault data have been summarized from WGCEP (2013) as implemented for the latest California fault model. Magnitudes are based on a probabilistic recurrence interval of 2,475 years for each source, binned to nearest 0.05 magnitude decrement. The reference magnitudes usually reflect cascade ruptures.

Regional Seismic Source Parameters

Fault Name (segment)	Distance from Site (km)	Length (km)	Geologic Slip Rate (mm/yr)	Magnitude @ 2% in 50 Yr. Prob., M_W
San Jacinto (w/ stepovers)	14.2	25	14.0	8.1
San Andreas (Coachella→Mojave South)	31.9	302	10.0 to 32.5	8.25

Version 3 of the Uniform California Earthquake Rupture Forecast (UCERF3) will be the reference fault source model for future California building codes and insurance risk analyses. Utilizing knowledge of tectonic slip rates and last historical or constrained paleoseismic event dates, UCERF3 includes *time-dependent* rupture probabilities for many major California faults. For the San Jacinto fault zone (stepovers combined) between Hemet and Moreno Valley, the model ascribed a 13.8% chance for an earthquake of $M \geq 6.7$ in the next 30 years beginning in 2015 (Field et al., 2015). The conditional probability for an earthquake of magnitude $M_W \geq 6.7$ somewhere along the southern San Andreas Fault was calculated at 57 percent in 30 years. These probabilities will increase each year for successive 30-year windows. Most researchers peg the southern San Andreas as "overdue" for a very large earthquake.

Earthquake shaking hazards are quantified by deterministic calculation (specified source, specified magnitude, and a distance attenuation function), or probabilistic analysis (chance of intensity exceedance considering all sources and all potential magnitudes for a specified exposure period). With certain special exceptions, today's engineering codes and practice generally utilize (time-independent) probabilistic hazard analysis. Prescribed parameter values calculated for the latest 2014 U.S. national hazard model indicate the site has a 10 percent risk in 50 years of peak ground accelerations (pga) exceeding approximately 0.53g, and 2 percent chance in 50-year exposure period of exceeding .96g (U.S. Geological Survey, 2019b). The reported pga values were linearly interpolated from 0.01-degree gridded data and include soil correction (NEHRP site class D; local shear wave velocity estimate $V_{s30} \approx 260$ m/sec). Calculated peak or spectral acceleration values should never be construed as representing exact predictions of site response, however. *Actual* shaking intensities from any seismic source may be substantially higher or lower than estimated for a given earthquake event, due to complex and unpredictable effects from variables such as:

- Near-source directivity of horizontal shaking components
- Fault rupture propagation direction, length, and mode (strike-slip, normal, reverse)
- Depth and consistency of unconsolidated sediments or fill

- Topography
- Geologic structure underlying the site
- Seismic wave reflection, refraction, and interference (basin effects)

5.5.3 Secondary Seismic Hazards

Secondary hazards include landsliding or mass wasting, liquefaction, flooding (from ruptured tanks or canals, inundation following dam collapse, surface oscillations in enclosed water bodies, or tsunami), and combined saturated-unsaturated soil subsidence as a result of dynamic soil densification. All of these induced hazards are consequences of earthquake ground motion given the right set of initial conditions.

Flooding. AGI categorically rules out tsunami and seiche hazards. The project site is inland and not adjacent to lakes or open reservoirs. Induced flooding risks from municipal water storage tanks are also absent.

Parts of the Perris Valley including the Rider Street site would be impacted by breaching of the Lake Perris dam. Other reservoirs near Hemet (Lake Hemet; Diamond Valley Lake) do not pose inundation hazard, as the site appears to be passively protected by elevation. In July 2005, the State identified potential seismic safety problems with Perris Dam. Deficiencies with the alluvial foundation soils were addressed by several years of construction to stabilize the downstream embankment and mitigate liquefaction potential. Work was completed in 2018. We believe reservoir loss potential is now extremely remote and is below a level of regulatory concern for ordinary construction.

Liquefaction. Riverside County classifies the site as "low" to "moderate" liquefaction potential. The site is not within State-delineated "Zones of Required Investigation" for either liquefaction potential or landsliding (California Department of Conservation, 2019b). Opportunity is present, as evidenced by interpreted perennial perched-water horizons less than 50 feet deep. However, our investigation findings are that the site lacks liquefaction-susceptible materials. The sedimentary layers are geologically old and have high relative densities. Field tests demonstrated that saturated older alluvium universally has corrected SPT $N_{1(60)cs}$ values exceeding 30. Worldwide empirical data have demonstrated that liquefaction triggering is extremely unlikely whenever saturated soils meet a criterion of corrected $N \geq 30$. The site *passes* regulatory screening criteria used to differentiate sites with liquefaction hazard from those that have minimal hazard (California Department of Conservation, 2008). Related permanent ground deformation phenomena such as ground fissuring, ejection of pressurized sand-water mixtures from shallow liquefied layers (sand boils), flow slides, and lateral spreading have also been ruled out as hazards.

Subsidence. AGI finds that surface settlements from saturated and dry-sand volumetric changes should be trivial assuming that very shallow soils are treated by remedial grading for structural support. Calculated total surface settlements from a liquefaction model analysis are of very low magnitude (approximately 0.2 inch). Differential settlements would be even less. We think the tiny calculated differential settlement potentials are reasonable engineering assumptions for this site, and are less than AGI's predicted consolidation settlements from structural loads. Both the total and differential settlements are far lower than typical allowable maximum deflections for concrete panel-wall construction on continuous foundations.

Landslides. Section 5.3 notes that the site is flat and far from steep or boulder-strewn mountain slopes. Earthquake-induced hazards from slope instability or tumbling rocks are believed to be zero.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 General

Based on the results of our field exploration and laboratory tests, engineering analyses, local experience, and judgment, it is our professional opinion that the project site should be suitable from a geotechnical viewpoint for the proposed project. Geological hazards imposed on the warehouse building appear to be limited to strong ground motion due to earthquake. Geotechnical constraints include surficial lower-density natural materials judged susceptible to hydrocollapse and compression under building loads. Deeper alluvium within zones of near-constant soil moisture is demonstrably hard, cemented, and has very low compressibility. Some very old alluvium is clayey and categorized as expansive, though.

Prescriptive mitigation for the hazard of strong ground motion is nominally provided structural design adherence to local adopted building codes. Section 6.7 contains recommended short- and long-period design spectral accelerations for the project.

Soil excavation and compaction to create dense engineered fill are recommended to mitigate unsuitable surficial alluvial deposits and disturbed horizons that would otherwise be present below shallow structural foundations, pavements, and planned engineered fills. Listed below are the recommended earthwork actions for existing soil conditions impacting site development:

(1) Remedial grading should replace the majority of “younger”, typically loose silty sand deposits capping older alluvium, and all active shrink-swell horizons, as compacted engineered fill beside and below the building envelope and attached concrete site walls. Based on the exploration logs, expected structural “removal” depths from existing grades will usually range between a minimum of approximately 5 feet up to about 7 feet. “Active” horizons are mostly in the northern third of the site. The soil types include silt and clayey silt. Active horizons will usually require 6 to 7 feet of removal, and are physically distinguishable by peculiar granulated or “exploded” textures, abundant white carbonate, and visible macro-porosity. There is a fairly abrupt transition from unsuitable materials to competent alluvium. We think this transition should be fairly obvious during mass grading.

(2) Overexcavations should be deepened, if required, so that at least 36 inches of engineered fill is created beneath all future continuous or spread footings. Concrete site walls not attached to the building should also be founded on a minimum of 36 inches of engineered fill. Lateral excavation limits at final bottom elevations should be at least 5.0 feet beyond footing edges. Bottom elevations should be uniform across the entire building design envelope, i.e., “slot-cutting” for individual column lines or continuous footings without treating unsuitable compressible-soil zones below industrial floors is not recommended.

(3) At least 24 inches of soil stripping before placement of compacted engineered fill is recommended in all future new pavement areas, including street widening for Rider Street and Redlands Avenue. The remaining 12 inches may be processed and compacted in place. The intent is to recompact loose, heavily bioturbated, and mechanically tilled soils. Should pavement subgrades be planned more than 24 inches below current surfaces, in-place processing is recommended to create at least 12 inches of engineered soil fill below flexible or rigid pavement structural sections.

Careful staging of earthwork is urged to help minimize chances for placing expansive soils in the upper foot of industrial floor slab subgrades. Pre-project consultations between AGI and earthwork contractors would be encouraged to formulate plans for initial stockpiling and “round-robin” excavations and fills. Clay content is much higher in the older, deeper fine-grained soil classifications. Active-zone removals will necessarily produce engineered fill with expansion potential. A goal of planning would be to devise schemes to keep excavated clayey soils only in the deeper portions of fills, and selectively retain shallow non-expansive materials that are thickest in the southern and western portions of the site for use in pad finishing. Alternatively, if import soil is required, proven non-expansive import materials could substitute for local soils when constructing pad subgrades.

6.2 Site Grading

The general guidelines presented below should be included in the project construction specifications to provide a basis for quality control during grading. It is recommended that all compacted fills be placed and compacted under continuous engineering observation and in accordance with the following:

- Demolition and removal of any and all abandoned buried improvements including foundations, slabs, irrigation pipes, tanks, or cables. Any abandoned septic tanks and leach fields should be excavated and removed in their entirety. If domestic water wells are found, they should be properly grouted, sealed, and capped by a C57-licensed drilling contractor in accordance with Riverside County and State DWR regulations. A copy of the well closure report(s) must be submitted to AGI.

- Clearing and disposal of weeds, shrubs, trees, tree roots larger than approximately one inch, and debris should be initiated prior to grading. If necessary in the opinion of the Geotechnical Engineer, the grading contractor must be prepared to supply personnel to pick woody debris or foreign objects from engineered fill during the grading operations.

- Excavation of fill, disturbed or porous native soil, or other unsuitable material as determined at the time of grading by the Geotechnical Engineer shall be performed as discussed in Section 6.1 for support of compacted engineered fill, structures, and improvements. Bottom acceptance will be by geological observation, probing, and density testing in alluvium. Natural soils shall demonstrate in-place dry densities of 85% or greater of the laboratory-determined maximum dry density to be classified competent, and exhibit insignificant macro-porosity. All of the site soils appear to be acceptable for re-use in new engineered compacted fill if free from organic debris and trash. Final determinations of removal depths shall be made during grading based upon conditions encountered during earthwork activities.

- Observation and acceptance of all stripped areas by the Geotechnical Engineer and/or Engineering Geologist and/or their designated representative shall be done prior to placing fill.

- Shallow scarification of exposed bottoms to depths of 4 to 6 inches (structural envelope), or to planned processing depths (pavement and other engineered fill areas), moisture-conditioning by adding moisture or drying back to above-optimum moisture contents as described below, and recompaction to at least 90 percent of the maximum dry density as determined by the ASTM D1557-12 test standard.

- Fill soils should be uniformly moisture-conditioned by mixing and blending to optimum water content or higher, and placed in lifts having thicknesses commensurate with the type of compaction equipment used, but generally no greater than 6 to 8 inches. Pre-watering of the site is recommended in advance of earthwork (depending upon seasonal conditions) to moisten the upper 48 to

60 inches of material. This will help reduce fugitive dust, and more importantly allow for easier mixing and clod crushing. Care will be needed to avoid overwatering the deeper clayey horizons and creating sticky, muddy, impassable conditions. Pre-watering is not recommended for the Reyez property (APN 300-210-002) in the northeast corner due to non-existent sand. *Fill water contents below the recommended minimum water content shall constitute a basis for non-acceptance of the fill irrespective of measured relative compaction, and at the discretion of the Geotechnical Engineer may require the fill be reworked to produce uniform water contents at or over the desired 100% of optimum moisture.*

- The contractor should utilize means and methods that result in uniform compaction of engineered fill meeting at least 90 percent of the laboratory maximum dry density determined by the ASTM D1557-12 standard. Sheepsfoot rollers and/or a Rex compactor are recommended for mixing and kneading action that will be needed to distribute water in clayey fill soils and break down cohesive clods. AGI recommends the uppermost 12 inches of pad and pavement subgrade material achieve at least 95 percent relative compaction for all project-site soil classifications except for silty clay (USCS CL). The latter is not anticipated, but would require special recommendations to minimize chances for heave and pavement distress.

- Rocks or other similar irreducible inert particles larger than about 3 inches in diameter should be excluded from engineered structural fills on this site. Rocks should be very rare or absent.

- Field observation and testing shall be performed to verify that the recommended compaction and soil water contents are being uniformly achieved. Where compaction of less than 90 percent is indicated (95 percent in identified subgrade zones as previously noted), additional compaction effort, with adjustment of the water content as necessary, should be made until at least minimum-accepted compaction is obtained. Field density tests should be performed at frequencies not less than one test per 2-foot rise in fill elevation and/or per 1,000 cubic yards of fill placed and compacted at this site.

- Import soils, if required, should consist of predominantly granular material with low or negligible expansion potential and be free of deleterious organic matter and large rocks. Import soils with an expansion index of under 20 are preferred and recommended for selective use in floor slab subgrade should import be part of the design plan. The borrow site and import soils must be reviewed and accepted by the Geotechnical Engineer prior to use. Geotechnical acceptance will only be predicated on meeting certain engineering criteria, and would not address any environmental testing or clearances required by local agencies or by the proposed end use.

- Proper surface drainage should be carefully taken into consideration during site development planning and warehouse construction. Finish surface contours should everywhere result in drainage being directed away from building foundations to swales, area drains, or water quality basins. The use of descending ramps to proposed dock doors should be discouraged; a better approach is an elevated building finish floor and exterior pavement surfaces sloping away from the dock doors. Roof runoff should be directed to LID BMPs at least 15 feet lateral to perimeter building foundations. Landscape beds should not be placed next to structures unless xeriscape and micro-irrigation design practices can be enforced.

- It is recommended that expansion index and soluble sulfate content tests be performed upon completion of rough grading in the building pad. The exact number of tests should be determined by site observations made during grading, but should not be less than one test for every soil type encountered or 8 tests overall, whichever is greater. Atterberg limits testing to help qualify soil activity is recommended in the event expansion indices greater than 20 are calculated.

6.3 Earthwork Volume Adjustments

Removal and recompaction of the unsuitable surficial alluvium will result in material volume loss. The calculation of earth balance factors for the site as a whole is subject to some uncertainty, based on imprecise estimates of shallow soil density from 0 to 2 feet (tilled zone), and the future achieved degrees of compaction. We believe that civil designers should make allowances for at least 12 to 15 percent shrinkage in the building removal areas. Exterior paved areas may shrink closer to 20 percent from 0 to 2 feet. Bottom subsidence from heavy equipment is predicted to be almost undetectable in the deep cemented soils, but on a site-wide average inclusive of paved areas should fall near 0.1 foot in our estimation.

6.4 Slopes

Slopes are not shown on the project conceptual drawing. However, low permanent manufactured fill slopes would not be unexpected along the eastern and southern site boundaries. Slope design should in general conform to the following recommendations:

- Cut and fill slopes should be constructed at maximum slope inclinations of 2:1 (horizontal:vertical).
- The surfaces of all fill slopes should be compacted as generally recommended under Site Grading, and should be free of slough or loose soils in their finished condition. The desired result should be 90 percent relative compaction to the slope face.
- The fill portion of any fill-over-cut slopes should maintain a minimum horizontal thickness of 5 feet or one-half the remaining fill slope height (whichever is greater), and be adequately benched into undisturbed competent materials. Cut slopes in local native surficial alluvium are preliminarily judged feasible without needs for stabilization fills.
- Erosion control measures should be implemented for all slopes as soon as practicable after slope completion, per applicable City ordinances.

6.5 Foundation Design

Although information regarding anticipated foundation loads was not available for this report, the predicted construction type implies moderate imposed soil loads. Foundation plans, once they become available, must be evaluated by this firm for compatibility with the preliminary recommendations presented below.

Conventional shallow continuous or spread footings embedded entirely within compacted engineered fill appear feasible for the light industrial building. Structural loads may be supported on continuous or isolated spread footings at least 18 inches wide. *All* footings including site wall foundations should be bottomed a minimum of 24 inches below the lowest adjacent final grade. The recommended maximum allowable bearing value is limited to 3,000 pounds per square foot (FS $\geq$3.0). Bearing values may be increased by one-third when considering short-duration seismic or wind loads.

Lateral load resistance will be provided by friction between the supporting materials and building support elements, and by passive pressure. A friction coefficient of 0.42 may be utilized for foundations and slabs constructed atop structural fill derived from granular surficial-zone alluvium or granular + fine-grained blended site materials. A passive earth pressure of 250 pounds per square foot, per foot of depth, may be used for the sides of footings. When combining passive pressure and frictional resistance, the passive pressure component should be reduced by one-third.

Any exterior isolated building footings should be tied in at least two perpendicular directions by grade beams or tie beams to reduce the potential for lateral drift or differential distortion. The base of the grade beams should enter the adjoining footings at the same depth as the footings (viewed in profile). The grade beam steel should be continuous at the footing connection. Footings should either be continuous across large openings, such as loading dock doors or main entrances, or be tied with a grade beam or tie beam.

Interior columns should be supported on spread footings or integrated footing and grade beam systems. Column loads should not be supported directly by slabs. When designing the interior building footings, the structural engineer should consider utilizing grade beams to control lateral drift of isolated column footings, if the combination of friction and passive earth pressure will not be sufficient to resist lateral forces.

Minimum foundation reinforcement should consist of four No. 5 bars, two near the top and two near the bottom (viewed in cross-section), or as dictated by loading conditions. However, footing and grade beam reinforcement specified by the project structural engineer shall take precedence over the latter guidelines.

Provided that AGI's recommendations for engineered fill depths below footings are incorporated into final design and construction, foundation settlements should be of low magnitude. Much of the anticipated foundation settlement is expected to occur during construction. Maximum consolidation settlements are not expected to exceed a ½-inch and should occur below the heaviest loaded columns. Differential settlement is not expected to exceed approximately ¼ to ½ of an inch between similarly loaded elements in a 30-foot span.

6.6 Floor Slab Design

Concrete slab-on-grade industrial floor construction is assumed. The following recommendations are presented as options for minimum design parameters for the slabs, accounting for soil expansive pressures and measured soil strengths only. The minimum design parameters do not account for concentrated loads (e.g., machinery, pallet racks, etc.) and/or the installation of freezers or heating boxes.

The information and recommendations presented in these sections are not meant to supersede design by the project structural engineer. We have conceptualized options based on an as-built subgrade having an expansion index of less than 20 and plasticity index of 0, as AGI anticipates for local sandy materials selectively placed during mass grading. Generally, the indicated dimensions or materials may be varied by the structural engineer to produce acceptable performance for heavy or point loads, or to reduce section thicknesses. Final verification of the applicability of these or any modified recommendations must be confirmed by expansion index testing at the conclusion of pad precise grading.

Lightly Loaded Floor Slabs. Commercial/office slabs in areas which will receive relatively light live loads (i.e., less than approximately 125 psf) may be a minimum of 4.5 inches thick if reinforced with No. 3 reinforcing bars at 18 inches on-center in two horizontally perpendicular directions. Reinforcing should be properly supported on chairs or blocks to ensure placement near the vertical midpoint of the slab. "Hooking" of the reinforcement is not considered an acceptable method of positioning the steel. The recommended minimum compressive strength of concrete in this application is 3,000 pounds per square inch (psi).

Transverse and longitudinal control joints are advised to isolate slab cracking due to concrete shrinkage or expansion. If utilized in lieu of added reinforcement or concrete additives, crack control joints should be spaced no more than 12 feet on center and constructed to a minimum depth of T/4, where "T" equals the slab thickness in inches. Construction joints between pours should utilize dowel baskets to control vertical deflections from either interior loads or soil uplift pressures.

Highly Loaded Floor Slabs. The project structural engineer should design slabs in the event of expected high loads (i.e., machinery, forklifts, storage racks, etc.). Designs utilizing the modulus of subgrade reaction (k-value) may be used. A k-value of 150 pounds per square inch per inch may conservatively used for on-site soils. Recommended R-value tests for final pavement section design, and/or plate load tests, may be used to verify the subgrade modulus after completion of grading.

For live loads of up to 250 psf, plain concrete slabs should be at least 5½ inches thick. The concrete used in slab construction should conform to Class 560-C-3250. Transverse and longitudinal crack control joints (if utilized) should be spaced no more than 12 feet on center and constructed to a minimum depth of T/4, where "T" equals the slab thickness in inches. Construction joints between pours should utilize dowel baskets to control vertical deflections from either interior loads or soil uplift pressures. These suggested design factors can be altered as long as comparable stiffness and strength objectives can be achieved.

Moisture Protection. Ground-floor office portions of the warehouse building slab would be expected to have interior floor finishes (wood, vinyl, carpet) potentially sensitive to subgrade moisture or water vapor. AGI recommends a minimum 6-mil-thick plastic vapor retarder installed per manufacturer and code specifications with all laps/openings sealed. The barrier may be situated atop as-built subgrades if reasonably free of large stones. Optional thicker 10-mil vapor retarders (e.g., StegoWrap®) should be favored due to greater damage resistance and even lower transmissivity. Protected areas should be separated from any areas that are not similarly protected. The separation may be created by a concrete cut-off wall extending at least 24 inches into the subgrade soil.

Subgrade Pre-Saturation. Pre-saturation is recommended for all pad soil and pedestrian walkway subgrades demonstrating post-grading expansion indices exceeding 20. It is our belief that selective grading can minimize chances for code-based categorization as an "expansive" pad. For as-built expansion indices under 20, AGI would recommend that soil water contents at least approach optimum soil water contents determined from ASTM D1557-12 to a depth of at least 12 inches prior to vapor retarder installation or industrial slab concrete placement. Extremely dry soils can pull water from wet concrete by capillary action and potentially affect hydration of cement pastes. Construction sequencing that helps preserve grading water should be encouraged. Pad subgrade soils with as-built expansion indices in the range of 20 to 50 should be at or over 110 percent of optimum water content to a depth of 12 inches. Subgrade soil water contents should be checked and verified as suitable by AGI technical staff no more than 48 hours prior to concrete placement.

6.7 2016 California Building Code Seismic Criteria

Prescriptive mitigation for the hazard of strong ground motion is nominally provided by structural design adherence to local adopted building codes. The 2016 CBC, based on the 2015 *International Building Code*, maintains a "look-up" code convention for seismic engineering, using as primary inputs the site's location and the assigned site class. The latter is a measure of soil or rock elastic resistance determined by borehole tests or geophysical methods. For non-critical structures, the 2016 code continues past practice that quantifies seismic risk based on the probabilistic 2008 National Seismic Hazard model and the 2009 NEHRP *Recommended Seismic Provisions*. Design coefficients are ultimately functions of distance to active faults, fault activity, and measured or correlated mean shear wave velocity within 30 meters (~100 feet) of the ground surface. The tabulated criteria presented below were derived in accordance with the rules of Section 1613 of the 2016 CBC and ASCE/SEI Standard 7-10.

Table 6.7-1
2016 CBC Seismic Design Factors and Coefficients
(Lat. 33.83002, Long. 117.21524)

2016 CBC Section #	Seismic Parameter	Indicated Value or Classification
1613.3.1	Mapped Acceleration S_s	1.500g (Note 1)
	Mapped Acceleration S_1	0.600g (Note 1)
1613.2.2	Site Class	D (Note 2)
1613.3.3(1)	Site Coefficient F_a	1.0
1613.3.3(2)	Site Coefficient F_v	1.5
1613.3.3	Adjusted MCE Spectral Response S_{MS}	1.500g
	Adjusted MCE Spectral Response S_{M1}	0.900g
1613.3.4	Design Spectral Response S_{DS}	1.000g (Note 3)
	Design Spectral Response S_{D1}	0.600g (Note 3)

Notes

(1) Interpolated from 0.01-degree gridded data in the probabilistic 2008 National Seismic Hazard Model (SEAOC, 2019), 2% in 50-year exceedance probability.
(2) Based on minimal site grading, borehole SPT data, and estimated $V_{s30} \approx$280 m/sec.
(3) Defined by 2016 CBC §1613.1 and the statement of ASCE/SEI 7-10 §21.2.3 indicating site-specific MCE response spectral acceleration at any period shall be taken as the lesser of the probabilistic or deterministic spectral response accelerations, with the latter subject to lower-limit values. The design spectral response accelerations are calculated as ⅔ of the MCE value.

Based on ASCE 7-10 and CBC §1613.3.5, a Seismic Design Category of **D** for risk category I-III buildings/structures is assigned for buildings sited where S_{D1} > 0.20g and S_1 < 0.75g. The option for alternative seismic design category determination based on a structure's fundamental period and CBC Table 1613.3.5(1) is allowed. The site-modified zero-period MCE_R ground motion estimate PGA_M is 0.50g. Seismic response coefficients determined by the SEAOC seismic design tool applied to Figures 22-17 and 22-18 of ASCE 7-10 would be:

C_{RS} = 1.058 C_{R1} = 1.027

It should be understood that the 2016 CBC and most other building codes define minimum criteria needed to produce acceptable life-safety performance. Codecompliant structures can still suffer damage. Project owners should be aware that structures can be designed to further limit earthquake damage, sometimes for modest cost premiums. Ultimately, final selection of design coefficients should be made by the structural consultant based on local guidelines and ordinances, expected structural response, and desired performance objectives. Please note that structural engineering approvals after January 1, 2020 will need to conform with the revised 2019 CBC. Seismic demands will change under the new code, and AGI's currently recommended coefficients will not be valid.

6.8 Pavements

Depending upon budget, aesthetics, life-cycle costs, and proposed end use, Portland cement concrete (PCC) pavement or a mix of PCC and lighter-duty asphalt surfaces could be specified for the project. Customarily, truck driveways and trailer stalls use PCC pavement. Conventional asphalt surfaces would be predicted for public roadway improvements, and might be elected for employee auto parking and driveways along Redlands Avenue. It is anticipated that the uppermost porous and mechanically tilled topsoils in areas that will support new asphalt or PCC pavements, curbs and gutter, sidewalks, or other flatwork will be removed and recompacted as recommended in Section 6.1.

For an assumed traffic index of 8.0, equivalent maximum single-axle loads of 13,000 pounds, an estimated R-value of 30 or greater for on-site *granular* soils, and assumed concrete modulus of rupture of 500 psi, the recommended preliminary PCC design section includes 7.0 inches of un-reinforced (plain) concrete over 12 inches of granular site soil compacted to not less than 95 percent relative compaction. Poorer soils exist in the north half of the trailer yard and north entrance. The local R-value may be under 15. Untreated USCS ML subgrades compacted to not less than 95 percent should have thicker unreinforced PCC design sections preliminarily estimated at 9.0 inches. Subgrade treatments such as lime or cement stabilization should be considered for low-strength soil classifications, and would be recommended for heavy-duty pavements resting on clay soils exhibiting plasticity indices greater than 10. Concrete used for pavement should have a minimum 28-day compressive strength f_c of 3,500 pounds per square inch. The structural engineer may evaluate alternative sections that include reinforcement or different-strength concrete mixes in the event of a different design traffic index, special conditions including ESALs exceeding 13,000 pounds, or requests for a thinner concrete section.

The following table presents *example* structural sections for street and parking lot hot-mix asphalt pavements based upon Caltrans design methods, a 20-year pavement lifetime, and an estimated soil R-value. The example sections may be useful for development cost estimates. Street traffic indexes are guidelines only. Confirmation of final design traffic indexes must be made with City of Perris Public Works officials. For regular parking lots, the tabulated dimensions are the minimum-recommended structural section for passenger automobile loads. Final recommended sections may change and should be based on expected loading, desired pavement lifetime, and recommended R-value tests on soils collected from as-built subgrades.

Table 6.8-1
Preliminary Example Asphalt Pavement Designs

Pavement End Use	Traffic Index	R-Value	A.C. Thickness	Base Thickness
Passenger Auto Parking	5.5	30	3.0"	6.5"
Rider Street & Redlands Avenue	8.0	30	4.0" 5.0"	11.0" 9.5"

It is recommended that concrete curbs and ribbon gutters be poured neat against compacted soil subgrades in advance of pavement subgrade excavation and base course placement. It is especially critical that drainage pathways from tree wells or nearby landscaped areas not be created by inadvertent construction of curbs atop permeable base course layers.

Generally, subexcavation of pavement areas should not exceed that needed to mitigate compressible surficial soils per the protocol in Section 6.1. Subgrades not classified as clay should be processed and compacted to a minimum of 95 percent of the laboratory maximum dry density determined by ASTM D1557-12 to depths of at least 12 inches. Base course should meet materials specifications for Caltrans

Class 2 aggregate base material or better, and should be placed and fully compacted in lifts no greater than 6 inches thick to a minimum dry density of 95 percent of the laboratory maximum dry density per the ASTM D1557-12 standard. Pavement gradients should be designed to allow rapid and unimpaired flows of runoff water, and concrete gutters should be provided at all flow lines.

6.9 Retaining Walls

Available plans did not depict retaining walls, and the limited site relief suggests walls may be avoidable except possibly for dock door areas. Preliminary recommended earth pressure values for walls are shown below. AGI assumes that a well-drained, select granular on-site or import material such as locally available decomposed granite sand with a sand equivalent value of 30 or better will be utilized for backfill. Very silty sand or clayey site soils are not recommended for wall backfill. Live loading (e.g., forklifts) must be added to the stated values. Wall pressures from seismic inertial loads must also be included for tall walls (none expected). Seismic loads may be based on a design peak ground acceleration of 0.50g and MCE event magnitude M_w8.1. Other expected site conditions such as drained, granular backfill soils appear to be consistent with the assumptions of the widely used Mononobe-Okabe method or similar later variations of rigid plastic methods for finding force magnitudes on the wall. Standard reduction factors for pga (e.g., 0.5 for M-O method) may thus be implemented.

Table 6.9-1
Preliminary Retaining Wall Fluid Pressure

Inclination of Retained Material	Equivalent Fluid Pressure (psf)	
	Unrestrained	Restrained
Level	36	56

AGI recommends reviews of preliminary wall designs to gauge needs for locality-specific modifications and/or supplemental soil tests before construction. The same recommended maximum foundation bearing value of 3,000 psf for structures may also be assumed for retaining walls and site walls founded atop engineered fill.

Granular wall backfill at dock doors should be mechanically compacted to a minimum of 95 percent relative compaction; 90 percent or greater is sufficient where not subject to live loads. Density testing is recommended to verify the adequacy of compaction. Substitution with crushed or pit-run clean rock materials in wall panel backfills is encouraged, but must also be accompanied by mechanical densification with plate compactors, ramming tampers, or concrete vibrators.

Exterior walls retaining more than 3 feet of soil should be provided with a means of drainage to prevent hydrostatic forces. Drainage provisions may be based on the wall height, wall length, and any irrigated land uses next to the improvement. Typical approaches would be a continuous perforated subdrain line embedded in open-graded crushed rock placed at the inside bottom of the wall, or through-the-wall options such as weepholes, or open head joints for CMU structures.

6.10 Temporary Sloped Excavations

Excavations at the site would be expected to encounter massive, non-raveling sequences of silty or clayey alluvium, and/or engineered fill after mass grading. Excavations up to 5 feet in depth in these materials should stand vertically for temporary periods. Trenches open for any extended period of time, trenches placed in disturbed native ground, and all excavations greater than 5 feet in depth should be properly sloped or shored. Where sufficient space is available for a sloped excavation, the side slopes should be inclined to no steeper than 1:1 (horizontal to vertical) per current rules for excavation material Type B and an excavation depth of 20 feet or less in unsaturated soil. The exposed earth materials in the excavation side slopes should be observed and verified as suitable by a geotechnical engineer or other qualified person. The exposed slope faces should be kept moist and not allowed to dry out.

Surcharge loads should not be permitted within five feet from the top of excavations, unless the cut or trench is properly shored. Contractors are ultimately responsible for verifying that slope height, slope inclination, excavation depths, and shoring design are in compliance with Cal-OSHA safety regulations (Title 8, Section 1540-1543 et seq.), or successor regulations.

6.11 Trench Backfill

All soil-backfilled utility trenches on this site should be backfilled in lifts and mechanically compacted to at least 90 percent of the laboratory maximum dry density. Utility purveyors may specify a greater degree of compaction in streets (e.g., lateral connections into Redlands Avenue or Rider Street) than this stated minimum. Flooded or jetted backfill is not recommended except for densification of select imported granular bedding materials placed directly around utility lines. The local soils are deemed unsuitable to serve as pipe bedding materials. Density testing is recommended to verify the adequacy of compaction efforts.

6.12 Soil Corrosivity

Chemical analyses were performed to provide a general evaluation of the corrosivity of the native soils and included soluble sulfates, soluble chlorides, nitrate, and ammonia in addition to several electrochemical potential tests. Findings indicated the site soils should not be aggressive to concrete, but could be highly corrosive to buried metal. Analytic tests reported soluble sulfate contents were low, quantified at only 0.00074 weight percent and 0.0207 weight percent in two samples from opposite ends of the building envelope. Minimum saturated resistivity ranged from 5,829 to 1,407 ohm-cm in two samples. The test data point to soluble salt enrichment and far higher corrosion potential in older silt and clay deposits toward the north end of the project. We encourage the owner to engage a qualified corrosion engineer for a more in-depth evaluation of risks to buried ferrous objects and for specification of special corrosion protection features that may be required. Metal fire protection lines should be keyed upon.

The categorically “negligible” sulfate concentrations indicate that normal Type I-II cement should be suitable for concrete mix designs utilized for this project, based on American Concrete Institute (ACI) 318 Table 4.3.1. Type V cement may optionally be used for any site concrete mix, and would be mandatory for measured sulfate concentrations exceeding 0.20 weight percent. It is recommended that all concrete which will come in contact with on-site soil materials be selected, batched, and placed in accordance with the latest California Building Code and ACI technical recommendations.

6.13 Construction Observation

The preliminary foundation recommendations presented in this report are based on the assumption that all foundations will bear entirely within properly compacted engineered fill approved by this office. It is recommended that all engineered fill placement operations be performed under continuous engineering observation and testing by AGI personnel. Engineered fill shall constitute any load-bearing soil placements, irrespective of yardage quantity or depth. Continuous observation is a 2016 CBC requirement for engineered fill. Continuous or periodic fill observation and testing may be suitable for trench backfills depending mostly on trench depth and contractor production. Verification testing of completed soil-subgrade expansion potential, soluble sulfate content, soil plasticity index, and pre-saturation (if required) is recommended at appropriate points in the construction time line. All foundation excavations should be observed prior to placing reinforcing steel to verify that foundations are embedded within satisfactory materials and that excavations are free of loose or disturbed soils and made to the recommended depths.

6.14 Investigation Limitations

The present findings and recommendations are based on the results of the field exploration combined with interpolations of soil and groundwater conditions between a limited number of subsurface excavations. The nature and extent of variations beyond or between the explorations may not become evident until construction. If conditions encountered during construction vary significantly from those indicated by this report, then additional geotechnical tests, analyses, and recommendations could be required from this office. Because this report has also incorporated assumed conditions or characteristics of the proposed structure where specific information was not available, foundation plan reviews by this firm are recommended prior to site grading in order to evaluate the proposed facilities from a geotechnical viewpoint and allow modifications to the preliminary recommendations developed to date.

We recommend that the project engineer incorporate this report and subsequent plan review reports into the overall project specification by title and date references on final drawings. Lastly, a pre-construction meeting with the owner, grading contractor, and civil engineer is strongly encouraged to present, explain, and clarify geotechnical concerns, uncertainties, and recommendations for the site.

7.0 CLOSURE

This report was prepared for the use of First Industrial Realty Trust, Inc. and their designates, in cooperation with this office. All professional services provided in connection with the preceding report were prepared in accordance with generally accepted professional engineering principles and local practice in the fields of soil mechanics, foundation engineering, and engineering geology, as well as the general requirements of Riverside County and the City of Perris in effect at the time of report issuance. We make no other warranty, either expressed or implied. We cannot guarantee acceptance of the final report by regulating authorities without needs for additional services.

AGI enthusiastically welcomes the opportunity to help engineer the owner's planned business improvements in the Inland Empire. If you should have any questions, please contact the undersigned at our Riverside office at (951) 776-0345.

Respectfully submitted,
Aragón Geotechnical, Inc.

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MGD/CFA:mma

Attachments: Appendices A and B
Geotechnical Map, Plate No. 1 (foldout)

Distribution: (4) Addressee

REFERENCES

California Division of Mines and Geology, 2008, *Guidelines for Evaluation and Mitigation of Seismic Hazards in California:* CDMG Special Publication 117 [Rev. September 11, 2008], online version at http://www.consrv.ca.gov/dmg/pubs/sp/117.htm

California Department of Conservation, Division of Mines and Geology, 2019a, Digital images of official maps of Alquist-Priolo Earthquake Fault Zones of California, on-line versions at Internet URL http://www.quake.ca.gov/gmaps/ap/ap_maps.htm

California Department of Conservation, California Geological Survey, 2019b, Digital images of official maps of liquefaction and landslide Seismic Hazard Zones, on-line versions at Internet URL http://www.conservation.ca.gov/cgs/shzp

County of Riverside, Transportation and Land Management Agency, 2002, *Technical Guidelines for Review of Geologic and Geotechnical Reports*, 63 p.

FEMA, 2008, Flood Insurance Rate Map, Community Map No. 06065C1410G, 8-28-2008.

Field, E.H., and 2014 Working Group on California Earthquake Probabilities, 2015, UCERF3: A new earthquake forecast for California's complex fault system: U.S. Geological Survey 2015–3009, 6 p., http://dx.doi.org/10.3133/fs20153009

Ishihara, K., 1985, Stability of natural deposits during earthquakes, in *Proceedings of the Eleventh International Conference on Soil Mechanics and Foundation Engineering*, San Francisco, CA, vol. 1, p. 321-376.

Ishihara, K., and Yoshimine, M., 1992, Evaluation of settlements in sand deposits following liquefaction during earthquakes: Soils and Foundations, JSSMFE, v. 32, no. 1, March 1992.

Matti, J.C., Morton, D.M., and Cox, B.F., 1985, Distribution and geologic relations of fault systems in the vicinity of the central Transverse Ranges, southern California: U.S. Geological Survey Open File Report OFR 85-365.

Morton, D.M., and Miller, F.K., 2006, Geologic map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California [ver. 1.0], U.S. Geological Survey Open File Report 2006-1217, scale 1:100,000.

Petersen, Mark D., Frankel, Arthur D., Harmsen, Stephen C., Mueller, Charles S., Haller, Kathleen M., Wheeler, Russell L., Wesson, Robert L., Zeng, Yuehua, Boyd, Oliver S., Perkins, David M., Luco, Nicolas, Field, Edward H., Wills, Chris J., and Rukstales, Kenneth S., 2008, *Documentation for the 2008 Update of the United States National Seismic Hazard Maps:* U.S. Geological Survey Open-File Report 2008–1128, 61 p.

Sieh, K, and Yule, D., 1997, Neotectonic and paleoseismic investigation of the San Andreas fault system, San Gorgonio Pass: Progress report to Southern California Earthquake Center, 4 p.

Sieh, K., and Yule, D., 1998, Neotectonic and paleoseismic investigation of the San Andreas fault system, San Gorgonio Pass: Southern California Earthquake Center, Annual Report for 1998, 2 p. and figures. http://www.scec.org/research/98progreports/

Sieh, K., and Yule, D., 1999, Neotectonic and paleoseismic investigation of the San Andreas fault system, San Gorgonio Pass: Southern California Earthquake Center, Annual Report for 1999, 4 p. and figures. http://www.scec.org/research/99progreports/

Structural Engineers Association of California [SEAOC], 2019, Seismic Design Map Tool: access date 7/19/19 from Internet URL https://www.seaoc.org/page/seismicdesignmaptool

Tokimatsu, K., and Seed, H.B., 1987, Evaluation of settlement in sands due to earthquake shaking: Journal of Geotechnical Engineering, ASCE, vol. 113, no. 8, p. 861-878.

U.S. Geological Survey, 2019a, Steele Peak (1953 and 1967) 7.5' topographic quadrangle sheets, and Perris (1953) 15' topographic quadrangle sheet, download files at The National Map: Historical Topographical Map Collection, access date 7/12/19 from Internet URL http://nationalmap.gove/historical/

U.S. Geological Survey, 2019b, Unified Hazard Tool: Internet URL https://earthquake.usgs.gov/hazards/interactive/

U.S. Geological Survey, 2019c, Worldwide Earthquake Map, with embedded access to Quaternary faults and folds, and ANSS Comprehensive Earthquake Catalog [COMCAT], Internet URL http://earthquake.usgs.gov/earthquakes/map/

Woodford, A.O., Shelton, J.S., Doehring, D.O., and Morton, R.K., 1971, Pliocene-Pleistocene history of the Perris Block, southern California: Geological Society of America Bulletin, v. 82, p. 3421-3448.

WGCEP, 2013, The uniform California earthquake rupture forecast, Version 3 (UCERF3) – the time-independent model: U.S. Geological Survey Open-File Report 2013-1165, 97 p.

AERIAL PHOTOGRAPHS

RCFCWCD Aerial Photography Collection, Riverside

Date Flown	Flight Number	Scale	Frame Numbers
1-28-62	Fairchild #24244	1:24,000	Line 1, Nos.81-82
5-24-74	1974 County	1:24,000	Nos. 380-381
4-10-80	1980 County	1:19,200	Nos. 399-400
2-4-84	1984 County	1:19,200	Nos. 1148-1149
1-21-90	1990 County	1:19,200	Line 8, Nos. 26-27
1-30-95	1995 County	1:19,200	Line 8, Nos. 24-25
3-11-00	2000 County	1:19,200	Line 8, Nos. 26-27
4-14-05	2005 County	1:19,200	Line 8, Nos. 23-24
3-29-10	2010 County	1:19,200	Line 8, Nos. 23-24

U.C. Santa Barbara Aerial Image Collections

Date Flown	Flight Number	Scale	Frame Numbers
6-7-38	AXM-1938A	1:20,000	Line 45, #58
8-28-53	AXM-1953B	1:20,000	Line 2K, #110
5-15-67	AXM-1967	1:12,000	3HH-31
3-8-04	EAG RV 04	1:21,000	616

Google Earth Pro Historical Image Archive

Image dates as shown in application:

6/5/02	1/3/06	2/9/16
5/21/02	4/27/06	10/21/16
12/30/02	5/24/09	2/9/18
10/25/03	11/15/09	8/10/18
12/18/03	3/9/11	8/24/18
1/4/04	6/17/12	
10/10/05	11/12/13	
12/2005	4/27/14	

APPENDIX A

A P P E N D I X A

MAP EXPLANATION & SUBSURFACE EXPLORATION LOGS

The Geotechnical Map (Plate No. 1, foldout at the back of this report) was prepared based upon information supplied by the client, or others, along with Aragón Geotechnical's field measurements and observations. Field exploration locations illustrated on the map were derived from taped and paced measurements of distance to existing improvements, and air photo overlays scaled to match the development plan. Locations should be considered approximate. The selected boring locations were deemed sufficient by AGI for characterizing the possible range of subsurface conditions occurring at the site.

The Field Boring Logs on the following pages schematically depict and describe the subsurface (soil and groundwater) conditions encountered at the specific exploration locations on the date that the explorations were performed. Unit descriptions reflect predominant soil types; actual variability may be much greater. Unit boundaries may be approximate or gradational. Text information often incorporates the field investigator's interpretations of geologic history, origin, diagenesis, and unit identifiers such as formation name or time-stratigraphic group. Additionally, soil conditions between recovered samples are based in part on judgment. Therefore, the logs contain both factual and interpretive information. Subsurface conditions may differ between exploration locations and within areas of the site that were not explored. The subsurface conditions may also change at the exploration locations over the passage of time.

The investigation scope and field operations were conducted in general accordance with the procedures recommended by the American Society for Testing and Materials (ASTM) standard D420-98 entitled "Site Characterization for Engineering Design and Construction Purposes" and/or other relevant specifications. Soil samples were preserved and transported to AGI's Riverside laboratory in general accordance with the procedures recommended by ASTM standard D4220 entitled "Standard Practices for Preserving and Transporting Soil Samples". Brief descriptions of the sampling and testing procedures are presented below:

Ring-Lined Barrel Sampling – ASTM D3550-01

In this procedure, a thick-walled barrel sampler constructed to receive thin-wall liners (either a stack of 1-inch-high brass rings or 6-inch stainless steel tubes for environmental testing) is used to collect soil samples for classification and laboratory tests. Samples were collected from selected depths in all 6 hollow-stem auger borings. The drilling rig was equipped with a 140-pound mechanically actuated automatic driving hammer operated to fall 30 inches, acting on rods. A 12-inch-long sample barrel fitted with 2.50-inch-diameter rings and tubes plus a waste barrel extension was subsequently driven a distance of 18 inches or to practical refusal (considered to be ≥50 blows for 6 inches). The raw blow counts for each 6-inch increment of penetration (or fraction thereof) were recorded and are shown on the Field Boring Logs. An asterisk (*) marks refusal within the initial 6-inch seating interval. The hammer weight of 140 pounds and fall of 30 inches allow rough *correlations to be made (via conversion factors that normally range from 0.60 to 0.65 in Southern California practice) to uncorrected Standard Penetration Test N-values, and thus approximate descriptions of consistency or relative density could be derived. The method provides relatively undisturbed samples that fit directly into laboratory test instruments without additional handling and disturbance.*

Standard Penetration Tests – ASTM D1586-11

In deeper boreholes, Standard Penetration Tests were performed to recover disturbed samples suitable for classification, and to provide baseline data for liquefaction susceptibility analyses and site class assignment for seismic design. A split-barrel sampler with a 2.0-inch outside diameter is driven by successive blows of a 140-pound hammer with a vertical fall of 30 inches, for a distance of 18 inches at the desired depth. The drill rig used for this investigation was equipped with an automatic trip hammer acting on drilling rods. The total number of blows required to drive the sampler the last 12 inches of the 18-inch sample interval is defined as the Standard Penetration Resistance, or "N-value". Penetration resistance counts for each 6-inch interval and the raw, uncorrected N-value for each test are shown on the Field Boring Logs. Drive efficiencies for automatic hammers are higher than older rope-and-cathead systems, which are disappearing from practice. Where practical refusal was encountered within a 6-inch interval, defined as penetration resistance ≥50 blows per 6 inches, the raw blow count was recorded for the noted fractional interval; an asterisk (*) marks refusal within the initial 6-inch seating interval. The N-value represents an index of the relative density for granular soils or comparative consistency for cohesive soils.

Bulk Sample

A relatively large volume of soil is collected with a shovel or trowel. The sample is transported to the materials laboratory in a sealed plastic bag or bucket.

Classification of Samples

Bulk auger cuttings and discrete soil samples were visually-manually classified based on texture and plasticity, utilizing the procedures outlined in the ASTM D2487-11 standard. The assignment of a group name to each of the collected samples was performed according to the Unified Soil Classification System (ASTM D2488-09). The plasticity reported on field logs refers to soil behavior at field moisture content unless noted otherwise. Site material classifications are reported on the Field Boring Logs.

FIELD LOG OF BORING B - 1

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/8/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**26.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1443 Ft. AMSL, RCFC NAD 83**

Comments: Located at SEC of proposed development site, within possible BMP outline.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
0				ML	Sandy Silt: Brown; mechanically disturbed to around 2 feet, abruptly becoming very stiff below; slightly moist; averages around 40% fine- to medium-grained sand; no clay. Non-plastic even with added water. [Older alluvium]				
	1440	SPT 3 5 15 N=20		ML	← Sandy silt, with trace clay and diffuse carbonate, mildly cemented, visibly porous.				
5		SPT 7 7 7 N=14		SM	Silty Sand: Brown; medium dense; slightly moist; fine to medium grained, with ~35-40% fines including trace of clay; massive; crumbly. Upper half with pinhole pores. [Older alluvium]				
		SPT 6 7 8 N=15		SM	← Silty sand, as above but with some diffuse carbonate, not visibly porous.				
	1435			ML	Sandy Silt: Brown; very stiff; slightly moist; estimated 30% fine to medium sand and possibly 5-8% clay; mildly cohesive; not visibly porous. [Very old alluvium]				
10		SPT 8 10 14 N=24		ML	← Sandy silt, weakly cemented and with few pinhole pores, crumbly. Traces of carbonate increase quickly with depth				
	1430								
15				ML	Clayey Silt: Brown; hard; moist; cohesive; traces of fine sand. [Very old alluvium]				

Continued on next sheet.

FIELD LOG OF BORING B - 1

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15		SPT 9 14 19 N=33		ML	Clayey Silt: Brown; hard; moist; moderately cohesive; traces of fine sand. Unit is massive and not visibly porous, with common veils of MnO. Non-plastic. [Very old alluvium]				
	1425								
20		SPT 9 15 20 N=35		ML	← Clayey silt, as above, estimated 15% fine to medium sand, not visibly porous.				
	1420				Sandy Silt: Brown to yellowish brown; hard; moist; typical 30-35% fine to medium grained sand; massive; non-plastic; common MnO spots and veils. Crumbly and essentially uncemented. [Very old alluvium]				
25		SPT 6 13 19 N=32		ML	← Sandy silt, as above with a trace of clay, ~30% f-m sand. massive.				

Bottom of boring at 26.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 2

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/8/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**51.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1444 Ft. AMSL, RCFC NAD 83**

Comments: Located at SEC of proposed building

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0		BULK	SM	Silty Sand: Brown; loose to around 2 feet, abruptly becoming medium dense below; slightly moist; fine to medium grained sand and around 40-45% silt; plus trace of clay; massive. [Older alluvium]			BULK: MAX, EI, SHEAR, CORROSION SUITE
		RING 5 17 22 (41)	SM	← Silty sand, some diffuse carbonate, mildly cemented, visibly porous.	108.7	7.2	
	1440						
5		RING 21 22 22 (44)	SM/ML	← Silty sand, now near 50:50 sand and fines proportions, less cemented and with few fine pores.	122.3	7.4	
		RING 10 16 21 (37)	SM	← Silty sand, coarser than above and with ~30% silt plus some clay, continued few fine pores, slightly cemented but friable.	117.7	6.4	
	1435						
10		RING 9 16 31 (47)	ML	Sandy Silt: Brown; very stiff to hard; moist; cemented with fine carbonate clots and threads; moderately cohesive. some clay and estimated ~30% sand. Few fine pores at 10 feet. [Very old alluvium]	119.0	12.2	
	1430		CL	Silty Clay: Brown; stiff; moist; heavy carbonate precipitates including some hard nodular concretions to ½" across; trace of fine sand. Cohesive. [Very old alluvium]			
15							

Continued on next sheet.

FIELD LOG OF BORING B - 2

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS (BULK / DRIVE / TYPE, "N" or (Blows/ft.))	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15		SPT 3 4 7 N=11	CL	Silty Clay: Brown; stiff; moist; heavy carbonate precipitates including some hard nodular concretions to ½" across; trace of fine sand; not visibly porous; non-plastic. Cohesive. [Very old alluvium]				
	1425		ML	Clayey Silt: Brown; very stiff; moist; mildly cohesive but crumbly and with common MnO veils; about 20-25% fine to medium sand; massive; non-plastic. [Very old alluvium]				
20		SPT 6 9 12 N=21	ML	← Clayey silt, as above, non-plastic.				
			ML	Sandy Silt: Brown to yellowish brown; hard; moist; uncemented and friable samples; massive; common stains and spots of metal oxides. No carbonate. [Very old alluvium]				
	1420							
25		SPT 7 14 16 N=30	ML	← Sandy silt with trace of clay, abundant fine MnO spots. Below 27 feet becomes browner color and very stiff drilling.				
	1415							
30		SPT 12 21 21 N=42	ML	← Sandy silt, traces of clay and coarse sand, massive, not visibly porous.				
	1410							
35								

Continued on next sheet.

FIELD LOG OF BORING B - 2

Sheet 3 of 3

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
35		SPT 9 13 17 N=30		ML	Sandy Silt: Brown; hard; moist; uncemented and friable sample at 35 feet, with some clay; massive. No carbonate. Lower unit contact marked by faster auger progress and appearance of wet cuttings. [Very old alluvium]				
				SC	Clayey Sand: Yellowish brown; medium dense; wet; fine to coarse weathered sand grains; estimated 30% fines; massive, but with some possible thin cleaner-sand beds in uppermost 2-3 feet. [Very old alluvium]				
	1405								
40		SPT 10 12 15 N=27		SC	← Clayey sand, wet, with slightly sticky matrix composing ~30% of sample, not visibly porous.				
					← Drilling rate slows.				
	1400								
45		SPT 15 23 33 N=53		SC	← Clayey sand, becomes very dense, matches 40' sample, wet.				
	1395								
50		SPT 18 29 36 N=65		SM	← Grades to silty sand with clay, massive, very moist.				

Bottom of boring at 51.5 ft.
Limited groundwater seepage noted at ~37-45 ft., no static level achieved.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 3

Sheet 1 of 2

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/8/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**21.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1445 Ft. AMSL, RCFC NAD 83**

Comments: Located close to SWC of proposed building.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0	1445		SM	Silty Sand: Brown; mechanically disturbed to around 1 foot, abruptly becoming medium dense below; slightly moist; fine to coarse grained sand averaging around 30% silt fines (seems clay-free); not stratified. [Older alluvium]			
		RING 12 30 36 (66)	SM	← Silty sand, dense and slightly cemented with fine carbonate clots and filaments, sample is fine to medium grained, visibly porous.	111.0	6.4	
5	1440	RING 20 20 18 (38)	SM	← Silty sand, now uncemented and not visibly porous.	114.6	6.5	
		RING 12 14 16 (30)	SM	← Silty sand, grades yellowish brown and siltier, uncemented, not visibly porous.	114.8	6.7	
			ML	Sandy Silt: Brown; hard; subjectively only slightly moist. Almost pure silt at top, grading to sandy silt with minor clay. Massive; few fine pores at 10 feet; non-plastic. [Very old alluvium]			
10	1435	RING 27 39 44 (83)			107.1	17.3	
15	1430						

Continued on next sheet.

FIELD LOG OF BORING B - 3

Sheet 2 of 2

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	1430	SPT 7 12 16 N=28		ML	Clayey Silt: Olive brown; very stiff; slightly moist; traces of fine sand and scattered carbonate filaments plus MnO spots/veils; friable; non-plastic; not visibly porous. [Very old alluvium]				
20	1425	SPT 12 15 20 N=35		ML, SC	← Clayey silt with subordinate coarse "gritty" immature clayey sand, fine carbonate threads.				

Bottom of boring at 21.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 4

Project:	*"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*
Location:	*CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/8/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**21.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1444 Ft. AMSL, RCFC NAD 83**

Comments: Located in proposed truck and trailer yard.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0			SM	Silty Sand: Brown; medium dense; slightly moist; fine to coarse grained sand averaging around 35% fines including trace of clay; not stratified. [Older alluvium]			
	1440	RING 7 7 10 (17)	SM	Silty sand, with sharp lower unit contact.	91.2	11.0	
5			ML	Clayey Silt: Brown; hard; moist; traces of fine sand; massive; cohesive and cemented near top; non-plastic. Sample at 5 feet has few fine pores. [Very old alluvium]			
		RING 18 27 30 (57)	ML		108.0	17.1	CONSOL
		RING 10 14 20 (34)	ML	← Clayey silt, moist, slightly punky and crumbly texture, about 20% fine sand and abundant pedogenic carbonate.	101.8	12.8	CONSOL
	1435						
10		RING 7 14 25 (39)	ML	← Silt, with some soft laminar carbonate and only trace of clay, not visibly porous.	104.1	18.6	
	1430		CL	Silty Clay: Variegated dark brown and lighter olive brown; hard; moist; traces of fine sand. [Very old alluvium]			
15							

Continued on next sheet.

FIELD LOG OF BORING B - 4

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15		SPT 7 12 19 N=31	CL	Silty Clay: Variegated dark brown and lighter olive brown; hard; moist; traces of fine sand. Lighter-colored zones contain abundant clots of carbonate; moderately cohesive; non-plastic; not visibly porous. Firm drilling. [Very old alluvium]				
	1425							
20		SPT 12 23 34 N=57	SC/CL	← Borderline clayey sand, fine to coarse weathered grains, massive, moist, massive.				

Bottom of boring at 21.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 5

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/8/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**21.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1446 Ft. AMSL, RCFC NAD 83**

Comments: West-central side of warehouse envelope.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
0			SM	Silty Sand: Brown; loose; slightly moist; predominatly fine to medium grained sand and very silty (40%); massive. [Older alluvium]				
	1445							
		RING 5 6 7 (13)	SM	← Silty sand, less silty and with traces of coarse sand.	113.1	2.7		
		RING 12 25 27 (52)	SM	← Silty sand, porous, and with sharp lower contact.	100.1	7.3		
5			ML	Sandy Silt: Olive brown to brown; very stiff; slightly moist; massive; mildly cemented and abundant carbonate near top plus some clay; non-plastic. [Very old alluvium]				
	1440	RING 11 17 18 (55)	ML	← Sandy silt, slightly cemented with abundant pedogenic carbonate, visibly porous.	112.8	6.0		
10								
	1435	RING 8 11 16 (27)	ML, SM	← Sandy silt, indistinctly layered with very silty fine sand. No clay, not visibly porous.	113.8	4.0		
15								

Continued on next sheet.

FIELD LOG OF BORING B - 5

Sheet 2 of 2

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	1430	SPT 6 9 12 N=21		ML	Sandy Silt: Brown; very stiff; moist; some clay. Sample at 15 feet with heavy filamentous carbonate (paleosol); massive. [Very old alluvium]				
20	1425	SPT 7 13 19 N=32		CL	← Classifies as silty clay, hard, non-plastic and with 10-15% fine sand, massive, minor filamentous carbonate.				

Bottom of boring at 21.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 6

Project: "RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT

Location: CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.

Date(s) Drilled:	**7/8/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**21.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1446 Ft. AMSL, RCFC NAD 83**

Comments: West-central side of warehouse envelope; drill site in former cultivated field.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
0	1445		SM	Silty Sand: Brown; loose; slightly moist; predominantly fine to medium grained sand with estimated 35% silt plus trace of clay; massive. Inferred heavily bioturbated; surface has been plowed. [Older alluvium]				
		RING 4 5 7 (12)	SM	← Silty sand, disturbed and bioturbated, fine to coarse grained.	110.8	6.6		
5	1440	RING 10 13 24 (37)	ML	Sandy Silt: Brown; very stiff; moist; massive; mildly cemented and abundant soft carbonate near top; estimated 20% fine sand plus some clay; non-plastic. Sample at 5 feet is visibly porous. [Very old alluvium]	103.5	12.4		
		RING 12 16 19 (35)	ML	← Sandy silt, now 30% sand, slightly cemented, few pinhole pores and carbonate threads.	118.5	9.5		
10	1435	RING 9 10 15 (25)	ML	← Clayey silt, becomes moist, still occasional pinhole pores, massive, crumbly or friable.	95.5	19.8		
15								

Continued on next sheet.

FIELD LOG OF BORING B - 6

Sheet 2 of 2

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: BULK	DRIVE	TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	1430			SPT 8 11 13 N=24		ML	Sandy Silt: Brown; very stiff; moist; increased clay versus shallower deposits. Sample at 15 feet with heavy soft clots of carbonate (paleosol?); massive and friable. [Very old alluvium]				
20	1425			SPT 14 15 22 N=37		SC, ML	← Faintly layered clayey sand and clayey silt, former tending to medium-coarse weathered sand, moist.				

Bottom of boring at 21.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 7

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/9/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**51.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1445 Ft. AMSL, RCFC NAD 83**

Comments: Located at NWC of proposed building

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0	1445	BULK	SM	Silty Sand: Brown; loose; slightly moist; fine to medium grained sand and very silty; plus trace of clay. Disturbed and bioturbated. [Older alluvium]			BULK: MAX, EI, CORROSION SUITE
		RING 4 7 13 (20)	ML	Silt: Brown; stiff to very stiff; slightly moist; some very fine sand; visibly porous; spotty pedogenic carbonate. [Older alluvium]	93.8	8.3	
5	1440	RING 16 28 25 (53)	SM	Silty Sand: Brown to yellowish brown; medium dense; slightly moist; fine to coarse grained, with estimated 40% fines; massive. Persistent pinhole porosity. [Older alluvium]	113.3	9.3	
		RING 10 15 16 (31)	SM	← Silty sand, slightly cemented, continued fine pores; massive.	115.2	5.1	
10	1435		ML	Clayey Silt: Brown and olive brown; very stiff; moist; massive; traces of fine sand. [Very old alluvium]			
		RING 9 20 33 (53)	ML		96.4	21.0	
				} Nodular carbonate zone, hard concretions to ¾" diameter.			
15	1430						

Continued on next sheet.

FIELD LOG OF BORING B - 7

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15	1430	SPT 12 13 16 N=29	ML	Clayey Silt: Brown; very stiff; moist; massive. Sandy between previous nodule zone and bottom of subunit. Sharp contact. [Very old alluvium]				
			SP-SM	Sand with Silt: Light brown; medium dense; slightly moist. Composed of low-silt, fine- to coarse-grained, low-cohesion sand from granitic watershed. May grade increasing fines with depth. [Very old alluvium] Gradational contact.				
20	1425	SPT 10 11 13 N=24	SC, SM	Clayey Sand: Yellowish brown; medium dense; moist; fine to coarse immature sand from granitic source; indistinct 6-8" layering; crumbly and low cohesion. Clay % may increase with depth. [Very old alluvium]				
25	1420	SPT 8 11 16 N=27	ML/CL	← Clayey sandy silt, yellowish brown, about 35% weathered sand, non-plastic. Lower unit contact marked by much slower drilling rate and distinctly brown color soil.				
			ML	Clayey Silt: Brown; hard; moist; uncemented but moderately cohesive. No carbonate. Firm drilling and tends to squeeze. Coarsens very slowly downward. [Very old alluvium]				
30	1415	SPT 8 15 24 N=39	ML, SM	← Clayey silt, with ~25-30% fine sand, indistinct layering over inches with very silty sand, uncemented but moderate cohesion, no carbonate.				
35	1410							

Continued on next sheet.

FIELD LOG OF BORING B - 7

Project: ***"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT***

Location: ***CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.***

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: BULK / DRIVE / TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
35	1410	SPT 6 12 13 N=25		SM	Silty Sand: Yellowish brown; medium dense; very moist; fine to medium sand. Interpreted as basal part of a 10-foot-thick fining-up sequence. [Very old alluvium]				
				SC	Clayey Sand: Yellowish brown; dense; moist to very moist; fine to coarse "gritty" immature and weathered sand grains, with traces of fine gravel. Matrix slightly plastic. Stiff drilling. [Very old alluvium]				
40	1405	SPT 7 12 19 N=31		SC	← Clayey sand, very moist, slightly sticky plastic matrix, very faint layering and graded beds. About 40% fines. Much easier drilling below 40 feet.				
45	1400	SPT 15 20 30 N=50		SC	← Clayey sand, as at 40'. Sharp contact.				
				SM	Silty Sand: Brown; dense; very moist to wet; fine to coarse grained sand with traces of clay; massive. Easier drill penetration than above. [Very old alluvium]				
50	1395	SPT 10 16 24 N=40		SM	← Silty sand, trace of clay, wet.				

Bottom of boring at 51.5 ft.
Limited groundwater seepage between ~45-50 ft., no static level achieved.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 8

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/9/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**21.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1444 Ft. AMSL, RCFC NAD 83**

Comments: Northeast quadrant of proposed structure.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0			SM	Silty Sand: Brown; loose; slightly moist; predominantly fine to medium grained sand and very silty (40%); massive. Disturbed. [Older alluvium]			
		RING 13 23 50 (73)	ML	Silt: Light brown and olive brown; hard, grading to stiff; subjectively only slightly moist; massive; cemented and cohesive near top, but quickly decreasing dry strength with depth. Abundant carbonate clots and veils; traces of very fine sand and clay. Porous. [Very old alluvium]	93.3	17.2	
	1440						
5		RING 15 16 17 (33)	ML	← Silt, much less cemented but continued visibly porous, friable.	88.3	19.3	CONSOL
		RING 10 10 11 (21)	ML	← Sandy silt, not visibly porous, heavy interstitial carbonate, friable.	106.6	6.5	CONSOL
	1435						
10		RING 8 12 20 (32)	ML	← Sandy silt, becomes more brown, subjectively moist, about 35% fine sand and almost no carbonate. Few pinhole pores. [Very old alluvium]	116.5	7.6	
			SC	Clayey Sand: Yellowish brown to brown; medium dense; moist; fine to coarse grained sand. [Very old alluvium]			
	1430						
15							

Continued on next sheet.

FIELD LOG OF BORING B - 8

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: BULK	SAMPLE INTERVALS: DRIVE	TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15				SPT 5 10 12 N=22		SC	Clayey Sand: Yellowish brown to brown; medium dense; moist; fine to coarse grained sand. Sample at 15 feet features a few ¼" hard carbonate nodules. Sand is highly weathered. Easily drilled. [Very old alluvium]				
	1425										
20				SPT 11 15 19 N=34		SC, ML	← Indistinctly layered clayey sand and sandy silt, dense, uncemented.				

Bottom of boring at 21.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 9

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/9/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**26.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1443 Ft. AMSL, RCFC NAD 83**

Comments: Located at NEC of proposed development site, next to possible BMP.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
0				ML	Silt: Light brown; stiff to very stiff; subjectively only slightly moist; trace of very fine sand; non-plastic. [Very old alluvium]				
	1440	RING 4 8 17 (28)		ML	← Silt, variegated colors due to bioturbation, with abundant carbonate, punky texture.	77.8	22.9		
5		RING 10 22 24 (46)		ML	← Silt, very heavy diffuse carbonate, cemented, visibly porous and with punky texture.	91.7	21.5		
		SPT 5 7 9 N=16		ML	Sandy Silt: Brown; very stiff; slightly moist; massive; slightly cemented but crumbly and with few pinhole pores. Abundant reticulate carbonate. [Very old alluvium]				
	1435								
10		SPT 8 13 20 N=33		ML/CL ML/CL	Clayey Silt: Brown; hard; slightly moist; mildly cohesive; massive; not visibly porous and non-plastic. Sample at 10' features abundant reticulate white-colored carbonate. [Very old alluvium]				
	1430								
15									

Continued on next sheet.

FIELD LOG OF BORING B - 9

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	GRAPHIC LOG	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	WELL COMPLETION	OTHER TESTS
15		SPT 7 14 21 N=35		ML	Clayey Silt: Grades yellowish brown; hard; slightly moist; minor carbonate and some MnO veils; typical 30% fine-grained sand. Non-plastic. Base of unit detected by color and faster drilling rate. [Very old alluvium]				
	1425				Sandy Silt: Yellowish brown; hard; moist; similar to overlying sediments bu little to no clay and no pedogenic carbonate but common MnO spots and films; friable and crumbly; not visibly porous. [Very old alluvium]				
20		SPT 14 23 28 N=51		ML	← Sandy silt, as above, zero carbonate but common coarse MnO spots, estimated 30% fine to medium grained sand. not visibly porous.				
	1420								
25		SPT 10 12 27 N=39		ML	← Sandy silt, no clay, massive and not visibly porous.				

Bottom of boring at 26.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 10

Sheet 1 of 1

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/9/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**11.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1443 Ft. AMSL, RCFC NAD 83**

Comments: North end of prospective truck and trailer yard.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0			ML	Clayey Silt: Light grayish brown; stiff; subjectively only slightly moist; variable proportions of very fine sand. Active soil horizon is at least 6-7 feet deep. [Very old alluvium]			
	1440	RING 6 8 17 (25)	ML	← Clayey silt, with active-soil "exploded" textures and some evidence for bioturbation. Cemented blocky granules are visibly porous. Pedogenic Bt horizon.	79.6	19.9	
5		RING 15 24 28 (52)	ML	← Silt, shot through with punky, soft carbonate, visibly porous, friable. Clayey at top of sample.	104.9	17.5	
		RING 11 14 16 (30)	CL, ML	← Silty clay and subordinate clayey silt, reticulate carbonate throughout, pinhole pores, non-plastic, granulated small peds.	103.0	15.1	
	1435						
10		RING 12 20 24 (44)	ML	← Sandy silt, becomes yellowish brown with some clay, moist, massive, non-porous, and almost no carbonate.	105.8	20.2	

Bottom of boring at 11.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 11

Project: *"RIDER AT REDLANDS" LIGHT INDUSTRIAL PROJECT*

Location: *CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.*

Date(s) Drilled:	**7/9/19**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**21.5 Ft.**
Rig Make/Model:	**Mobile B-61**	Hammer Type:	**Automatic trip**
Drilling Method:	**Hollow-Stem Auger**	Hammer Weight/Drop:	**140 Lb./30 In.**
Hole Diameter:	**8 In.**	Surface Elevation:	**± 1444 Ft. AMSL, RCFC NAD 83**

Comments: East side dock door area.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0			SM	Silty Sand: Brown; loose; slightly moist to moist; fine to coarse grained sand and very silty (40%); massive. Disturbed. [Older alluvium]			
		RING 5 15 27 (42)	SM	← Silty sand, grayish brown, moist, visibly porous.	100.1	16.4	
	1440		ML	Clayey Silt: Generally brown; stiff; subjectively moist; massive; typical 20% fine to medium sand. Granulated, active-soil textures and usually visibly porous near top. [Very old alluvium]			
5		RING 5 5 7 (12)			78.7	24.6	
		RING 6 9 12 (21)	ML	← Sandy silt, heavy interstitial carbonate, friable, few macroscopic vesicles/pores.	112.6	14.4	
	1435						
10			SM	Silty Sand: Yellowish brown; medium dense; moist; fine to coarse grained sand. [Very old alluvium]			
		RING 7 12 12 (24)			118.1	7.3	
			CL	Silty Clay: Brown; stiff; moist; plastic with added water and molding; common reticulate carbonate but not visibly porous; massive; cohesive. [Very old alluvium]			
	1430						
15							

Continued on next sheet.

APPENDIX B

A P P E N D I X B

LABORATORY TESTING

Water Content - Dry Density Determinations – ASTM D2216-10
The dry unit weight and field moisture content were determined for each of the recovered barrel samples. The moisture-density information provides a gross indication of soil consistency and can assist in delineating local variations. The information can also be used to correlate soils and define units between individual exploration locations on the project site, as well as with units found on other sites in the general area.

Measured dry densities ranged from approximately 77.8 to 122.3 pounds per cubic foot. Water contents in ring samples ranged from 2.7 to 24.6 percent of dry unit weight. Sample locations and the corresponding test results are illustrated on the Field Boring Logs.

Modified Effort Compaction Tests – ASTM D1557-12
Bulk soil samples were collected from the northern and southern ends of the prospective building envelope. The representative future fill materials were tested to determine their maximum dry densities and optimum water contents per the Method A procedure in the noted ASTM standard. The test method uses 25 blows of a 10-pound hammer falling 18 inches on each of 5 soil layers in a 1/30 cubic foot cylinder. Soil samples were prepared at varying moisture contents to create a curve illustrating achieved dry density as a function of water content. The test results are listed below and shown graphically on pages B-6 and B-7.

Maximum Density - Optimum Water Content Determinations

Soil Description	Location	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
Silty Sand (SM), trace of clay [Older alluvium]	B - 2 @ 0 - 4 ft.	134.0	7.0
Silty Sand (SM), some clay [Older alluvium, silt blend]	B - 7 @ 0 - 4 ft.	129.5	9.5

Shear Strength Tests – ASTM D3080-11

Direct shear tests were performed on soils prepared to represent future compacted fill derived from surficial native site alluvium. We expect mass grading operations should produce soil masses with roughly equivalent strengths. "Fill" test samples were remolded to approximately 90 percent of the maximum dry density, at optimum water content as determined from a compaction test. All samples were initially saturated, consolidated and drained of excess moisture, and tested in a direct shear machine of the strain control type. Test samples are initially prepared and/or retained within standard one-inch-high brass rings. Samples were tested at increasing normal loads to determine the Mohr-Coulomb shear strength parameters illustrated on page B-8. Peak and ultimate shear strength values are illustrated on the plot.

Expansion Index Tests – ASTM D4829-11

Laboratory clay expansion tests of typical clay materials expected to be incorporated into structural compacted fill were performed in general accordance with the 1994 Uniform Building Code Standard 18-2 and subsequent modern ASTM adoption. A remolded sample is compacted in two layers in a 4-inch I.D. mold to a total compacted thickness of about 1.0 inch, using a 5.5-pound hammer falling 12 inches at 15 blows per layer. The sample is initially at a saturation between 49 and 51 percent. After remolding, the sample is confined under a normal load of 144 pounds per square foot and allowed to soak for 24 hours. The resulting volume change due to increase in moisture content within the sample is recorded and the Expansion Index (EI) calculated.

Expansion Index Test Results

Soil Description	Location	Expansion Index	Expansion Classification
Silty Sand (SM), trace of clay [Older alluvium]	B - 2 @ 0 - 4 ft.	2	Very Low
Silty Sand (SM), some clay [Older alluvium, silt blend]	B - 7 @ 0 - 4 ft.	20	Low

Consolidation Tests – ASTM D2435M-11

Natural alluvium was checked for collapse susceptibility and overall compressibility within predicted removal intervals and in probable competent materials. Testing imposes a series of cumulative vertical loads to a small, laterally confined soil sample. The apparatus is designed to accept a one-inch-high brass ring containing an undisturbed or remolded soil sample. During each load increment, vertical compression (consolidation) of the sample is measured and recorded at selected time intervals. Porous stones are placed in contact with both sides of the specimen to permit the ready addition or release of water. Undisturbed samples are initially at field moisture content, and are subsequently inundated to determine soil behavior under saturated conditions. The test results are plotted graphically on pages B-9 through B-12.

Soil Corrosivity

Soil samples representative of future mass-graded fill in future contact with concrete or ferrous metals were tested in the laboratories of Project X Corrosion Engineers, Murrieta, California, to determine the tabulated data on the next two pages. The submitted soil samples were tested in general accordance with ASTM and Caltrans Standard Methods listed at the top of the table. Soluble-species quantitative determinations were based on 1:3 water-to-soil extracts.

Soil Analysis Lab Results

Client: Aragon Geotechnical Inc
Job Name: First Industrial
Client Job Number: 4534-SFI
Project X Job Number: S190715A
July 17, 2019

	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM G51	ASTM G200	SM 4500-S2-D	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	
Bore# / Description	**Depth**	**Sulfates** SO_4^{2-}		**Chlorides** Cl^-		**Resistivity**		**pH**	**Redox**	**Sulfide** S^{2-}	**Nitrate** NO_3^-	**Ammonia** H_4N^+	**Lithium** Li^+	**Sodium** Na^+	**Potassium** K^+	**Magnesium** Mg^{2+}	**Calcium** Ca^{2+}	**Flouride** F_2^{--}	**Phosphate** PO_4^{3-}	**Bicarbonate** HCO_3^-
						As Rec'd	Minimum													
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
B-7 #19-1524	0.0-4.0	207.3	0.0207	169.4	0.0169	7,370	1,407	8.8	157.0	0.5	10.2	ND	0.2	178.0	2.5	11.7	69.1	6.2	2.1	228

Anions and Cations, except Sulfide and Bicarbonate, tested with Ion Chromatography
mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract

Soil Analysis Lab Results

Client: Aragon Geotechnical Inc
Job Name: First Industrial
Client Job Number: 4534-SFI
Project X Job Number: S190710B
July 12, 2019

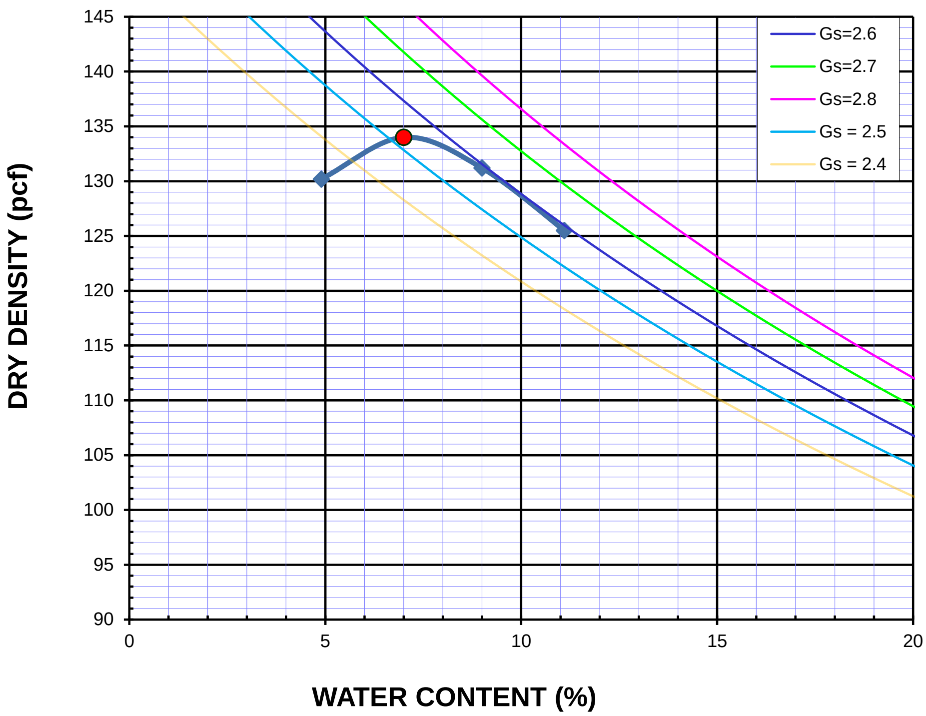
	Method	ASTM D4327		ASTM D4327		ASTM G187		ASTM G51	ASTM G200	SM 4500-S2-D	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327	ASTM D4327
Bore# / Description	**Depth**	**Sulfates**		**Chlorides**		**Resistivity**		**pH**	**Redox**	**Sulfide**	**Nitrate**	**Ammonia**	**Lithium**	**Sodium**	**Potassium**	**Magnesium**	**Calcium**	**Flouride**	**Phosphate**
						As Rec'd	Minimum												
	(ft)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(Ohm-cm)	(Ohm-cm)		(mV)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
B-2 #19-1503	0.0-4.0	7.4	0.00074	2.3	0.0002	18,090	5,829	8.4	166.0	1.3	12.9	0.4	ND	48.6	3.2	10.5	43.5	3.9	9.2

mg/kg = milligrams per kilogram (parts per million) of dry soil weight
ND = 0 = Not Detected | NT = Not Tested | Unk = Unknown
Chemical Analysis performed on 1:3 Soil-To-Water extract

ARAGÓN GEOTECHNICAL, INC.
16801 Van Buren Blvd.
Riverside, California 92504
(951) 776-0345

Maximum Density Test

Client:	First Industrial Realty Trust, Inc. 898 N. Pacific Coast Highway, Suite 175 El Segundo, CA 90245	**Project Name:**	Rider St. at Redlands Ave. Perris, California
Project No.:	4534-SFI	**Report Date:**	August 9, 2019
Sampled By:	Mark Doerschlag	**Lab ID No.:**	19-1503
Date of Sampling:	July 8, 2019		
Information provided by Technician	X Performed at Laboratory ☐ Performed at Jobsite		X Moist Preparation ☐ Dry Preparation
Tested By:	Cesar Lopez	**Date Tested:**	July 9, 2019
Sample Location:	B-2	**Source:**	Native — **Depth/Elev:** 0 - 4 ft
Sample Description:	Silty sand (SM), fine to medium grained. [Older alluvium]		



A	METHOD USED (A,B or C)
-	SIEVE NUMBER
Mechanical	TYPE OF RAMMER
4.9%	AS REC'D MOISTURE
-	PERCENT RETAINED
-	OVEN DRY (C127)
134.0	**MAXIMUM DENSITY [PCF]**
7.0	**OPTIMUM MOISTURE [%]**
-	**CORRECTED MAXIMUM DENSITY [PCF]**
-	**CORRECTED OPTIMUM MOISTURE [%]**

Remarks: No modifications made to test method, followed exact test procedure.

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AASHTO/ASTM/CTM Standards Used:	Unless noted, material was sampled in accordance with AASHTO T2/ASTM D75/CTM 125. Sample tested in accordance with ASTM D2216, D1557-C & D4718.

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Riverside, California 92504
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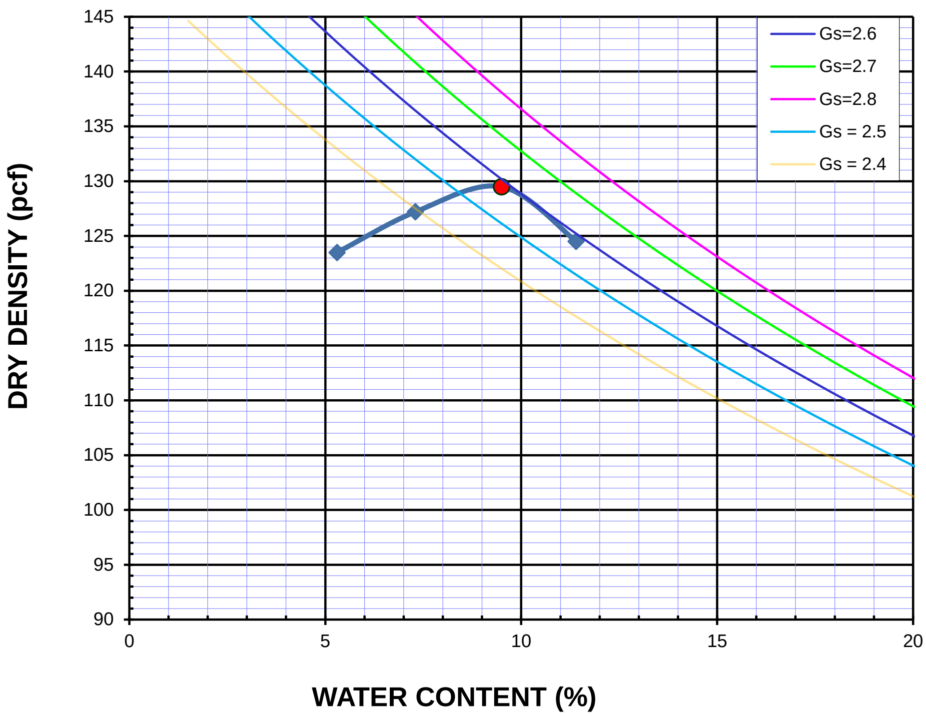
Maximum Density Test

Client:	First Industrial Realty Trust, Inc. 898 N. Pacific Coast Highway, Suite 175 El Segundo, CA 90245	**Project Name:**	Rider St. at Redlands Ave. Perris, California
Project No.:	4534-SFI	**Report Date:**	August 9, 2019
Sampled By:	Mark Doerschlag	**Lab ID No.:**	19-1524
Date of Sampling:	July 9, 2019		
Information provided by Technician	X Performed at Laboratory Performed at Jobsite		X Moist Preparation Dry Preparation
Tested By:	Cesar Lopez	**Date Tested:**	July 12, 2019
Sample Location:	B-7	**Source:**	Native — **Depth/Elev:** 0 - 4 ft
Sample Description:	Silty sand (SM) with some clay. [Older alluvium blend]		



A	METHOD USED (A,B or C)
-	SIEVE NUMBER
Mechanical	TYPE OF RAMMER
5.3%	AS REC'D MOISTURE
-	PERCENT RETAINED
-	OVEN DRY (C127)
129.5	**MAXIMUM DENSITY [PCF]**
9.5	**OPTIMUM MOISTURE [%]**
-	**CORRECTED MAXIMUM DENSITY [PCF]**
-	**CORRECTED OPTIMUM MOISTURE [%]**

Remarks: No modifications made to test method, followed exact test procedure.

.

AASHTO/ASTM/CTM Standards Used:	Unless noted, material was sampled in accordance with AASHTO T2/ASTM D75/CTM 125. Sample tested in accordance with ASTM D2216, D1557-C & D4718.

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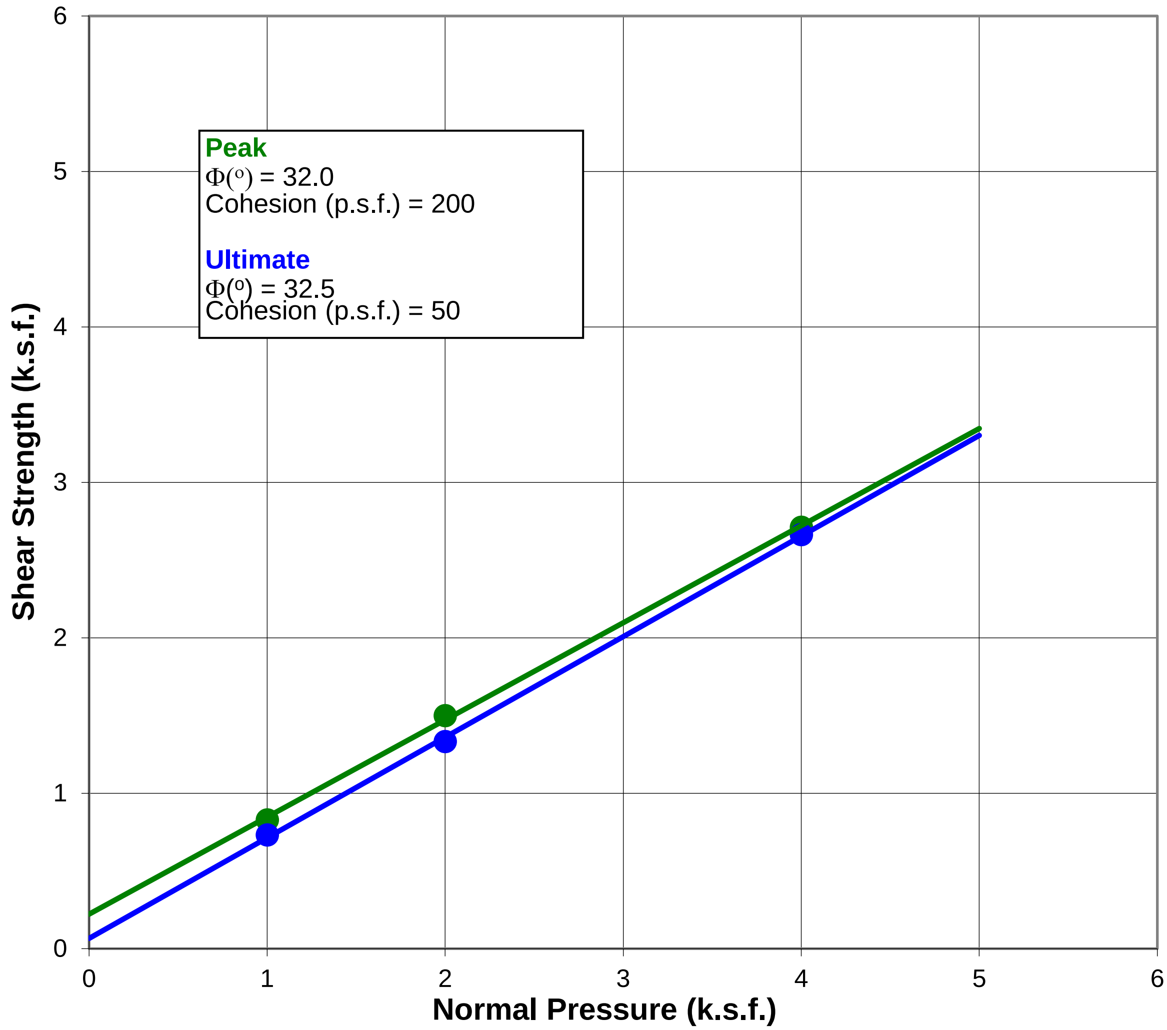
Direct Shear Test Diagram

Project Name:	First Industrial Realty Trust, Inc. - Rider St. at Redlands Ave., Perris, CA		
Project Number:	4534-SFI	Tested by:	Cesar Lopez
Sample Location:	B-2	Date Tested:	7/10/2019
Sampled by:	Mark Doerschlag	Depth (ft):	0.0 - 4.0
Date Sampled:	7/8/2019	Lab I.D. No.:	19-1503
Test Condition:	Remolded, Consolidated, Drained.		
Sample Description:	Silty sand (SM), fine to medium grained. [Older alluvium]		



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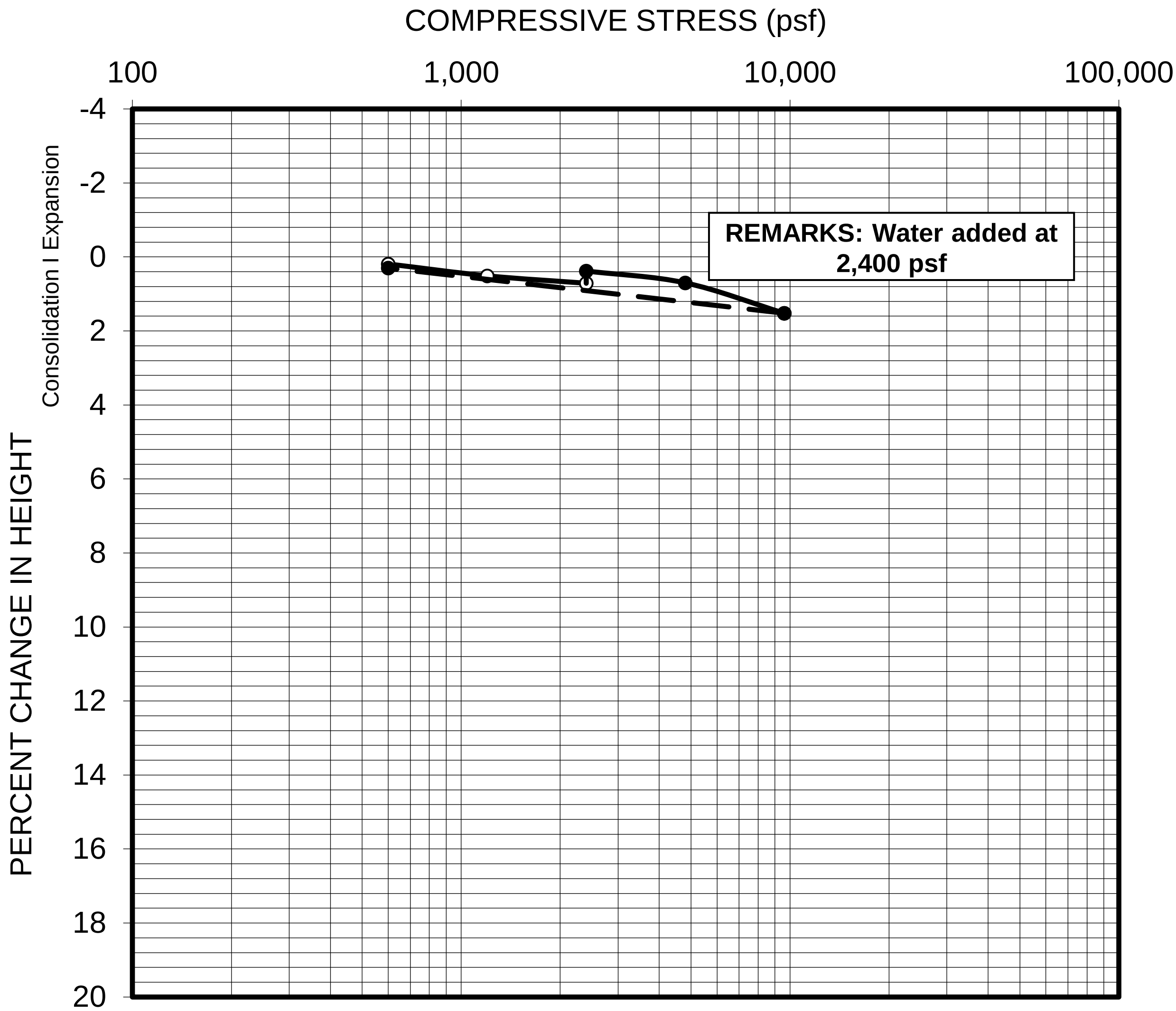
Consolidation Curve

Project Name:	Rider St. at Redlands Ave., Perris, CA		
Project Number:	4534-SFI	Tested by:	Cesar Lopez
Sample Location:	B-4	Date Tested:	7/10/19
Sampled by:	Mark Doerschlag	Depth (ft):	5.0
Date Sampled:	7/8/19	Moisture %:	17.1
Dry Density (pcf):	108.0	Saturation %:	82.3
Sample Description:	Clayey silt (ML), cemented, few fine pores. [Very old alluvium]		



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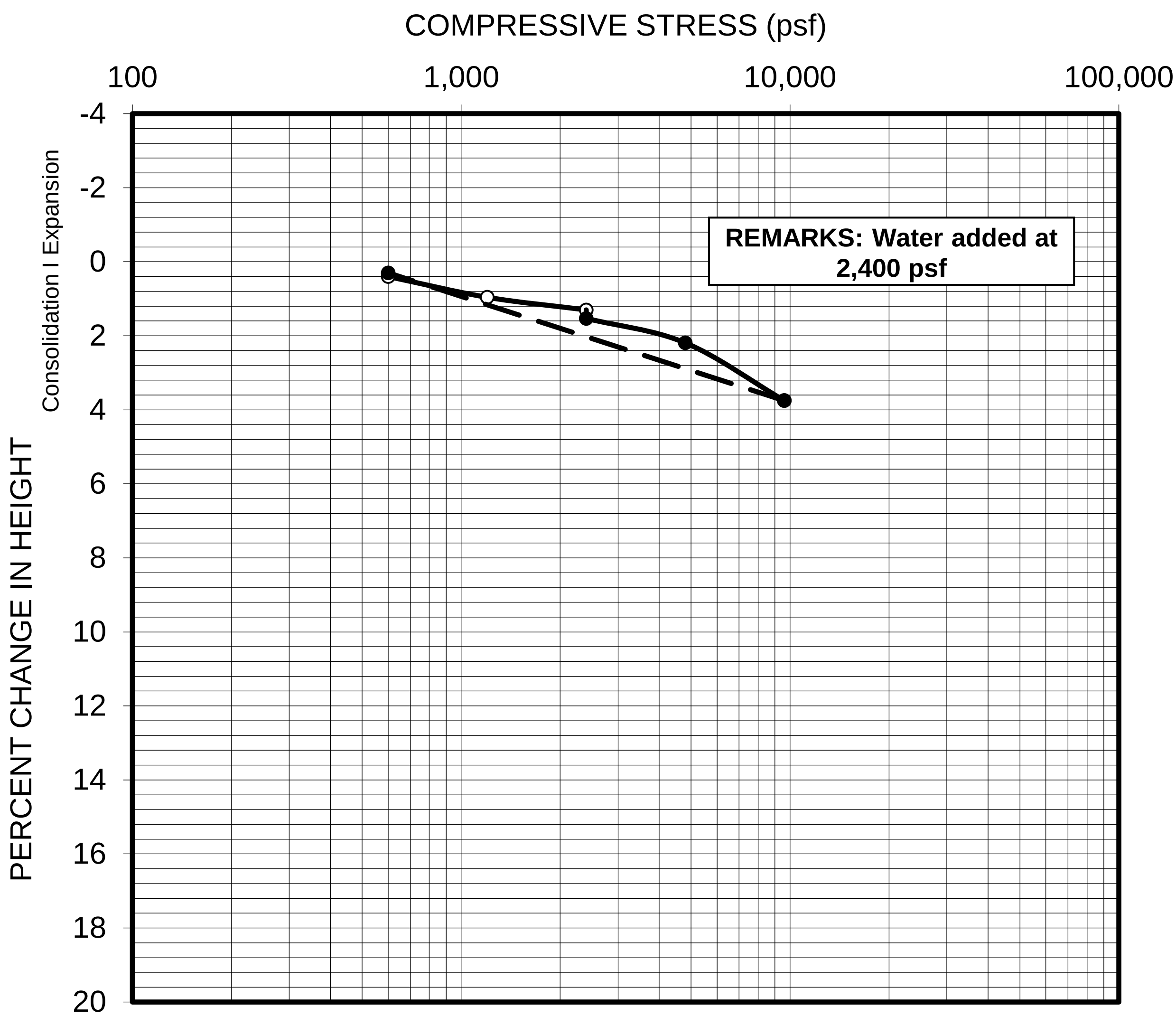
Consolidation Curve

Project Name:	Rider St. at Redlands Ave., Perris, CA		
Project Number:	4534-SFI	Tested by:	Cesar Lopez
Sample Location:	B-4	Date Tested:	7/10/19
Sampled by:	Mark Doerschlag	Depth (ft):	7.0
Date Sampled:	7/8/19	Moisture %:	12.8
Dry Density (pcf):	101.8	Saturation %:	52.7
Sample Description:	Clayey silt (ML), abundant carbonate. [Very old alluvium]		



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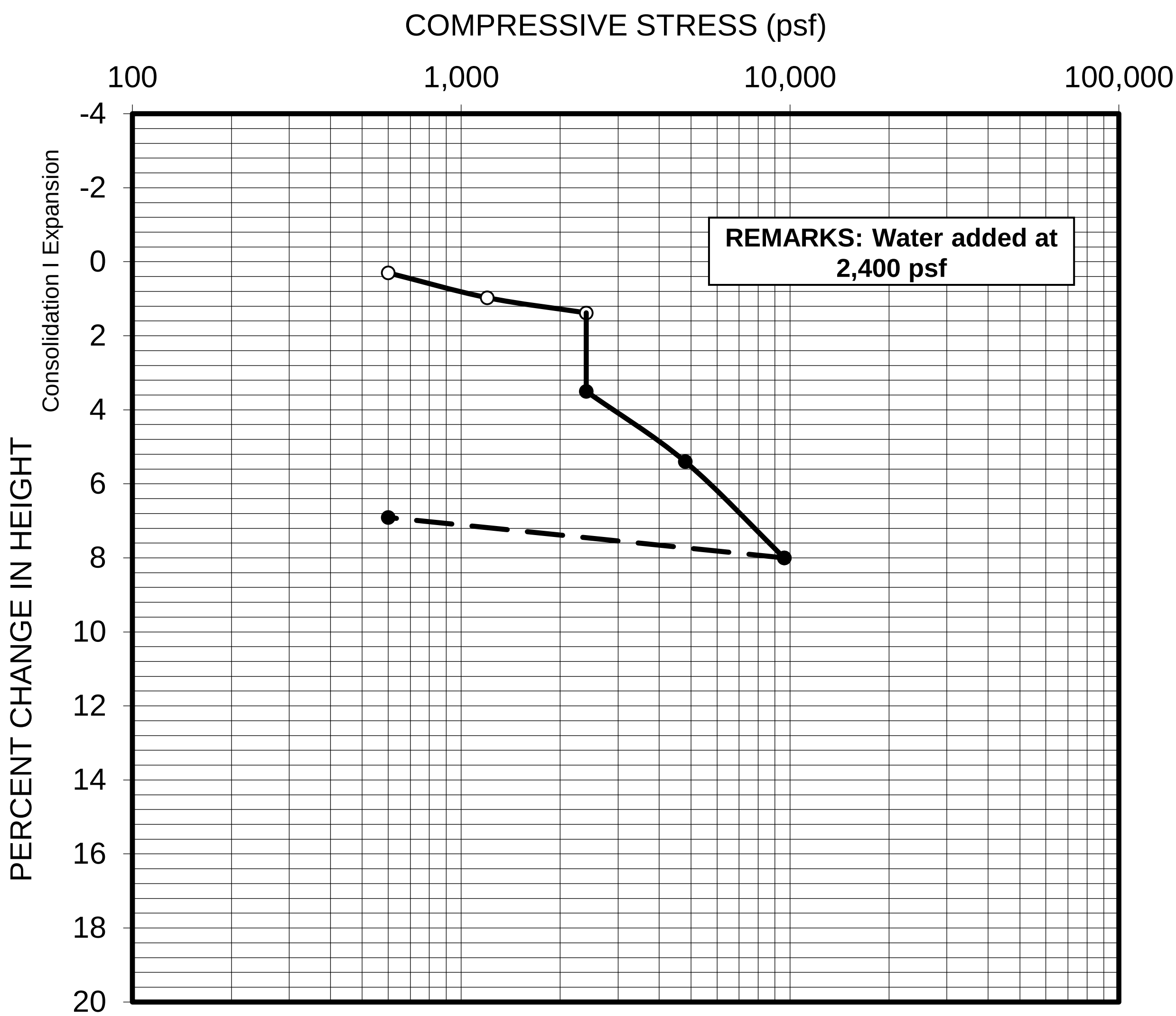
Consolidation Curve

Project Name:	Rider St. at Redlands Ave., Perris, CA		
Project Number:	4534-SFI	Tested by:	Cesar Lopez
Sample Location:	B-8	Date Tested:	7/12/19
Sampled by:	Mark Doerschlag	Depth (ft):	4.0
Date Sampled:	7/9/19	Moisture %:	19.3
Dry Density (pcf):	88.3	Saturation %:	57.3
Sample Description:	Silt (ML), visibly porous. [Very old alluvium]		



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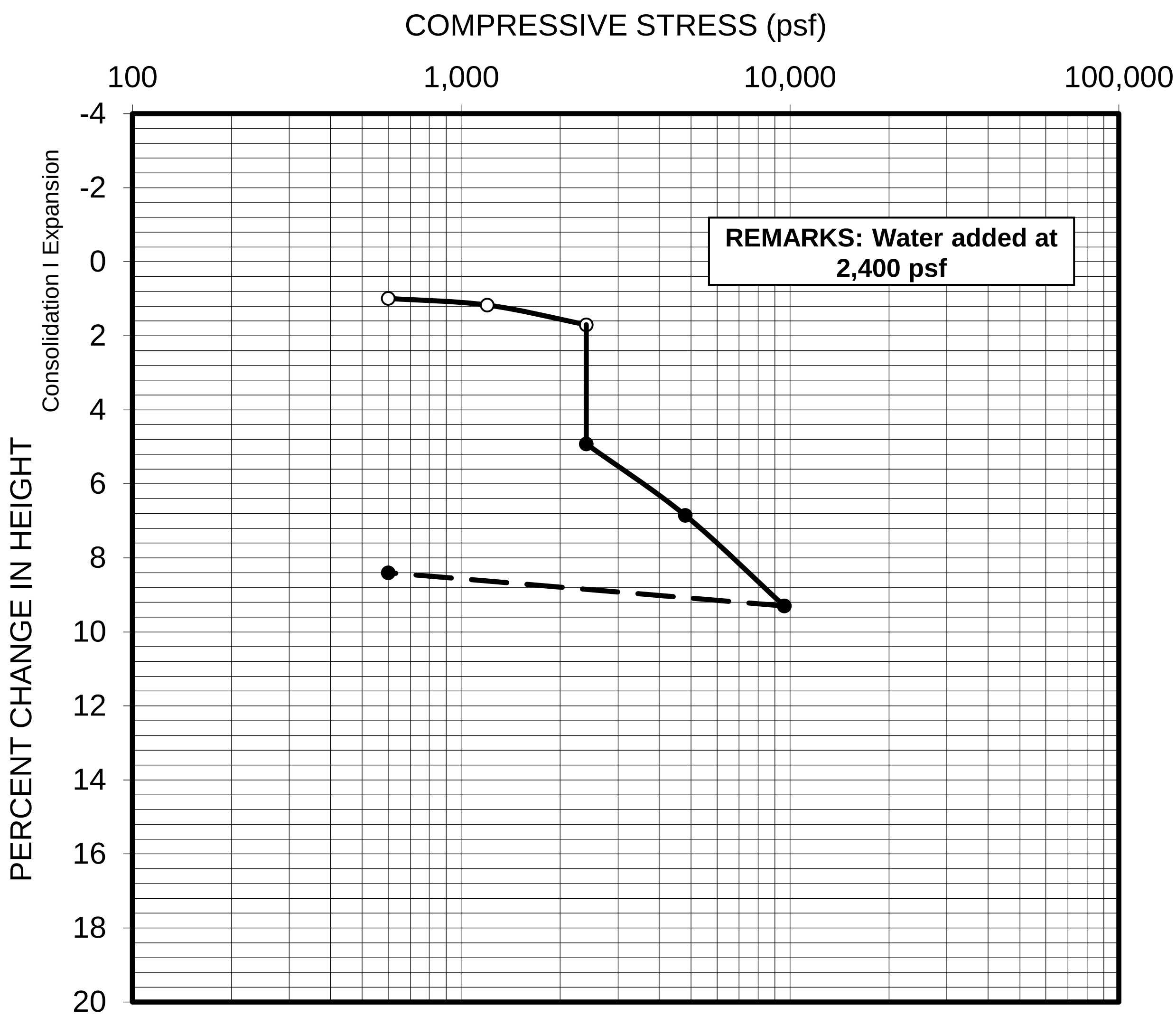
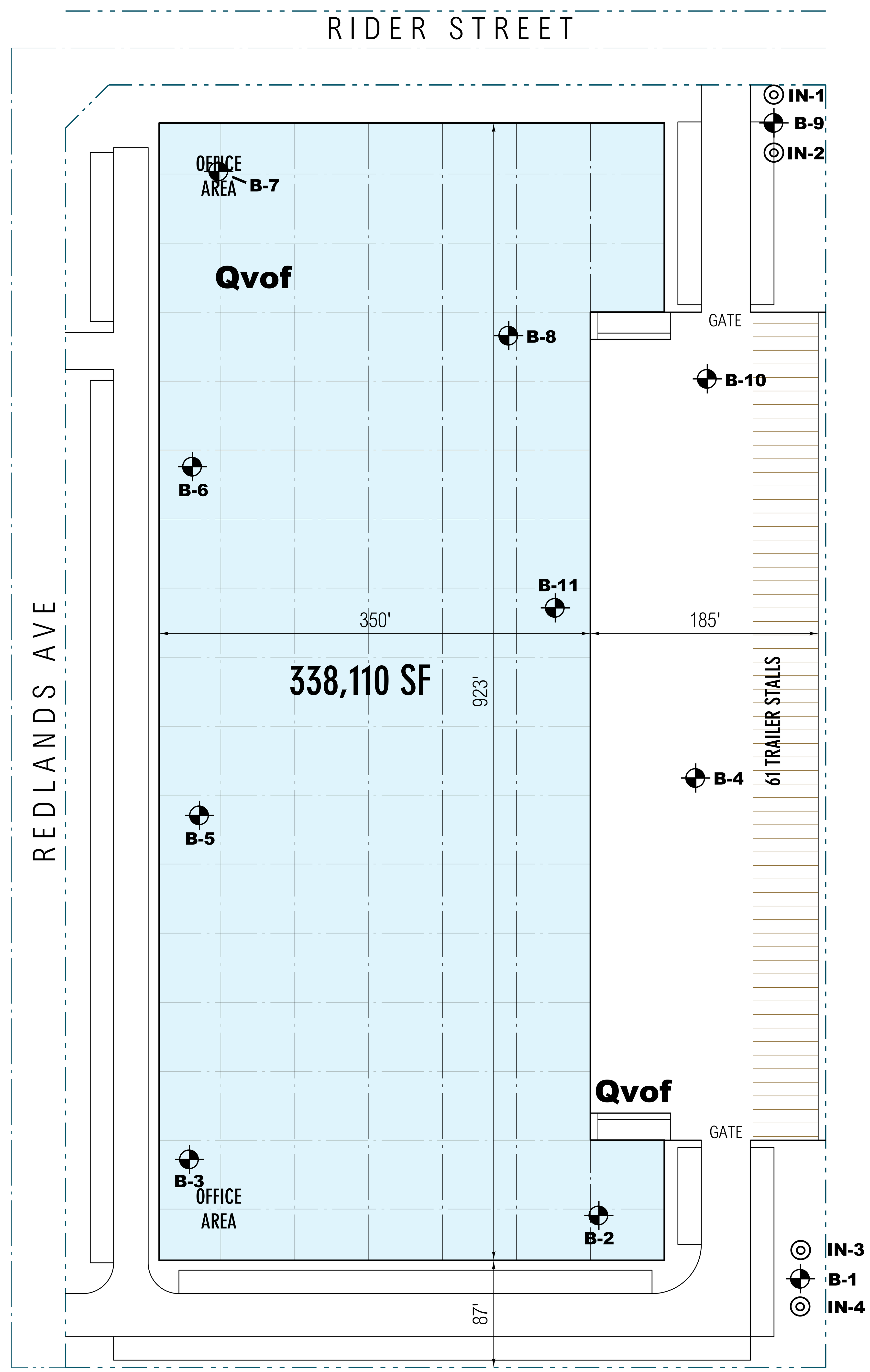
Consolidation Curve

Project Name:	Rider St. at Redlands Ave., Perris, CA		
Project Number:	4534-SFI	Tested by:	Cesar Lopez
Sample Location:	B-8	Date Tested:	7/12/19
Sampled by:	Mark Doerschlag	Depth (ft):	6.0
Date Sampled:	7/9/19	Moisture %:	6.5
Dry Density (pcf):	106.6	Saturation %:	30.2
Sample Description:	Sandy silt (ML), heavy carbonate, not visibly porous. [Very old alluvium]		





LEGEND

B-11	Approximate location of exploratory boring
IN-4	Approximate location of infiltration test
Qvof	Very old fan alluvium
	Not shown: Minor surficial cover of later Pleistocene fan alluvium in south half of site.

PROJECT DATA:

APPROX. SITE AREA:	641,631 SF 14.72 AC
BUILDING AREA:	338,110 SF
COVERAGE:	52.69 %

AGI

GEOTECHNICAL MAP

RIDER STREET AT REDLANDS AVENUE, CITY OF PERRIS, CA

PROJECT NO. 4534-SFI	DATE: 8/9/19	PLATE NO. 1

SCALE: 1" = 40'-0" 0' 10' 20' 50' 100'

RGA
Office of Architectural Design
15231 Alton Parkway, Suite 100
Irvine, CA 92618
T 949-341-0920
FX 949-341-0922

PROJECT NAME

ADDRESS, CITY

PRELIMINARY SITE PLAN - SCHEME 01

MARK	DATE	DESCRIPTION
	XX/XX/XX	CONCEPTUAL SITE PLAN

RGA PROJECT NO:	15XXX.00
CAD FILE NAME:	15XXX-00-A1-01
DRAWN BY:	CS
CHK'D BY:	CS

SHEET TITLE

A1-01