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

PRELIMINARY GEOTECHNICAL INVESTIGATION
LIGHT INDUSTRIAL PROJECT, APN 300-170-009
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. 4488-SFLI
JANUARY 21, 2019

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January 21, 2019
Project No. 4488-SFLI

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 Light Industrial Project, APN 300-170-009
City of Perris, Riverside County, California.

Gentlemen:

In accordance with our revised proposal dated December 4, 2018 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 storm water 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 designer's use in formulating a required water quality management plan.

Ten exploratory borings were sited within the proposed construction area to characterize local soil units and potential influences from groundwater. The locality is fundamentally a deep alluvium site. Drilled intervals encountered massive Pleistocene-age alluvial strata comprising silty clay, clayey silt, and clayey sand as majority classifications within 35 feet of existing grades. Deeper horizons were typically dense to very dense silty sand. Surficial clay soils have become thoroughly weathered and texturally altered to low-density masses within 5 to 8 feet of the surface. AGI did not find evidence for pre-existing fill. However, the entire site appears to have undergone agricultural ripping to depths of 2½ to 3 feet. Groundwater was encountered in only one boring at a depth of 34.0 feet.

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 adequate from a geotechnical viewpoint, with the proviso that site design and construction account for highly expansive soils. AGI recommends that the shallow porous 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 be between 5 and 8 feet below existing surfaces. Reuse of clay soil in structural fills is acceptable unless extreme flatness or floor stability is required by a proposed industrial process.

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 24 inches of engineered fill below all shallow spread and continuous footings. Pavement areas should be partly stripped and partly processed-in-place to create recompacted depths of approximately 36 inches. AGI has preliminarily determined that pavements should rest on an engineered lime-treated zone at least 18 inches thick to minimize future distress and to reduce design structural sections.

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

MGD/CFA:mma

Distribution: (4) Addressee

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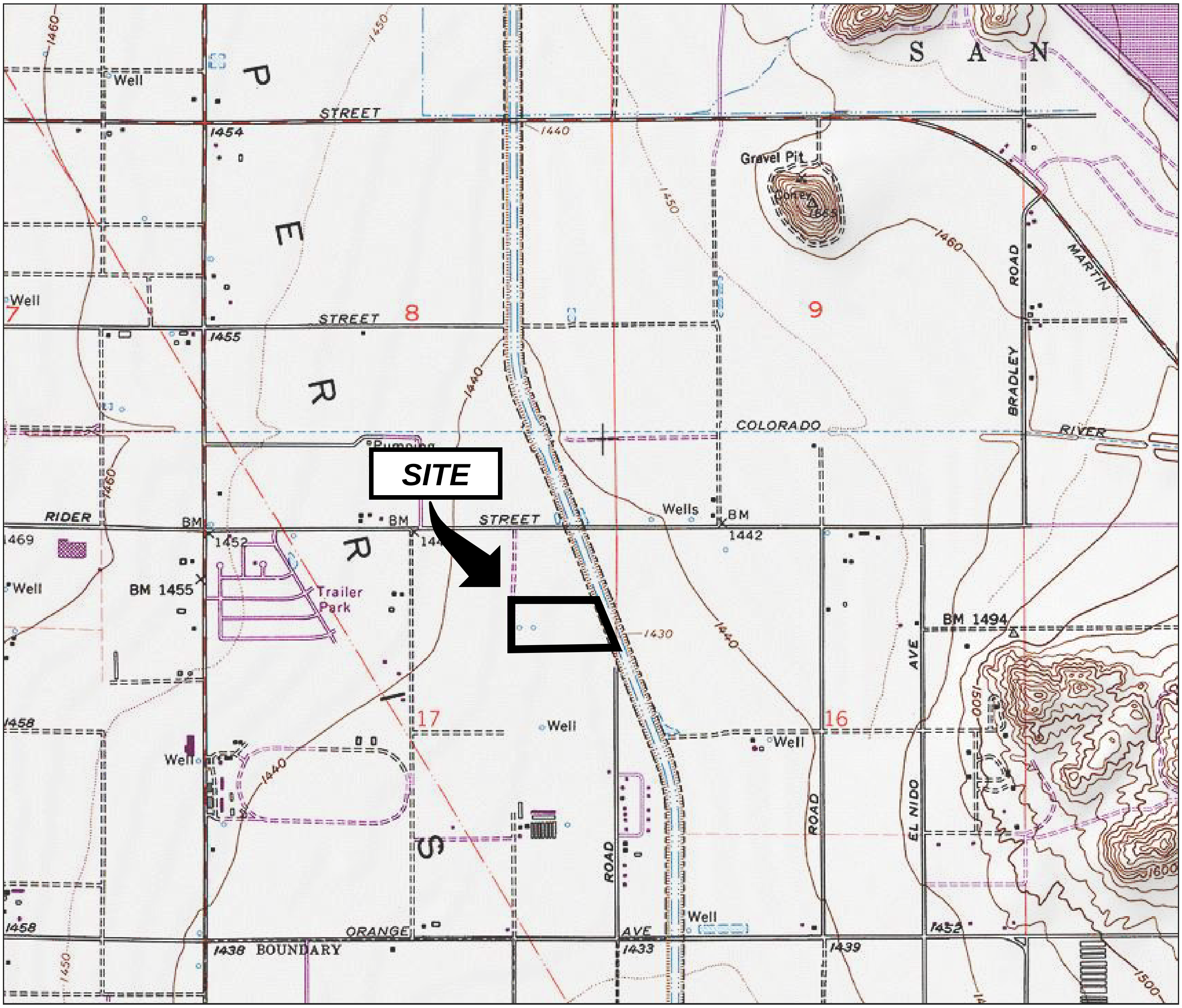
PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED LIGHT INDUSTRIAL PROJECT, APN 300-170-009
CITY OF PERRIS, RIVERSIDE COUNTY, CALIFORNIA

1.0 INTRODUCTION

This report presents the results of preliminary soils engineering and geologic evaluations conducted by Aragón Geotechnical, Inc. (AGI) for the noted project, located south of the intersection of Wilson Avenue at Rider Street, Perris, California. The trapezoidal project site encompasses 15.45 acres. Map coordinates are 33.82732°N x 117.20958°W at the northeast corner of the project (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). Construction is envisioned to include a logistics warehouse or light manufacturing facility with all access points facing Wilson Avenue. The accompanying Site Location Map (Figure No. 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 clearer depictions of ground slope and drainage patterns.

The primary objectives of our preliminary investigation were to determine the nature and engineering properties of the subsurface materials underlying the project area, in order to confirm general site suitability for the building and to provide *preliminary* foundation design, grading, and construction recommendations. Accordingly, our scope included reconnaissance of the site and surrounding acreage, aerial photo interpretation, geologic literature research, subsurface exploration, recovery of representative soil samples, laboratory testing, and geotechnical analyses. Authorized services included field tests to characterize water infiltration potential at a prospective water-quality basin site. 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 quantitative analyses, plus conclusions drawn from field findings and local case-history experience. However, environmental research, Phase I or Phase II environmental site assessments, well construction, or contaminant testing of air or groundwater found in the site were beyond the scope of this geotechnical investigation.



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0 2000 4000 FT.

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

AGI	SITE LOCATION MAP		
	APN 300-170-009, CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.		
	PROJECT NO. 4488-SFLI	DATE: 1/21/19	**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 plan (Scheme A1-01r1) lacked elevation contours but included the planned envelope of an approximately rectangular 301,020-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, one or both with mezzanine levels, would be situated in the southwestern and southeastern building corners. Thirty-nine dock doors would be included in the structure. Based on regional practices, AGI anticipated that the structural system would feature concrete tilt-up walls with parapet heights of possibly 38 to 45 feet, resting on perimeter shallow foundations. Engineered roof trusses would rest on isolated interior steel columns. Moderate foundation loads would be predicted for walls and columns.

Surrounding the building, concrete paving is expected in truck areas while lighter-duty asphalt sections could be substituted in automobile driveways and stalls. Basements or other subterranean construction were not shown on the drawing and would be unlikely. Live sewer, water, and gas utilities exist next to the property, and would presumably connect with the new building via buried service laterals.

It is believed raw cut-and-fill earthwork volumes required to develop the very flat site will be modest. Maximum elevation changes from present surface grades in the project area are not expected to exceed two to three feet. It is speculated that a slightly raised fill pad will be needed to promote proper drainage. Slopes were not illustrated on the available concept plan and are not expected except for shallow basin side slopes.

3.0 FIELD INVESTIGATION AND LABORATORY TESTING

Subsurface geotechnical site characterization comprising 10 exploratory soil borings was completed by AGI on December 28, 2018. The site did not have access impediments posed by very soft soils, vegetation, or existing structures. AGI-selected drill sites were cleared of utility interference issues by notification to the 811 DigAlert service in advance of AGI's work. Soil boring sites 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 7.5 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 eastern and western 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 fold-out), 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, plasticity index, 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 maps used for Figure No. 1. Reviewed historical sources are listed under "References" at the end of this report.

For decades beginning before 1938 and up until after 2010, the site was used for dry-farmed grain crops and possibly irrigated alfalfa. Buildings have never existed on the property. There were no confirmed past uses for stock raising, poultry, feedlot, or dairying operations.

Incomplete State records and site reconnaissance disclosed at least one former on-site agricultural well that may have been drilled in 1953. A small concrete pad for an engine-driven pump and a bent and blocked steel casing were observed about 120 feet east of the Wilson Avenue street centerline (Plate No. 1). If the well records correctly correlate to the found bore, then the well would be about 440 feet deep. Closer to the paved road, standpipes or weirs may have served to distribute the groundwater. A speculative second well might have been installed later. No records or obvious field evidence exists for the second well, but aerial images less than 10 years old show some shed-like feature roughly coincident with a well symbol [small circles] placed on the 1978 topographic quadrangle map excerpted in Figure 1. Wilson Avenue does not appear to have been built as a dedicated improved street until around 1990.

4.2 Surface Conditions

The site features an extremely low-gradient slope of under one percent toward the south-southeast according to Riverside County Flood Control contour maps. Relief within the project area is estimated to be only about 2 feet. Disturbed soil surfaces dominate the site. Regular weed abatement discing has been applied for several years. It appears that most incident rainfall is absorbed by the loosened surface horizons, although excess water runoff can move unimpeded as sheetflow toward the Perris Valley Drain bordering the eastern edge of the site. The drain channel is a simple unlined trapazoidal cut about 8 feet deep with near-continuous wet-season surface stream flows. Information from the Eastern Municipal Water District indicated a buried 36-inch diameter water transmission line parallels the channel about 10 feet inside the APN 300-170-009 property line.

At the time of AGI's field work, the site was only sparsely vegetated except for incipient green annual grasses and weeds, plus clumps of dried Russian thistle (tumbleweeds). There was flowing water in the Perris Valley Drain. Surrounding land uses composed other vacant and fallow terrain, a fenced but unused equipment storage yard to the south, and a small industrial building surrounded by pavement and a block wall owned by a distributor of erosion control products to the north.

4.3 Subsurface Conditions

AGI soil borings penetrated vertically heterogeneous alluvial soil sequences dominated by silty clay (USCS classification CL) within 5 to 9½ feet of existing grades. The clay zone thickens westward, toward Wilson Avenue. No signs of man-made fill were noted in borings. Silt and very fine sand proportions increased almost imperceptibly from west to east (toward the Perris Valley Drain). Laboratory tests corroborated field logs of expansive, fine-grained soils. Near-surface clay collected from a boring near Wilson Avenue produced an expansion index of 91 (categorically "highly expansive" soil), a plasticity index of 16, and a relatively low modified-Proctor maximum dry density of 111.0 pounds per cubic foot. The slightly siltier soils farther east had a lower "medium" expansion index of 59, lower plasticity index of 11, and slightly higher achievable maximum dry density of 115 pounds per cubic foot.

Most of the silty clay layer was shot through with abundant whitish-colored carbonate deposits. The carbonates and possibly some silica cement are chemical precipitates that form *in situ* from intense and very long-term weathering of the soil surface. Textural attributes included very soft, porous, "punky" carbonate + clay fillings between small cohesive blocks (soil peds) caused by seasonal shrink-swell effects. The active soil zone was noted to range from about 5 feet to 8 feet thick, deepening westward. The active zone was marked by lower penetration resistance for soil sampling tools and significantly lower dry unit weights.

All borings encountered mechanical soil disturbance to an average depth of about 3 feet. This is believed to be an artifact of agricultural deep ripping, a very common practice in Perris Valley that is done to help break up clay hardpans for increased water retention. We would extrapolate 3-foot-thick disturbed zones exist over the *entire* development site.

Below the silty clay horizon, alluvial sediments were logged as very stiff to hard clayey or sandy silt, sandy clay, and sometimes dense very silty sand. In some borings, the upper 15 to 20 feet of the alluvial sequence could be interpreted as gradually fining-up deposits. Below 35 feet, stratification became more distinct. The sedimentary layers were dominated by silty and clayey sand, sometimes with occasional thin beds of almost clean sand. Visible macro-porosity was uniformly absent below surficial silty clay deposits. Penetration resistance was typically high for soil sampling tools, with raw SPT N-values ranging from 28 to 88 blows per one-foot increment for sample depths between 15 and 50 feet. Bedrock was not encountered, and would not likely occur shallower than 400 feet at the study site based on water well data (Woodford, et al., 1971). 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

Slow groundwater inflows were observed in one exploratory boring close to the Perris Valley Drain. A stable water level 34.0 feet below grade was measured after several hours. Shallower and deeper soil samples were not mottled with iron oxide stains, a common proxy for detecting past historical high groundwater. All other soil borings remained dry.

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 northeast 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. Shallow groundwater close to the Perris Valley Drain would not be unexpected, as this feature represents a (seasonal) line of basin recharge. There has 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 measured 34-foot depth*. Shallower soils tend to be cemented and/or fine-grained, and will not readily transmit the seasonal recharge volumes that manage to infiltrate through the bottom of the Perris Valley Drain. Groundwater should not influence building design or construction. Any open excavation or shaft deeper than 35 feet, however, could encounter saturated ground and water inflows. Future fluctuations in shallow water elevations are possible, however, due to variations in precipitation, temperature, consumptive uses, or land use changes in Perris 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 underlie the site. AGI drill findings showed that younger deposits are absent, however. In our experience, the younger sediments are generally sandy, fairly loose, and are more obvious much farther north such as toward Moreno Valley and March ARB. The regional map is erroneous. Most of Moreno Valley and the Perris Plain where the Wilson Avenue industrial project is located are considered part of the "Paloma" depositional surface of Woodford et al. (1971), typified by fairly strongly developed illuvial clay and calcic horizons atop the older parent materials.

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 as noted earlier has been 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 0.9 miles east of the project site.

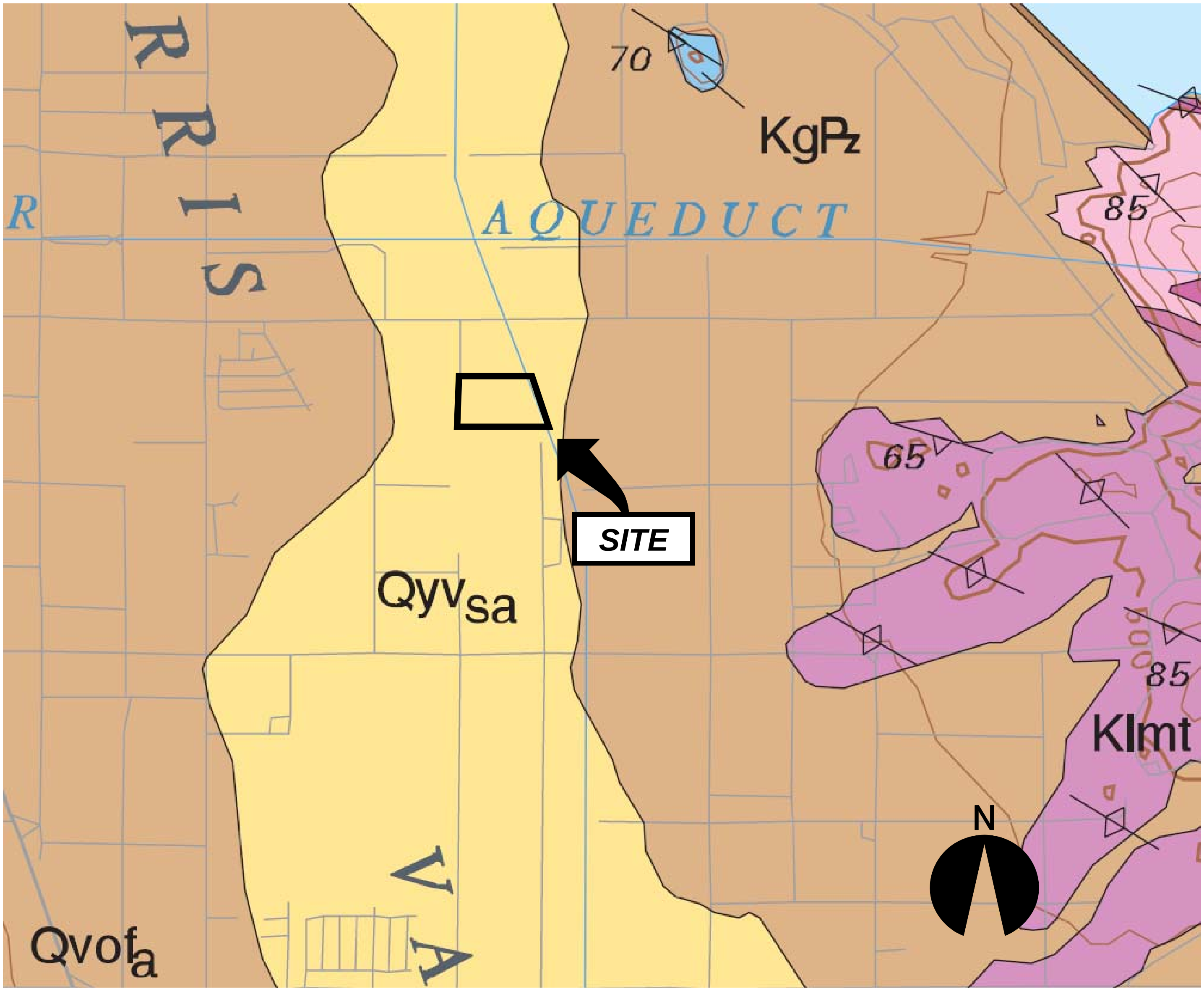
5.3 Slope Stability

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 noted early in the project scope that about 1.8 acres of the site next to the Perris Valley Drain was labeled on the site plan for dedication to the County for flood control. The dedication appeared to correlate to mapped limits of the "100-year" floodplain shown on Riverside County GIS maps. However, according to the revised (2014) FEMA Flood Insurance Rate Map for the site and vicinity, "100-year" flood volumes should remain within the Perris Valley Drain channel (Figure 3). We suspect the GIS map is out-of-date.

Fig 2 geo map



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.

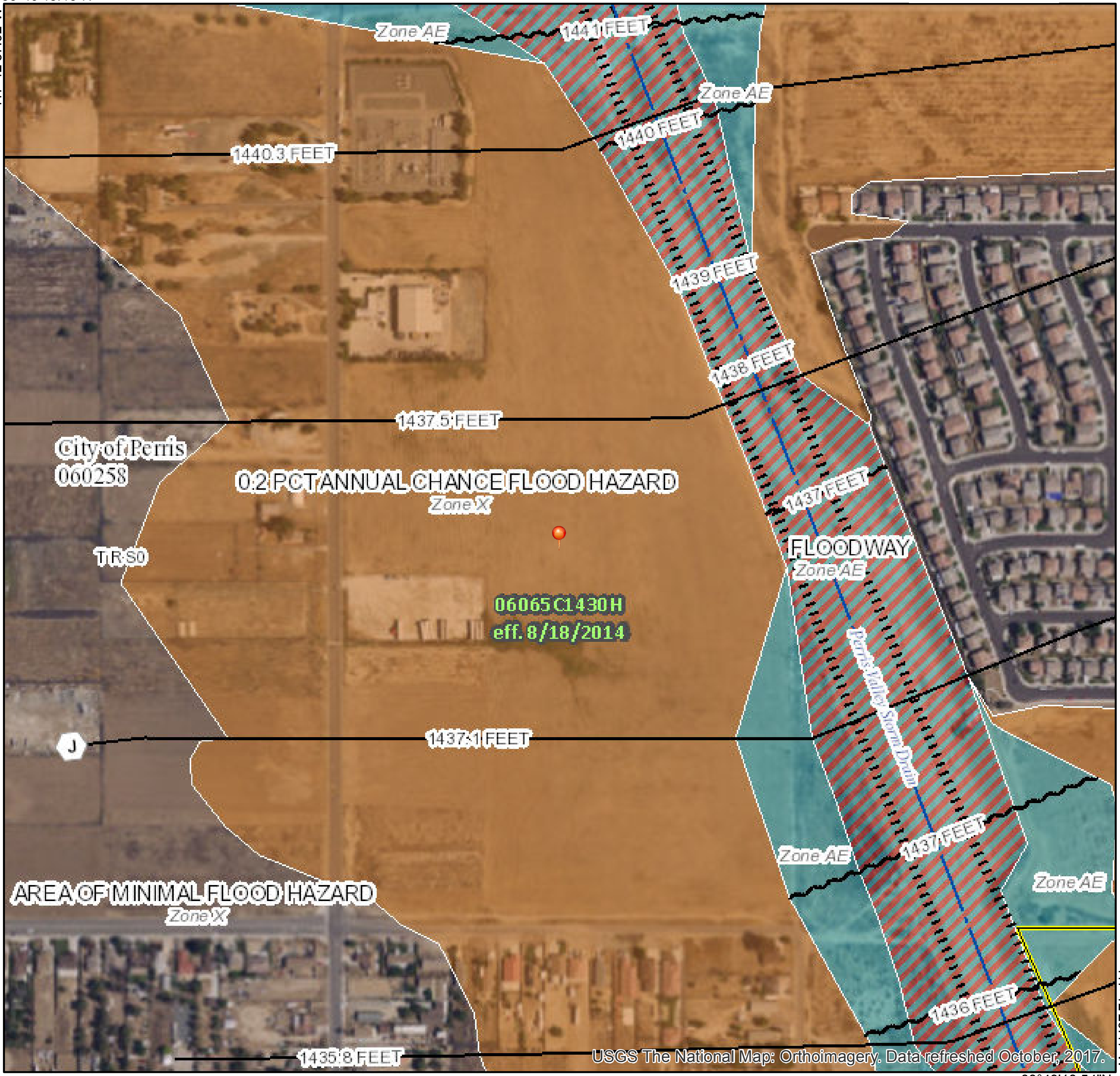
AGI	**VICINITY GEOLOGIC MAP**
	APN 300-170-009, CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.
	PROJECT NO. 4488-SFLI / DATE: 1/21/19 / **FIGURE 2**

National Flood Hazard Layer FIRMette

FEMA

33°49'48.43"N

117°12'57.92"W



117°12'20.47"W

33°49'18.54"N

Feet 1:6,000

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

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	B 20.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 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 1/23/2019 at 1:48:38 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

Per the referenced rate map, all of the project site 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. The owner and civil designer may wish to review whether the 123-foot-wide dedication strip is mandated by the local building authority, thus potentially expanding the development area.

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

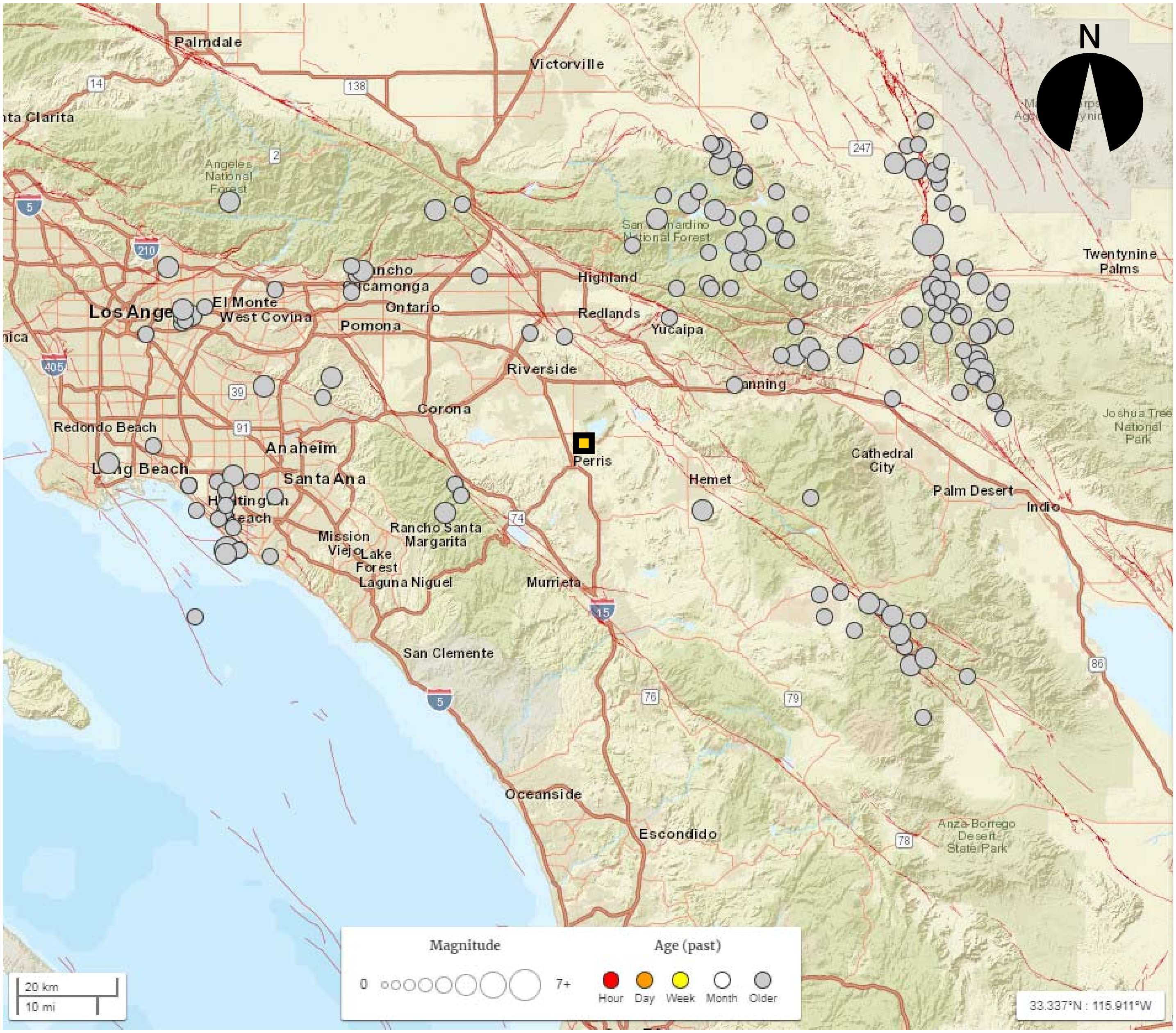
Surface rupture presents a primary or direct potential hazard to structures built across an active fault trace. Reviews of official maps delineating State of California Earthquake Fault Zones and Riverside County Fault Hazard Management zones indicated the project site is distant from zones of required investigation for active faulting. The closest known active regional fault traces are associated with the San Jacinto Fault east of Moreno Valley, about 6.9 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 159 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



Reference: U. S. Geological Survey (2019c) real-time earthquake epicenter map. Plotted are 159 epicenters of instrument-recorded events from 1932 to present (1/21/19) 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

APN 300-170-009, CITY OF PERRIS, RIVERSIDE COUNTY, CALIF.

PROJECT NO. 4488-SFLI	DATE: 1/21/19	**FIGURE 4**

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.

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)	11.2	25	14.0	8.1
San Andreas (Coachella→Mojave South)	26.5	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 .95g (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 $V_{s30} \approx 280$ 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)

5.6 Liquefaction Potential

Liquefaction is the transformation of a granular material from a solid state into a semi-fluid state as a consequence of increased pore-water pressure. Certain soil materials subjected to ground vibrations will tend to compact and decrease in volume. If the materials are saturated and drainage is unable to occur, the tendency to decrease in volume will result in an increase in pore-water pressure. Intergranular pressures may build up to a point where they equal the overburden stress and the effective stress becomes zero, whereupon the soil loses strength and may become capable of flowing as a viscous fluid. Liquefaction risks are usually highest in seismic regions where loose sand or non-plastic silt occur below groundwater.

Calculation or estimation of two variables is required for evaluation of liquefaction potential. These variables are the seismic demand placed on a soil layer, expressed in terms of cyclic stress ratio (CSR), and the capacity of the soil to resist liquefaction, expressed in terms of cyclic resistance ratio (CRR) (Youd and Idriss, 1997). CSR is dependent on the peak horizontal ground acceleration, depth to groundwater, and depth of the soil layer under analysis. CRR is an empirically derived value that discriminates between soils with observed liquefaction effects and those that did not liquefy in actual earthquakes. In most natural soil deposits, CRR increases with increasing depth, increasing geologic age, or increasing clay content. Soils that are not close to or at saturation are normally considered free of liquefaction hazards, but may still have susceptibility and opportunity for related phenomena such as volumetric strain settlement to occur.

Riverside County has classified parts of the site as “high” liquefaction potential. Our suspicion is that the classification was based on (erroneous) regional mapping identifying young sediments at the property, combined with projected shallow-water influences from seepage beneath Perris Dam. SPT-based liquefaction and settlement potential analyses were completed for the sedimentary stack represented by Boring B-5, using the PC-hosted software package LiquefyPro (version 4.3, ©CivilTech Software, 2003). The analyses were done in conformance with the 2016 California Building Code for triggering at the MCE_G value, published guidelines and recommendations of the State of California (California Geological Survey, 1997) and a technical committee of seismological researchers, consultants, and building officials (Martin and Lew, 1999). For risk screening purposes we considered a reasonable speculative present and future high-water level of 34 feet below the surface. Details of user-selectable parameters, the expected seismic condition assumed by AGI for this investigation, settlement calculations, and a program output plot with liquefiable zones and total strain settlements depicted are presented in Appendix C.

The evaluation results indicate that liquefaction triggering is not expected. The sedimentary layers are geologically old and have high relative densities. Saturated granular sediments at depth meet simplified screening criteria for non-susceptibility based on corrected SPT $N_{1(60)cs}$ values uniformly in excess of 30. Special structural design or ground modification will not be required for the project.

5.7 Secondary Seismic Hazards

Settlement. Calculated total surface settlements from the liquefaction model analysis are of extremely low magnitude (approximately 0.1 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. Risks will be insignificant.

Flow Slides and Lateral Spreading. Translational site instability, mobilized by either a reduction in static resisting forces to values lower than static driving forces (flow slides) or by earthquake inertial loading (lateral spreads), often poses the most damaging liquefaction-related hazard. Early concerns focused on the nearby Perris Valley Drain and whether loose and liquefiable material might be present close to the channel bed elevation. Empirical research (e.g., Bartlett and Youd, 1995; Youd et al., 2002) has found that for earthquakes of less than magnitude M_w8.0, lateral spreads can occur when liquefiable materials exist at depths shallower than 30 feet and $(N_1)_{60}$ <15. However, bored explorations have confirmed more than 30 feet of cemented, cohesive, and unsaturated surficial soils are present near the drain channel. This fact, combined with almost-flat site gradients and the modest depth of the Perris Valley Drain should completely prevent flow slide or free-face lateral spread hazards, in our opinion.

Surface Manifestation. In addition to large-scale translational failures from flow slides or lateral spreads, common surface manifestations of liquefaction include ground cracking or fissuring, and ejection of pressurized sand-water mixtures from shallow liquefied layers. With anticipated depths to historic high groundwater exceeding 30 feet and non-susceptibility of shallower soils to liquefaction triggering, fissures and sand boils should not occur.

Landsliding. It is our opinion that induced landslide hazard potentials (collectively deep-seated landslides or shallow earth flows, slumps, slides, or rockfall) are effectively zero. The project site is flat and very distant from possible landslide or rockfall runout zones.

Induced 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 Wilson Avenue 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 embankment 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.

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 materials disturbed by deep tilling, low-density natural materials judged susceptible to compression under building loads, and highly expansive clay soils. Deeper alluvium within zones of near-constant soil moisture is demonstrably hard, cemented, and has very low compressibility.

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.

The clayey site soils pose serious potential project performance problems without substantial remedial earthwork and careful detailing of site drainage, flexible and rigid pavements, and concrete floor slabs. Soil excavation and compaction to create dense engineered fill are recommended to mitigate the unsuitable active-soil horizon 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 all active shrink-swell horizons as compacted engineered fill beside and below the building envelope, and below concrete site walls. The active horizon is physically distinguishable by a peculiar granulated or “exploded” texture, abundant white carbonate, and visible macro-porosity. There is a fairly abrupt

transition from unsuitable clay to competent alluvium. Based on the exploration logs, expected "removal" depths from existing grades will range between approximately 5 feet and 8 feet. The deepest removals will occur close to Wilson Avenue, and should lessen to the predicted minimum near the east end of the light industrial building. Overexcavations should be deepened, if required, so that at least 24 inches of engineered fill is created beneath all future continuous or spread footings. 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 design envelope, i.e., "slot-cutting" for individual column lines or continuous footings without treating unsuitable clay zones below industrial floors is not recommended.

(2) At least 24 inches of soil stripping before placement of compacted engineered fill is recommended in all future new pavement or walkway areas. The remaining 12 inches may be processed and compacted in place. The intent is to recompact all mechanically tilled soils. Should pavement or walkway subgrades be planned more than 24 inches below current surfaces, in-place processing shall be instituted to create at least 12 inches of engineered soil fill below flexible or rigid pavement structural sections.

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. Features may be found due east and due west of the one known well site. Live utilities next to Wilson Avenue and the EMWD transmission line next to the Perris Valley Drain should be protected in place.

- Well closure: The known well casing and any other confirmed water wells should be properly grouted, sealed, and capped by a C57-licensed drilling contractor in accordance with Riverside County and State DWR regulations. We advise exploratory potholes or obtaining a geophysical survey (magnetometer) to rule out a second well near Wilson Avenue close to the labeled box on Plate No. 1. A copy of the well closure report(s) must be submitted to AGI.

- Clearing and disposal of heavy weeds and foreign objects 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 roots or debris 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. Competent soils shall demonstrate in-place dry densities of 85% or greater of the laboratory-determined maximum dry density to be accepted, 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 a depth of 4 to 6 inches (or as field conditions dictate), 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 110 percent of 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. Light pre-watering of the site is recommended in advance of earthwork (depending upon seasonal conditions) to moisten the upper 36 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 clay and creating sticky, muddy, impassable conditions. *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 110% 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 the clayey fill and break down clods.

- 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, additional compaction effort, with adjustment of the water content as necessary, should be made until at least 90 percent 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. The borrow site and import soils must be reviewed and accepted by the Geotechnical Engineer prior to 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 not be directed to planter strips. 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 Atterberg limits testing 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 5 tests overall, whichever is greater.

6.3 Earthwork Volume Adjustments

Removal and recompaction of the unsuitable surficial clay 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 3 feet (tilled zone), and the future achieved degrees of compaction. We believe that civil designers should make allowances for at least 12 to 17 percent shrinkage in the building removal areas. Exterior paved areas may shrink closer to 20 percent. Bottom subsidence from heavy equipment is predicted to be very low in the cemented soils, and would conservatively not even reach 0.1 foot.

6.4 Slopes

Permanent manufactured slopes of any height are not expected at this project. If expectations change, though, 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 (other than basin side slopes 3:1 or flatter) should be reconstructed as stabilization fill slopes with the same minimum horizontal dimensions.
- 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 2,000 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 0.28 may be utilized for foundations and slabs constructed atop structural fill composed of silty clay. 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 docks 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 planned. 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 use of freezers or heating boxes.

AGI believes there is an unavoidable and substantial probability that as-built pad soils will fall into the medium-high expansive soil range (expansion indices ~80-95). A relatively low soil modulus can be expected. For smaller buildings, these conditions can be mitigated by soil pre-conditioning (presaturation), thicker concrete, thicker and more closely-spaced reinforcing bars, or selection of structural options such as post-tensioned slabs-on-grade. For large buildings with multi-acre floor areas, structural reinforcement options can become technically or economically infeasible. If absolute flatness and settlement-swell resistance is required (not expected of a warehouse-type end use), then soil stabilization or substitution with non-expansive sand would be the recommended approaches.

AGI recommends that all interior floor slabs and exterior walkway or patio slabs rest on a minimum of 6 inches of ¾-inch clean crushed rock or similar *open-graded* aggregate rolled and/or vibrated into place. A chocking layer of coarse sand is acceptable on the top course if needed to counteract instability or to leave a smooth subgrade surface. Well-graded road base or reclaimed materials are not advised since in the compacted state they become almost impermeable and can allow capillary moisture to reach the concrete. The underlayment should be compacted to a minimum relative compaction of 95 percent in the upper 12 inches.

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 as-built subgrades having an expansion index of 90 or less, at a plasticity index less than 20, as AGI anticipates for local silty clay materials 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 5.0 inches thick if reinforced with No. 3 reinforcing bars at 12 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).

The owner and civil designer should consider the same dimensions, concrete materials, and slab reinforcement for non-structural exterior pedestrian and landscape walkways. Plain concrete or only wire-mesh reinforcement are not recommended. Differential movement may be unavoidable between walkway slabs and heavier building walls or curbs unless special joint detailing and sealing can be specified.

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 100 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.

Plain concrete slabs should be at least 6 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 should be situated between the gravel underlayment and clay subgrade. Optional thicker 10-mil vapor retarders (e.g., StegoWrap®) have 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. For expansion indices of 50 to 90, AGI would recommend that soil water contents meet or exceed 120 percent of the optimum soil water content to a depth of at least 18 inches prior to vapor retarder installation or concrete placement. Open-graded gravel underlayment is specified in large part because it is permeable, and can be placed and densified before starting any required watering. Construction sequencing that helps preserve grading water should be encouraged. Allowing the pad to dry back will be detrimental. Pre-saturation could then take several days. 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. 33.82732, Long. 117.20958)

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 (U.S. Geol. Survey, 2019d), 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 $S_{D1} > 0.20$g and $S_1 < 0.75$g. 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 USGS tool from Figures 22-17 and 22-18 of ASCE 7-10 would be:

$C_{RS} = 1.057$ $C_{R1} = 1.025$

It should be understood that the 2016 CBC and most other building codes define minimum criteria needed to produce acceptable life-safety performance. Code-compliant 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.

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. It is anticipated that the uppermost 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. Mechanical stabilization alone, however, will not change soil plasticity indices that may range to 15 or greater, or raise subgrade R-values beyond a predicted range of 5 to 15.

AGI recommends chemical soil stabilization measures to mitigate very low subgrade R-values and provide a stronger, uniform bearing substrate for the engineered pavement structural sections. Using specialty mixing and spreading equipment, we advise selection of lime+soil stabilization to a depth of 18 inches. Lime treatment is preliminarily judged feasible based on plasticity tests and predicted clay type. Treatment should encompass the entire proposed vehicular pavement area. Mixtures should be compacted in lifts as engineered fill. After initial curing, most flexible pavement installations are preceded by a “pre-cracking” process to restore resiliency to the subgrade and help reduce chances for development of block cracks in the final hot mix asphalt (HMA) mat.

Lime stabilization treatment changes the clay chemistry. When selected as a subgrade stabilization method, multiple important benefits are gained: (1) Treatment reduces soil plasticity, while improving workability and compaction properties; (2) Infiltration potential (hydraulic conductivity) is minimized; (3) Volumetric stability is achieved; (4) Soil strengths are greatly increased, sometimes by a factor of 10 or higher; and (5) Pavement structural section thicknesses, inclusive of aggregate base courses and HMA layers, can be reduced to dimensions approaching or meeting practical minimums demanded only by expected traffic loading. Many engineering studies have demonstrated lime stabilization benefits are maintained and even improve after years of in-service life for roads and airfields, although it should be noted that truly permanent improvement (decades) remains outside of case-history experience.

The following table presents *preliminary* recommended structural sections for employee parking lot asphalt pavement based upon Caltrans design methods, a 20-year pavement lifetime, and a representative soil R-value for the untreated case. An estimated R-value is shown for lime-treated soils. Generally, the recommended section for treated soils will be applicable for any final R-value greater than 40, for loading corresponding to a traffic index of 5.5 or less. This is the minimum structural section recommended 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 Conventional Asphalt Pavement Designs

Employee Parking Lot Automobile Stalls & Driveways	Traffic Index	R-Value	A.C. Thickness	Base Thickness
Untreated Clay Subgraded	5.5	10	3.5" 4.5"	10.0" 8.0"
Hydrated Lime-treated Subgrade	5.5	40	3.0"	6.0"

Soils treated with hydrated lime may have different compaction control criteria than those outlined for untreated clay subgrades. These criteria will need to be developed in concert with the mix design.

Portland Cement Concrete Pavements. Portland cement concrete pavements are expected for the truck dock areas and could be implemented site-wide. It is expected that concrete pavements will rest on lime-treated subgrade. It may be feasible, though, to waive lime treatment should at least 18 inches of compacted granular soil, granular subbase, or select aggregate base be used in substitution of active clayey soils beneath the structural section. The soil replacement option depends in large part on whether adequate site slope and drainage characteristics can be engineered. - Substitute materials should classify as non-expansive (expansion index <20).

For an assumed traffic index of 8.0 and equivalent maximum single-axle loads of 13,000 pounds, the recommended preliminary design section includes 7 inches of un-reinforced (plain) concrete, over 18 inches of lime stabilized soil. Concrete used for pavement should have a minimum 28-day compressive strength f_c of 4,500 pounds per square inch. The structural engineer could consider 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.

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 described in Section 6.1. AGI recommends the uppermost 12 inches of (untreated) soil subgrade materials that are composed of silty clay or clayey silt (USCS classifications CL, ML) below pavement structural sections or curb-and-gutter installations be processed and compacted to a minimum of 90 percent of the laboratory maximum dry density determined by ASTM D1557-12. Granular subgrades, if used, should be processed and compacted to a minimum of 95 percent of the laboratory maximum dry density determined by ASTM D1557-12. 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 lack of site relief suggests walls will not be required except possibly for dock door areas. Preliminary recommended earth pressure values for walls are shown below. AGI assumes that a well-drained, select granular import material with a sand equivalent value of 30 or better will be utilized for backfill. Site clay soil is 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_w7.5. 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	40	60

It is recommended preliminary wall designs be reviewed by AGI for locality-specific modifications and/or needs for additional soil tests before construction. The same recommended maximum foundation bearing value of 2,000 psf for structures may also be assumed for retaining walls and site walls. 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. 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, cohesive sequences of 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 and the cut will be open for 24 hours or less, the side slopes should be inclined to no steeper than ½:1 (horizontal to vertical) per current rules for excavation material Type A and an excavation depth of 12 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. 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 Wilson Avenue) 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 highly aggressive to concrete, but could be extremely corrosive to buried metal. Analytic tests reported soluble sulfate ranged from 0.0021 to 0.0120 weight percent across the property. Slightly saline conditions were detected toward the Perris Valley Drain. Saturated resistivity was only 737 to 938 ohm-cm in two samples, confirming that all surficial site soils fall under a general classification of “very severe” risk for electrolytic-type corrosion of ferrous metals. We strongly 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. 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 potentials, soluble sulfate content, soil plasticity index, and pre-saturation of the fill pad is recommended at appropriate points in the construction time line. All foundation excavations should be observed prior to placing concrete 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

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 appreciates 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,
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Attachments: Appendices A-C
Geotechnical Map, Plate No. 1 (foldout)

Distribution: (4) Addressee

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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.43-44
5-24-74	1974 County	1:24,000	Nos. 380-381
4-10-80	1980 County	1:24,000	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
3-14-10	2010 County	1:19,200	Line 8, Nos. 24-25

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, #111
5-15-67	AXM-1967	1:12,000	3HH-31
3-8-04	EAG RV 04	1:21,000	616

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 surrounding improvements, and 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 analysis and site class 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

Sheet 1 of 2

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	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:	**± 1440.5 Ft. AMSL, RCFC NAD 83**

Comments: Located near NWC 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	1440		CL	Silty Clay: Brown; soft upper 3' (mechanically disturbed), becoming very stiff below; subjectively slightly moist; traces of fine to medium sand. Granulated, fine blocky texture, with abundant carbonate below 2 feet. [Very old alluvium]			BULK: MAX, SHEAR, EI, LL/PL, CORROSION SUITE
		RING 6 13 13 (26)	CL	← Silty clay, disaggregated small blocky peds with soft punky interstitial fills, abundant carbonate, visibly porous.	88.2	12.5	CONSOL
5	1435	RING 13 15 17 (32)	CL	← Silty clay, similar to 3' sample and continued visibly porous to at least 6' depth.	102.4	14.1	CONSOL
		RING 13 17 19 (36)	CL	← Silty clay, with 15-20% fine sand. Heavy carbonate and punky textures die out by ~8 feet, not visibly porous below.	103.0	13.9	
			ML	Clayey Silt: Yellowish brown; very stiff; slightly moist; moderately cohesive; non-plastic; massive; not visibly porous. Common MnO spots/films. Very slowly grades less clay and more granular with depth (coarsening down). [Very old alluvium]			
10	1430	RING 13 17 20 (37)			125.2	6.7	
15							

Continued on next sheet.

AGI	**FIELD LOG OF BORING B - 1** Sheet 2 of 2
	Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*
	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	1425			SPT 22 26 27 N=53		ML	Sandy Silt: Dark yellowish brown; primarily hard; moist; cohesive and with some clay content but lacks visible carbonate; non-plastic; averages ~15% fine to medium-grained sand; massive. Continues to slowly coarsen with depth. [Very old alluvium]				
20	1420			SPT 10 17 22 N=39		SM/ML	← Grades to very silty f-m sand, massive, friable and uncemented, dark yellowish brown.				

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

FIELD LOG OF BORING B - 2

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**31.5 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:	**± 1440.0 Ft. AMSL, RCFC NAD 83**

Comments: Located near SWC 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	1440		CL	Silty Clay: Brown; soft in mechanically disturbed zone, becoming very stiff below; subjectively slightly moist; traces of fine to medium sand. Granulated, fine blocky texture, with ubiquitous carbonate below 2.5 feet. [Very old alluvium]			
		RING 15 24 22 (46)	CL	← Silty clay, with sharp contact between mechanically ripped and natural deposits at 2.5-foot depth, latter with disaggregated small blocky peds with soft punky interstitial fills, abundant carbonate, visibly porous.	102.9	14.0	CONSOL
5	1435	RING 8 17 18 (35)	CL	← Silty clay, similar to 3' sample and continued visibly porous.	104.4	12.6	CONSOL
		RING 17 21 24 (45)	CL	← Silty clay, carbonate now finely disseminated, sandier (about 20%). Continues partly friable and punky texture, with some pinhole pores. Lower unit contact approximate.	106.6	11.4	
			SC, ML	Clayey Sand: Brown; dense; slightly moist; cohesive and cemented; non-plastic; not visibly porous. Some subordinate zones classify as sandy silt. Not visibly porous. [Very old alluvium]			
10	1430	RING 18 27 35 (62)			124.1	5.2	
15	1425						

Continued on next sheet.

FIELD LOG OF BORING B - 2

Sheet 2 of 2

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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	1425	SPT 10 16 22 N=38		SC	Clayey Sand: At 15 feet grades dark yellowish brown; dense; slightly moist; cohesive and with estimated 35-40% fines; non-plastic; not visibly porous. Becomes firm drilling in remainder of boring. [Very old alluvium]				
20	1420	SPT 16 35 40 N=75		SC, CL	← Becomes very dense clayey sand and sandy clay, crude beds, cohesive, brown color, lacks carbonate.				
25	1415	SPT 16 21 24 N=45		CL					
				SM	Silty Sand: Primarily yellowish brown; dense to very dense; slightly moist; averages around 20-25% almost entirely silty fines, but is very clayey and very cohesive at top of sample (paleosol?). May be crudely layered ~1 foot thick. Easier drilling. [Very old alluvium]				
30	1410	SPT 9 16 34 N=50		ML	← Massive yellowish brown moist silt, traces of sand and clay.				

Bottom of boring at 31.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 3

Sheet 1 of 2

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	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:	**± 1440.0 Ft. AMSL, RCFC NAD 83**

Comments: Warehouse building, center region.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0	1440		CL	Silty Clay: Brown; soft in mechanically disturbed zone, becoming very stiff below; subjectively slightly moist; traces of fine to medium sand. Granulated, fine blocky texture, with ubiquitous carbonate below 3 feet. [Very old alluvium]			
		RING 5 7 13 (20)	CL	← Silty clay, with sharp contact between mechanically ripped and natural deposits at 3-foot depth, latter with disaggregated small blocky peds with soft punky interstitial fills, abundant carbonate, visibly porous.	92.2	11.2	
5	1435	RING 8 13 25 (38)	CL	← Silty clay, blocky small peds with abundant reticulate and diffuse carbonate, crumbly, continued visibly porous.	97.5	14.2	
		RING 15 21 31 (52)	CL	← Silty clay, cohesive and far better texture than "exploded" active zone above, minor finely disseminated carbonate, not visibly porous.	118.2	12.0	
10	1430	SPT 8 12 16 N=28	SC	Clayey Sand: Brown; medium dense grading to dense; slightly moist; fine to medium grained; cohesive, but relatively low fines at estimated 20%; not visibly porous. Appears massive. [Very old alluvium]			
15	1425						

Continued on next sheet.

FIELD LOG OF BORING B - 3

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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	1425			SPT 11 17 33 N=50		SC/CL	Clayey Sand: At 15 feet grades dark reddish brown and much more clay; very dense; slightly moist; strongly cohesive; non-plastic at field water content; fine to medium weathered sand; not visibly porous. Firm drilling. [Very old alluvium]				
							Silty Sand: Yellowish brown; very dense; slightly moist; averages around 25% fines with traces of clay (still uncemented); fine to medium grained; appears massive. Notably easier drilling. [Very old alluvium]				
20	1420			SPT 15 33 55 N=88		SM	← Silty sand, as above.				

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

FIELD LOG OF BORING B - 4

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	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:	**± 1440.0 Ft. AMSL, RCFC NAD 83**

Comments: Warehouse building, center region.

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	1440		CL	Silty Clay: Brown; mechanically disturbed to around 3 feet, abruptly becoming very stiff below; subjectively slightly moist; traces of fine to medium sand. Granulated, fine blocky texture, with ubiquitous carbonate below tilled layer. [Very old alluvium]				
		RING 9 13 13 (26)	CL	← Silty clay, with sharp contact between mechanically ripped and natural deposits near the 3-foot mark, native soils feature soft punky interstitial fills of pedogenic carbonate, visibly porous.	101.6	11.0		
5	1435	RING 9 15 26 (41)	CL	← Silty clay, common reticulate carbonate with punky expanded textures and visibly porous to ~5' depth.	101.4	13.9		
		RING 19 36 50/5"	ML	Clayey Silt: Dark yellowish brown; hard; slightly moist; moderately cohesive with ~15% fine sand; non-plastic; not visibly porous; massive. Common MnO grain films. [Very old alluvium]	125.4	9.7		
10	1430	SPT 23 36 50 N=86	CL	Sandy Clay: Brown; hard; slightly moist; strongly cohesive but with estimated 35-40% sand; not visibly porous. May be upper part of a thick fining-up sedimentary package. [Very old alluvium]				
15	1425			Approximate or gradational contact.				

Continued on next sheet.

FIELD LOG OF BORING B - 4

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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	1425		■	SPT 10 24 40 N=64		ML	Sandy Silt: Primarily yellowish brown; hard; still only slightly moist; averages around 30-40% fine to medium-grained sand; uncemented; lacks carbonate. Firm drilling to bottom. [Very old alluvium]				
20	1420		■	SPT 20 29 41 N=70		SM	← Sample classifies as silty sand with trace of clay, uncemented, fine to medium grained. lacks carbonate.				

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

FIELD LOG OF BORING B - 5

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	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:	**± 1440.0 Ft. AMSL, RCFC NAD 83**

Comments: Located at NEC of proposed industrial building. Perris Valley Drain has surface stream flow.

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	1440	BULK		CL	Silty Clay: Pale brown; mechanically disturbed to around 3 feet, abruptly becoming very stiff below; subjectively slightly moist; traces of fine-grained sand. Granulated, fine blocky texture, with ubiquitous carbonate below tilled layer. [Very old alluvium]				BULK: MAX, EI, LL/PL, CORROSIVITY SUITE
		RING 8 12 21 (33)		CL	← Very silty clay, with sharp contact between mechanically ripped and natural deposits near the 3-foot mark, native soils feature soft punky interstitial fills of pedogenic carbonate, not visibly porous and appears massive.	95.4	10.8		
		RING 17 50/6"				117.8	7.6		
5	1435			ML/SM	Sandy Silt: Light yellowish brown; hard and cemented; slightly moist; cohesive with subequal proportions of silt and fine sand; non-plastic; not visibly porous; massive. Possible top of 20'+ thick very gradual fining-up package. [Very old alluvium]				
		RING 27 50/6"		ML/SM		114.8	6.3		
10	1430	RING 12 30 39 (69)		SM	Silty Sand: Yellowish brown; very dense; slightly moist; fine to coarse grained (weathered granitic particles); slightly cohesive and cemented but lacks visible carbonate; estimated 35-40% fines; not visibly porous. [Very old alluvium]	128.8	4.8		
15	1425								

Continued on next sheet.

FIELD LOG OF BORING B - 5

Project: ***LIGHT INDUSTRIAL PROJECT, APN 300-170-009***

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	1425	SPT 11 36 50/5"		SM	Silty Sand: Yellowish brown; very dense; still only slightly moist; mostly fine to medium grained and siltier than above, plus traces of clay which may increase with depth (drill rate firms for next several feet); uncemented and lacks carbonate. [Very old alluvium]				
20	1420	SPT 13 18 21 N=39		SM	← Silty sand, grades to moist, estimated 40% fines including traces of clay, massive and not visibly porous. Grades sandier with depth.				
25	1415	SPT 15 22 26 N=48		SM	Base of fining-up sequence?				
				ML	Sandy Silt: Yellowish brown; hard; moist; no clay at top and averages 20% very fine sand. Cuttings continue to be low-clay silt. [Very old alluvium]				
30	1410	SPT 9 17 18 N=35		ML	← Silt, with some clay and traces of fine sand, grossly uncemented but exhibits thin laminar carbonate deposits, not visibly porous.				
35	1405								

Continued on next sheet.

FIELD LOG OF BORING B - 5

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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	1405	SPT 9 12 18 N-30		SC	Clayey Sand: Around 35 feet begins better-stratifed sequences of predominantly coarse-grained classifications, beds commonly 2"-10" thick. Clayey sand is wet, variably as low as 20-25% fines, and is fine to coarse grained. Slow, stiff drilling progress noted to beyond 40 feet, with plastic silty clay cuttings recorded between 35 and 40 feet. [Very old alluvium]				
40	1400	SPT 7 18 18 N=36		ML, SP-SM	← Bedded clayey silt and medium to coarse-grained sand with silt (granitic source), layers 4-8" thick, wet.				
45	1395	SPT 16 22 24 N=46		SM, SP-SM	Silty Sand: Stratified yellowish brown and light brown; dense; wet. Crude beds 8"-12" thick of silty sand and almost clean medium-coarse sand. Uncemented. [Very old alluvium]				
50	1390	SPT 9 12 19 N=31		SM, ML	← About half silty f-c sand and half hard, non-plastic clayey silt, former with traces of fine gravel, strata 3-6" thick.				

Bottom of boring at 51.5 ft.
Static groundwater measured at 34.0 feet after 8 hours.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 6

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	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:	**± 1440.0 Ft. AMSL, RCFC NAD 83**

Comments: Warehouse building, south-center dock door areas.

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	1440		CL	Silty Clay: Brown; mechanically disturbed to around 2½ feet, abruptly becoming very stiff below; subjectively slightly moist; traces of fine to medium sand. Granulated, fine blocky texture, with ubiquitous carbonate below tilled layer. [Very old alluvium]				
		RING 6 13 25 (38)	CL	← Silty clay, with sharp contact between mechanically ripped and natural deposits near the 2½-foot mark, native soils feature soft punky interstitial fills of pedogenic carbonate, visibly porous.	99.8	13.0		
5	1435	RING 17 18 33 (51)	CL	← Silty clay, estimated 10-15% sand, abundant carbonate with punky expanded textures and visibly porous to ~5' depth.	98.9	14.0		
		RING 15 15 23 (38)	ML/CL	← Borderline clayey silt, about 15% sand, continued abundant carbonate, but better textured and lacks soft crumbly ped interstices.	106.4	14.8		
			ML	Clayey Silt: Dark yellowish brown; hard; slightly moist; moderately cohesive with typical ~15% fine sand (more sand near 10-foot depth); non-plastic; not visibly porous; massive. [Very old alluvium]				
10	1430	SPT 16 35 39 N=74	ML					
15	1425							

Continued on next sheet.

FIELD LOG OF BORING B - 6

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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	1425	SPT 10 15 23 N=38	ML	Clayey Silt: Dark yellowish brown; hard but easily crumbled; slightly moist; estimated 15-20% fine sand; massive; not visibly porous. Common MnO spots and grain films, but no obvious carbonate. [Very old alluvium]				
20	1420	SPT 25 34 45 N=79	SC	← Sample classifies as reddish brown clayey sand, fine to coarse grained, cohesive, ~30% fines.				

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

FIELD LOG OF BORING B - 7

Sheet 1 of 1

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**7.5 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:	**± 1440.0 Ft. AMSL, RCFC NAD 83**

Comments: Truck yard area, west.

DEPTH (ft.)	ELEVATION (MSL DATUM)	SAMPLE INTERVALS: TYPE, "N" or (Blows/ft.)	USCS	GEOTECHNICAL DESCRIPTION	DRY DENSITY (pcf)	WATER CONTENT (%)	OTHER TESTS
0	1440		CL	Silty Clay: Brown; mechanically disturbed to around 3 feet, abruptly becoming stiff below; subjectively slightly moist; traces of fine to medium sand. Soft, porous textures indicative of highly active soils. [Very old alluvium]			
		RING 7 7 10 (17)	CL	← Silty clay, with sharp contact between mechanically ripped and natural deposits at 3 feet. Native is porous, with soft and punky interstitial white ped fills.	89.6	10.5	
5	1435	RING 6 9 12 (21)	CL	← Silty clay, composed of small die-shaped cohesive peds surrounded by soft punky carbonate.	89.5	15.6	
		RING 12 23 39 (62)	ML/CL	← Borderline clayey silt, about 15% sand, far better texture but still with abundant veins/clots of carbonate, cohesive, not visibly porous.	115.6	12.1	

Bottom of boring at 7.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 8

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**7.5 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:	**± 1439.5 Ft. AMSL, RCFC NAD 83**

Comments: Truck yard area, east.

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				CL	Silty Clay: Very pale brown; mechanically disturbed to around 3 feet, abruptly becoming very stiff below; subjectively slightly moist; traces of fine to medium sand. Soft, porous textures to about 5' deep indicative of highly active soils. [Very old alluvium]				
		RING 6 12 22 (34)		CL	← Silty clay, undisturbed deposits start at about 3 feet. Native is porous, with soft and punky interstitial white ped fills.	98.7	14.0		
5	1435	RING 13 14 16 (30)		CL	← Silty clay, lightens to brownish yellow, continued abundant soft, punky carbonate.	97.3	6.6		
		RING 22 39 50 (89)		ML	Sandy Silt: Yellowish brown; hard; slightly moist; contains a few pinhole pores to 6½ feet in massive, non-plastic deposit, some fine laminar MnO films. [Very old alluvium]	125.6	9.8		

Bottom of boring at 7.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 9

Sheet 1 of 2

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**21.0 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:	**± 1439.0 Ft. AMSL (RCFC NAD 83**

Comments: Located near SEC 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			CL	Silty Clay: Brown; soft upper 3' (mechanically disturbed), becoming very stiff below; slightly moist; traces of fine to medium sand. Massive and porous, with abundant carbonate below 3 feet. [Very old alluvium]			
	1435	RING 10 27 30 (57)	CL	← Silty clay, with heavy diffuse carbonate and visibly porous. Has rare thin stringers of medium to coarse sand.	104.6	7.6	
5		RING 15 22 27 (49)	SM	Silty Sand: Brown; dense to very dense; slightly moist; fines-rich at 45-50% with trace of clay, cohesive; massive; some diffuse carbonate but not visibly porous. [Very old alluvium]	115.6	7.5	CONSOL
		RING 22 33 50/4"	SM/ML	← Silty sand, very fine-grained and very silty, cemented, with thin laminar carbonate deposits and common MnO grain films.	120.0	5.9	CONSOL
	1430	RING 17 31 50/5"					
10			CL	Sandy Clay: Brown; hard; moist; strongly cohesive, with around 30% fine to coarse weathered sand grains; non-plastic. Hard drilling. [Very old alluvium]	127.0	11.4	
				Drill rate picks up.			
	1425		SC	Clayey Sand: Yellowish brown; very dense; slightly moist; [Very old alluvium]			
15							

Continued on next sheet.

FIELD LOG OF BORING B - 9

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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 17 31 40 N=71		SC	Clayey Sand: Yellowish brown; very dense; slightly moist; fine to medium grained and cemented; massive, not visibly porous. Lacks carbonate. [Very old alluvium]				
	1420			ML	Sandy Silt: Yellowish brown; hard; slightly moist; mostly fine-grained sand but has rare weathered granules and a trace of clay, massive; not visibly porous. Easier drilling than above subunit. [Very old alluvium]				
20		SPT 17 50/6"		ML	← Sandy silt, as above.				

Bottom of boring at 21.0 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

FIELD LOG OF BORING B - 10

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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

Date(s) Drilled:	**12/28/18**	Logged By:	**M. Doerschlag**
Drilled By:	**GP Drilling**	Total Depth:	**19.5 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:	**± 1438.5 Ft. AMSL, RCFC NAD 83**

Comments: Water quality basin boring, expected bottom elevation of about -6 feet bgs.

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
0						CL	Silty Clay: Very pale brown; mechanically disturbed to around 3 feet, abruptly becoming very stiff and cohesive below; subjectively slightly moist; about 15% very fine sand. [Very old alluvium]				
	1435										
				SPT 8 15 19 N=34		CL	← Silty clay, slightly porous, with abundant soft vein-like carbonate.				
5						SM	Silty Sand: Brown; medium dense rapidly becoming clay-cemented and very dense; slightly moist; not visibly porous. [Very old alluvium]				
				SPT 14 14 14 N=28		SM					
	1430			SPT 13 27 50 N=77		SM	← Silty sand, may be faintly bedded around 1' thick, locally with trace of clay.				
10				SPT 19 32 33 N=65		SC	← Clayey sand, cemented, grades yellowish brown.				
				SPT 19 26 33 N=59		ML	Clayey Silt: Yellowish brown; hard; slightly moist; about 15% fine sand; massive, with common MnO spots. Upper part of a fining-up sedimentary package. [Very old alluvium]				
	1425										
15				SPT 11 25		ML					

Continued on next sheet.

FIELD LOG OF BORING B - 10

Sheet 2 of 2

Project: *LIGHT INDUSTRIAL PROJECT, APN 300-170-009*

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				47 N=72		SC	Clayey Sand: Yellowish brown; very dense; slightly moist; somewhat variable clay content but generally cemented and very firm drilling. [Very old alluvium]				
				SPT 19 40 50/4"							
	1420			SPT 13 25 33 N=58		SC	← Clayey sand, up to ~40% fines, moist.				

Bottom of boring at 19.5 ft.
No groundwater encountered.
Boring backfilled with compacted soil cuttings.

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 88.2 to 128.8 pounds per cubic foot. Water contents in ring samples ranged from 4.8 to 15.6 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 eastern and western 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-4 and B-5.

Maximum Density - Optimum Water Content Determinations

Soil Description	Location	Maximum Dry Density (pcf)	Optimum Moisture Content (%)
Silty Clay (CL), trace of sand [Very old alluvium]	B - 1 @ 0 - 5 ft.	111.0	16.5
Silty Clay (CL), trace of sand [Very old alluvium]	B - 5 @ 0 - 4 ft.	115.0	14.5

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-7. 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 Clay (CL), trace of sand [Very old alluvium]	B - 1 @ 0 - 5 ft.	91	High
Silty Clay (CL), trace of sand [Very old alluvium]	B - 5 @ 0 - 4 ft.	59	Medium

Consolidation Tests – ASTM D2435M-11

Natural alluvium was checked for collapse susceptibility and overall compressibility within predicted removal intervals and in probable competent materials. A series of cumulative vertical loads are applied 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-8 through B-13.

Atterberg Limits Determinations – ASTM D4318-10e1

Liquid limit and plastic limit determinations were made on selected samples of clayey alluvium as a check on soil classification and potential suitability for soil-cement treatments. The plastic limit constitutes the water content at which a manually remolded cohesive soil will just form a 1/8-inch-diameter thread without crumbling. The liquid limit constitutes the water content at which a soil will just begin to flow if jarred several times. Practically, it is determined by subjecting a grooved remolded soil pat to successive small impacts in a mechanical liquid limit device; the numerical result is the minimum water content at which the groove closes. The plasticity index (liquid limit minus plastic limit) and derived soil classification for the tested samples are indicated below. The test is performed only on the grain size fraction passing a 40-mesh screen.

Logged Soil Description	Location	Plastic Limit	Liquid Limit	Plasticity Index	USCS Symbol (Fines)
Silty Clay (CL), trace of sand [Very old alluvium]	Boring B - 1 0 - 5 ft.	20	36	16	CL
Silty Clay (CL), trace of sand [Very old alluvium]	Boring B-5 0 - 4 ft.	17	29	12	CL

Soil Corrosivity

Soil samples representative of future mass-graded fill in future contact with concrete or ferrous metals was tested in the laboratories of Project X Corrosion Engineers, Murrieta, California, to determine the tabulated data on the next page. The submitted soil samples were tested in general accordance with ASTM and 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: 4488-SFI FIRST IND REALTY
Client Job Number: 4488
Project X Job Number: S190108E-2
January 11, 2019

	Method	ASTM G187		ASTM D516		ASTM D512B		SM 4500-NO3-E	SM 4500-NH3-C	SM 4500-S2-D	ASTM G200	ASTM G51
Bore# / Description	**Depth**	**Resistivity** As Rec'd	Minimum	**Sulfates**		**Chlorides**		**Nitrate**	**Ammonia**	**Sulfide**	**Redox**	**pH**
	(ft)	(Ohm-cm)	(Ohm-cm)	(mg/kg)	(wt%)	(mg/kg)	(wt%)	(mg/kg)	(mg/kg)	(mg/kg)	(mV)	
B-1	0.0-5.0	12,060	938	21	0.0021	69	0.0069	36	0.5	ND	182	8.25
B-5	0.0-4.0	6,097	737	120	0.0120	324	0.0324	42	1.0	ND	176	7.93

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

Please call if you have any questions.

Prepared by,

Ernesto Padilla, BSME
Field Engineer

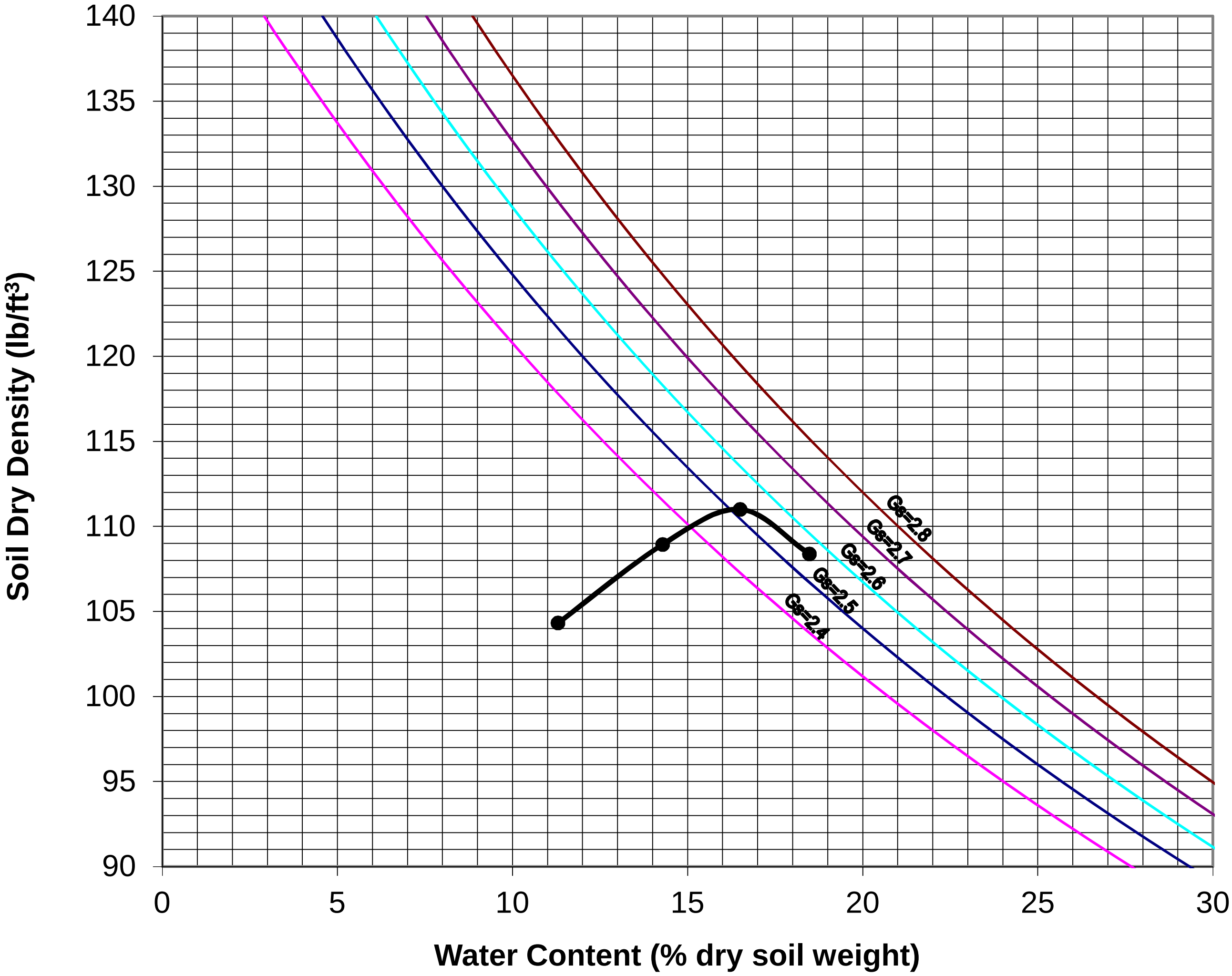
Respectfully Submitted,

Eddie Hernandez, M.Sc., P.E.
Sr. Corrosion Consultant
NACE Corrosion Technologist #16592
Professional Engineer
California No. M37102
ehernandez@projectxcorrosion.com

REGISTERED PROFESSIONAL ENGINEER
EDUARDO HERNANDEZ
No. M37102
MECHANICAL
STATE OF CALIFORNIA

29990 Technology Dr, Suite 13, Murrieta, CA 92563 Tel: 213-928-7213 Fax: 951-226-1720
www.projectxcorrosion.com

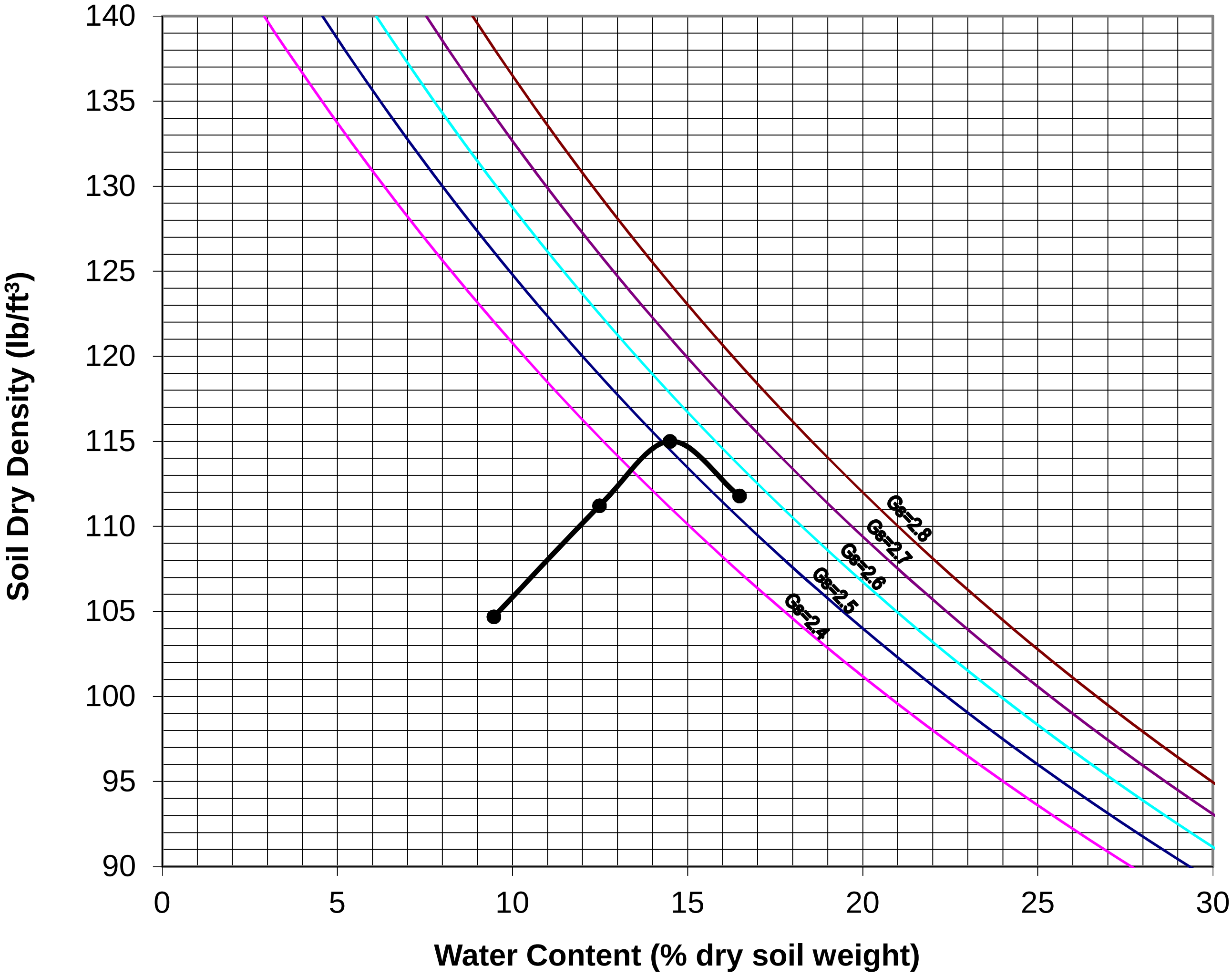
Soil Dry Density vs. Water Content



Boring: B - 1	Depth (ft.): 0.0 - 5.0	
Optimum Water Content (%): 16.5		Maximum Density (pcf): 111.0
Sample Description: Silty clay (CL), trace of sand. [Very old alluvium]		

AGI	**MODIFIED EFFORT COMPACTION CURVE**		
	APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA		
	PROJECT NO. 4488-SFLI	DATE: 1/21/19	**PAGE B-5**

Soil Dry Density vs. Water Content



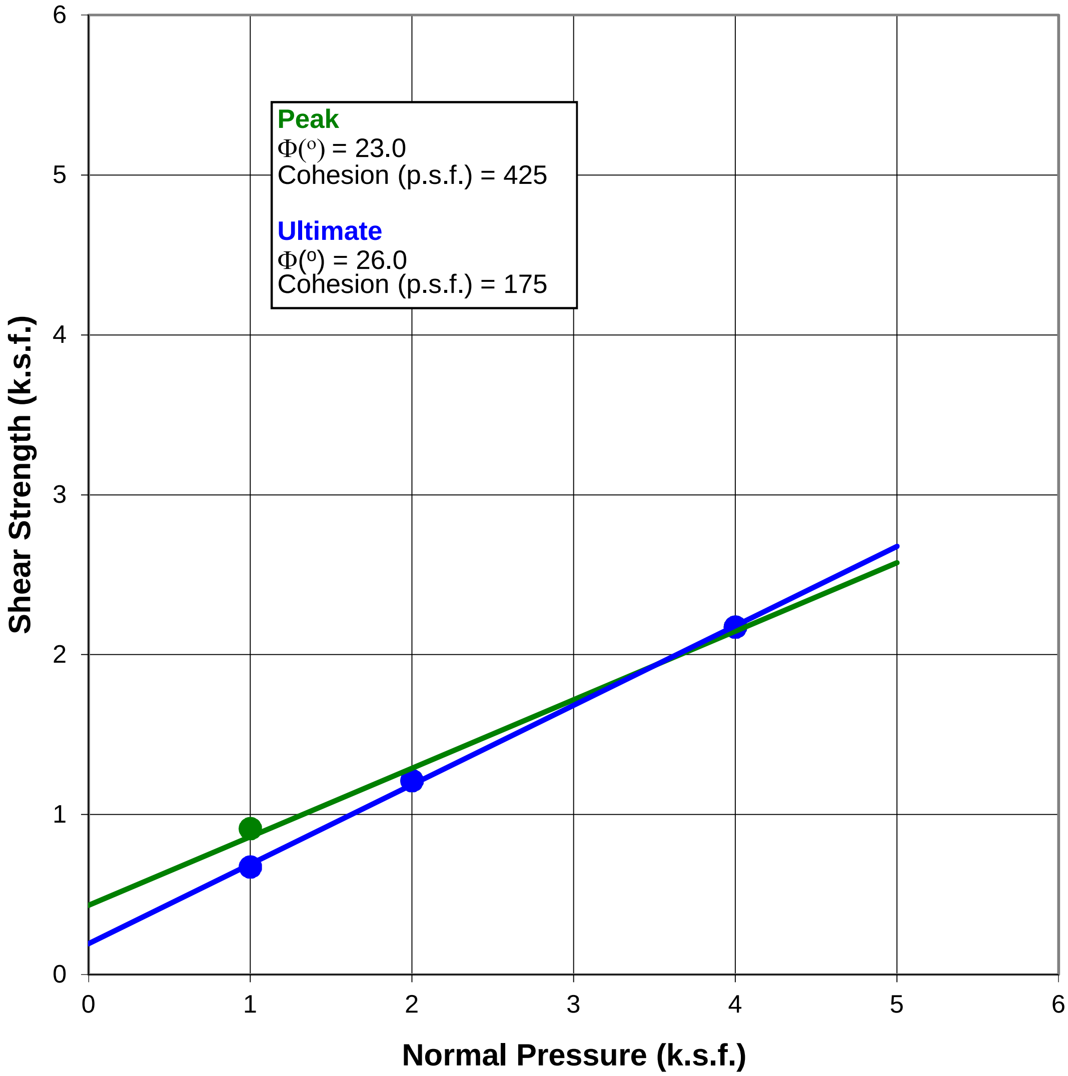
Boring: B - 5	Depth (ft.): 0.0 - 4.0	
Optimum Water Content (%): 14.5		Maximum Density (pcf): 115.0
Sample Description: Silty clay (CL), trace fine sand. [Very old alluvium]		

AGI

MODIFIED EFFORT COMPACTION CURVE

APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 4488-SFLI	DATE: 1/21/19	**PAGE B-6**



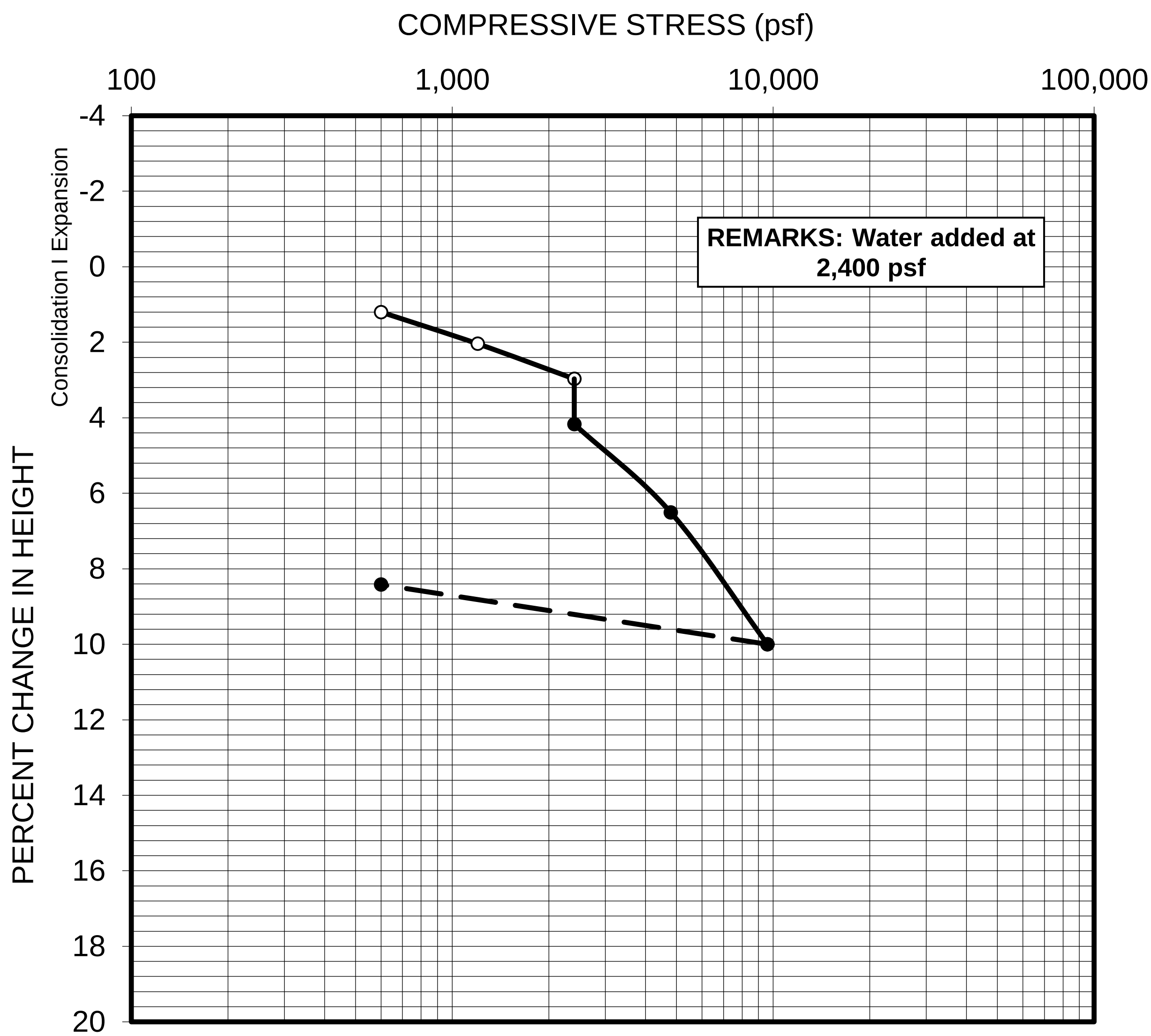
Location: B - 1	Depth (ft.): 0.0 - 5.0	Sample I.D. Number: 19-1006
Test Condition: Remolded, Consolidated, Drained.		
Sample Description: Silty clay (CL), trace of sand. [Very old alluvium]		

AGI

DIRECT SHEAR TEST DIAGRAM

APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 4488-SFLI	DATE: 1/21/19	**PAGE B-7**



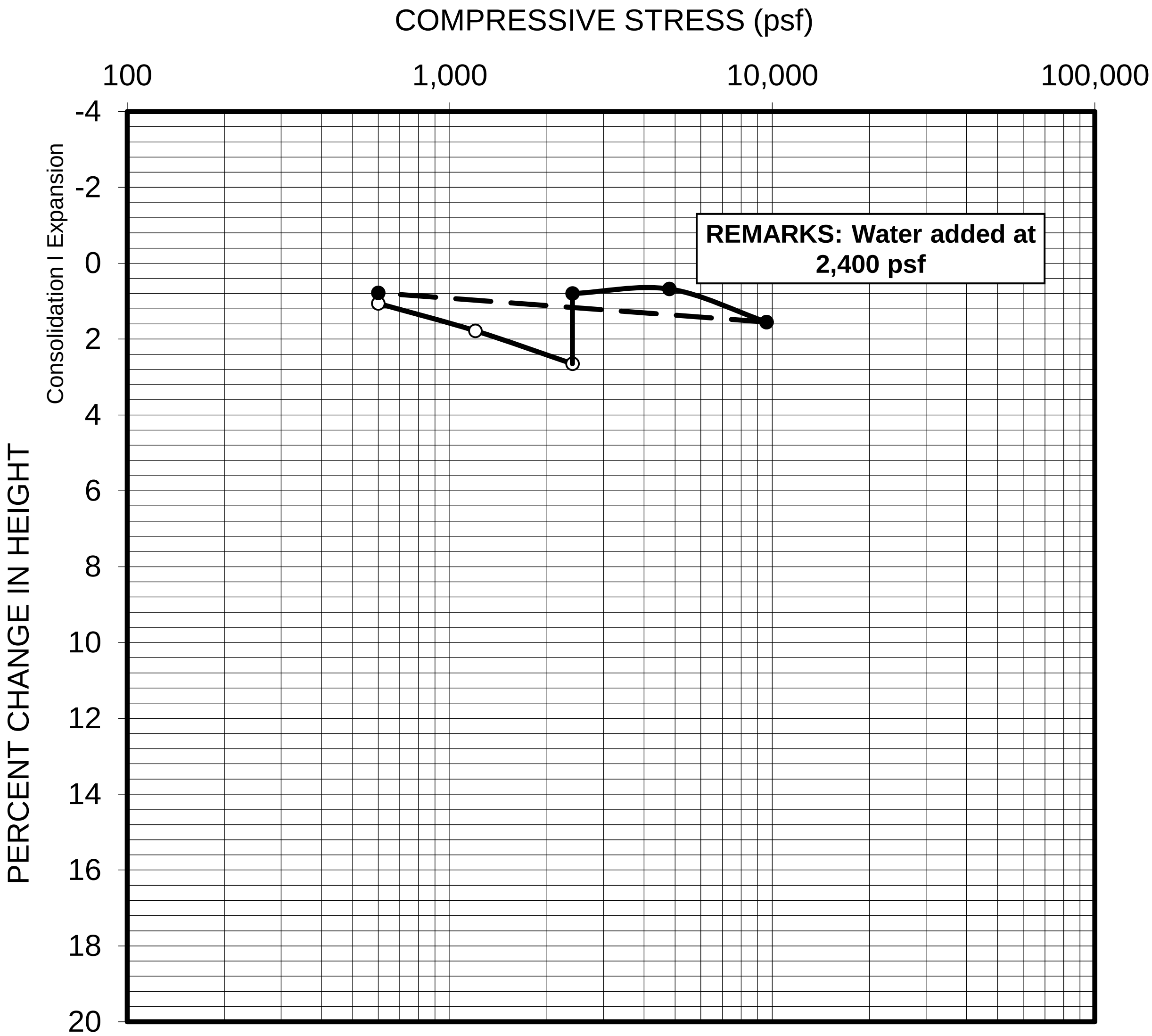
Boring: B - 1	Depth (ft.): 3.0	
Dry Density (pcf): 88.2	Saturation (%): 37.0	Moisture (%): 12.5
Sample Description: Silty clay (CL), small peds and visibly porous. [Very old alluvium]		

AGI

CONSOLIDATION CURVE

APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 4488-SFLI	DATE: 1/21/19	**PAGE B-8**



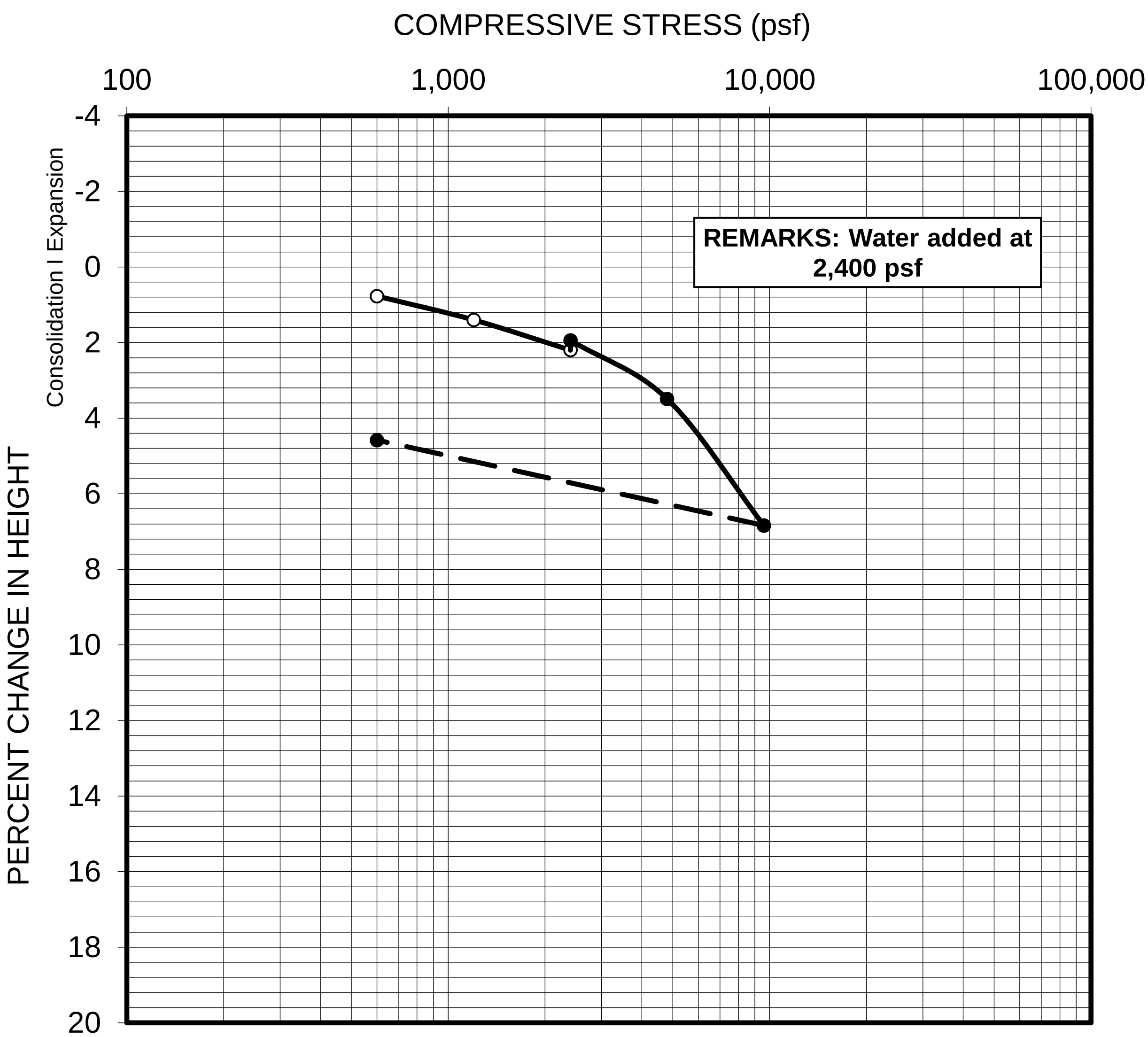
Boring: B - 1	Depth (ft.): 5.0	
Dry Density (pcf): 102.4	Saturation (%): 58.9	Moisture (%): 14.1
Sample Description: Silty clay (CL), visibly porous. [Very old alluvium]		

AGI

CONSOLIDATION CURVE

APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 4488-SFLI	DATE: 1/21/19	**PAGE B-9**

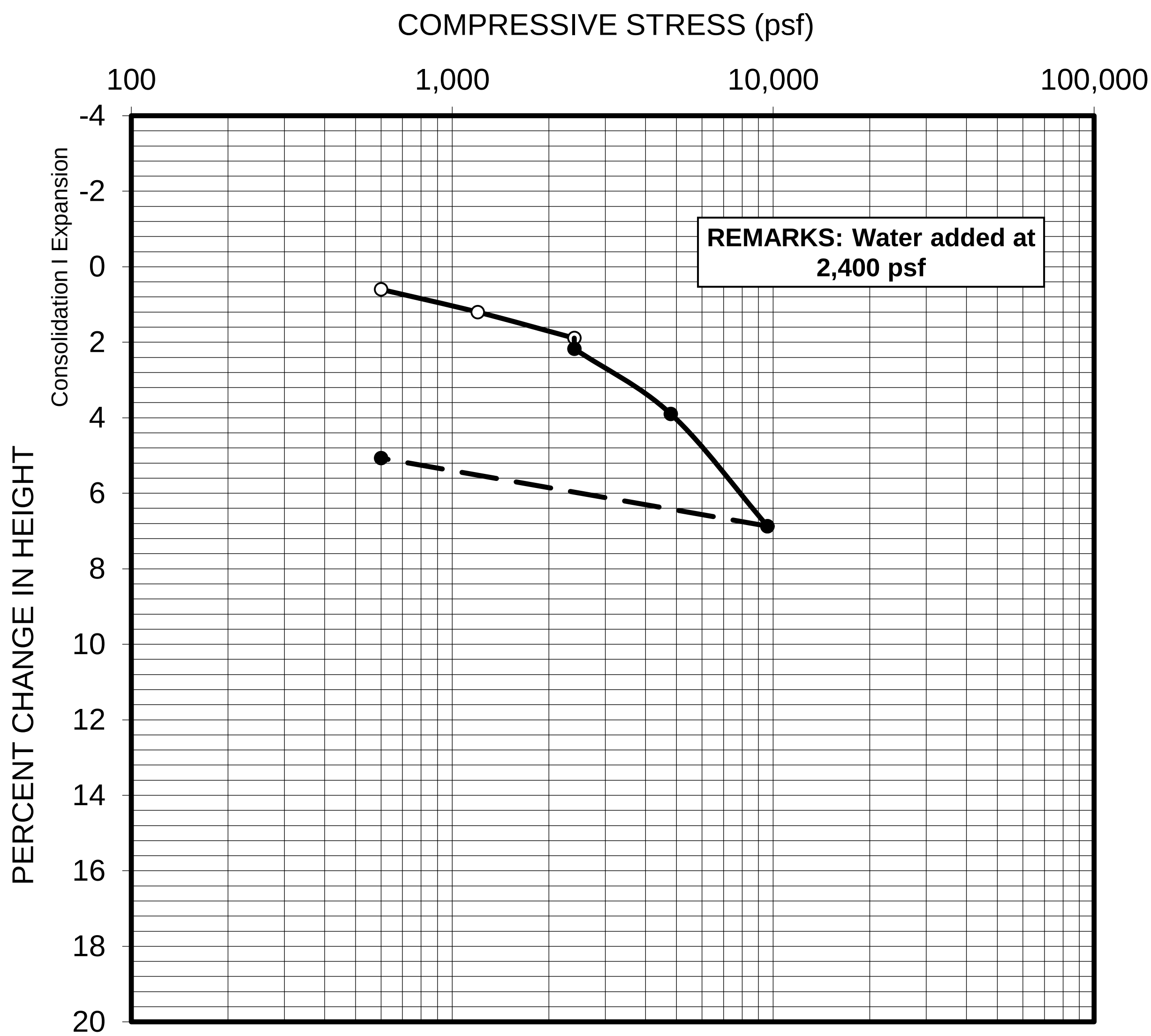


Boring: B - 2	Depth (ft.): 4.0	
Dry Density (pcf): 104.4	Saturation (%): 55.3	Moisture (%): 12.6
Sample Description: Silty clay (CL), small blocky peds. [Very old alluvium]		

CONSOLIDATION CURVE

APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 4488-SFLI | DATE: 1/21/19 | **PAGE B-10**



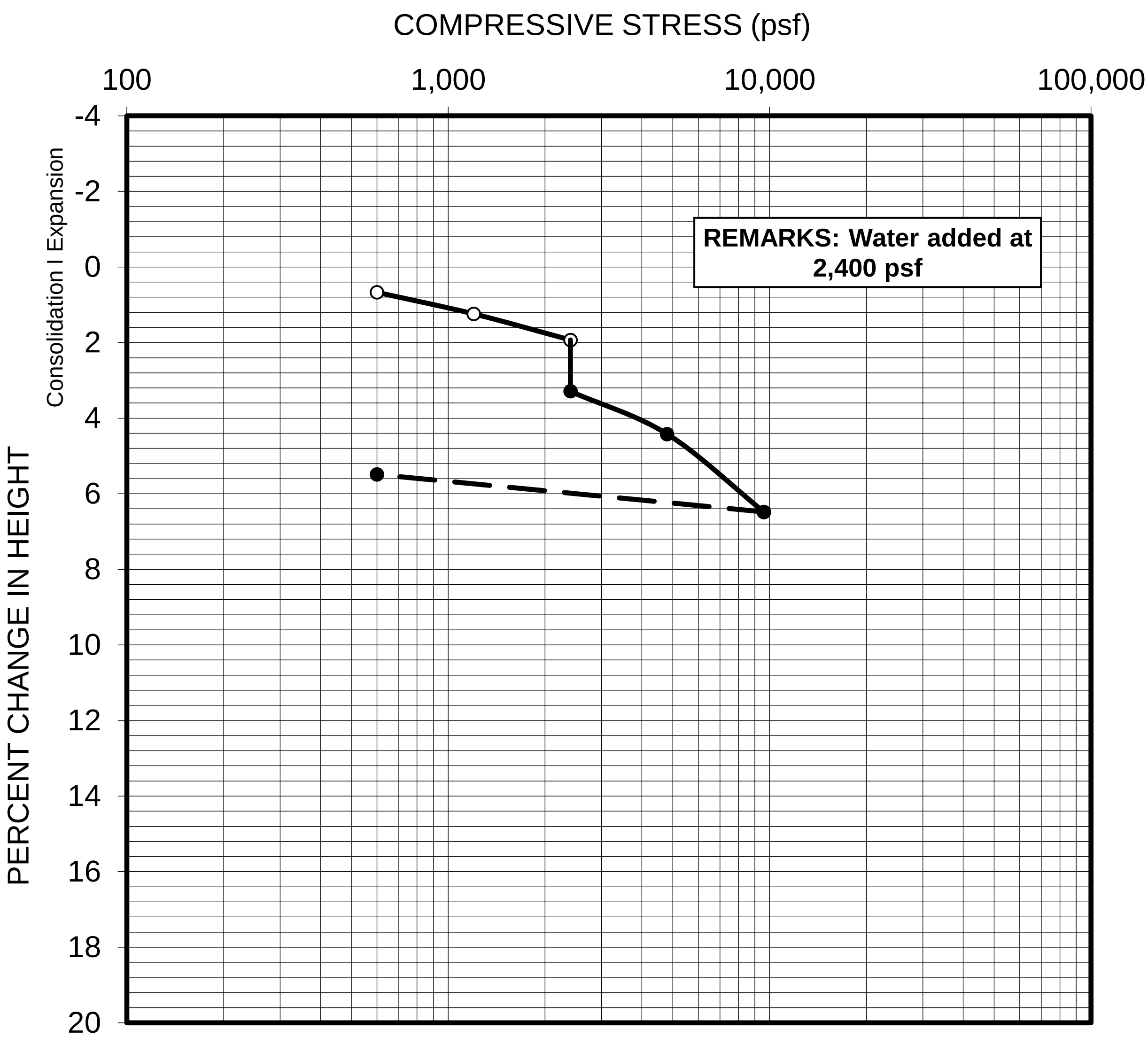
Boring: B - 2	Depth (ft.): 6.0	
Dry Density (pcf): 106.6	Saturation (%): 52.9	Moisture (%): 11.4
Sample Description: Silty clay (CL), porous, crumbly. [Very old alluvium]		

AGI

CONSOLIDATION CURVE

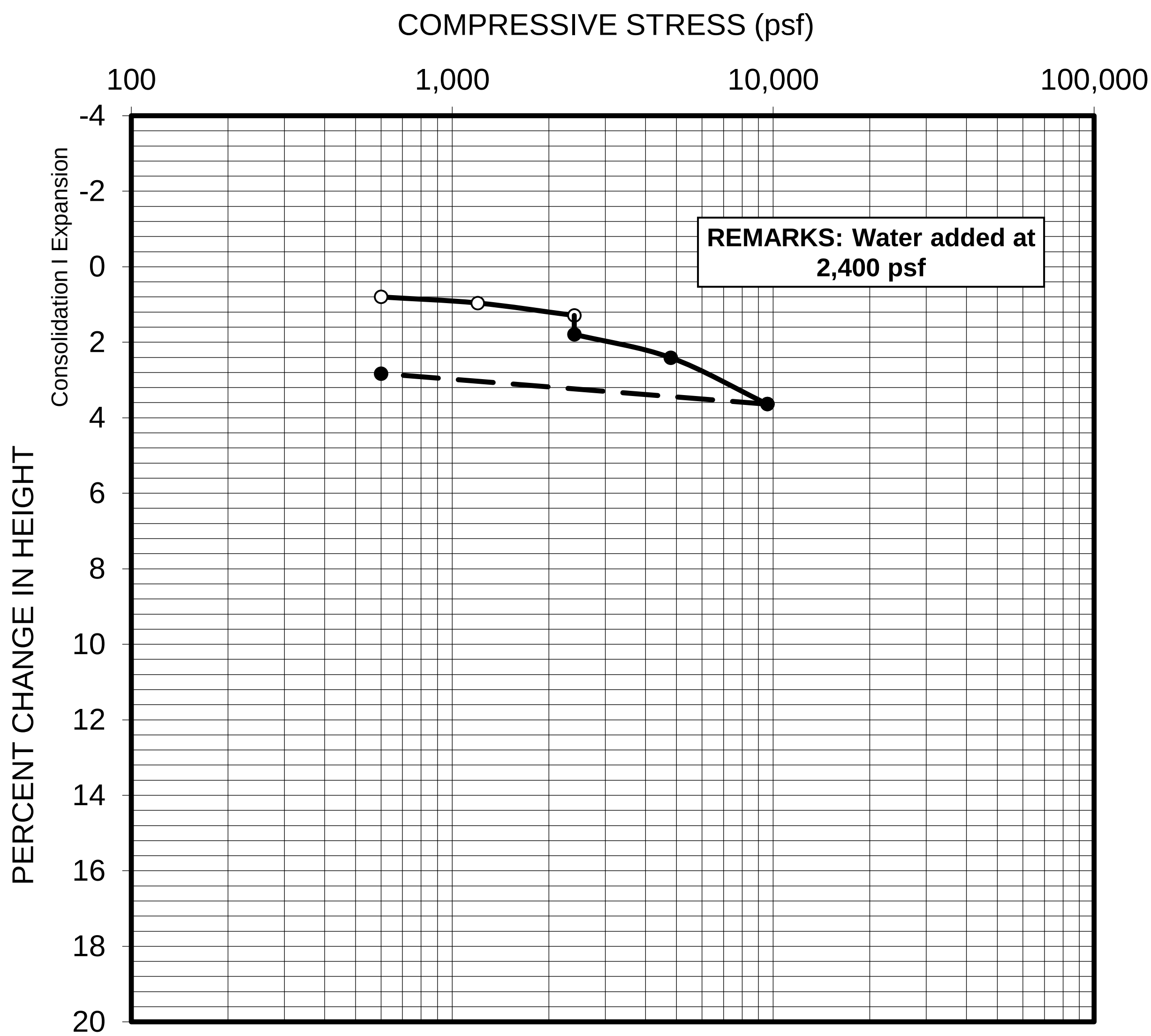
APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 4488-SFLI	DATE: 1/21/19	**PAGE B-11**



Boring: B - 9	Depth (ft.): 5.0	
Dry Density (pcf): 115.6	Saturation (%): 44.2	Moisture (%): 7.5
Sample Description: Silty sand (SM), trace clay, not visibly porous. [Very old alluvium]		

AGI	**CONSOLIDATION CURVE**	
	APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA	
PROJECT NO. 4488-SFLI	DATE: 1/21/19	**PAGE B-12**



Boring: B - 9	Depth (ft.): 7.0	
Dry Density (pcf): 120.0	Saturation (%): 39.3	Moisture (%): 5.9
Sample Description: Silty sand (SM), cemented. [Very old alluvium]		

AGI

CONSOLIDATION CURVE

APN 300-170-009, PERRIS, RIVERSIDE COUNTY, CALIFORNIA

PROJECT NO. 4488-SFLI | DATE: 1/21/19 | **PAGE B-13**

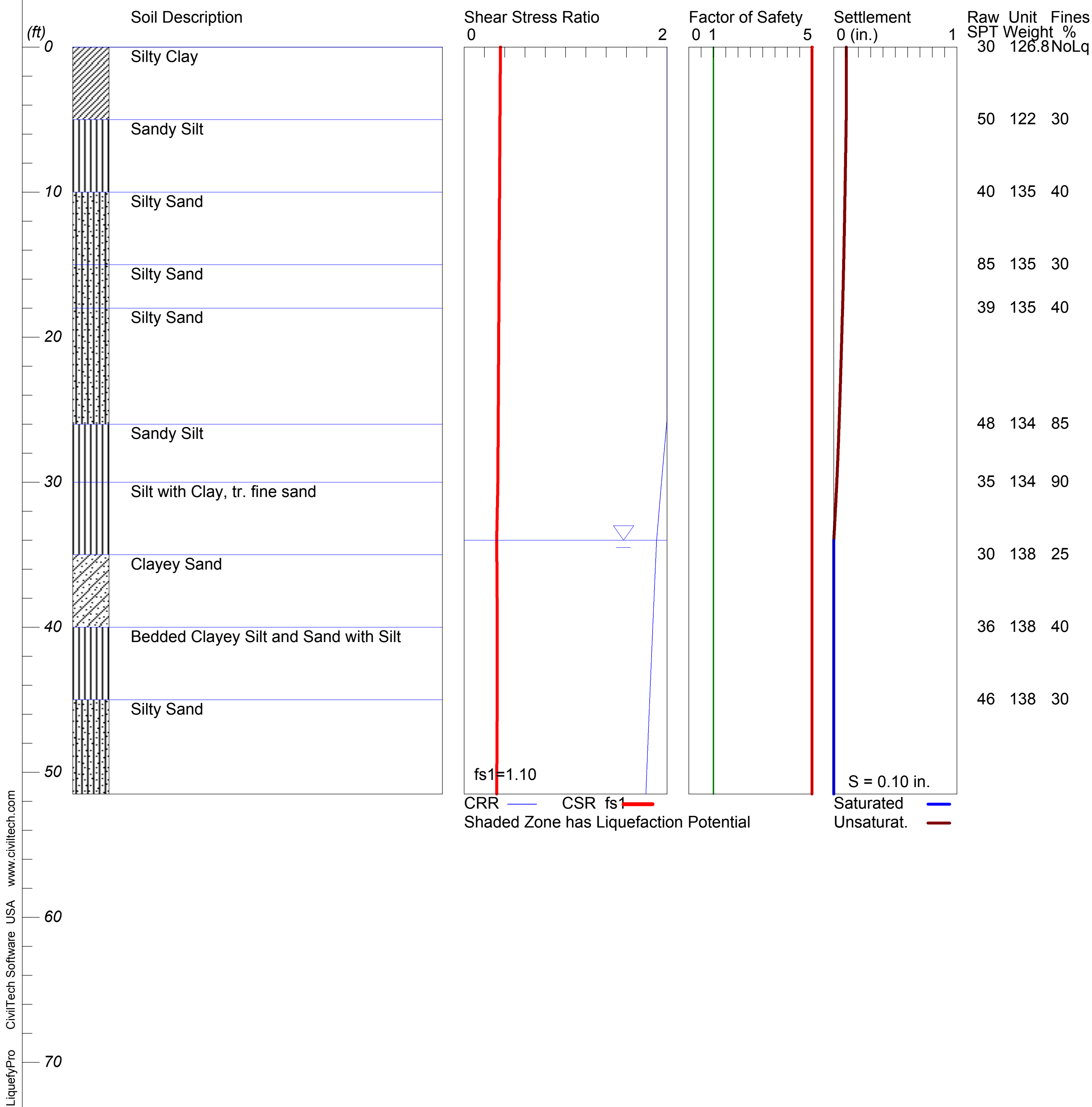
APPENDIX C

LIQUEFACTION ANALYSIS

APN 300-170-009, Perris, County of Riverside

Hole No.=B-5 Water Depth=34 ft Surface Elev.=~1440

Magnitude=7.5
Acceleration=0.5g



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LIQUEFACTION ANALYSIS SUMMARY

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Font: Courier New, Regular, Size 8 is recommended for this report.
Licensed to , 1/24/2019 2:00:29 PM

Input File Name: \\agi\Documents\To File\First Industrial\Wilson Avenue\4488-SFLI Liquefaction\4488-SFLI B-5.liq
Title: APN 300-170-009, Perris, County of Riverside
Subtitle: 4488-SFLI

Surface Elev.=~1440
Hole No.=B-5
Depth of Hole= 51.50 ft
Water Table during Earthquake= 34.00 ft
Water Table during In-Situ Testing= 34.00 ft
Max. Acceleration= 0.5 g
Earthquake Magnitude= 7.50

Input Data:
Surface Elev.=~1440
Hole No.=B-5
Depth of Hole=51.50 ft
Water Table during Earthquake= 34.00 ft
Water Table during In-Situ Testing= 34.00 ft
Max. Acceleration=0.5 g
Earthquake Magnitude=7.50
No-Liquefiable Soils: CL, OL are Non-Liq. Soil

1. SPT or BPT Calculation.
2. Settlement Analysis Method: Ishihara / Yoshimine
3. Fines Correction for Liquefaction: Idriss/Seed
4. Fine Correction for Settlement: During Liquefaction*
5. Settlement Calculation in: All zones*
6. Hammer Energy Ratio, Ce = 1.3
7. Borehole Diameter, Cb= 1.15
8. Sampling Method, Cs= 1.15
9. User request factor of safety (apply to CSR) , User= 1.1
   Plot one CSR curve (fs1=User)
10. Use Curve Smoothing: Yes*
* Recommended Options

In-Situ Test Data:

Depth ft	SPT	gamma pcf	Fines %
0.00	30.00	126.80	NoLiq
5.00	50.00	122.00	30.00
10.00	40.00	135.00	40.00
15.00	85.00	135.00	30.00
18.00	39.00	135.00	40.00
26.00	48.00	134.00	85.00
30.00	35.00	134.00	90.00
35.00	30.00	138.00	25.00
40.00	36.00	138.00	40.00

45.00	46.00	138.00	30.00
51.50	46.00	138.00	30.00

Output Results:

Settlement of Saturated Sands=0.00 in.
Settlement of Unsaturated Sands=0.10 in.
Total Settlement of Saturated and Unsaturated Sands=0.10 in.
Differential Settlement=0.050 to 0.067 in.

Depth ft	CRRm	CSRfs	F.S.	S_sat. in.	S_dry in.	S_all in.
0.00	2.00	0.36	5.00	0.00	0.10	0.10
0.10	2.00	0.36	5.00	0.00	0.10	0.10
0.20	2.00	0.36	5.00	0.00	0.10	0.10
0.30	2.00	0.36	5.00	0.00	0.10	0.10
0.40	2.00	0.36	5.00	0.00	0.10	0.10
0.50	2.00	0.36	5.00	0.00	0.10	0.10
0.60	2.00	0.36	5.00	0.00	0.10	0.10
0.70	2.00	0.36	5.00	0.00	0.10	0.10
0.80	2.00	0.36	5.00	0.00	0.10	0.10
0.90	2.00	0.36	5.00	0.00	0.10	0.10
1.00	2.00	0.36	5.00	0.00	0.10	0.10
1.10	2.00	0.36	5.00	0.00	0.10	0.10
1.20	2.00	0.36	5.00	0.00	0.10	0.10
1.30	2.00	0.36	5.00	0.00	0.10	0.10
1.40	2.00	0.36	5.00	0.00	0.10	0.10
1.50	2.00	0.36	5.00	0.00	0.10	0.10
1.60	2.00	0.36	5.00	0.00	0.10	0.10
1.70	2.00	0.36	5.00	0.00	0.10	0.10
1.80	2.00	0.36	5.00	0.00	0.10	0.10
1.90	2.00	0.36	5.00	0.00	0.10	0.10
2.00	2.00	0.36	5.00	0.00	0.10	0.10
2.10	2.00	0.36	5.00	0.00	0.10	0.10
2.20	2.00	0.36	5.00	0.00	0.10	0.10
2.30	2.00	0.36	5.00	0.00	0.10	0.10
2.40	2.00	0.36	5.00	0.00	0.10	0.10
2.50	2.00	0.36	5.00	0.00	0.10	0.10
2.60	2.00	0.36	5.00	0.00	0.10	0.10
2.70	2.00	0.36	5.00	0.00	0.10	0.10
2.80	2.00	0.36	5.00	0.00	0.10	0.10
2.90	2.00	0.36	5.00	0.00	0.10	0.10
3.00	2.00	0.35	5.00	0.00	0.10	0.10
3.10	2.00	0.35	5.00	0.00	0.10	0.10
3.20	2.00	0.35	5.00	0.00	0.10	0.10
3.30	2.00	0.35	5.00	0.00	0.10	0.10
3.40	2.00	0.35	5.00	0.00	0.10	0.10
3.50	2.00	0.35	5.00	0.00	0.10	0.10
3.60	2.00	0.35	5.00	0.00	0.10	0.10
3.70	2.00	0.35	5.00	0.00	0.10	0.10
3.80	2.00	0.35	5.00	0.00	0.10	0.10
3.90	2.00	0.35	5.00	0.00	0.10	0.10
4.00	2.00	0.35	5.00	0.00	0.10	0.10
4.10	2.00	0.35	5.00	0.00	0.10	0.10
4.20	2.00	0.35	5.00	0.00	0.10	0.10
4.30	2.00	0.35	5.00	0.00	0.10	0.10
4.40	2.00	0.35	5.00	0.00	0.10	0.10
4.50	2.00	0.35	5.00	0.00	0.10	0.10
4.60	2.00	0.35	5.00	0.00	0.10	0.10
4.70	2.00	0.35	5.00	0.00	0.10	0.10
4.80	2.00	0.35	5.00	0.00	0.10	0.10
4.90	2.00	0.35	5.00	0.00	0.10	0.10

5.00	2.00	0.35	5.00	0.00	0.10	0.10
5.10	2.00	0.35	5.00	0.00	0.10	0.10
5.20	2.00	0.35	5.00	0.00	0.10	0.10
5.30	2.00	0.35	5.00	0.00	0.10	0.10
5.40	2.00	0.35	5.00	0.00	0.10	0.10
5.50	2.00	0.35	5.00	0.00	0.10	0.10
5.60	2.00	0.35	5.00	0.00	0.10	0.10
5.70	2.00	0.35	5.00	0.00	0.10	0.10
5.80	2.00	0.35	5.00	0.00	0.10	0.10
5.90	2.00	0.35	5.00	0.00	0.10	0.10
6.00	2.00	0.35	5.00	0.00	0.10	0.10
6.10	2.00	0.35	5.00	0.00	0.10	0.10
6.20	2.00	0.35	5.00	0.00	0.10	0.10
6.30	2.00	0.35	5.00	0.00	0.10	0.10
6.40	2.00	0.35	5.00	0.00	0.10	0.10
6.50	2.00	0.35	5.00	0.00	0.10	0.10
6.60	2.00	0.35	5.00	0.00	0.10	0.10
6.70	2.00	0.35	5.00	0.00	0.10	0.10
6.80	2.00	0.35	5.00	0.00	0.10	0.10
6.90	2.00	0.35	5.00	0.00	0.10	0.10
7.00	2.00	0.35	5.00	0.00	0.10	0.10
7.10	2.00	0.35	5.00	0.00	0.10	0.10
7.20	2.00	0.35	5.00	0.00	0.10	0.10
7.30	2.00	0.35	5.00	0.00	0.10	0.10
7.40	2.00	0.35	5.00	0.00	0.10	0.10
7.50	2.00	0.35	5.00	0.00	0.10	0.10
7.60	2.00	0.35	5.00	0.00	0.10	0.10
7.70	2.00	0.35	5.00	0.00	0.10	0.10
7.80	2.00	0.35	5.00	0.00	0.10	0.10
7.90	2.00	0.35	5.00	0.00	0.10	0.10
8.00	2.00	0.35	5.00	0.00	0.10	0.10
8.10	2.00	0.35	5.00	0.00	0.10	0.10
8.20	2.00	0.35	5.00	0.00	0.10	0.10
8.30	2.00	0.35	5.00	0.00	0.10	0.10
8.40	2.00	0.35	5.00	0.00	0.09	0.09
8.50	2.00	0.35	5.00	0.00	0.09	0.09
8.60	2.00	0.35	5.00	0.00	0.09	0.09
8.70	2.00	0.35	5.00	0.00	0.09	0.09
8.80	2.00	0.35	5.00	0.00	0.09	0.09
8.90	2.00	0.35	5.00	0.00	0.09	0.09
9.00	2.00	0.35	5.00	0.00	0.09	0.09
9.10	2.00	0.35	5.00	0.00	0.09	0.09
9.20	2.00	0.35	5.00	0.00	0.09	0.09
9.30	2.00	0.35	5.00	0.00	0.09	0.09
9.40	2.00	0.35	5.00	0.00	0.09	0.09
9.50	2.00	0.35	5.00	0.00	0.09	0.09
9.60	2.00	0.35	5.00	0.00	0.09	0.09
9.70	2.00	0.35	5.00	0.00	0.09	0.09
9.80	2.00	0.35	5.00	0.00	0.09	0.09
9.90	2.00	0.35	5.00	0.00	0.09	0.09
10.00	2.00	0.35	5.00	0.00	0.09	0.09
10.10	2.00	0.35	5.00	0.00	0.09	0.09
10.20	2.00	0.35	5.00	0.00	0.09	0.09
10.30	2.00	0.35	5.00	0.00	0.09	0.09
10.40	2.00	0.35	5.00	0.00	0.09	0.09
10.50	2.00	0.35	5.00	0.00	0.09	0.09
10.60	2.00	0.35	5.00	0.00	0.09	0.09
10.70	2.00	0.35	5.00	0.00	0.09	0.09
10.80	2.00	0.35	5.00	0.00	0.09	0.09
10.90	2.00	0.35	5.00	0.00	0.09	0.09
11.00	2.00	0.35	5.00	0.00	0.09	0.09
11.10	2.00	0.35	5.00	0.00	0.09	0.09
11.20	2.00	0.35	5.00	0.00	0.09	0.09

11.30	2.00	0.35	5.00	0.00	0.09	0.09
11.40	2.00	0.35	5.00	0.00	0.09	0.09
11.50	2.00	0.35	5.00	0.00	0.09	0.09
11.60	2.00	0.35	5.00	0.00	0.09	0.09
11.70	2.00	0.35	5.00	0.00	0.09	0.09
11.80	2.00	0.35	5.00	0.00	0.09	0.09
11.90	2.00	0.35	5.00	0.00	0.09	0.09
12.00	2.00	0.35	5.00	0.00	0.09	0.09
12.10	2.00	0.35	5.00	0.00	0.09	0.09
12.20	2.00	0.35	5.00	0.00	0.09	0.09
12.30	2.00	0.35	5.00	0.00	0.09	0.09
12.40	2.00	0.35	5.00	0.00	0.09	0.09
12.50	2.00	0.35	5.00	0.00	0.09	0.09
12.60	2.00	0.35	5.00	0.00	0.09	0.09
12.70	2.00	0.35	5.00	0.00	0.09	0.09
12.80	2.00	0.35	5.00	0.00	0.09	0.09
12.90	2.00	0.35	5.00	0.00	0.09	0.09
13.00	2.00	0.35	5.00	0.00	0.09	0.09
13.10	2.00	0.35	5.00	0.00	0.09	0.09
13.20	2.00	0.35	5.00	0.00	0.08	0.08
13.30	2.00	0.35	5.00	0.00	0.08	0.08
13.40	2.00	0.35	5.00	0.00	0.08	0.08
13.50	2.00	0.35	5.00	0.00	0.08	0.08
13.60	2.00	0.35	5.00	0.00	0.08	0.08
13.70	2.00	0.35	5.00	0.00	0.08	0.08
13.80	2.00	0.35	5.00	0.00	0.08	0.08
13.90	2.00	0.35	5.00	0.00	0.08	0.08
14.00	2.00	0.35	5.00	0.00	0.08	0.08
14.10	2.00	0.35	5.00	0.00	0.08	0.08
14.20	2.00	0.35	5.00	0.00	0.08	0.08
14.30	2.00	0.35	5.00	0.00	0.08	0.08
14.40	2.00	0.35	5.00	0.00	0.08	0.08
14.50	2.00	0.35	5.00	0.00	0.08	0.08
14.60	2.00	0.35	5.00	0.00	0.08	0.08
14.70	2.00	0.35	5.00	0.00	0.08	0.08
14.80	2.00	0.35	5.00	0.00	0.08	0.08
14.90	2.00	0.35	5.00	0.00	0.08	0.08
15.00	2.00	0.34	5.00	0.00	0.08	0.08
15.10	2.00	0.34	5.00	0.00	0.08	0.08
15.20	2.00	0.34	5.00	0.00	0.08	0.08
15.30	2.00	0.34	5.00	0.00	0.08	0.08
15.40	2.00	0.34	5.00	0.00	0.08	0.08
15.50	2.00	0.34	5.00	0.00	0.08	0.08
15.60	2.00	0.34	5.00	0.00	0.08	0.08
15.70	2.00	0.34	5.00	0.00	0.08	0.08
15.80	2.00	0.34	5.00	0.00	0.08	0.08
15.90	2.00	0.34	5.00	0.00	0.08	0.08
16.00	2.00	0.34	5.00	0.00	0.08	0.08
16.10	2.00	0.34	5.00	0.00	0.08	0.08
16.20	2.00	0.34	5.00	0.00	0.08	0.08
16.30	2.00	0.34	5.00	0.00	0.08	0.08
16.40	2.00	0.34	5.00	0.00	0.08	0.08
16.50	2.00	0.34	5.00	0.00	0.08	0.08
16.60	2.00	0.34	5.00	0.00	0.08	0.08
16.70	2.00	0.34	5.00	0.00	0.08	0.08
16.80	2.00	0.34	5.00	0.00	0.08	0.08
16.90	2.00	0.34	5.00	0.00	0.08	0.08
17.00	2.00	0.34	5.00	0.00	0.07	0.07
17.10	2.00	0.34	5.00	0.00	0.07	0.07
17.20	2.00	0.34	5.00	0.00	0.07	0.07
17.30	2.00	0.34	5.00	0.00	0.07	0.07
17.40	2.00	0.34	5.00	0.00	0.07	0.07
17.50	2.00	0.34	5.00	0.00	0.07	0.07

17.60	2.00	0.34	5.00	0.00	0.07	0.07
17.70	2.00	0.34	5.00	0.00	0.07	0.07
17.80	2.00	0.34	5.00	0.00	0.07	0.07
17.90	2.00	0.34	5.00	0.00	0.07	0.07
18.00	2.00	0.34	5.00	0.00	0.07	0.07
18.10	2.00	0.34	5.00	0.00	0.07	0.07
18.20	2.00	0.34	5.00	0.00	0.07	0.07
18.30	2.00	0.34	5.00	0.00	0.07	0.07
18.40	2.00	0.34	5.00	0.00	0.07	0.07
18.50	2.00	0.34	5.00	0.00	0.07	0.07
18.60	2.00	0.34	5.00	0.00	0.07	0.07
18.70	2.00	0.34	5.00	0.00	0.07	0.07
18.80	2.00	0.34	5.00	0.00	0.07	0.07
18.90	2.00	0.34	5.00	0.00	0.07	0.07
19.00	2.00	0.34	5.00	0.00	0.07	0.07
19.10	2.00	0.34	5.00	0.00	0.07	0.07
19.20	2.00	0.34	5.00	0.00	0.07	0.07
19.30	2.00	0.34	5.00	0.00	0.07	0.07
19.40	2.00	0.34	5.00	0.00	0.07	0.07
19.50	2.00	0.34	5.00	0.00	0.07	0.07
19.60	2.00	0.34	5.00	0.00	0.07	0.07
19.70	2.00	0.34	5.00	0.00	0.07	0.07
19.80	2.00	0.34	5.00	0.00	0.07	0.07
19.90	2.00	0.34	5.00	0.00	0.07	0.07
20.00	2.00	0.34	5.00	0.00	0.07	0.07
20.10	2.00	0.34	5.00	0.00	0.06	0.06
20.20	2.00	0.34	5.00	0.00	0.06	0.06
20.30	2.00	0.34	5.00	0.00	0.06	0.06
20.40	2.00	0.34	5.00	0.00	0.06	0.06
20.50	2.00	0.34	5.00	0.00	0.06	0.06
20.60	2.00	0.34	5.00	0.00	0.06	0.06
20.70	2.00	0.34	5.00	0.00	0.06	0.06
20.80	2.00	0.34	5.00	0.00	0.06	0.06
20.90	2.00	0.34	5.00	0.00	0.06	0.06
21.00	2.00	0.34	5.00	0.00	0.06	0.06
21.10	2.00	0.34	5.00	0.00	0.06	0.06
21.20	2.00	0.34	5.00	0.00	0.06	0.06
21.30	2.00	0.34	5.00	0.00	0.06	0.06
21.40	2.00	0.34	5.00	0.00	0.06	0.06
21.50	2.00	0.34	5.00	0.00	0.06	0.06
21.60	2.00	0.34	5.00	0.00	0.06	0.06
21.70	2.00	0.34	5.00	0.00	0.06	0.06
21.80	2.00	0.34	5.00	0.00	0.06	0.06
21.90	2.00	0.34	5.00	0.00	0.06	0.06
22.00	2.00	0.34	5.00	0.00	0.06	0.06
22.10	2.00	0.34	5.00	0.00	0.06	0.06
22.20	2.00	0.34	5.00	0.00	0.06	0.06
22.30	2.00	0.34	5.00	0.00	0.06	0.06
22.40	2.00	0.34	5.00	0.00	0.06	0.06
22.50	2.00	0.34	5.00	0.00	0.06	0.06
22.60	2.00	0.34	5.00	0.00	0.06	0.06
22.70	2.00	0.34	5.00	0.00	0.06	0.06
22.80	2.00	0.34	5.00	0.00	0.06	0.06
22.90	2.00	0.34	5.00	0.00	0.06	0.06
23.00	2.00	0.34	5.00	0.00	0.05	0.05
23.10	2.00	0.34	5.00	0.00	0.05	0.05
23.20	2.00	0.34	5.00	0.00	0.05	0.05
23.30	2.00	0.34	5.00	0.00	0.05	0.05
23.40	2.00	0.34	5.00	0.00	0.05	0.05
23.50	2.00	0.34	5.00	0.00	0.05	0.05
23.60	2.00	0.34	5.00	0.00	0.05	0.05
23.70	2.00	0.34	5.00	0.00	0.05	0.05
23.80	2.00	0.34	5.00	0.00	0.05	0.05

23.90	2.00	0.34	5.00	0.00	0.05	0.05
24.00	2.00	0.34	5.00	0.00	0.05	0.05
24.10	2.00	0.34	5.00	0.00	0.05	0.05
24.20	2.00	0.34	5.00	0.00	0.05	0.05
24.30	2.00	0.34	5.00	0.00	0.05	0.05
24.40	2.00	0.34	5.00	0.00	0.05	0.05
24.50	2.00	0.34	5.00	0.00	0.05	0.05
24.60	2.00	0.34	5.00	0.00	0.05	0.05
24.70	2.00	0.34	5.00	0.00	0.05	0.05
24.80	2.01	0.34	5.00	0.00	0.05	0.05
24.90	2.01	0.34	5.00	0.00	0.05	0.05
25.00	2.01	0.34	5.00	0.00	0.05	0.05
25.10	2.01	0.34	5.00	0.00	0.05	0.05
25.20	2.01	0.34	5.00	0.00	0.05	0.05
25.30	2.00	0.34	5.00	0.00	0.05	0.05
25.40	2.00	0.34	5.00	0.00	0.05	0.05
25.50	2.00	0.34	5.00	0.00	0.05	0.05
25.60	2.00	0.34	5.00	0.00	0.05	0.05
25.70	2.00	0.34	5.00	0.00	0.04	0.04
25.80	2.00	0.34	5.00	0.00	0.04	0.04
25.90	2.00	0.34	5.00	0.00	0.04	0.04
26.00	2.00	0.34	5.00	0.00	0.04	0.04
26.10	1.99	0.34	5.00	0.00	0.04	0.04
26.20	1.99	0.34	5.00	0.00	0.04	0.04
26.30	1.99	0.34	5.00	0.00	0.04	0.04
26.40	1.99	0.34	5.00	0.00	0.04	0.04
26.50	1.99	0.34	5.00	0.00	0.04	0.04
26.60	1.99	0.34	5.00	0.00	0.04	0.04
26.70	1.99	0.34	5.00	0.00	0.04	0.04
26.80	1.99	0.34	5.00	0.00	0.04	0.04
26.90	1.98	0.34	5.00	0.00	0.04	0.04
27.00	1.98	0.33	5.00	0.00	0.04	0.04
27.10	1.98	0.33	5.00	0.00	0.04	0.04
27.20	1.98	0.33	5.00	0.00	0.04	0.04
27.30	1.98	0.33	5.00	0.00	0.04	0.04
27.40	1.98	0.33	5.00	0.00	0.04	0.04
27.50	1.98	0.33	5.00	0.00	0.04	0.04
27.60	1.98	0.33	5.00	0.00	0.04	0.04
27.70	1.97	0.33	5.00	0.00	0.04	0.04
27.80	1.97	0.33	5.00	0.00	0.04	0.04
27.90	1.97	0.33	5.00	0.00	0.04	0.04
28.00	1.97	0.33	5.00	0.00	0.03	0.03
28.10	1.97	0.33	5.00	0.00	0.03	0.03
28.20	1.97	0.33	5.00	0.00	0.03	0.03
28.30	1.97	0.33	5.00	0.00	0.03	0.03
28.40	1.97	0.33	5.00	0.00	0.03	0.03
28.50	1.96	0.33	5.00	0.00	0.03	0.03
28.60	1.96	0.33	5.00	0.00	0.03	0.03
28.70	1.96	0.33	5.00	0.00	0.03	0.03
28.80	1.96	0.33	5.00	0.00	0.03	0.03
28.90	1.96	0.33	5.00	0.00	0.03	0.03
29.00	1.96	0.33	5.00	0.00	0.03	0.03
29.10	1.96	0.33	5.00	0.00	0.03	0.03
29.20	1.96	0.33	5.00	0.00	0.03	0.03
29.30	1.95	0.33	5.00	0.00	0.03	0.03
29.40	1.95	0.33	5.00	0.00	0.03	0.03
29.50	1.95	0.33	5.00	0.00	0.03	0.03
29.60	1.95	0.33	5.00	0.00	0.03	0.03
29.70	1.95	0.33	5.00	0.00	0.03	0.03
29.80	1.95	0.33	5.00	0.00	0.03	0.03
29.90	1.95	0.33	5.00	0.00	0.03	0.03
30.00	1.95	0.33	5.00	0.00	0.02	0.02
30.10	1.94	0.33	5.00	0.00	0.02	0.02

30.20	1.94	0.33	5.00	0.00	0.02	0.02
30.30	1.94	0.33	5.00	0.00	0.02	0.02
30.40	1.94	0.33	5.00	0.00	0.02	0.02
30.50	1.94	0.33	5.00	0.00	0.02	0.02
30.60	1.94	0.33	5.00	0.00	0.02	0.02
30.70	1.94	0.33	5.00	0.00	0.02	0.02
30.80	1.94	0.33	5.00	0.00	0.02	0.02
30.90	1.93	0.33	5.00	0.00	0.02	0.02
31.00	1.93	0.33	5.00	0.00	0.02	0.02
31.10	1.93	0.33	5.00	0.00	0.02	0.02
31.20	1.93	0.33	5.00	0.00	0.02	0.02
31.30	1.93	0.33	5.00	0.00	0.02	0.02
31.40	1.93	0.33	5.00	0.00	0.02	0.02
31.50	1.93	0.33	5.00	0.00	0.02	0.02
31.60	1.93	0.33	5.00	0.00	0.02	0.02
31.70	1.92	0.33	5.00	0.00	0.01	0.01
31.80	1.92	0.33	5.00	0.00	0.01	0.01
31.90	1.92	0.33	5.00	0.00	0.01	0.01
32.00	1.92	0.33	5.00	0.00	0.01	0.01
32.10	1.92	0.33	5.00	0.00	0.01	0.01
32.20	1.92	0.33	5.00	0.00	0.01	0.01
32.30	1.92	0.33	5.00	0.00	0.01	0.01
32.40	1.92	0.33	5.00	0.00	0.01	0.01
32.50	1.92	0.33	5.00	0.00	0.01	0.01
32.60	1.91	0.32	5.00	0.00	0.01	0.01
32.70	1.91	0.32	5.00	0.00	0.01	0.01
32.80	1.91	0.32	5.00	0.00	0.01	0.01
32.90	1.91	0.32	5.00	0.00	0.01	0.01
33.00	1.91	0.32	5.00	0.00	0.01	0.01
33.10	1.91	0.32	5.00	0.00	0.01	0.01
33.20	1.91	0.32	5.00	0.00	0.01	0.01
33.30	1.91	0.32	5.00	0.00	0.00	0.00
33.40	1.90	0.32	5.00	0.00	0.00	0.00
33.50	1.90	0.32	5.00	0.00	0.00	0.00
33.60	1.90	0.32	5.00	0.00	0.00	0.00
33.70	1.90	0.32	5.00	0.00	0.00	0.00
33.80	1.90	0.32	5.00	0.00	0.00	0.00
33.90	1.90	0.32	5.00	0.00	0.00	0.00
34.00	1.90	0.32	5.00	0.00	0.00	0.00
34.10	1.90	0.32	5.00	0.00	0.00	0.00
34.20	1.90	0.32	5.00	0.00	0.00	0.00
34.30	1.90	0.32	5.00	0.00	0.00	0.00
34.40	1.89	0.32	5.00	0.00	0.00	0.00
34.50	1.89	0.32	5.00	0.00	0.00	0.00
34.60	1.89	0.32	5.00	0.00	0.00	0.00
34.70	1.89	0.32	5.00	0.00	0.00	0.00
34.80	1.89	0.32	5.00	0.00	0.00	0.00
34.90	1.89	0.32	5.00	0.00	0.00	0.00
35.00	1.89	0.32	5.00	0.00	0.00	0.00
35.10	1.89	0.32	5.00	0.00	0.00	0.00
35.20	1.89	0.32	5.00	0.00	0.00	0.00
35.30	1.89	0.32	5.00	0.00	0.00	0.00
35.40	1.89	0.32	5.00	0.00	0.00	0.00
35.50	1.89	0.32	5.00	0.00	0.00	0.00
35.60	1.89	0.32	5.00	0.00	0.00	0.00
35.70	1.89	0.32	5.00	0.00	0.00	0.00
35.80	1.89	0.32	5.00	0.00	0.00	0.00
35.90	1.88	0.32	5.00	0.00	0.00	0.00
36.00	1.88	0.32	5.00	0.00	0.00	0.00
36.10	1.88	0.32	5.00	0.00	0.00	0.00
36.20	1.88	0.32	5.00	0.00	0.00	0.00
36.30	1.88	0.32	5.00	0.00	0.00	0.00
36.40	1.88	0.32	5.00	0.00	0.00	0.00

36.50	1.88	0.32	5.00	0.00	0.00	0.00
36.60	1.88	0.32	5.00	0.00	0.00	0.00
36.70	1.88	0.32	5.00	0.00	0.00	0.00
36.80	1.88	0.32	5.00	0.00	0.00	0.00
36.90	1.88	0.32	5.00	0.00	0.00	0.00
37.00	1.88	0.32	5.00	0.00	0.00	0.00
37.10	1.88	0.32	5.00	0.00	0.00	0.00
37.20	1.88	0.32	5.00	0.00	0.00	0.00
37.30	1.88	0.32	5.00	0.00	0.00	0.00
37.40	1.88	0.32	5.00	0.00	0.00	0.00
37.50	1.87	0.32	5.00	0.00	0.00	0.00
37.60	1.87	0.32	5.00	0.00	0.00	0.00
37.70	1.87	0.32	5.00	0.00	0.00	0.00
37.80	1.87	0.32	5.00	0.00	0.00	0.00
37.90	1.87	0.32	5.00	0.00	0.00	0.00
38.00	1.87	0.33	5.00	0.00	0.00	0.00
38.10	1.87	0.33	5.00	0.00	0.00	0.00
38.20	1.87	0.33	5.00	0.00	0.00	0.00
38.30	1.87	0.33	5.00	0.00	0.00	0.00
38.40	1.87	0.33	5.00	0.00	0.00	0.00
38.50	1.87	0.33	5.00	0.00	0.00	0.00
38.60	1.87	0.33	5.00	0.00	0.00	0.00
38.70	1.87	0.33	5.00	0.00	0.00	0.00
38.80	1.87	0.33	5.00	0.00	0.00	0.00
38.90	1.87	0.33	5.00	0.00	0.00	0.00
39.00	1.87	0.33	5.00	0.00	0.00	0.00
39.10	1.86	0.33	5.00	0.00	0.00	0.00
39.20	1.86	0.33	5.00	0.00	0.00	0.00
39.30	1.86	0.33	5.00	0.00	0.00	0.00
39.40	1.86	0.33	5.00	0.00	0.00	0.00
39.50	1.86	0.33	5.00	0.00	0.00	0.00
39.60	1.86	0.33	5.00	0.00	0.00	0.00
39.70	1.86	0.33	5.00	0.00	0.00	0.00
39.80	1.86	0.33	5.00	0.00	0.00	0.00
39.90	1.86	0.33	5.00	0.00	0.00	0.00
40.00	1.86	0.33	5.00	0.00	0.00	0.00
40.10	1.86	0.33	5.00	0.00	0.00	0.00
40.20	1.86	0.33	5.00	0.00	0.00	0.00
40.30	1.86	0.33	5.00	0.00	0.00	0.00
40.40	1.86	0.33	5.00	0.00	0.00	0.00
40.50	1.86	0.33	5.00	0.00	0.00	0.00
40.60	1.86	0.33	5.00	0.00	0.00	0.00
40.70	1.85	0.33	5.00	0.00	0.00	0.00
40.80	1.85	0.33	5.00	0.00	0.00	0.00
40.90	1.85	0.33	5.00	0.00	0.00	0.00
41.00	1.85	0.33	5.00	0.00	0.00	0.00
41.10	1.85	0.33	5.00	0.00	0.00	0.00
41.20	1.85	0.33	5.00	0.00	0.00	0.00
41.30	1.85	0.33	5.00	0.00	0.00	0.00
41.40	1.85	0.33	5.00	0.00	0.00	0.00
41.50	1.85	0.33	5.00	0.00	0.00	0.00
41.60	1.85	0.33	5.00	0.00	0.00	0.00
41.70	1.85	0.33	5.00	0.00	0.00	0.00
41.80	1.85	0.33	5.00	0.00	0.00	0.00
41.90	1.85	0.33	5.00	0.00	0.00	0.00
42.00	1.85	0.33	5.00	0.00	0.00	0.00
42.10	1.85	0.33	5.00	0.00	0.00	0.00
42.20	1.85	0.33	5.00	0.00	0.00	0.00
42.30	1.85	0.33	5.00	0.00	0.00	0.00
42.40	1.84	0.33	5.00	0.00	0.00	0.00
42.50	1.84	0.33	5.00	0.00	0.00	0.00
42.60	1.84	0.33	5.00	0.00	0.00	0.00
42.70	1.84	0.33	5.00	0.00	0.00	0.00

42.80	1.84	0.33	5.00	0.00	0.00	0.00
42.90	1.84	0.33	5.00	0.00	0.00	0.00
43.00	1.84	0.33	5.00	0.00	0.00	0.00
43.10	1.84	0.33	5.00	0.00	0.00	0.00
43.20	1.84	0.33	5.00	0.00	0.00	0.00
43.30	1.84	0.33	5.00	0.00	0.00	0.00
43.40	1.84	0.33	5.00	0.00	0.00	0.00
43.50	1.84	0.33	5.00	0.00	0.00	0.00
43.60	1.84	0.33	5.00	0.00	0.00	0.00
43.70	1.84	0.33	5.00	0.00	0.00	0.00
43.80	1.84	0.33	5.00	0.00	0.00	0.00
43.90	1.84	0.33	5.00	0.00	0.00	0.00
44.00	1.83	0.33	5.00	0.00	0.00	0.00
44.10	1.83	0.33	5.00	0.00	0.00	0.00
44.20	1.83	0.33	5.00	0.00	0.00	0.00
44.30	1.83	0.33	5.00	0.00	0.00	0.00
44.40	1.83	0.33	5.00	0.00	0.00	0.00
44.50	1.83	0.33	5.00	0.00	0.00	0.00
44.60	1.83	0.33	5.00	0.00	0.00	0.00
44.70	1.83	0.33	5.00	0.00	0.00	0.00
44.80	1.83	0.33	5.00	0.00	0.00	0.00
44.90	1.83	0.33	5.00	0.00	0.00	0.00
45.00	1.83	0.33	5.00	0.00	0.00	0.00
45.10	1.83	0.33	5.00	0.00	0.00	0.00
45.20	1.83	0.33	5.00	0.00	0.00	0.00
45.30	1.83	0.33	5.00	0.00	0.00	0.00
45.40	1.83	0.33	5.00	0.00	0.00	0.00
45.50	1.83	0.33	5.00	0.00	0.00	0.00
45.60	1.83	0.33	5.00	0.00	0.00	0.00
45.70	1.82	0.33	5.00	0.00	0.00	0.00
45.80	1.82	0.33	5.00	0.00	0.00	0.00
45.90	1.82	0.33	5.00	0.00	0.00	0.00
46.00	1.82	0.33	5.00	0.00	0.00	0.00
46.10	1.82	0.33	5.00	0.00	0.00	0.00
46.20	1.82	0.33	5.00	0.00	0.00	0.00
46.30	1.82	0.33	5.00	0.00	0.00	0.00
46.40	1.82	0.33	5.00	0.00	0.00	0.00
46.50	1.82	0.32	5.00	0.00	0.00	0.00
46.60	1.82	0.32	5.00	0.00	0.00	0.00
46.70	1.82	0.32	5.00	0.00	0.00	0.00
46.80	1.82	0.32	5.00	0.00	0.00	0.00
46.90	1.82	0.32	5.00	0.00	0.00	0.00
47.00	1.82	0.32	5.00	0.00	0.00	0.00
47.10	1.82	0.32	5.00	0.00	0.00	0.00
47.20	1.82	0.32	5.00	0.00	0.00	0.00
47.30	1.82	0.32	5.00	0.00	0.00	0.00
47.40	1.81	0.32	5.00	0.00	0.00	0.00
47.50	1.81	0.32	5.00	0.00	0.00	0.00
47.60	1.81	0.32	5.00	0.00	0.00	0.00
47.70	1.81	0.32	5.00	0.00	0.00	0.00
47.80	1.81	0.32	5.00	0.00	0.00	0.00
47.90	1.81	0.32	5.00	0.00	0.00	0.00
48.00	1.81	0.32	5.00	0.00	0.00	0.00
48.10	1.81	0.32	5.00	0.00	0.00	0.00
48.20	1.81	0.32	5.00	0.00	0.00	0.00
48.30	1.81	0.32	5.00	0.00	0.00	0.00
48.40	1.81	0.32	5.00	0.00	0.00	0.00
48.50	1.81	0.32	5.00	0.00	0.00	0.00
48.60	1.81	0.32	5.00	0.00	0.00	0.00
48.70	1.81	0.32	5.00	0.00	0.00	0.00
48.80	1.81	0.32	5.00	0.00	0.00	0.00
48.90	1.81	0.32	5.00	0.00	0.00	0.00
49.00	1.81	0.32	5.00	0.00	0.00	0.00

49.10	1.81	0.32	5.00	0.00	0.00	0.00
49.20	1.80	0.32	5.00	0.00	0.00	0.00
49.30	1.80	0.32	5.00	0.00	0.00	0.00
49.40	1.80	0.32	5.00	0.00	0.00	0.00
49.50	1.80	0.32	5.00	0.00	0.00	0.00
49.60	1.80	0.32	5.00	0.00	0.00	0.00
49.70	1.80	0.32	5.00	0.00	0.00	0.00
49.80	1.80	0.32	5.00	0.00	0.00	0.00
49.90	1.80	0.32	5.00	0.00	0.00	0.00
50.00	1.80	0.32	5.00	0.00	0.00	0.00
50.10	1.80	0.32	5.00	0.00	0.00	0.00
50.20	1.80	0.32	5.00	0.00	0.00	0.00
50.30	1.80	0.32	5.00	0.00	0.00	0.00
50.40	1.80	0.32	5.00	0.00	0.00	0.00
50.50	1.80	0.32	5.00	0.00	0.00	0.00
50.60	1.80	0.32	5.00	0.00	0.00	0.00
50.70	1.80	0.32	5.00	0.00	0.00	0.00
50.80	1.80	0.32	5.00	0.00	0.00	0.00
50.90	1.79	0.32	5.00	0.00	0.00	0.00
51.00	1.79	0.32	5.00	0.00	0.00	0.00
51.10	1.79	0.32	5.00	0.00	0.00	0.00
51.20	1.79	0.32	5.00	0.00	0.00	0.00
51.30	1.79	0.32	5.00	0.00	0.00	0.00
51.40	1.79	0.32	5.00	0.00	0.00	0.00
51.50	1.79	0.32	5.00	0.00	0.00	0.00

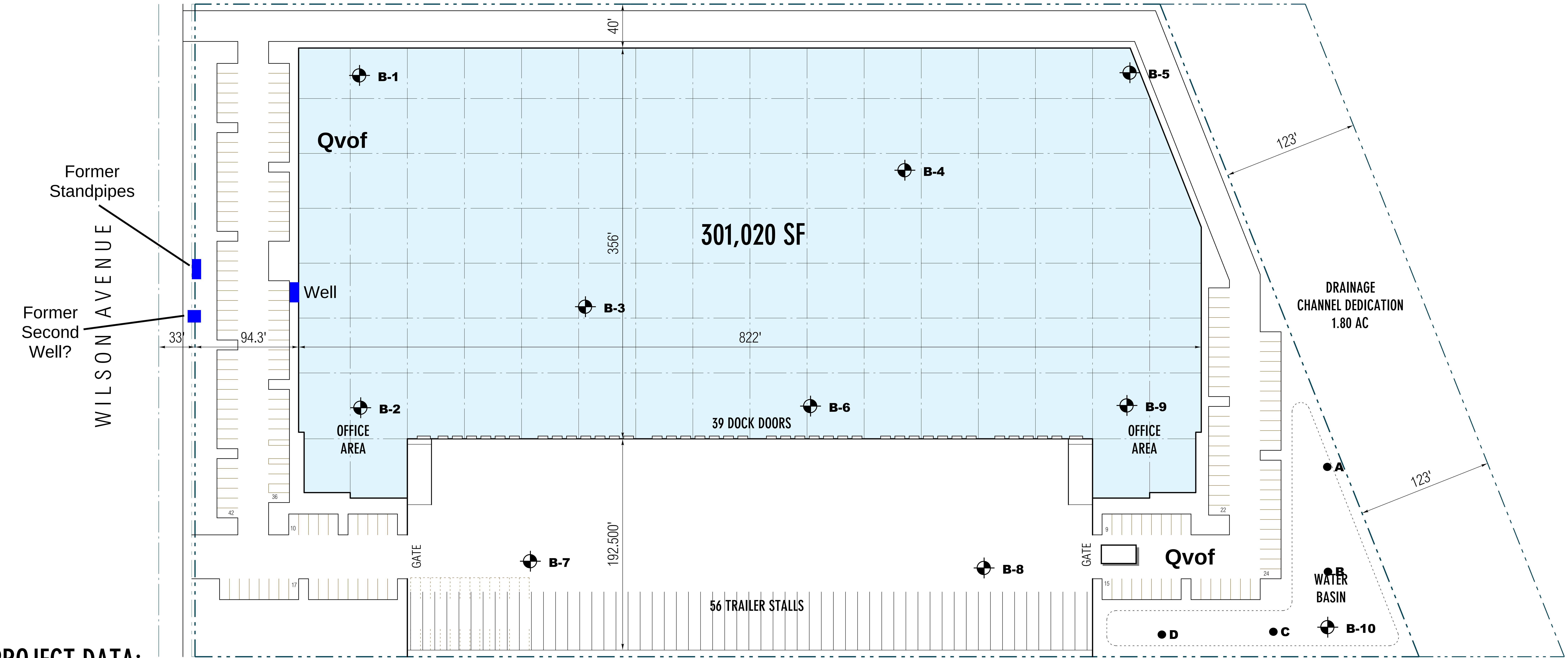
* F.S.<1, Liquefaction Potential Zone
(F.S. is limited to 5, CRR is limited to 2, CSR is limited to 2)

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

---

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

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



PROJECT DATA:

ZONE:	LIGHT INDUSTRIAL
GROSS SITE AREA:	673,003 SF / 15.45 AC
CHANNEL DEDICATION:	78,670 SF / 1.80 AC
NET SITE AREA	594,333 SF / 13.65 AC
BUILDING AREA:	
FOOTPRINT:	297,020 SF
MEZZANINE:	4,000 SF
TOTAL:	301,020 SF
NET LOT COVERAGE: (50% MAX)	49.97 %
NET FAR: (75% MAX)	50.64 %
PARKING REQUIRED:	
6,000 SF OFFICE @ 1/300 SF	20 STALLS
WAREHOUSE	
0-20,000 SF (1/1000 SF)	20 STALLS
20K AND ABV (1/2000 SF)	138 STALLS
TOTAL	178 STALLS
PARKING PROVIDED:	179 STALLS
LANDSCAPE:	80,546 SF / 12 % MIN.

GEOTECHNICAL LEGEND

B-10	Approximate location of exploratory boring
● D	Approximate location of percolation test
Qvof	Very old fan alluvium (valley fill), weathered surface

EXPLORATION & TEST LOCATION MAP

APN 300-170-009, PERRIS, CALIFORNIA

PROJECT NO. 4488-I	DATE: 1/21/19	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
F X 949-341-0922

WILSON AVENE

00000 WILSON AVENUE, CITY OF PERRIS

PRELIMINARY SITE PLAN - SCHEME 01r1

MARK	DATE	DESCRIPTION
	10/1/18	CONCEPTUAL SITE PLAN

RGA PROJECT NO:	18120.00
CAD FILE NAME:	18120-00-A1-01r1
DRAWN BY:	MG
CHK'D BY:	CS

SHEET TITLE

A1-01r1