Appendix E: Geotechnical/Geologic Hazard Report

GEOTECHNICAL/GEOLOGIC HAZARD REPORT
PROPOSED NEW CLASSROOM BUILDINGS
MURRIETA CANYON ACADEMY
24150 HAYES AVENUE, MURRIETA, CALIFORNIA

Prepared for

MURRIETA VALLEY UNIFIED SCHOOL DISTRICT
41870 McAlby Court
Murrieta, California 92562

Project No. 12393.001

August 20, 2019

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A LEIGHTON GROUP COMPANY

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Murrieta Valley Unified School District
41870 McAlby Court
Murrieta, California 92562

Attention: Mr. Randy White

Subject: Geotechnical/Geologic Hazard Report
Proposed New Classroom Buildings
Murrieta Canyon Academy
24150 Hayes Avenue, Murrieta, California

In accordance with your request and authorization, we have performed a geotechnical/ geologic exploration for the proposed Classroom Buildings located within the existing Murrieta Canyon Academy/Thompson Middle School campuses in the City of Murrieta, California. This report summarizes our geotechnical findings, conclusions and recommendations regarding the proposed building. Although this is an existing school site, our report is prepared in general accordance with California Geologic Survey (CGS), Note 48. It should be noted that Leighton previously performed a subsurface fault investigation for the overall property that included also Murrieta Valley HS and Thompson MS (see references) and determined that active faulting does not exist at this site. Further, Leighton also performed compaction testing during grading.

If you have any questions regarding this report, please do not hesitate to contact the undersigned. We appreciate this opportunity to be of service on this project.

Respectfully submitted,

LEIGHTON CONSULTING, INC.

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1.0 INTRODUCTION

1.1 Purpose and Scope

This geotechnical/geologic hazard report is for the proposed Classroom Buildings at the Murrieta Canyon Academy/Thompson Middle School campuses located at 24150 Hayes Avenue, City of Murrieta, California (*see Figure 1, Site Location Map*). Our scope of services included the following:

- Review of available site-specific geologic information, including previous geotechnical reports listed in the references at the end of this report.
- A site reconnaissance and excavation of fourteen (14) exploratory borings and two percolation tests. Approximate locations of these exploratory borings are depicted on Figure 2.
- Geotechnical laboratory testing of selected soil samples obtained from this exploration. Test procedures and results are presented in Appendix B.
- Geotechnical engineering analyses performed or as directed by a California registered Geotechnical Engineer (GE) and reviewed by a California Certified Engineering Geologist (CEG).
- Preparation of this report which presents our geotechnical conclusions and recommendations regarding the proposed structures.

This report is not intended to be used as an environmental assessment (Phase I or other), or foundation and/or grading plan review.

1.2 Site and Project Description

The Murrieta Canyon Academy located at 24150 Hayes Avenue, Murrieta, California, is a fully functioning adult education school campus constructed during various phases. As depicted on Figure 2, the proposed buildings are generally located within the existing softball fields located immediately north of the existing campus and south of Thompson Middle School. The existing Murrieta Canyon Academy buildings are to be demolished and new parking/landscape to be constructed. Access to all portions of the site was through a locked gate along the south side of the campus.

Our understanding of this project is based on our review of a conceptual site plan prepared by Baker-Nowicki Design Studio (see Figure 2). The project will generally include the design of a new campus (Buildings A through D) with approximately 33,000 square-feet footprint total and associated parking lot, and other site improvements. More specifically, the new campus will include construction of a single-story laboratory and classroom building, student pavilion, administration office, various academic and activity courts with additional parking and landscape at the existing campus. The proposed buildings will contain various classrooms, a library, restrooms, and storage rooms. Details of the proposed grading and construction are not known at this time. The proposed buildings are expected to be single-story structures founded on isolated/spread or continuous wall footings with typical structural loads near existing grades.

2.0 FIELD EXPLORATION AND LABORATORY TESTING

2.1 Field Exploration

Our field exploration for the proposed buildings and parking areas consisted of the excavation of fourteen (14) borings within accessible areas of the site to explore subsurface conditions and provide basis for ground preparation and foundation design. During excavation, in-situ undisturbed (Cal Ring) and disturbed/bulk samples were collected from the exploration borings for further laboratory testing and evaluation. Approximate locations of these exploratory borings are depicted on the *Boring Location Plan* (Figure 2). Sampling was conducted by a staff geologist/engineer from our firm. After logging and sampling, the excavations were loosely backfilled with spoils generated during excavation and cold patch asphalt or rapid-set concrete was used where drilled in existing concrete pavement. The exploration logs from this and previous explorations are included in Appendix A.

2.2 Laboratory Testing

Laboratory tests were performed on representative bulk samples to provide a basis for development of remedial earthwork and geotechnical design parameters. Selected samples were tested to determine the following parameters: maximum dry density and optimum moisture, particle size, expansion index, swell or collapse potential, in-situ moisture and density, and soluble sulfate content. The results of our laboratory testing are presented in Appendix B.

3.0 GEOTECHNICAL AND GEOLOGIC FINDINGS

3.1 Regional Geology

The site is located within a prominent natural geomorphic province in southwestern California known as the Peninsular Ranges. This province is characterized by steep, elongated ranges and valleys that trend northwestward. More specifically, the site is situated within the southern portion of the Perris Block, an eroded mass of Cretaceous and older crystalline rock.

The Perris Block is approximately 20 miles by 50 miles in extent, is bounded by the San Jacinto Fault Zone to the northeast, the Elsinore Fault Zone to the southwest, the Cucamonga Fault Zone to the northwest, and the Temecula Basin to the south. The Perris Block has had a complex tectonic history, apparently undergoing relative vertical land-movements of several thousand feet in response to movement on the Elsinore and San Jacinto Fault Zones. Thin sedimentary and volcanic materials locally mantle crystalline bedrock. Young and older alluvial deposits fill the lower valley areas, as mapped regionally on Figure 4, *Regional Geology Map*.

3.2 Site Specific Geology

3.2.1 Earth Materials

Our field exploration, observations, and review of the pertinent literature indicate that the site is underlain by alluvial deposits and dense formational materials locally known as Pauba Formation. Artificial fill associated with previous site grading mantles the site. The following is a summary of the geologic conditions based on our borings.

- **Artificial Fill:** Artificial fill soils were generally observed within the upper 10 feet below ground surface. As encountered, these fills consist of moist, medium dense to dense, silty to clayey sand and sandy clay. Based on the results of our laboratory testing, these materials are expected to possess low to medium expansion potential (EI<91).

- **Pauba Formation:** Pleistocene aged Pauba Formation materials were encountered in our borings below the artificial fill. As encountered in the exploratory excavations, these materials consist of damp to moist, very stiff to dense, silty to clayey sand and sandy to silty clay. These materials are expected to possess similar expansion potential as the artificial fill.

3.3 Groundwater and Surface Water

No standing or surface water was observed on the site at the time of our field exploration. In addition, no groundwater was encountered during this investigation to the total depth explored of 31.5 feet. Historic groundwater data is not available for this site or nearby sites.

3.4 Faulting

The subject site, like the rest of Southern California, is located within a seismically active region as a result of being located near the active margin between the North American and Pacific tectonic plates. The principal source of seismic activity is movement along the northwest-trending regional fault systems such as the San Andreas, San Jacinto, and Elsinore Fault Zones. Based on published geologic maps, this site is not located within a currently designated Alquist-Priolo Earthquake Fault Zone, but located within Riverside County Fault Hazard Zone (see Figure 5). However, this site was cleared of any active faulting based on previous fault studies (Leighton, 1989). Moreover, no indications of faulting or fault related fissuring or fracturing was observed onsite during this investigation. The nearest known active fault is the Temecula Segment of the Elsinore Fault Zone located approximately 0.6 miles (0.97 kilometers) northeast of the site.

Historically, the Elsinore fault zone has produced earthquakes in the magnitude range of 6.5Mw to 7.1Mw ('Mw' is the Moment Magnitude as defined by the U.S.G.S). A table of major quakes (>5.5 Mw) within 30 miles of the site in the last 150 years (per CGS Website, December 2017), is presented in table below:

Table 1. Major Quakes (>5.5 Mw) in the last 150 years

Date	Moment Magnitude (Mw)	Approx. Distance from Site (km)	General Location
1880-12-19	6.0	37.8	East San Bernardino
1899-12-25	6.4	34.2	San Jacinto / Hemet
1910-05-15	6.0	21.8	Glen Ivy Hot Springs
1918-04-21	6.8	30.1	San Jacinto

3.5 Ground Shaking / Site-Specific Ground Motion Analysis

A site-specific ground motion analysis was performed in accordance with the 2016 California Building Code (CBC) following the procedures of ASCE 7-10 Publication, Section 21.2, as presented in Appendix C.

The probabilistic seismic hazard analysis was performed using the computer program EZ-FRISK (Risk Engineering, 2011) to estimate peak horizontal ground acceleration (PHGA) that could occur at the site, and to develop design response spectra. Various probabilistic density functions were used in this analysis to assess uncertainty inherent in these calculations with respect to magnitude, distance and ground motion. An averaging of the following four next-generation attenuation relationships (NGAs) was used with equal weights to calculate site-specific PHGA and spectra:

- Abrahamson-Silva (2008)
- Boore-Atkinson (2008),
- Campbell-Bozorgnia (2008), and
- Chiou-Youngs (2007)

The design response spectrum shown on Figure C-1 is derived from a comparison of probabilistic Maximum Considered Earthquake (MCE) and the 150 percent of the deterministic MCE as presented in Figures C-2 through C-3. In accordance with the 2016 CBC, peak ground accelerations are estimated based on maximum considered earthquake ground motion having a 2 percent probability of exceedance in 50 years) or site specific seismic hazard analysis (ASCE, 2010). The site-specific seismic coefficients are presented in Table 2 below.

Table 2. Site-Specific Seismic Coefficients

CBC Categorization/Coefficient		USGS General Procedure (g)*	EZ Frisk Procedure (g)
Site Longitude (decimal degrees)	-117.23306		
Site Latitude (decimal degrees)	33.56075		
Site Class Definition	**D**		
Mapped Spectral Response Acceleration at 0.2s Period, S_s		**2.02**	**2.05**
Mapped Spectral Response Acceleration at 1s Period, S_1		**0.81**	**0.71**
Short Period Site Coefficient at 0.2s Period, F_a		**1.00**	**1.00**
Long Period Site Coefficient at 1s Period, F_v		**1.50**	**1.50**
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS}		**2.02**	**2.05**
Adjusted Spectral Response Acceleration at 1s Period, S_{M1}		**1.22**	**1.07**
Design Spectral Response Acceleration at 0.2s Period, S_{DS}		**1.35**	**1.37**
Design Spectral Response Acceleration at 1s Period, S_{D1}		**0.81**	**0.71**

*g- Gravity acceleration, ***S_{D1} is calculated based on 2xSa* at 2s

The above listed seismic coefficients were calculated following the ASCE 7-10 procedures. We recommend the higher of the seismic coefficients be used in the design.

3.6 Secondary Seismic Hazards

Ground shaking can induce "secondary" seismic hazards such as liquefaction, dynamic densification, and differential subsidence along ground fissures, seiches and tsunamis, as discussed in the following subsections:

3.6.1 Dynamic Settlement (Liquefaction and Dry Settlement)

Liquefaction-induced or dynamic dry settlement is not considered a hazard at this site due to the lack of shallow groundwater and dense underlying Pauba formation. The seismic differential settlement is expected to be less than 0.5 inch in a 40-foot horizontal distance within this site.

3.6.2 Lateral Spreading

The potential for lateral spreading is considered non-existent on this site.

3.6.3 Ground Rupture

Since no active faults are known to cross or trend into the site, the possibility of damage due to ground surface-fault-rupture at this site is considered very low.

3.6.4 Seiches, Tsunamis, Inundation Due to Large Water Storage Facilities

Due to the great distance to large bodies of water, the possibility of seiches and tsunamis impacting the site is considered remote. This report does not address conventional flood hazard risk.

3.6.5 Rock Falls

The potential for rock fall due to either erosion or seismic ground shaking is considered non-existent on this area.

3.6.6 Slope Stability and Landslides

Due to the relatively modest relief across the site, the risk of deep-seated slope failure on this site or adjacent sites is considered non-existent. The existing 2:1 fill slope along the south side of the campus is considered grossly stable. The site is not considered susceptible to seismically induced landslides.

3.6.7 Dam Inundation/Flood Hazard

This report does not address conventional flood hazard risk associated with this site. However, per the official FEMA Flood Hazard Areas Map (FIRM Panel 06065C2715G), this site is located in Zone X – "Area of minimal flood hazard" In accordance with Figure 8, the site is not located within Diamond Valley Saddle dam inundation zone (Riverside, 2019).

3.6.8 Subsidence

In accordance with County of Riverside Geologic Hazard Maps (Riverside, 2019), the site is located within an area susceptible to subsidence. However, based on the results of our subsurface evaluation and lack of evidence of differential subsidence and associated ground fissuring, we consider the potential for differential subsidence and ground fissuring on this site to be very low.

3.7 Percolation/Infiltration Test Results

Two percolation tests were performed within the proposed infiltration areas at the site in the existing playfield area (see Figure 2). The percolation tests were performed in accordance with procedures of Section 2.3 of the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Design Handbook (RCFC, 2011). Results presented below are the most conservative reading in minutes per inch drop. The infiltration rates were estimated using the Porchet Method. No factor of Safety was applied to these values.

Table 3. Summary of Percolation/Infiltration Test Results

Test Hole #	Depth BGS (ft)	Percolation Rate (min/in)	Infiltration Rate (in/hr)	Soil Description
P-1	4	>120	<0.01	Silty/Clayey SAND (SC-SM) / Artificial Fill
P-2	4	27.8	0.20	Silty SAND (SM) / Artificial Fill

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4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 General

The proposed buildings/improvements appear feasible from a geotechnical viewpoint provided that the following recommendations are incorporated into the design and construction phases of development.

4.2 Earthwork

Earthwork should be performed in accordance with the following recommendations and the *Earthwork and Grading Specifications* included in Appendix D of this report. In case of conflict, the following recommendations should supersede those in Appendix D. The contract between the Owner and the earthwork contractor should be worded such that it is the responsibility of the contractor to place fill properly and in accordance with recommendations presented in this report, including the guide specifications in Appendix D, notwithstanding the testing and observation of the geotechnical consultant.

4.2.1 Site Preparation and Remedial Grading

Prior to grading, the proposed structural improvement areas (i.e. all-structural fill areas, pavement areas, buildings, etc.) of the site should be cleared of surface and subsurface obstructions. Heavy vegetation, roots and debris should be disposed of offsite. Although not anticipated, water wells, septic tanks and cesspools, if encountered, should be removed or abandoned in accordance with the Riverside County Department of Health Services guidelines. Voids created by removal of buried material should be backfilled with properly compacted soil in general accordance with the recommendations of this report. Area specific remedial grading recommendations are provided as follows:

- **Building Footprints:** Within the building footprint, the upper 3 feet of soils, or 2 feet below bottom of footings/slab-on-grade, whichever is deeper, should be removed/over-excavated and recompacted. If bottom of footings are deeper than 3 feet below existing grade, no over-excavation will be required provided the exposed bottom of excavation is scarified and recompacted to minimum of 90 percent of the ASTM D 1557 and approved by the geotechnical consultant. The over-excavation and recompaction should extend a minimum horizontal distance equal to the depth of removal. Localized areas of deeper removals/over-excavation may be required depending on the actual conditions encountered pending verification by our field representative during grading to confirm encountered soils are suitable.

- **<u>Flatwork/Pavement</u>:** In areas of proposed concrete flatwork or pavement, a minimum remedial removal and recompaction of 2-feet below existing grade or 12-inches below proposed subgrade elevation, whichever is deeper, should be performed. This remedial removal should be performed to a minimum of 2 feet beyond the limits of improvements. The bottom of the removal should be proof-rolled with heavy equipment to identify yielding subgrade conditions (for additional removal, if necessary) under the observation of the geotechnical consultant.

After completion of the recommended removal of existing fill soils and prior to fill placement, the exposed surface should be scarified to a minimum depth of 8-inches, moisture conditioned as necessary to near optimum moisture content and recompacted using heavy compaction equipment to an unyielding condition. All structural fill within the building footprints should be compacted throughout to 90 percent per ASTM D 1557.

4.2.2 <u>Suitability of Site Soils for Fills</u>

Topsoil and vegetation layers, root zones, and similar surface materials should be striped and stockpiled for either reuse in landscape surface areas or removed from the site. Site existing fill should be considered suitable for re-use as compacted fills provided the recommendations contained herein are followed. If cobbles/boulders larger than 6-inches in largest diameter or expansive soils (21<EI<91) are encountered, these materials should not be placed with the upper 5 feet of subgrade soils.

4.2.3 <u>Import Soils</u>

Import soils and/or borrow sites, if needed, should be evaluated by us prior to import. Import soils should be uncontaminated, granular in nature, free of organic material (loss on ignition less-than 2 percent), have low expansion potential (EI<91) and have a low corrosion impact to the proposed improvements.

4.2.4 <u>Utility Trenches</u>

Utility trenches should be backfilled with compacted fill in accordance with the *Standard Specifications for Public Works Construction,* ("Greenbook"), 2018 Edition. Fill material above the pipe zone should be placed in lifts not exceeding 8 inches in uncompacted thickness and should be compacted to at least 90 percent relative compaction (ASTM D 1557) by mechanical means only. Site soils may generally be suitable as trench backfill provided these soils are screened of rocks over 1½ inches in diameter and organic matter. The upper 6 inches of backfill in all pavement areas should be compacted to at least 95 percent relative compaction.

Where granular backfill is used in utility trenches adjacent moisture sensitive subgrades and foundation soils, we recommend that a cut-off "plug" of impermeable material be placed in these trenches at the perimeter of buildings, and at pavement edges adjacent to irrigated landscaped areas. A "plug" can consist of a 5-foot long section of clayey soils with more than 35-percent passing the No. 200 sieve, or a Controlled Low Strength Material (CLSM) consisting of one sack of Portland-cement plus one sack of bentonite per cubic-yard of sand. CLSM should generally conform to "Greenbook", latest edition. This is intended to reduce the likelihood of water permeating trenches from landscaped areas, then seeping along permeable trench backfill into the building and pavement subgrades, resulting in wetting of moisture sensitive subgrade earth materials under buildings and pavements.

Excavation of utility trenches should be performed in accordance with the project plans, specifications and the *California Construction Safety Orders*. The contractor should be responsible for providing a "competent person" as defined in Article 6 of the *California Construction Safety Orders*. Contractors should be advised that sandy soils (such as fills generated from the onsite alluvium) could make excavations particularly unsafe if all safety precautions are not properly implemented. In addition, excavations at or near the toe of slopes and/or parallel to slopes may be highly unstable due to the increased driving force and load on the trench wall. Spoil piles from the excavation(s) and construction equipment should be kept away from the sides of the trenches. Leighton Consulting, Inc. does not consult in the area of safety engineering.

4.2.5 Shrinkage

The volume change of excavated onsite soils upon recompaction is expected to vary with materials, density, insitu moisture content, and location and compaction effort. The in-place and compacted densities of soil materials vary and accurate overall determination of shrinkage and bulking cannot be made. Therefore, we recommend site grading include, if possible, a balance area or ability to adjust grades slightly to accommodate some variation. Based on our geotechnical laboratory results, we expect a recompaction shrinkage (when recompacted at 90 to 95 percent of ASTM D 1557) of 5- to 15-percent by volume, for the onsite fill or alluvium. Subsidence due solely to scarification, moisture conditioning and recompaction of the exposed bottom of over-excavation, is expected to be on the order of 0.10 foot. This should be added to the above shrinkage value for the recompacted fill zone, to calculate overall recompaction subsidence.

4.2.6 Drainage

All drainage should be directed away from structures and pavements by means of approved permanent/temporary drainage devices. Adequate storm drainage of any proposed pad should be provided to avoid wetting of foundation soils. Irrigation adjacent to buildings should be avoided when possible. As an option, sealed-bottom planter boxes and/or drought resistant vegetation should be used within 5-feet of buildings.

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4.3 Foundation Design

Shallow spread footings bearing on a newly placed and properly compacted fill are anticipated for the proposed structures.

4.3.1 Design Parameters – Spread/Continuous Shallow Footings

Conventional spread/continuous shallow footings appear to be feasible to support the proposed structures. Footings should be embedded at least 12-inches below lowest adjacent grade for the proposed structure. Footing embedments should be measured from lowest adjacent finished grade, considered as the top of interior slabs-on-grade or the finished exterior grade, excluding landscape topsoil, whichever is lower. Footings located adjacent to utility trenches or vaults should be embedded below an imaginary 1:1 (horizontal:vertical) plane projected upward and outward from the bottom edge of the trench or vault, up towards the footing.

- **Bearing Capacity**: A net allowable bearing capacity of 2,000 pounds per square foot (psf) may be used for design assuming that footings have a minimum base width of 18 inches for continuous wall footings and a minimum bearing area of 3 square feet (1.75-ft by 1.75-ft) for pad foundations. These bearing values may also be increased by one-third when considering short-term seismic or wind loads. All continuous perimeter or interior footings should be reinforced with at least one No. 5 bar placed both top and bottom.

- **Lateral loads**: Lateral loads may be resisted by friction between the footings and the supporting subgrade. A maximum allowable frictional resistance of 0.30 may be used for design. In addition, lateral resistance may be provided by passive pressures acting against foundations poured neat against properly compacted granular fill. We recommend that an allowable passive pressure based on an equivalent fluid pressure of 300 pounds-per-cubic-foot (pcf) be used in design. These friction and passive values have already been reduced by a factor-of-safety of 1.5.

Based on Section 1808.6.2 of the 2016 California Building Code, slab-on-grade design for expansive soils (EI>21) should be designed in accordance with *WRI/CRSI Design of Slab-On-Ground Foundations* or *PTI DC 10.5* taking into consideration the anticipated differential settlement. The following soil parameters may be used:

WRI/CRSI Design Method

- Effective Plasticity Index: 20
- Climatic Rating: Cw = 15
- Reinforcement: Per structural designer.
- Moisture condition subgrade soils to 100% of optimum moisture content to a depth of 12 inches prior to trenching for footings.

PTI DC 10.5 Design Method

The following PTI design parameters were derived using VOLFLO 1.5 computer program developed by Geostructural Tool Kit, Inc. and laboratory test results:

Table 4. PTI Design Parameters

Design Parameters	EI≤90
Thornthwaite Moisture Index	-20
Depth to Constant Soil Suction	9.0 feet
Constant Soil Suction	3.9 feet
Edge Moisture Variation Distance, e_m - Edge Lift - Center Lift	 4.8 feet 9.0 feet
Soil Differential Movement, y_m - Edge Lift - Swell - Center Lift – Shrink	 1.2 inches 0.7 inch

The differential settlements provided below should be considered in addition to the shrink/swell settlement given in table above.

4.3.2 Settlement Estimates

For settlement estimates, we assumed that column loads will be no larger than 100 kips, with bearing wall loads not exceeding 5 kips per foot of wall. If greater column or wall loads are required, we should re-evaluate our foundation recommendation, and re-calculate settlement estimates.

Buildings located on compacted fill soils (as recommended in Section 4.2.1) should be designed in anticipation of 1-inch of total static settlement and ½- inch of static differential settlement within a 40 foot horizontal run. The majority of this settlement is anticipated to occur during construction as the load is applied. The estimated differential dynamic settlement will be less than ½-inch within a 40 feet horizontal distance or between two similar structural elements. These settlement estimates should be reevaluated by this firm when foundation plans and actual loads for the proposed structure(s) become available. The structural engineer should consider the effects of both static and dynamic settlements.

4.4 Retaining Walls

The proposed building will require a large retaining wall up to approximately 10 feet in height. Retaining wall earth pressures are a function of the amount of wall yielding horizontally under load. If the wall can yield enough to mobilize full shear strength of backfill soils, then the wall can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the soil cannot be mobilized and the earth pressure will be higher. Such walls should be designed for "at rest" conditions. If a structure moves toward the soils, the resulting resistance developed by the soil is the "passive" resistance. Retaining walls backfilled with non-expansive soils should be designed using the following equivalent fluid pressures:

Table 5. Retaining Wall Design Earth Pressures (Static, Drained)

Loading Conditions	Equivalent Fluid Density (pcf)	
	Level Backfill	2:1 Backfill
Active	36	50
At-Rest	55	85
Passive*	300	150 (2:1, sloping down)

* This assumes level condition in front of the wall will remain for the duration of the project, not to exceed 4,500 psf at depth.

Unrestrained (yielding) cantilever walls should be designed for the active equivalent-fluid weight value provided above for very low expansive soils that are free draining. In the design of walls restrained from movement at the top (non-yielding) such as basement or elevator pit/utility vaults, the at-rest equivalent fluid weight value should be used. Total depth of retained earth for design of cantilever walls should be measured as the vertical distance below the ground surface measured at the wall face for stem design, or measured at the heel of the footing for overturning and sliding calculations. Should a sloping backfill other than a 2:1 (horizontal:vertical) be constructed above the wall (or a backfill is loaded by an adjacent surcharge load), the equivalent fluid weight values provided above should be re-evaluated on an individual case basis by us. Non-standard wall designs should also be reviewed by us prior to construction to check that the proper soil parameters have been incorporated into the wall design.

All retaining walls should be provided with appropriate drainage. The outlet pipe should be sloped to drain to a suitable outlet. Wall backfill should be non-expansive (EI $\leq$ 21) sands compacted by mechanical methods to a minimum of 90 percent relative compaction (ASTM D 1557). Clayey site soils should not be used as wall backfill. Walls should not be backfilled until wall concrete attains the 28-day compressive strength and/or as determined by the Structural Engineer that the wall is structurally capable of supporting backfill. Lightweight compaction equipment should be used, unless otherwise approved by the Engineer.

4.5 Vapor Retarder

It has been a standard of care to install a moisture retarder underneath all slabs where moisture condensation is undesirable. Moisture vapor retarders may retard but not totally eliminate moisture vapor movement from the underlying soils up through the slabs. Moisture vapor transmission may be additionally reduced by use of concrete additives. Leighton Consulting, Inc., does not practice in the field of moisture vapor transmission evaluation/mitigation. Therefore, we recommend that a qualified person/firm be engaged/consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. This person/firm should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structure as deemed appropriate.

4.6 Footing Setbacks

We recommend a minimum horizontal setback distance from the face of slopes for all structural footings (including retaining and decorative walls, building footings, etc.). This distance is measured from the outside bottom edge of the footing horizontally to the slope face (or to the face of a retaining wall) and should be a minimum of H/3, where H is the slope height (in feet). The setback should not be less than 7 feet and need not be greater than 15 feet.

The soils within the structural setback area may possess poor lateral stability and improvements (such as retaining walls, decks, sidewalks, fences, pavements, etc.) constructed within this setback area may be subject to lateral movement and/or differential settlement. Potential distress to such improvements may be mitigated by providing a deepened footing or a pier and grade-beam foundation system to support the improvement. The deepened footing should meet the setback as described above.

4.7 Sulfate Attack

The results of our laboratory testing indicate that the onsite soils have soluble sulfate content of less than 2,000 ppm. Type II cement or similar may be used for design of concrete structures in contact with the onsite soils.

4.8 Preliminary Pavement Design

Our preliminary pavement design is based on an assumed R-value of 17 and the guidelines included in Caltrans Highway Design Manual. For planning and estimating purposes, the pavement sections are calculated based on Traffic Indexes (TI) as indicated in Table below:

Table 6. Asphalt Pavement Sections

General Traffic Condition	Design Traffic Index (TI)	Asphalt Concrete (inches)	Aggregate Base* (inches)
Automobile Parking Lanes	4.5	3.0	6.0
	5.0	3.0	7.5
Truck Access & Driveways	6.0	4.0	9.0
	6.5	4.5	10.0

Appropriate Traffic Index (TI) should be selected or verified by the project civil engineer or traffic engineering consultant and appropriate R-value of the subgrade soils will need to be verified after completion of rough grading to finalize the pavement design. Pavement design and construction should also conform to applicable local, county and industry standards. The Caltrans pavement section design calculations were based on a pavement life of approximately 20 years with a normal amount of flexible pavement maintenance

For preliminary planning purposes, fire lanes and truck loading areas may be constructed of Portland Cement Concrete (PCC) with a minimum thickness of 6.0 inches assuming light axle loads and an average daily truck traffic (ADTT) of less than 500. For medium/heavy axle loads and an ADT of 500 or more, a minimum PCC thickness of 8 inches should be used, such as for trash corrals and trash truck aprons, loading docks, etc. All PCC pavement should have a minimum 28-day concrete compressive strength of 3,250 psi and have appropriate joints and saw cuts in accordance with either Portland Cement Association (PCA) or American Concrete Institute (ACI) guidelines. PCC subgrade should be compacted to 95 percent relative compaction in the upper 6 inches. A 4-inch (minimum) layer of Class 2 aggregate base at 95 percent relative compaction should be considered beneath the PCC paving. The upper 6 inches of the underlying subgrade soils should also be compacted to at least 95 percent relative compaction (ASTM D1557). Minimum relative compaction requirements for aggregate base should be 95 percent of the maximum laboratory density as determined by ASTM D1557. If applicable, aggregate base should conform to the "Standard Specifications for Public Works Construction" (green book) current edition or Caltrans Class 2 aggregate base.

If pavement areas are adjacent to heavily watered landscape areas, some deterioration of the subgrade load bearing capacity may result. Moisture control measures such as deepened curbs or other moisture barrier materials may be used to prevent the subgrade soils from becoming saturated. The use of concrete cutoff or edge barriers should be considered when pavement is planned adjacent to either open (unfinished) or irrigated landscaped areas.

5.0 GEOTECHNICAL CONSTRUCTION SERVICES

Geotechnical review is of paramount importance in engineering practice. Poor performances of many foundation and earthwork projects have been attributed to inadequate construction review. We recommend that Leighton Consulting, Inc. be provided the opportunity to review the grading plan and foundation plan(s) prior to bid.

Reasonably-continuous construction observation and review during site grading and foundation installation allows for evaluation of the actual soil conditions and the ability to provide appropriate revisions where required during construction. Geotechnical conclusions and preliminary recommendations should be reviewed and verified by Leighton Consulting, Inc. during construction, and revised accordingly if geotechnical conditions encountered vary from our findings and interpretations. Geotechnical observation and testing should be provided:

- After completion of site demolition and clearing,
- During over-excavation of compressible soil,
- During compaction of all fill materials,
- After excavation of all footings and prior to placement of concrete,
- During utility trench backfilling and compaction, and
- When any unusual conditions are encountered.

Additional geotechnical exploration and analysis may be required based on final development plans, for reasons such as significant changes in proposed structure locations/footprints. We should review grading (civil) and foundation (structural) plans, and comment further on geotechnical aspects of this project.

Project: 12393.001	Eng/Geol: SIS/RFR
Scale:1 " = 2,000 '	Date: August 2019

Base Map: ESRI ArcGIS Online 2019
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

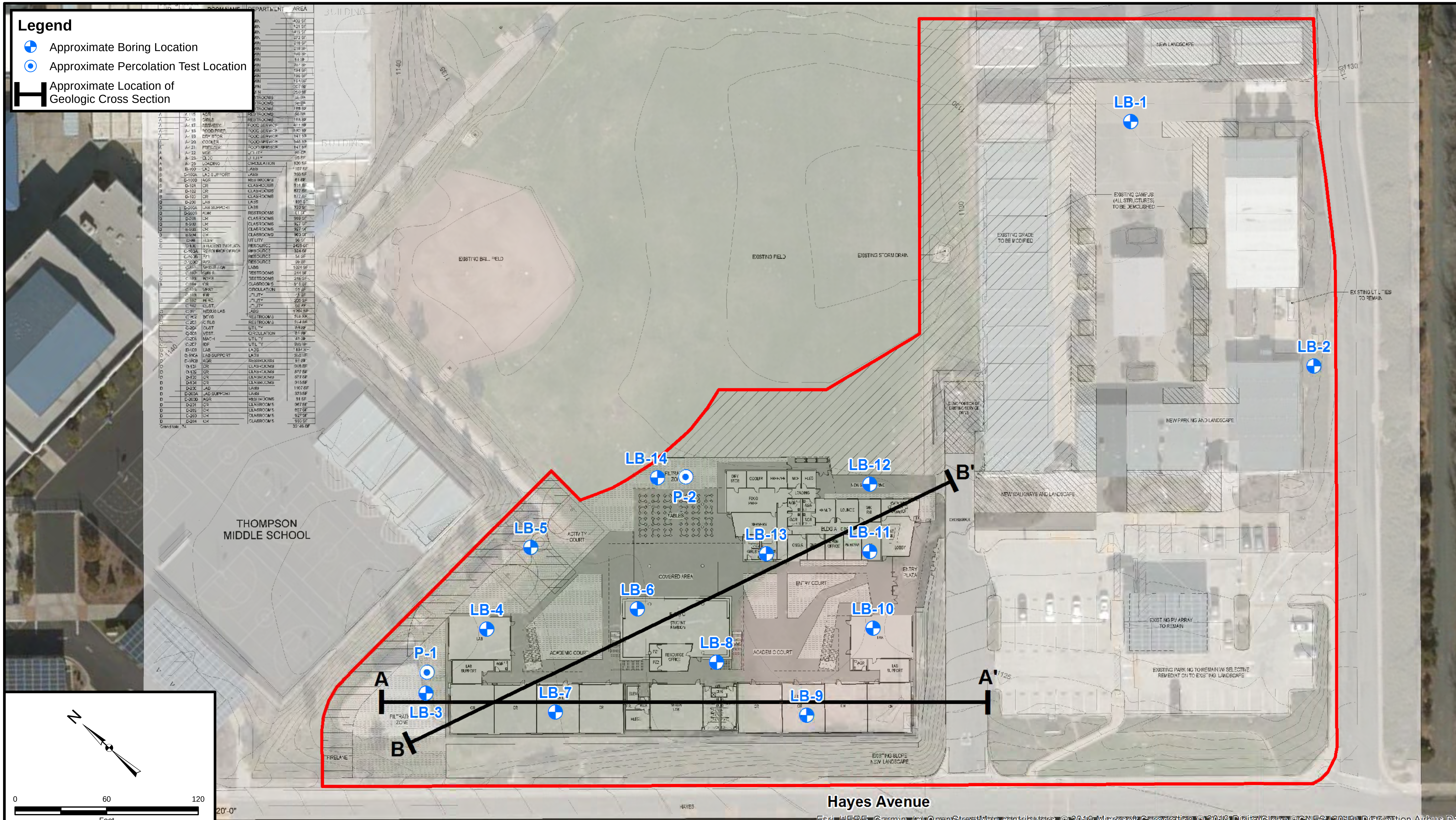
SITE LOCATION MAP

Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 1

Leighton

Map Saved as V:\Drafting\12393\001\Maps\12393-001_F01_SLM_2019-08-20.mxd on 8/20/2019 11:17:54 AM



Project: 12393.001	Eng/Geol: SIS/RFR
Scale:1 " = 60 '	Date: August 2019

Base Map: ESRI ArcGIS Online 2019
Thematic Information: Leighton
Author: Leighton Geomatics (btran)

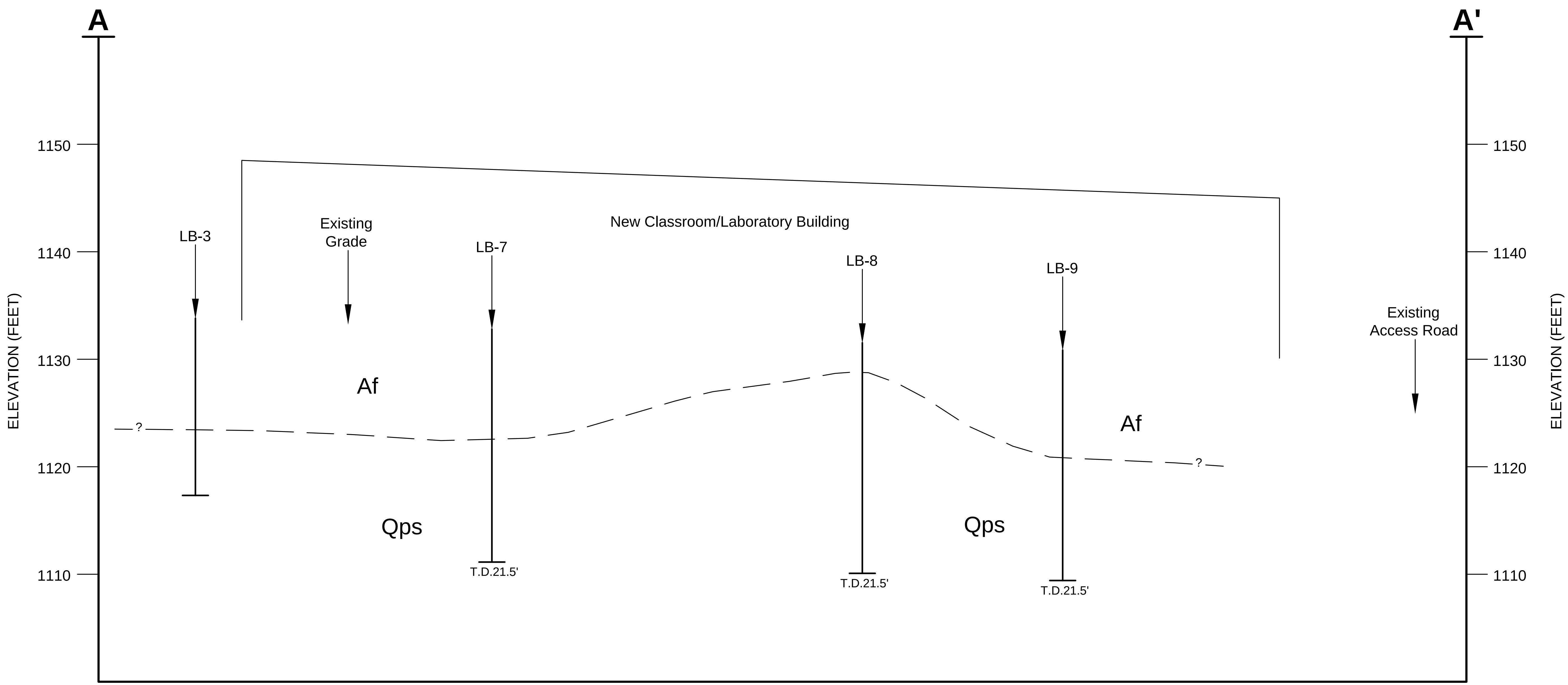
BORING LOCATION MAP

Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 2

Leighton

Map Saved as V:\Drafting\12393\001\Maps\12393-001_F02_BLM_2019-08-20.mxd on 8/20/2019 9:25:28 AM



GEOLOGIC CROSS SECTION A-A'

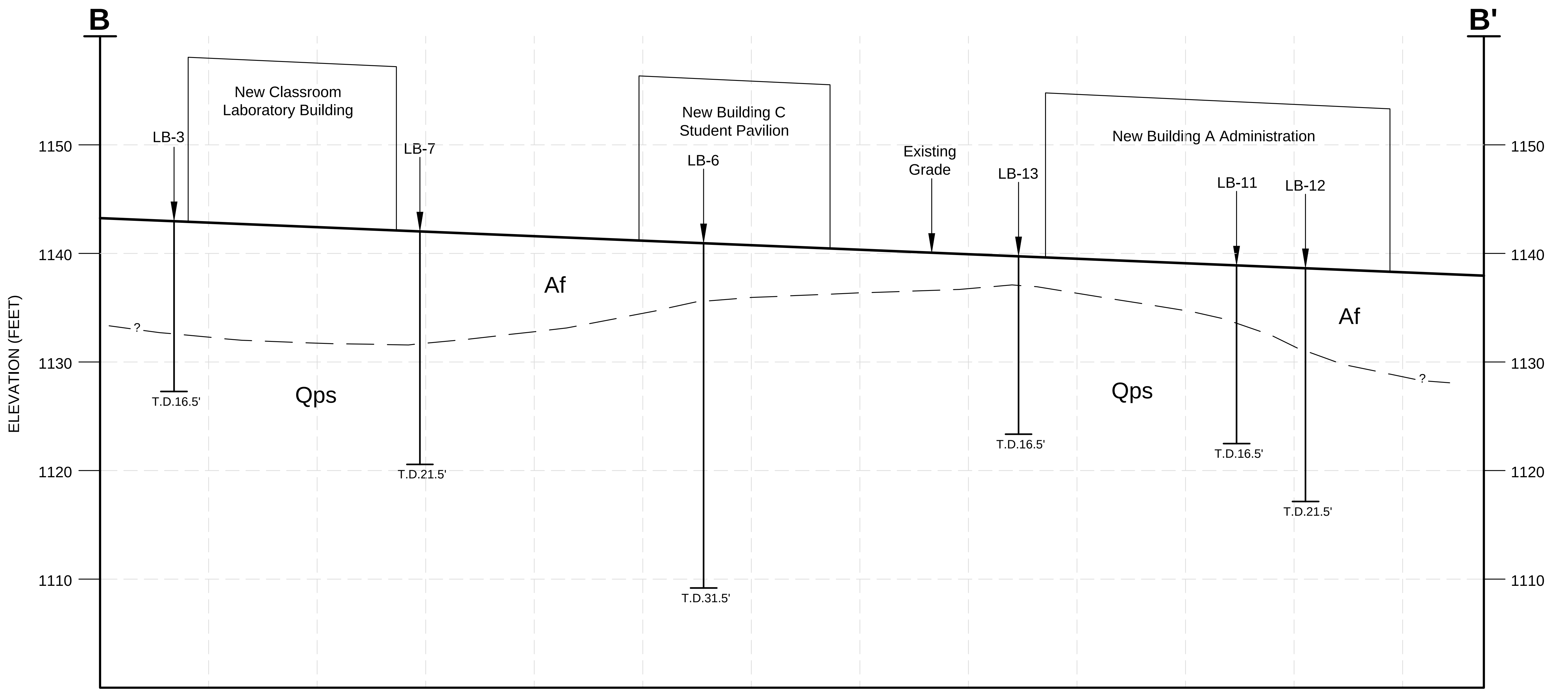
Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 3A

Leighton

Proj: 12393.001	Eng/Geol: SIS/RFR
Scale: V: 1"=10' H: 1"=30'	Date: August 2019

Drafted By: BQT | Checked By: BQT



GEOLOGIC CROSS SECTION B-B'

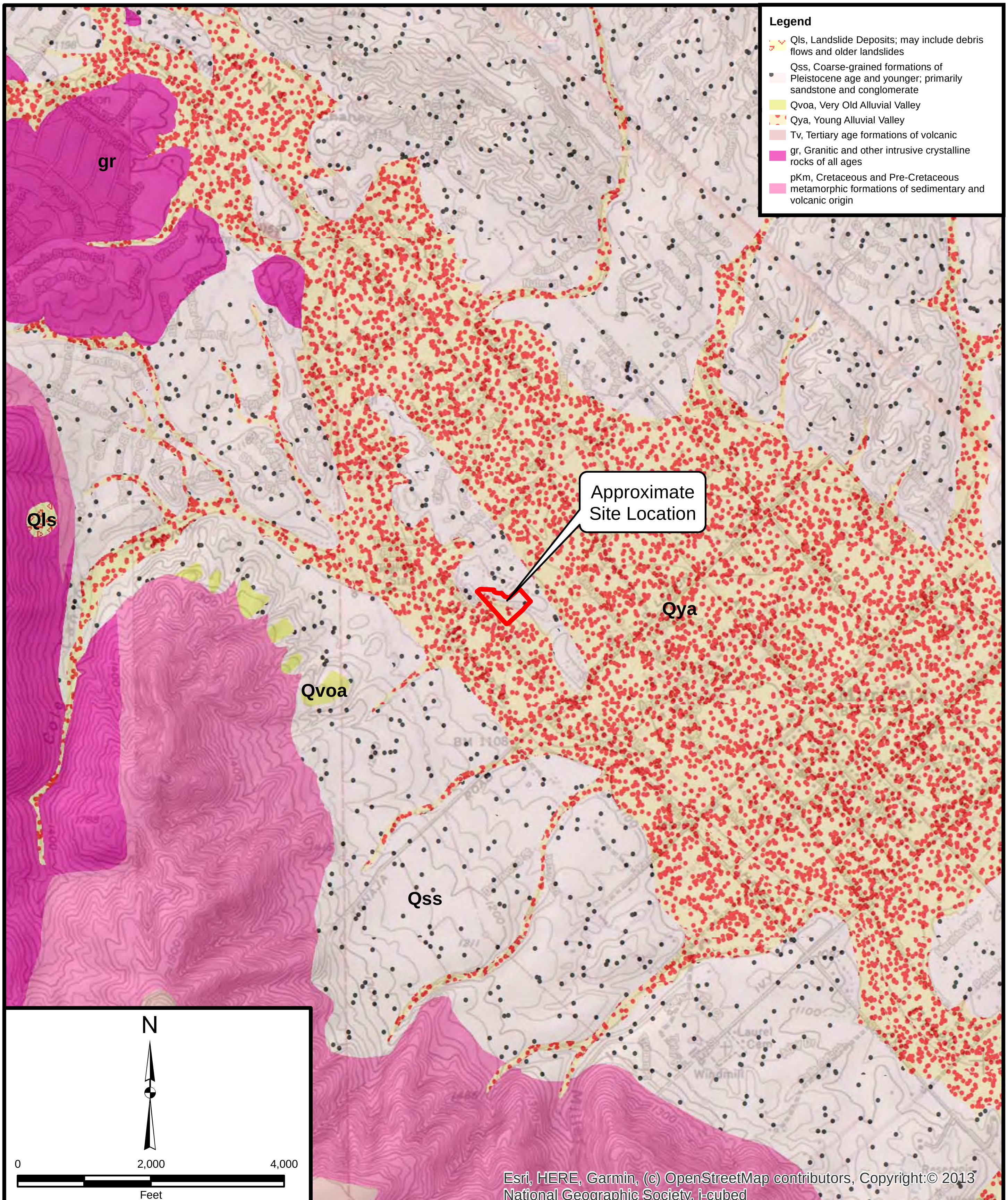
Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Proj: 12393.001	Eng/Geol: SIS/RFR
Scale: V: 1"=10' H: 1"=30'	Date: August 2019

Drafted By: BQT | Checked By: BQT | V:\DRAFTING\12393\001\CAD\2019-08-20\12393-001_FIGURES-3AB_2019-08-20.DWG (08-20-19 12:39:24PM) Plotted by: btran

Figure 3B

Leighton



Project: 12393.001	Eng/Geol: SIS/RFR
Scale:1 " = 2,000 '	Date: August 2019

Base Map: ESRI ArcGIS Online 2019
Thematic Information: Leighton, USGS
Author: Leighton Geomatics (btran)

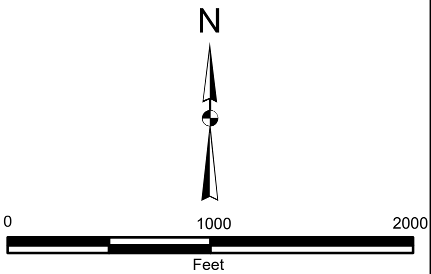
REGIONAL GEOLOGY MAP

Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 4

Leighton

Map Saved as V:\Drafting\12393\001\Maps\12393-001_F04_RGM_2019-07-11.mxd on 7/11/2019 2:39:37 PM



Project: 12393.001	Eng/Geol: SIS/RFR
Scale:1 " = 1000'	Date: August 2019

Base Map: ESRI Riverside Co RCIT 2019
Thematic Information: Leighton,
Author: Leighton Geomatics (msb)

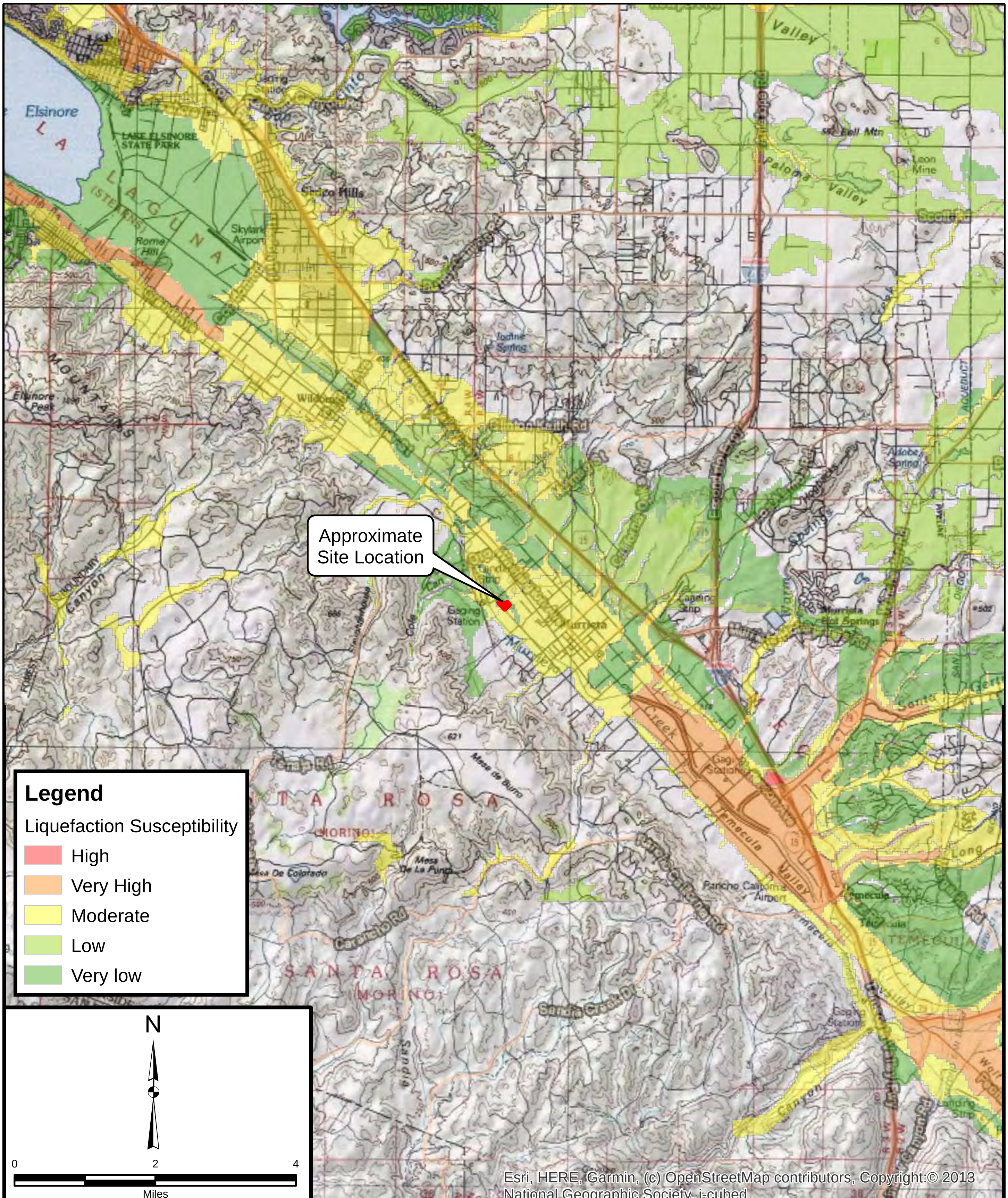
REGIONAL FAULT MAP

Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 5

Leighton

Map Saved as V:\Drafting\12393\001\Maps\12393-001_F05_RFM_2019-07-11.mxd on 7/11/2019 2:42:42 PM



Project: 12393.001	Eng/Geol: SIS/RFR
Scale:1 " = 2 miles	Date: August 2019

Base Map: ESRI ArcGIS Online 2019
Thematic Information: Leighton, CGS
Author: Leighton Geomatics (btran)

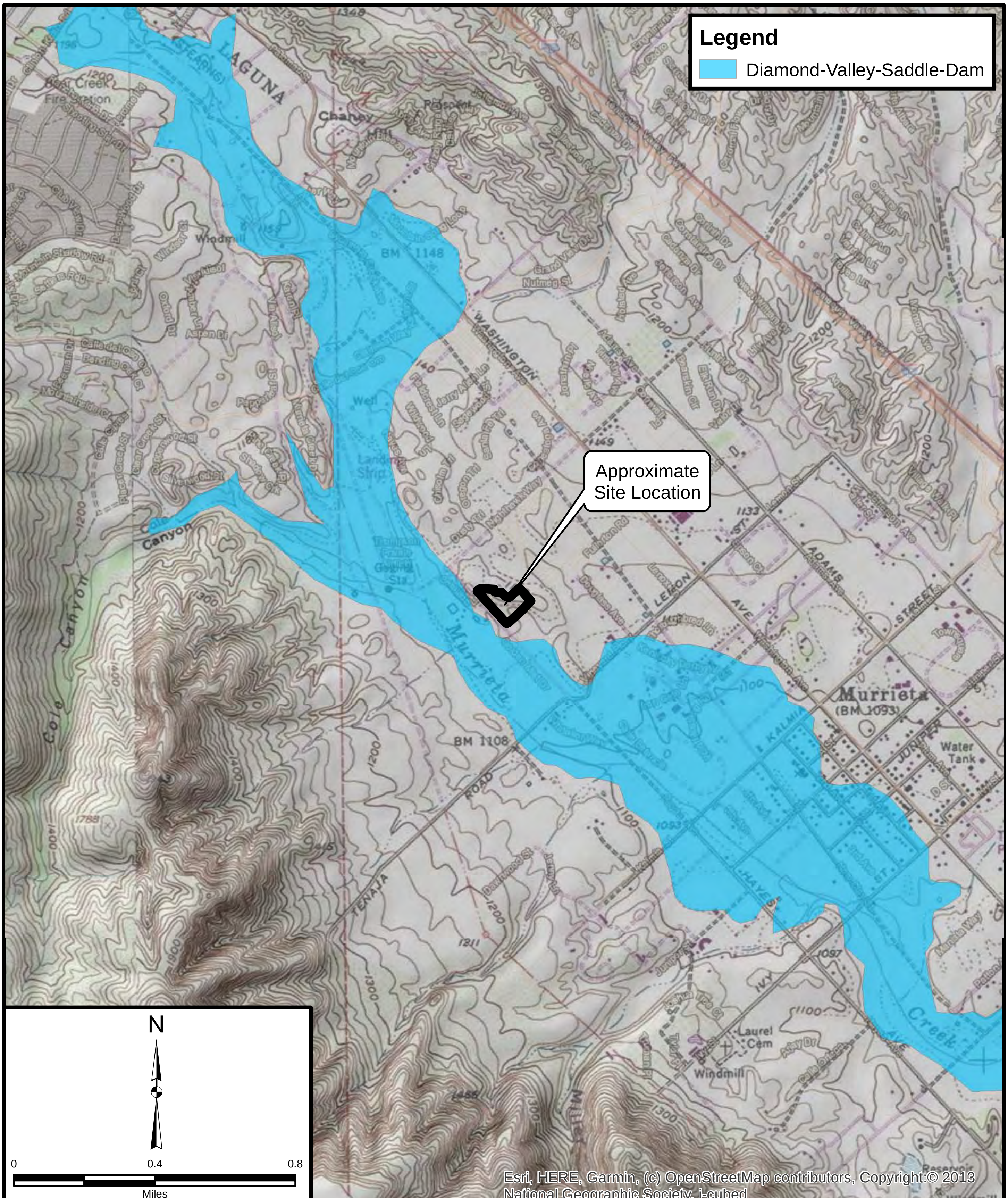
LIQUEFACTION MAP

Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 6

Leighton

Map Saved as V:\Drafting\12393\001\Maps\12393-001_F06_LM_2019-07-11.mxd on 7/11/2019 2:44:58 PM



Project: 12393.001	Eng/Geol: SIS/RFR
Scale:1 " = 0 miles	Date: August 2019

Base Map: ESRI ArcGIS Online 2019
Thematic Information: Leighton, CGS, Bryant 2010
Author: Leighton Geomatics (btran)

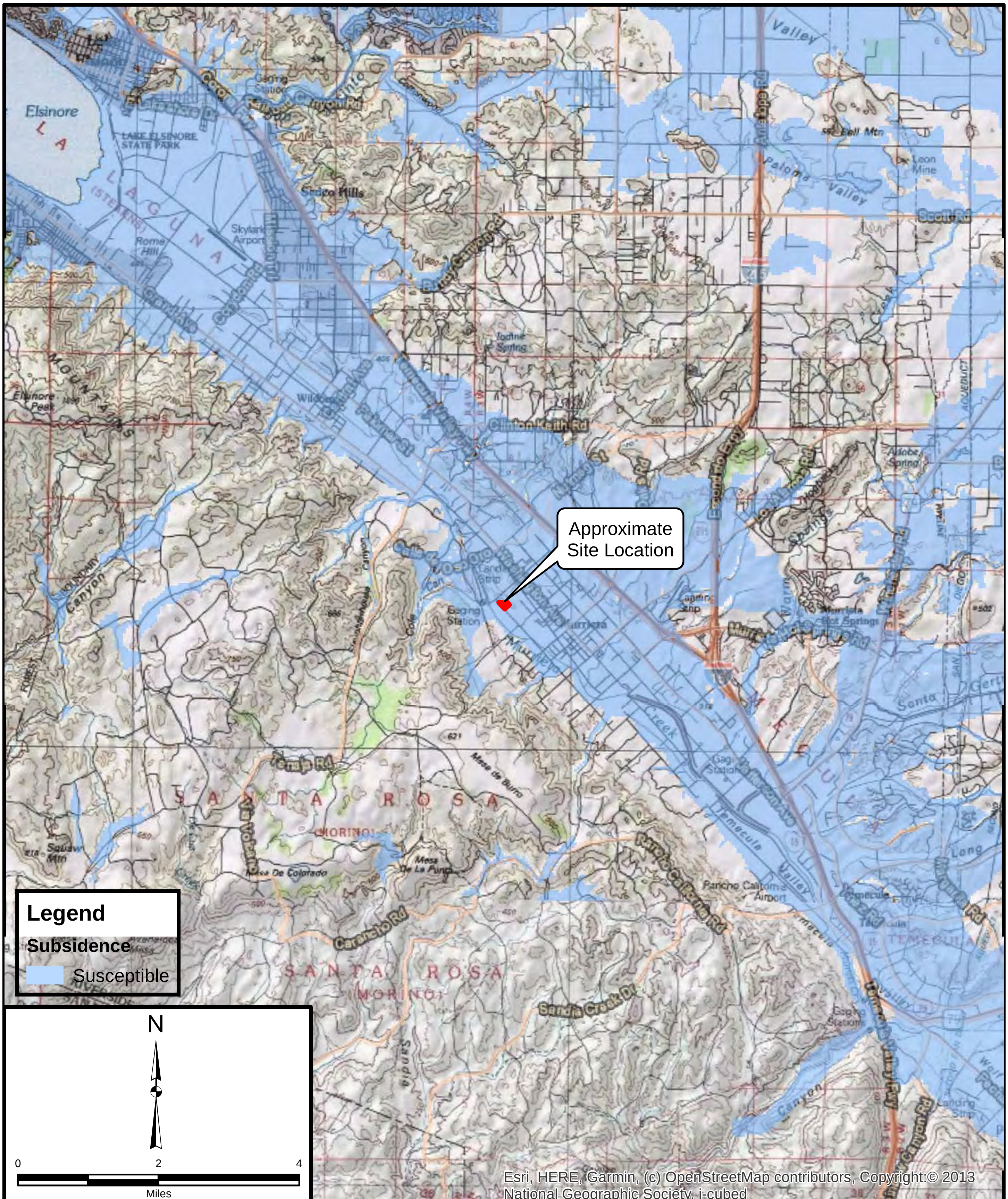
DAM INUNDATION MAP

Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 7

Leighton

Map Saved as V:\Drafting\12393\001\Maps\12393-001_F08_DIM_2019-07-11.mxd on 7/11/2019 2:51:55 PM



Project: 12393.001	Eng/Geol: SIS/RFR
Scale:1 " = 2 miles	Date: August 2019

Base Map: ESRI ArcGIS Online 2019
Thematic Information: Leighton, County of Riverside
Author: Leighton Geomatics (btran)

SUBSIDENCE MAP

Murrieta Valley Unified School District
Murrieta Canyon Academy New Buildings
24150 Hayes Avenue, Murrieta, California

Figure 8

Leighton

Map Saved as V:\Drafting\12393\001\Maps\12393-001_F07_SM_2019-07-11.mxd on 7/11/2019 2:47:24 PM

6.0 LIMITATIONS

This report was based in part on data obtained from a limited number of observations, site visits, soil excavations, samples and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions and recommendations presented in this report are based on the assumption that we (Leighton Consulting, Inc.) will provide geotechnical observation and testing during construction as the Geotechnical Engineer of Record for this project.

This report was prepared for the sole use of Client and their design team, for application to design of the proposed Murrieta Canyon Academy, Proposed New Classroom Buildings, in accordance with generally accepted geotechnical engineering practices at this time in California. In addition, since this is a public school project, our report may be subject to review by the California Geological Survey (CGS) and/or the California Division of the State Architect (DSA). As such, we recommend that geologic/geotechnical data in this report be only used in the design of this project after review and approval by CGS. Any premature (before CGS approval) or unauthorized use of or reliance on this report constitutes an agreement to defend and indemnify Leighton Consulting, Inc. from and against any liability which may arise as a result of such use or reliance, regardless of any fault, negligence, or strict liability of Leighton Consulting, Inc.

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APPENDIX A

LOGS OF EXPLORATORY BORINGS

Encountered earth materials were continuously logged and sampled in the field by our representative and described in accordance with the Unified Soil Classification System (ASTM D 2488). During drilling, bulk and relatively undisturbed ring-lined split-barrel driven earth material samples were obtained from our borings for geotechnical laboratory testing and classification. Drive-samples were driven with a 140-pound auto-hammer falling 30-inches. Samples were transported to our in-house Temecula laboratory for geotechnical testing. After logging and sampling, our borings were backfilled with spoils generated during drilling.

The attached subsurface exploration logs and related information depict subsurface conditions only at the locations indicated and at the particular date designated on these logs. Subsurface conditions at other locations may differ from conditions occurring at these logged locations. Passage of time may result in altered subsurface conditions due to environmental changes. In addition, any stratification lines on these logs represent an approximate boundary between sampling intervals and soil types; and transitions may be gradual.

GEOTECHNICAL BORING LOG LB-1

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1			21.3	CONCRETE	4" Concrete/4" Sand	MD, EI, RV
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, olive brown, moist, fine grained sand	
									Lean CLAY, brown, moist	
	5			R-1	5 11 18	114	15	SC	CLAYEY SAND, medium dense, brown, moist, fine grained sand	
	10			R-2	6 10 22	113	18	CL	**Pauba Formation (Qps)**; SANDY Lean CLAY, stiff, dark yellowish brown, moist, fine to medium grained sand	
									Drilled to 11.5' Sampled to 11.5' Groundwater not encountered Backfilled with cuttings	
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-2

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	4"
Drilling Method	Hand Auger - Hand Sampling	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0			B-1			15.1	CL	**Artificial Fill (Af)**; Lean CLAY, dark brown, moist to wet	
									SANDY Lean CLAY, brown, moist, fine to medium grained sand	
	5								Drilled to 3' Sampled to 3' Groundwater not encountered Backfilled with cuttings	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-3

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0								@ Surface: Grass	
								SM	**Artificial Fill (Af)**; SILTY SAND, grayish brown, moist, fine to medium grained sand	
								SC-SM	SILTY, CLAYEY SAND, reddish brown, moist, fine to medium grained sand	
	5			R-1	5 12 16	126	10	SC	CLAYEY SAND with GRAVEL, medium dense, dark brown, moist, fine to coarse grained sand with fine gravel	
	10			R-2	5 14 23	112	18	ML	**Pauba Formation (Qps)**; SANDY SILT, stiff, olive brown, moist, very fine to fine grained sand	CO
	15			R-3	15 22 24			SM	SILTY SAND, medium dense, olive brown, moist, fine grained sand	
									Drilled to 16.5' Sampled to 16.5' Groundwater not encountered Backfilled with cuttings	
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-4

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0		B-1			7.6		@ Surface: Grass	
							SC-SM	**Artificial Fill (Af)**; SILTY, CLAYEY SAND, yellowish brown, moist, fine to coarse grained sand	
			R-1	5 8 11	114	8		SILTY, CLAYEY SAND, medium dense, yellowish brown, moist, fine to coarse grained sand	
	5		R-2	4 9 16	99	23	CL	**Pauba Formation (Qps)**; Lean CLAY, stiff, olive brown, moist	
	10		R-3	4 10 18				SANDY Lean CLAY, very stiff, yellowish brown, moist, fine grained sand	
	15		R-4	6 13 22			ML	SANDY SILT, very stiff, olive brown, moist, very fine to fine grained sand	
	20		R-5	9 13 21			CL-ML	SILTY CLAY with sand, very stiff, grayish brown to olive brown, moist, very fine to fine grained sand	
								Drilled to 21.5' Sampled to 21.5' Groundwater not encountered Backfilled with cuttings	
	25								
	30								

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

* * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * *

GEOTECHNICAL BORING LOG LB-5

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1					@ Surface: Grass	CR, EI
								SC	**Artificial Fill (Af)**; CLAYEY SAND, dark grayish brown, moist, fine to coarse grained sand	
	5			R-1	5 10 12	90	30	CL-ML	**Pauba Formation (Qps)**; SILTY CLAY, stiff, olive, moist	
	10			R-2	8 16 26			SW-SM	Well-graded SAND with SILT, medium dense, yellowish brown, moist, fine to coarse grained sand	
									Drilled to 11.5' Sampled to 11.5' Groundwater not encountered Backfilled with cuttings	
	15									
	20									
	25									
	30									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-6

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								@ Surface: Grass	
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, dark grayish brown, moist, fine to medium grained sand	AL, MD, CR
	5			R-1 B-1	11 16 19			SC-SM	**Pauba Formation (Qps)**; SILTY, CLAYEY SAND, medium dense, dark yellowish brown, moist, fine grained sand	
								CL	SANDY Lean CLAY, stiff, dark yellowish brown and olive brown, moist, fine grained sand	
				R-2	8 17 29	78	58	SC	CLAYEY SAND, medium dense, olive brown, moist, fine grained sand	
	10			R-3	9 19 26			SW-SM	Well-graded SAND with SILT, medium dense, light gray to grayish brown, moist, fine to coarse grained sand	
	15			R-4	10 17 22			SM	SILTY SAND, medium dense, dark yellowish brown, moist, fine to medium grained sand	
	20			R-5	6 16 30			CL-ML	SILTY CLAY, hard, olive brown, moist	
	25			R-6	9 33 50			SM-ML	SILTY SAND to SANDY SILT, dense to hard, olive, moist, fine grained sand	
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:

-200	% FINES PASSING	DS	DIRECT SHEAR	SA	SIEVE ANALYSIS
AL	ATTERBERG LIMITS	EI	EXPANSION INDEX	SE	SAND EQUIVALENT
CN	CONSOLIDATION	H	HYDROMETER	SG	SPECIFIC GRAVITY
CO	COLLAPSE	MD	MAXIMUM DENSITY	UC	UNCONFINED COMPRESSIVE STRENGTH
CR	CORROSION	PP	POCKET PENETROMETER		
CU	UNDRAINED TRIAXIAL	RV	R VALUE		

*** * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * ***

GEOTECHNICAL BORING LOG LB-6

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	30			R-7	15 28 50			SC-SM	SILTY, CLAYEY SAND, dense, dark grayish brown, moist, very fine to fine grained sand	
									Drilled to 31.5' Sampled to 31.5' Groundwater not encountered Backfilled with cuttings	
	35									
	40									
	45									
	50									
	55									
	60									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-7

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								@ Surface: Grass	
								SC-SM	**Artificial Fill (Af)**; SILTY, CLAYEY SAND, gray, moist, fine to medium grained sand	
	5			R-1	9 11 17	120	13	CL	SANDY Lean CLAY, stiff, dark brown, moist, fine to coarse grained sand	
	10			R-2	6 9 31	118	14	SM	**Pauba Formation (Qps)**; SILTY SAND, medium dense, olive brown, moist, fine to medium grained sand	
	15			R-3	9 21 36			SC-SM	SILTY, CLAYEY SAND, dense, dark grayish brown to yellowish brown, moist, fine to coarse grained sand	
	20			R-4	5 12 23			CL	Lean CLAY, very stiff, olive, moist	
									Drilled to 21.5' Sampled to 21.5' Groundwater not encountered Backfilled with cuttings	
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-8

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	**SOIL DESCRIPTION** *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0			B-1					@ Surface: Grass	EI
								SC	**Artificial Fill (Af)**; CLAYEY SAND, gray, moist, fine to medium grained sand	
				R-1	9 15 25	115	16	SC	**Pauba Formation (Qps)**; CLAYEY SAND, medium dense, olive brown, moist, fine grained sand	
	5			R-2	7 11 18	110	18	SM	SILTY SAND, medium dense, olive brown, moist, fine grained sand	
	10			R-3	7 12 18			CL-ML	SILTY CLAY, stiff, olive, moist	
	15			R-4	8 11 16	113	16		SILTY CLAY with sand, stiff, olive brown, moist, fine grained sand	
	20			R-5	6 17 19				SILTY CLAY, stiff, olive, moist	
									Drilled to 21.5' Sampled to 21.5' Groundwater not encountered Backfilled with cuttings	
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

* * * This log is a part of a report by Leighton and should not be used as a stand-alone document. * * *

GEOTECHNICAL BORING LOG LB-9

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
									This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.	
	0								Well-graded SAND with SILT, reddish brown, dry, fine to coarse grained sand, softball infield crushed brick	
								SC	**Artificial Fill (Af)**; CLAYEY SAND with GRAVEL, dark grayish brown, moist, fine to coarse grained sand	
	5			R-1	20 38 43	165	7		CLAYEY SAND with GRAVEL, dense, yellowish brown, moist, fine to coarse grained sand with fine gravel	
	10			R-2	24 33 42	122	6	SC	**Pauba Formation (Qps)**; CLAYEY SAND, dense, olive gray, moist, fine to coarse grained sand	
	15			R-3	9 22 28			SM	SILTY SAND, dense, olive, moist, fine to coarse grained sand	
	20			R-4	5 18 22			SC	CLAYEY SAND, medium dense, olive gray, moist, fine to medium grained sand	
									Drilled to 21.5' Sampled to 21.5' Groundwater not encountered Backfilled with cuttings	
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-10

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SW-SM	Well-graded SAND with SILT, reddish brown, dry, fine to coarse grained sand, softball infield crushed brick	
								SC	**Artificial Fill (Af)**; CLAYEY SAND with GRAVEL, dark grayish brown, moist, fine to coarse grained sand	
				R-1	5 6 11	116	14		CLAYEY SAND with GRAVEL, medium dense, dark grayish brown to olive brown, moist, fine to coarse grained sand with fine gravel	
	5			R-2	5 10 20	118	13		CLAYEY SAND with GRAVEL, medium dense, dark grayish brown, moist, fine to coarse grained sand with fine gravel	
	10			R-3	20 20 27			SC	**Pauba Formation (Qps)**; CLAYEY SAND with GRAVEL, medium dense, dark grayish brown and olive brown, moist, fine to coarse grained sand	
	15			R-4	9 31 50/5"			SM-ML	SILTY SAND to SANDY SILT, dense to hard, dark olive gray, moist, fine to medium grained sand	
									Drilled to 16.42' Sampled to 16.42' Groundwater not encountered Backfilled with cuttings	
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-11

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0							SW-SM	Well graded SAND with Silt (SW-SM), reddish brown, dry, fine to coarse grained sand, softball inield crushed brick	
								SC-SM	**Artificial Fill (Af)**; SILTY, CLAYEY SAND, olive brown, moist, fine to coarse grained sand	
	5			R-1	20 37 48	128	10	SM	**Pauba Formation (Qps)**; SILTY SAND, dense, olive, moist, fine to medium grained sand	
	10			R-2	10 16 28			CL	Lean CLAY, very stiff, olive, moist	
	15			R-3	15 24 35			SM	SILTY SAND, dense, olive, moist, fine grained sand	
									Drilled to 16.5' Sampled to 16.5' Groundwater not encountered Backfilled with cuttings	
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-12

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								@ Surface: Grass	
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, olive gray, moist, fine to medium grained sand	
	5			R-1 B-1	9 22 28	117	8	SW-SC	Well-graded SAND with CLAY (or SILTY CLAY), dense, reddish brown, moist, fine to coarse grained sand	
				R-2	5 9 15	104	21	CL	**Pauba Formation (Qps)**; SANDY Lean CLAY, stiff, dark grayish brown and olive gray, moist, very fine to fine grained sand	
	10			R-3	4 16 41			SM	SILTY SAND, dense, olive brown, moist, fine grained sand	
	15			R-4	7 12 22			SM-ML	SILTY SAND to SANDY SILT, medium dense to very stiff, olive gray, moist, very fine to fine grained sand	
	20			R-5	4 10 16			CL	SANDY Lean CLAY, stiff, olive, moist, very fine to fine grained sand	
									Drilled to 21.5' Sampled to 21.5' Groundwater not encountered Backfilled with cuttings	
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG LB-13

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-1				SW-SM	Well-graded SAND with SILT, reddish brown, dry, fine to coarse grained sand, softball infield crushed brick	EI
								CL	**Artificial Fill (Af)**; Lean CLAY, olive, moist	
				R-1	4 9 21	113	17	CL	**Pauba Formation (Qps)**; SANDY Lean CLAY, stiff, olive brown, moist, very fine to fine grained sand	
	5			R-2	7 12 23	115	16	SM	SILTY SAND, medium dense, olive, moist, fine grained sand	
	10			R-3	5 9 14			CL	Lean CLAY, stiff, olive, moist	
	15			R-4	12 23 34			SM	SILTY SAND, dense, olive brown, moist, fine grained sand	
									Drilled to 16.5' Sampled to 16.5' Groundwater not encountered Backfilled with cuttings	
	20									
	25									
	30									

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

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GEOTECHNICAL BORING LOG LB-14

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

SOIL DESCRIPTION

This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								@ Surface: Grass	
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, grayish brown, moist to wet, fine to coarse grained sand	
								SC	CLAYEY SAND, reddish brown, moist to wet, fine to coarse grained sand	
	5			R-1	5 16 20	117	7		CLAYEY SAND, medium dense, yellowish brown, moist, fine to coarse grained sand	
	10			R-2	4 8 18	104	21	CL	**Pauba Formation (Qps)**; SANDY Lean CLAY, stiff, olive brown, moist, fine to coarse grained sand	
	15			R-3	8 15 19				SANDY Lean CLAY, stiff, dark olive gray, moist, fine to medium grained sand	
									Drilled to 16.5' Sampled to 16.5' Groundwater not encountered Backfilled with Cuttings	
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG P-1

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								@ Surface: Grass	
								SC-SM	**Artificial Fill (Af)**; SILTY, CLAYEY SAND with GRAVEL, grayish brown, moist, fine to coarse grained sand	
				S-1	3 6 13				SILTY, CLAYEY SAND, medium dense, dark yellowish brown, moist, fine grained sand	
	5								Drilled to 4' Sampled to 4' Groundwater not encountered Backfilled with cuttings	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

GEOTECHNICAL BORING LOG P-2

Project No.	12393.001	**Date Drilled**	7-9-19
Project	MVUSD Murrieta Canyon Academy New Buildings	**Logged By**	JTD
Drilling Co.	Martini Drilling Corp	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer	**Ground Elevation**	'
Location	See Boring Location Map	**Sampled By**	JTD

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								@ Surface: Grass	
								CL	**Artificial Fill (Af)**; SANDY Lean CLAY, gray, moist, fine to coarse grained sand	
				S-1	5 8 9			SM	SILTY SAND, medium dense, yellowish brown, moist, fine to coarse grained sand	SA
	5								Drilled to 4' Sampled to 4' Groundwater not encountered Backfilled with cuttings	
	10									
	15									
	20									
	25									
	30									

SAMPLE TYPES:
- B BULK SAMPLE
- C CORE SAMPLE
- G GRAB SAMPLE
- R RING SAMPLE
- S SPLIT SPOON SAMPLE
- T TUBE SAMPLE

TYPE OF TESTS:
- -200 % FINES PASSING
- AL ATTERBERG LIMITS
- CN CONSOLIDATION
- CO COLLAPSE
- CR CORROSION
- CU UNDRAINED TRIAXIAL
- DS DIRECT SHEAR
- EI EXPANSION INDEX
- H HYDROMETER
- MD MAXIMUM DENSITY
- PP POCKET PENETROMETER
- RV R VALUE
- SA SIEVE ANALYSIS
- SE SAND EQUIVALENT
- SG SPECIFIC GRAVITY
- UC UNCONFINED COMPRESSIVE STRENGTH

APPENDIX B

GEOTECHNICAL LABORATORY TEST RESULTS

Leighton

PARTICLE-SIZE DISTRIBUTION (GRADATION) of SOILS USING SIEVE ANALYSIS
ASTM D 6913

Project Name:	MCA New Buildings Geohazard	Tested By:	FLM	Date:	08/07/19
Project No.:	12393.001	Checked By:	MRV	Date:	08/13/19
Boring No.:	P-2	Depth (feet):	2.5		
Sample No.:	S-1				
Soil Identification:	Silty Sand (SM), Reddish Brown.				

		Moisture Content of Total Air - Dry Soil	
Container No.:	123	Wt. of Air-Dry Soil + Cont. (g)	1082.2
Wt. of Air-Dried Soil + Cont.(g)	1082.2	Wt. of Dry Soil + Cont. (g)	1049.8
Wt. of Container (g)	699.8	Wt. of Container No.______ (g)	699.8
Dry Wt. of Soil (g)	350.0	Moisture Content (%)	9.3

After Wet Sieve	Container No.	123
	Wt. of Dry Soil + Container (g)	1000.5
	Wt. of Container (g)	699.8
	Dry Wt. of Soil Retained on # 200 Sieve (g)	300.7

U. S. Sieve Size (in.)	U. S. Sieve Size (mm.)	Cumulative Weight Dry Soil Retained (g)	Percent Passing (%)
3"	75.000		100.0
1"	25.000		100.0
3/4"	19.000		100.0
1/2"	12.500		100.0
3/8"	9.500	0.0	100.0
#4	4.750	2.3	99.3
#8	2.360	27.6	92.1
#16	1.180	82.5	76.4
#30	0.600	146.2	58.2
#50	0.300	219.9	37.2
#100	0.150	276.8	20.9
#200	0.075	299.7	14.4
PAN			

GRAVEL: **1 %**

SAND: **85 %**

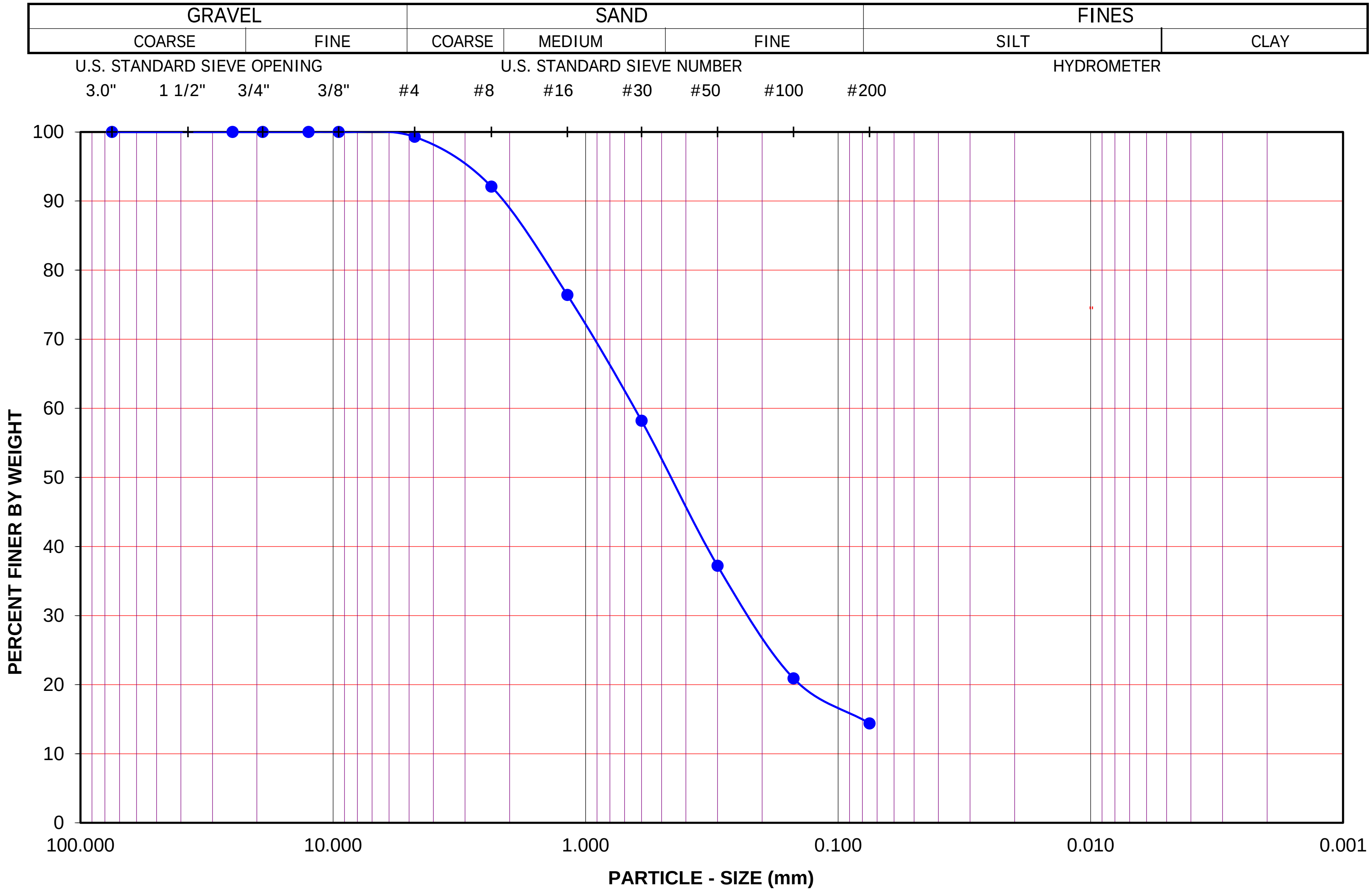
FINES: **14 %**

GROUP SYMBOL: **SM**

$Cu = D60/D10 =$ N/A

$Cc = (D30)^2/(D60*D10) =$ N/A

Remarks:



Project Name: MCA New Buildings Geohazard

Project No.: 12393.001

Boring No.: P-2 | Sample No.: S-1

Depth (feet): 2.5 | Soil Type : SM

Soil Identification: Silty Sand (SM), Reddish Brown.

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 6913

GR:SA:FI : (%) 1 : 85 : 14

Aug-19

ATTERBERG LIMITS
ASTM D 4318

Project Name:	MCA New Buildings Geohazard	Tested By:	F. Mina	Date:	8/12/19
Project No. :	12393.001	Input By:	M. Vinet	Date:	8/13/19
Boring No.:	LB-6	Checked By:	M. Vinet	Date:	8/13/19
Sample No.:	B-1	Depth (ft.)	5.0 - 10.0		

Sample Description: Sandy Lean Clay s(CL), Dark Yellowish Brown.

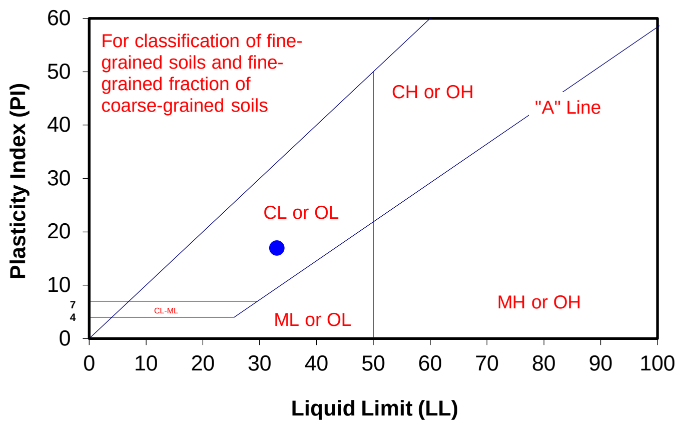
	PLASTIC LIMIT		LIQUID LIMIT			**IN-SITU
TEST NO.	1	2	1	2	3	MOISTURE
Number of Blows [N]			17	25	33	
Wet Wt. of Soil + Cont. (gm)	22.794	22.855	19.633	21.794	21.261	
Dry Wt. of Soil + Cont. (gm)	21.576	21.604	18.078	19.787	19.366	
Wt. of Container (gm)	13.601	13.697	13.602	13.734	13.539	
Moisture Content (%) [Wn]	15.3	15.8	34.7	33.2	32.5	

Liquid Limit	**33**
Plastic Limit	**16**
Plasticity Index	**17**
Classification	**CL**

PI at "A" - Line = 0.73(LL-20) = 9.49

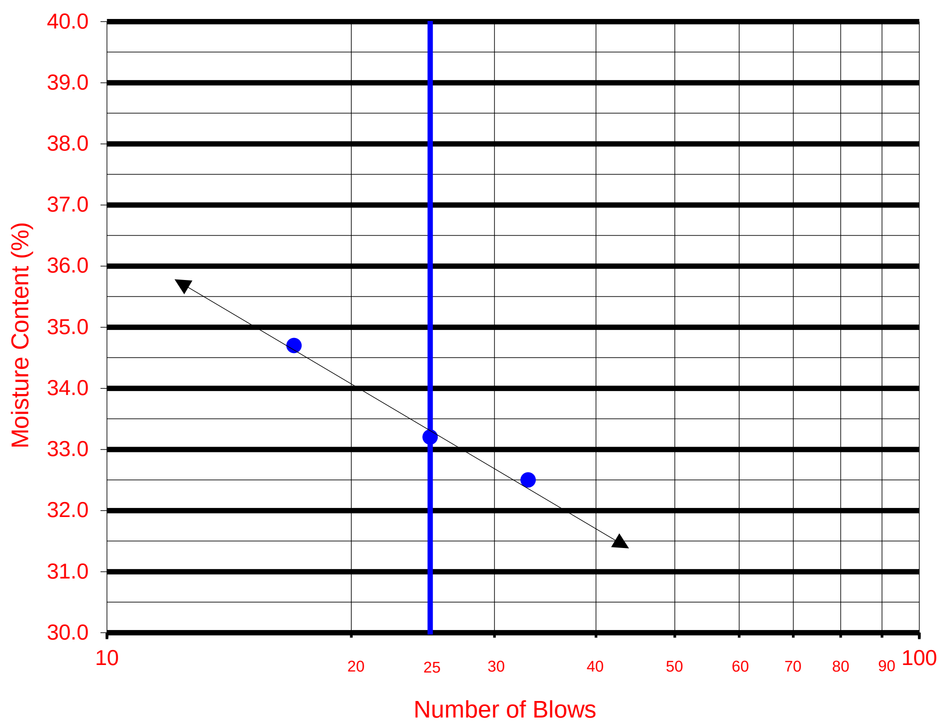
One - Point Liquid Limit Calculation

LL =Wn(N/25) $^{0.121}$



PROCEDURES USED

- [ ] Wet Preparation — Multipoint - Wet
- [X] Dry Preparation — Multipoint - Dry
- [X] Procedure A — Multipoint Test
- [ ] Procedure B — One-point Test



Rev. 08-04

MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Project Name:	MCA New Buildings Geoharzard	Tested By:	F. Mina	Date:	08/08/19
Project No.:	12393.001	Input By:	M. Vinet	Date:	08/13/19
Boring No.:	LB-1	Depth (ft.):	0 - 5.0		
Sample No.:	B-1				
Soil Identification:	Sandy Lean Clay s(CL), Yellowish Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft³) 0.03340

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5510	5570	5582	5554		
Weight of Mold (g)	3578	3578	3578	3578		
Net Weight of Soil (g)	1932	1992	2004	1976		
Wet Weight of Soil + Cont. (g)	693.2	674.9	565.5	441.2		
Dry Weight of Soil + Cont. (g)	653.5	635.3	515.9	401.8		
Weight of Container (g)	157.4	239.8	127.4	130.6		
Moisture Content (%)	8.0	10.0	12.8	14.5		
Wet Density (pcf)	127.5	131.5	132.3	130.4		
Dry Density (pcf)	118.1	119.5	117.3	113.9		

Maximum Dry Density (pcf) **119.5** **Optimum Moisture Content (%)** **10.0**

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

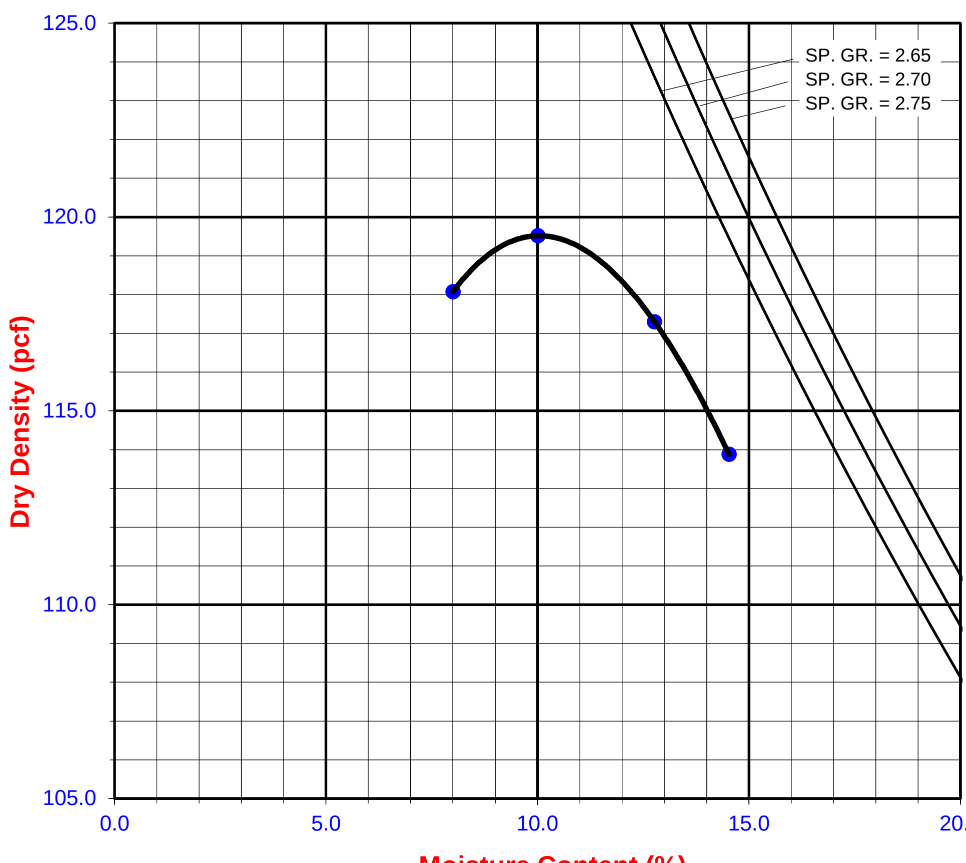
[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



MODIFIED PROCTOR COMPACTION TEST

ASTM D 1557

Leighton

Project Name:	MCA New Buildings Geoharzard	Tested By:	F. Mina	Date:	08/08/19
Project No.:	12393.001	Input By:	M. Vinet	Date:	08/13/19
Boring No.:	LB-6	Depth (ft.):	5.0 - 10.0		
Sample No.:	B-1				
Soil Identification:	Sandy Lean Clay s(CL), Dark Yellowish Brown.				

Preparation Method: [X] Moist [ ] Dry

[X] Mechanical Ram [ ] Manual Ram

Mold Volume (ft^3) 0.03340

Ram Weight = 10 lb.; Drop = 18 in.

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	5540	5584	5557	5518		
Weight of Mold (g)	3578	3578	3578	3578		
Net Weight of Soil (g)	1962	2006	1979	1940		
Wet Weight of Soil + Cont. (g)	693.2	610.3	564.1	628.9		
Dry Weight of Soil + Cont. (g)	643.0	556.8	507.8	556.5		
Weight of Container (g)	201.2	159.6	152.2	163.4		
Moisture Content (%)	11.4	13.5	15.8	18.4		
Wet Density (pcf)	129.5	132.4	130.6	128.1		
Dry Density (pcf)	116.3	116.7	112.8	108.1		

Maximum Dry Density (pcf) **117.1** **Optimum Moisture Content (%)** **12.5**

PROCEDURE USED

[X] **Procedure A**
Soil Passing No. 4 (4.75 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
May be used if +#4 is 20% or less

[ ] **Procedure B**
Soil Passing 3/8 in. (9.5 mm) Sieve
Mold : 4 in. (101.6 mm) diameter
Layers : 5 (Five)
Blows per layer : 25 (twenty-five)
Use if +#4 is >20% and +3/8 in. is 20% or less

[ ] **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

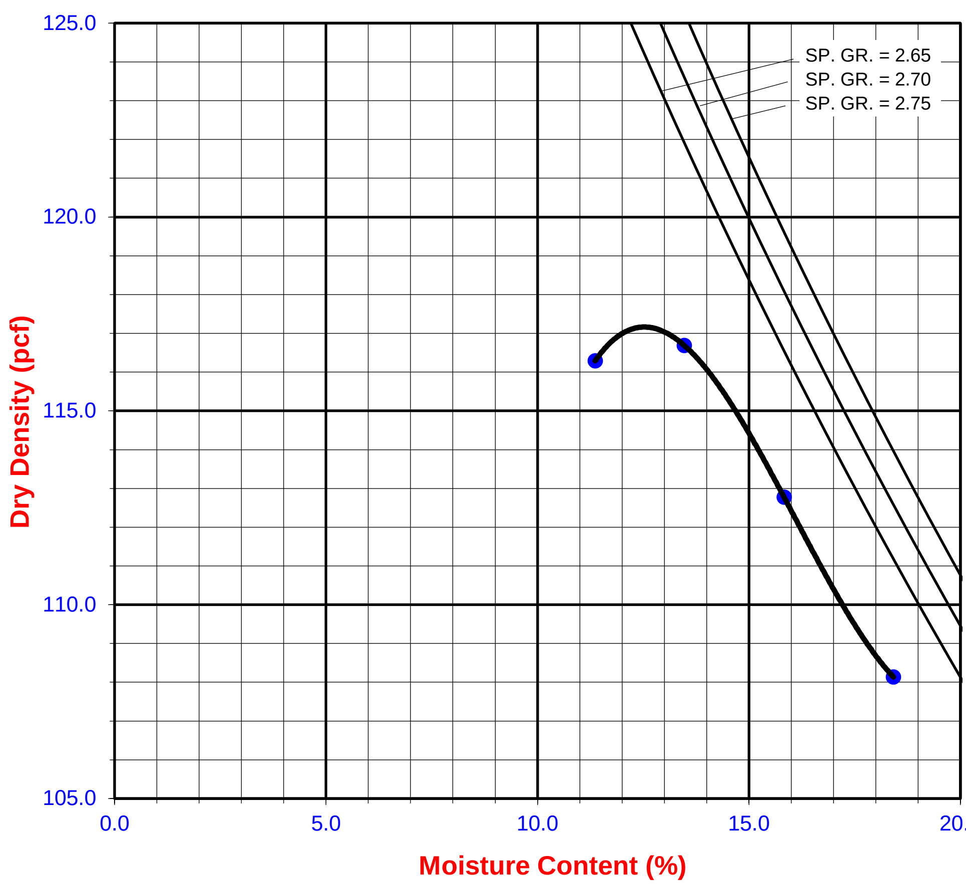
Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

33:16:17

LL,PL,PI



EXPANSION INDEX of SOILS

ASTM D 4829

Leighton

Project Name:	MCA New Buildings Geohazard	Tested By: F. Mina	Date: 8/8/19
Project No. :	12393.001	Checked By: M. Vinet	Date: 8/13/19
Boring No.:	LB-1	Depth: 0 - 5.0	
Sample No. :	B-1	Location: N/A	
Sample Description:	Sandy Lean Clay s(CL), Yellowish Brown.		

Dry Wt. of Soil + Cont. (gm.)	1883.8
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	1883.8
Weight Soil Retained on #4 Sieve	6.7
Percent Passing # 4	99.6

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0756
Wt. Comp. Soil + Mold (gm.)	590.1	633.1
Wt. of Mold (gm.)	208.7	208.7
Specific Gravity (Assumed)	2.70	2.70
Container No.	7	7
Wet Wt. of Soil + Cont. (gm.)	350.5	633.1
Dry Wt. of Soil + Cont. (gm.)	319.6	342.1
Wt. of Container (gm.)	50.5	208.7
Moisture Content (%)	11.5	24.1
Wet Density (pcf)	115.0	119.0
Dry Density (pcf)	103.2	95.9
Void Ratio	0.634	0.757
Total Porosity	0.388	0.431
Pore Volume (cc)	80.3	96.0
Degree of Saturation (%) [S meas]	**49.0**	**85.8**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
8/8/19	11:30	1.0	0	0.5000
8/8/19	11:40	1.0	10	0.5000
	Add Distilled Water to the Specimen			
8/9/19	8:00	1.0	1220	0.5756
8/9/19	9:00	1.0	1280	0.5756

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	75.6
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**76**

Rev. 03-08

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	MCA New Buildings Geohazard	Tested By:	F. Mina	Date:	8/8/19
Project No. :	12393.001	Checked By:	M. Vinet	Date:	8/13/19
Boring No.:	LB-5	Depth:	0 - 5.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Sandy Lean Clay s(CL), Dark Yellowish Brown.				

Dry Wt. of Soil + Cont. (gm.)	2938.8
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2938.8
Weight Soil Retained on #4 Sieve	11.1
Percent Passing # 4	99.6

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0609
Wt. Comp. Soil + Mold (gm.)	595.7	642.5
Wt. of Mold (gm.)	188.3	188.3
Specific Gravity (Assumed)	2.70	2.70
Container No.	8	8
Wet Wt. of Soil + Cont. (gm.)	350.3	642.5
Dry Wt. of Soil + Cont. (gm.)	324.3	372.1
Wt. of Container (gm.)	50.3	188.3
Moisture Content (%)	9.5	22.1
Wet Density (pcf)	122.9	129.1
Dry Density (pcf)	112.2	105.8
Void Ratio	0.502	0.594
Total Porosity	0.334	0.373
Pore Volume (cc)	69.2	81.8
Degree of Saturation (%) [S meas]	**51.1**	**100.4**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
8/8/19	10:30	1.0	0	0.5000
8/8/19	10:40	1.0	10	0.5000
	Add Distilled Water to the Specimen			
8/9/19	8:00	1.0	1280	0.5609
8/9/19	9:00	1.0	1340	0.5609

Expansion Index (EI meas) =	((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	60.9
Expansion Index (Report) =	Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**61**

Rev. 03-08

Leighton

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	MCA New Buildings Geohazard	Tested By:	F. Mina	Date:	8/8/19
Project No. :	12393.001	Checked By:	M. Vinet	Date:	8/13/19
Boring No.:	LB-8	Depth:	0 - 5.0		
Sample No. :	B-1	Location:	N/A		
Sample Description:	Lean Clay (CL), Dark Yellowish Brown.				

Dry Wt. of Soil + Cont. (gm.)	2241.1
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2241.1
Weight Soil Retained on #4 Sieve	5.0
Percent Passing # 4	99.8

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0874
Wt. Comp. Soil + Mold (gm.)	597.8	646.7
Wt. of Mold (gm.)	208.7	208.7
Specific Gravity (Assumed)	2.70	2.70
Container No.	9	9
Wet Wt. of Soil + Cont. (gm.)	350.3	646.7
Dry Wt. of Soil + Cont. (gm.)	319.8	349.6
Wt. of Container (gm.)	50.3	208.7
Moisture Content (%)	11.3	25.3
Wet Density (pcf)	117.4	121.5
Dry Density (pcf)	105.5	97.0
Void Ratio	0.599	0.738
Total Porosity	0.374	0.425
Pore Volume (cc)	77.5	95.6
Degree of Saturation (%) [S meas]	**51.0**	**92.5**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
8/8/19	10:00	1.0	0	0.5000
8/8/19	10:10	1.0	10	0.5000
	Add Distilled Water to the Specimen			
8/9/19	8:00	1.0	1310	0.5874
8/9/19	9:00	1.0	1370	0.5874

Expansion Index (EI meas) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	87.4
Expansion Index (Report) = Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**87**

Rev. 03-08

EXPANSION INDEX of SOILS

ASTM D 4829

Project Name:	MCA New Buildings Geohazard	Tested By: F. Mina	Date: 8/8/19
Project No. :	12393.001	Checked By: M. Vinet	Date: 8/13/19
Boring No.:	LB-13	Depth: 0 - 5.0	
Sample No. :	B-1	Location: N/A	
Sample Description:	Sandy Lean Clay s(CL), Yellowish Brown.		

Dry Wt. of Soil + Cont. (gm.)	2122.6
Wt. of Container No. (gm.)	0.0
Dry Wt. of Soil (gm.)	2122.6
Weight Soil Retained on #4 Sieve	18.3
Percent Passing # 4	99.1

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0554
Wt. Comp. Soil + Mold (gm.)	602.5	630.0
Wt. of Mold (gm.)	208.7	208.7
Specific Gravity (Assumed)	2.70	2.70
Container No.	11	11
Wet Wt. of Soil + Cont. (gm.)	350.3	630.0
Dry Wt. of Soil + Cont. (gm.)	323.0	358.0
Wt. of Container (gm.)	50.3	208.7
Moisture Content (%)	10.0	17.7
Wet Density (pcf)	118.8	120.4
Dry Density (pcf)	108.0	102.3
Void Ratio	0.561	0.648
Total Porosity	0.359	0.393
Pore Volume (cc)	74.4	85.9
Degree of Saturation (%) [S meas]	**48.1**	**73.7**

SPECIMEN INUNDATION in distilled water for the period of 24 h or expansion rate < 0.0002 in./h.

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
8/8/19	9:00	1.0	0	0.5000
8/8/19	9:10	1.0	10	0.5000
	Add Distilled Water to the Specimen			
8/9/19	8:00	1.0	1370	0.5554
8/9/19	9:00	1.0	1430	0.5554

Expansion Index (EI meas) =	((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	55.4
Expansion Index (Report) =	Nearest Whole Number or Zero (0) if Initial Height is > than Final Heigh	**55**

Rev. 03-08

One-Dimensional Swell or Settlement Potential of Cohesive Soils
(ASTM D 4546) -- Method 'B'

Leighton

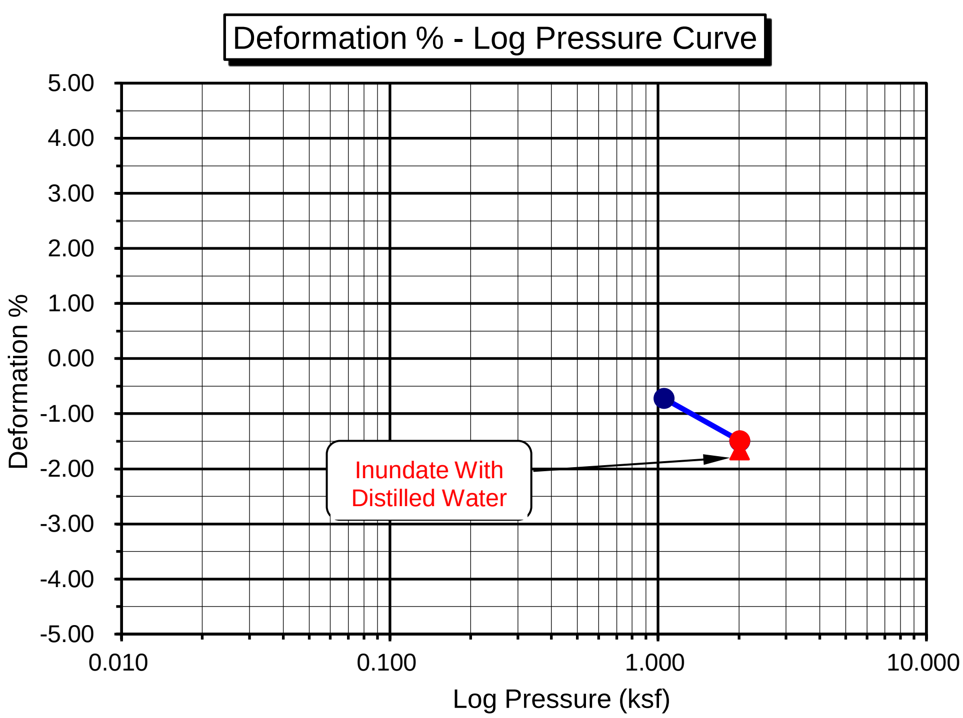
Project Name: MCA New Buildings Geohazard   Tested By: M. Vinet   Date: 8/12/19
Project No.: 12393.001   Checked By: M. Vinet   Date: 8/13/19
Boring No.: **LB-3**   Sample Type: IN SITU
Sample No.: **R-2**   Depth (ft.) 10.0
Sample Description: Silty Clay (CL-ML), Dark Olive Brown.
Source and Type of Water Used for Inundation: Arrowhead (Distilled)
** Note: Loading After Wetting (Inundation) not Performed Using this Test Method.

Initial Dry Density (pcf):	110.9
Initial Moisture (%):	16.9
Initial Height (in.):	1.0000
Initial Dial Reading (in):	0.0000
Inside Diameter of Ring (in):	2.416

Final Dry Density (pcf):	112.8
Final Moisture (%) :	18.7
Initial Void ratio:	0.5194
Specific Gravity (assumed):	2.70
Initial Degree of Saturation (%):	87.6

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
1.050	0.0072	0.9928	0.00	-0.72	0.5085	-0.72
2.013	0.0149	0.9851	0.00	-1.49	0.4968	-1.49
H2O	0.0166	0.9834	0.00	-1.66	0.4942	-1.66

Percent Swell / Settlement After Inundation = -0.17



Rev. 01-10

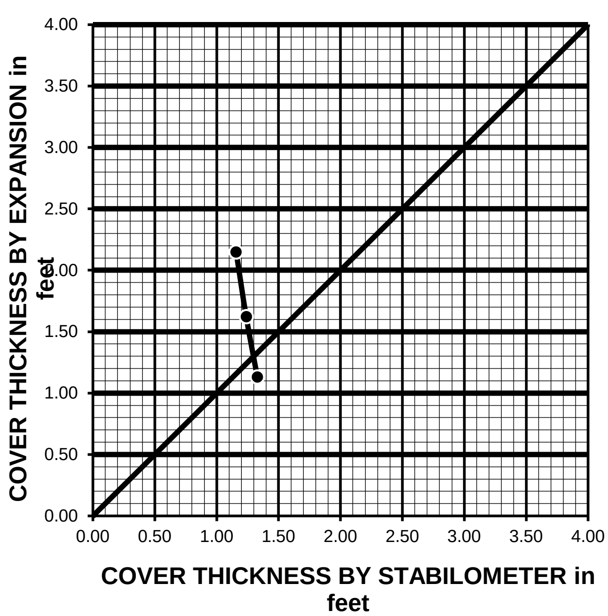
R-VALUE TEST RESULTS
ASTM D 2844

Project Name:	MCA New Buildings Geohazard	Date:	8/9/19
Project Number:	12393.001	Technician:	F. Mina
Boring Number:	LB-1	Depth (ft.):	0 - 5.0
Sample Number:	B-1	Sample Location:	N/A
Sample Description:	Sandy Lean Clay s(CL), Dark Yellowish Brown.		

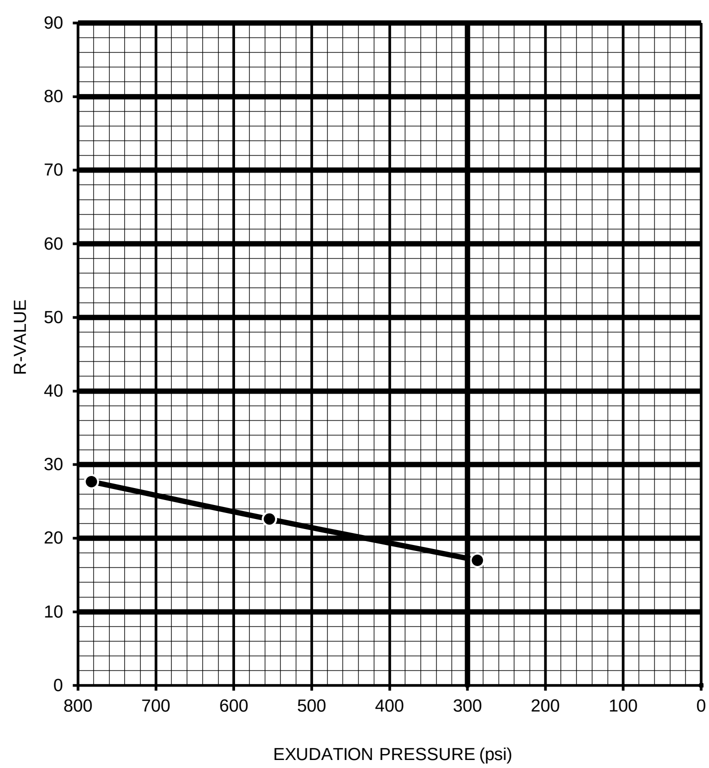
TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	13.8	15.8	17.9
HEIGHT OF SAMPLE, Inches	2.48	2.51	2.47
DRY DENSITY, pcf	102.0	104.3	98.4
COMPACTOR AIR PRESSURE, psi	125	75	25
EXUDATION PRESSURE, psi	783	554	287
EXPANSION, Inches x 10exp-4	57	43	30
STABILITY Ph 2,000 lbs (160 psi)	105	112	120
TURNS DISPLACEMENT	3.42	3.67	4.07
R-VALUE UNCORRECTED	28	23	17
R-VALUE CORRECTED	28	23	17

DESIGN CALCULATION DATA	a	b	c
GRAVEL EQUIVALENT FACTOR	1.0	1.0	1.0
TRAFFIC INDEX	5.0	5.0	5.0
STABILOMETER THICKNESS, ft.	1.16	1.24	1.33
EXPANSION PRESSURE THICKNESS, ft.	2.15	1.62	1.13

EXPANSION PRESSURE CHART



EXUDATION PRESSURE CHART



R-VALUE BY EXPANSION:	19
R-VALUE BY EXUDATION:	17
EQUILIBRIUM R-VALUE:	17

Leighton

TESTS for SULFATE CONTENT CHLORIDE CONTENT and pH of SOILS

Project Name: MCA New Buildings Geohazard | Tested By : F. Mina | Date: 08/12/19

Project No. : 12393.001 | Data Input By: M. Vinet | Date: 08/13/19

Boring No.	LB-5	LB-6		
Sample No.	B-1	B-1		
Sample Depth (ft)	0 - 5.0	5.0 - 10.0		
Soil Identification:	s(CL)	s(CL)		
Wet Weight of Soil + Container (g)	100.00	100.00		
Dry Weight of Soil + Container (g)	100.00	100.00		
Weight of Container (g)	0.00	0.00		
Moisture Content (%)	0.00	0.00		
Weight of Soaked Soil (g)	100.00	100.00		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	1	2		
Crucible No.	1	2		
Furnace Temperature (°C)	850	850		
Time In / Time Out	Timer	Timer		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	25.2205	24.6325		
Wt. of Crucible (g)	25.2113	24.6255		
Wt. of Residue (g) (A)	0.0092	0.0070		
PPM of Sulfate (A) x 41150	378.58	288.05		
PPM of Sulfate, Dry Weight Basis	**379**	**288**		

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	30			
ml of AgNO3 Soln. Used in Titration (C)	3.8			
PPM of Chloride (C -0.2) * 100 * 30 / B	360			
PPM of Chloride, Dry Wt. Basis	**360**			

pH TEST, DOT California Test 643

pH Value	**6.37**			
Temperature °C	21.0			

SOIL RESISTIVITY TEST

DOT CA TEST 643

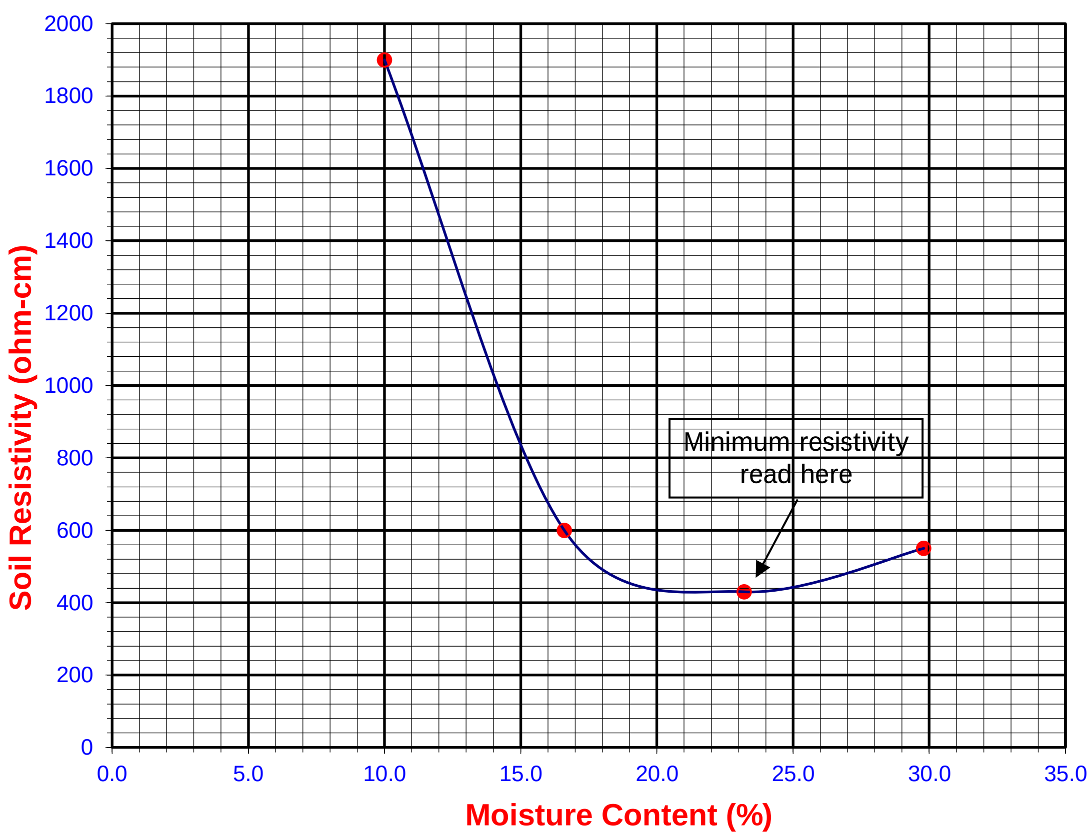
Project Name:	MCA New Buildings Geohazard	Tested By :	F. Mina	Date:	08/12/19
Project No. :	12393.001	Data Input By:	M. Vinet	Date:	08/13/19
Boring No.:	LB-5	Depth (ft.) :	0 - 5.0		
Sample No. :	B-1				
Soil Identification:*	s(CL)				

*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	50	10.00	1900	1900
2	83	16.60	600	600
3	116	23.20	430	430
4	149	29.80	550	550
5				

Moisture Content (%) (MCi)	0.00
Wet Wt. of Soil + Cont. (g)	100.00
Dry Wt. of Soil + Cont. (g)	100.00
Wt. of Container (g)	0.00
Container No.	A
Initial Soil Wt. (g) (Wt)	500.00
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH: pH	Soil pH: Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
430	**23.2**	**379**	**360**	**6.37**	**21.0**



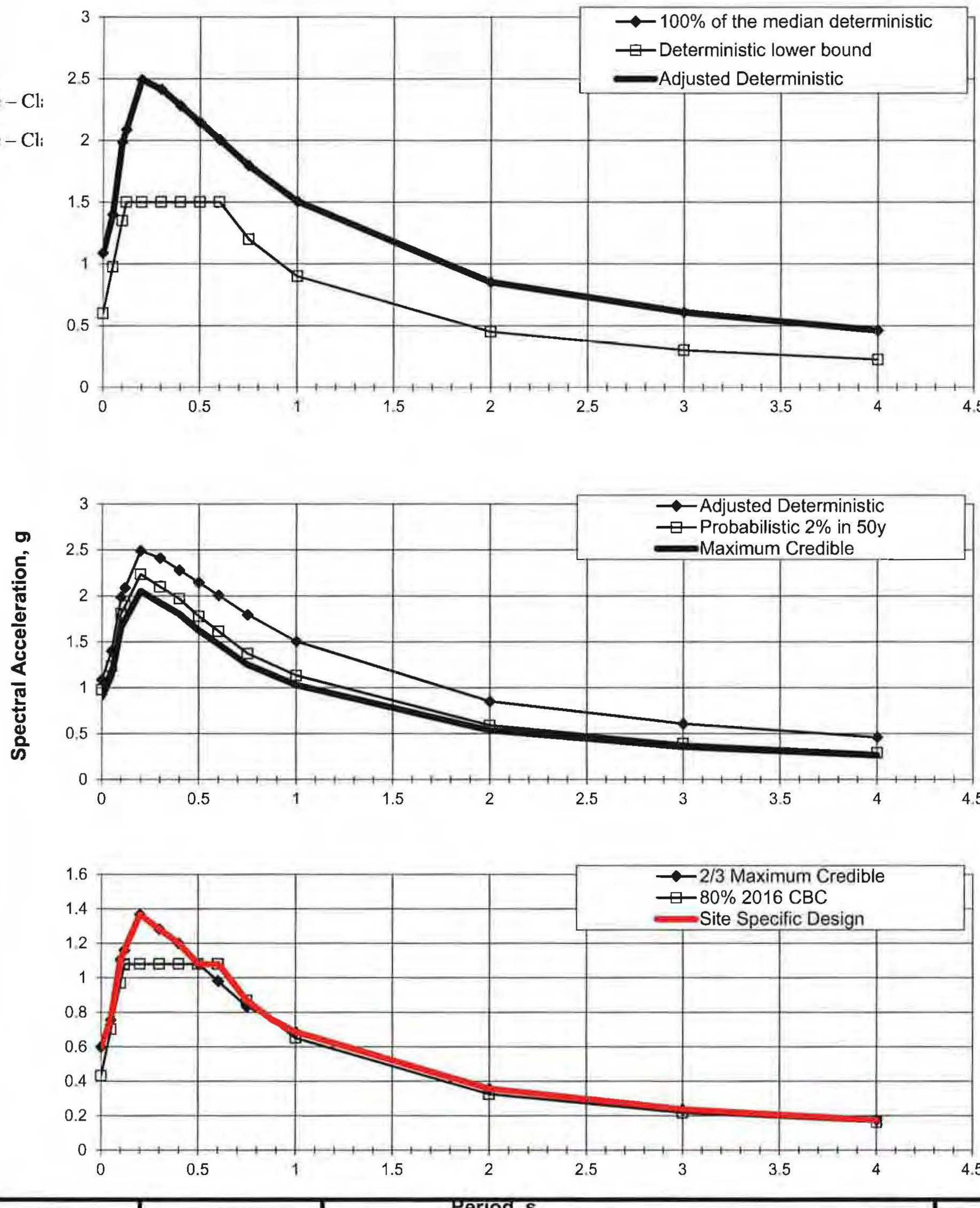
APPENDIX C

SITE-SPECIFIC SEISMIC ANALYSIS

Site Specific Response Spectrum

Project Name: MVUSD Murrieta Canyon Academy
Project No.: 12393.001

Parameter	Value
Spectral Response – Class C (short), S_S	2.052
Spectral Response – Class C (1 sec), S_1	0.713
Site Coefficient, F_a	1
Site Coefficient, F_v	1.5
Maximum Considered Earthquake Spectral Response Acceleration (short), S_{MS}	2.052
Maximum Considered Earthquake Spectral Response Acceleration – (1 sec), S_{M1}	1.07
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.368
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.713



Proj: 12393.001	Eng/Geol: SIS/RFR	**SITE-SPECIFIC RESPONSE SPECTRA** Murrieta VAlley Unified School District Proposed Murrieta Canyon Academy Murrieta, California	Figure C-1
Scale: NTS	Date: 08/2019		Leighton
Reference:			

APPENDIX D

EARTHWORK AND GRADING SPECIFICATIONS

A P P E N D I X D

L E I G H T O N C O N S U L T I N G, I N C.
E A R T H W O R K A N D G R A D I N G G U I D E S P E C I F I C A T I O N S

T A B L E O F C O N T E N T S

D-1.0 GENERAL

D-1.1 <u>Intent</u>

These Earthwork and Grading Guide Specifications are for grading and earthwork shown on the current, approved grading plan(s) and/or indicated in the Leighton Consulting, Inc. geotechnical report(s). These Guide Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the project-specific recommendations in the geotechnical report shall supersede these Guide Specifications. Leighton Consulting, Inc. shall provide geotechnical observation and testing during earthwork and grading. Based on these observations and tests, Leighton Consulting, Inc. may provide new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

D-1.2 <u>Role of Leighton Consulting, Inc.</u>

Prior to commencement of earthwork and grading, Leighton Consulting, Inc. shall meet with the earthwork contractor to review the earthwork contractor's work plan, to schedule sufficient personnel to perform the appropriate level of observation, mapping and compaction testing. During earthwork and grading, Leighton Consulting, Inc. shall observe, map, and document subsurface exposures to verify geotechnical design assumptions. If observed conditions are found to be significantly different than the interpreted assumptions during the design phase, Leighton Consulting, Inc. shall inform the owner, recommend appropriate changes in design to accommodate these observed conditions, and notify the review agency where required. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include (1) natural ground after clearing to receiving fill but before fill is placed, (2) bottoms of all "remedial removal" areas, (3) all key bottoms, and (4) benches made on sloping ground to receive fill.

Leighton Consulting, Inc. shall observe moisture-conditioning and processing of the subgrade and fill materials, and perform relative compaction testing of fill to determine the attained relative compaction. Leighton Consulting, Inc. shall provide *Daily Field Reports* to the owner and the Contractor on a routine and frequent basis.

D-1.3 <u>The Earthwork Contractor</u>

The earthwork contractor (Contractor) shall be qualified, experienced and knowledgeable in earthwork logistics, preparation and processing of ground to receive fill, moisture-conditioning and processing of fill, and compacting fill. The Contractor shall review and accept the plans, geotechnical report(s), and these Guide

Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing grading and backfilling in accordance with the current, approved plans and specifications.

The Contractor shall inform the owner and Leighton Consulting, Inc. of changes in work schedules at least one working day in advance of such changes so that appropriate observations and tests can be planned and accomplished. The Contractor shall not assume that Leighton Consulting, Inc. is aware of all grading operations.

The Contractor shall have the sole responsibility to provide adequate equipment and methods to accomplish earthwork and grading in accordance with the applicable grading codes and agency ordinances, these Guide Specifications, and recommendations in the approved geotechnical report(s) and grading plan(s). If, in the opinion of Leighton Consulting, Inc., unsatisfactory conditions, such as unsuitable soil, improper moisture condition, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, Leighton Consulting, Inc. shall reject the work and may recommend to the owner that earthwork and grading be stopped until unsatisfactory condition(s) are rectified.

D-2.0 PREPARATION OF AREAS TO BE FILLED

D-2.1 Clearing and Grubbing

Vegetation, such as brush, grass, roots and other deleterious material shall be sufficiently removed and properly disposed of in a method acceptable to the owner, governing agencies and Leighton Consulting, Inc.. Care should be taken not to encroach upon or otherwise damage native and/or historic trees designated by the Owner or appropriate agencies to remain. Pavements, flatwork or other construction should not extend under the “drip line” of designated trees to remain.

Leighton Consulting, Inc. shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 3 percent of organic materials (by dry weight: ASTM D 2974). Nesting of the organic materials shall not be allowed.

If potentially hazardous materials are encountered, the Contractor shall stop work in the affected area, and a hazardous material specialist shall be informed immediately for proper evaluation and handling of these materials prior to continuing to work in that area. As presently defined by the State of California, most refined petroleum products (gasoline, diesel fuel, motor oil, grease, coolant, etc.) have chemical constituents that are considered to be hazardous waste. As such, the indiscriminate dumping or spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

D-2.2 Processing

Existing ground that has been declared satisfactory for support of fill, by Leighton Consulting, Inc., shall be scarified to a minimum depth of 6 inches (15 cm). Existing ground that is not satisfactory shall be over-excavated as specified in the following Section D-2.3. Scarification shall continue until soils are broken down and free of large clay lumps or clods and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

D-2.3 Overexcavation

In addition to removals and over-excavations recommended in the approved geotechnical report(s) and the grading plan, soft, loose, dry, saturated, spongy, organic-rich, highly fractured or otherwise unsuitable ground shall be over-excavated to competent ground as evaluated by Leighton Consulting, Inc. during grading. All undocumented fill soils under proposed structure footprints should be excavated

D-2.4 Benching

Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), (>20 percent grade) the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet (4.5 m) wide and at least 2 feet (0.6 m) deep, into competent material as evaluated by Leighton Consulting, Inc.. Other benches shall be excavated a minimum height of 4 feet (1.2 m) into competent material or as otherwise recommended by Leighton Consulting, Inc.. Fill placed on ground sloping flatter than 5:1 (horizontal to vertical units), (<20 percent grade) shall also be benched or otherwise over-excavated to provide a flat subgrade for the fill.

D-2.5 Evaluation/Acceptance of Fill Areas

All areas to receive fill, including removal and processed areas, key bottoms, and benches, shall be observed, mapped, elevations recorded, and/or tested prior to being accepted by Leighton Consulting, Inc. as suitable to receive fill. The Contractor shall obtain a written acceptance (*Daily Field Report*) from Leighton Consulting, Inc. prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys and benches.

D-3.0 FILL MATERIAL

D-3.1 Fill Quality

Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by Leighton Consulting, Inc. prior to placement. Soils of poor quality, such as those with unacceptable gradation, high expansion potential, or low strength shall be placed in areas acceptable to Leighton Consulting, Inc. or mixed with other soils to achieve satisfactory fill material.

D-3.2 Oversize

Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 6 inches (15 cm), shall not be buried or placed in fill unless location, materials and placement methods are specifically accepted by Leighton Consulting, Inc.. Placement operations shall be such that nesting of oversized material does not occur and such that oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet (3 m) measured vertically from finish grade, or within 2 feet (0.61 m) of future utilities or underground construction.

D-3.3 Import

If importing of fill material is required for grading, proposed import material shall meet the requirements of Section D-3.1, and be free of hazardous materials ("contaminants") and rock larger than 3-inches (8 cm) in largest dimension. All import soils shall have an Expansion Index (EI) of 20 or less and a sulfate content no greater than (≤) 500 parts-per-million (ppm). A representative sample of a potential import source shall be given to Leighton Consulting, Inc. at least four full working days before importing begins, so that suitability of this import material can be determined and appropriate tests performed.

D-4.0 FILL PLACEMENT AND COMPACTION

D-4.1 Fill Layers

Approved fill material shall be placed in areas prepared to receive fill, as described in Section D-2.0, above, in near-horizontal layers not exceeding 8 inches (20 cm) in loose thickness. Leighton Consulting, Inc. may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers, and only if the building officials with the appropriate jurisdiction approve. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

D-4.2 Fill Moisture Conditioning

Fill soils shall be watered, dried back, blended and/or mixed, as necessary to attain a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM) Test Method D 1557.

D-4.3 Compaction of Fill

After each layer has been moisture-conditioned, mixed, and evenly spread, each layer shall be uniformly compacted to not-less-than (≥) 90 percent of the maximum dry density as determined by ASTM Test Method D 1557. In some cases, structural fill may be specified (see project-specific geotechnical report) to be uniformly compacted to at-least (≥) 95 percent of the ASTM D 1557 modified Proctor laboratory maximum dry density. For fills thicker than (>) 15 feet (4.5 m), the portion of fill deeper than 15 feet below proposed finish grade shall be compacted to 95 percent of the ASTM D 1557 laboratory maximum density. Compaction equipment shall be adequately sized and be either specifically designed for soil compaction or of proven reliability to efficiently achieve the specified level of compaction with uniformity.

D-4.4 Compaction of Fill Slopes

In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by back rolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet (1 to 1.2 m) in fill elevation, or by other methods producing satisfactory results acceptable to Leighton Consulting, Inc.. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of the ASTM D 1557 laboratory maximum density.

D-4.5 Compaction Testing

Field-tests for moisture content and relative compaction of the fill soils shall be performed by Leighton Consulting, Inc.. Location and frequency of tests shall be at our field representative(s) discretion based on field conditions encountered. Compaction test locations will not necessarily be selected on a random basis. Test locations shall be selected to verify adequacy of compaction levels in areas that are judged to be prone to inadequate compaction (such as close to slope faces and at the fill/bedrock benches).

D-4.6 Compaction Test Locations

Leighton Consulting, Inc. shall document the approximate elevation and horizontal coordinates of each density test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that Leighton

Consulting, Inc. can determine the test locations with sufficient accuracy. Adequate grade stakes shall be provided.

D-5.0 EXCAVATION

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by Leighton Consulting, Inc. during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by Leighton Consulting, Inc. based on the field evaluation of exposed conditions during grading. Where fill-over-cut slopes are to be graded, the cut portion of the slope shall be made, then observed and reviewed by Leighton Consulting, Inc. prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by Leighton Consulting, Inc..

D-6.0 TRENCH BACKFILLS

D-6.1 Safety

The Contractor shall follow all OSHA and Cal/OSHA requirements for safety of trench excavations. Work should be performed in accordance with Article 6 of the *California Construction Safety Orders*, 2009 Edition or more current (see also: http://www.dir.ca.gov/title8/sb4a6.html).

D-6.2 Bedding and Backfill

All utility trench bedding and backfill shall be performed in accordance with applicable provisions of the 2015 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Bedding material shall have a Sand Equivalent greater than 30 (SE>30). Bedding shall be placed to 1-foot (0.3 m) over the top of the conduit, and densified by jetting in areas of granular soils, if allowed by the permitting agency. Otherwise, the pipe-bedding zone should be backfilled with Controlled Low Strength Material (CLSM) consisting of at least one sack of Portland cement per cubic-yard of sand, and conforming to Section 201-6 of the 2015 Edition of the *Standard Specifications for Public Works Construction* (Green Book). Backfill over the bedding zone shall be placed and densified mechanically to a minimum of 90 percent of relative compaction (ASTM D 1557) from 1 foot (0.3 m) above the top of the conduit to the surface. Backfill above the pipe zone shall **not** be jetted. Jetting of the bedding around the conduits shall be observed by Leighton Consulting, Inc. and backfill above the pipe zone (bedding) shall be observed and tested by Leighton Consulting, Inc..

D-6.3 Lift Thickness

Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to Leighton Consulting, Inc. that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method, and only if the building officials with the appropriate jurisdiction approve.

APPENDIX E

GBA – IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL REPORT

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org