LGC GEO-ENVIRONMENTAL, INC.
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING • SWPPP

September 13, 2016

Project No. G14-1194-10

Mr. Craig Cristina, Director of Entitlement
RICHLAND REAL ESTATE FUND, LLC
3161 Michelson Drive, Suite 425
Irvine, California 92612

Subject: ***Geotechnical Investigation and Manure Evaluation for the Proposed 121 Acre Richland/Chino Bickmore Properties Business Center and Residential Development in the City of Chino, San Bernardino County, California.***

LGC Geo-Environmental, Inc. (LGC) is pleased to submit our geotechnical investigation and manure evaluation for the proposed 121 acre Richland/Chino Bickmore Properties business center and residential development in the city of Chino, San Bernardino County, California. This report presents the results of our background review, aerial photo review, recent geologic field mapping, field exploration, and laboratory testing; geotechnical and geologic opinions and conclusions; and our updated preliminary geotechnical recommendations relative to the proposed commercial and residential development.

Based on the results of our research, field exploration, geologic mapping, laboratory testing, geologic and geotechnical engineering evaluations, along with review of the referenced multiple grading plans prepared by Proactive Engineering Consultants, it is our opinion that the site is suitable for the proposed industrial/commercial and residential development, provided that the recommendations presented herein are utilized during the design and grading, and implemented during construction. LGC should review any rough grading plans, in addition to any foundation/structural plans when those become available, and perform additional subsurface exploration, laboratory testing and revise the recommendations presented herein, if necessary.

It has been a pleasure to be of service to you on the design aspects of this project. Should you have any questions regarding the content of this report or should you require additional information, please do not hesitate to contact this office at your earliest convenience.

Respectfully submitted,

LGC Geo-Environmental, Inc.

REGISTERED GEOLOGIST
ROBERT L. GREGOREK II
No. 1257
CERTIFIED ENGINEERING GEOLOGIST
Exp. 8/31/17
STATE OF CALIFORNIA

Robert L. Gregorek II, CEG 1257
Certified Engineering Geologist

Larry D. Cooley, RCE 54037
Project Engineer

KRM/RLG/LDC
Distribution: (4) Addressee

27570 COMMERCE CENTER DR., #128, TEMECULA, CALIFORNIA 92590
PHONE: (951) 297-2450 • FAX: (951) 719-2998

WWW.LGCGEOENV.COM

TABLE OF CONTENTS

LIST OF TABLES, APPENDICES AND ILLUSTRATIONS

Tables

Appendices

Figures & Plates

1.0 INTRODUCTION

1.1 Purpose and Scope of Services

The purpose of our geotechnical report is to evaluate the existing surface and subsurface conditions pertinent to the geologic, geotechnical and manure conditions at the site-and to provide opinions, conclusions and preliminary recommendations pertaining to overexcavation recommendations relative to the existing soil materials, manure/organic soil handling and review of the rough grading aspects of the proposed commercial and residential development.

The referenced multiple various scale plans, prepared by Proactive Engineering Consultants (Appendix A), were combined and utilized as the base map for our geologic field mapping.

Our scope of services included:

- Review of available previous geotechnical/geologic reports pertinent to the site.
- Geologic field mapping of the site.
- Subsurface exploration consisting of the excavation, sampling, and logging of ten (10) borings to depths ranging from approximately 27.5 feet to 49.5 feet below the existing ground surface utilizing a hollow-stem drill rig and twenty four (24) trenches, to depths ranging from approximately 5.0 feet to 11.5 feet below the existing ground surface utilizing a backhoe. The borings and trenches were excavated to evaluate the general characteristics of the subsurface geotechnical/geologic conditions on the site, classification of the site soils and to obtain representative soil samples. Also included was determination of estimated depth of overexcavation and determining the estimated depth and extent of existing manure/organic soil that may exist. The trench and boring logs are included in Appendix B.
- Laboratory testing of representative soil samples obtained during our subsurface exploration (Appendix C).
- Geotechnical engineering and geologic analyses of the data with respect to the proposed industrial/commercial and residential development.
- Estimated depths and lateral extent of overexcavation.
- Estimated depths and lateral extent of existing manure and organic soils and evaluation of organic content of upper soils and acceptability for use as fill or backfill.
- Site seismicity parameters, including an evaluation of liquefaction potential and amount of dynamic seismic settlement.
- Foundation types and geotechnical foundation design parameters.
- Parameters for retaining wall design, including lateral pressures and drainage requirements.
- A description of soil corrosivity potential to concrete, and mitigation procedures.
- Preliminary pavement section design parameters.
- Geotechnical engineering and geologic analysis of the data with respect to the proposed single-family residential development.
- Preparation of this report presenting our findings, conclusions and updated geotechnical recommendations relative to rough grading and construction of the proposed development.

1.2 *Location and Site Description*

The subject site is irregular shaped and is about 121 acres in size which is located southwest of the Chino airport between Bickmore Avenue and Kimball Avenue in the city of Chino, County of San Bernardino, California. The site is bounded on the north by Kimball Avenue and undeveloped land, on the east by multi-family residential development, on the west by a storage facility and undeveloped land and on the south by Bickmore Avenue.

The topography of the site is relatively level, with a change in elevation roughly 39 feet from the northeast corner to the southwest corner. Drainage appears to flow south to southwest, with elevations ranging from approximately 605 feet msl in the northeast portion of the site to approximately 566 feet above mean sea level (msl) in the southwest portion of the site.

The majority of the site appears to be mainly agricultural crop lands, with an abandoned existing dairy with related buildings, cow pens and other related improvements in the northeast corner of the site. The southwestern corner and an area of the south central portion of the site are 2 existing plant nurseries with several permanent and temporary greenhouse structures, some small nursery related buildings, and private residences. There are some existing gravel and dilapidated concrete roadways on the property. In addition existing retention basins are present at the southeast corner and southwest portion of the site. Portions of the perimeters of the site have a light to moderate growth of annual weeds and grasses. Some scattered large piles of concrete exist in the northern portion of the site as well as other small piles of debris/trash and vegetation also existing on the rest of the site.

The general location and configuration of the site is shown on the Site Location Map (Figure 1).

1.3 *Proposed Development and Grading*

Based on the referenced various 50-scale development plans, the proposed development will consist of 19 industrial and/or commercial units/buildings of various sizes within the northern and western portions of the site. The site will also consist of a 185 lot and a 106 lot single family residential developments as well as a 16 lot multi-family residential development consisting of 94 units in total within the south central and southeast portion of the site. In addition, there are proposed 2 private parks, 3 retention basins, a pavilion, parking areas, interior roadways, landscaping and 2 water quality basins. There is also a future residential development designated in the southern portion of the site, with no proposed grading indicated, on Parcel 20.

The grading plans also indicate that cuts and fills of approximately 9 feet to 10 feet, respectively, are proposed. Proposed maximum cut and fill slope heights from approximately 10 feet and 5 feet respectively, at maximum slope ratios of 2:1 (h:v) or flatter are also proposed. The retention basins are proposed to be up to approximately 5 feet to 10 feet deep. Retaining walls are proposed to be up to approximately 3 feet in height.

1.4 *Previous Geotechnical Reports and Aerial Photographs*

The geotechnical report (2012) by Leighton and Associates, Inc. (L&A, Inc.) for a portion of the site was reviewed by LGC and is referenced in Appendix A.

Paired stereo aerial photographs of the site and vicinity from 1949 through 1999 were reviewed and evaluated by this firm. The photographs were obtained from Continental Aerial Photo, Inc. Scales of the photographs reviewed (where available) ranged from approximately 1" = 1,667' to approximately 1" = 2,000'. A summary table of the photos reviewed is presented in Appendix A.

LGC

FIGURE 1
SITE LOCATION MAP

Project Name	RICHLAND/ CHINO, BICKMORE PROPERTY
Project No.	G14-1194-10
Geol./ Eng.	RLG/LDC
Scale	AS SHOWN
Date	SEPTEMBER 2016

1.5 *Geologic Field Mapping*

Our geologic field mapping was performed by an engineering geologist from this firm in March of 2015 to March of 2016, and utilized the combined referenced various 50-scale development plans and the 300-scale net acreage exhibit as a base map for our geologic field mapping.

1.6 *Subsurface Exploration and Geologic Mapping*

Our subsurface exploration was performed on March 6 through May 6, 2015, and March 17, 2016, and consisted of the excavation, sampling, and logging of ten (10) borings to depths ranging from approximately 27.5 feet to 49.5 feet below the existing ground surface utilizing a hollow-stem drill rig and twenty four (24) trenches, to depths ranging from approximately 5.0 feet to 11.5 feet below the existing ground surface utilizing a backhoe. The borings and trenches were excavated to evaluate the general characteristics of the subsurface geotechnical/geologic conditions on the site, classification of the site soils and to obtain representative soil samples. Also included was determination of estimated depth of overexcavation and determining the estimated depth and extent of existing manure/organic soil that may exist. The trench and boring logs are included in Appendix B.

Associated with the subsurface exploration was the collection of bulk and relatively undisturbed ring samples of soil within hollow-stem auger borings for laboratory testing. Bulk samples consisted of selected soil materials obtained at various depth intervals from the exploratory borings and trenches. Undisturbed ring samples were obtained from the exploratory borings using a 3-inch outside diameter modified California split-spoon soil sampler lined with brass rings. Standard Penetration Tests were also performed in accordance with the American Society for Testing and Materials (ASTM) test method D1586. The soil samplers were driven with successive 30-inch drops of a mechanically driven, 140-pound automatic-trip hammer on the hollow-stem auger drill rig. Blow counts were recorded for each 6-inch driving increment; however, the number of blows required to drive the split-spoon sampler and the standard split-barrel samplers for the last 12 of the 18 inches was identified as the standard penetration resistance of N-count and recorded in the boring logs. The central portions of the driven ring samples were placed in sealed containers and transported to our laboratory for testing. Disturbed soil samples from the unlined standard split-barrel sampler were placed in plastic bags and also transported to our laboratory for testing.

The representative relatively undisturbed and bulk samples collected during our subsurface exploration were retained for laboratory testing. Laboratory testing was performed on representative soil samples and included in-situ density and moisture content, maximum dry density and optimum moisture content, expansion, Atterberg limits, sulfate content, chloride content, pH, resistivity, R-value, organic content, shear strength, consolidation, grain size and volatile organic compounds. The in-situ density and moisture content of samples taken within the trenches were determined in the field with a nuclear testing gauge in accordance with ASTM Test Method D6938-08a. A discussion of the tests performed and a summary of the results are presented in Appendix C

2.0 *GEOTECHNICAL CONDITIONS*

2.1 *Local Geology*

Based on our review of the available geological and geotechnical literature, referenced previous geotechnical reports, exploration and geologic field mapping, it is our understanding that the site

is primarily underlain by manure/organic soil, undocumented artificial fill soils, topsoil, alluvium and older alluvium. A description of the earth material soils encountered is described below:

Manure/Organic Soils (no map symbol): The northern and southeastern portions of the site with the existing abandoned dairy and existing agricultural fields, is generally partially covered by up to about 0.3 foot to 1.2 feet of manure or partially organic soils. Isolated areas of the south central portion of the site, in an existing agricultural field, have about 2.4 feet to 9.0 feet of manure and/or partially organic soils. These areas include backfilled former retention basins from the previous dairy operations. The area of thickest previous manure coverage has been from the existing abandoned dairy in the northwest corner of the site and the previous dairy portions on the north central and south central portions of the site, which have since been removed and turned into agricultural fields, apparently circa 2008 to 2009. These areas are indicated on the Geotechnical Maps Plates 1 and 2.

Artificial Fill, Undocumented (Afu): Undocumented non-engineered artificial fills are present, scattered over the majority of the of the subject site, associated with the previous dairy structures and operations as well as the existing agricultural operations. These areas include backfilled former retention basins from the previous dairy operations in the northeast, northwest and southwest corners of the site. Based on current and previous exploration and mapping, the approximate depth of these fill soils is estimated to range in depth from about 0.5 feet to 6.5 feet, to as much as 9.0 feet. Where observed these non-engineered fill soils are generally comprised of silty sand, clayey sand and sandy silt, which are very fine to coarse grained, various shades of yellow, brown and olive, dry to very moist, loose to dense and soft to stiff, desiccated, locally porous, some gravel, root and rootlets with some organics and traces of manure. Minor amounts of hydrocarbons were encountered within the backfilled former retention basin in the south central portion of the site.

Topsoil (No map symbol): Topsoil was encountered within the majority of the current and previous exploratory trenches and borings at the surface ranging in depth from 0.6 foot to 6.0 feet. These materials were generally consisted of silty sand, clayey sand and sandy silt, which were very fine to coarse grained, various shades of olive, brown, gray and orange, dry to moist, loose to medium dense and soft to stiff, with some gravel, desiccated, porous, locally micaceous and slightly mottled, with some organics, roots and rootlets.

Alluvium (Qal): Alluvium was present below the undocumented artificial fill and topsoil, ranging in depths to about 0.8 feet to 20.0 feet. These materials were generally comprised of silty sand, clayey sand, sandy silt, clayey silt, silty clay and sandy clay; with a trace of gravel; which were very fine to coarse grained; various shades of brown, olive, gray and orange, dry to very moist, medium dense to dense and firm to very stiff, local areas of abundant calcium nodules and caliche, some pinhole pores, with a trace of mottling and locally desiccated. Portions of the alluvium are wet at various depths. These materials were typically weathered, higher in porosity, more desiccated and lower in density within about the upper 0.5 foot to 3.0 feet.

Older Alluvium (Qoal): Older alluvium, where observed in exploratory borings and trenches, was present below the alluvium ranging in depth from 0.8 foot 20.0 feet. These materials were generally comprised of sand, silty sand, clayey sand, sandy silt, clayey silt, silty clay and sandy clay; with some gravel; which were very fine to coarse grained; various shades of yellow, brown, orange and gray, damp to wet, medium dense to very dense and firm to very stiff, locally friable, with some pinhole pores, trace of caliche, slightly micaceous; some oxidation, locally desiccated, with some root casts and rootlets.

2.2 *Groundwater*

Groundwater was encountered during subsurface exploration investigation of the site and the referenced previous geotechnical report (L&A, Inc., 2012), for a portion of the site, at a depth of approximately 24 feet to 30 feet below the existing surface. A review of the referenced Chino Basin Watermaster "Depth to Groundwater Contour Map, Fall 2006" and "Groundwater Elevation Contours Map, in Spring of 2012" as well as near-by water well information indicates groundwater in the general site area is estimated to be at a depth of about 25 feet to 75 feet.

2.3 *Caving*

Caving was not encountered in the borings or the majority of the trenches. However, caving was encountered in one exploratory trench TR-15, located in the south central portion of the site in the existing agricultural fields. The caving occurred in undocumented artificial fill at a depth of about 5 feet. In addition, localized caving may occur within excavations made into the sandier portions of the on site soils.

2.4 *Surface Water*

Surface water runoff relative to project design is the purview of the project civil engineer and should be designed to be directed away from the proposed structures.

2.5 *Faulting*

The subject site is not located within an Alquist-Priolo Earthquake Fault Zone and there are no known faults (active, potentially active, or inactive) onsite. The possibility of damage due to ground rupture is considered negligible since active faults are not known to cross the site. The subject site is also not located within State of California Seismic Hazards Zone for liquefaction.

Secondary effects of seismic shaking resulting from large earthquakes on the major faults in the southern California region, which may affect the site, include soil liquefaction and dynamic settlement. Other secondary seismic effects include shallow ground rupture, and seiches and tsunamis. In general, these secondary effects of seismic shaking are a possibility throughout the Southern California region and are dependant on the distance between the site and causative fault and the onsite geology. The major active faults, within 25 miles of the subject site that could produce these secondary effects are the Chino-Central Avenue Fault (3.4 miles away), the Whittier Fault (7.1 miles away), the Elsinore-Glen Ivy Fault (7.8 miles away), the San Jose (10.4 miles away), the Sierra Madre (13.9 miles away), the Cucamonga Fault (14.2 miles away), the Elysian Park Thrust Fault (14.4 miles away), the San Jacinto-San Bernardino (19.0 miles away) and the and the San Andreas-San Bernardino and Southern Faults (23.0 miles away), among others. A risk assessment of these secondary effects is provided in the following sections.

2.5.1 *Liquefaction*

Liquefaction is a seismic phenomenon in which loose, saturated, granular soils behave similarly to a fluid when subject to high-intensity ground shaking. Liquefaction occurs when three general conditions exist: 1) shallow groundwater; 2) low density non-cohesive (granular) soils; and 3) high-intensity ground motion. Studies indicate that saturated, loose to medium dense, near surface cohesionless soils exhibit the highest liquefaction potential, while dry, dense, cohesionless soils and cohesive soils exhibit low to negligible liquefaction potential. The project site will be underlain by engineered compacted fill as

well as competent alluvium and/or competent older alluvium with current groundwater at a depth of approximately 27 feet.

Liquefaction analyses were performed for the anticipated graded site conditions. The soil and conditions encountered in Borings B-1, B-8 and B-9 were utilized in our analyses. Our field exploration indicated groundwater to be at depths ranging from 27 feet to 30 feet below the existing surface. A conservative level of 15 feet was used for the liquefaction analyses to represent the recent historic high groundwater level, since development has occurred in the area surrounding the site; as well as the depth of saturated soils currently being encountered. Our analyses of post graded conditions indicated potentially liquefiable soils at depths of approximately 15 feet to 20 feet below existing grade. The potential total dynamic settlement for these soils, due to possible liquefaction, is about 0.72-inch and the differential dynamic settlement is about 0.36- inch. Due to the amount of overburden and this minor amount of potential total dynamic settlement, due to liquefaction there should not be manifestation at the surface even if the anticipated high groundwater, however unlikely, ever exists in the future. Results of the liquefaction analyses are indicated in Appendix D.

2.5.2 Shallow Ground Rupture

Ground rupture due to active faulting is not likely to occur on site due to the absence of known active fault traces. Cracking due to shaking from distant seismic events is not considered a significant hazard, although it is a possibility at any site.

2.5.3 Tsunamis and Seiches

Based on the elevation of the proposed development at the site with respect to sea level and its distance from large open bodies of water, the potential of a seiche and/or tsunami is considered to be negligible.

2.6 Ground Motions

The site will probably experience ground shaking from moderate to large size earthquakes during the life of the proposed development. Furthermore, it should be recognized that the Southern California region is an area of high seismic risk, and that it is not considered feasible to make structures totally resistant to seismic-related hazards.

Structures within the site should be designed and constructed to resist the effects of seismic ground motions as provided in the 2013 CBC, Section 1613 and 1616 and 2010 ASCE 7. The method of design is dependent on the seismic zoning, site characterizations, occupancy category, building configuration, type of structural system and building height.

The following seismic design parameters, presented in Table 1, were developed based on the CBC 2013 and should be used for the proposed structures. A site coordinate of 33.9636° N, 117.6420° W was used to derive the seismic parameters presented below:

TABLE 1
Seismic Design Soil Parameters

Seismic Design Soil Parameters **(2013 CBC Section 1613 and 2010 ASCE 7)**	
Site Class Definition (ASCE 7; Chapter 20) [Table 20.3-1]	D
Mapped Spectral Response Acceleration Parameter S_s (for 0.2 second) [Table 1613.5.3(1)]	1.69
Mapped Spectral Response Acceleration Parameter, S_1 (for 1.0 second) [Table 1613.5.3(2)]	0.61
Site Coefficient F_a (short period) [Table 1613.3.3(1)]	1.00
Site Coefficient F_v (1-second period) [Table 1613.3.3(2)]	1.50
Adjusted Maximum Considered Earthquake (MCE) Spectral Response Acceleration Parameter S_{MS} (short period) [Eq. 16-37]	1.69
Adjusted Maximum Considered Earthquake (MCE) Spectral Response Acceleration Parameter S_{M1} (1-second period) [Eq. 16-38]	0.91
Design Spectral Response Acceleration Parameter, S_{DS} (short period) [Eq. 16-39]	1.13
Design Spectral Response Acceleration Parameter, S_{D1} (1-second period) [Eq. 16-40]	0.61

The Mean Peak Ground Acceleration (PGA_m) is 0.64 g.

2.7 Slope Stability

Proposed cut and fill slopes constructed at a 2:1 horizontal to vertical (h:v) should be grossly stable. However, portions of the proposed cut slopes may expose low-density, undocumented artificial fill, topsoil or weathered portions of the upper alluvium as well as significant layers of relatively non-cohesive alluvium which will likely require stabilization by overexcavation and replacement with compacted fill.

2.8 Organic Content

Current laboratory test results by LGC and previous laboratory test results by L&A, Inc. (for a portion of the site) of the upper near surface partially organic soils (artificial fill and disturbed soils) indicated the northern and southeastern portions of the site with the existing abandoned dairy and existing agricultural fields and former removed dairies have organic contents, in about the upper 0.5 foot to 1.2 foot, and locally from depths ranging from 2.4 feet to 6.5 feet, of about 1.9 percent to 11.0 percent, for an average organic content of about 4.7 percent in the partially organic soils. Laboratory testing also indicated that generally the undisturbed natural soils below these depths (topsoil and alluvium) had natural organic contents ranging from 0.2 percent to 3.2 percent, for an average of about 1.3 percent. Based on these results, and considering the organic content of the underlying undisturbed natural soils, the actual organic content of these partially organic soils in the upper 0.1 foot to 1.2 foot, and locally from depths ranging from 2.4 feet to 6.5 feet, is about 0.6 percent to 9.7 percent. Laboratory test results of approximately 0.1 foot to 1.0 foot of the upper near surface highly organic soil (with manure) located in the existing abandoned dairy at the northwest corner of the site indicated organic contents of about 25.1 percent.

2.9 Hydrocarbon Content

Laboratory test results by LGC of the backfill soils within the former retention basin in the south central portion of the site, as indicated on the geotechnical map, Plate 2, showed minor concentrations of hydrocarbons at about 56.0 ppm within the backfill soils tested. Laboratory

testing also indicated that any hydrocarbons within the undisturbed natural soils below backfill soils were not detected. Based on these results the levels of hydrocarbons within the backfill soils of the subject former retention basin are below any health concern or that would require any type of remediation/clean up for the site relative to residential land use, as per California Human Health Screening Levels.

2.10 Settlement

Based on field observations and testing, in addition to laboratory testing and settlement analysis, the existing non-engineered artificial fill, topsoil, and weathered portions of the upper alluvium in their existing state exhibit the potential to settle or hydro-consolidate under the surcharge of the future proposed structural and fill loads. Consolidation testing indicated that the alluvium and older alluvium below the weathered zone is in an over consolidated state beyond the anticipated future structural loads and proposed fill loads of up to about 5 feet to 10 feet.

Based on the general settlement characteristics of compacted fill and in-situ natural soils, as well as the forthcoming overexcavation recommendations, presented later in this report, and anticipated loading, it is estimated that the total settlement of conventional footings will be approximately 0.50 inch. Differential settlement is expected to be 0.25-inch over a horizontal distance of approximately 30 feet. It is anticipated that the majority of the settlement will occur during construction, or shortly thereafter, as building loads are applied. This settlement does not include the potential total dynamic settlement of 0.72-inch and differential dynamic settlement of about 0.36-inch due to possible liquefaction.

The above settlement estimates are based on the assumption that the grading will be performed in accordance with the following grading recommendations presented later in this report and that the project geotechnical consultant will observe or test the soil conditions in the footing excavations.

3.0 CONCLUSIONS

Based on the results of our geotechnical investigation and manure evaluation, it is our opinion that the proposed industrial/commercial and residential development is feasible from a geotechnical and geologic standpoint, provided the recommendations presented in this geotechnical report are utilized during the design and construction. The following is a summary of the primary geotechnical and geologic factors determined from our updated geotechnical investigation and manure evaluation.

- Based on our geologic field mapping, review of the referenced geotechnical reports and review of pertinent geologic maps, the site is underlain by manure/organic soil, non-engineered fill, manure/organic soil, topsoil, alluvium and older alluvium.
- Laboratory test results and the previous laboratory test results from the referenced previous geotechnical report (L&A, Inc., 2012) indicated that the upper onsite soils have an expansion potential of Low.
- laboratory test results and the previous laboratory test results from the referenced previous geotechnical report (L&A, Inc., 2012) of the upper soils, indicate a negligible potential for soluble sulfate effects on normal concrete and chloride effects on reinforcing steel.
- Laboratory testing and the previous laboratory test results from the referenced previous geotechnical report (L&A, Inc., 2012) indicated that upper onsite soils are moderately to severely corrosive to buried

metals.

- Laboratory test results and the previous laboratory test results from the referenced previous geotechnical report (L&A, Inc., 2012) of the upper near surface partially organic soils (artificial fill and disturbed soils) indicated the northern and southeastern portions of the site have organic contents of about 1.9 percent to 11.0 percent in about the upper 0.5 foot to 1.2 foot and locally ranging in depth from 2.4 feet to 9.0 feet. In general, the undisturbed natural soils below these depths (topsoil and alluvium) had organic contents ranging from 0.2 percent to 3.2 percent.

- Portions of the northeast corner of the site have about 0.1 foot to 1.0 foot of manure and highly organic soils. Laboratory test results of the manure and highly organic soils in theses areas indicated organic contents of about 25.1 percent

- Isolated areas of the site in the south central portion of the site, as indicated on the geotechnical map, Plate 2, may have approximately 3.0 foot to 9.0 feet of partially organic soils and soils with minor concentrations of hydrocarbons. These areas include backfilled former retention basins from the previous dairy operations. Laboratory test results of the backfill in the south central former dairy retention basin indicated minor concentrations of hydrocarbons of about 56.0 percent/ppm, which is below any levels that are of a health concern or that would require any type of remediation/clean-up for the site relative to residential land use, as per California Human Health Screening Levels. However, these soils should still be placed below any paved roadways or at least 5 feet below grade in any industrial/commercial residential building pad areas or parks.

- Excluding manure and organic soils the site is generally underlain below the surface by up to about 2.0 feet to 6.0 feet and locally up to about 7.0 feet to 9.0 feet of potentially compressible artificial fill, topsoil and weathered portions of alluvium, which may be prone to potential post-grading settlement and/or hydro-consolidation, under the surcharge of the existing or future proposed structural loads and fill loads.

- Based on laboratory testing and settlement analysis, fills compacted to 90 percent relative compaction with up to approximately 2 percent organic material, should not have any potential for post-grading settlement and/or hydro-consolidation under the surcharge of the existing or future proposed structural loads and fill loads within building areas or areas of other improvements.

- Proposed cut slopes may expose low-density, undocumented artificial fill, topsoil or weathered portions of the upper alluvium as well as significant layers of relatively non-cohesive alluvium which will likely require stabilization by overexcavation and replacement with compacted fill.

- From a geotechnical perspective, the existing onsite soils appear to be suitable material for use as fill, provided they are relatively free from rocks (larger than 8 inches in maximum dimension), construction debris, highly organic material and manure.

- It is anticipated that the onsite soils may be excavated with conventional heavy-duty construction equipment. However, portions of approximately the upper 2 feet to 6 feet of soil on the site may be relatively dry and may require appreciable amounts of water to bring these soils to optimum moisture content prior to use as fill. In addition silty and clayey soil material in the bottoms of the existing retention basins at the southeast corner and southwest portion of the of the site as well as the backfilled former retention basins in the south central portion of the site may be very moist to wet and require drying prior to use as fill.

4.0 RECOMMENDATIONS

4.1 Site Earthwork

We anticipate that earthwork at the site will consist of site preparation and remedial grading followed by construction of slab-on-grade type foundations. All earthwork and grading should be performed in accordance with all applicable requirements of the appropriate reviewing agency and LGC's General Earthwork and Grading Specifications for Rough Grading (Appendix E). In case of conflict, the following recommendations shall supersede those included in as part of LGC's General Earthwork and Grading Specifications for Rough Grading.

4.1.1 Site Preparation

Prior to remedial grading of areas to receive structural fill, engineered structures or other improvements, the areas should be cleared of surface obstructions, any existing debris, organic rich soils and significant manure, as well as stripped of any vegetation. Vegetation, debris, organic rich soils and any significant manure should be removed and properly disposed of offsite. Holes resulting from the removal of buried tree root systems, obstructions, structures or utilities, should be replaced with suitable compacted fill material. An area of minor concentrations of hydrocarbons in the backfill of the southwestern former dairy retention basin is estimated to range in depth from 6.5 foot to 9.0 feet thick, as indicated on the Geotechnical Map, Plate 2. These materials will require will require selective placement as fill materials if utilized for this project site.

4.1.2 Private Sewage System Abandonment

Any existing seepage pit and other private sewage systems, and/or other subsurface structures that may be encountered, should be located, removed and/or properly abandoned from a geotechnical standpoint. Abandonment and/or removal of septic systems that may exist should be in accordance with local codes and recommendations by LGC. Seepage pits, if abandoned in-place, should be pumped clean, backfilled with gravel or clean sand jetted into place, and then capped with a minimum of 2 feet or more of a 2-sack or greater slurry or concrete for a distance of 2 feet or more outside the edge of the seepage pit. The top of the slurry or concrete cap should be at a minimum 10 feet below proposed grade.

4.1.3 Overexcavation and Recompaction

The site is generally underlain by approximately 2.0 feet to 6.0 feet, and locally up to about 7.0 feet to 9.0 feet, of potentially compressible soils (organic soil, artificial fill, topsoil, and weathered portions of alluvium) which may be prone to future settlement under the surcharge of foundation and/or fill loads. These materials should be overexcavated to competent alluvium and replaced with compacted fill soils. Within the entire level portions of the lots with proposed structures and walls, overexcavations should extend at least 5.0 feet below proposed pad grade as well as 3.0 feet below the lowest proposed footings, within the proposed building areas, and 2.0 feet below the proposed wall footings areas, whichever is deeper. However, localized, deeper overexcavation could be encountered where recommended by the geotechnical consultant based on observations during grading.

The estimated locations and approximate depths of overexcavation of unsuitable, compressible soil materials are indicated on the Geotechnical Map Plates 1 and 2.

Areas to receive fill and/or other surface improvements should be scarified to a minimum depth of 6 inches, brought to a near-optimum moisture condition, and recompacted to at least 90 percent relative compaction (based on American Standard of Testing and Materials [ASTM] Test Method D1557).

4.1.4 Fill Slopes

Following overexcavation of unsuitable soils, a 15-foot wide fill key excavated into competent dune sand deposits or alluvium should be provided at the toes of fill and fill over cut slopes. The bottom of the fill keys should be tilted at 2 percent back into the slope.

4.1.5 Cut Slopes

The majority of the proposed cut slopes may expose may expose low-density, undocumented artificial fill, topsoil or weathered sand deposits/alluvium as well as significant layers of relatively non-cohesive alluvium, which will likely require stabilization by overexcavation and replacement with compacted fill.

4.1.6 Benching

Where compacted fills are to be placed on natural slope surfaces inclining at 5:1 (h:v) or greater, the ground should be excavated to create a series of level benches, which are a minimum height of 4 feet, excavated into competent materials.

4.1.7 Cut and Shallow Fill Lots

All cut and shallow fill lots should be capped with a minimum of 5.0 feet of engineered structural fill, so that all footings for structures and walls are founded into engineered fill with a minimum of 3.0 feet of fill below footings for proposed structures and 2.0 feet below footings for proposed walls. Overexcavation should extend to the entire level portions of the lots with proposed structures or walls.

4.1.8 Cut/Fill Transition and Fill Differentials

To mitigate distress to structures related to the potential adverse effects of excessive differential settlement, cut/fill transitions should be eliminated from all level portions of the lots with proposed structures. The entire structure should be founded on a uniform bearing material. This should be accomplished by overexcavating the entire "cut" portion of the entire level portion of the lots and replacing the excavated materials as properly compacted fill, so that all footings for structures and walls are founded into engineered fill with a minimum of 3.0 feet of fill below footings for proposed structures and 2.0 feet below footings for proposed walls. Recommended depths of overexcavation are provided in the following table:

DEPTH OF FILL ("fill" portion)	*DEPTH OF OVEREXCAVATION ("cut" portion)*
Up to 15.0 feet	5.0 feet
Greater than 15.0 feet	One-third the maximum thickness of fill placed on the "fill" portion (15 feet maximum)

4.1.9 *Shrinkage and Subsidence*

Volumetric changes in earth quantities will occur when excavated onsite earth materials are replaced as properly compacted fill. The following (Table 2) is an estimate of shrinkage and bulking factors for the various geologic units found onsite. These estimates are based on in-place densities of the various materials and on the estimated average degree of relative compaction achieved during grading.

TABLE 2
Estimated Shrinkage

GEOLOGIC UNIT	*SHRINKAGE/BULKING PERCENT*
Artificial Fill, Undocumented (Afu)	10% to 15% Shrinkage
Topsoil	5% to 15% Shrinkage
Alluvium (Qal)	2% to 7% Shrinkage
Older Alluvium (Qoal)	0% to 5% Shrinkage

Subsidence of the alluvium and older alluvium soils, because of recompaction of exposed soils, prior to fill placement, and placement of proposed fills, is estimated to be about 0.15 foot to 0.20 feet.

The above estimates of shrinkage are intended as an aid for project engineers in determining earthwork quantities. **However, these estimates should be used with some caution since they are not absolute values.** These are preliminary rough estimates which may vary with depth of removal, stripping losses, field conditions at the time of grading, etc. Handling losses, and reduction in volume due to removal of oversized material, are not included in the estimates.

4.1.10 *Import Soils for Grading*

In the event import soils are needed to achieve final design grades, all potential import materials should be free of deleterious/oversize or organic materials, very low in expansion, and approved by the project geotechnical consultant; with appropriate laboratory testing as necessary, prior to commencement of delivery onsite.

4.1.11 *Fill Placement and Compaction*

The optimum lift thickness to produce a uniformly compacted fill will depend on the type and size of compaction equipment used. In general, fill should be placed in uniform lifts generally not exceeding 8 inches in compacted thickness, brought to at least optimum-moisture content, and compacted to at least 90 percent relative compaction (based on ASTM Test Method D1557).

Fill materials should contain no more than 2 percent overall organics. Based on laboratory testing for percent organic content of partially organic disturbed soils and natural soils generally the upper 0.5 foot to 1.2 foot and locally ranging in depths from 2.4 feet to 9.0 feet of the partially organic soils on the site, as indicated on the Geotechnical Maps Plates 1 and 2, can be blended with the on-site natural soils at a ratio of 3 to 1 (natural soils/clean imported soils to partially organic soils) and placed as compacted fill, provided they are completely mixed during fill placement. The type of equipment and method of placement; blending and mixing of the partially organic materials with onsite natural soils or clean

imported soils to be utilized by the grading contractor, should be reviewed and accepted by the geotechnical consultant prior to implementation. A possible method of placement that could be considered would to place the partially organic materials at an angle to the pattern of the placement of the onsite natural soils or clean imported soils. The testing frequency for verifying the percent organic content should be established by the geotechnical consultant prior to fill placement once the method of blending, placement, and mixing of the partially organic materials with onsite natural soils or clean imported soils.

The area in the southwest corner of the site, as indicated on Geotechnical Map, Plate 1, which may have soils ranging in depth from 6.0 feet to 9.0 feet of with minor concentrations of hydrocarbons should still be placed below any paved roadways or at least 5 feet below grade in any residential building pad areas or parks.

Placement and compaction of all fills should be performed in accordance with local grading ordinances under the observation and testing of the geotechnical consultant. In general, oversized material, greater than 8 inches, shall not be placed within any fills during grading.

5.0 POST GRADING CONSIDERATIONS

5.1 Control of Surface Water and Drainage Control

Positive-drainage devices such as sloping sidewalks, graded-swales and/or area drains, should be provided to collect and direct water away from the structure and slopes. Neither rain nor excess irrigation water should be allowed to collect or pond against building foundations. Roof gutters and downspouts should be provided on the sides of structures. Drainage should be directed to adjacent driveways, adjacent streets or storm-drain faculties and maintained at all times. Since the site is in a semi-arid climate area, from a geotechnical standpoint, the ground surface adjacent to the structures should be sloped at a gradient of at least 2 percent for a distance of at least 10 feet. Each graded lot should be further maintained by a swale or drainage path at a gradient of at least 1 percent. Where necessary, drainage paths may be shortened by use of area drains and collector pipes.

Planters with open bottoms adjacent to buildings should be avoided. Planters should not be designed adjacent to buildings unless provisions for drainage, and incorporated, such as catch basins, liners, and/or area drains. Over watering must be avoided.

5.2 Utility Trenches

Utility-trench backfill within roadways, utility easements, under walls, sidewalks, driveways, floor slabs and any other structures or improvements should be compacted. The onsite soils should generally be suitable as trench backfill provided they are screened of rocks and other material over 3 inches in diameter and organic matter. Trench backfill should be compacted in uniform lifts (generally not exceeding 8 inches in uncompacted thickness) by mechanical means to at least 90 percent relative density (per ASTM Test Method D1557).

Where onsite soils are utilized as backfill, mechanical compaction should be used. Density testing, along with probing, should be performed by the project geotechnical consultant or his representative to document proper compaction.

If trenches are shallow and the use of conventional equipment may result in damage to the utilities; clean sand, having sand equivalent (SE) of 30 or greater, should be used to bed and

shade the utilities. Sand backfill should be densified. The densification may be accomplished by jetting or flooding and then tamping to ensure adequate compaction. A representative from LGC should observe, probe, and test the backfill to verify compliance with the project specifications.

Utility-trench sidewalls deeper than 5 feet should be laid back at a ratio of 1:1 (h:v) or flatter or braced. A trench box may be used in lieu of shoring. If shoring is anticipated, LGC should be contacted to provide design parameters.

To avoid point-loads and subsequent distress to clay, cement or plastic pipe, imported sand bedding should be placed 1-foot or more above pipe in areas where excavated trench materials contain significant cobbles. Sand-bedding materials should be compacted and tested prior to placement of backfill.

Where utility trenches are proposed parallel to building footings (interior and/or exterior trenches), the bottom of the trench should not be located within a 1:1 (h:v) plane projected downward from the outside bottom edge of the adjacent footing.

6.0 PRELIMINARY FOUNDATION DESIGN RECOMMENDATIONS

6.1 General

Provided that site rough grading is performed in accordance with the recommendations of this report, conventional shallow foundations are still considered feasible for support of the proposed residential structures. Updated, tentative foundation recommendations are provided herein. The information and recommendations presented in this section are not meant to supersede design by the project structural engineer or civil engineer specializing in the structural design or a corrosion consultant. When the final structural loads for the proposed structures are known, these should be provided to our office, in order to determine final geotechnical foundation design parameters. Final recommendations may require modification depending on as-graded conditions within the building pad areas upon completion of rough grading.

6.2 Allowable-Bearing Values

An allowable-bearing value of 2,500 pounds per square foot (psf) may be used for 15-inch wide or greater continuous footings or 24-inch square pad footings, founded completely within in competent compacted fill at a depth of 12-inches or more below the lowest adjacent final grade. This value may be increased by 20 percent for each additional foot of width and depth, to a value no greater than 3,500 psf. The recommended allowable-bearing value includes both dead and live loads and may be increased by one-third for short-duration wind and seismic forces. The bearing capacities should be re-evaluated when loads and footing sizes have been finalized.

6.3 Settlement

Based on the general settlement characteristics of compacted fill, as well as the aforementioned overexcavation recommendations and anticipated loading, it is estimated that the total settlement of conventional footings will be approximately 0.50 inch. Differential settlement is expected to be 0.25-inch over 30 feet. It is anticipated that the majority of the settlement will occur during construction or shortly thereafter as building loads are applied. This settlement does not include the potential total dynamic settlement of approximately 0.72-inch and differential dynamic settlement of approximately 0.36-inch due to possible liquefaction that should be considered in foundation design.

The above settlement estimates are based on the assumption that the grading will be performed in accordance with the grading recommendations presented in this report and that the project geotechnical consultant will observe or test the soil conditions in the footing trenches.

6.4 *Lateral Resistance*

Lateral forces on footings should be resisted by passive earth resistance and friction at the bottom of the footing. Foundations should be designed for a coefficient of friction of 0.35 and a passive earth pressure of 250 psf per foot of depth to a maximum value of 2,500 psf. The passive earth pressure incorporates a minimum factor of safety of 1.5. When combining passive and friction forces, passive resistance should be reduced by 1/3.

The above values are based on footings placed directly against competent properly compacted fill. In the case where footing sides are formed, backfill placed against the footings should be compacted to 90 percent or more of maximum dry density as determined by ASTM D1557.

6.5 *Expansive Soil Considerations*

Results of current and previous laboratory tests indicate onsite soil materials exhibit expansion potential of **LOW** in accordance with 2013 CBC, Chapter 18. However, expansive soil conditions should be evaluated and tested for individual building pads during and at the completion of rough grading to observe and document the anticipated conditions. The design and construction details presented herein are intended to provide recommendations for the levels of expansion potential which may be evident at the completion of rough grading. Furthermore, it should be noted that additional slab thickness, footing sizes and/or reinforcement more stringent than the recommendations that follow should be provided as recommended by the project architect or structural engineer.

6.6 *Footing/Floor Slabs – Low Expansion Potential*

The following are our recommendations where foundation soils exhibit **LOW** expansion potential as classified in accordance with 2013 CBC. Slab-on-ground foundations resting on soils with an expansion index greater than 20 require special design considerations in accordance with the 2013 CBC, Chapter 18, or by soil stabilization by geotechnical recommendations as approved by the building official. We recommend using a plasticity index of 16 to 23.

The design and construction recommendations that follow may be considered for reducing the effects of **LOW** expansion soils. These recommendations have been based on the previous experience of LGC on projects with similar soil conditions in addition to the design criteria defined in the 2013 CBC, Chapter 18. Although construction performed in accordance with these recommendations has been found to reduce post-construction movement and/or cracking, they generally do not mitigate potential effects of expansive soil action. The owner, architect, design civil engineer, structural engineer and contractors must be made aware of the expansive soil conditions which exist at the site. However, additional slab thickness, footing sizes and/or reinforcement may be required by the project architect or structural engineer.

- ***Footings***
  - Exterior continuous footings should be founded into compacted engineered fill below the lowest adjacent final grade at minimum depths of 12 inches and 18 inches deep for one-story and two-story construction, respectively. Interior continuous footings may be founded at a depth of 12 inches or greater into

compacted engineered fill below the lowest adjacent final grade. Continuous footings should have a minimum width of 15 inches or more for one-story and two-story structures.

- Continuous footings should be reinforced with four (4) No. 4 bars, two top and two bottom.

- Interior isolated pad footings should be 24 inches or more square and founded at a depth of 12 inches or more below the lowest adjacent grade; and if isolated, should be isolated interconnected and connected to the main foundation by in-grade beams and reinforced in accordance with the structural engineer's recommendation.

- Exterior pad footings should be 24 inches or more square and founded at a depth of 18 inches or more below the lowest adjacent grade. Footings should be reinforced in accordance with the structural engineer's recommendations.

- ***Floor Slabs***

  - Unless a more stringent design is recommended by the architect or the structural engineer, concrete interior floor slabs for industrial/commercial structures should be 6 inches or more thick and interior living area floor slabs for residential structures should be 4 inches or more thick. Interior floor slabs should be reinforced with No. 3 bars spaced 18 inches or less on-centers, both ways. Slab reinforcement should be supported on concrete chairs so that the desired placement is properly placed per the design engineer.

  - Concrete floors should be underlain with a moisture-vapor retarder consisting of a 15-mil thick vapor barrier. Laps within the membrane should be sealed and overlapped 12 inches. Two inches or more of clean sand should be placed above and below the membrane. These recommendations must be confirmed (and/or modified) by the foundation engineer with our concurrence, based upon the performance expectations of the foundation. It is the responsibility of the contractor to ensure that the moisture/vapor barrier systems are placed in accordance with the project plans and specifications, and that the moisture/vapor retarder materials are free of tears and punctures prior to concrete placement. Additional moisture reduction and/or prevention measures may be needed, depending on the performance requirements of future interior floor coverings.

  - Garage area floor slabs for residential structures should be a minimum of 5 inches thick and should be reinforced in a similar manner as concrete interior living area floor slabs. Garage area floor slabs should be placed separately from adjacent wall footings with a positive separation maintained with 3/8-inch minimum felt expansion joint materials and quartered with weakened-plane joints. A 12-inch wide grade beam founded at the same depth as adjacent footings should be provided across garage entrances. The grade beam should be reinforced with a minimum of two No. 4 bars, one top and one bottom.

  - Prior to placing concrete, the subgrade soils below all floor slabs should be pre-watered to achieve a moisture content that is equal to 110% of the optimum moisture content of the subgrade soils. The moisture content should penetrate to a

minimum depth of 18 inches. This will also promote uniform curing of the concrete and minimize the development of shrinkage cracks.

6.7 *Non Structural Concrete Flatwork*

Concrete flatwork (such as walkways, bicycle trails, etc.) has a high potential for cracking due to changes in soil volume related to soil-moisture fluctuations. To reduce the potential for excessive cracking and lifting, concrete should be designed in accordance with the minimum guidelines for **LOW** expansive soils, outlined in Tables 3. These guidelines will reduce the potential for irregular cracking and promote cracking along construction joints, but will not eliminate all cracking or lifting. Thickening the concrete and/or adding additional reinforcement will further reduce cosmetic distress.

TABLE 3
Nonstructural Concrete Flatwork for Low Expansive Soils

	Private Sidewalks	*Private Drives*	*Patios/ Entryways*	*City Sidewalk Curb and Gutters*
Minimum Thickness (in.)	4 (nominal)	4(full)	4 (full)	City/Agency Standard
Presaturation	Presoak to 18 inches	Presoak to 18 inches	Presoak to 18 inches	City/Agency Standard
Reinforcement	—	No. 3 at 18 inches on centers	No. 3 at 18 inches on centers	City/Agency Standard
Thickened Edge	—	8" x 8"	8" X 8"	City/Agency Standard
Crack Control	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	Saw cut or deep open tool joint to a minimum of 1/3 the concrete thickness	City/Agency Standard
Maximum Joint Spacing	5 feet	10 feet or quarter cut whichever is closer	6 feet	City/Agency Standard

7.0 RETAINING WALLS

7.1 *Lateral Earth Pressures and Retaining Wall Design Parameters*

Conventional foundations for retaining walls within properly compacted fill within competent bedrock should be embedded at least 18 inches below lowest adjacent grade. At this depth, an allowable bearing capacity of 2,500 psf may be assumed for retaining walls founded in competent compacted fill.

The following lateral earth pressures are recommended for retaining walls that may be proposed up to 6 feet high and for dynamic conditions for retaining walls with heights ranging from greater than 6 feet up to 10 feet. The recommended lateral pressures for approved on-site soils **(with an expansion index of 20 or less and phi angle of internal friction of at least 30 degrees)** for level or sloping backfill are presented in Table 3. **Onsite fill soil with an expansion index of**

greater than 20 should not be used as backfill due to the expansive nature. Onsite fill soil should be screened of rocks and other material over 3 inches in diameter.

TABLE 4
Lateral Earth Pressures

CONDITIONS	EQUIVALENT FLUID WEIGHT (pcf)			
	Level Backfill (up to 6 feet)	*Level Backfill-Dynamic (>6 feet to 10 feet)*	*2:1 Backfill Ascending (up to 6 feet)*	*2:1 Backfill Ascending-Dynamic (>6 feet to 10 feet)*
Active	45	65	70	95
At-Rest	65	90	95	120
Passive	250	250	125	125

For sliding resistance, the friction coefficient of 0.35 may be used at the concrete and soil interface. Wall footings should be designed in accordance with structural considerations. The passive resistance value may be increased by one-third when considering loads of short duration such as wind or seismic loads.

Embedded structural walls should be designed for lateral earth pressures exerted on them. Restrained structural walls should be designed for at rest conditions. The magnitude of those pressures depends on the amount of deformation that the wall can yield under load. If the wall can yield enough to mobilize the full shear strength of the soil, it can be designed for "active" pressure. If the wall cannot yield under the applied load, the shear strength of the retained 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.

The equivalent fluid pressure values assume free-draining conditions and a soil expansion index of 20 or less. If conditions other than those assumed above are anticipated, revised equivalent fluid pressure values should be provided on an individual-case basis by the geotechnical engineer. Surcharge loading effects from the adjacent structures should be evaluated by the geotechnical and structural engineers.

7.2 Footing Embedments

The base of retaining wall footings constructed on level ground may be founded at a depth of 18 inches or more below the lowest adjacent final grade. Where retaining walls are proposed on or within 15 feet from the top of an adjacent descending fill slopes, the footings should be deepened such that a horizontal clearance of H/3 or more (one-third the slope height) is maintained between the outside bottom edges of the footings and the face of the slope but not to exceed 15 feet nor be less than 5 feet. The above recommended footing setbacks are preliminary and may be revised based on site specific soil conditions. Footing or pier excavations should be observed by the project geotechnical representative to document that the footing trenches have been excavated into competent bearing soils and to the embedments recommended above. These observations should be performed prior to placing forms or reinforcing steel.

7.3 Drainage

Surcharge loading effects from the adjacent structures should be evaluated by the geotechnical and structural engineers. All retaining wall structures should be provided with appropriate drainage and

appropriately waterproofed. The outlet pipe should be sloped to drain to a suitable outlet. It should be noted that that recommended subdrains does not provide protection against seepage through the face of the wall and/or efflorescence. If such seepage or efflorescence is undesirable, retaining walls should be waterproofed to reduce this potential.

Weep holes or open vertical masonry joints should be provided in retaining walls 3 feet or less in height to reduce the likelihood of entrapment of water in the backfill. Weep holes, if used, should be 3 inches or more in diameter and provided at intervals of 6 feet or less along the wall. Open vertical masonry joints, if used, should be provided at 32-inch or less intervals. A continuous gravel fill, 12 inches by 12 inches, should be placed behind the weep holes or open masonry joints. The gravel should be wrapped in filter fabric to reduce infiltration of fines and subsequent clogging of the gravel. Filter fabric may consist of Mirafi 140N or equivalent.

In lieu of weep holes or open joints, for retaining walls less than 3 feet, a perforated pipe and gravel subdrain may be used. Perforated pipe should consist of 4-inch or more diameter PVC Schedule 40 or ABS SDR-35, with the perforations laid down. The pipe should be embedded in 1.5 cubic feet per foot of 0.75 or 1.5-inch open graded gravel wrapped in filter fabric. Filter fabric may consist of Mirafi 140N equivalent.

Retaining walls greater than 3 feet high should be provided with a continuous backdrain for the full height of the wall. This drain could consist of geosynthetic drainage composite, such as Miradrain 6000 or equivalent, or a permeable drain material, placed against the entire backside of the wall. If a permeable drain material is used, the backdrain should be 1 or more feet thick. Caltrans Class II permeable material or open graded gravel or crushed stone (described above) may be used as permeable drain material. If gravel or crushed stone is used, it should have less than 5 percent material passing the No. 200 sieve. The drain should be separated from the backfill with a geofabric. The upper 1 foot of the backdrain should be covered with compacted fill. A drainage pipe consisting of 4-inch diameter perforated pipe (described above) surrounded by 1 cubic foot per foot of gravel or crushed rock wrapped in a filter fabric should be provided along the back of the wall. The pipe should be placed with perforations down, sloped at 2 percent or more and discharge to an appropriate outlet through a solid pipe. The pipe should outlet away from structures and slopes. The outside portions of retaining walls supporting backfill should be coated with an approved waterproofing compound to inhibit infiltration of moisture through the walls.

7.4 Temporary Excavations

Retaining walls, if any are proposed, should be constructed and backfilled as soon as possible after backcut excavations are constructed. Prolonged exposure of backcut slopes may result in some localized slope instability. To facilitate retaining wall construction, the lower 5 feet of temporary slopes may be cut vertical and the upper portions exceeding a height of 5 feet should be cut back at a gradient of 1:1 (h:v) or flatter for the duration of construction. However, temporary slopes should be observed by the project geotechnical consultant for evidence of potential instability. Depending on the results of these observations, flatter slopes may be necessary. The potential effects of various parameters such as weather, heavy equipment travel, storage near the tops of the temporary excavations and construction scheduling should also be considered in the stability of temporary slopes. Water should not be permitted to drain away from the slope. Surcharges, due to equipment, spoil piles, etc., should not be allowed within 10 feet of the top of the slope.

All excavations should be made in accordance with Cal/OSHA. Excavation safety is the sole responsibility of the contractor.

7.5 *Retaining Wall Backfill*

Any retaining wall backfill soils (with an expansion index of 20 or less) should be placed in 6 to 8 inch loose lifts, watered or air-dried as necessary to achieve near optimum moisture conditions and compacted to at least 90 percent relative density (based on ASTM Test Methods D2922 and D3017).

8.0 *MASONRY GARDEN WALLS*

8.1 *Construction on Level Ground*

Where masonry screen walls or garden walls are proposed on level ground and 5 feet or more from the tops of descending slopes, the footings for these walls may be founded at a depth of 18 inches or more below the lowest adjacent final grade. These footings should also be reinforced with two No. 4 bars, one top and one bottom and in accordance with the structural engineer's recommendations.

8.2 *Construction Joints*

In order to mitigate the potential for unsightly cracking related to the effects of differential settlement, positive separations (construction joints) should be provided in the walls at horizontal intervals of approximately 25 feet and at each corner. The separations should be provided in the blocks only and not extend through the footings. The footings should be placed monolithically with continuous rebar to serve as effective "grade beams" along the full lengths of the walls.

9.0 *PLANTERS*

Area drains should be extended into planters that are located within 5 feet of building walls, foundations, retaining walls and masonry garden walls to reduce excessive infiltration of water into the adjacent foundation soils. The surface of the ground in these areas should also be sloped at a gradient of 2 percent or more away from the walls and foundations. Drip-irrigation systems are also recommended to reduce overwatering and subsequent saturation of the adjacent foundation soils.

10.0 *SOIL CORROSIVITY*

10.1 *Corrosivity to Concrete and Metal*

The National Association of Corrosion Engineers (NACE) defines corrosion as "a deterioration of a substance or its properties because of a reaction with its environment". From a geotechnical viewpoint, the "environment" is the prevailing foundation soils and the "substances" are the reinforced concrete foundations or various buried metallic elements such as rebar, piles, pipes, etc., which are in direct contact with or within close vicinity of the foundation soil.

In general, soil environments that are detrimental to concrete have high concentrations of soluble sulfates. ACI 318R-05 Table 4.3.1 provides specific guidelines for the concrete mix design based on different amount of soluble sulfate content. The minimum amount of chloride ions in the soil environment that are corrosive to steel, either in the form of reinforcement protected by concrete cover, or plain steel substructures such as steel pipes or piles, is 500 ppm per California Test 532 and ACI 318R-05, Table 4.4.1.

Based on current and previous laboratory testing contained in the referenced geotechnical report the onsite soils are classified as having a negligible sulfate exposure condition in accordance with

ACI 318R-05 Table 4.3.1, and negligible chloride exposure condition in accordance with ACI 318R-05, Table 4.4.1.

Based previous laboratory testing of on-site soils it is also our opinion that onsite soil should be considered highly to severely corrosive to buried metals due to the very low to low resistivity.

Despite the minimum recommendation above, LGC is not a corrosion-engineering firm. Therefore, we recommend that you consult with a competent corrosion engineer and conduct additional testing (if required) to evaluate the actual corrosion potential of the site and to provide recommendations to reduce the corrosion potential with respect to the proposed improvements. The recommendations of the corrosion engineer may supersede the above requirements.

These recommendations are based on the previous samples of the near surface engineered fill soils. The initiation of re-grading at the site could blend various soil types and import soils may be used locally. These changes made to the foundation soils could alter sulfate-content levels. Accordingly, it is recommended that additional testing may be performed at the completion of grading.

11.0 PRELIMINARY PAVEMENT DESIGN

Structural pavement section design recommendations presented herein are based on a soil samples recovered during our subsurface exploration. However, it should be understood that the soil material exposed during grading may differ from the materials sampled and tested during this investigation. Therefore, preliminary pavement recommendations are subject to verification and possible revision based on actual traffic indices as well as sampling and testing of subgrade soils that exist after grading.

For planning and design purposes LGC has prepared the following preliminary pavement sections based on R-value testing on a near surface soil sample collected by LGC. R-value testing indicated R-values of 38 and 41. Based on assumed Traffic Indices (T.I.'s) for the proposed interior roadways, Table 5 presents recommended pavement design for assumed Traffic Indices (T.I.'s) of 5.0, 6.0, 7.0 and 8.0. City of Chino minimum asphalt pavement thickness requirements were also considered in LGC's pavement design.

TABLE 5
Preliminary Pavement Design

AREA	ASSIGNED TRAFFIC INDEX	DESIGN MAXIMUM R-VALUE	ASPHALTIC CONCRETE (AC) (inches)	AGGREGATE BASE (AB) (inches)
Interior Roadways and Parking Areas	5.0	38	3.0	4.0
Entrance Areas and Heavy Traffic Areas	6.0	38	3.5	6.0
Exterior Roadways	7.0	38	4.0	8.0
Major Arterial Roadways	8.0	38	5.0	9.0

Subgrade soil immediately below the aggregate base (base) should be compacted to a minimum of 95 percent relative compaction based on ASTM Test Method D1557 to a minimum depth of 12 inches. Final subgrade compaction should be performed prior to placing base or asphaltic concrete and after all utility trench backfills have been compacted and tested.

Base materials should consist of crushed aggregate base conforming to Section 200-2 of Greenbook. The upper 12 inches of the subgrade soils and all aggregate base materials should be compacted to at least 95 percent of the laboratory maximum dry density determined in accordance with ASTM D1557.

Our pavement recommendations should be considered as minimum and can be superseded by the City of Chino.

12.0 PLAN REVIEWS AND CONSTRUCTION SERVICES

Future plan reviews are necessary to ensure that recommendations and conclusions from LGC Geo-Environmental, Inc.'s preliminary studies have been incorporated into the plans. Modifications to the plan or additional subsurface exploration/laboratory testing may be required based upon our review; therefore our review should be performed as soon as practical. Such reviews should include, but are not limited to:

- Rough Grading Plans
- Precise Grading Plans
- Foundation Plans
- Utility Plans

Plans should be forwarded to the project geotechnical engineer and/or engineering geologist for LGC for review and comments, as deemed necessary.

The preliminary conclusions and recommendations provided in this summary report are based on review of previous geotechnical reports, geologic field mapping, and geotechnical/geologic analyses to date. A representative of LGC should observe the interpolated subsurface conditions in the field during construction.

Construction observation and testing should also be performed by the geotechnical consultant during future grading, foundation excavations, backfill of utility trenches, or when an unusual soil condition is encountered at the site. Future grading plans, foundation plans, and final project drawings should be reviewed by this office prior to construction.

13.0 LIMITATIONS

Our services were performed using the degree of care and skill ordinarily exercised, under similar circumstances, by reputable engineers and geologists practicing in this or similar localities. No other warranty, expressed or implied, is made as to the conclusions and professional advice included in this report. The previous subsurface observations and information contained in the previous referenced geotechnical reports are believed representative of the entire project, based on review of the referenced previous geotechnical reports; however, soil and geologic conditions revealed by excavation may be different than our preliminary findings. If this occurs, the changed conditions must be evaluated by the project geotechnical engineer and engineering geologist and design(s) adjusted as required or alternate design(s) recommended.

The findings of this report may be modified upon performing future geotechnical/geologic evaluations. However, changes in the conditions of a property can and do occur with the passage of time, whether they be due to natural processes or the works of man on this or adjacent properties.

This report is issued with the understanding that it is the responsibility of the owner, or of his/her

representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and/or project engineer and incorporated into the plans, and the necessary steps are taken to see that the contractor and/or subcontractor properly implements the recommendations in the field. The contractor and/or subcontractor should notify the owner if they consider any of the recommendations presented herein to be unsafe.

The conclusions and opinions contained in this report are based on the results of the described geotechnical evaluations and represent our professional judgment. The findings, conclusions and recommendations contained in this report are to be considered tentative only and subject to confirmation by LGC during the construction process. Without this confirmation, this report is to be considered incomplete and LGC will not assume any responsibility for its use.

The conclusions and opinions contained in this report are valid up to a period of 2 years from the date of this report or changes within the California Building Code, which ever occurs first. Changes in the conditions of a property can and do occur with the passage of time, whether those be because of natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate codes or standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside LGC's control. Therefore, if any of the above mentioned situations occur, an update of this report must be completed.

This report has not been prepared for use by parties or projects other than those named or designed above. It may not contain sufficient information for other parties or other purposes.

The opportunity to be of service is appreciated. Should you have any questions regarding the content of this report, or should you require additional information, please do not hesitate to contact this office at your earliest convenience.

APPENDIX A

REFERENCES

APPENDIX A

REFERENCES

Technical Reports

Leighton and Associates, Inc., Preliminary Geotechnical Investigation, Proposed 20-Acre Residential Development, Tentative Tract 18858, 7311 Kimball Avenue, Chino, California, dated June 29, 2012 (Project No. 022600-001).

LGC Geo-Environmental, Inc., Preliminary Geotechnical Investigation and Grading Plan Review, Proposed Temporary Sewer Lift Station, 121-Acre West Preserve Project, City of Chino, County of San Bernardino, California, dated July 11, 2016, (Project No. G14-1194-25).

LGC Geo-Environmental, Inc., Update Preliminary Geotechnical Investigation, Manure Evaluation and Rough Grading Plan Review, "Bruechert Property", Tract 18858, of the 121 Acre West Preserve Project, City of Chino, County of San Bernardino, California, dated May20, 2016, (Project No. G14-1194-25).

Publications

Blake, T.F., 1998, Maps of Known Active Fault Near-Source Zones in California and Adjacent Portions of Nevada, Prepared by California Division of Mines and Geology.

Bortugono, E.J. and Spiller, J.E., 1986, Geologic Map of San Bernardino Quadrangle, C.D.M.G. Map No. 3A.

Fife, D.L., Rodgers, D.A., chase, G.W., Chapman, R.H., and Sprotte, E.C., 1976, Geologic hazards in southwester San Bernardino County, California: California Division of Mines and Geology Special Report 113, 40 p.

Jennings, Charles W., 1994, Fault Activity Map of California and Adjacent areas, Map No. 6, California Division of Mines and Geology.

Morton, Douglas M., and Miller, Fred K., 2003, Preliminary Geologic Map of the San Bernardino 30'x60' quadrangle, California: U.S. Geological Survey Open File Report 03-293, USGS, Menlo Park, CA.

Western – San Bernardino Watermaster, 2006, Cooperative Well Measuring Program, San Bernardino Valley/Western Municipal Water District, dated Fall 2006.

Ziony, J.L., and Jones, L.M., 1989, Map Showing Late Quaternary Faults and 1978-84 Seismicity of the Los Angeles Region, California: U.S.G.S. Miscellaneous Field Studies, Map MF-1964.

Plans

Proactive Engineering Consultants, Conceptual Grading Plan, Tentative Tract Map 2008, Sheets 2 of 2, City of Chino, Scale: 1"=50', dated May 12, 2016.

Proactive Engineering Consultants, Tentative Parcel Map 19756, Sheets 1 to 7, City of Chino, County of San Bernardino, Scale: 1"=50', dated April 27, 2016.

Proactive Engineering Consultants, Tentative Tract Map 18858, Sheets 1 of 1, City of Chino, County of San Bernardino, Scale: 1"=50', dated June 4, 2015.

Proactive Engineering Consultants, Richland Chino Bickmore Properties Net Acreage Exhibit, Scale: 1"=300', dated October 3, 2014.

Aerial Photograph Interpretation Table

SOURCE	*FLIGHT*	*FRAME(S)*	*FLIGHT DATE*	*SCALE*
Continental	C31-130	118-120	2/2/99	1"=2000'
Continental	C119-30	171-172	10/16/97	1"=2000'
Continental	C114-30	71-73	7/11/95	1"=2000'
Continental	C92-18	134-135	5/19/93	1"=2000'
Continental	C83-12	28-29	6/12/90	NA
Continental	83001	64-65	1/2/83	NA
Continental	SBD-16	10-11	1/80	NA
Continental	75000	48	10/24/75	NA
Continental	60-3	85-86	1/30/70	NA
Continental	65200	23-25	5/8/65	NA
USDA	AXC-18W	125-127	11/6/59	1"=1667'
USDA	AXC-7F	21-22	5/21/49	1"=1667'

APPENDIX B

BORING AND TRENCH LOGS

APPENDIX B

Field Exploration

B-1 General

A reconnaissance of the site was carried out by LGC's personnel. The locations of the exploratory excavations were chosen to obtain subsurface information needed to achieve the objective for this investigation.

A visual survey was conducted to verify that the proposed excavations would not encounter any subsurface utility lines. No underground lines were encountered during the field exploratory program.

B-2 Excavation and Sampling

Subsurface exploration consisted of the excavation, sampling, and logging of ten (10) borings to depths ranging from approximately 27.5 feet to 49.5 feet below the existing ground surface utilizing a hollow-stem drill rig and twenty four (24) trenches, to depths ranging from approximately 5.0 feet to 11.5 feet below the existing ground surface utilizing a backhoe. The trenches and borings were excavated to evaluate the general characteristics of the subsurface geotechnical/geologic conditions on the site, classification of the site soils and to obtain representative soil samples. Also included was determination of estimated depth of overexcavation and determining the estimated depth and extent of existing manure/organic soil that may exist. The trench and boring logs are included in Appendix B.

Relatively undisturbed and bulk samples were collected during the course of trenching and were selected for classification and testing purposes and may represent a mixture of soils within the noted depths. Recovered samples were returned to the laboratory for further classification and testing. In-situ density and moisture content was determined in the field with a nuclear testing gauge in accordance with ASTM Test Method D6938-08a. The in-situ density and moisture content results are indicated on the trench logs.

B-3 Miscellaneous

The trench logs describe the earth materials encountered, the trench number, date of completion, and the name of the logger. An engineering geologist of LGC logged the trenches in accordance with the Standard Practice for Description and Identification of Soils (Visual-Manual Procedure) ASTM D2488-93. The boundaries between soil types shown on the logs are approximate and the transition between different soil layers may be gradual. The logs of the trenches are presented on the following pages.

Geotechnical Boring Log B-1

Date: 3-6-15	**Project Name:** Richland-Chino	Page 1 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 578'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
0				ML ML	**TOPSOIL** Sandy SILT; dark brown, damp, medium dense, very fine to fine grained occasional coarse gravel,						Bulk @ 0-5'
575	5 15 16	R1		Qal SC	**YOUNGER ALLUVIUM** Clayey SAND; olive gray and gray, damp to moist, medium dense, desiccated, very fine to fine grained, occasional fine gravel	17.3	109.7	3.0-4.0	21		R-Value
5	4 5 8	R2			@5.0'; highly mottled, desiccated, abundant caliche	25.9	97.8	5.0-6.0	9		Consol Sieve
570	15 22 23	R3			@8.0'; very fine to fine grained with occasional medium grained	12.6	118.2	8.0-9.0	30		
565	10 15 20	R4		Qoal SM-ML	**OLDER ALLUVIUM** Sandy SILT/Silty SAND; dark to medium brown orange, dry, dense/very stiff, fine to medium grained, desiccated, abundant pinhole pores, ped development, slightly mottled, some caliche	14.3	118.2	13.0-14.0	24		
560	12 12 12	S1		SM	Silty SAND; dark brown orange, dry to damp, medium dense, very fine to fine grained, slightly desiccated, trace caliche and pinhole pores	9.8		18.0-20.0	16		Sieve
555	3 3 7	R5		CL	Silty CLAY; light olive gray, wet, medium stiff to stiff, fine grained, slightly mottled	32.8	91.9	23.0-24.0	7		Consol
550	1 2 4	S2			@28.0', olive gray, wet, firm, very fine to fine grained, caliche nodules and trace of caiche	36.2		28.0-30.0	4		Sieve
30											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-1

Date: 3-6-15 | **Project Name:** Richland-Chino

Project Number: G141194-10 | **Logged By:** KRM

Drilling Company: 2R | **Type of Rig:** Hollow Stem Auger

Drive Weight (lbs.): 140 | **Drop (in.):** 30 | **Hole Dia. (in.):** 8"

Top of Hole Elevation (ft): 578' | **Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	Type of Test
30					trace caiche					
545	6 11 18	R6		SC	Clayey SAND; dark to medium olive brown and brown orange, damp to moist, medium dense to dense, very fine to fine grained, occasional fine gravel, trace oxidation and coarse gravel	18.7	110.8	33.0-34.0	19	Sieve
35										
540	9 14 14	S3		SM	Silty SAND; orange brown, moist, medium dense to dense, fine to coarse grained, occasional fine gravel and trace carbon	16.2		38.0-40.0	19	Sieve
40										
535	26 50/5"	R7			@43.0'; dense to very dense, slightly micaceous and mottled	14.9	118.0	43.0-44.0	34	Sieve
45										
530	10 23 50/5"	S4		SP	Poorly Sorted SAND; dark to medium orange brown, moist to wet, very dense, fine to very coarse grained, friable, occasional fine gravel	17.4		48.0-50.0	34	
50					Total Depth: 49.5' Groundwater at 29.5 No Caving					
525										
55										
520										
60										

CURVE: 10 30 50

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-2

Date: 3-6-15	**Project Name:** Richland-Chino	Page 1 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 575'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE (10 30 50)	Type of Test
	3 12 21	R1		ML	**TOPSOIL** Sandy SILT; dark brown, damp to moist, very stiff, very fine to medium grained, occasional fine and coarse gravel, slightly desiccated, possible paleosol at 2.0', trace of root casts	17.6	112.2	1.0-2.0	22		
570 — 5	10 10 12	R2		Qal SC	**YOUNGER ALLUVIUM** Clayey SAND; medium to light gray brown, damp to moist, medium dense to dense, slightly weathered, very fine to fine grained, slightly mottled, pinhole pores common	15.9	113.2	4.0-5.0	15		
	4 9 10	R3			@7.0', dark orange brown, damp, occasional medium grains, slightly oxidized, trace of fine gravel and caliche	22.3	101.8	7.0-8.0	13		Consol
565 — 10											
	6 8 11	S1		Qoal SM	**OLDER ALLUVIUM** Silty SAND; dark brown orange, damp, medium dense, fine to coarse grained, mottled, abundant caliche	15.2		12.0-14.0	13		
560 — 15											
	10 20 40	R4		SC	Clayey SAND; dark orange brown, damp to moist, very dense, fine to coarse grained, mottled, abundant caliche	16.2	114.1	17.0-18.0	40		
555 — 20											
	4 3 5	S2		ML	Sandy SILT; orange brown, wet, firm to stiff, very fine to medium grained, slightly desiccated and mottled, some clay, massive	34.2		22.0-24.0	5		
550 — 25											
	3 3 2	R5			@27.0', some caliche	38.9	82.1	27.0-28.0	3		Consol
545 — 30											

Sample Legend
- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-2

Date: 3-6-15	**Project Name:** Richland-Chino
Project Number: G141194-10	**Logged By:** KRM
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"
Top of Hole Elevation (ft): 575'	**Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
540 — 35	6 6 7	R6		CL	Sandy Clay; medium to light gray brown, wet, stiff, very fine to coarse grained, slightly mottled, interbedded silt and clay layers, trace caliche nodules	26.6	102.6	33.0-34.0	9		
535 — 40					Total Depth: 34.5' Groundwater at 28.5' No Caving						
530 — 45											
525 — 50											
520 — 55											
515 — 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-3

Date: 3-6-15	**Project Name:** Richland-Chino
Project Number: G141194-10	**Logged By:** KRM
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"
Top of Hole Elevation (ft): 580'	**Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
				SM-ML	**TOPSOIL** Silty SAND/Sandy SILT; blackish brown, dry to damp, mediu dense/stiff, fine to coarse						
	4 6 11	R1		ML	grained, trace fine gravel and rootlets	27.3	95.5	3.0-4.0	11		
575 — 5					Sandy SILT; dark brown, damp, stiff, very fine to fine grained occasional fine gravel, desiccated and weathered, slightly						
	7 9 10	R2		Qal ML	micaceous, trace clay	15.7	113.8	6.0-7.0	13		
					YOUNGER ALLUVIUM Silty SAND; dark brown gray, dry, very stiff, fine grained, desiccated, highly mottled, some oxidation, pores and pinhole pores, slightly micaceous						
570 — 10	10 10 12	R3			Same; highly oxidized	15.7	115.5	9.0-10.0	15		
565 — 15	11 16 20	R4		Qoal	**OLDER ALLUVIUM** Sandy SILT; dark to medium orange brown, dry to damp, very fine to fine grained, very stiff to hard, mottled and oxidized, trace coarse grains, desiccated	15.1	115.6	14.0-15.0	24		
560 — 20	6 16 24	S1		SP	Poorly Sorted SAND; dark brown, dry, dense, fine to coarse grained, slightly friable, trace fine gravel	10.0		19.0-21.0	27		
555 — 25	12 15 27	R5		ML	Sandy SILT; orange brown, moist to wet, hard, very fine to fine grained, highly desiccated, slightly mottled and oxidized, slightly micaceous, trace pinhole pores, some clay	22.0	104.9	24.0-25.0	28		
550 — 30	4 8 9	S2		ML	Clayey SILT; orange brown, damp to moist, stiff, fine to medium grained, slightly	26.0		29.0-31.0	11		

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

Geotechnical Boring Log B-3

Date: 3-6-15	**Project Name:** Richland-Chino
Project Number: G141194-10	**Logged By:** KRM
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"
Top of Hole Elevation (ft): 580'	**Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	Standard Penetration Test CURVE 10 30 50	Type of Test
545 — 35					desiccated, slightly micaceous, trace carbon Total Depth: 30.5' Seepage at 24.0' No Caving						
540 — 40											
535 — 45											
530 — 50											
525 — 55											
520 — 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-4

Date: 3-6-15	**Project Name:** Richland-Chino	Page 1 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 591'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
590	6 8 9	R1		ML	**TOPSOIL** Sandy SILT; dark brown, dry, stiff, fine to medium grained, desiccated	22.5	105.5	1.0-2.0	11		
				Qal ML	**YOUNGER ALLUVIUM**						
	6 9 11	R2		SC	Sandy SILT; light olive, dry to damp, stiff, very fine to medium grained, desiccated, trace clay	17.3	107.6	4.0-5.0	13		
585	6 12 16	R3			Clayey SAND; olive brown, dry to damp, medium dense, desiccated and mottled, some pinhole pores, trace rootlets and caliche @7.0'; abundant caliche and calcite nodules	25.5	96.9	7.0-8.0	19		Consol
580	4 6 8	S1			@12.0'; some fine gravel	21.5		12.0-14.0	9		
575	29 50/4	R4		Qoal SP	**OLDER ALLUVIUM** Poorly-Sorted SAND; dark to medium orange brown, dry to damp, very dense, fine to coarse grained, well-indurated	6.5	124.6	17.0-18.0	34		
570	11 20 13	S2		SP SC	Poorly Sorted SAND; orange brown, dry, dense, very fine to coarse grained, slightly friable, unconformity at 23.0'	6.8		22.0-24.0	22		
565	6 19 20	R5		CL	Clayey SAND; olive, dry to damp, medium dense to dense, very fine to fine grained, trace oxidation and carbon						
560					Silty CLAY; dark to medium olive brown, moist, hard, very fine to fine grained with occasional coarse grains, slightly mottled and desiccated, trace pinhole pores and oxidation	30.2	92.6	27.0-28.0	26		
					Total Depth: 28.5'						

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-4

Date: 3-6-15	**Project Name:** Richland-Chino	Page 2 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 591'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	Standard Penetration Test SPT N	Standard Penetration Test CURVE 10 30 50	Type of Test
560					No Groundwater No Caving						
35											
555											
40											
550											
45											
545											
50											
540											
55											
535											
60											
530											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-5

Date: 3-6-15 | **Project Name:** Richland-Chino

Project Number: G141194-10 | **Logged By:** KRM

Drilling Company: 2R | **Type of Rig:** Hollow Stem Auger

Drive Weight (lbs.): 140 | **Drop (in.):** 30 | **Hole Dia. (in.):** 8"

Top of Hole Elevation (ft): 603' | **Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	Type of Test
0				Afu	**ASPHALT**					
				SM	**TOPSOIL/ARTIFICIAL FILL** Silty SAND; dark brown, dry, medium dense, fine to medium grained, slightly desiccated and micaceous					
600	6 12 15	R1		Qal SM	**YOUNGER ALLUVIUM** Silty SAND; medium to light brown, dry, medium dense, fine to medium grained, desiccated and micaceous	17.2	107.2	3.0-4.0	18	
5	11 11 12	R2		SC	Clayey SAND; medium to light olive brown, dry to damp, medium dense, very fine to medium grained, mottled and desiccated, some pinhole pores, trace coarse grained	16.1	110.7	6.0-7.0	15	
595	9 13 12	R3			@ 9.0'; abundant calcite and caliche nodules	27.9	93.5	9.0-10.0	17	
10										
590	4 5 9	R4			@ 14.0'; medium to light olive brown, increased caliche and pinhole pores, possible paleosol	28.2	85.9	14.0-15.0	9	Consol
15										
585	5 5 7	S1		Qoal ML	**OLDER ALLUVIUM** Sandy SILT; dark orange brown, damp, stiff, very fine to fine grained with occasional medium grains, slightly mottled and oxidized, some caliche and clay	16.5		19.0-21.0	8	
20										
580	15 20 26	R5		SM	Silty SAND; olive brown, damp to moist, dense to very dense, fine to medium grained, mottled, slightly micaceous, some clay well-indurated, trace carbon	15.2	116.3	24.0-25.0	31	
25										
575	7 8			ML	Sandy SILT; olive, dry to damp, stiff to very					
30										

Standard Penetration Test CURVE: 10 30 50

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-5

Date: 3-6-15	**Project Name:** Richland-Chino
Project Number: G141194-10	**Logged By:** KRM
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"
Top of Hole Elevation (ft): 603'	**Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
30	10	S2			stiff, very fine to fine grained, slightly mottled, micaceous, becomes friable at 30.2', trace clay	12.3		29.0-31.0	12		
570					Total Depth: 30.5' No Groundwater No Caving						
35											
565											
40											
560											
45											
555											
50											
550											
55											
545											
60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-6

Date: 4-17-15	**Project Name:** Richland-Chino	Page 1 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 599'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
595 / 0	6 6 8	R1		ML	**TOPSOIL** Sandy SILT; dark brown, damp, medium, very fine to fine grained, slightly micaceous, trace rootlets and mottling	23.4	85.6	2.0-3.0	9		
5	10 15 18	R2		Qal ML	**YOUNGER ALLUVIUM** Clayey SILT; dark to medium olive brown, damp, very stiff to hard, fine to medium grained, slightly mottled and desiccated, slightly micaceous, trace pinhole pores	17.3	110.8	5.0-6.0	22		
590 / 10	2 2 2	R3		CL	Silty CLAY; medium to light gray, moist, firm, fine grained, desiccated, slight porosity, slightly micaceous, trace oxidation	39.3	77.2	8.0-9.0	3		Bulk 8-18' Expansion Index Consol Atterberg Sulfates, Chlorides, pH, Resistivity
585 / 15	1 2 4	S1			@ 13.0'; dark to light olive brown, some calcite nodules	25.3		13.0-15.0	4		
580 / 20	9 14 17	R4		Qoal CL	**OLDER ALLUVIUM** Sandy CLAY; dark to medium orange brown and olive brown, damp to moist, stiff, fine to medium grained, highly mottled and slightly micaceous	16.4	116.6	18.0-19.0	21		
575 / 25	5 11 14	S2		SM	Silty SAND; orange brown and olive brown, damp, medium dense, fine to coarse grained, trace clay and pinhole pores	12.6		23.0-25.0	17		
570 / 30	15 28 26	R5		SW	Well Sorted SAND; olive brown and light orange brown, moist, very dense, mottled, oxidized and slightly micaceous	10.9	105.7	28.0-29.0	36		

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-6

Date: 4-17-15	**Project Name:** Richland-Chino	Page 2 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 599'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
565 / 35	1 2 2	S3		CL	Silty CLAY; orange brown, moist, soft, very fine to fine grained, high plasticity, slightly micaceous, trace pinhole pores, rootcasts and carbon	34.4		33.0-35.0	3		
	4 7 8	R6		CL	@ 36.0'; stiff, slightly mottled and dessicated, medium to high plasticity	31.5	90.5	36.0-37.0	10		
560 / 40					Total Depth: 37.5' No Groundwater No Caving						
555 / 45											
550 / 50											
545 / 55											
540 / 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-7

Date: 4-17-15	**Project Name:** Richland-Chino	Page 1 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 589'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
				ML	**TOPSOIL** Sandy Silt; dark brown, damp, medium, fine to medium grained, roots and rootlets						
585 / 5	4 8 10	R1		Qal SC	**YOUNGER ALLUVIUM** Clayey SAND; medium to light olive brown, damp, stiff, desiccated, fine grained, slightly mottled, trace oxidation, pinhole pores and rootlets	22.6	98.0	3.0-4.0	12		
	5 7 8	R2		SC	@ 6.0'; dark brown olive, increased oxidation	28.1	95.9	6.0-7.0	10		Consol
580 / 10	6 9 11	R3		SC-SM	Clayey SAND/Silty SAND; dark to light olive brown and orange brown, damp, medium dense/stiff, fine to medium grained, interbedded laminations of silty clay, desiccated, slightly mottled, trace roothairs and oxidation	17.3	113.2	9.0-10.0	13		
575 / 15	11 17 19	R4		Qoal SC	**OLDER ALLUVIUM** Clayey SAND; brown orange and orange brown, damp, stiff, fine to medium grained, highly oxidized and mottled, desiccated, slightly micaceous, trace pinhole pores	16.8	113.6	14.0-15.0	24		
570 / 20	4 4 10	S1		SM	Silty SAND; orange brown and olive brown, damp, medium dense, fine to coarse grained, oxidized and mottled, slightly micaceous	20.8		19.0-21.0	9		
565 / 25	19 29 42	R5		SW	Well Sorted SAND; orange brown, damp, very dense, fine to medium grianed, slightly micaceous, oxidized, mottled and friable	17.9	114.0	24.0-25.0	48		
560 / 30	3 6 7	S2		CL	Silty CLAY; orange brown and olive brown, damp, stiff, fine to medium grained, slightly	26.8					

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-7

Date: 4-17-15	**Project Name:** Richland-Chino
Project Number: G141194-10	**Logged By:** KRM
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"
Top of Hole Elevation (ft): 589'	**Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	Standard Penetration Test SPT N	Standard Penetration Test CURVE 10 30 50	Type of Test
					micaceous, trace pinhole pores						
					Total Depth: 30.5'						
					No Groundwater						
					No Caving						
555 – 35											
550 – 40											
545 – 45											
540 – 50											
535 – 55											
530 – 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-8

Date: 4-17-15	**Project Name:** Richland-Chino	Page 1 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 584'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
580	4 4 6	R1		ML	**TOPSOIL** Sandy SILT; dark brown, dry, soft to firm, fine to medium grained with occasional coarse grains, slightly micaceous, roots and rootlets	33.6	77.2	1.0-2.0	7		
5	8 15 18	R2		Qal SM	**YOUNGER ALLUVIUM** SIlty SAND; dark olive brown, dry to damp, dense, fine to medium grained, desiccated, slightly micaceous, trace clay	17.0	111.5	4.0-5.0	22		
	4 7 8	R3		CL	Sandy CLAY; light gray, damp, stiff, highly desiccated, some pinhole pores, trace oxidation and rootcasts	25.4	98.8	7.0-8.0	10		Consol
575 10	13 13 21	R4			@10.0'; slightly porous	35.1	75.8	10.0-11.0	23		
570 15	4 4 6	S1		SC	Clayey SAND; dark to medium olive brown and orange brown, damp to wet, stiff, fine to medium grained, slightly micaceous, trace oxidation	26.8		15.0-17.0	7		
565 20	11 18 25	R5		Qoal SM	**OLDER ALLUVIUM** Silty SAND; orange brown and gray brown, damp to moist, dense to very dense, fine to medium grained, desiccated, abundant mottling, some oxidation	20.6	108.9	20.0-21.0	29		
560 25	1 1 1	S2		CL	Silty CLAY; olive brown, damp to moist, soft, fine grained, slightly oxidated and mottled, some pinhole pores and micaceous	36.2		25.0-27.0	1		
555 30	5 8	R6		CL	@30.0'; wet	49.4	69.1	30.0-31.0	15		Consol

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-8

Date: 4-17-15	**Project Name:** Richland-Chino
Project Number: G141194-10	**Logged By:** KRM
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"
Top of Hole Elevation (ft): 584'	**Hole Location:** See Geotechnical Map

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
	15				Total Depth: 31.5' No Groundwater No Caving						
550 — 35											
545 — 40											
540 — 45											
535 — 50											
530 — 55											
525 — 60											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-9

Date: 4-17-15	**Project Name:** Richland-Chino	Page 1 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):**	
Top of Hole Elevation (ft): 581'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
580				ML	**TOPSOIL** Sandy SILT; medium to light brown, dry, medium, fine to medium grained, slightly micaceous, roots and rootlets						
	9 9 10	R1		Qal ML	**YOUNGER ALLUVIUM** Clayey SILT; medium to light olive brown and orange brown, damp, stiff, fine to medium grained, desiccated, some mottling and pinhole pores	18.7	110.5	3.0-4.0	13		
575	5 5 7	R2			@6.0'; increased pinhole pores and roots	22.6	105.6	6.0-7.0	8		Consol
570	5 7 8	R3		CL	Silty CLAY; medium to light brown olive, damp, stiff, fine to medium grained, mottled, oxidation staining, some caliche and calcite nodules	20.5	107.2	9.0-10.0	10		
565	8 11 14	R4		Qoal SC	**OLDER ALLUVIUM** Clayey SAND; olive brown, damp, medium dense, fine to coarse grained, slightly oxidized and mottled, slightly micaceous	20.0	110.3	14.0-15.0	17		
560	5 7 9	S1			@19.0'; damp to moist	28.0		19.0-21.0	11		
555	7 8 9	R5		CL	Silty CLAY; olive brown and orange brown, wet, stiff, fine to medium grained, mottled, oxidized, slightly micaceous, pinhole pores, medium plasticity	40.8	83.7	24.0-25.0	11		
550	2 5 5	S2			@29.0'; moist to wet, abundant mottling	37.0		29.0-31.0	7		

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-9

Date: 4-17-15	**Project Name:** Richland-Chino	Page 2 of 2
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):**	
Top of Hole Elevation (ft): 581'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
550					Total Depth: 30.5' Groundwater at 29.0' No Caving						
35											
545											
40											
540											
45											
535											
50											
530											
55											
525											
60											
520											

Sample Legend

- SPT
- Ring Sample (CA modified)

Geotechnical Consulting

LGC

Geotechnical Boring Log B-10

Date: 4-17-15	**Project Name:** Richland-Chino	Page 1 of 1
Project Number: G141194-10	**Logged By:** KRM	
Drilling Company: 2R	**Type of Rig:** Hollow Stem Auger	
Drive Weight (lbs.): 140	**Drop (in.):** 30 **Hole Dia. (in.):** 8"	
Top of Hole Elevation (ft): 585'	**Hole Location:** See Geotechnical Map	

Elevation (MSL) and Depth (ft.)	Blow Count / 6"	Sample No.	Soil Graphic	Geologic / Group Symbol	DESCRIPTION	In-Situ Moist.(%)	Dry Density (pcf)	Standard Penetration Test SPT Depth	SPT N	CURVE 10 30 50	Type of Test
				ML	**TOPSOIL**						
	10 14 10	R1		Qal ML	Sandy SILT; light brown gray, dry, loose to medium dense, fine to medium grained, roots and rootlets, trace fine gravel	18.7	100.3	2.0-3.0	16		
					YOUNG ALLUVIUM						
580 — 5	17 18 44	R2		SC	Sandy SILT; light gray brown, dry to damp, very stiff, fine grained, desiccated, some mottling, pinhole pores and trace rootlets	22.6	96.4	5.0-6.0	42		
	5 9 11	R3		ML	Clayey SAND; light brown olive and gray, dry, very dense, fine to medium grained, highly desiccated, some caliche nodules, slightly micaceous and oxidized	23.0	103.2	8.0-9.0	13		
575 — 10	2 4 6	S1		ML	Clayey SILT; brown gray, damp, very stiff, fine to medium grained, slightly mottled, pinhole pores and rootcasts, slightly micaceous, trace oxidation and calcite nodules up to 0.5" @ 11.0'; fine to coarse grained, gravel lens from 11.5' to 11.7'	20.5		11.0-13.0	7		
570 — 15	8 14 18	R4		Qoal SW	**OLDER ALLUVIUM** Well Sorted SAND; olive brown and orange brown, damp, dense, fine grained, mottled, some pinhole pores and oxidation, slightly desiccated and micaceous	20.4	109.0	16.0-17.0	21		
565 — 20	3 3 4	S2		ML	Clayey SILT; brown olive, damp to moist, medium to stiff, fine grained, micaceous, slightly mottled and oxidized	42.5		21.0-23.0	5		
560 — 25	4 6 6	R5		CL	Silty CLAY; light brown olive and gray, moist, stiff, heavily desiccated, fine to medium grained, mottled, some oxidation, trace pinhole pores and coarse gravel up to 2"	37.7	84.3	26.0-27.0	8		
555 — 30					Total Depth: 27.5' No Groundwater No Caving						

Sample Legend
- SPT
- Ring Sample (CA modified)

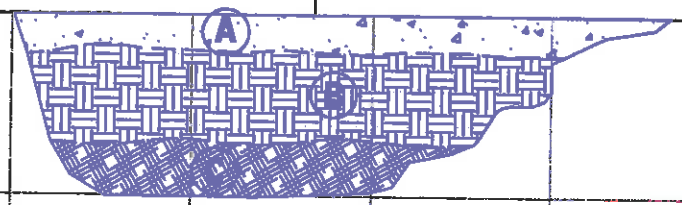
Geotechnical Consulting

LGC

Project Name: BICKMORE AVE	**Logged by:** KRM	**LOG OF TEST PIT TR-1**
Project Number: G141194-10	**Elevation:**	**Engineering Properties**
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15 — Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-1.0'	A TOPSOIL: Sandy SILT; medium to light olive brown, dry to damp, loose to medium dense, very fine to medium grained, desiccated in upper 1.0', porous		ML	--	--	--
1-3.5'	B WEATHERED ALLUVIUM: Silty SAND/Sandy SILT; dark to medium olive brown, dry to damp, dense/stiff. very fine to medium grained, highly porous (pinhole pores, pores and rootcasts up to 0.25", porosity decreases at 2.5'	Qal	SM/ML	Nuc @ 1.5'	21.1	95.9
3.5-5.0'	C ALLUVIUM: Silty SAND/Clayey SAND; dark to medium brown and olive brown, damp to moist, dense/stiff, very fine to medium grained, lens of abundant calcite nodules and caliche, some pinhole pores, trace mottling.	--	SM/SC	Nuc @ 3.0'	21.1	101.6
--		--	--	Nuc @ 5.0'	18.7	119.3
				--	--	--
				--	--	--

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N8E**



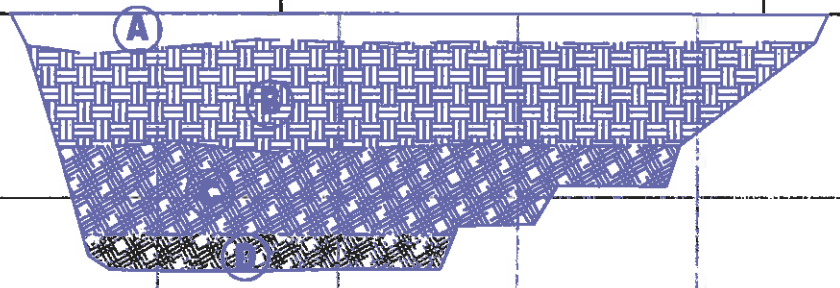
TOTAL DEPTH= 5.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	Logged by: KRM	LOG OF TEST PIT TR-2			
Project Number: G141194-10	Elevation:	Engineering Properties			
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP				

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-0.6'	A	TOPSOIL: Sandy SILT; medium to light olive brown, dry to damp, stiff, very fine to medium grained, desiccated, porous, roots and rootlets		ML	Bulk @ 0-2'	--	--
					--	--	--
0.6-3.5'	B	WEATHERED ALLUVIUM: Silty SAND/Sandy SILT; olive brown, dry to damp, dense/stiff. very fine to medium grained, highly porous (pinhole pores, pores up to 0.5"), trace rootlets	Qal	SM/ML	Nuc @ 2.0'	35.8	87.9
					--	--	--
3.5-6.0'	C	ALLUVIUM: Silty SAND/Clayey SAND; brown olive, damp to moist, medium dense/stiff, fine to coarse grained, trace caliche nodules, slightly mottled, pores and pinhole pores		SM/SC	--	--	--
					--	--	--
6.0-7.0'	D	ALLUVIUM: Clayey SAND; brown gray, damp to moist, stiff, very fine to medium grained, abundant caliche nodules, slightly mottled, some pinhole pores and rootcasts		SC	Nuc @ 7.0'	21.7	120.2
--			--	--	--	--	--
					--		

GRAPHICAL REPRESENTATION: EAST WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N5E



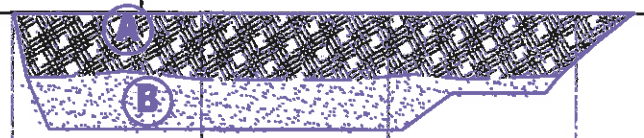
TOTAL DEPTH= 7.0 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	Logged by: KRM	LOG OF TEST PIT TR-3
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf
0-1.5'	A	ALLUVIUM: Silty SAND/Clayey SAND; brown gray and buff gray, dry, gets damp at 1.0', dense/stiff, very fine to medium grained, abundant caliche nodules, blocky in upper 0.8', pores up to 0.25" and voids up to 0.5", roots and rootlets	Qal	SM/SC	Bulk @ 0-1.0'	--	--
					Bulk @ 1.5-3.0'	--	--
					Nuc @ 2.0'	16.7	114.
1.5-3.0'	B	OLDER ALLUVIUM: Silty SAND; yellowish brown and orange brown, damp to moist, dense, fine to medium grained, pinhole pores, trace caliche, oxidation and rootlets	Qoal	SM	Nuc @ 3.0'	15.6	114.
--			--	--	--	--	--
--			--	--	--	--	--
--			--	--	--	--	--
--			--	--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N80E



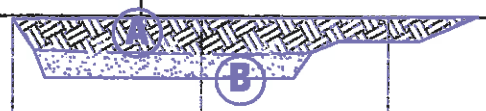
TOTAL DEPTH= 3.0 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-4
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Densit (pcf
0-0.8'	A	ALLUVIUM: Silty SAND/Clayey SAND; brown, dry, loose to medium dense, fine to coarse grained, highly desiccated, some fine gravel, abundant caliche nodules	Qal	SM/SC	--	--	--
					--	--	--
					Nuc @ 1.5'	18.0	105.
0.8-1.5'	B	OLDER ALLUVIUM: Silty SAND; yellowish brown, damp to moist, dense, fine to medium grained, slightly mottled, trace calcite nodules	Qoal	SM		--	--
					--	--	--
--			--	--	--	--	--
					--	--	--
--			--	--	--	--	--
					--		

GRAPHICAL REPRESENTATION: EAST WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N85E



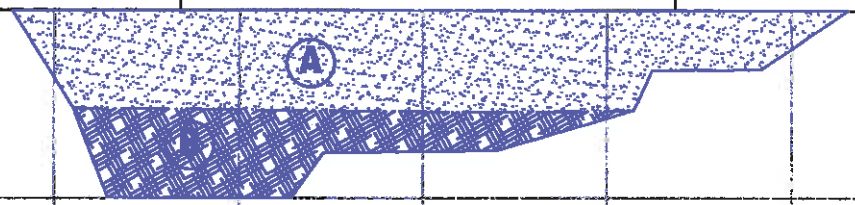
TOTAL DEPTH= 1.5 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	**Logged by:** KRM	**LOG OF TEST PIT TR-5**	
Project Number: G141194-10	**Elevation:**	**Engineering Properties**	
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP		

Depth	Date: 4/28/15 — Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-2.5'	A TOPSOIL: Clayey fine SAND; dark brown to black, dry to damp at 1.0', fine to medium grained, abundant pinhole pores and pores up to 0.25" with reduced porosity at 2.5', crushed stone placed in upper 0.3', slightly desiccated in upper 0.3', slightly mottled and micaceous		SC	Nuc @ 0.5'	9.0	111.4
2.5-5.0'	B ALLUVIUM: Silty SAND; dark to light orange brown and gray brown, dry to damp, dense, pinhole pores, slightly mottled, abundant caliche nodules at 4.0-5.0' up to 3", some clay, trace fine gravel and roothairs	Qal	SM	Bulk @ 2.5'-5.0'	--	--
				Nuc @ 5.0'	23.6	111.2

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N85E**



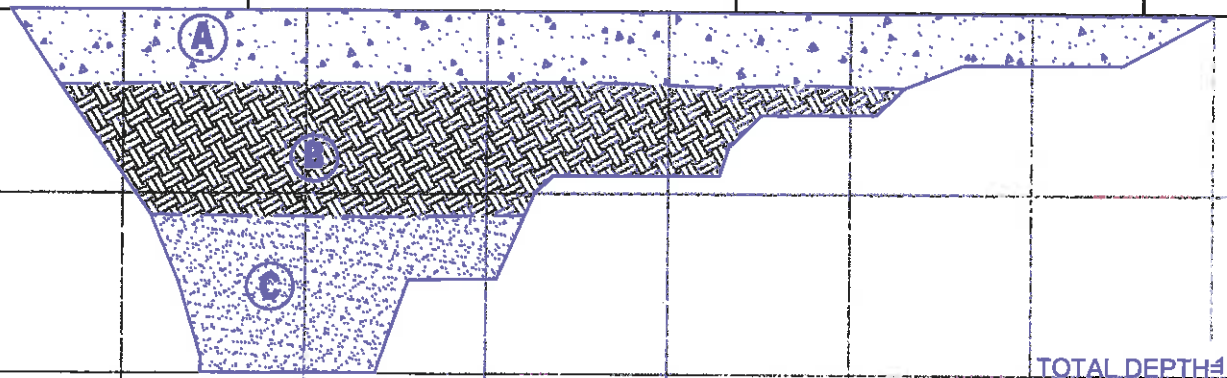
TOTAL DEPTH= 5.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-6
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-2.0'	A TOPSOIL: Sandy SILT; medium to light brown and gray brown, dry, soft to firm, very fine to medium grained, highly desiccated with abundant voids up to 0.5", roots and rootlets		ML	Bulk @ 1.5' - 4.5'	--	--
2-5.5'	B ALLUVIUM: Clayey SILT; light gray and olive gray, dry, stiff to very stiff, abundant pinhole pores and pores, desiccated, trace caliche and rootlets along desiccation fractures	Qal	CL	--	--	--
5.5-10.0'	C OLDER ALLUVIUM: Well-Sorted Fine SAND; yellowish gray, gray brown, dry to damp below 9.0', dense to very dense, fine grained, friable, rootcasts, trace oxidation, slightly micaceous	Qoal	SW	--	--	--
--		--	--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N4E



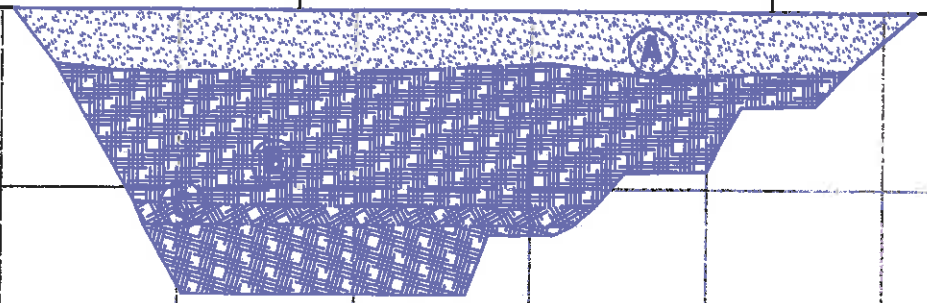
TOTAL DEPTH=10.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	**Logged by:** KRM	**LOG OF TEST PIT TR-7**
Project Number: G141194-10	**Elevation:**	**Engineering Properties**
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15 — Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-1.3	A ARTIFICIAL FILL, UNDOCUMENTED: Silty SAND; yellowish brown and olive brown, dry to damp, medium dense to dense, very fine to coarse grained, desiccated, abundant gravel locally, layers visible	Afu	SM	Bulk @ 1.0'-4.0'	--	--
1.3-5.5'	B ALLUVIUM: Silty SAND/Sandy SILT; dark to medium brown and olive brown, damp to moist, dense/stiff, very fine to medium grained, increased moisture at 4.8', some pinhole pores, massive, some clay	Qal	SM/ML		--	--
5.5-6.0'	Clayey SAND; medium to light brown gray, damp, dense to very dense very fine to medium grained, pores and pinhole pores, slightly desiccated, trace rootcasts		SC		--	--
6-8.0'	Silty SAND/Clayey SAND; dark to medium gray brown, damp to moist, dense, stiff to very stiff, fine to medium grained, increased moisture at 7.0', generally massive	--	SM/SC	Nuc @ 6.0'	19.7	103.1

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N4E**



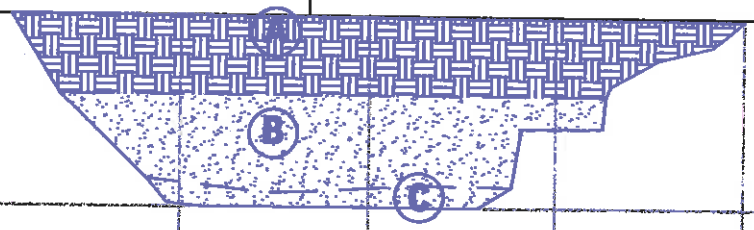
TOTAL DEPTH= 8.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-8
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Densit (pcf)
0-2.0	A	TOPSOIL/WEATHERED ALLUVIUM: Silty SAND; dark brown, dry to damp, loose to medium dense, very fine to medium grained, micaceous, trace clay and gravel		SM	--	--	--
2-4.5'	B	OLDER ALLUVIUM: Silty SAND/Sandy SILT; yellowish brown, damp to moist, dense/stiff, very fine to medium grained, slightly porous and micaeous	Qoal	SM/SC	--	--	--
4.5-5.0'	C	Clayey SAND; yellowish brown and brown yellow, damp to moist, stiff, very fine to medium grained, pinhole pores and pores, trace oxidation		SC	--	--	--
--			--	--	--	--	--
--			--	--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N10E



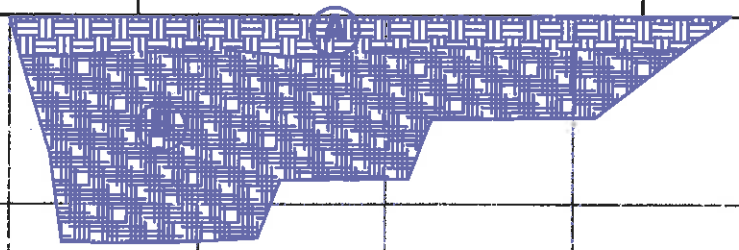
TOTAL DEPTH= 5.0 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-9
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf
0-0.75'	A	TOPSOIL/WEATHERED ALLUVIUM: Silty SAND; dark to medium brown, dry to damp, loose to medium dense, fine to coarse grained, some fine gravel and rootlets	Qal	SM/SC	Bulk @ 0-0.5'	--	--
						--	--
	B	ALLUVIUM;		CL	Bulk @ 2'-3'	--	--
0.75-6.0'		Silty CLAY; dark brown and medium to light brown gray, dry to moist, stiff, very fine to medium grained, slightly porous from 0.75-1.5', highly porous below 1.5', abundant rootcasts, dry and desiccated between 1.5-3.0', some fine coarse caliche nodules			--	--	--
					Nuc @ 6.0'	27.6	113.
					--	--	--
--			--	--	--	--	--
					--	--	--
--			--	--	--	--	--
					--		

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N8E



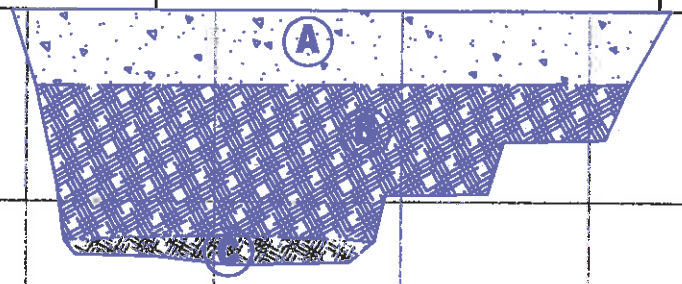
TOTAL DEPTH= 6.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-10
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Densit (pcf
0-1.9'	A	TOPSOIL: Silty SAND; dark brown, dry to damp. loose to medium dense, fine to medium grained, blocky in upper 0.5', occasional pinhole pores, trace fine gravel and rootlets		SM	--	--	--
1.9-6.0'	B	ALLUVIUM: Silty SAND/Clayey SAND; dark to medium brown, and gray brown, damp to moist, dense/stiff, highly porous between 1,9-5.0', abundant caliche from 1.9-3.0', slightly mottled	Qal	SM/SC	Nuc @ 4.0'	15.3	118.
6-6.5'	C	Sandy CLAY; light brown gray, dry to damp, stiff, very fine to fine grained, abundant calcite nodules		CL	Nuc @ 6.5'	25.1	121.3

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N2E**



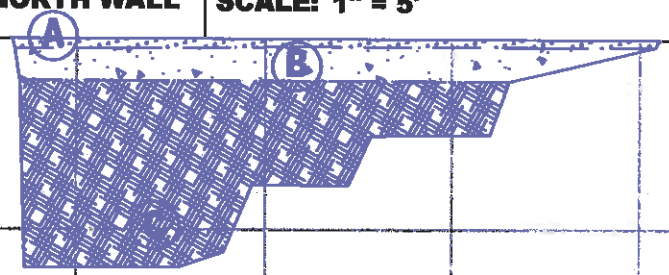
TOTAL DEPTH= 6.5' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-11
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Densit (pcf
0-0.3'	A	MANURE: ORGANICS; orange brown, dry, loose to medium dense, desiccated and blocky			Bulk @ 0-0.3'	--	--
						--	--
0.3-1.0'	B	ARTIFICIAL FILL, UNDOCUMENTED: Silty SAND/Sandy SILT; blackish brown, brownish orange and olive brown, dry to damp, medium dense, stiff, fine to coarse grained, layering visible, lenses of organics	Afu	SM/ML	Bulk @ 0.3'-1.0'	--	--
						--	--
					--		
					--	--	--
					--	--	--
1.0-6.0'	C	ALLUVIUM: Sandy SILT; medium to light olive brown, dry with increased moisture at 3.5' to damp, stiff, very fine to medium grained, slightly mottled, massive, porous from 1.0-4.0', fine gravel and oxidation, trace clay	Qal	ML	Nuc @ 6.0'	27.2	100.
					--	--	--
--			--	--	--	--	--
					--		

GRAPHICAL REPRESENTATION: NORTH WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N85E**



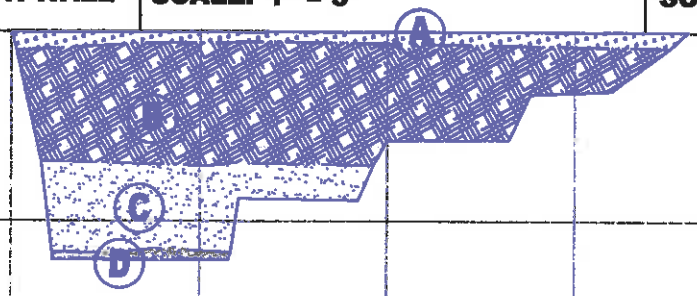
TOTAL DEPTH= 6.0 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-12
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Densit (pcf
0-0.3'	A	MANURE: ORGANICS; orange brown, dry, loose to medium dense, desiccated and blocky			--	--	--
0.3-3.5'	B	ALLUVIUM: Sandy SILT; dark to medium olive brown, dry to damp, stiff to very stiff, very fine to medium grained, abundant pinhole pores, pores and rootcasts up to 0.25", resiccated, trace caliche	Qal	ML	--	--	--
3.5-5.8'	C	OLDER ALLUVIUM: Clayey SAND; yellow brown and tan brown, damp, stiff to very stiff, very fine to medium grained, some pinhole pores, calcite nodules at 4.4-4.7', slightly mottled	Qoal	SC	--	--	--
5.8-6.0'	D	Sandy CLAY; light brown gray, dry to damp, stiff, very fine to fine grained, abundant calcite nodules		CL	--	--	--
--			--	--	Nuc @ 6.0'	24.8	118.
					--	--	--

GRAPHICAL REPRESENTATION: NORTH WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N85E**



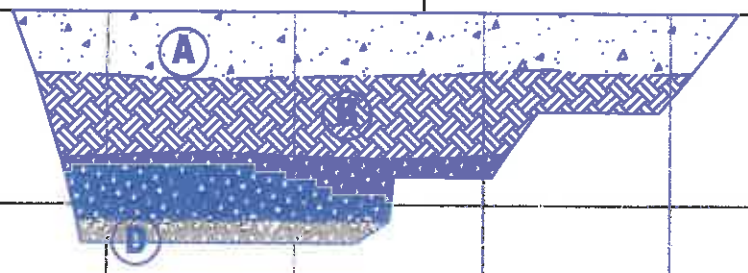
TOTAL DEPTH=6.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-13
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 4/28/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-1.3'	A	TOPSOIL: Silty SAND; dark to medium brown, dry to damp, loose to dense, fine to coarse grained, slightly desiccated, some pores and pinhole pores and roots/rootlets		SM	--	--	--
					--	--	--
1.3-3.8'	B	ALLUVIUM: Sandy SILT; dark olive brown, damp, stiff to very stiff, fine to medium grained, lighly porous with rootcasts up to 1/8"	Qal	ML	Nuc @ 2.0'	30.1	91.3
					Nuc @ 3.0'	21.1	109.
3.8-5.3'	C	OLDER ALLUVIUM: Clayey SAND; yellow brown, damp to moist, stiff, fine to coarse grained, some pinhole pores, trace oxidation and mottling	Qoal	SC	Nuc @ 4.0'	19.0	122.
					Nuc @ 5.0'	23.8	124.
5.3-6.0'	D	Sandy CLAY; olive gray, damp to moist, stiff to very stiff, very fine to medium grained, slightly desiccated locally, abundant calcite nodules, trace pinhole pores		CL	Nuc @ 6.0'	22.5	113.
--				--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N5E



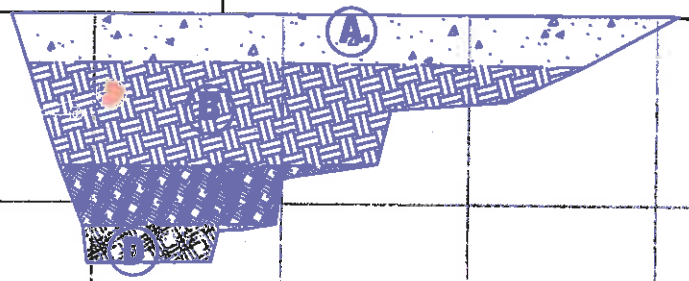
TOTAL DEPTH= 6.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	Logged by: KRM	LOG OF TEST PIT TR-14
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 5/6/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Densit (pcf)
0-1.2	A	TOPSOIL: Sandy SILT; dark to medium brown and orange brown, dry to damp, stiff, fine to medium grained, roots and rootlets		ML	--	--	--
1.2-4.0'	B	ALLUVIUM: Silty SAND/Sandy SILT; dark gray brown, damp, medium dense/stiff, very fine to medium grained, desiccated, abundant pinhole pores, pores and rootcasts, slightly mottled and micaceous, krotovinas ranging in size from 2" to 8"	Qal	SM/ML	Nuc @ 2.0'	26.4	98.4
4.0-5.5'	C	Clayey SAND; yellow brown, damp to moist, dense, fine to coarse grained, slightly mottled, trace pinhole pores, oxidation and roothairs		SC	Nuc @ 4.0'	18.2	113.
5.5-6.5'	D	Sandy CLAY; light gray, dry to moist, stiff, very fine to medium grained, slighly desiccated, abundant caliche and calcite nodules from 1/8- 3" in diameter		CL	Nuc @ 5.0'	18.7	117.
--			--	--	Nuc @ 6.0'	18.2	121.

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N6E



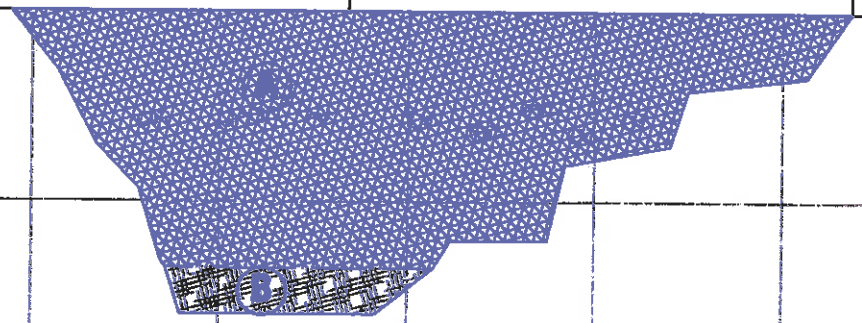
TOTAL DEPTH= 6.5' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	Logged by: KRM	LOG OF TEST PIT TR-15
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 5/6/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-6.5'	A	ARTIFICIAL FILL, UNDOCUMENTED: Silty SAND/CLayey SAND; medium to light olive brown, dark green gray and brown gray, damp to moist, medium dense, fine to very coarse grained, abundant lenses of fine to coarse gravel and organics, layering and debris visible, caving at 5.0', strong chemical/petroleum odor	Afu	SM/SC	Bulk @0'-6.0'	--	--
					Nuc @ 3.0'	44.7	91.1
6.5-8.0'	B	ALLUVIUM: Silty SAND/Sandy CLAY; pale green gray, damp to moist, dense/very stiff, fine to medium grained, some pinhole pores, slightly desiccated and mottled, trace fine gravel, chemical/petroleum odor	Qal	SM/CL	--	--	--
--			--	--	--	--	--
--			--	--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL	SCALE: 1" = 5'	SURFACE SLOPE: LEVEL	TREND: N5W



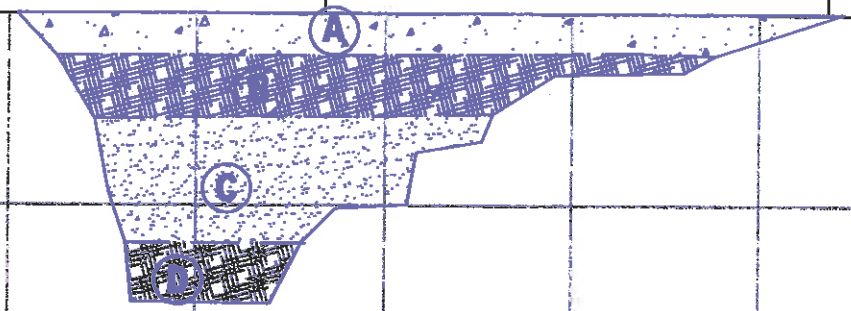
TOTAL DEPTH= 8.0' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	**Logged by:** KRM	**LOG OF TEST PIT TR-16**	
Project Number: G141194-10	**Elevation:**	**Engineering Properties**	
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP		

Depth	Date: 5/6/15 — Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-1.0'	A ARTIFICIAL FILL, UNDOCUMENTED/TOPSOIL: Silty SAND; light brown gray and tannish brown, dry, loose to medium dense, fine to medium dense, blocky with voids up to 1", roots and rootlets, trace debris	Afu	SM	--	--	--
1.0-2.5'	B ALLUVIUM: Silty SAND/Sandy SILT; olive brown and brown orange, dry, dense/stiff, fine to medium grained, highly desiccated, abundant porosity, fine to coarse gravel from 2.0-2.5', some calcite nodules	Qal	SM/ML	--	--	--
2.5-6.0'	C OLDER ALLUVIUM: Silty SAND/Clayey SAND; orange brown and yellowish brown, dry to damp, stiff to very stiff, fine to coarse grained, some mottling, massive, increased moisture at 5.0', trace pinhole pores	Qoal	SM/SC	Nuc @ 2.5'	17.3	105.
6-7.5'	D Silty CLAY; light gray and plae green gray, damp to moist, very stiff, fine to medium grained, some calcite nodules, trace oxidation		CL	Nuc @ 7.5'	16.9	128.
--		--	--	--	--	--

GRAPHICAL REPRESENTATION: NORTH WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N86E**



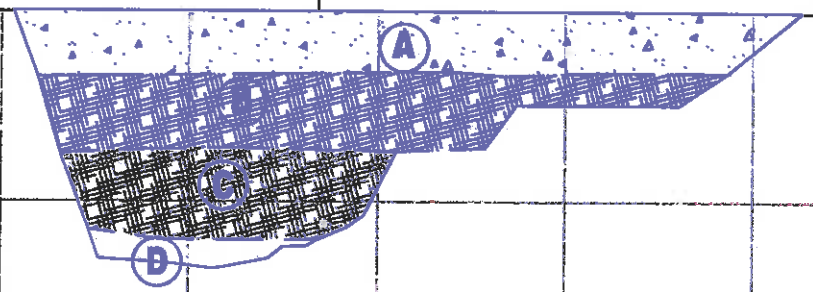
TOTAL DEPTH= 7.5' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-17
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 5/6/15 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-1.5'	A TOPSOIL: Silty SAND; dark to medium brown, dry to moist, medium dense, fine to medium grained, occasional 1" voids, roots and rootlets, trace pores		SM	--	--	--
				--	--	--
1.5-3.5'	B ALLUVIUM: Sandy SILT; dark to medium gray brown, moist to wet, medium stiff with soft lens locally, fine to medium grained, abundant porosity, roots common	Qal	ML	Nuc @ 2.0'	41.6	94.8
				Nuc @ 4.0'	27.6	118.
3.5-6.0'	C Clayey SAND; olive gray and pale green gray, moist, stiff to very stiff, fine to coarse grained, some pinhole pores and pores, slightly desiccated and mottled, calcite nodules at 3.5'		SC	Nuc @ 5.0'	27.3	113.
6-6.5'	D Sandy CLAY; medium to light brown gray, moist, stiff, fine to medium grained, some thinly laminated lenses of silty sand, trace mica		CL	Nuc @ 6.5'	38.7	100.
--		--	--	--	--	--

GRAPHICAL REPRESENTATION: NORTH WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N85E**



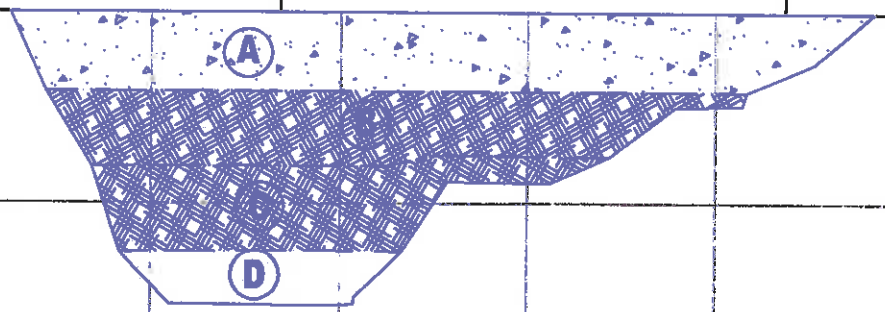
TOTAL DEPTH= 6.5' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: BICKMORE AVE	Logged by: KRM	LOG OF TEST PIT TR-18
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 5/6/15	Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf
0-2.0'	A	ARTIFICIAL FILL, UNDOCUMENTED: Sandy SILT; dark to medium gray brown, dry, stiff to very stiff, fine to medium grained, voids in upper 0.5', slightly micaceous, trace pinhole pores and gravel	Afu	ML	--	--	--
2.0-4.0'	B	ALLUVIUM: Silty SAND/Sandy SILT; gray brown and brown gray, dry to damp, dense/stiff, fine to medium grained, abundant porosity, slightly micaceous and mottled	Qal	SM/ML	--	--	--
4.0-6.2'	C	OLDER ALLUVIUM: Sandy SILT; dark brown, pale tan brown, damp to moist, stiff, fine to medium grained, slightly desiccated, massive, some mottling and clay, trace roots/rootlets	Qoal	ML	--	--	--
6.2-7.5	D	Silty CLAY; olive white and tannish white, plae green gray, moist, stiff, very fine to medium grained, abundant calcite nodules at 6-6.5', moderately to highly mottled, trace roots/rootlets		CL	--	--	--
--			--	--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N5W**



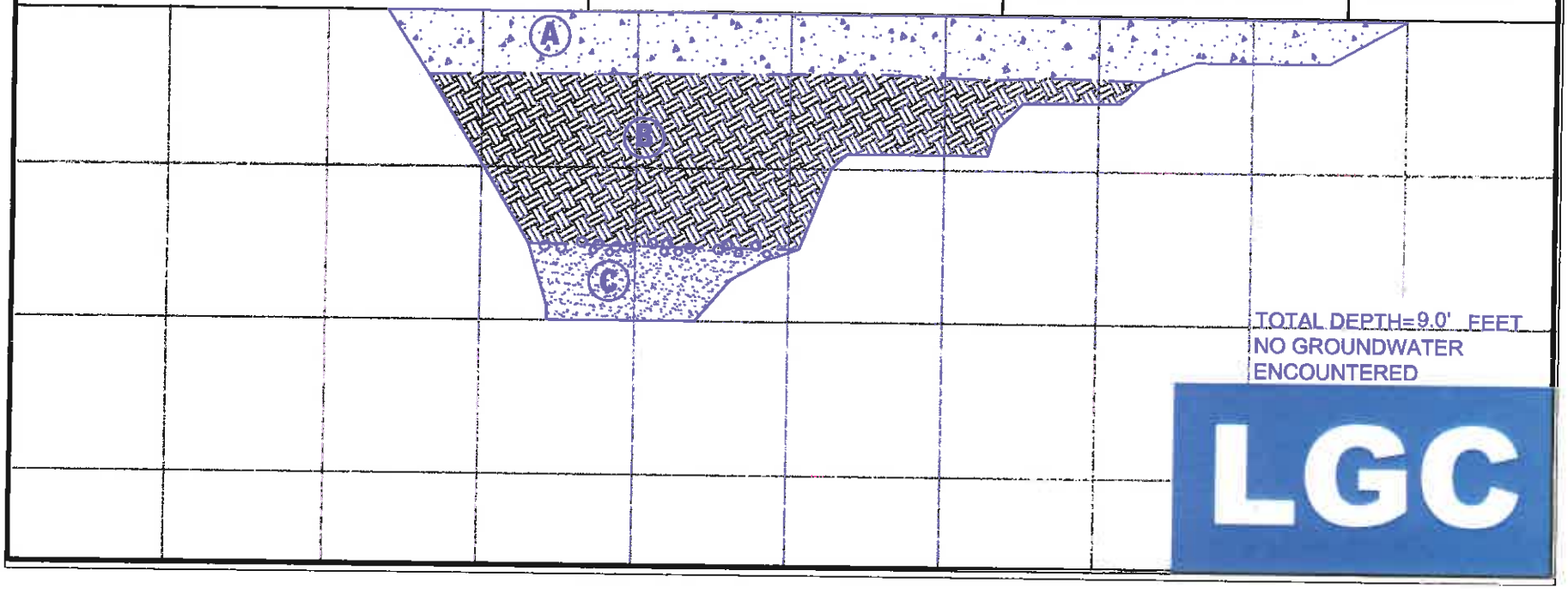
TOTAL DEPTH= 7.5' FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	**Logged by:** KRM	**LOG OF TEST PIT TR-19**
Project Number: G141194-10	**Elevation:**	**Engineering Properties**
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP	

Depth	Date: 3/17/16 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-3.8'	A TOPSOIL: Sandy SILT; dark brown and gray brown, dry, loose to medium dense, very fine to medium grained, slight porosity, roots and rootlets		ML	bULK @ 0-1.0'	--	--
				--	--	--
3.8-7.5'	B ALLUVIUM: Clayey SILT; medium to light olive and olive gray, dry to damp @ 5.5', stiff to very stiff, some pinhole pores and pores, decreased porosity @ 6.0', occasional caliche nodules and stringers, roothairs and rootcasts	Qal	ML	Nuc @ 3.5'	11.7	105.8
				--	--	--
7.5-9.0'	C Clayey SILT/Silty CLAY; light olive gray, olive brown, damp to moist, moist at 8.6', stiff to very stiff, very fine to medium grained, abundant caliche nodules from 7.5-7.8', some pinhole pores and pores			Nuc @ 5.5'	16.2	106.0
--				--	--	--
			ML/CL	--	--	--
				--	--	--
		--	--	--	--	--
				--		

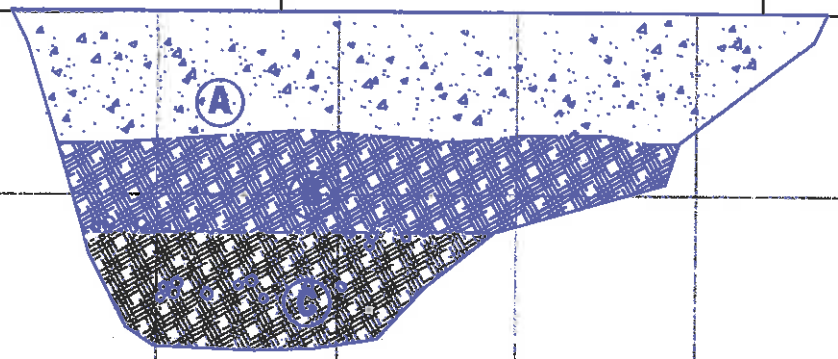
GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N4E**



Project Name: RICHLAND-CHINO	**Logged by:** KRM	**LOG OF TEST PIT TR-20**	
Project Number: G141194-10	**Elevation:**	**Engineering Properties**	
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP		

Depth	Date: 3/17/16 — Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-3.4'	A TOPSOIL: Silty SAND/Sandy SILT; medium to light olive brown, dry to damp @0.8', loose to medium dense, fine to medium grained, abundant porosity up to ⅛ ", clay stringers, roots and rootlets, organics in upper 1.0'		SM/ML	Bulk @ 0-1.0'	--	--
				--	--	--
3.4-6.0'	B ALLUVUIM: Clayey SILT; medium to light olive gray, damp to moist, stiff to very stiff, very fine to medium grained, occasional caliche nodules and stringers, porous to 5.5'	Qal	ML	Nuc @ 4.0'	14.3	105.2
				--	--	--
6.0-9.5'	C Silty CLAY; light gray, pale brown gray, damp to moist, very stiff, very fine to fine grained, medium plasticity, abundant caliche nodules @ 7.8-8.3', some porosity			--	--	--
			CL	--	--	--
				--	--	--
				--	--	--
--		--	--	--	--	--
				--		

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N2E**



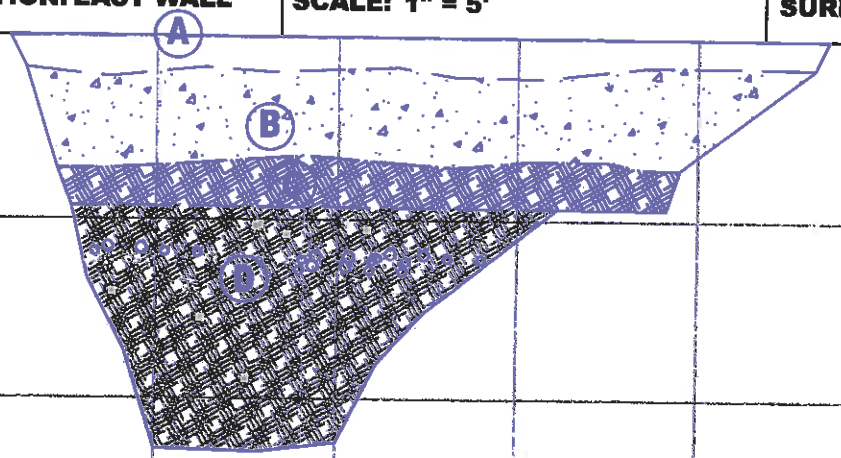
TOTAL DEPTH= 9.5 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	**Logged by:** KRM	**LOG OF TEST PIT TR-21**	
Project Number: G141194-10	**Elevation:**	**Engineering Properties**	
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP		

Depth	Date: 3/17/16 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-1.0'	A ARTIFICIAL FILL, UNDOCUMENTED: Sandy SILT; medium to light olive brown, dry to damp, stiff, very fine to medium grained, desiccated, porous, roots and rootlets, some organics	Afu	ML	Bulk @ 0-1.0'	--	--
1.0-3.2'	B Silty SAND/Sandy SILT; olive brown, dry to damp, increased moisture at 3.5', dense/stiff. very fine to medium grained, blocky in the upper 0.4', trace fine to coarse gravel, some clay and debris		SM/ML	--	--	--
3.2-4.5'	C ALLUVIUM: Clayey SILT/Silty CLAY; olive gray, damp, stiff, very fine to fine grained, abundant pores and pinhole pores up to ⅛", trace caliche nodules	Qal	ML/CL	Nuc @ 4.0' Bulk @ 4.0-5.0'	15.8	103.6
4.5-11.5'	D Silty CLAY; light gray, light olive gray, dry to damp with increased moisture at 8.0', stiff, very fine to fine grained, desiccated in upper 2.5', caliche, calcite nodules, massive , medium plasticity		CL	--	--	--
--		--	--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N80E**



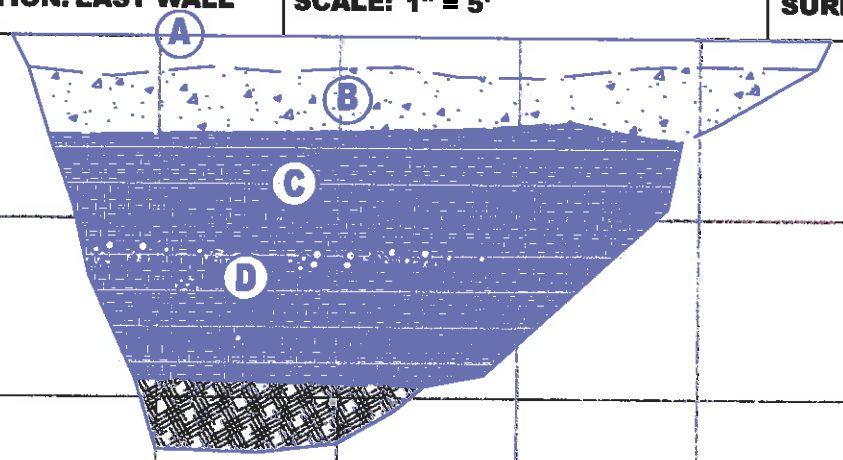
TOTAL DEPTH=11.5 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	**Logged by:** KRM	**LOG OF TEST PIT TR-22**	
Project Number: G141194-10	**Elevation:**	**Engineering Properties**	
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP		

Depth	Date: 3/17/16 — Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-0.8'	A ARTIFICIAL FILL, UNDOCUMENTED: Sandy SILT; medium to light olive brown, dry to damp, stiff, very fine to medium grained, desiccated, porous, roots and rootlets, some organics	Afu	ML	Bulk @ 0-1.0'	--	--
0.8-2.3'	B Silty SAND/Sandy SILT; olive brown, dry to damp, increased moisture at 3.5', dense/stiff. very fine to medium grained, blocky in the upper 0.4', trace fine to coarse gravel, some clay and debris		SM/ML	--	--	--
2.3-9.8'	C ALLUVIUM: Silty CLAY; medium to dark olive gray, damp to moist @5.0', stiff, very fine to fine grained, abundant pores and pinhole pores up to ⅛", trace caliche nodules	Qal	CL	Nuc @ 5.0'	14.9	109.1
9.8-10.5'	D Silty CLAY; light gray, light olive gray, moist', stiff, very fine to fine grained, desiccated in upper 2.5', caliche, calcite nodules, massive, medium plasticity		CL	--	--	--
--		--	--	--	--	--

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N82E**



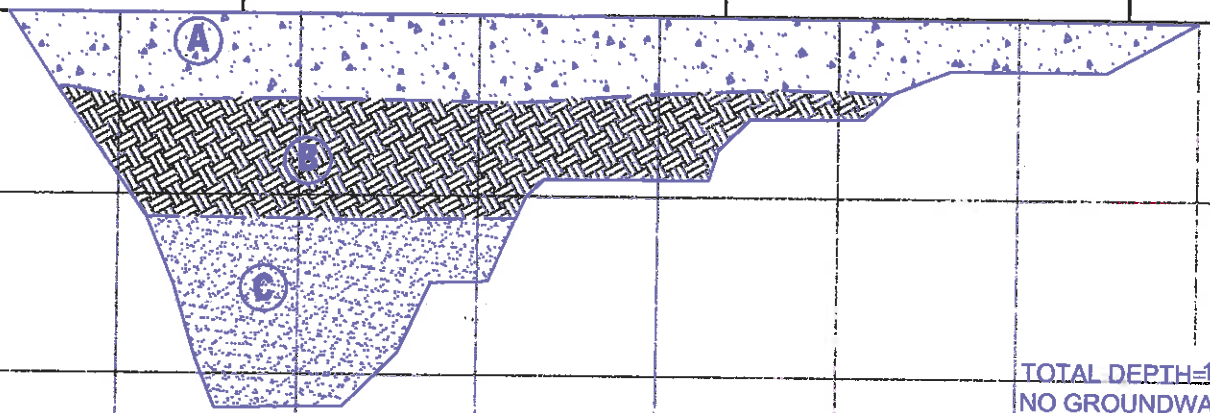
TOTAL DEPTH=10.5 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	**Logged by:** KRM	**LOG OF TEST PIT TR-23**	
Project Number: G141194-10	**Elevation:**	**Engineering Properties**	
Equipment:	**Location/Grid:** SEE GEOTECHNICAL MAP		

Depth	Date: 3-17-16 Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-2.2'	A TOPSOIL: Sandy SILT; medium to light brown and gray brown, dry, soft to stiff, very fine to medium grained, highly desiccated with abundant voids up to 0.5", roots and rootlets, abundant organics in upper 1.0'		ML	Bulk @ 0-1.0'	--	--
2.2-6.3'	B ALLUVIUM: Clayey SILT; medium to light gray and olive gray, dry, stiff to very stiff, abundant pinhole pores and pores, desiccated, trace caliche and rootlets along desiccation fractures	Qal	ML	Nuc @ 4.0'	16.9	91.7
				Nuc @ 5.5'	15.9	102.8
6.3-11.0'	C Silty CLAY; light gray, light olive gray, moist, stiff, very fine to fine grained, caliche, calcite nodules, massive, medium plasticity		CL	Bulk @ 6.0-7.0'	--	--

GRAPHICAL REPRESENTATION: EAST WALL | **SCALE: 1" = 5'** | **SURFACE SLOPE: LEVEL** | **TREND: N8E**



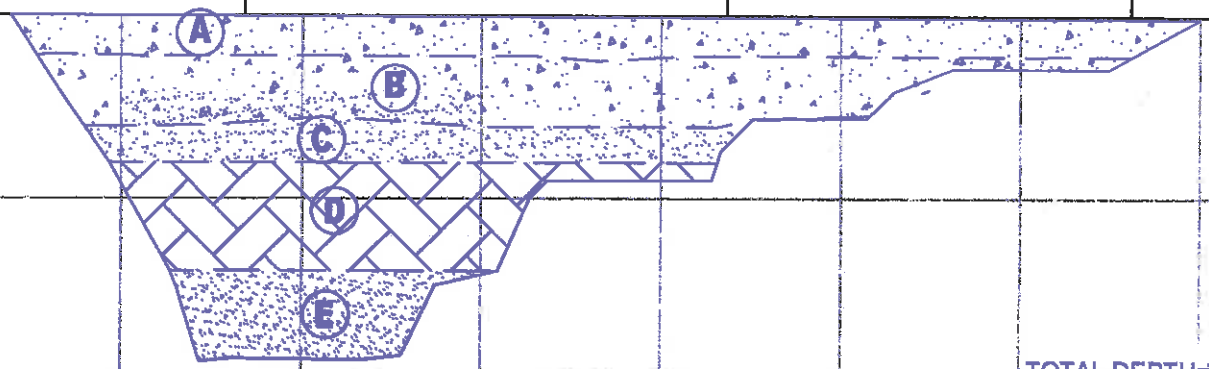
TOTAL DEPTH=11.0 FEET
NO GROUNDWATER ENCOUNTERED

LGC

Project Name: RICHLAND-CHINO	Logged by: RLG	LOG OF TEST PIT TR-24
Project Number: G141194-10	Elevation:	Engineering Properties
Equipment:	Location/Grid: SEE GEOTECHNICAL MAP	

Depth	Date: 3-25-16 / Description:	Geologic Unit	USCS	Sample No.	Moisture (%)	Dry Density (pcf)
0-1.0'	A ARTIFICIAL FILL, UNDOCUMENTED: Silty SAND/Sandy SILT; dark gray brown, dry to damp, loose and soft, trace manure and organics, abundant rootlets	Afu	SM/ML	--	--	--
1.0-3.0'	B TOPSOIL: Sandy SILT/Silty SAND; medium to dark gray brown dry, soft to stiff/loose to medium dense, fine grained, porous	Qal	ML/SM	--	--	--
3.0-4.0'	C ALLUVIUM: Sandy SILT; light to medium yellowish gray to brownish gray, damp, firm to stiff, slightly porous, some caliche, rootlets, weathered and trace of clay		ML	--	--	--
4.0-7.0'	D Silty SAND/Sandy SILT; light yellowish brown, damp to moist, medium dense to dense/stiff, slightly porous, trace of clay		SM/ML	Bulk 4.0-7.0'	--	--
7.0-9.5'	E OLDER ALLUVIUM: Clayey SAND/Sandy CLAY; light gray brown, light gray, moist/very moist, dense/ stiff/dense, some pinhole pores, slightly oxidized, traces of carbon, abundant caliche	Qoal	SC/CL	Nuc @ 4.5'	13.9	95.2
					--	--

GRAPHICAL REPRESENTATION: EAST WALL | SCALE: 1" = 5' | SURFACE SLOPE: LEVEL | TREND: N8E



TOTAL DEPTH=11.0 FEET
NO GROUNDWATER ENCOUNTERED

LGC

APPENDIX B-1

PREVIOUS BORING LOGS BY LEIGHTON AND ASSOCIATES, INC.

GEOTECHNICAL BORING LOG LB-1

Project No.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	578'
Location	Southwest end of site (See Geotechnical Map)	**Sampled By**	S. Richards

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*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								**Alluvium**	
				B-1						EI
575				R-1	16 28 50/4"	120	13	ML	@2': SILT, hard, light brown, slightly moist, trace sand, slight porosity, siltstone pieces at sampler tip	
	5			R-2	8 14 16	98	23	ML	@5': SILT, very stiff, light brown, slightly moist, trace fine sand, some pores	
570										
	10			R-3	9 14 22	115	17	ML	@10': SILT with sand, very stiff, olive brown, moist, trace fine gravel, thin layers of interbedded light brown silt, some oxidation	
565										
	15			S-1	12 27 23			SP-SM	@15': Poorly graded SAND with silt and gravel, very dense, brown, moist, fine to medium sand with fine to medium gravel	
560										
	20			R-4	16 26 37	103	8	SP	@20': Poorly graded SAND, dense, light brown to brown, fine sand	
555										
	25			S-2	4 2 4			CL	@25': LEAN CLAY with sand, medium stiff, brown, very moist, trace fine sand, fine gravel, LL = 42, PI = 20, gravel 5%, sand 11%, fines 84%	AL, SA
550									Groundwater depth 27.7 feet at 7:43 AM Groundwater depth 28.5 feet at 8:00 AM	
	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.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	582'
Location	West end of site (See Geotechnical Map)	**Sampled By**	S. Richards

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								**Alluvium**	
580				R-1	8 10 15	99	23	SM	@2': SILTY SAND, medium dense, dark brown to black, slightly moist, fine to medium sand, stringers, gypsum, rootlets	
	5			R-2	10 12 12	101	22	ML	@5': SILT with sand, stiff, light brown, slightly moist, fine sand	
575										
	10			R-3	9 11 15	104	21	ML	@10': SILT with sand and gravel, very stiff, light brown, slightly moist, some oxidation	
570									**Total depth of boring 11.5 feet** **Groundwater not encountered** **Slotted pipe and pea gravel inserted in hole for percolation testing and removed following testing** **Backfilled with cuttings 5/23/2012**	
	15									
565										
	20									
560										
	25									
555										
	30									

The 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

*** 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.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	584'
Location	East end of site (See Geotechnical Map)	**Sampled By**	S. Richards

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								*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.*	
									Alluvum	
				R-1	14 20 27	92	24	ML	@2': SILT with sand, very stiff, brown to dark brown, slightly moist, fine sand, trace fine gravel, some rootlets	
580	5			R-2 B-1	14 20 23	116	16	ML	@5': SILT with gravel, medium dense, light brown to brown, slightly moist, fine gravel, angular, minor porosity, weathered gravel	CR, MD
575	10			R-3	8 15 15	107	19	ML	@10': SILT with gravel, medium dense, light brown, moist, fine gravel, angular, some porosity, weathered	
570	15			S-1	10 16 24	117	17	ML	@15': SANDY SILT, medium dense, brown, moist, fine sand with trace coarse sand and fine gravel, interbedded silt and silty sand, slight porosity	
565	20			R-4	5 11 17	91	30	ML	@20': SILT, very stiff, brown, moist, fine sand, highly weathered siltstone, abundant mica, gray zones, LL = 33, PI = 8	AL
560	25			S-2	6 9 7			ML	@25': SANDY SILT, very stiff, brown, moist, fine sand, LL = 31, PI = 10	AL
555	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.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	584'
Location	East end of site (See Geotechnical Map)	**Sampled By**	S. Richards

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
	30			S-3	3 3 3			CL	@30': LEAN CLAY, medium stiff, brown, very moist, abundant mica, LL = 47, PI = 25	AL
550									Groundwater depth 33.3 feet at 10:14 AM Groundwater depth 33.8 feet at 10:04 AM	
	35			S-4	2 1 4			CL	@35': LEAN CLAY, medium stiff, brown, very moist, abundant mica	
545										
	40			S-5	2 3 7			ML	@40': SANDY SILT, stiff, brown, moist, fine sand	
540										
	45			S-6	7 8 10			CL	@45': SANDY LEAN CLAY with gravel, very stiff, brown, fine gravel, subangular, some oxidation, fines 60%, LL = 43, PI = 23	-200, AL
535										
	50			S-7	8 9 13			CL	@50': SANDY LEAN CLAY with gravel, very stiff, brown, fine gravel, subangular, some oxidation	
									Total depth of boring 51.5 feet **Depth to groundwater 33.8 feet at 10:04 AM 5/23/2012** **Depth to groundwater 33.3 feet at 10:14 AM 5/23/2012** **Backfilled with cuttings 5/23/2012**	
530										
	55									
525										
	60									

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-4

Project No.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	585'
Location	Northwest end of site (See Geotechnical Map)	**Sampled By**	S. Richards

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.	
585	0								**Alluvium**	
				R-1	5 9 10	91	28	ML	@2': SILT, very stiff, dark brown, slightly moist, blocky texture, rootlets	
580	5			R-2	5 8 9	112	18	ML	@5': SANDY SILT, very stiff, dark brown to brown, slightly moist, fine sand, rootlets	CO
575	10			R-3 B-1	6 9 12			ML	@10': SILT, very stiff, gray, slightly moist, slightly mottled, angular siltstone fragments, gray fine sand at sampler shoe	CO
570	15			S-1	8 12 14	108	20	ML	@15': SANDY SILT, very stiff, brown, slightly moist, gray zones, some oxidation, minor porosity	
565	20			R-4	3 8 10			ML	@20': SILT with sand, stiff, brown, moist, fine sand, mica, LL = 29, PI = 5	AL
560	25			S-2	4 9 8			ML	@25': SILT with sand, stiff, brown, moist, fine sand, mica, fines 74%	-200
555	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		

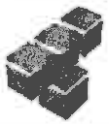
GEOTECHNICAL BORING LOG LB-4

Project No.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	585'
Location	Northwest end of site (See Geotechnical Map)	**Sampled By**	S. Richards

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.	
555	30			S-3	2 3 3			CL	@30': LEAN CLAY, medium stiff, brown to light brown, very moist, LL = 43, PI = 22	AL
550	35			S-4	3 4 5			CL	@35': LEAN CLAY with gravel, stiff, light brown, moist, fine gravel, sand 13%, fines 87%	SA
545	40			S-5	5 6 9			CL	@40': LEAN CLAY with gravel, stiff, light brown, very moist, fine gravel Groundwater depth 40.8 feet at 12:30 PM Groundwater depth 43.5 feet at 12:05 PM	
540	45			S-6	4 3 6			CL	@45': LEAN CLAY with sand, stiff, light brown, moist, fine sand, trace clay	
535	50			S-7	4 3 4			CL	@50': LEAN CLAY with gravel, medium stiff, light brown to light gray, wet	
									Total depth of boring 51.5 feet **Depth to groundwater 43.5 feet at 12:05 PM 5/23/2012** **Depth to groundwater 40.8 feet at 12:30 AM 5/23/2012** **Backfilled with cuttings 5/23/2012**	
530	55									
525	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



*** 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.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	588'
Location	Northeast end of site (See Geotechnical Map)	**Sampled By**	S. Richards

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								**Alluvium**	
585				R-1	8 15 15	101	20	ML	@2': SANDY SILT, medium dense, black, slightly moist, fine sand, porous, abundant rootlets	
	5			R-2	5 10 12	99	21	CL-ML	@5': SILTY CLAY with gravel, stiff, gray, moist, siltstone fragments	
580										
	10			R-3 B-1	3 4 6			CL-ML	@10': SILTY CLAY, medium stiff, gray, very moist	CO
575										
	15			S-1	3 2 5			CL	@15': LEAN CLAY with sand, medium stiff, brown, moist, fine to medium sand, trace manganese staining, LL = 32, PI = 14	AL
570										
	20			R-4	7 11 13	97	27	CL	@20': LEAN CLAY, stiff, brown, moist, fine sand, abundant mica, iron staining, LL = 34, PI = 11	AL
565										
	25			S-2	6 10 7			CL	@25': LEAN CLAY, stiff, brown, moist, fine sand, abundant mica, iron staining	
560										
	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.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	588'
Location	Northeast end of site (See Geotechnical Map)	**Sampled By**	S. Richards

Elevation Feet	Depth Feet	Graphic Log	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
		N S							*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.*	
	30			S-3	2 2 2			CL	@30': SANDY LEAN CLAY, soft, brown, pockets of gray silt, manganese staining	
555										
									Groundwater depth 34.3 feet at 1:55 PM	
	35			S-4	4 6 6			CL	@35': SANDY LEAN CLAY, medium stiff, brown, moist, fine to medium sand, coarse sand, LL = 42, PI = 23, sand 31%, fines 69%	SA, AL
550										
									Groundwater depth 38 feet at 1:45 PM	
	40			S-5	4 7 9			CL	@40': LEAN CLAY with sand, stiff, brown to olive brown, very moist, fine sand	
545										
	45			S-6	4 5 7			CL	@45': LEAN CLAY with sand, stiff, brown to light brown, moist, fine sand, LL = 40, PI = 20, gravel 2%, sand 20%, fines 78%	AL, SA
540										
	50			S-7	5 8 12			CL	@50': LEAN CLAY with sand, very stiff, brown to light brown, moist, fine to medium sand, subangular, trace fine gravel	
									Total depth of boring 51.5 feet **Depth to groundwater 38.0 feet at 1:45 PM 5/23/2012** **Depth to groundwater 34.3 feet at 1:55 PM 5/23/2012** **Backfilled with cuttings 5/23/2012**	
535										
	55									
530										
	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

GEOTECHNICAL BORING LOG LB-6

Project No.	022600-001	**Date Drilled**	5-23-12
Project	Oakville Chino	**Logged By**	S. Richards
Drilling Co.	2R Drilling, Inc.	**Hole Diameter**	8"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	582'
Location	Southeast end of site (See Geotechnical Map)	**Sampled By**	S. Richards

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								**Alluvium**	
580				R-1 B-1	14 20 23	109	16	ML	@2': SANDY SILT, very stiff, dark brown to black, slightly moist, some rootlets	
	5			R-2	9 9 9	109	16	ML	@5': SANDY SILT, medium stiff, brown, fine sand, trace medium to coarse sand, pockets of grey silt	
575										
	10			R-3 B-2	4 6 14	104	21	CL-ML	@10': SILTY CLAY with gravel, stiff, light brown, moist, fine to medium sand	
570										
	15			R-4	10 18 22	113	17	ML	@15': SILT with sand, very stiff, dark brown, moist, fine sand, trace coarse sand, some iron staining, black manganese staining	
565										
	20			R-5	8 14 17	82	36	ML	@20': SILT with sand, very stiff, brown, moist, fine sand	
560									**Total depth of boring 21.5 feet** **Groundwater not encountered** **Backfilled with cuttings 5/23/2012**	
	25									
555										
	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. ***

APPENDIX C

LABORATORY TESTING PROCEDURES AND TEST RESULTS

APPENDIX C

Laboratory Testing Procedures and Test Results

The LGC laboratory testing program was directed towards providing quantitative data relating to the relevant engineering properties of the soils. Samples considered representative of site conditions were tested in general accordance with American Society for Testing and Materials (ASTM) procedure and/or California Test Methods (CTM), where applicable. The following summary is a brief outline of the test type and a table summarizing the test results.

Soil Classification: Soils were classified according the Unified Soil Classification System (USCS) in accordance with ASTM Test Methods D2487 and D2488. The soil classifications (or group symbol) are shown on the laboratory test data, and backhoe trench logs.

Maximum Dry Density Tests: The maximum dry density and optimum moisture content of typical materials were determined in accordance with ASTM D1557. The test results are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION (USCS)*	*MAXIMUM DRY DENSITY (% by weight)*	*OPTIMUM MOISTURE CONTENT (%)*
TR-3 @ 1.5`-3.0'	Clayey SAND w/some silt (SC)	121.5	12.3
TR-6 @ 1.5-4.5'	Sandy SILT/Clayey SILT (ML)	85.4	31.7
TR-7 @ 1.0'-4.0'	Sandy SILT (ML)	87.0	31.0
TR-24 @ 4.0'-7.0'	Silty SAND/Sandy SILT (SM/ML)	115.0	15.5

Expansion Index: The expansion potential of a selected sample was evaluated by the Expansion Index Test, U.B.C. Standard No. 18-2 and/or ASTM D4829. Specimens are molded under a given compactive energy to approximately the optimum moisture content and approximately 50 percent saturation or approximately 90 percent relative compaction. The prepared 1-inch-thick by 4-inch-diameter specimens are loaded to an equivalent 144 psf surcharge and are inundated with tap water until volumetric equilibrium is reached. The results of these tests are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION (USCS)*	*EXPANSION INDEX*	*EXPANSION POTENTIAL*
B-6 @ 8.0'-18.0'	Silty CLAY (CL)	45	Low
TR-3 @ 1.5'-3.0'	Clayey SAND w/some silt (SC)	43	Low
TR-6 @ 1.5'-4.5'	Sandy SILT/Clayey SILT (ML)	34	Low
TR-7 @ 1.0'-4.0'	Sandy SILT (ML)	29	Low

*Per ASTM D4829

Atterberg Limits: The liquid and plastic limits ("Atterberg Limits") were determined with ASTM D 4318 for engineering classification of fine material and presented in the table below:

SAMPLE LOCATION	*LIQUID LIMIT*	*PLASTIC LIMIT*	*PLASTICITY INDEX*	*USCS SOIL SYMBOL*
B-6 @ 8.0'-18.0'	42	19	23	CL/ML
TR-7 @ 1.0'-4.0'	53	37	16	ML/OH

Soluble Sulfates: The soluble sulfate content of a selected sample was determined by standard geotechnical methods (CTM 417). The soluble sulfate content is used to determine the appropriate cement type and maximum water-cement ratios. The test results are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION* (USCS)	*SULFATE CONTENT (ppm)*	*SULFATE EXPOSURE**
B-6 @ 8.0'-18.0'	Silty CLAY (CL)	100	Negligible
TR-6 @ 1.5'-4.5'	Sandy SILT/Clayey SILT (ML)	43	Negligible
TR-7 @ 1.0'-4.0'	Sandy SILT (ML)	170	Negligible

*Per ACI 318R-05 Table 4.3.1

Chloride Content: Chloride content was tested with CTM 422. The results are presented below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION* (USCS)	*CHLORIDE CONTENT (ppm)*
B-6 @ 8.0'-18.0'	Silty CLAY (CL)	100
TR-6 @ 1.5'-4.5'	Sandy SILT/Clayey SILT (ML)	170
TR-7 @ 1.0'-4.0'	Sandy SILT (ML)	160

Minimum Resistivity and pH Tests: Minimum resistivity and pH tests were performed with CTM 643. The results are presented in the table below:

SAMPLE LOCATION	*SAMPLE DESCRIPTION* (USCS)	*pH*	*MINIMUM RESISTIVITY (Ohm-cm)*
B-6 @ 8.0'-18.0'	Silty CLAY (CL)	8.53	950
TR-6 @ 1.5'-4.5'	Sandy SILT/Clayey SILT (ML)	8.31	1800
TR-7 @ 1.0'-4.0'	Sandy SILT (ML)	8.20	380

R-Value: The resistance R-value was determined by the ASTM D2844 for base, sub-base, and basement soils. The samples were prepared and exudation pressure and R-value were determined. These results were used for pavement design:

SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*R-VALUE*
B-1 @ 0'-5.0'	Clayey SAND/Sandy SILT (SC/ML)	38
TR-6 @ 1.5'-4.5'	Sandy SILT/Clayey SILT (ML)	41

Organic Matter Content: The percent organic matter content was determined in accordance with ASTM D2974-13, Method C. The results are presented below:

SAMPLE LOCATION	SAMPLE DESCRIPTION (USCS)	ORGANIC MATTER CONTENT (%)
TR-3 @ 0'-1.0'	Silty SAND/Clayey SAND (SM/SC)	1.9
TR-4 @ 0'-1.0'	Silty SAND/Clayey SAND (SM/SC)	3.5
TR-9 @ 0'-0.5'	Silty SAND (SM)	7.8
TR-9 @ 2.0'-3.0'	Silty CLAY (CL)	1.1
TR-11 @ 0-0.3'	Manure & Soil Mixture	25.1
TR-11 @ 0.3'-1.0'	Silty SAND/Sandy/SILT (SM/ML)	3.3
TR-19 @ 0'-1.0'	Sandy SILT (ML)	3.1
TR-20 @ 0'-1.0'	Silty SAND/Sandy/SILT (SM/ML)	6.9
TR-21 @ 0'-1.0'	Sandy SILT (ML)	4.8
TR-21 @ 4.0'-5.0'	Clayey SILT/Silty CLAY (ML/CL)	0.8
TR-22 @ 0'-1.0'	Silty SAND/Sandy/SILT (SM/ML)	4.7
TR-23 @ 0'-1.0'	Sandy SILT (ML)	10.7
TR-23 @ 6.0'-7.0'	Silty CLAY (CL)	1.3

Direct Shear: Direct shear tests were performed on selected undisturbed samples, which were soaked for a minimum of 24 hours under a surcharge equal to the applied normal force during testing. After transfer of the sample to the shear box, and reloading the sample, pore pressures set up in the sample due to the transfer were allowed to dissipate for a period of approximately 1 hour prior to application of shearing force. The samples were tested under various normal loads, a motor-driven, strain-controlled, direct-shear testing apparatus at a strain rate of about 0.3 inch per minute (depending upon the soil type). The test results of the ultimate strengths are presented below:

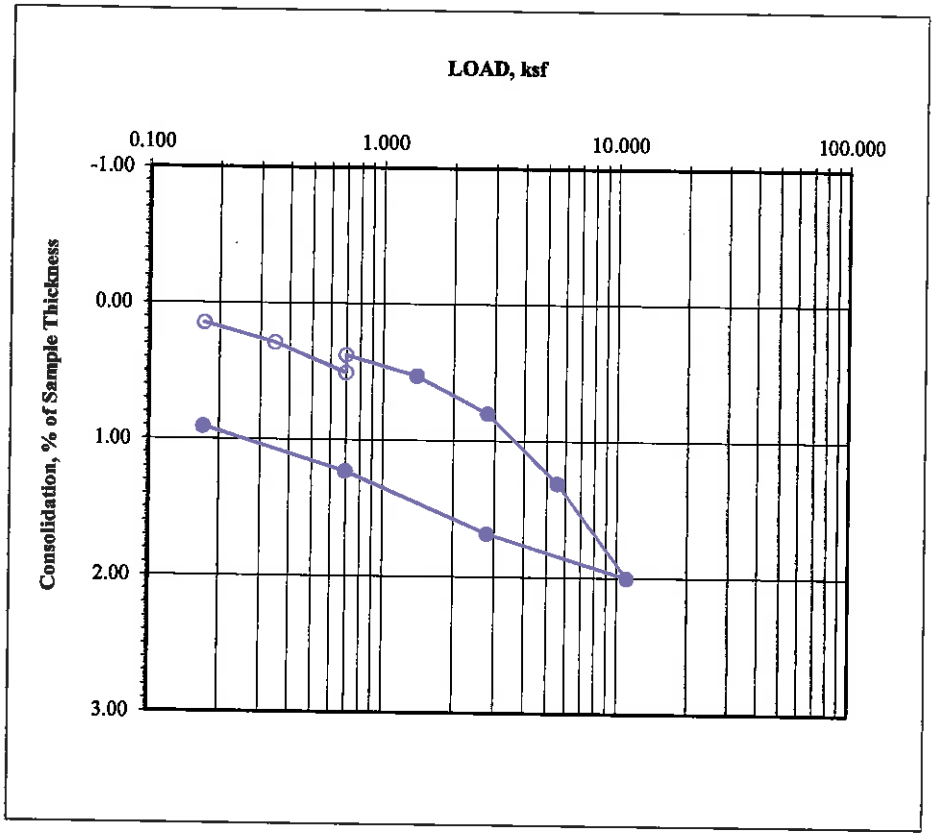
SAMPLE LOCATION	*SAMPLE DESCRIPTION*	*ANGLE OF INTERNAL FRICTION (degrees)*	*COHESION (pcf)*
TR-7 @ 1.0'-4.0'	Sandy SILT (ML)	34	130
TR-24 @ 4.0'-7.0'	Silty SAND/Sandy SILT (SM/ML)	30	370

Consolidation: Consolidation tests were performed on undisturbed samples (Modified ASTM Test method D2435). The sample (2.42 inches in diameter and 1-inch in height) was placed in a consolidometer and increasing loads were applied. The sample was allowed to consolidate under "double drainage" and total deformation for each loading step was recorded. The percent consolidation for each load stamp was recorded as the ration of the amount of vertical compression to the original sample height. The graphical test results are presented on the following pages.

Grain Size Distribution: Representative samples were dried, weighted, and soaked in water until individual soil particles were separated (per ASTM D421) and then washed on a No. 200 sieve. The portion retained on the No. 200 sieve was dried and then sieved on a U.S. Standard brass sieve set in accordance with ASTM D422 (CTM 202). The graphical test results are presented on the following pages.

Hydrocarbons, Organics and Volatile Organic Compounds: Representative bulk samples of fill and natural soil materials, underlying the site that could contain diesel range hydrocarbons, gasoline range organics and volatile organic compounds were obtained at 1 suspected sample location. The samples were sent to E.S. BABCOCK & Sons, Inc. Laboratory testing was performed on random samples for arsenic and pesticides of the representative natural topsoil. Testing was performed utilizing EPA methods 8015 AND 8260B. The test results are presented on the following pages.

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	100.1	
Moisture (%):	25.9	

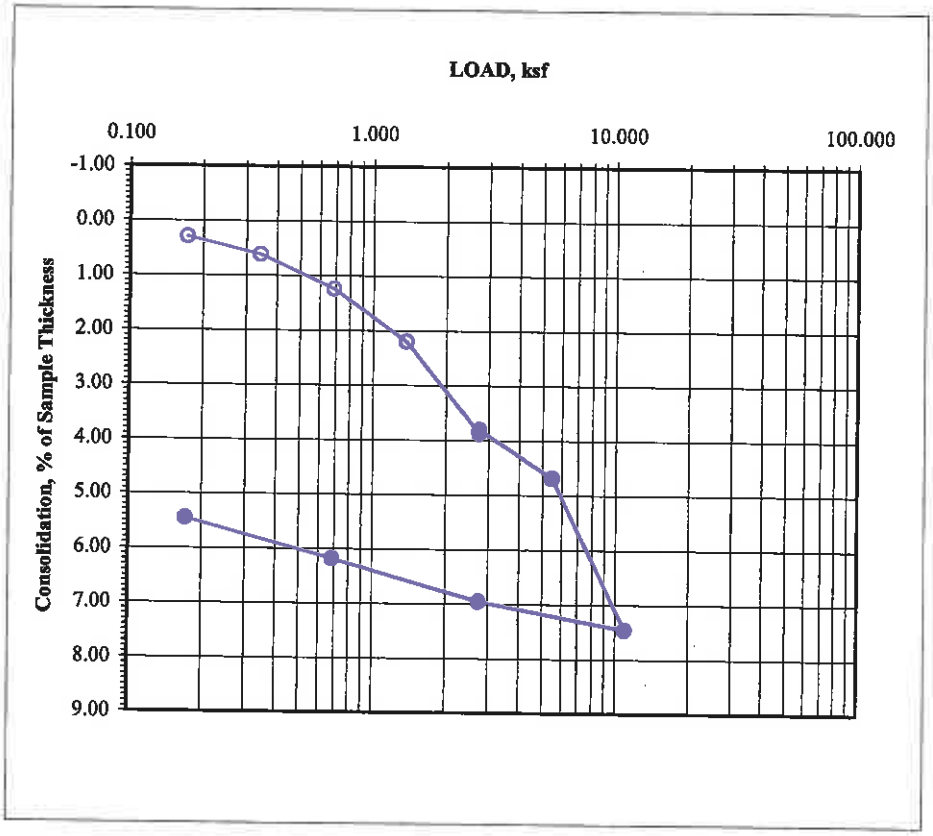
WATER ADDED @ ksf:	0.689
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Clayey Sand
U.S.C.S.	SC
% Collapse/Swell (-):	-0.13

P.N. G141194-10 **LOCATION:** B-1 @ 5.0'
CLIENT: Richland Communities

LGC

Plate: C-1

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	94.7	
Moisture (%):	32.8	

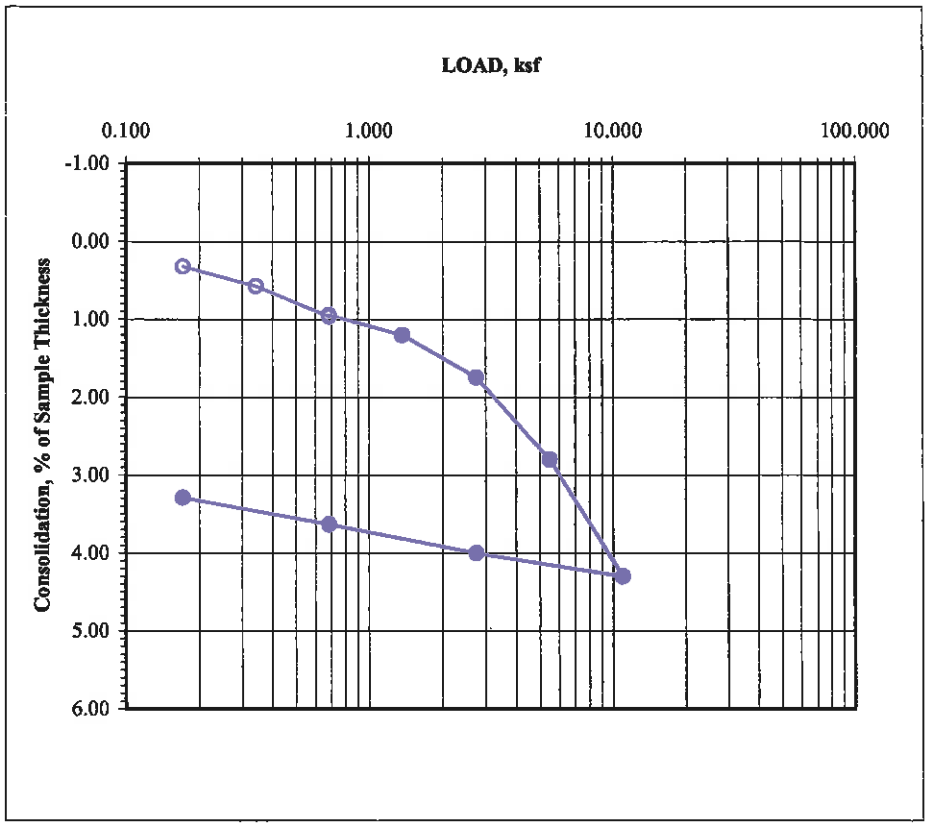
WATER ADDED @ ksf:	2.755
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Silty Clay
U.S.C.S.	CL
% Collapse/Swell (-):	-0.07

P.N. G141194-10 **LOCATION:** B-1 @ 23.0'
CLIENT: Richland Communities

LGC

Plate: C-2

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	102.0	
Moisture (%):	22.3	

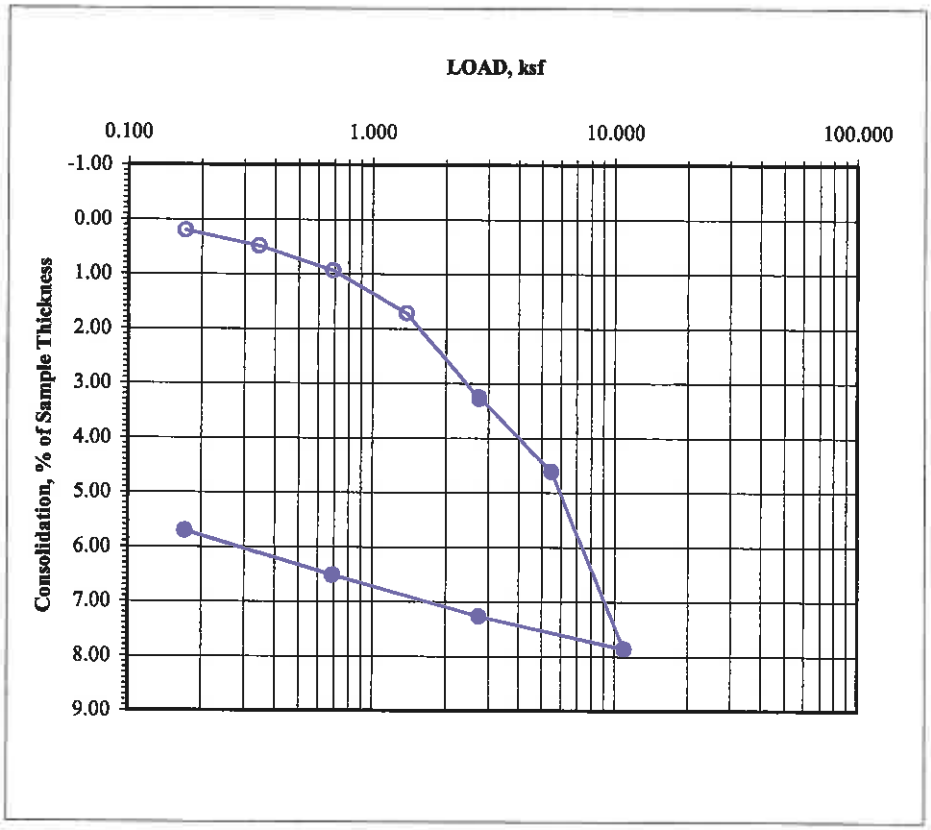
WATER ADDED @ ksf:	0.689
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Clayey Sand
U.S.C.S.	SC
% Collapse/Swell (-):	-0.02

P.N. G141194-10 **LOCATION:** B-2 @ 7.0'
CLIENT: Richland Communities

LGC

Plate: C-3

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place
Dry Density, (pcf):	86.9
Moisture (%):	38.9

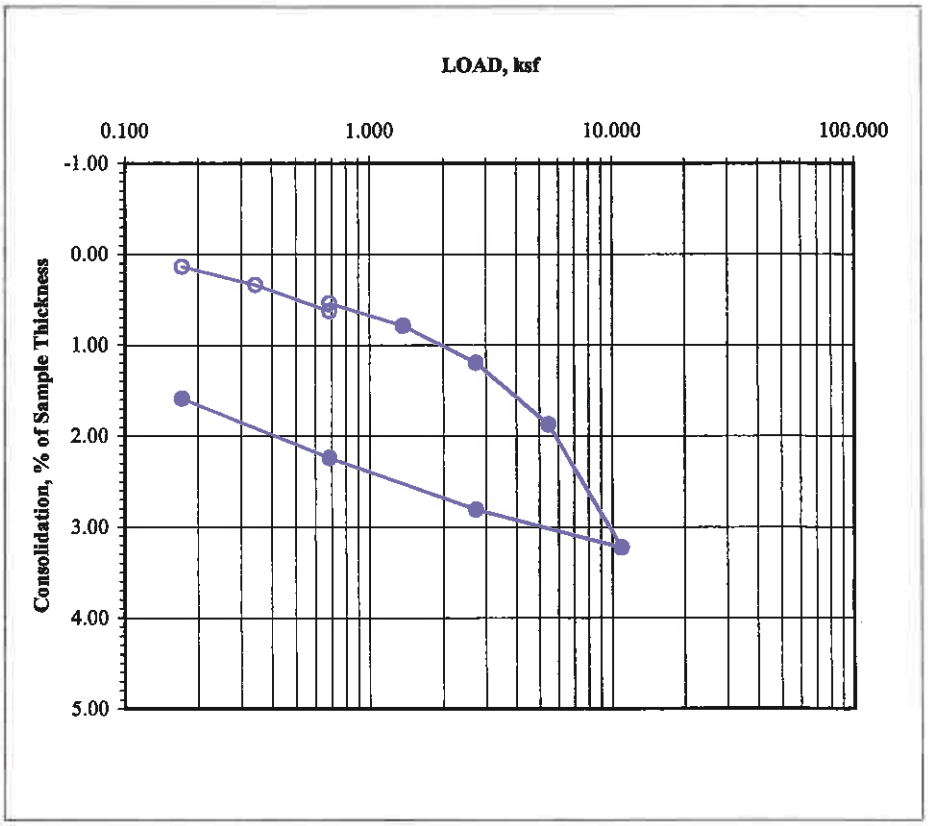
WATER ADDED @ ksf:	2.755
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Sandy Silt
U.S.C.S.	ML
% Collapse/Swell (-):	-0.04

P.N. G141194-10 **LOCATION:** B-2 @ 27.0'
CLIENT: Richland Communities

LGC

Plate: C-4

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	106.3	
Moisture (%):	17.3	

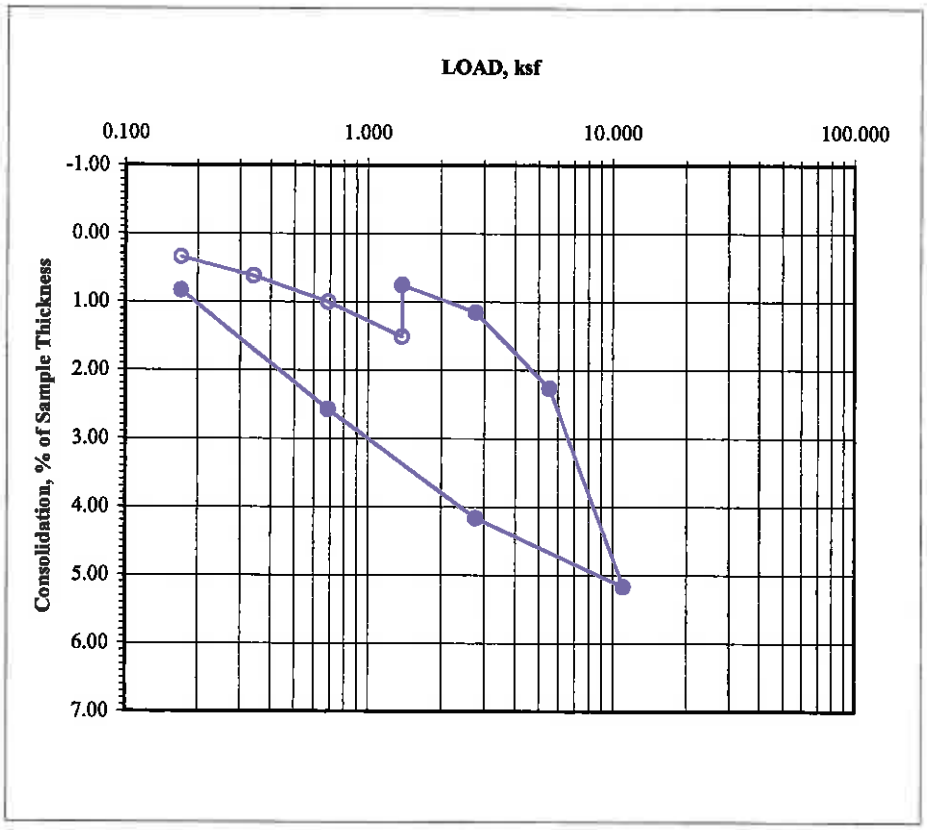
WATER ADDED @ ksf:	0.689
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Clayey Sand
U.S.C.S.	SC
% Collapse/Swell (-):	-0.09

P.N. G141194-10 **LOCATION:** B-4 @ 4.0'
CLIENT: Richland Communities

LGC

Plate: C-5

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	83.6	
Moisture (%):	28.2	

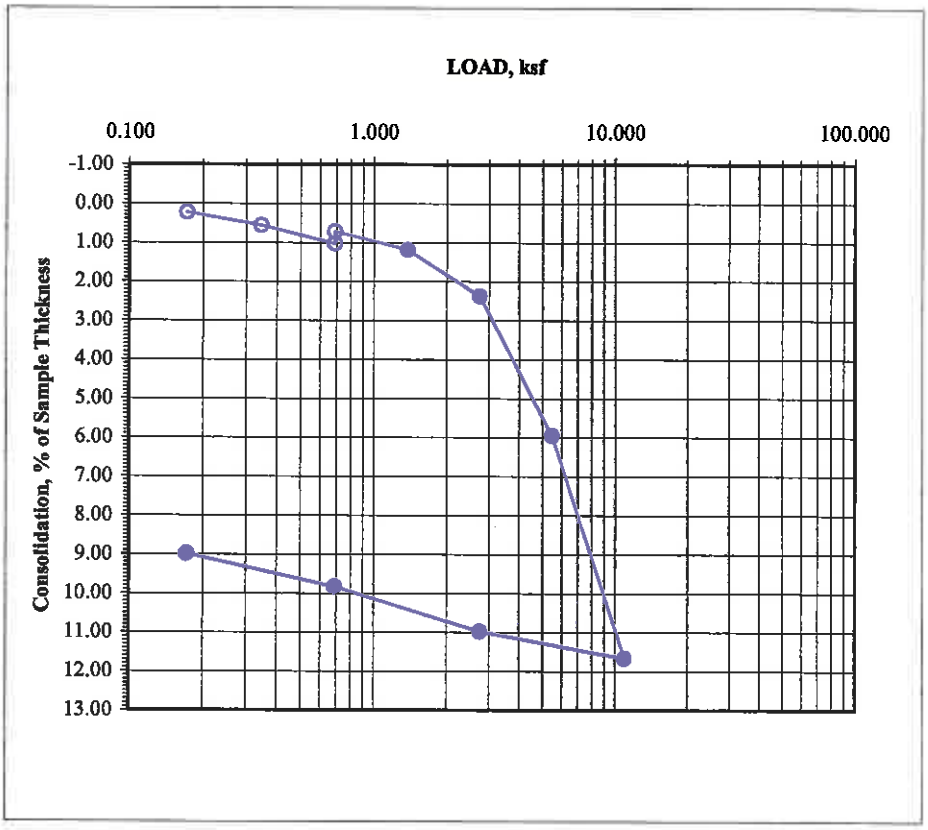
WATER ADDED @ ksf:	1.378
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Clayey Sand
U.S.C.S.	SC
% Collapse/Swell (-):	-0.76

P.N. G141194-10 **LOCATION:** B-5 @ 14.0'
CLIENT: Richland Communities

LGC

Plate: C-6

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	75.0	
Moisture (%):	39.3	

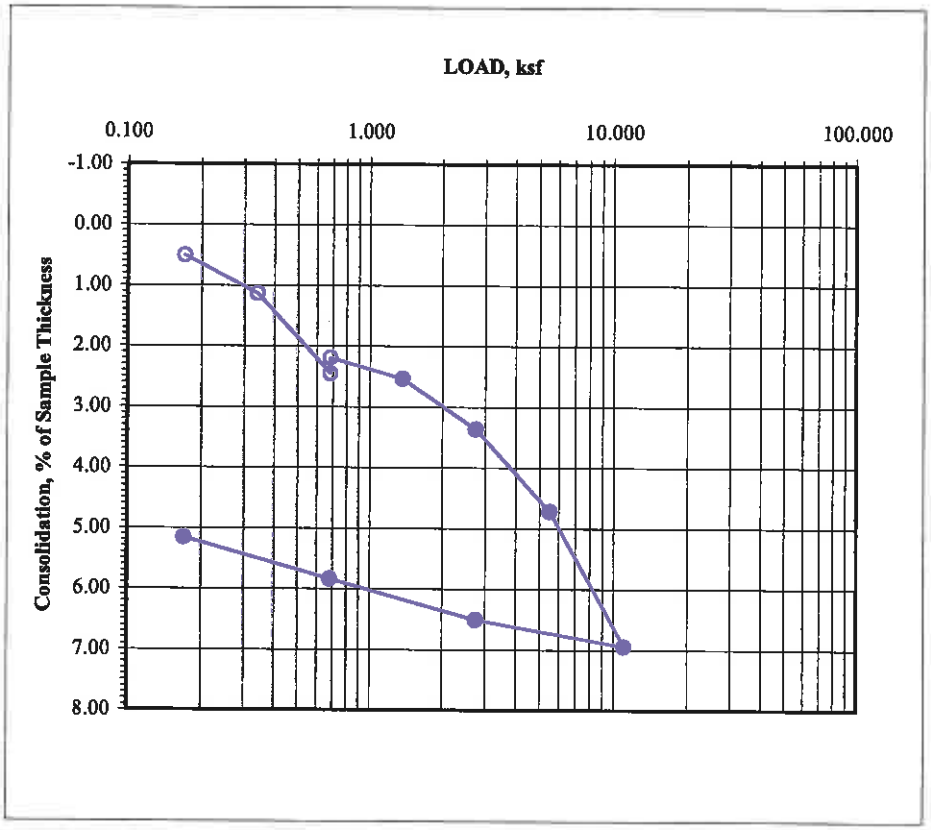
WATER ADDED @ ksf:	0.689
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Silty Clay
U.S.C.S.	CL
% Collapse/Swell (-):	-0.31

P.N. G141194-10 **LOCATION:** B-6 @ 8.0'
CLIENT: Richland Communities

LGC

Plate: C-7

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	96.1	
Moisture (%):	28.1	

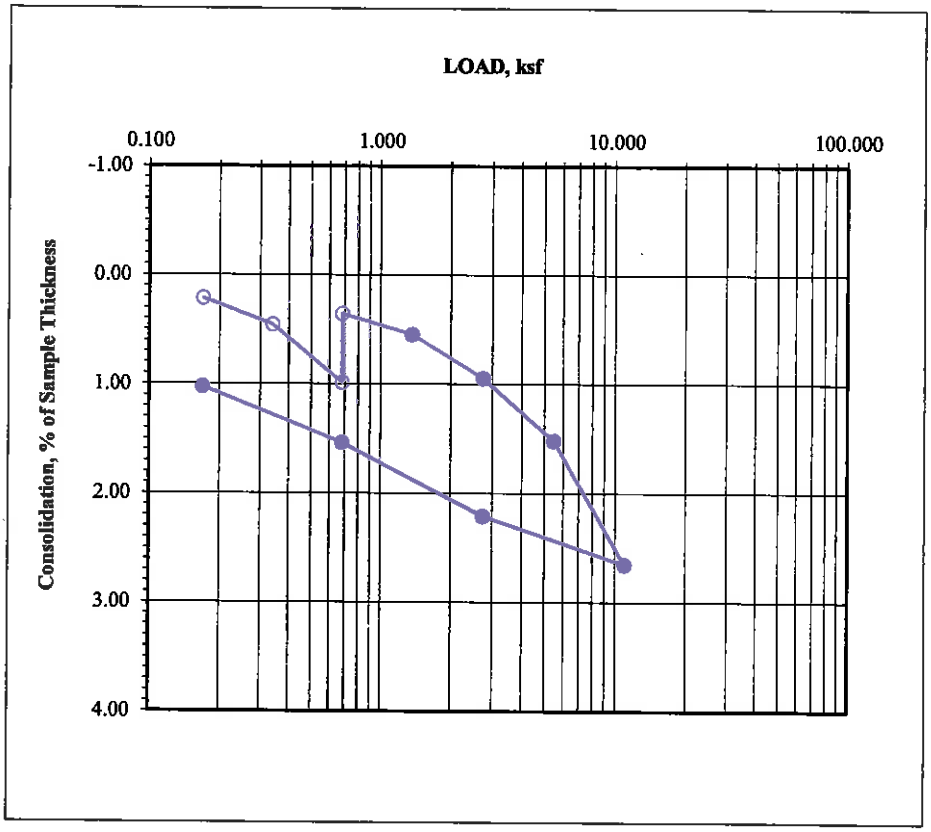
WATER ADDED @ ksf:	0.689
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Clayey Sand
U.S.C.S.	SC
% Collapse/Swell (-):	-0.26

P.N. G141194-10 **LOCATION:** B-7 @ 6.0'
CLIENT: Richland Communities

LGC

Plate: C-8

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	96.9	
Moisture (%):	28.1	

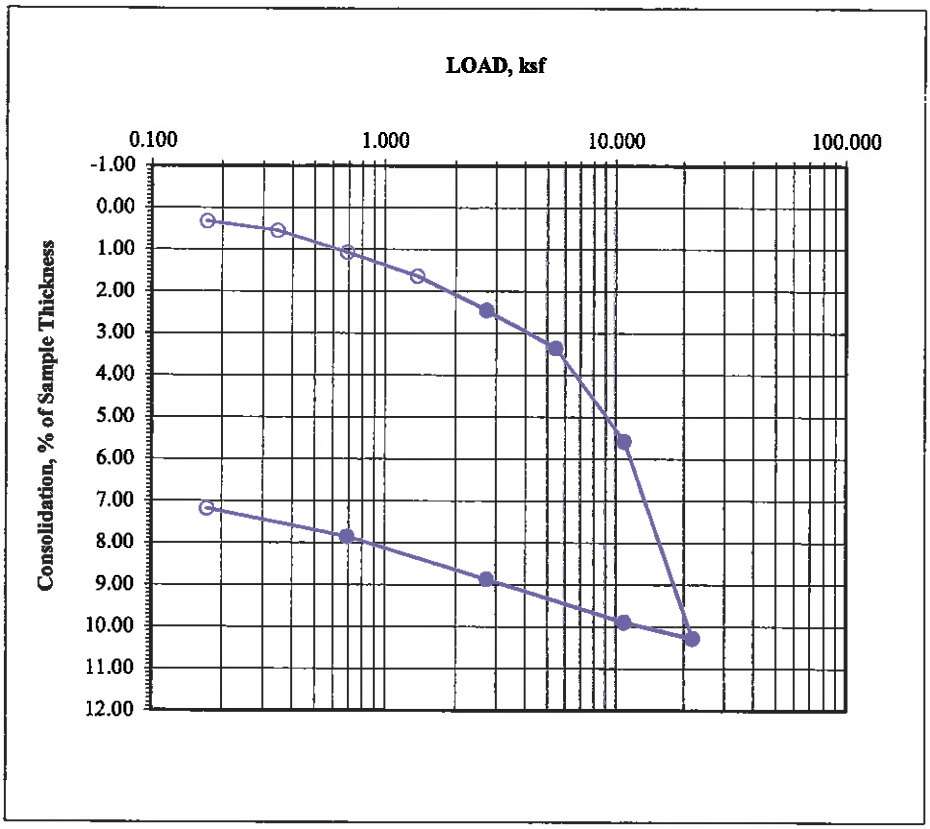
WATER ADDED @ ksf:	0.689
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Sandy Clay
U.S.C.S.	CL
% Collapse/Swell (-):	-0.63

P.N. G141194-10 **LOCATION:** B-8 @ 7.0'
CLIENT: Richland Communities

LGC

Plate: C-9

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	68.3	
Moisture (%):	49.4	

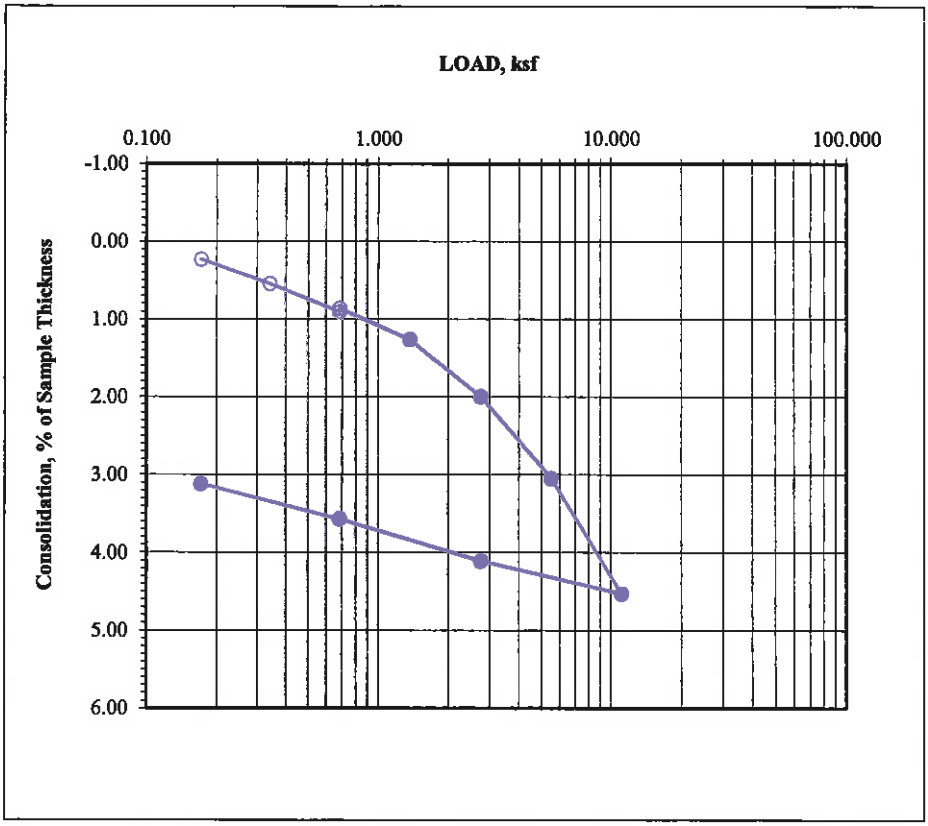
WATER ADDED @ ksf:	2.755
MAXIMUM LOAD, ksf:	22.040
SOIL DESCRIPTION:	Silty Clay
U.S.C.S.	CL
% Collapse/Swell (-):	0.01

P.N. G141194-10 **LOCATION:** B-8 @ 30.0'
CLIENT: Richland Communities

LGC

Plate: C-10

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

	In-place	Remolded:
Dry Density, (pcf):	107.2	
Moisture (%):	22.6	

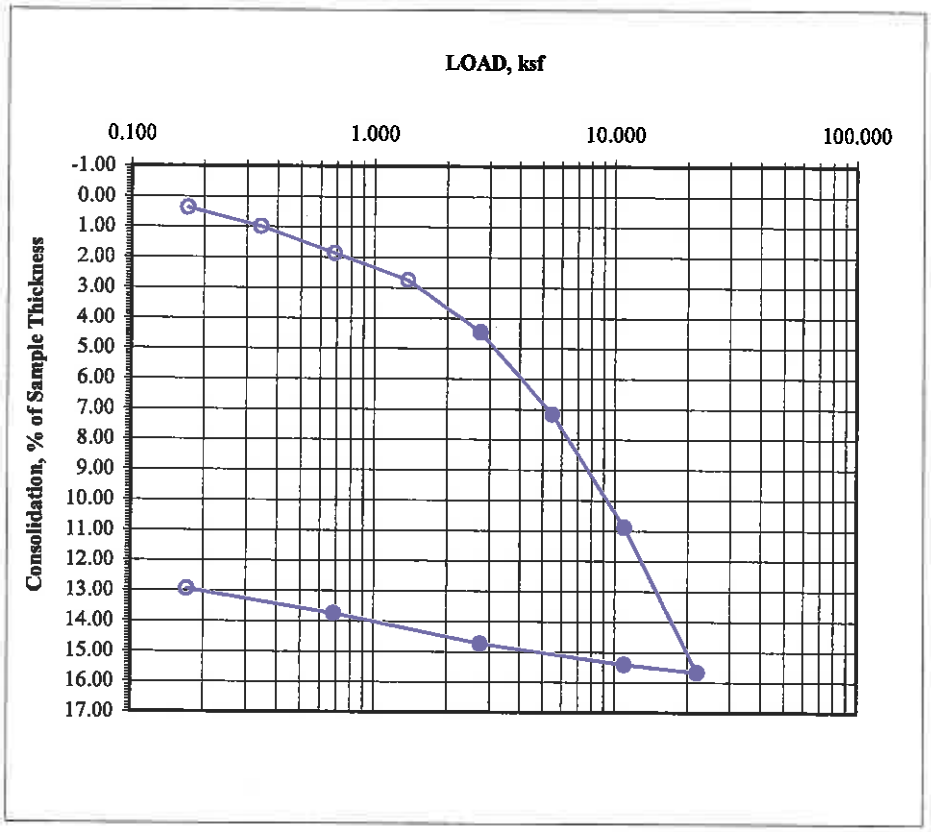
WATER ADDED @ ksf:	0.689
MAXIMUM LOAD, ksf:	11.020
SOIL DESCRIPTION:	Clayey Silt
U.S.C.S.	ML
% Collapse/Swell (-):	-0.04

P.N. G141194-10 **LOCATION:** B-9 @ 6.0'
CLIENT: Richland Communities

LGC

Plate: C-11

CONSOLIDATION TEST RESULTS



Note: Filled circle denotes readings after sample was submerged in water

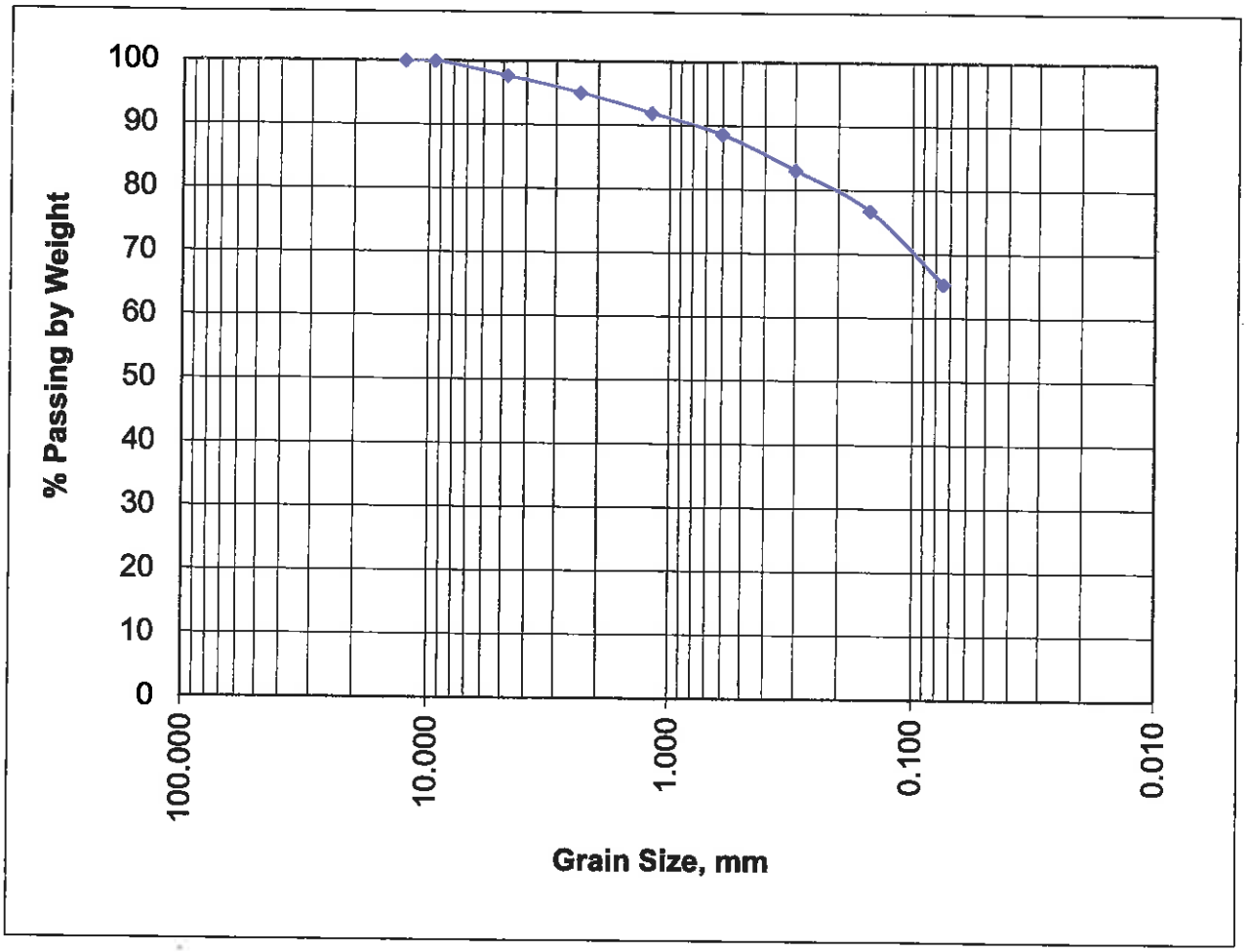
	In-place	Remolded:
Dry Density, (pcf):	82.4	
Moisture (%):	37.7	

WATER ADDED @ ksf:	2.755
MAXIMUM LOAD, ksf:	22.040
SOIL DESCRIPTION:	Silty Clay
U.S.C.S.	CL
% Collapse/Swell (-):	0.01

P.N. G141194-10 **LOCATION:** B-10 @ 26.0'
CLIENT: Richland Communities

LGC

Plate: C-12



U.S. Standard Sieve Sizes

3"	1.5"	3/4"	3/8"	#4	#8	#30	#50	#100	#200	
	Gravel			Sand						
Cobbles	Coarse		Fine	Coarse		Medium		Fine	Silt	Clay

GRAIN SIZE DISTRIBUTION

Sample	Depth, ft.	Description
B-1/R2	5.0	Clayey Sand

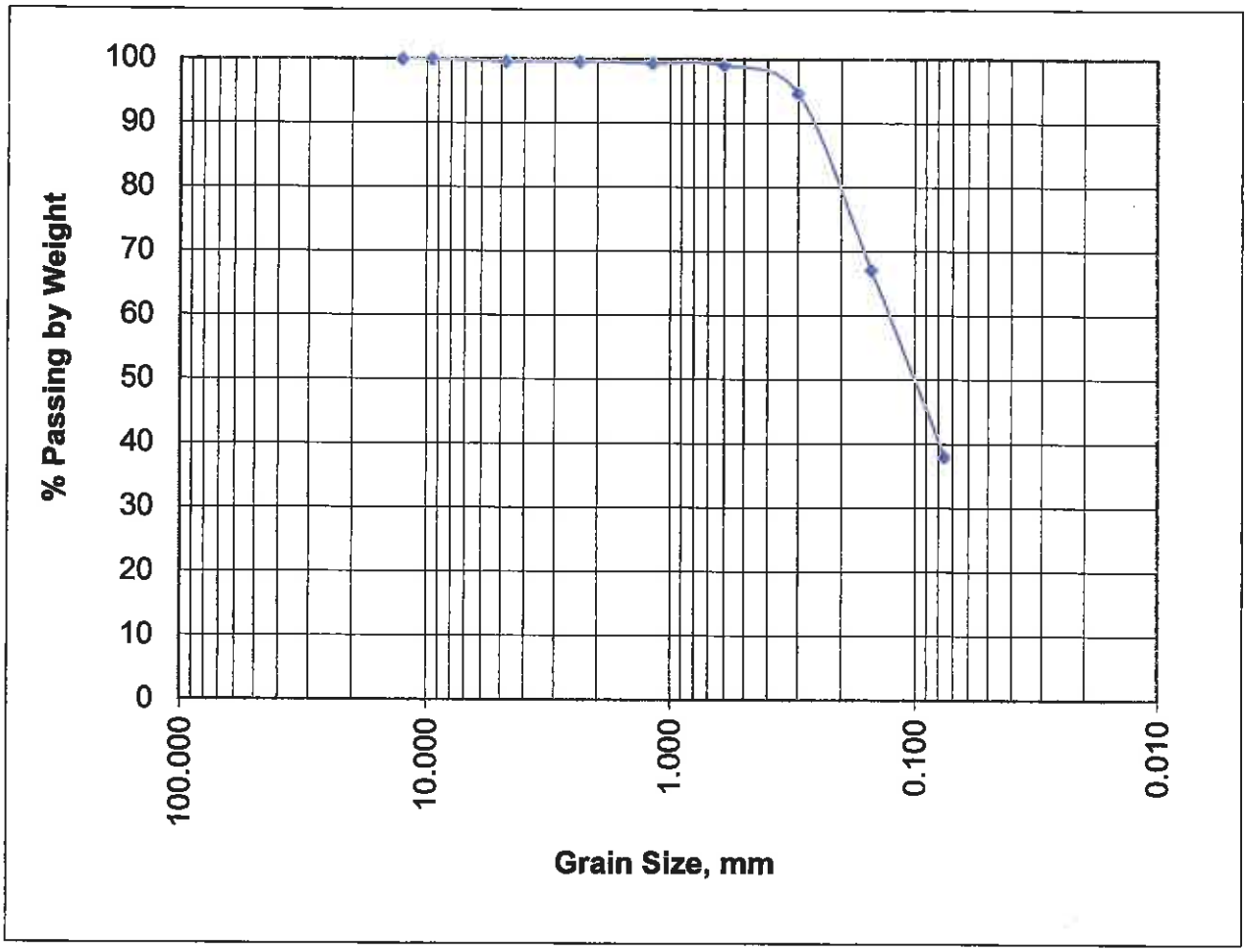
Classification
SC

Project No.	G141194-10
Project Name	Bickmore Ave
Client	Richland Communities

Sieve Size	Grain Size, mm	% Passing	% Retained
1/2 in.	12.500	100.0	0.0
3/8 in.	9.500	100.0	0.0
#4	4.750	97.7	2.3
#8	2.360	95.1	4.9
#16	1.180	92.0	8.0
#30	0.600	88.7	11.3
#50	0.300	83.2	16.8
#100	0.150	76.9	23.1
#200	0.075	65.5	34.5

LGC

DATE	PLATE
4/6/2016	C-13



U.S. Standard Sieve Sizes

3"	1.5"	3/4"	3/8"	#4	#8	#30	#50	#100	#200		
	Gravel			Sand							
Cobbles	Coarse		Fine	Coarse		Medium		Fine		Silt	Clay

GRAIN SIZE DISTRIBUTION

Sample	Depth, ft.	Description
B-1/S1	18.0	Silty Sand

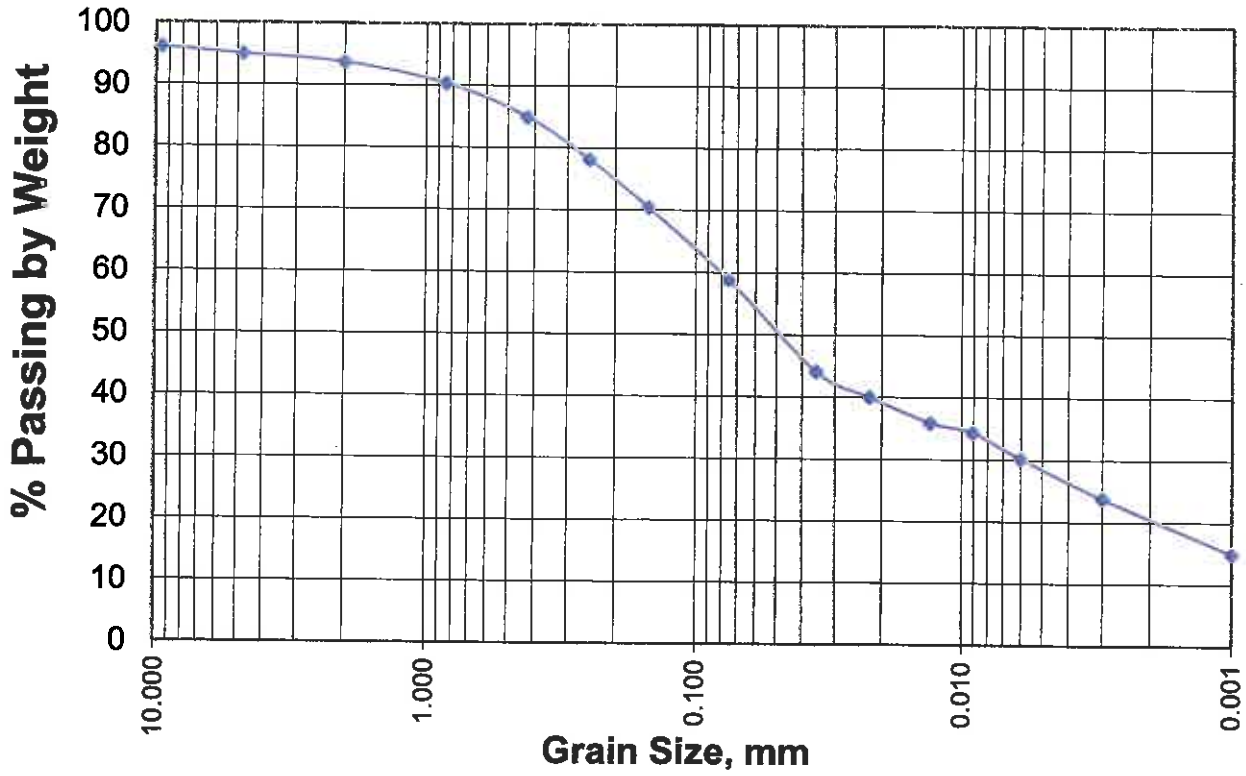
Classification
SM

Project No.	G141194-10
Project Name	Bickmore Ave
Client	Richland Communities

Sieve Size	Grain Size, mm	% Passing	% Retained
1/2 in.	12.500	100.0	0.0
3/8 in.	9.500	100.0	0.0
#4	4.750	99.6	0.4
#8	2.360	99.6	0.4
#16	1.180	99.4	0.6
#30	0.600	99.1	0.9
#50	0.300	94.7	5.3
#100	0.150	67.1	32.9
#200	0.075	38.0	62.0

LGC

DATE	PLATE
4/6/2016	C-14



U.S. Standard Sieve Sizes

3	1.5	3/4	3/8	#4	#8	#30	#50	#100	#200		
	Gravel			Sand							
Cobbles	Coarse		Fine	Coarse		Medium		Fine		Silt	Clay

Sieve Size	Grain Size, mm	% Passing
3/4 in.	19.000	100.0
3/8 in.	9.500	96.2
#4	4.750	95.1
#10	2.000	93.8
#20	0.850	90.5
#40	0.425	85.1
#60	0.250	78.3
#100	0.150	70.6
#200	0.075	59.0
	0.035	44.2
	0.022	40.1
	0.013	36.0
	0.009	34.4
	0.006	30.3
	0.003	23.9
	0.001	15.0

Sample	
Number:	S2
Depth, ft:	28
Location:	B-1
Discription	Silty Clay

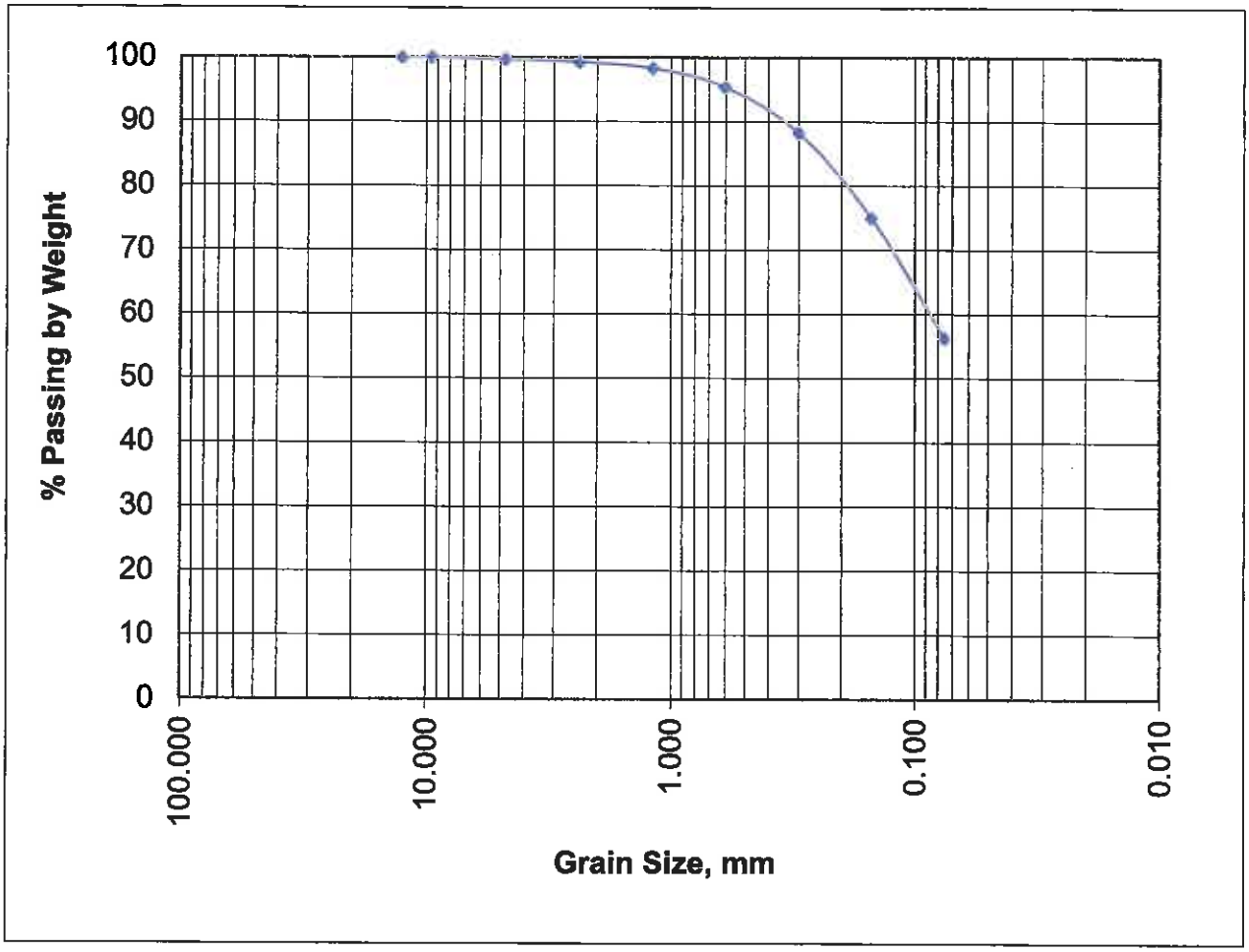
Classification
CL

Project	
Number:	G141194-10
Name:	Chino
Client:	Richland Communities

GRAIN SIZE DISTRIBUTION

LGC

PLATE
C-15



U.S. Standard Sieve Sizes

3"	1.5"	3/4"	3/8"	#4	#8	#30	#50	#100	#200		
	Gravel			Sand							
Cobbles	Coarse		Fine	Coarse		Medium		Fine		Silt	Clay

GRAIN SIZE DISTRIBUTION

Sample	Depth, ft.	Description
B-1/R6	33.0	Sandy Clay

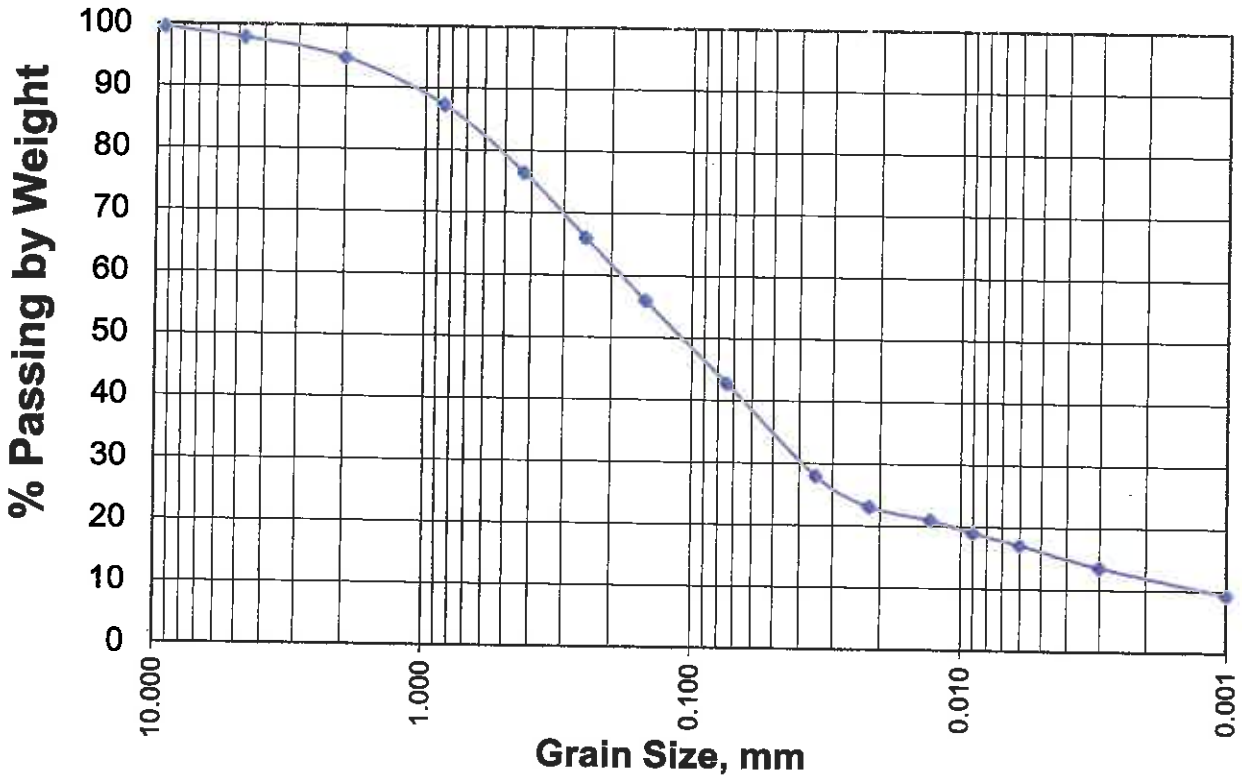
Classification
CL

Project No.	G141194-10
Project Name	Bickmore Ave
Client	Richland Communities

Sieve Size	Grain Size, mm	% Passing	% Retained
1/2 in.	12.500	100.0	0.0
3/8 in.	9.500	100.0	0.0
#4	4.750	99.7	0.3
#8	2.360	99.3	0.7
#16	1.180	98.3	1.7
#30	0.600	95.4	4.6
#50	0.300	88.3	11.7
#100	0.150	75.0	25.0
#200	0.075	56.3	43.7

LGC

DATE	PLATE
4/6/2016	C-16



U.S. Standard Sieve Sizes

	3	1.5	3/4	3/8	#4	#8	#30	#50	#100	#200		
	Gravel				Sand							
Cobbles	Coarse			Fine	Coarse		Medium		Fine		Silt	Clay

Sieve Size	Grain Size, mm	% Passing
3/4 in.	19.000	100.0
3/8 in.	9.500	99.5
#4	4.750	97.9
#10	2.000	94.8
#20	0.850	87.3
#40	0.425	76.5
#60	0.250	66.1
#100	0.150	56.0
#200	0.075	42.8
	0.035	28.0
	0.022	23.1
	0.013	21.0
	0.009	19.0
	0.006	17.1
	0.003	13.6
	0.001	9.3

Sample	
Number:	S3
Depth, ft:	38
Location:	B-1
Discription	Silty Sand

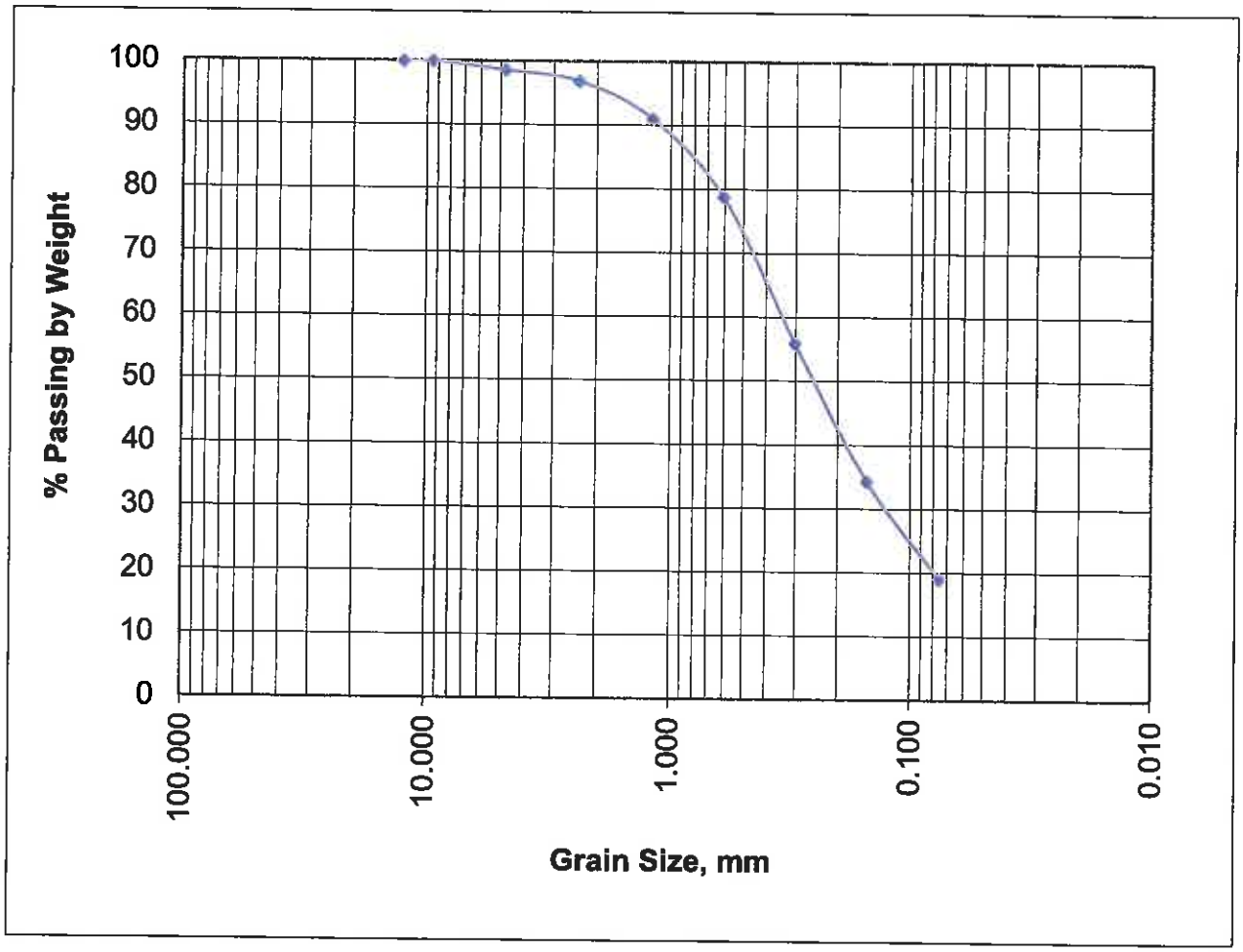
Classification
SM

Project	
Number:	G141194-10
Name:	Chino
Client:	Richland Communities

GRAIN SIZE DISTRIBUTION

LGC

PLATE
C-17



U.S. Standard Sieve Sizes

3"	1.5"	3/4"	3/8"	#4	#8	#30	#50	#100	#200		
	Gravel			Sand							
Cobbles	Coarse		Fine	Coarse		Medium		Fine		Silt	Clay

GRAIN SIZE DISTRIBUTION

Sample	Depth, ft.	Description
B-1/R7	43.0	Silty Sand

Classification
SM

Project No.	G141194-10
Project Name	Bickmore Ave
Client	Richland Communities

Sieve Size	Grain Size, mm	% Passing	% Retained
1/2 in.	12.500	100.0	0.0
3/8 in.	9.500	100.0	0.0
#4	4.750	98.6	1.4
#8	2.360	96.9	3.1
#16	1.180	91.0	9.0
#30	0.600	78.8	21.2
#50	0.300	55.9	44.1
#100	0.150	34.3	65.7
#200	0.075	19.0	81.0

LGC

DATE	PLATE
4/6/2016	C-18

APPENDIX D

LIQUEFACTION EVALUATION

LIQUEFACTION EVALUATION

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997
and *Evaluation of Settlements in Sand due to Earthquake Shaking*, Tokimatsu and Seed, 1987

Seismic Event		**Profile Constants**		**Depth to GWT**		**Project Name**	Richland-Chino
Max. Moment Magnitude	6.7	Total Unit Weight (lb/ft^3)	130.7	During Investigation (ft)	29.5	**Project Number**	G14-1194-10
Design Ground Motion	0.64	Unit Weight of Water (lbs/ft^3	62.4	During Design Event (ft)	15	**Boring**	B-1

Determination of Cyclic Resistance Ratio

Sampling Data				During Investigation			Sampling Correction Factors											
		Blow Count		Total Stress	Pore Pressure	Effective	Sampler	SPT	Overburden	Energy	Borehole	Rod Length	Sampler Type		Fines			
Depth (ft)	Depth (m)	SPT	Rings	Stress (psf)	Pressure (psf)	Stress (psf)	Diameter	N_m	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60}$	Content	$(N_1)_{60cs}$	K_σ	$CRR_{7.5}$	
2	0.6		30	261	0	261.4	0.750	22.500	2.000	1.50	1.00	0.75	1.00	50.6	42.8	65.8	1.00	SPT >30 NL	?
5	1.5		13	654	0	653.5	0.750	9.750	1.787	1.50	1.00	0.75	1.00	19.6	65.5	28.5	1.00	0.36	?
8	2.4		45	1046	0	1045.6	0.750	33.750	1.413	1.50	1.00	0.75	1.00	53.7	65.5	69.4	1.00	SPT >30 NL	?
13	4.0		44	1699	0	1699.1	0.750	33.000	1.109	1.50	1.00	0.85	1.00	46.6	38.0	61.0	1.00	SPT >30 NL	?
18	5.5	24		2353	0	2352.6	1.000	24.000	0.942	1.50	1.00	0.95	1.20	38.7	38.0	51.4	0.98	SPT >30 NL	?
23	7.0		10	3006	0	3006.1	0.750	7.500	0.833	1.50	1.00	0.95	1.00	8.9	59.0	15.7	0.93	0.16	
28	8.5	6		3660	0	3659.6	1.000	6.000	0.755	1.50	1.00	0.95	1.20	7.7	59.0	14.3	0.89	0.14	
33	10.1		29	4313	218.4	4094.7	0.750	21.750	0.714	1.50	1.00	1.00	1.00	23.3	56.3	33.0	0.87	SPT >30 NL	?
38	11.6	28		4967	530	4436.2	1.000	28.000	0.686	1.50	1.00	1.00	1.20	34.6	42.8	46.5	0.85	SPT >30 NL	
43	13.1		74	5620	842.4	4777.7	0.750	55.500	0.661	1.50	1.00	1.00	1.00	55.0	19.0	62.5	0.84	SPT >30 NL	?
48	14.6		73	6274	1154.4	5119.2	0.750	54.750	0.639	1.50	1.00	1.00	1.00	52.4	19.0	59.7	0.82	SPT >30 NL	?
50	15.2		73	6535	1279.2	5255.8	0.750	54.750	0.630	1.50	1.00	1.00	1.00	51.8	19.0	59.0	0.82	SPT >30 NL	?

Determination of Cyclic Stress Ratio

Sampling Data				During Design Event							
		Blow Count		Total Stress	Pore Pressure	Effective					
Depth (ft)	Depth (m)	SPT	Rings	Stress (psf)	Pressure (psf)	Stress (psf)	r_d	CSR	MSF	FS	(N1)60cs
2	0.61		30	261.4	0	261.4	0.997	0.415	1.334	Above GWT Not Liquefiable	65.8
5	1.52		13	653.5	0	653.5	0.990	0.412	1.334	Fine Grained/Clay - Not Liquefiable	28.5
8	2.44		45	1045.6	0	1045.6	0.983	0.409	1.334	Fine Grained/Clay - Not Liquefiable	69.4
13	3.96		44	1699.1	0	1699.1	0.973	0.405	1.334	Above GWT Not Liquefiable	61.0
18	5.49	24		2352.6	187.2	2165.4	0.962	0.435	1.334	Corr. SPT>30	51.4
23	7.01		10	3006.1	499.2	2506.9	0.948	0.473	1.334	Fine Grained/Clay - Not Liquefiable	15.7
28	8.53	6		3659.6	811.2	2848.4	0.930	0.497	1.334	Fine Grained/Clay - Not Liquefiable	14.3
33	10.06		29	4313.1	1123.2	3189.9	0.904	0.508	1.334	Fine Grained/Clay - Not Liquefiable	33.0
38	11.58	28		4966.6	1435.2	3531.4	0.868	0.508	1.334	Corr. SPT>30	46.5
43	13.11		74	5620.1	1747.2	3872.9	0.823	0.497	1.334	Corr. SPT>30	62.5
48	14.63		73	6273.6	2059.2	4214.4	0.773	0.479	1.334	Corr. SPT>30	59.7
50	15.24		73	6535	2184	4351	0.753	0.470	1.334	Corr. SPT>30	59.0

Assumptions

4.5 Inch diameter boring (inside of hollow stem auger)
3 Rod Sitck up above boring in feet
no liner in SPT (Cs=1.20 for SPT)
Upper 5 feet is overexcavated and recompacted (SPT Blow Count = 30)

SETTLEMENT EVALUATION IN SATURATED SANDS

Project Name: Richland-Chino
Project No.: G14-1194-10
Boring No.: B-1

Layer Thickness t (ft)	Layer Thickness t (inches)	(N1)60	CSR	Volumetric Strain %	Settlement Per Liquefied Sand Layer (inches)
2	24.0	66	0.41	0.00	0.00
3	36.0	29	0.41	0.80	Fine Grained
3	36.0	69	0.41	0.00	Fine Grained
5	60.0	61	0.40	0.00	0.00
5	60.0	51	0.43	0.00	0.00
5	60.0	16	0.47	1.90	Fine Grained
5	60.0	14	0.50	2.00	Fine Grained
5	60.0	33	0.51	0.00	Fine Grained
5	60.0	46	0.51	0.00	0.00
5	60.0	62	0.50	0.00	0.00
5	60.0	60	0.48	0.00	0.00
2	24.0	59	0.47	0.00	0.00
				Total Settlement (inches)	**0.00**

Reference: Tokumatsu & Seed (1987)

LIQUEFACTION EVALUATION

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997
and *Evaluation of Settlements in Sand due to Earthquake Shaking*, Tokimatsu and Seed, 1987

Seismic Event		**Profile Constants**		**Depth to GWT**		**Project Name**	Richland-Chino
Max. Moment Magnitude	6.7	Total Unit Weight (lb/ft^3)	116.4	During Investigation (ft)	29	**Project Number**	G14-1194-10
Design Ground Motion	0.64	Unit Weight of Water (lbs/ft^3	62.4	During Design Event (ft)	15	**Boring**	B-8

Determination of Cyclic Resistance Ratio

Sampling Data				During Investigation			Sampling Correction Factors												
		Blow Count		Total Stress	Pore Pressure	Effective	Sampler	SPT	Overburden	Energy	Borehole	Rod Length	Sampler Type		Fines				
Depth (ft)	Depth (m)	SPT	Rings	Stress (psf)	Pressure (psf)	Stress (psf)	Diameter	N_m	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60}$	Content	$(N_1)_{60cs}$	K_σ	$CRR_{7.5}$	
1	0.3		30	116	0	116.4	0.750	22.500	2.000	1.50	1.00	0.75	1.00	50.6	42.8	**65.8**	1.00	SPT >30 NL	?
4	1.2		33	466	0	465.6	0.750	24.750	2.000	1.50	1.00	0.75	1.00	55.7	38.0	**71.8**	1.00	SPT >30 NL	?
7	2.1		15	815	0	814.8	0.750	11.250	1.601	1.50	1.00	0.75	1.00	20.3	65.5	**29.3**	1.00	0.39	?
10	3.0		34	1164	0	1164.0	0.750	25.500	1.339	1.50	1.00	0.75	1.00	38.4	65.5	**51.1**	1.00	SPT >30 NL	?
15	4.6	10		1746	0	1746.0	1.000	10.000	1.094	1.50	1.00	0.85	1.20	16.7	42.8	**25.1**	1.00	0.28	?
20	6.1		43	2328	0	2328.0	0.750	32.250	0.947	1.50	1.00	0.95	1.00	43.5	38.0	**57.2**	0.98	SPT >30 NL	
25	7.6	2		2910	0	2910.0	1.000	2.000	0.847	1.50	1.00	0.95	1.20	2.9	59.0	**8.5**	0.94	0.09	
30	9.1		23	3492	62.4	3429.6	0.750	17.250	0.780	1.50	1.00	1.00	1.00	20.2	56.3	**29.2**	0.91	0.35	?
31.5	9.6		23	3667	156	3510.6	0.750	17.250	0.771	1.50	1.00	1.00	1.00	20.0	56.3	**28.9**	0.90	0.34	
																			?
																			?
																			?

Determination of Cyclic Stress Ratio

Sampling Data				During Design Event							
		Blow Count		Total Stress	Pore Pressure	Effective					
Depth (ft)	Depth (m)	SPT	Rings	Stress (psf)	Pressure (psf)	Stress (psf)	r_d	CSR	MSF	FS	(N1)60cs
1	0.30		30	116.4	0	116.4	1.000	0.416	1.334	Above GWT Not Liquefiable	**65.8**
4	1.22		33	465.6	0	465.6	0.993	0.413	1.334	Above GWT Not Liquefiable	**71.8**
7	2.13		15	814.8	0	814.8	0.986	0.410	1.334	Fine Grained/Clay - Not Liquefiable	**29.3**
10	3.05		34	1164	0	1164	0.979	0.407	1.334	Fine Grained/Clay - Not Liquefiable	**51.1**
15	4.57	10		1746	0	1746	0.969	0.403	1.334	0.94	**25.1**
20	6.10		43	2328	312	2016	0.957	0.460	1.334	Corr. SPT>30	**57.2**
25	7.62	2		2910	624	2286	0.942	0.499	1.334	Fine Grained/Clay - Not Liquefiable	**8.5**
30	9.14		23	3492	936	2556	0.921	0.523	1.334	Fine Grained/Clay - Not Liquefiable	**29.2**
31.5	9.60		23	3666.6	1029.6	2637	0.913	0.528	1.334	Fine Grained/Clay - Not Liquefiable	**28.9**

Assumptions

4.5 Inch diameter boring (inside of hollow stem auger)
3 Rod Sitck up above boring in feet
no liner in SPT (Cs=1.20 for SPT)
Upper 4 feet is overexcavated and recompacted (SPT Blow Count = 30)

SETTLEMENT EVALUATION IN SATURATED SANDS

Project Name: Richland-Chino
Project No.: G14-1194-10
Boring No.: B-8

Layer Thickness t (ft)	Layer Thickness t (inches)	(N1)60	CSR	Volumetric Strain %	Settlement Per Liquefied Sand Layer (inches)
1	12.0	66	0.42	0.00	0.00
3	36.0	72	0.41	0.00	0.00
3	36.0	29	0.41	0.80	Fine Grained
3	36.0	51	0.41	0.00	Fine Grained
5	60.0	25	0.40	1.20	0.72
5	60.0	57	0.46	0.00	0.00
5	60.0	8	0.50	2.90	Fine Grained
5	60.0	29	0.52	0.90	Fine Grained
1.5	18.0	29	0.53	0.90	Fine Grained
				Total Settlement (inches)	**0.72**

Reference: Tokumatsu & Seed (1987)

LIQUEFACTION EVALUATION

Based on *Proceeding of the NCEER Workshop on Evaluation of Liquefaction Resistance of Soils*, Technical Report NCEER-97-0022, December 31, 1997
and *Evaluation of Settlements in Sand due to Earthquake Shaking*, Tokimatsu and Seed, 1987

Seismic Event		**Profile Constants**		**Depth to GWT**		**Project Name**	Richland-Chino
Max. Moment Magnitude	6.7	Total Unit Weight (lb/ft^3)	128.2	During Investigation (ft)	29	**Project Number**	G14-1194-10
Design Ground Motion	0.64	Unit Weight of Water (lbs/ft^3	62.4	During Design Event (ft)	15	**Boring**	B-9

Determination of Cyclic Resistance Ratio

Sampling Data				During Investigation			Sampling Correction Factors												
		Blow Count		Total Stress	Pore Pressure	Effective	Sampler	SPT	Overburden	Energy	Borehole	Rod Length	Sampler Type		Fines				
Depth (ft)	Depth (m)	SPT	Rings	Stress (psf)	Pressure (psf)	Stress (psf)	Diameter	N_m	C_N	C_E	C_B	C_R	C_S	$(N_1)_{60}$	Content	$(N_1)_{60cs}$	K_σ	$CRR_{7.5}$	
3	0.9		30	385	0	384.6	0.750	22.500	2.000	1.50	1.00	0.75	1.00	50.6	42.8	**65.8**	1.00	SPT >30 NL	?
6	1.8		13	769	0	769.2	0.750	9.750	1.648	1.50	1.00	0.75	1.00	18.1	56.3	**26.7**	1.00	0.31	?
9	2.7		15	1154	0	1153.8	0.750	11.250	1.345	1.50	1.00	0.75	1.00	17.0	55.5	**25.4**	1.00	0.29	?
14	4.3		34	1795	0	1794.8	0.750	25.500	1.079	1.50	1.00	0.85	1.00	35.1	38.0	**47.1**	1.00	SPT >30 NL	?
19	5.8	16		2436	0	2435.8	1.000	16.000	0.926	1.50	1.00	0.95	1.20	25.3	38.0	**35.4**	0.97	SPT >30 NL	?
24	7.3		17	3077	0	3076.8	0.750	12.750	0.824	1.50	1.00	0.95	1.00	15.0	59.0	**23.0**	0.93	0.23	
29	8.8	13		3718	0	3717.8	1.000	13.000	0.749	1.50	1.00	0.95	1.20	16.7	59.0	**25.0**	0.89	0.25	
30.5	9.3	13		3910	93.6	3816.5	1.000	13.000	0.740	1.50	1.00	1.00	1.20	17.3	59.0	**25.8**	0.88	0.26	?
																			?
																			?
																			?

Determination of Cyclic Stress Ratio

Sampling Data				During Design Event							
		Blow Count		Total Stress	Pore Pressure	Effective					
Depth (ft)	Depth (m)	SPT	Rings	Stress (psf)	Pressure (psf)	Stress (psf)	r_d	CSR	MSF	FS	(N1)60cs
3	0.91		30	384.6	0	384.6	0.995	0.414	1.334	Above GWT Not Liquefiable	**65.8**
6	1.83		13	769.2	0	769.2	0.988	0.411	1.334	Fine Grained/Clay - Not Liquefiable	**26.7**
9	2.74		15	1153.8	0	1153.8	0.981	0.408	1.334	Fine Grained/Clay - Not Liquefiable	**25.4**
14	4.27		34	1794.8	0	1794.8	0.971	0.404	1.334	Above GWT Not Liquefiable	**47.1**
19	5.79	16		2435.8	249.6	2186.2	0.959	0.445	1.334	Corr. SPT>30	**35.4**
24	7.32		17	3076.8	561.6	2515.2	0.945	0.481	1.334	Fine Grained/Clay - Not Liquefiable	**23.0**
29	8.84	13		3717.8	873.6	2844.2	0.925	0.503	1.334	Fine Grained/Clay - Not Liquefiable	**25.0**
30.5	9.30	13		3910.1	967.2	2942.9	0.918	0.507	1.334	Fine Grained/Clay - Not Liquefiable	**25.8**

Assumptions

4.5 inch diameter boring (inside of hollow stem auger)
3 Rod Sitck up above boring in feet
no liner in SPT (Cs=1.20 for SPT)
Upper 6 feet is overexcavated and recompacted (SPT Blow Count = 30)

SETTLEMENT EVALUATION IN SATURATED SANDS

Project Name: Richland-Chino
Project No.: G14-1194-10
Boring No.: B-9

Layer Thickness t (ft)	Layer Thickness t (inches)	(N1)60	CSR	Volumetric Strain %	Settlement Per Liquefied Sand Layer (inches)
3	36.0	66	0.41	0.00	0.00
3	36.0	27	0.41	1.00	Fine Grained
3	36.0	25	0.41	1.20	Fine Grained
5	60.0	47	0.40	0.00	0.00
5	60.0	35	0.44	0.00	0.00
5	60.0	23	0.48	1.30	Fine Grained
5	60.0	25	0.50	1.20	Fine Grained
1.5	18.0	26	0.51	1.10	Fine Grained
				Total Settlement (inches)	0.00

Reference: Tokumatsu & Seed (1987)

APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

APPENDIX E

LGC Geo-Environmental, Inc.

General Earthwork and Grading Specifications for Rough Grading

1.0 General

1.1 ***Intent:*** These General Earthwork and Grading Specifications are for the grading and earthwork shown on the approved grading plan(s) and/or indicated in the geotechnical report(s). These Specifications are a part of the recommendations contained in the geotechnical report(s). In case of conflict, the specific recommendations in the geotechnical report shall supersede these more general Specifications. Observations of the earthwork by the project Geotechnical Consultant during the course of grading may result in new or revised recommendations that could supersede these specifications or the recommendations in the geotechnical report(s).

1.2 ***The Geotechnical Consultant of Record:*** Prior to commencement of work, the owner shall employ a qualified Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultant shall be responsible for reviewing the approved geotechnical report(s) and accepting the adequacy of the preliminary geotechnical findings, conclusions, and recommendations prior to the commencement of the grading.

Prior to commencement of grading, the Geotechnical Consultant shall review the "work plan" prepared by the Earthwork Contractor (Contractor) and schedule sufficient personnel to perform the appropriate level of observation, mapping, and compaction testing.

During the grading and earthwork operations, the Geotechnical Consultant shall observe, map, and document the subsurface exposures to verify the geotechnical design assumptions. If the observed conditions are found to be significantly different from the interpreted assumptions during the design phase, the Geotechnical Consultant shall inform the owner, recommend appropriate changes in design to accommodate the observed conditions, and notify the review agency where required.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to confirm that the attained level of compaction is being accomplished as specified. The Geotechnical Consultant shall provide the test results to the owner and the Contractor on a routine and frequent basis.

1.3 ***The Earthwork Contractor:*** 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 Specifications prior to commencement of grading. The Contractor shall be solely responsible for performing the grading in accordance with the project plans and specifications. The Contractor shall prepare and submit to the owner and the Geotechnical Consultant a work plan that indicates the sequence of earthwork grading, the number of "equipment" of work and the estimated quantities of daily earthwork contemplated for the site prior to commencement of grading. The Contractor shall inform the owner and the

Geotechnical Consultant of changes in work schedules and updates to the work plan at least 24 hours in advance of such changes so that appropriate personnel will be available for observation and testing. The Contractor shall not assume that the Geotechnical Consultant is aware of all grading operations.

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

2.0 Preparation of Areas to be Filled

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 the Geotechnical Consultant.

The Geotechnical Consultant shall evaluate the extent of these removals depending on specific site conditions. Earth fill material shall not contain more than 2 percent of organic materials (by volume). No fill lift shall contain more than 2 percent of organic matter. 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 pillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed. The contractor is responsible for all hazardous waste relating to his work. The Geotechnical Consultant does not have expertise in this area. If hazardous waste is a concern, then the Client should acquire the services of a qualified environmental assessor.

2.2 Processing: Existing ground that has been declared satisfactory for support of fill by the Geotechnical Consultant shall be scarified to a minimum depth of 6 inches. Existing ground that is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until soils are broken down and free of oversize material and the working surface is reasonably uniform, flat, and free of uneven features that would inhibit uniform compaction.

2.3 Overexcavation: In addition to removals and overexcavations 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 overexcavated to competent ground as evaluated by the Geotechnical Consultant during grading.

2.4 ***Benching:*** Where fills are to be placed on ground with slopes steeper than 5:1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench or key shall be a minimum of 15 feet wide and at least 2 feet deep, into competent material as evaluated by the Geotechnical Consultant. Other benches shall be excavated a minimum height of 4 feet into competent material or as otherwise recommended by the Geotechnical Consultant. Fill placed on ground sloping flatter than 5:1 shall also be benched or otherwise overexcavated to provide a flat subgrade for the fill.

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 the Geotechnical Consultant as suitable to receive fill. The Contractor shall obtain a written acceptance from the Geotechnical Consultant prior to fill placement. A licensed surveyor shall provide the survey control for determining elevations of processed areas, keys, and benches.

3.0 Fill Material

3.1 ***General:*** Material to be used as fill shall be essentially free of organic matter and other deleterious substances evaluated and accepted by the Geotechnical Consultant 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 the Geotechnical Consultant or mixed with other soils to achieve satisfactory fill material.

3.2 ***Oversize:*** Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fill unless location, materials, and placement methods are specifically accepted by the Geotechnical Consultant. 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 vertical feet of finish grade or within 2 feet of future utilities or underground construction.

3.3 ***Import:*** If importing of fill material is required for grading, proposed import material shall meet the requirements of Section 4.1.3. The potential import source shall be given to the Geotechnical Consultant at least 48 hours (2 working days) before importing begins so that its suitability can be determined and appropriate tests performed.

4.0 Fill Placement and Compaction

4.1 ***Fill Layers:*** Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 8 inches in loose thickness. The Geotechnical Consultant may accept thicker layers if testing indicates the grading procedures can adequately compact the thicker layers. Each layer shall be spread evenly and mixed thoroughly to attain relative uniformity of material and moisture throughout.

4.2 ***Fill Moisture Conditioning:*** Fill soils shall be watered, dried back, blended, and/or mixed, as necessary to attain 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 D1557-91).

4.3 ***Compaction of Fill:*** After each layer has been moisture-conditioned, mixed, and evenly spread, it shall be uniformly compacted to not less than 90 percent of maximum dry density (ASTM Test Method D1557-91). 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.

4.4 ***Compaction of Fill Slopes:*** In addition to normal compaction procedures specified above, compaction of slopes shall be accomplished by backrolling of slopes with sheepsfoot rollers at increments of 3 to 4 feet in fill elevation, or by other methods producing satisfactory results acceptable to the Geotechnical Consultant. Upon completion of grading, relative compaction of the fill, out to the slope face, shall be at least 90 percent of maximum density per ASTM Test Method D1557-91.

4.5 ***Compaction Testing:*** Field tests for moisture content and relative compaction of the fill soils shall be performed by the Geotechnical Consultant. Location and frequency of tests shall be at the Consultant'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).

4.6 ***Frequency of Compaction Testing:*** Tests shall be taken at intervals not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of compacted fill soils embankment. In addition, as a guideline, at least one (1) test shall be taken on slope faces for each 5,000 square feet of slope face and/or each 10 feet of vertical height of slope. The Contractor shall assure that fill construction is such that the testing schedule can be accomplished by the Geotechnical Consultant. The Contractor shall stop or slow down the earthwork construction if these minimum standards are not met.

4.7 ***Compaction Test Locations:*** The Geotechnical Consultant shall document the approximate elevation and horizontal coordinates of each test location. The Contractor shall coordinate with the project surveyor to assure that sufficient grade stakes are established so that the Geotechnical Consultant can determine the test locations with sufficient accuracy. At a minimum, two (2) grade stakes within a horizontal distance of 100 feet and vertically less than 5 feet apart from potential test locations shall be provided.

5.0 Subdrain Installation

Subdrain systems shall be installed in accordance with the approved geotechnical report(s) and the grading plan. The Geotechnical Consultant may recommend additional subdrains and/or changes in subdrain extent, location, grade, or material depending on conditions encountered during grading. All subdrains shall be surveyed by a land surveyor/civil engineer for line and grade after installation and prior to burial. Sufficient time should be allowed by the Contractor for these surveys.

6.0 Excavation

Excavations, as well as over-excavation for remedial purposes, shall be evaluated by the Geotechnical Consultant during grading. Remedial removal depths shown on geotechnical plans are estimates only. The actual extent of removal shall be determined by the Geotechnical Consultant 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, evaluated, and accepted by the

Geotechnical Consultant prior to placement of materials for construction of the fill portion of the slope, unless otherwise recommended by the Geotechnical Consultant.

7.0 ***Trench Backfills***

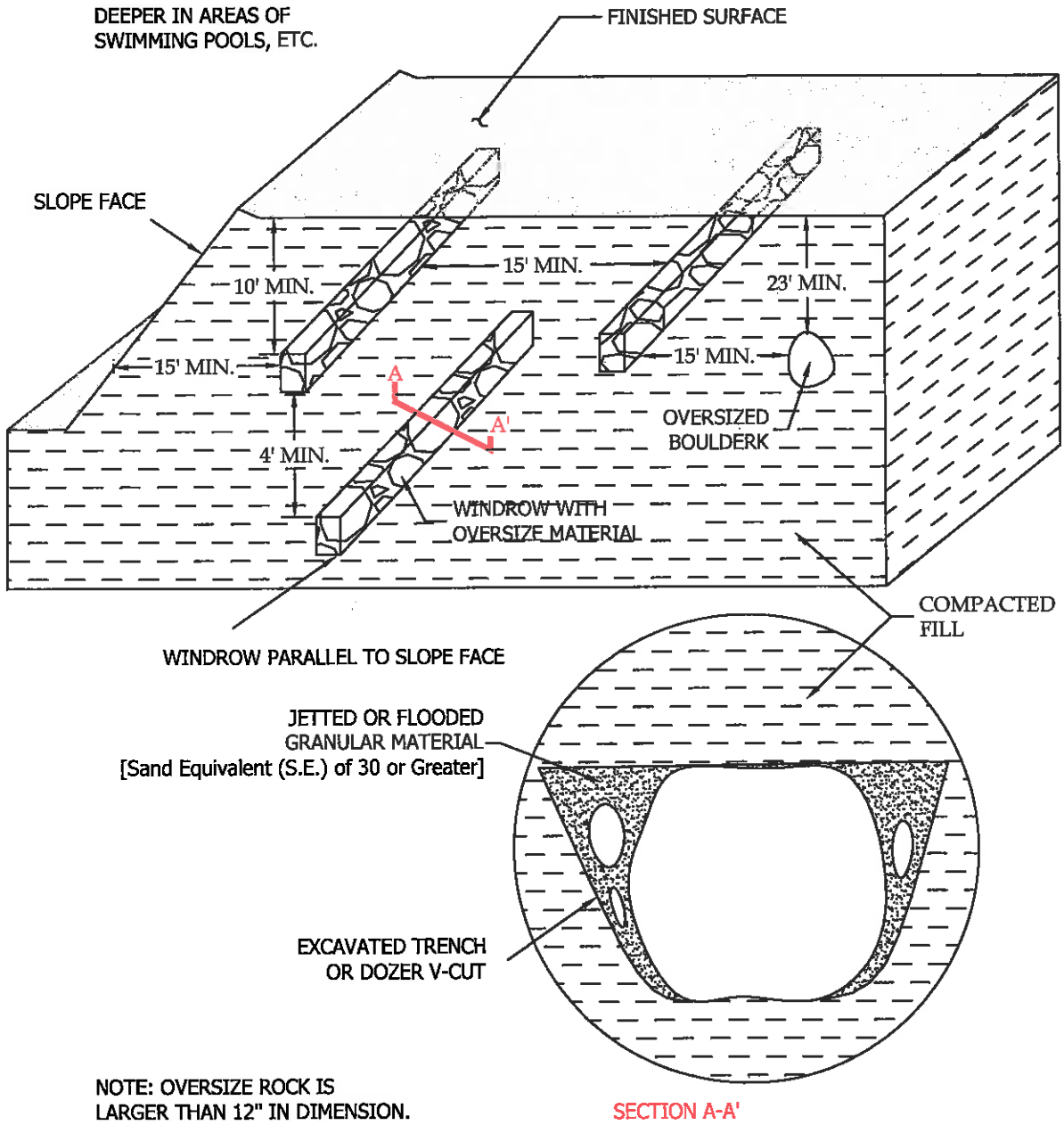
7.1 The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 All bedding and backfill of utility trenches shall be done in accordance with the applicable provisions of Standard Specifications of Public Works Construction. Bedding material shall have a Sand Equivalent greater than 30 (SE>30). The bedding shall be placed to 1 foot over the top of the conduit and densified by jetting. Backfill shall be placed and densified to a minimum of 90 percent of maximum from 1 foot above the top of the conduit to the surface.

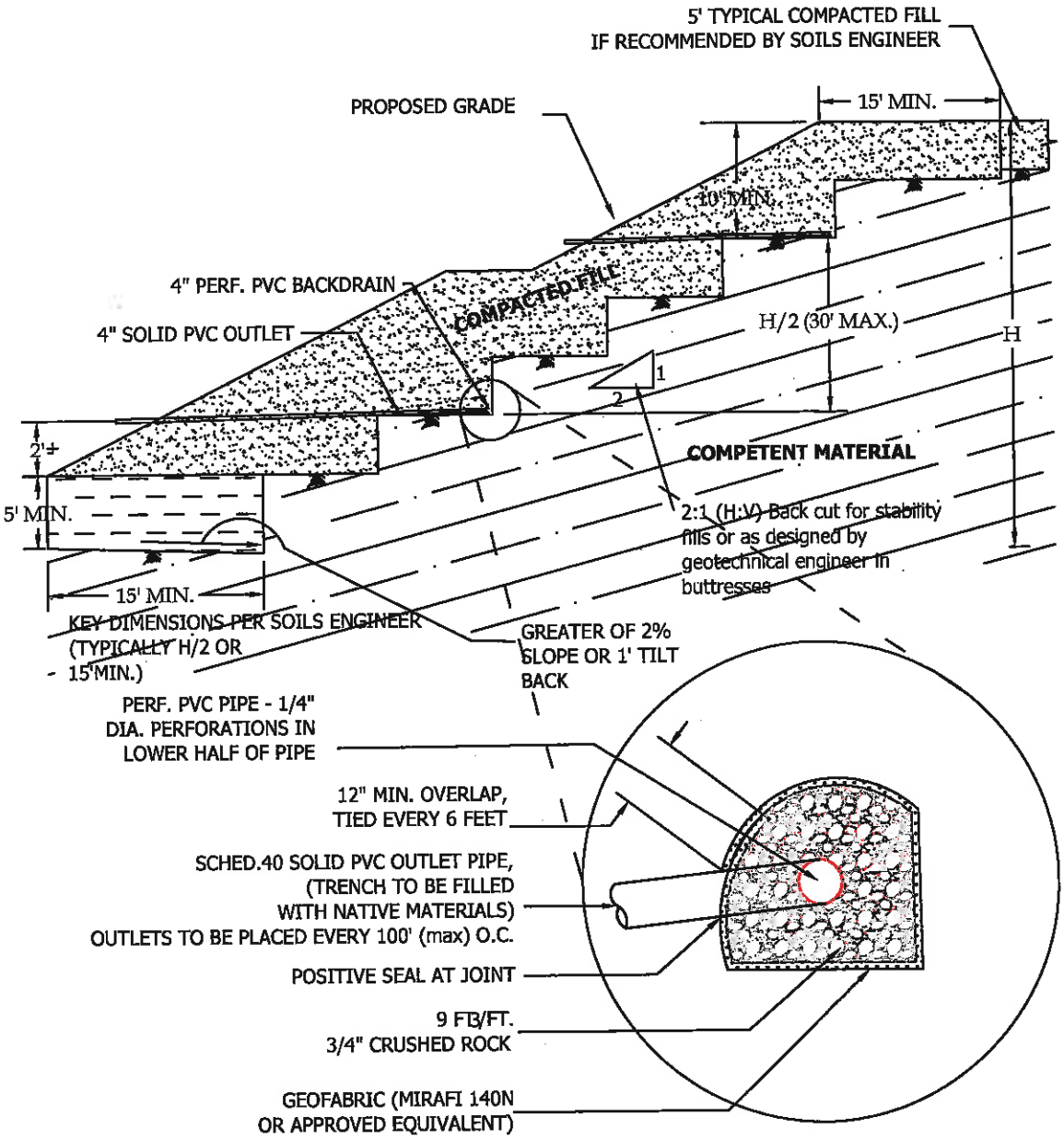
7.3 The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.

7.4 The Geotechnical Consultant shall test the trench backfill for relative compaction. At least one (1) test should be made for every 300 feet of trench and 2 feet of fill.

7.5 Lift thickness of trench backfill shall not exceed those allowed in the Standard Specifications of Public Works Construction unless the Contractor can demonstrate to the Geotechnical Consultant that the fill lift can be compacted to the minimum relative compaction by his alternative equipment and method.



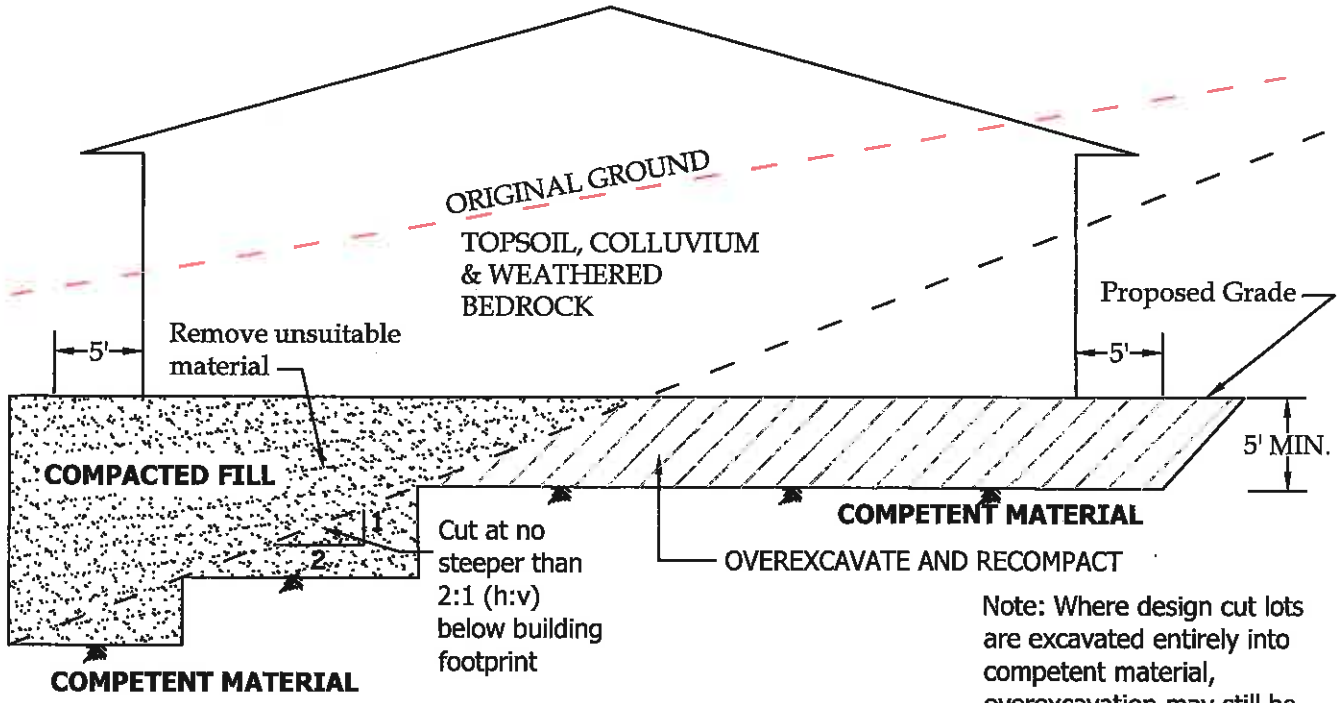
OVERSIZE ROCK DISPOSAL



TYPICAL STABILIZATION FILL DETAIL

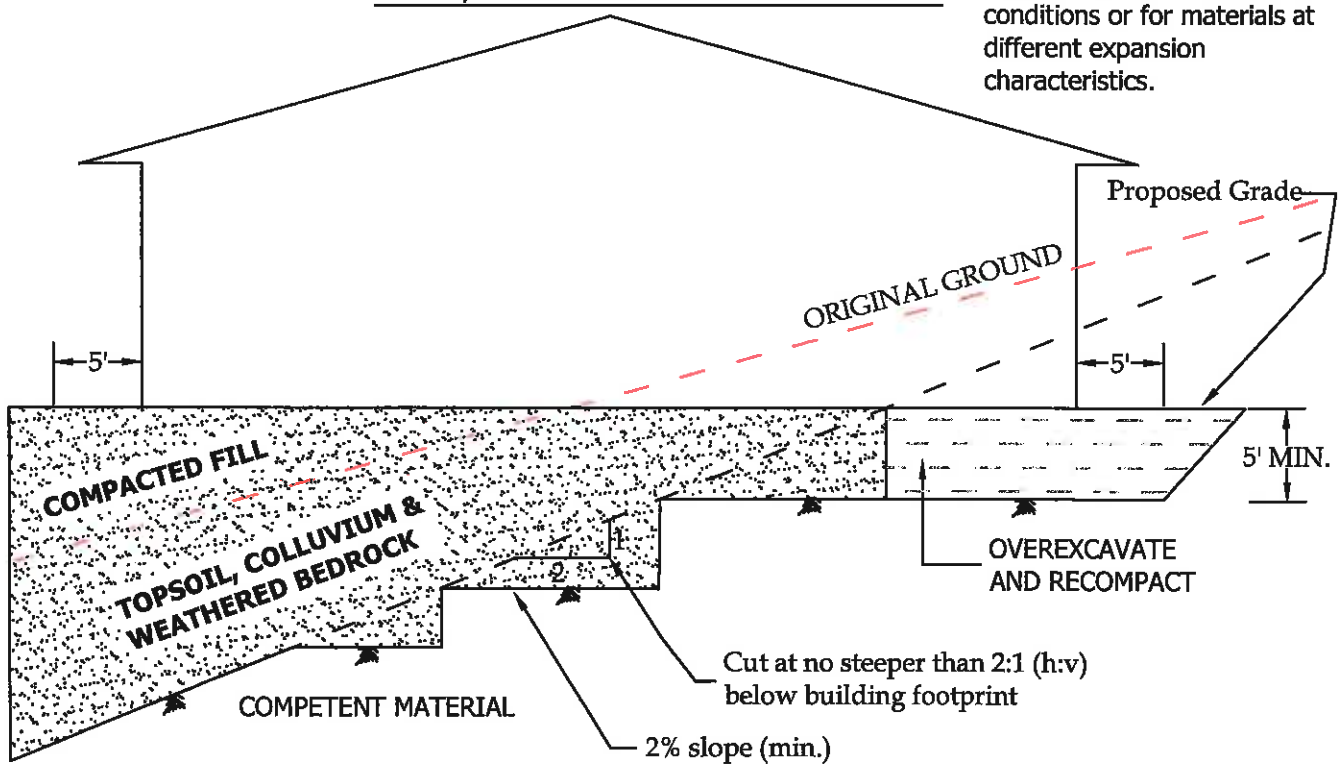
CUT LOT

(Exposing Unsuitable Soils/Bedrock @ Design Grade)



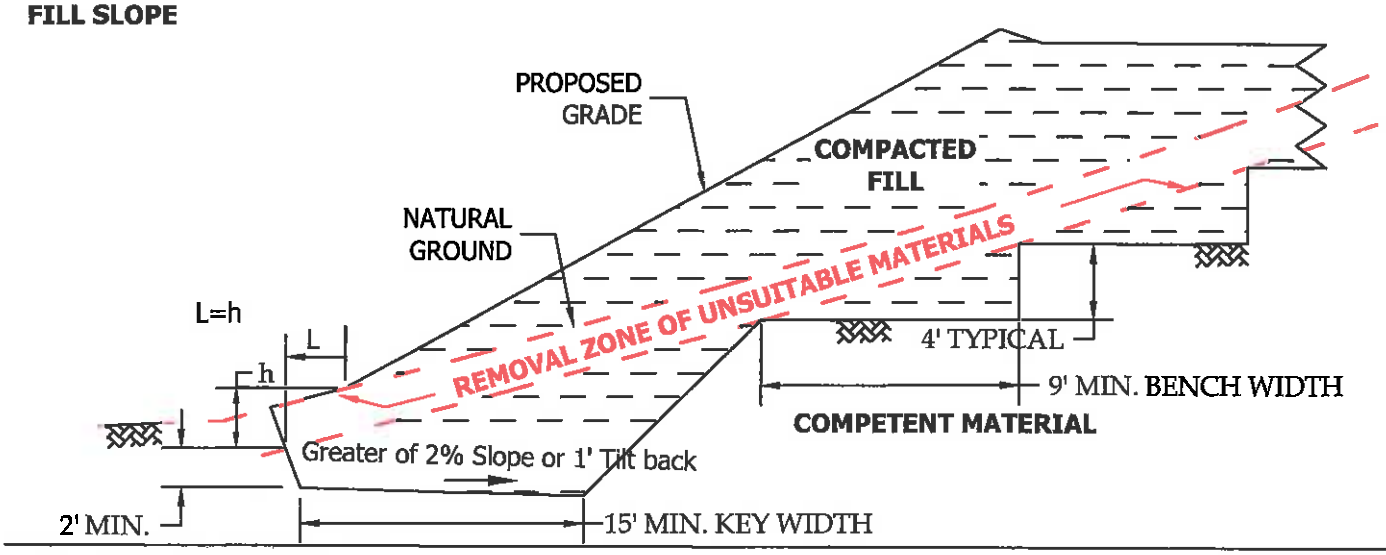
Note: Where design cut lots are excavated entirely into competent material, overexcavation may still be required for hard-rock conditions or for materials at different expansion characteristics.

CUT/FILL TRANSITION LOT

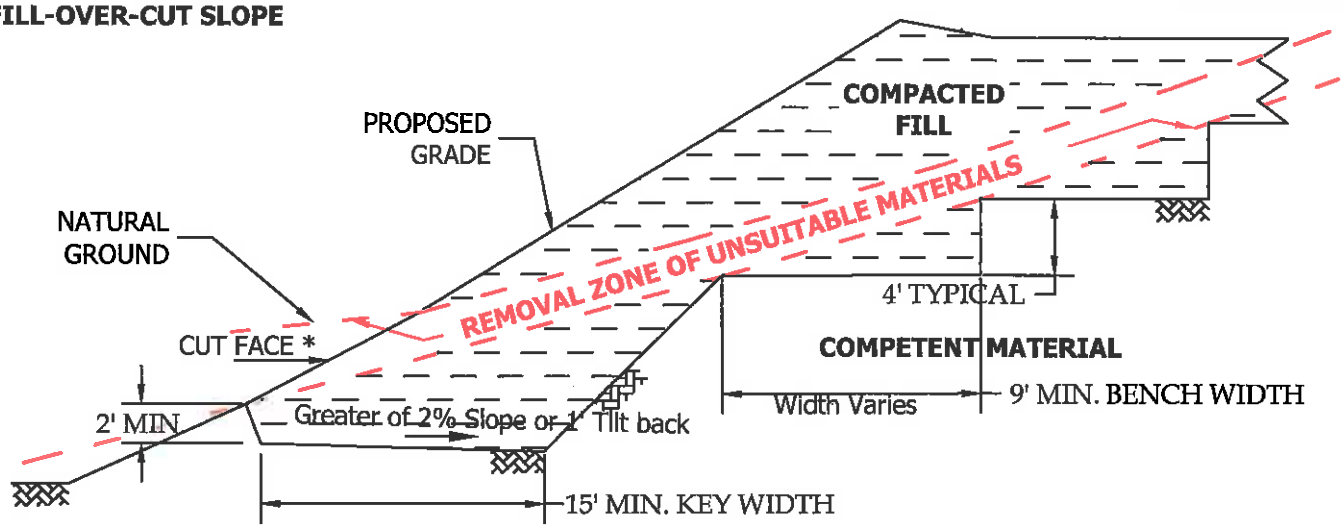


TRANSITION LOT OVEREXCAVATION DETAIL

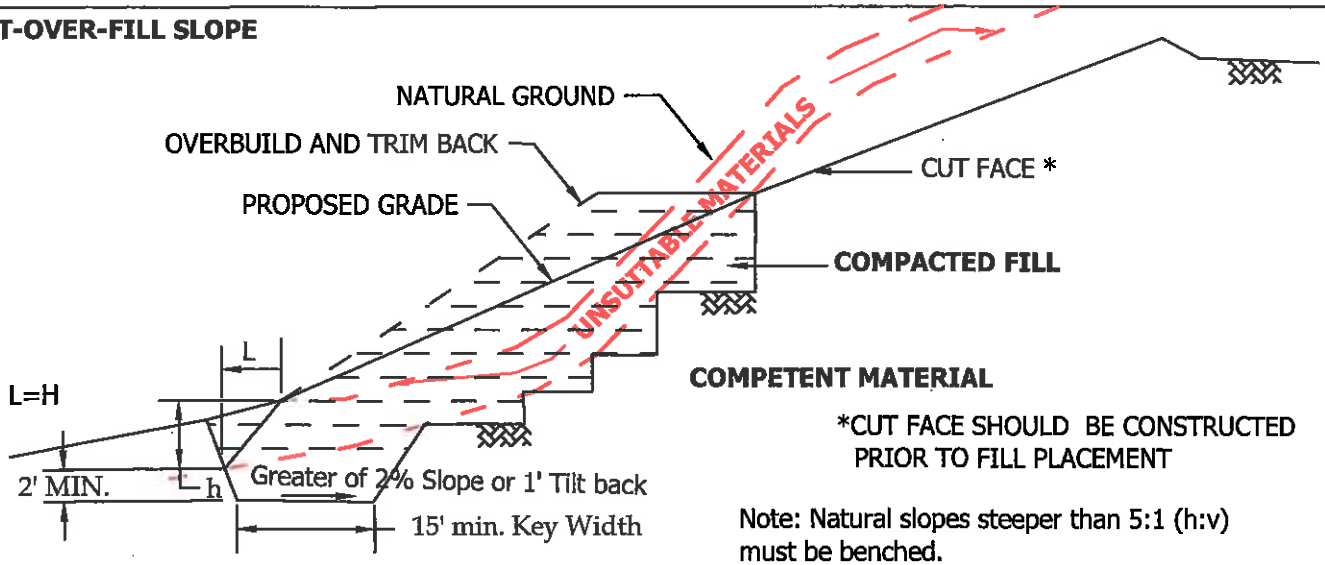
FILL SLOPE



FILL-OVER-CUT SLOPE

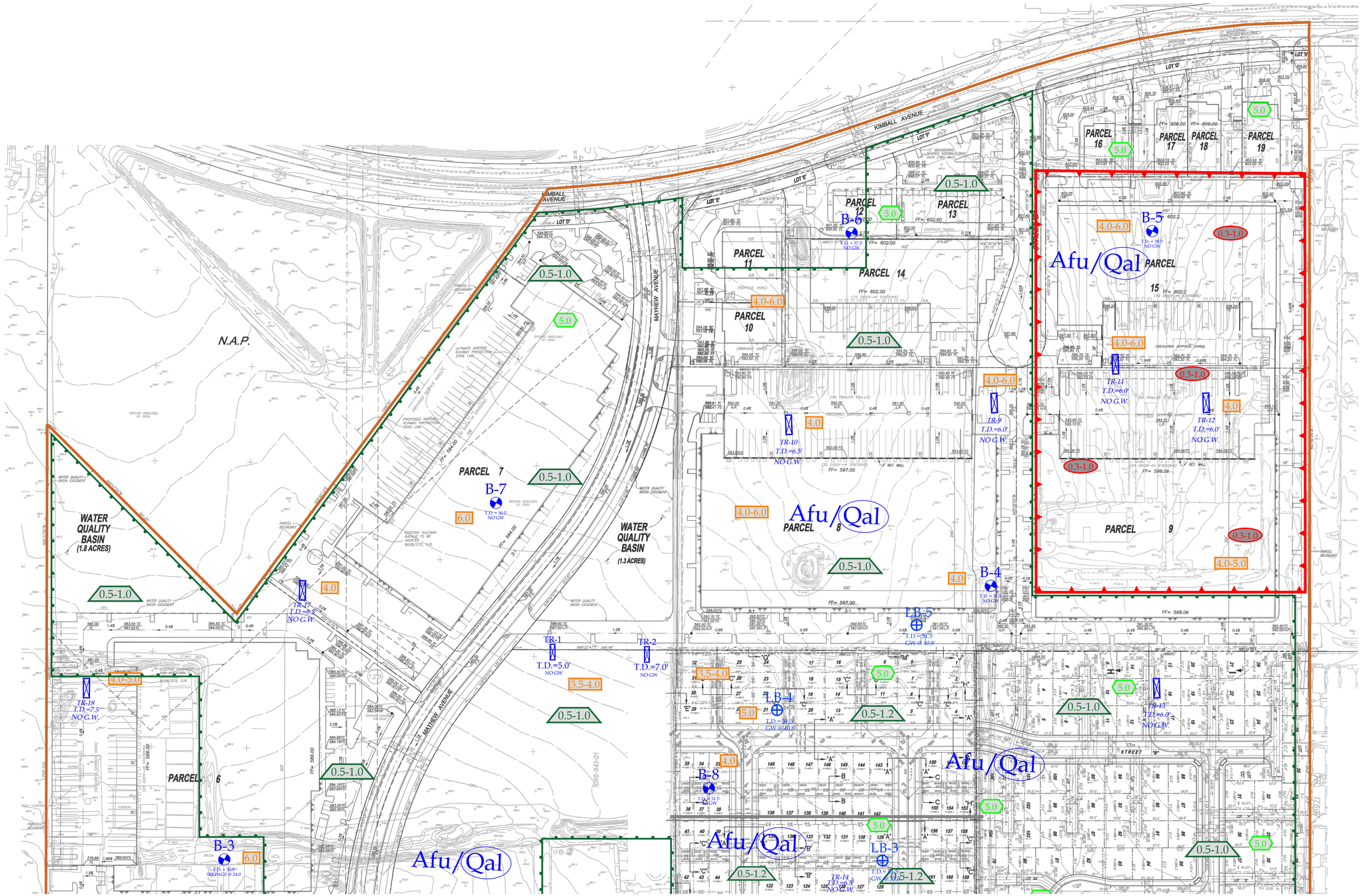


CUT-OVER-FILL SLOPE



Note: Natural slopes steeper than 5:1 (h:v) must be benched.

KEYING AND BENCHING



LEGEND

(Locations are Approximate)

Geologic Earth Units

Afu - Artificial Fill, Undocumented

Qal - Alluvium (Circled Where Buried)

Symbols

- Limits of This Report
- B-10 (T.D. = 27.5' NO GW) - Exploratory Boring Location
- TR-24 (T.D.=11.0' NO G.W.) - Exploratory Trench Location
- LB-6 (T.D.= 21.5' NO G.W.) - Boring Location (Leighton & Associates, Inc., 2012)
- 6.0-9.0 - Approximate Depths of Overexcavation Below Existing Grade (ft.)
- 5.0 - Approximate Depths of Overexcavation In Proposed Cut Areas (ft.)
- 0.5-1.2 - Area of Manure or Highly Organic Soils to be Removed and Approximate Depth (ft.)
- 0.5-1.2 - Area of Partially Organic Soils which can be Blended with Natural Soils as Fill to 2% or less and Approximate depth (ft.)

LOGICAL GEOTECHNICAL CONSULTANTS
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING • SWPPP
27570 COMMERCE CENTER DR., #128, TEMECULA, CA 92590
PHONE: 951.297.2450 FAX: 951.719.2998
WWW.LGCGEOENV.COM

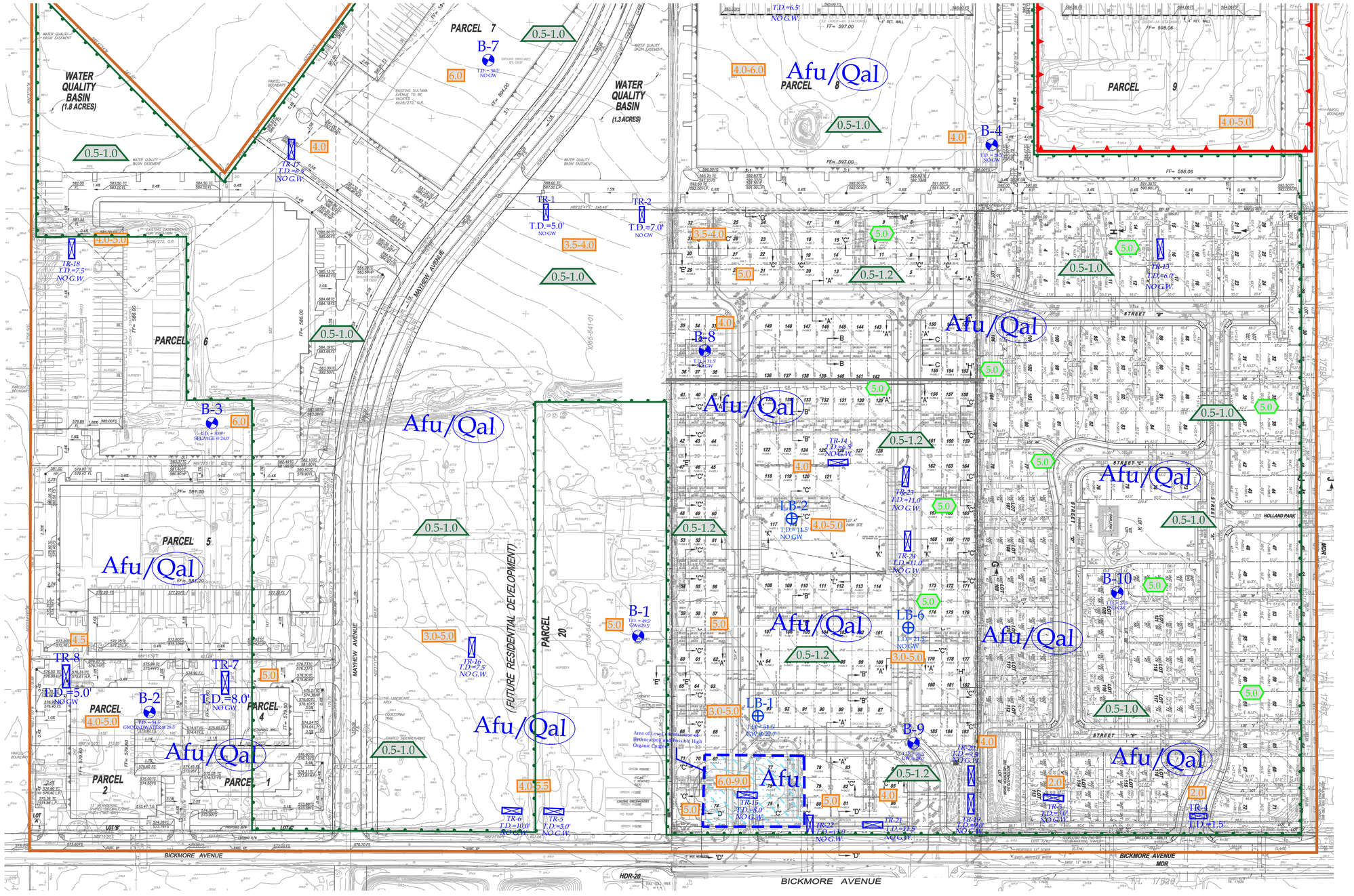
Robert L. Gregorek, II — Engineering Geologist
Larry D. Cooley — Project Engineer

GEOTECHNICAL MAP

121 ACRE MASTER PLANNED DEVELOPMENT
CITY OF CHINO, SAN BERNARDINO COUNTY, CALIFORNIA

Name:	RICHLAND/CHINO BICHMORE PROPERTIES
Project No.	G141194-10
Client:	RICHLAND REAL ESTATE FUND, LLC
Scale:	1" = 100'
Date:	SEPTEMBER 2016
References:	PROACTIVE ENGINEERING, VARIOUS PLANS
Plate No.	1 OF 2

See Plate 1



LEGEND

(Locations are Approximate)

Geologic Earth Units

Afu - Artificial Fill, Undocumented

Qal - Alluvium (Circled Where Buried)

Symbols

- Limits of This Report
- B-10 (T.D. = 27.5' NO GW) - Exploratory Boring Location
- TR-24 (T.D.=11.0' NO G.W.) - Exploratory Trench Location
- LB-6 (T.D.= 21.5' NO G.W.) - Boring Location (Leighton & Associates, Inc., 2012)
- 6.0-9.0 - Approximate Depths of Overexcavation Below Existing Grade (ft.)
- 5.0 - Approximate Depths of Overexcavation In Proposed Cut Areas (ft.)
- 0.5-1.2 - Area of Manure or Highly Organic Soils to be Removed and Approximate Depth (ft.)
- 0.5-1.2 - Area of Partially Organic Soils which can be Blended with Natural Soils as Fill to 2% or less and Approximate depth (ft.)
- Area of Low Concentration of Hydrocarbon and Possible High Organic Content

LOGICAL GEOTECHNICAL CONSULTANTS
GEOTECHNICAL • ENVIRONMENTAL • MATERIALS TESTING • SWPPP
27570 COMMERCE CENTER DR., #128, TEMECULA, CA 92590
PHONE: 951.297.2450 FAX: 951.719.2998
WWW.LGCGEOENV.COM

Robert L. Gregorek, II — Engineering Geologist
Larry D. Cooley — Project Engineer

GEOTECHNICAL MAP

121 ACRE MASTER PLANNED DEVELOPMENT
CITY OF CHINO, SAN BERNARDINO COUNTY, CALIFORNIA

Name:	RICHLAND/CHINO BICHMORE PROPERTIES
Project No.	G141194-10
Client:	RICHLAND REAL ESTATE FUND, LLC
Scale:	1" = 100'
Date:	SEPTEMBER 2016
References:	PROACTIVE ENGINEERING, VARIOUS PLANS
Plate No.	2 OF 2