Appendix D

Geotechnical Report

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PRELIMINARY GEOTECHNICAL INVESTIGATION, PROPOSED RESIDENTIAL DEVELOPMENT, FORMER CLIPPINGER CHEVROLET DEALERSHIP, 137 WEST SAN BERNARDINO ROAD AND ADJACENT AREAS, CITY OF COVINA, CALIFORNIA

Prepared For:

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Project No. 11176.001

December 9, 2015

DRAFT

December 9, 2015

Project No. 11176.001

To: Hassen Development Corporation
100 North Barranca Street, Suite 900
West Covina, California 91791

Attention: Mr. Tarif Alhassen

Subject: Preliminary Geotechnical Investigation, Proposed Residential Development, Former Clippinger Chevrolet Dealership, 137 West San Bernardino Road and Adjacent Areas, City of Covina, California

In accordance with your request and authorization, Leighton and Associates, Inc. (Leighton) has conducted this geotechnical investigation for the proposed residential development at the former Clippinger Chevrolet dealership and several nearby properties in the vicinity of San Bernardino Road, Geneva Road, Citrus Avenue and Orange Street in the City of Covina, California. Several properties proposed for development include:

- The former Chevrolet dealership located at 137 W. San Bernardino Road (north of San Bernardino Road, west of Citrus, south of Geneva Place and east of 3rd Avenue).
- The former Chevrolet Collision Center and adjacent property located at 141 and 167 West Geneva Place (north of Geneva Place and east of 3rd Avenue).
- The former gas station at 401 N. Citrus Avenue (on the northwest corner of Citrus Avenue and Orange Street).
- The vacant lots at 129 and 137 W. Orange Street (north of Orange Street, west of Citrus Avenue).
- The vacant lot at 155 E. San Bernardino Road.

The purpose of this study has been to evaluate the general geotechnical conditions at the site with respect to the proposed development and to provide preliminary geotechnical recommendations for design and construction.

Based on this investigation, construction of the proposed residential development is feasible from a geotechnical standpoint. The most significant geotechnical issues at the site are those related to the potential for strong seismic shaking and potentially compressible soils. Good planning and design of the project can limit the impact of these constraints. This report presents our preliminary findings, conclusions, and geotechnical recommendations for the project.

We appreciate the opportunity to work with you on the development of this project. If you have any questions regarding this report, please call us at your convenience.

Respectfully submitted,

LEIGHTON AND ASSOCIATES, INC.

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1.0 INTRODUCTION

1.1 Site Location and Description

The sites range in size, the biggest being approximately 3.5 acres, and are relatively flat, as are the surrounding properties. Most of the area planned for development was formerly a Chevrolet dealership. Sales and showroom offices, repair facilities and structures associated with the dealership are present on the two northern parcels. The majority of the area is covered with asphalt pavement. A former gas station at Citrus Avenue and Orange Street included a station building setback from and facing Citrus Avenue. The pumps and fueling island have been removed. The properties are all within approximately 800 feet from the intersection of San Bernardino Road and Citrus Avenue (see Figure 1). The properties all drain slightly to the south.

Based on our review of historical aerial photos, it appears that in 1948 the properties were mainly residential units, some having active orchards. From 1954 to 1964, most of the orchards and residences had been cleared and the Clippinger car dealership structures had been built. Since 1964, the site appears to have had few structural changes.

1.2 Proposed Development

No development plans were available during our investigation. We understand residential developments with 2- to 3-story multi-family residences are planned. The project includes designs with ground floor parking and residences above as well as structures planned with retail space on the ground floor, and residences above. Based on the relatively gentle topography, only minor cuts and fills (on the order of 5 feet or less) are expected to achieve design grades. Drainage, utility, street, hardscape and landscape improvements are also planned.

1.3 Purpose of Investigation

The purpose of this study has been to evaluate the general geotechnical conditions at the site with respect to the proposed development and provide preliminary geotechnical recommendations for design and construction.

Our geotechnical exploration included hollow-stem auger soil borings, laboratory testing and geotechnical analysis to evaluate existing conditions and develop the recommendations contained in this report. We also conducted infiltration testing to evaluate general infiltration characteristics at the locations and depths tested for water quality basin design.

1.4 Scope of Investigation

The scope of our study has included the following tasks:

- Background Review: We reviewed available, relevant geotechnical and geologic maps and reports and aerial photographs available from our in-house library. This included a review of geotechnical reports previously prepared for the site.

- Utility Coordination: We contacted Underground Service Alert (USA) prior to excavating borings and test pits so that utility companies could mark utilities onsite. We also coordinated our work with you and the property representative.

- Field Exploration: A total of 13 exploratory soil borings (LB-1 through LB-13) were sampled and logged onsite to evaluate subsurface conditions.

    - The borings were drilled to depths ranging from approximately 21.0 to 51.5 feet below the existing ground surface (bgs) by a subcontracted drill rig operator. The borings were logged by our field representative during drilling. Relatively undisturbed soil samples were obtained at selected intervals within the borings using a California Ring Sampler. Standard Penetration Tests (SPT) were conducted at selected depths and samples were obtained. Representative bulk soil samples were also collected at shallow depths from the borings.

    - Well permeameter tests were conducted within 5 of the borings (LB-2, 5, 9, 11 and 12) to evaluate general infiltration rates of subsurface soils at the depths and locations tested. The well permeameter tests were conducted based on the USBR-7300-89 method. Tests were conducted at depths of approximately 5.0 to 9.5 feet bgs to estimate the infiltration rate.

All excavations were backfilled with the soil cuttings. Logs of the geotechnical borings and the well permeameter test results are presented in Appendix B. Approximate boring and well permeameter test locations are shown on the accompanying Boring Location Map, Figure 2.

- Geotechnical Laboratory Testing: Geotechnical laboratory tests were conducted on selected relatively undisturbed and bulk soil samples obtained during our field investigation. This laboratory testing program was designed to evaluate engineering characteristics of site soils. Laboratory tests conducted during this investigation include:

  - In situ moisture content and dry density
  - Swell or Collapse Potential
  - Consolidation
  - Expansion Index
  - Maximum dry density and optimum moisture content
  - Water-soluble sulfate concentration in the soil
  - Resistivity, chloride content and pH
  - Pocket Penetrometer

  The in situ moisture content and dry density test results are shown on the boring logs in Appendix B. The other laboratory test results are presented in Appendix C.

- Engineering Analysis: Data obtained from our background review, field exploration and geotechnical laboratory testing was evaluated and analyzed to develop geotechnical conclusions and provide preliminary recommendations presented in this report.

- Report Preparation: Results of our preliminary geotechnical investigation have been summarized in this report, presenting our findings, conclusions and preliminary geotechnical recommendations for design and construction of the proposed development.

2.0 FINDINGS

2.1 Regional Geologic Conditions

The site is located within the San Gabriel Valley in the Transverse Range geomorphic province of California. Major structural features surround this region, including the Sierra Madre fault and the San Gabriel Mountains to the north, the Santa Fe Flood Control Basin to the west, and the San Jose Hills and San Jose Fault to the southeast. This is an area of large-scale crustal disturbance as the relatively northwestward-moving Peninsular Range Province collides with the Transverse Range Province (San Gabriel and San Bernardino Mountains) to the north. Several active or potentially active faults have been mapped in the region and are believed to accommodate compression associated with this collision. The site is underlain by younger alluvial soil deposits eroded from the mountains surrounding the valley and deposited in the site vicinity.

2.2 Subsurface Soil Conditions

Based upon our review of pertinent geotechnical literature and our subsurface exploration, the site is underlain by alluvial soil deposits. The alluvial soil encountered within our excavations generally consisted of combinations of silty sand, sandy silt, and sand with gravel. The soil encountered was generally slightly moist to moist and was medium dense to dense. The in-situ moisture content within the upper approximately 15 feet generally ranged from 2 to 16 percent. More detailed descriptions of the subsurface soil are presented on the boring logs.

2.2.1 Compressible and Collapsible Soil

Soil compressibility refers to a soil’s potential for settlement when subjected to increased loads as from a fill surcharge. Based on our laboratory test results, the native soil encountered is generally considered slightly to moderately compressible. Partial removal and recompaction of this material under shallow foundations is recommended to reduce the potential for adverse total and differential settlement of the proposed improvements. Based upon our laboratory test results, the potential for hydrocollapse (settlement upon wetting) is expected to be very low.

2.2.2 Expansive Soils

Expansive soils contain significant amounts of clay particles that swell considerably when wetted and shrink when dried. Foundations constructed on these soils are subjected to large uplifting forces caused by the swelling. Without proper measures taken, heaving and cracking of building foundations and slabs-on-grade could result.

Near-surface soil samples were tested for expansion index. The results of these tests indicated an expansion index of 2 and 9. Based on these test results, the near surface soil is expected to have a very low expansion potential.

2.2.3 Sulfate Content

Water-soluble sulfates in soil can react adversely with concrete. However, concrete in contact with soil containing sulfate concentrations of less than 0.1 percent by weight is considered to have negligible sulfate exposure based on the American Concrete Institute (ACI) provisions, adopted by the 2013 CBC (CBC, 2013, Chapter 19; and ACI, 2008).

Near-surface soil samples were tested for soluble sulfate content. The results of these tests indicated a sulfate content of less than 0.02 percent by weight, indicating negligible sulfate exposure. Recommendations for concrete in contact with the soil are provided in Section 3.12.

2.2.4 Resistivity, Chloride and pH

Soil corrosivity to ferrous metals can be estimated by the soil's electrical resistivity, chloride content and pH. In general, soil having a minimum resistivity less than 1,000 ohm-cm is considered severely corrosive. Soil with a chloride content of 500 parts-per-million (ppm) or more is considered corrosive to ferrous metals.

As a screening for potentially corrosive soil, soil samples were tested during this investigation to determine minimum resistivity, chloride content, and pH. These tests indicated a minimum resistivity of 4,500 ohm-cm, chloride content of 41 ppm, and pH of 7.9. Based on this, the onsite soil is considered mildly corrosive to ferrous metals.

2.3 Groundwater

Groundwater was not encountered in our borings excavated to a maximum depth of 51.5 feet below the existing ground surface (bgs). Current groundwater levels in the area are on the order of 300 feet deep (CDWR, 2011). Historical high groundwater levels in the area were estimated to have been on the order of 200 feet bgs (CGS, 1998). Based on this, groundwater has historically been deep, and shallow groundwater is not expected at the site.

2.4 Faulting and Seismicity

Our review of available in-house literature indicates that there are no known active faults traversing the site. The closest known active or potentially active fault is the San Jose fault, located approximately 3 miles southeast of the site.

The principal seismic hazard that could affect the site is ground shaking resulting from an earthquake occurring along several major active or potentially active faults in southern California. The known regional active and potentially active faults that could produce the most significant ground shaking at the site include the San Jose, Sierra Madre, Raymond, Clamshell, Chino (Elsinore), Whittier, Cucamonga, Elysian Park, Verdugo, and Hollywood Thrust Faults.

Based on ASCE 7-10 Equation 11.8-1, the F_{PGA} is 1, the PGA is 0.76g, and the PGA_M is 0.76g. As an added check, PGA and hazard deaggregation were also estimated using the United States Geological Survey's (USGS) 2008 Interactive Deaggregations utility. The results of this analysis indicate that the predominant modal earthquake has a PGA of 0.78g with magnitude of approximately 6.6 (M_W) at a distance on the order of 13 kilometers for the Maximum Considered Earthquake (2% probability of exceedance in 50 years). Based on the above, we have selected a design PGA of 0.76g for seismic analysis of the onsite soils (seismic settlement).

2.5 Secondary Seismic Hazards

In general, secondary seismic hazards for sites in the region could include soil liquefaction, earthquake-induced settlement, lateral displacement, landsliding, and earthquake-induced flooding. The potential for secondary seismic hazards at the site is discussed below.

2.5.1 Liquefaction Potential

Liquefaction is the loss of soil strength or stiffness due to a buildup of pore-water pressure during severe ground shaking. Liquefaction is associated primarily with loose (low density), saturated, fine-to-medium grained, cohesionless soils. As the shaking action of an earthquake progresses, the soil grains are rearranged and the soil densifies within a short period of time. Rapid densification of the soil results in a buildup of pore-water pressure. When the pore-water pressure approaches the total overburden pressure, the soil reduces greatly in strength and temporarily behaves similarly to a fluid. Effects of liquefaction can include sand boils, settlement, and bearing capacity failures below structural foundations.

The state of California liquefaction hazard map for this area, (CGS, 1999) does not show the site in a zone of susceptibility for liquefaction.

Based on our study, the historically highest groundwater levels are on the order 200 feet bgs. As such, the potential for liquefaction at the site is very low.

2.5.2 Seismically Induced Settlement

During a strong seismic event, seismically induced settlement can occur within loose to moderately dense, dry or saturated granular soil. Settlement caused by ground shaking is often nonuniformly distributed, which can result in differential settlement.

We have performed analyses to estimate the potential for seismically induced settlement using the method of Tokimatsu and Seed (1987), and based on Martin and Lew (1999), considering the maximum considered earthquake (MCE) peak ground acceleration (PGA_M). The results of our analyses suggest that the onsite soils are susceptible to roughly 2 inches of seismic settlement based on the MCE. Differential settlement due to seismic loading is assumed to be less than 1 inch over a horizontal distance of 40 feet based on the MCE. A summary of seismic settlement analysis is included in Appendix D.

2.5.3 Seismically Induced Landslides

The site is level without significant slopes. This site is not considered susceptible to static slope instability or seismically induced landslides.

2.6 Infiltration Testing

Five well permeameter tests (LB-2, 5, 9, 11, and 12) were conducted, one at each property, to estimate the infiltration rate of the onsite soils in those locations and at the depths tested. These infiltration tests were conducted at depths between approximately 5.5 and 9.5 feet below the ground surface. The infiltration locations were provided by the project civil engineer.

Well permeameter tests are useful for field measurements of soil infiltration rates, and are suited for testing when the design depth of the basin or chamber is deeper than current existing grades. It should be noted that this is a clean-water, small-scale test, and that correction factors need to be applied. The test consists of excavating a boring to the depth of the test (or deeper if it is partially backfilled with soil and a bentonite plug with a thin soil covering is placed just below the design test elevation). A layer of clean sand is placed in the boring bottom to support temporary perforated well casing pipe and a float valve. In addition, course sand is poured around the outside of the well casing within the test zone to prevent the boring from caving/collapsing or eroding when water is added. The float valve, lowered into the boring inside the casing, adds water stored in barrels at the top of the hole to the boring as water infiltrates into the soil, while maintaining a relatively constant water head in the boring. The incremental infiltration rate as measured during intervals of the test is defined as the incremental flow rate of water infiltrated, divided by the surface area of the infiltration interface. The test was conducted based on the USBR 7300-89 test method.

Small-scale infiltration test rates were measured at the 5 well permeameter locations (LB-2, 5, 9, 11, and 12). At locations LB-2 and LB-5, small-scale infiltration test rates were estimated to be 0.2 to 0.4 inches per hour, and were tested within silty alluvial soils. At locations LB-9, LB-11, and LB-12, small-scale infiltration test rates were estimated to be 2.3 inches per hour or greater, and were tested within sandy soils with low fines contents. These are raw values, before applying an appropriate factor safety or correction factor. Based on these results, the onsite silty soils or soils with a higher fines content are not anticipated to have satisfactory infiltration rates. Sandy soils with a low fines content are anticipated to have higher infiltration rates. Results of the infiltration testing are provided in Appendix B. Design rates, correction factors, and other infiltration facility recommendations are discussed in Section 3.7.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Based on this investigation, construction of the proposed residential development is feasible from a geotechnical standpoint. No severe geologic or soils related issues were identified that would preclude development of the site for the proposed improvements. The most significant geotechnical issues at the site are those related to the potential for strong seismic shaking and potentially compressible soils. Good planning and design of the project can limit the impact of these constraints. Remedial recommendations for these and other geotechnical issues are provided in the following sections.

Although not encountered during this investigation, abandoned septic tanks, seepage pits, or other buried structures, trash pits, or items related to past site uses may be present. If such items are encountered during grading, they will require further evaluation and special consideration.

3.1 General Earthwork and Grading

All grading should be performed in accordance with the General Earthwork and Grading Specifications presented in Appendix E, unless specifically revised or amended below or by future recommendations based on final development plans.

3.1.1 Site Preparation

Prior to construction, the site should be cleared of vegetation, trash and debris, which should be disposed of offsite. Any underground obstructions should be removed, as should large trees and their root systems. Resulting cavities should be properly backfilled and compacted. Efforts should be made to locate existing utility lines. Those lines should be removed or rerouted if they interfere with the proposed construction, and the resulting cavities should be properly backfilled and compacted.

3.1.2 Overexcavation and Recompaction

To reduce the potential for adverse differential settlement of the proposed improvements, the underlying subgrade soil should be prepared in such a manner that a uniform response to the applied loads is achieved. For structures up to 3 stories constructed with shallow foundations, we recommend that onsite alluvial soils be overexcavated and recompacted to a minimum depth of 3 feet below the bottom of the proposed footings or 5 feet below existing grade, whichever is deeper. Overexcavation and recompaction should extend a minimum horizontal distance of 5 feet from perimeter edges of the proposed footings. Additional deeper overexcavation may be required for taller structures or parking structures, if planned.

Local conditions may require that deeper overexcavation be performed; such areas should be evaluated by Leighton during grading.

Areas outside these overexcavation limits planned for asphalt or concrete pavement, flatwork, and site walls, and areas to receive fill should be overexcavated to a minimum depth of 18 inches below the existing ground surface or 12 inches below the proposed subgrade, whichever is deeper.

After completion of the overexcavation, and prior to fill placement, the exposed surfaces should be scarified to a minimum depth of 6 inches, moisture conditioned to or slightly above optimum moisture content, and recompacted to a minimum 90 percent relative compaction, relative to the ASTM D 1557 laboratory maximum density.

These recommendations should be reviewed once grading and foundation plans are available.

3.1.3 Fill Placement and Compaction

The onsite soil is suitable for use as compacted structural fill, provided it is free of debris and oversized material (greater than 8 inches in largest dimension). Any soil to be placed as fill, whether onsite or imported material, should be reviewed and possibly tested by Leighton.

All fill soil should be placed in thin, loose lifts, moisture conditioned, as necessary, and compacted to a minimum 90 percent relative compaction. Relative compaction should be determined in accordance with ASTM Test Method D1557. Aggregate base for pavement should be compacted to a minimum of 95 percent relative compaction.

3.1.4 Import Fill Soil

If import soil is to be placed as fill, it should be geotechnically accepted by Leighton. Preferably at least 3 working days prior to proposed import to the site, the contractor should provide Leighton pertinent information of the proposed import soil, such as location of the soil, whether stockpiled or native in place, and pertinent geotechnical reports if available. We recommend that a Leighton representative visit the proposed import site to observe the soil conditions and obtain representative soil samples. Potential issues may include soil that is more expansive than onsite soil, soil that is too wet, soil that is too rocky or too dissimilar to onsite soils, oversize material, organics, debris, etc.

3.1.5 Shrinkage and Subsidence

The change in volume of excavated and recompacted soil varies according to soil type and location. This volume change is represented as a percentage increase (bulking) or decrease (shrinkage) in volume of fill after removal and recompaction. Subsidence occurs as in-place soil (e.g., natural ground) is moisture-conditioned and densified to receive fill, such as in processing an overexcavation bottom. Subsidence is in addition to shrinkage due to recompaction of fill soil. Field and laboratory data used in our calculations included laboratory-measured maximum dry densities for soil types encountered at the subject site, the measured in-place densities of soils encountered and our experience. We preliminarily estimate the following earth volume changes will occur during grading:

Table 1 - Shrinkage and Subsidence

Shrinkage	Approximately 15 +/- 5 percent
Subsidence (overexcavation bottom processing)	Approximately 0.15 foot

The level of fill compaction, variations in the dry density of the existing soils and other factors influence the amount of volume change. Some adjustments to earthwork volume should be anticipated during grading of the site.

3.1.6 Rippability and Oversized Material

Oversized material (rock or rock fragments greater than 8 inches in dimension) was not observed during our investigation. Oversized material should not be used within structural fill areas.

3.2 Foundation Recommendations

The following recommendations are based on soils with a very low expansion potential. Structures constructed on soils with a very low expansion potential may be constructed on shallow foundations, provided they meet minimum California Building Code (CBC) requirements. The structural engineer should design the footing reinforcement in accordance with CBC requirements. If post-tension foundations are to be used, they should be designed by the structural engineer based on the settlement estimates noted herein. Local agencies, the structural engineer or the CBC may have requirements that are more stringent.

3.2.1 Minimum Embedment and Width

Based on our preliminary investigation, footings should have a minimum embedment depth and width per the 2013 California Building Code (CBC).

3.2.2 Allowable Bearing

An allowable bearing pressure of 1,800 pounds-per-square-foot (psf) may be used, based on the minimum embedment depth and width above. This allowable bearing value may be increased by 250 psf per foot increase in depth or width to a maximum allowable bearing pressure of 4,500 psf. These allowable bearing pressures are for total dead load and sustained live loads. Footing reinforcement should be designed by the structural engineer.

3.2.3 Lateral Load Resistance

Soil resistance available to withstand lateral loads on a shallow foundation is a function of the frictional resistance along the base of the footing and the passive resistance that may develop as the face of the structure tends to move into the soil. The frictional resistance between the base of the foundation and the subgrade soil may be computed using a coefficient of friction of 0.35. The passive resistance may be computed using an allowable equivalent fluid pressure of 240 pounds per cubic foot (pcf), assuming there is constant contact between the footing and undisturbed soil. The coefficient of friction and passive resistance may be combined without further reduction.

3.2.4 Increase in Bearing and Friction - Short Duration Loads

The allowable bearing pressure and coefficient of friction values may be increased by one-third when considering loads of short duration, such as those imposed by wind and seismic forces.

3.2.5 Settlement Estimates

The recommended allowable bearing capacity is generally based on a total allowable, post construction settlement of 1½ inches. Differential settlement due to static loading is estimated at ¾ inch over a horizontal distance of 30 feet. Since settlement is a function of footing sustained load, size and contact bearing pressure, differential settlement can be expected between adjacent columns or walls where a large differential loading condition exists.

3.3 Recommendations for Slabs-On-Grade

Concrete slabs-on-grade should be designed by the structural engineer in accordance with the current CBC for a soil with a very low expansion potential. Where conventional light floor loading conditions exist, the following minimum recommendations should be used. More stringent requirements may be required by local agencies, the structural engineer, the architect, or the CBC. Laboratory testing should be conducted at finish grade to evaluate the Expansion Index (EI) of near-surface subgrade soils. Slabs-on-grade should have the following minimum recommended components:

- Subgrade Moisture Conditioning: The subgrade soil should be moisture conditioned to at least 2 percent above optimum moisture content to a minimum depth of 12 inches prior to placing steel or concrete.

- Moisture Vapor Retarder: A minimum of a 10-mil vapor retarder should be placed below slabs where moisture-sensitive floor coverings or equipment is planned. Since moisture will otherwise be transmitted up from the soil through the concrete, it is important that an intact vapor retarder be installed. We recommend that the vapor retarder intended for the specific conditions present be used. We recommend that the vapor retarder meet the requirements of ASTM E1745 and be installed per ASTM E1643. The structural engineer should specify pertinent concrete design parameters and moisture migration prevention measures, such as whether or not a sand blotter layer should be placed over the vapor retarder. If sand is placed on top of the vapor retarder, the contractor should not allow the sand to become wet prior to concrete placement (e.g., sand should not be placed if rain is expected). Sharp objects, such as gravel or other protruding objects that could puncture the moisture retarder should be removed from the subgrade prior to placing the vapor retarder, or a stronger vapor retarder intended for the specific conditions present can be used.

- Concrete Thickness: Slabs-on-grade should be at least 4 inches thick. Reinforcing steel should be designed by the structural engineer, but as a minimum should be No. 3 rebar placed at 18 inches on center, each direction, mid-depth in the slab.

Minor cracking of the concrete as it cures, due to drying and shrinkage is normal and should be expected. However, cracking is often aggravated by a high water/cement ratio, high concrete temperature at the time of placement, small nominal aggregate size, and rapid moisture loss due to hot, dry, and/or windy weather conditions during placement and curing. Cracking due to temperature and moisture fluctuations can also be expected. Low slump concrete can reduce the potential for shrinkage cracking. Additionally, our experience indicates that reinforcement in slabs and foundations can generally reduce the potential for concrete cracking. The structural engineer should consider these components in slab design and specifications.

Moisture retarders can reduce, but not eliminate moisture vapor rise from the underlying soils up through the slab. Floor covering manufacturers should be consulted for specific recommendations.

Leighton does not practice in the field of moisture vapor transmission evaluation, since this is not specifically a geotechnical issue. Therefore, we recommend that a qualified person, such as the flooring subcontractor and/or structural engineer, be consulted with to evaluate the general and specific moisture vapor transmission paths and any impact on the proposed construction. That person should provide recommendations for mitigation of potential adverse impact of moisture vapor transmission on various components of the structures as deemed appropriate.

3.4 Exterior Concrete Slab Construction

Exterior concrete in contact with expansive soils such as driveways, ramps, curbs, gutters, sidewalks, and pool decking will generally crack or heave. Inclusion of joints at frequent intervals and reinforcement will help control the locations of the cracks, and thus reduce the unsightly appearance. When cracking or heaving occurs, repairs may be needed to mitigate the trip hazard and/or improve the appearance.

There are a number of well-known steps that can be taken during construction to reduce the amount of cracking or its consequences. These steps include, but are not limited to, the following. As a minimum, exterior concrete slabs should be at least 4 inches thick. Construction or weakened plane joints should be spaced at intervals of 8 feet or less for driveways, ramps, sidewalks, patio slabs, pool decks, curbs and gutters.

Cracking of concrete is often not due to settlement or heave of soils, but often due to other factors such as the use of too high a water/cement ratio and/or inadequate steps taken to prevent moisture loss during curing. These causes of concrete distress can be reduced by proper design of the concrete mix and by proper placement and curing of the concrete.

3.5 Seismic Design Parameters

Seismic parameters presented in this report should be considered during project design. In order to reduce the effects of ground shaking produced by regional seismic events, seismic design should be performed in accordance with the most recent edition of the California Building Code (CBC). The following data should be considered for the seismic analysis of the subject site:

2013 CBC Categorization/Coefficient	Design Value
Site Latitude (decimal degrees)	34.0904
Site Longitude (decimal degrees)	-117.8905
Site Class Definition (ASCE 7 Table 20.3-1)	D
Mapped Spectral Response Acceleration at 0.2s Period, S_s (Figure 1613.3.1(1))	2.178 g
Mapped Spectral Response Acceleration at 1s Period, S_1 (Figure 1613.3.1(2))	0.743 g
Short Period Site Coefficient at 0.2s Period, F_a (Table 1613.3.3(1))	1.0
Long Period Site Coefficient at1s Period, F_v (Table 1613.3.3(2))	1.5
Adjusted Spectral Response Acceleration at 0.2s Period, S_{MS} (Eq. 16-37)	2.178 g
Adjusted Spectral Response Acceleration at 1s Period, S_{M1} (Eq. 16-38)	1.115 g
Design Spectral Response Acceleration at 0.2s Period, S_{DS} (Eq. 16-39)	1.452 g
Design Spectral Response Acceleration at 1s Period, S_{D1} (Eq. 16-40)	0.743 g

3.6 Retaining Walls

We recommend that retaining walls be backfilled with non-expansive soil and constructed with a backdrain in accordance with the recommendations provided on Figure 3 (rear of text). Using expansive soil as retaining wall backfill will result in higher lateral earth pressures exerted on the wall. Based on these recommendations, the following parameters may be used for the design of conventional retaining walls:

Static Equivalent Fluid Weight (pcf)	
Condition	Level Backfill
Active	37 pcf
At-Rest	57 pcf
Passive	240 pcf (allowable) (Maximum of 3,500 psf)

The above values do not contain an appreciable factor of safety unless noted, so the structural engineer should apply the applicable factors of safety and/or load factors during design, as specified by the California Building Code.

Cantilever walls that are designed to yield at least 0.001H, where H is equal to the wall height, may be designed using the active condition. Rigid walls and walls braced at the top should be designed using the at-rest condition.

Passive pressure is used to compute soil resistance to lateral structural movement. In addition, for sliding resistance, a frictional resistance coefficient of 0.35 may be used at the concrete and soil interface. The lateral passive resistance should be taken into account only if it is ensured that the soil providing passive resistance, embedded against the foundation elements, will remain intact with time.

In addition to the above lateral forces due to retained earth, surcharge due to improvements, such as an adjacent structure or traffic loading, should be considered in the design of the retaining wall. Loads applied within a 1:1 projection from the surcharging structure on the stem of the wall should be considered in the design.

A soil unit weight of 120 pcf may be assumed for calculating the actual weight of the soil over the wall footing.

3.7 Infiltration Recommendations

Infiltration Rate:

We recommend that the onsite silty soils and soils with a relatively high fines content (such as at LB-2 and 5 at the depths tested) not be relied upon for infiltration, unless further evaluation is conducted. For onsite alluvial soils that are sandy with a low fines content, we recommend an unfactored (small-scale) infiltration rate of 2.3 inches per hour. We recommend that a correction factor/safety factor be applied to the infiltration rate in conformance with Los Angeles County guidelines, since monitoring of actual facility performance has shown that actual infiltration rates are lower than for small-scale tests. The small-scale infiltration rate should be divided by a correction factor of at least 2 for buried chambers and at least 3 for open basins, but the correction/safety factor may be higher based on project-specific aspects.

The infiltration rates described herein are for a clean, unsilted infiltration surface in native, sandy alluvial soil. These values may be reduced over time as silting of the basin or chamber occurs. Furthermore, if the basin or chamber bottom is allowed to be compacted by heavy equipment, this value is expected to be significantly reduced. Infiltration of water through soil is highly dependent on such factors as grain size distribution of the soil particles, particle shape, fines content, clay content, and density. Small changes in soil conditions, including density, can cause large differences in observed infiltration rates. Infiltration is not suitable in compacted fill.

It should be noted that during periods of prolonged precipitation, the underlying soils tend to become saturated to greater and greater depths/extents. Therefore, infiltration rates tend to decrease with prolonged rainfall. It is difficult to extrapolate longer-term, full-scale infiltration rates from small-scale tests, and as such, this is a significant source of uncertainty in infiltration rates.

Additional Review and Evaluation:

Infiltration rates are anticipated to vary significantly based on the location and depth. Infiltration concepts should be discussed with Leighton as infiltration plans are being developed. Leighton should review all infiltration plans, including locations and depths of proposed facilities. Further testing may be required depending on the design of infiltration facilities, particularly considering their type, depth and location.

General Design Considerations:

The periodic flow of water carrying sediments in the basin or chamber, plus the introduction of wind-blown sediments and sediments from erosion of the basin side walls, can eventually cause the bottom of the basin or chamber to accumulate a layer of silt, which has the potential of significantly reducing the overall infiltration rate of the basin or chamber. Therefore, we recommend that significant amounts of silt/sediment not be allowed to flow into the facility within stormwater, especially during construction of the project and prior to achieving a mature landscape on site. We recommend that an easily maintained, robust silt/sediment removal system be installed to pretreat storm water before it enters the infiltration facility.

As infiltrating water can seep within the soil strata nearly horizontally for long distances, it is important to consider the impact that infiltration facilities can have on nearby subterranean structures, such as basement walls or open excavations, whether onsite or offsite, and whether existing or planned. Any such nearby features should be identified and evaluated as to whether infiltrating water can impact these. Such features should be brought to Leighton's attention as they are identified.

Infiltration facilities should not be constructed adjacent to or under buildings. Setbacks should be discussed with Leighton during the planning process.

Infiltration facilities should be constructed with spillways or other appropriate means that would cause overfilling to not be a concern to the facility or nearby improvements.

For buried chambers, control/access manhole covers should not contain holes or should be screened to prevent mosquitos from entering the cambers.

Additional Design Considerations (Particularly for Open Basins):

If open basins are planned, additional infiltration exploration and testing should be conducted, as the soils that will be exposed at the bottom of the basin are critical to the basin's success. Soils at the bottom of buried chambers are also important, but not as critical to their success, provided the infiltration chamber cuts through sufficiently granular soils.

In general, the rate of infiltration reduces as the head of water in the infiltration facility reduces, and it also reduces with prolonged periods of infiltration. As such, water typically infiltrates much faster near the beginning of and/or immediately after storm events than at times well after a storm when the water level in the facility has receded, since the infiltration rate is then slower due to both lower head and longer overall duration of infiltration. In open basins with compacted or silty bottoms, this could be problematic, in that, even if the basin had already infiltrated significant amounts of storm water, the lower several inches or feet of water could remain in the basin for an extended period of time, creating a prolonged open-water safety concern and potential for mosquitos. In a buried/covered infiltration chamber, these conditions would be of less concern.

Parks or play/recreation areas should not be constructed within basin bottoms or below the spillway level.

For open basins and swales, vegetation within the basin bottoms and sides is expected to help reduce erosion and help maintain infiltration rates.

Estimating infiltration rates, especially based on small-scale testing, is inexact and indefinite, and often involves known and unknown soil complexities, potentially resulting in a condition where actual infiltration rates of the completed facility are significantly less than design rates. In open infiltration basins, this could create nuisance water in the basin. As such, enhancements may be needed after completion of the basin if prolonged or frequent standing water is experienced. A potential basin enhancement, if needed, might be to install infiltration trenches or borings in the basin bottom to capture and infiltrate low flows and to help speed infiltration during/after storms; specific recommendations, such as minimum trench/boring depth, would be developed based on conditions observed. Such a contingency should be anticipated for open basins.

Construction Considerations:
We recommend that Leighton evaluate the infiltration facility excavations, to confirm that granular, undisturbed alluvium is exposed in the bottoms and sides. Additional excavation or evaluation may be required if silty or clayey soils are exposed.

It is critical to infiltration that the basin or chamber bottom not be allowed to be compacted during construction or maintenance; rubber-tired equipment and vehicles should not be allowed to operate on the bottom. We recommend that at least the bottom 3 feet of the basins or chambers be excavated with an excavator or similar.

If fill material is needed to be placed in the basin, such as due to removal of uncontrolled artificial fill, the fill material should be select and free-draining sand, and should be observed and evaluated by Leighton.

Maintenance Considerations:
The infiltration facilities should be routinely monitored, especially before and during the rainy season, and corrective measures should be implemented as/when needed. Things to check for include proper upkeep, proper infiltration, absence of accumulated silt, and that de-silting filters/features are clean and functioning. Pretreatment desilting features should be cleaned and maintained per manufacturers' recommendations. Even with measures to prevent silt from flowing into the infiltration facility, accumulated silt may need to be removed occasionally as part of maintenance.

3.8 Pavement Design

Based on the design procedures outlined in the current Caltrans Highway Design Manual, and using an assumed design R-value of 50, flexible pavement sections may consist of the following for the Traffic Indices indicated. Final pavement design should be based on the Traffic Index determined by the project civil engineer and R-value testing provided near the end of grading.

Recommend Asphalt Pavement Section Thickness			
Traffic Index	Asphaltic Concrete (AC) Thickness (inches)	Class 2 Aggregate Base Thickness (inches)	Total Pavement Section Thickness (inches)
5	3	4	7
6	3	4.5	7.5
7	4	4.5	8.5

All pavement construction should be performed in accordance with the Standard Specifications for Public Works Construction or Caltrans Specifications. Field observations and periodic testing, as needed during placement of the base course materials, should be undertaken to ensure that the requirements of the standard specifications are fulfilled.

Prior to placement of aggregate base, the subgrade soil should be processed to a minimum depth of 6 inches, moisture-conditioned, as necessary, and recompacted to a minimum of 90 percent relative compaction. Aggregate base should be moisture conditioned, as necessary, and compacted to a minimum of 95 percent relative compaction.

If the pavement is to be constructed prior to construction of the structures, we recommend that the full depth of the pavement section be placed in order to support heavy construction traffic.

3.9 Temporary Excavations

All temporary excavations, including utility trenches, retaining wall excavations and other excavations should be performed in accordance with project plans, specifications and all OSHA requirements.

No surcharge loads should be permitted within a horizontal distance equal to the height of cut or 5 feet, whichever is greater from the top of the slope, unless the cut is shored appropriately. Excavations that extend below an imaginary plane inclined at 45 degrees below the edge of any adjacent existing site foundation should be properly shored to maintain support of the adjacent structures.

Cantilever shoring should be designed based on an active equivalent fluid pressure of 35 pcf. If excavations are braced at the top and at specific design intervals, the active pressure may then be approximated by a rectangular soil pressure distribution with the pressure per foot of width equal to 25H, where H is equal to the depth of the excavation being shored.

During construction, the soil conditions should be regularly evaluated to verify that conditions are as anticipated. The contractor should be responsible for providing the "competent person" required by OSHA, standards to evaluate soil conditions. Close coordination between the competent person and the geotechnical engineer should be maintained to facilitate construction while providing safe excavations.

3.10 Trench Backfill

Utility-type trenches onsite can be backfilled with onsite material, provided it is free of debris, significant organic material and oversized material. Prior to backfilling the trench, pipes should be bedded and shaded in a granular material that has a sand equivalent of 30 or greater. We recommend that open-graded crushed rock or similar material not be used as bedding material, unless special provisions are implemented to limit the migration of surrounding soil into the open-graded material, such as the use of filter fabric around the open-graded material. The bedding material should extend 12 inches above the top of the pipe. The bedding/shading sand should be densified in-place by mechanical means, or, if the soil exposed in the bottom and sides of the trench has a sand equivalent greater than 15, the sand may be densified by jetting, in accordance with the Greenbook. Bedding sand should be placed in accordance with the Standard Specifications for Public Works Construction – Greenbook (Public Works Standard, Inc., 2015), current edition. The native soil fill should be placed in loose layers, moisture conditioned, as necessary, and mechanically compacted using a minimum standard of 90 percent relative compaction based on ASTM D 1557. The thickness of layers should be based on the compaction equipment used in accordance with the current Greenbook.

3.11 Surface Drainage

Inadequate control of runoff water and/or poorly controlled irrigation can cause the onsite soils to expand and/or shrink, producing heaving and/or settlement of foundations, flatwork, walls, and other improvements. Maintaining adequate surface drainage, proper disposal of runoff water, and control of irrigation should help reduce the potential for future soil moisture problems.

Positive surface drainage should be designed to be directed away from foundations and toward approved drainage devices, such as gutters, paved drainage swales, or watertight area drains and collector pipes.

Surface drainage should be provided to prevent ponding of water adjacent to the structures. In general, the area around the buildings should slope away from the building. We recommend that unpaved landscaped areas adjacent to the buildings be avoided. Roof runoff should be carried to suitable drainage outlets by watertight drain pipes or over paved areas.

3.12 Sulfate Attack and Corrosion Protection

Based on the results of laboratory testing, concrete structures in contact with the onsite soil will have negligible exposure to water-soluble sulfates in the soil. Type II cement may be used for concrete construction where the underlying soil. The concrete should be designed in accordance with Table 4.3.1 of the American Concrete Institute ACI 318-08 provisions (ACI, 2008).

Based on our laboratory testing, the onsite soil is considered mildly corrosive to ferrous metals. Typical corrosion protection of underground metallic utilities should be provided. Corrosion information presented in this report should be provided to your underground utility subcontractors.

3.13 Additional Geotechnical Services

The preliminary geotechnical recommendations presented in this report are based on subsurface conditions as interpreted from limited subsurface explorations and limited laboratory testing. Our preliminary geotechnical recommendations provided in this report are based on information available at the time the report was prepared and may change as plans are developed. Additional geotechnical investigation and analysis may be required based on final improvement plans. Leighton should review the site and grading plans when available and comment further on the geotechnical aspects of the project. Geotechnical observation and testing should be conducted during excavation and all phases of grading operations. Our conclusions and preliminary recommendations should be reviewed and verified by Leighton during construction and revised accordingly if geotechnical conditions encountered vary from our preliminary findings and interpretations.

Geotechnical observation and testing should be provided:

- After completion of site clearing.
- During overexcavation of compressible soil.
- During compaction of all fill materials.
- After excavation of all footings and prior to placement of concrete.
- During utility trench backfilling and compaction.
- During pavement subgrade and base preparation.
- When any unusual conditions are encountered.

4.0 LIMITATIONS

This report was based in part on data obtained from a limited number of observations, site visits, soil excavations, samples, and tests. Such information is, by necessity, incomplete. The nature of many sites is such that differing soil or geologic conditions can be present within small distances and under varying climatic conditions. Changes in subsurface conditions can and do occur over time. Therefore, our findings, conclusions, and recommendations presented in this report are based on the assumption that Leighton and Associates, Inc. will provide geotechnical observation and testing during construction. Please refer to the GBA "Important Information about This Geotechnical Engineering Report" presented on at the end of this report.

This report was prepared for the sole use of Hassen Development Corporation for application to the design of the proposed residential development in accordance with generally accepted geotechnical engineering practices at this time in California.

Important Information about This Geotechnical-Engineering Report

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

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

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

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical- engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply this report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

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

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by*: the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Environmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold- prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical- engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with you GBC-Member geotechnical engineer for more information.

GBC GEOTECHNICAL BUSINESS COUNCIL
of the Geoprofessional Business Association

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@geoprofessional.org www.geoprofessional.org

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Project: 11176.001	Eng/Geol: JDH/PB
Scale:1 " = 2,000 '	Date: December 2015

Base Map: ESRI ArcGIS Online 2015
Thematic Information: Leighton
Author: (mmurphy)

SITE LOCATION MAP

Proposed Residential Development
Former Clippinger Chevrolet Dealership
137 West San Bernardino Road and Adjacent Areas
City of Covina, California

Figure 1

Leighton

Map Saved as V:\Drafting\11176\001\Maps\11176-001_F01_SLM_2015-12-07.mxd on 12/7/2015 11:17:32 AM

Project: 11176.001	Eng/Geol: JDH/PB
Scale: 1 " = 150 '	Date: December 2015

Base Map: Google Earth, 2015
Thematic Information: Leighton
Author: (mmurphy)

TEST LOCATION MAP

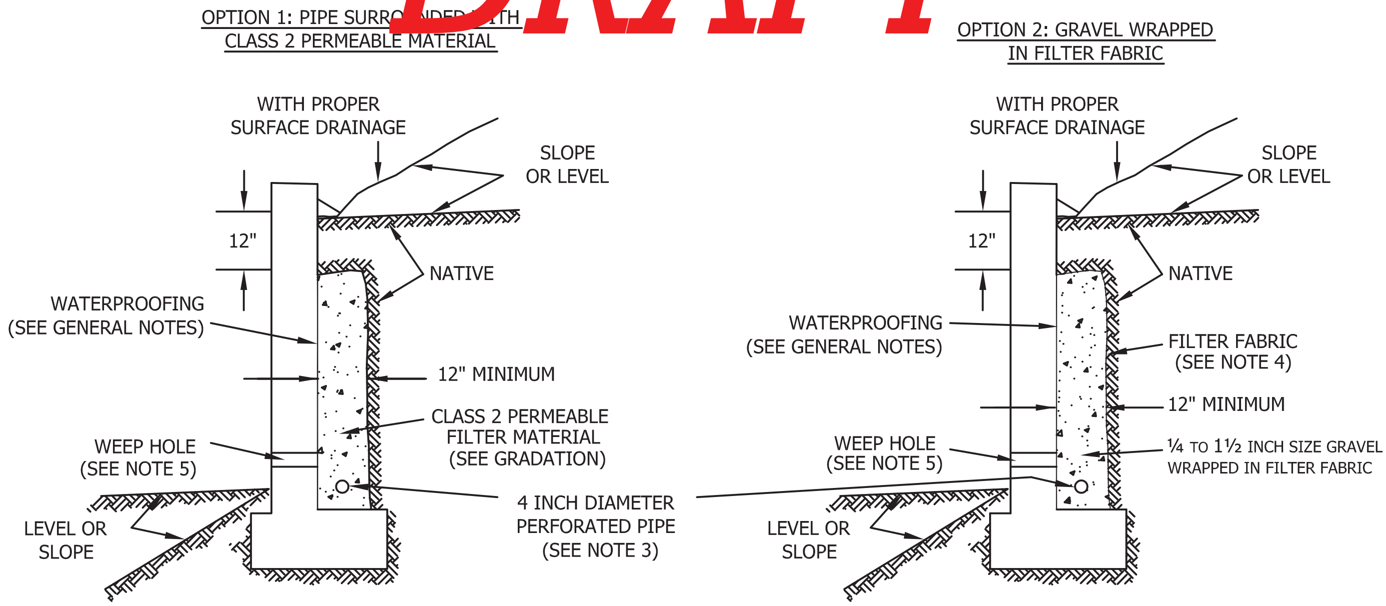
Proposed Residential Development
Former Clippinger Chevrolet Dealership
137 West San Bernardino Road and Adjacent Areas
City of Covina, California

Figure 2

Leighton

Map Saved as P:\Drafting\11176\001\Maps\11176-001_F02_TLM_2015-12-07.mxd on 12/8/2015 7:40:34 AM

SUBDRAIN OPTIONS AND BACKFILL WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF $\leq$50



Class 2 Filter Permeable Material Gradation
Per Caltrans Specifications

Sieve Size	Percent Passing
1"	100
3/4"	90-100
3/8"	40-100
No. 4	25-40
No. 8	18-33
No. 30	5-15
No. 50	0-7
No. 200	0-3

GENERAL NOTES:

* Waterproofing should be provided where moisture nuisance problem through the wall is undesirable.
* Water proofing of the walls is not under purview of the geotechnical engineer
* All drains should have a gradient of 1 percent minimum
*Outlet portion of the subdrain should have a 4-inch diameter solid pipe discharged into a suitable disposal area designed by the project engineer. The subdrain pipe should be accessible for maintenance (rodding)
*Other subdrain backfill options are subject to the review by the geotechnical engineer and modification of design parameters.

Notes:
1) Sand should have a sand equivalent of 30 or greater and may be densified by water jetting.
2) 1 Cu. ft. per ft. of 1/4- to 1 1/2-inch size gravel wrapped in filter fabric
3) Pipe type should be ASTM D1527 Acrylonitrile Butadiene Styrene (ABS) SDR35 or ASTM D1785 Polyvinyl Chloride plastic (PVC), Schedule 40, Armco A2000 PVC, or approved equivalent. Pipe should be installed with perforations down. Perforations should be 3/8 inch in diameter placed at the ends of a 120-degree arc in two rows at 3-inch on center (staggered)
4) Filter fabric should be Mirafi 140NC or approved equivalent.
5) Weephole should be 3-inch minimum diameter and provided at 10-foot maximum intervals. If exposure is permitted, weepholes should be located 12 inches above finished grade. If exposure is not permitted such as for a wall adjacent to a sidewalk/curb, a pipe under the sidewalk to be discharged through the curb face or equivalent should be provided. For a basement-type wall, a proper subdrain outlet system should be provided.
6) Retaining wall plans should be reviewed and approved by the geotechnical engineer.
7) Walls over six feet in height are subject to a special review by the geotechnical engineer and modifications to the above requirements.

RETAINING WALL BACKFILL AND SUBDRAIN DETAIL FOR WALLS 6 FEET OR LESS IN HEIGHT

WHEN NATIVE MATERIAL HAS EXPANSION INDEX OF $\leq$50

Leighton

Figure 3

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APPENDIX A

REFERENCES

APPENDIX A

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APPENDIX B

GEOTECHNICAL BORING LOGS
& INFILTRATION TEST RESULTS

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GEOTECHNICAL BORING LOG LB- 1

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	554'
Location	see Figure 2	**Sampled By**	BER

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
554	0		B-1					@surface: 3" asphalt over 5.5" base	EI, MD, CR
			R-1	9 8 8	110	8	SM	**Alluvium (Qal)** @2.5' SILTY SAND, medium dense, dark brown, slightly moist, nonplastic, 35% fines (field estimate)	PP
550	5		R-2	3 2 5	103	11	ML	@5' SANDY SILT, medium stiff, dark brown, slightly moist, nonplastic	CN, PP
545	10		R-3	7 8 10	108	7	ML	@10' same as above, very stiff	PP
540	15		R-4	5 6 11	121	8	SM	@15' SILTY SAND, medium dense, brown, slightly moist, nonplastic, 30% fines (field estimate), trace gravel, 1" gravel max, fractured rock in sampler tip	CO, PP
535	20		S-5	7 5 5			SW	@20' SAND with gravel, loose-medium dense, light brown, slightly moist, coarse sand, nonplastic, 1" gravel max	
							ML	@21.2' SILT, stiff, brown, slightly moist, nonplastic	
530	25							Total depth of 21.5 feet No groundwater encountered Backfilled with soil cuttings on 11/5/15	
525	30								

Graphic Log: N S

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. ***

DRAFT

GEOTECHNICAL BORING LOG LB- 2

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	552'
Location	see Figure 2	**Sampled By**	BER

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0								@surface: 2.5" asphalt over 4.5" base **Undocumented Fill**	
550				R-1	5 10 13	112	16	CL	@2.5' CLAY with gravel, very stiff, dark gray, slightly moist, high plasticity, 0.5" gravel max, silt in sampler tip	PP
	5			R-2	3 3 5	106	9	ML	**Alluvium (Qal)** @5' SANDY SILT, medium stiff, dark brown, slightly moist, nonplastic, 25% sand (field estimate)	CO, PP
545										
	10			R-3	6 8 10	117	11	ML	@10' SANDY SILT, very stiff, dark brown, slightly moist, nonplastic, 0% gravel, 46% sand, 54% fines	SA, PP
540										
	15			R-4	7 8 12	109	6	SM	@15' SILTY SAND, medium dense, brown, slightly moist, nonplastic, 20% fines (field estimate)	PP
535										
	20			S-5	3 6 3			SM	@20' SILTY SAND, loose, brown, moist, coarse sand, nonplastic, 26% fines, trace clay, trace gravel, 1" gravel max	-200
530										
	25			S-6	15 18 50/6"			SW	@25' SAND with gravel, very dense, light brown, slightly moist, coarse sand, nonplastic, 2" gravel max	
525										
	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. * * ***

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GEOTECHNICAL BORING LOG LB- 2

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	552'
Location	see Figure 2	**Sampled By**	BER

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-7	6 8 10			ML	@30' SILT, very stiff, brown, slightly moist, nonplastic, mica flakes	
520										
									Total depth of 31.5 feet No groundwater encountered Backfilled with soil cuttings on 11/5/15 Moved over 5 feet and straight drilled to 10 feet for infiltration testing, backfilled on 11/9/15	
	35									
515										
	40									
510										
	45									
505										
	50									
500										
	55									
495										
	60									

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

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

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

GEOTECHNICAL BORING LOG LB- 3

DRAFT

Project No.	11176.001	Date Drilled	11-5-15
Project	Hassen Covina	Logged By	BER
Drilling Co.	2R Drilling	Hole Diameter	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	Ground Elevation	552'
Location	see Figure 2	Sampled By	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	0								@surface: 3" asphalt over 0" base	
550				R-1	1 3 4	106	10	ML	**Alluvium (Qal)** @2.5' SILT, medium stiff, dark brown, moist, nonplastic	PP
	5			R-2	4 6 8	115	11	ML	@5' same as above, stiff	PP
545										
	10			R-3	7 8 15	107	2	SW	@10' SAND, medium dense, brown, very moist, coarse sand, nonplastic, trace gravel, 1" gravel max	PP
540										
	15			R-4	6 12 33	108	3	SP-SM	@15' SAND with silt and gravel, dense, dark brown, moist, coarse sand, nonplastic, 10% fines (field estimate), 2" gravel max	PP
535										
	20			S-5	38 40 25			SW	20' SAND with gravel, very dense, light brown, moist, coarse sand, nonplastic, 1" gravel max	
530									Total depth of 21.5 feet No groundwater encountered Backfilled with soil cuttings on 11/5/15	
	25									
525										
	30									

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

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

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GEOTECHNICAL BORING LOG LB- 4

DRAFT

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	550'
Location	see Figure 2	**Sampled By**	BER

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
550	0								@surface: asphalt, 2" AC over 0" base	
				R-1	3 4 7	109	9	ML	**Alluvium (Qal)** @2.5' SILT, stiff, dark brown, slightly moist, nonplastic, mica flakes	PP
545	5			R-2	6 8 9	114	10	ML	@5' same as above, very stiff	PP
540	10			R-3	5 7 9	112	9	ML	@10' same as above, very stiff	PP
535	15			R-4	7 25 50	122	4	ML	@15' SANDY SILT with gravel, hard, brown, moist, nonplastic, 25% sand (field estimate), 1" gravel max, fracture rock present, 2" max fractured rock	PP
530	20			S-5	25 50/5"			SW	@20' SAND with gravel, very dense, light brown, slightly moist, coarse sand, nonplastic, 1.5" gravel max	
									Total depth of 20.9 feet No groundwater encountered Backfilled with soil cuttings on 11/5/15	
525	25									
520	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

DRAFT

GEOTECHNICAL BORING LOG LB- 5

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	550'
Location	see Figure 2	**Sampled By**	BER

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
550	0								@surface: 4" asphalt over 6.5" base	
				R-1	3 3 3	100	9	ML	**Alluvium (Qal)** @2.5' SILT, medium stiff, dark brown, slightly moist, nonplastic	PP
545	5			R-2	3 4 6	106	9	ML	@5' same as above, stiff	PP
540	10			R-3	5 5 8	112	10	SM	@10' SILTY SAND, stiff, 1% gravel, 52% sand, 47% fines, mica flakes	SA, CO, PP
535	15			R-4	5 6 9	116	12	SM	@15' SILTY SAND, stiff-very stiff, dark brown, slightly moist, nonplastic, 16% fines	-200, PP
530	20			S-5	28 20 18			SW	@20' SAND with gravel, dense, light brown, moist, coarse sand, nonplastic, 1.5" gravel max @22' gravel/cobbles in soil cuttings, 2"- 4" average	
525	25			S-6	28 40 38			SW	@25' SAND with gravel, very dense, light brown, moist, coarse sand, nonplastic, 1.5" gravel max, fractured rock present	
520	30									

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

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

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GEOTECHNICAL BORING LOG LB- 5

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	550'
Location	see Figure 2	**Sampled By**	BER

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
520	30			S-7	5 10 12			ML	@30' SANDY SILT with gravel, very stiff, brown, moist, nonplastic, 20% sand (field estimate), 0.5" gravel max	
515	35			S-8	30 50/6"			SW	@35' SAND with gravel, very dense, light brown, moist, coarse sand, nonplastic, 1" gravel max	
510	40			S-9	50/4"			SW	@40' same as above, very dense, 1.5" gravel max	
505	45			S-10	22 24 28			SW	@45' same as above, very dense, 1.5" gravel max	
500	50			S-11	31 50/6"			SW	@50' same as above, very dense, 1" gravel max	
									Total depth of 51 feet No groundwater encountered Backfilled with soil cuttings on 11/5/15 Moved over 5 feet and straight drilled to 10 feet for infiltration testing, backfilled on 11/9/15	
495	55									
490	60									

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

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

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GEOTECHNICAL BORING LOG LB- 6

DRAFT

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	553'
Location	see Figure 2	**Sampled By**	BER

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0								@ 3" asphalt over 4" base	
550				R-1	2 2 2	100	9	SM	**Alluvium (Qal)** @2.5' SILTY SAND, loose, dark brown, moist, nonplastic, 30% fines (field estimate)	PP
	5			R-2	5 8 15	103	5	SP	@5' SAND, medium dense, brown, moist, medium sand, nonplastic	PP
545										
	10			R-3	10 18 22	117	2	SW	@10' SAND with gravel, dense, brown, moist, nonplastic, 1.5" gravel max	PP
540										
	15			R-4	15 27 40	93	4	SW	@15' same as above, very dense, more gravel, 30% gravel (field estimate)	PP
535										
	20			S-5	27 40 30			SW	@20' SAND with gravel, very dense, light brown, moist, coarse sand, nonplastic, 1.5" gravel max	
530									Total depth of 21.5 feet No groundwater encountered Backfilled with soil cuttings on 11/5/15	
	25									
525										
	30									

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

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

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GEOTECHNICAL BORING LOG LB- 7

DRAFT

Project No.	11176.001	**Date Drilled**	11-5-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	555'
Location	see Figure 2	**Sampled By**	BER

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
555	0								@surface: 3" asphalt over 6" base	
				R-1	3 2 3	103	10	ML	**Alluvium (Qal)** @2.5' SILT, medium stiff, dark brown, moist, nonplastic	PP
550	5			R-2	2 3 5	112	4	ML	@5' SANDY SILT, stiff-medium stiff, dark brown, moist, nonplastic, 10% sand (field estimate), sand with gravel in sampler tip	PP
545	10			R-3	7 18 15	118	3	SM	@10' SILTY SAND with gravel, dense, brown, moist, fine to medium sand, subrounded, nonplastic, 25% fines (field estimate), 1.5" gravel max	PP
540	15			R-4	8 11 15	118	7	SM	@15' same as above, medium dense, 20% fines (field estimate)	PP
535	20			S-5	13 23 18			SW	@20' SAND with gravel, very dense, light brown, moist, coarse sand, nonplastic, 1" gravel max	
									Total depth of 21.5 feet No groundwater encountered Backfilled with soil cuttings on 11/5/15	
530	25									
525	30									

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

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

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GEOTECHNICAL BORING LOG LB- 8

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	549'
Location	see Figure 2	**Sampled By**	BER

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
	0								@surface: 4" asphalt over 6" base	
				R-1	3 5 5	105	11	ML	**Alluvium (Qal)** @2.5' SANDY SILT, stiff, dark brown, moist, nonplastic, 20% sand (field estimate)	PP
545	5			R-2	3 4 6	111	12	ML	@5' same as above, stiff	PP
540	10			R-3	6 9 10	109	7	SM	@10' SILTY SAND, medium dense, dark brown, moist, nonplastic, 35% fines (field estimate), 2" gravel in sampler tip	PP
535	15			R-4	6 8 24	122	7	ML	@15' SANDY SILT, hard, dark brown, moist, nonplastic, 20% sand (field estimate), trace clay	PP
530	20			S-5	16 14 17			SW	@20' SAND with gravel, dense, light brown, moist, nonplastic, 1.5" gravel max	
525	25								Total depth of 21.5 feet No groundwater encountered Backfilled with soil cuttings on 11/6/15	
520	30									

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

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

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GEOTECHNICAL BORING LOG LB- 9

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	562'
Location	see Figure 2	**Sampled By**	BER

SOIL DESCRIPTION

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

Elevation Feet	Depth Feet	Graphic Log (N–S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-2					@surface: 2.5" asphalt over 0" base	
560				R-1	3 5 5	101	5	SM	**<u>Alluvium (Qal)</u>** @2.5' SILTY SAND, medium dense, dark brown, moist, nonplastic, 30% fines (field estimate)	PP
	5			R-2	3 5 8	99	3	SW	@5' SAND with gravel, medium dense, brown, moist, coarse sand, subrounded, nonplastic, 1.5" gravel max	PP
555										
	10			R-3	8 9 15	117	10	ML	@10' SILT, very stiff, dark brown, slightly moist, nonplastic, 10% sand (field estimate), trace gravel, 0.5" gravel max	PP
550										
	15			R-4	19 36 50	102	2	SW	@15' SAND with gravel, very dense, light brown, slightly moist, coarse sand, subangular, nonplastic, 1" gravel max	PP
545										
	20			S-5	18 13 16			SP	@20' SAND with gravel, medium dense, light brown, slightly moist, medium sand, subrounded, nonplastic, 1" gravel max	
540										
	25			S-6	21 36 48			SW	@25' SAND with gravel, very dense, light brown, slightly moist, coarse sand, subangular, nonplastic, 1" gravel max	
535										
	30									

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

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

GEOTECHNICAL BORING LOG LB- 9

DRAFT

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	562'
Location	see Figure 2	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION *This Soil Description applies only to a location of the exploration at the time of sampling. Subsurface conditions may differ at other locations and may change with time. The description is a simplification of the actual conditions encountered. Transitions between soil types may be gradual.*	Type of Tests
	30			S-7	14 18 25			SW	@30' SAND with gravel, dense, light brown, moist, coarse sand, subangular, nonplastic, 1.75" gravel max	
530										
	35			S-8	18 35 47			SW	@35', same as above, 1.5" gravel max	
525										
	40			S-9	41 50/6"			SW	@40' same as above	
520										
									Total depth of 41 feet No groundwater encountered Backfilled with soil cuttings on 11/6/15 Moved over 5 feet and straight drilled to 10 feet for infiltration testing, backfilled on 11/9/15	
	45									
515										
	50									
510										
	55									
505										
	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. * * *

DRAFT

GEOTECHNICAL BORING LOG LB-10

Project No. 11176.001
Project Hassen Covina
Drilling Co. 2R Drilling
Drilling Method Hollow Stem Auger - 140lb - Autohammer - 30" Drop
Location see Figure 2
Date Drilled 11-6-15
Logged By BER
Hole Diameter 10"
Ground Elevation 560'
Sampled By BER

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.

Graphic Log: N – S

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	Soil Description	Type of Tests
560	0							@surface: 2.5" asphalt over 0" base	
			R-1	4 6 7	105	2	SM	**Alluvium (Qal)** @2.5' SILTY SAND, medium dense, brown, slightly moist, medium to coarse sand, nonplastic, 15% fines (field estimate)	PP
555	5		R-2	6 10 14				@5', no recovery, medium dense	
550	10		R-3	10 14 26	117	4	SM	@10' SILTY SAND with gravel, dense, brown, slightly moist, coarse sand, subangular, nonplastic, 25% fines (field estimate), 1.5" gravel max	PP
545	15		R-4	24 50/6"				@15', no recovery, very dense	
540	20		S-5	19 14 19			SW	@20' SAND with gravel, dense, light brown, moist, coarse sand, subangular, nonplastic, 1.5" gravel max	
								Total depth of 21.5 feet No groundwater encountered Backfilled with soil cuttings on 11/6/15	
535	25								
530	30								

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

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

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GEOTECHNICAL BORING LOG LB-11

DRAFT

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	554'
Location	see Figure 2	**Sampled By**	BER

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.

Graphic Log: N S

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							@surface: 1.5" asphalt over 3" concrete over 0" base **Undocumented Fill**	
			R-1	5 4 4	106	5	SW	@2.5' SAND, loose, brown, slightly moist, medium sand, nonplastic, two 2.5" fractured rocks in sampler	PP
550	5		R-2	3 5 5	103	10	SM	**Alluvium (Qal)** @5' SILTY SAND, loose-medium dense, brown, slightly moist, nonplastic, 20% fines (field estimate)	CN, PP
545	10		R-3	5 6 8	119	13	ML	@10' SANDY SILT, stiff, dark brown, slightly moist, nonplastic, 35% sand (field estimate)	CO, PP
540	15		R-4	12 20 22	122	3	GW-SW	@15' SAND and GRAVEL, dense, brown, moist, coarse sand, nonplastic, 1.5" gravel max	PP
535	20		S-5	12 19 25			SW	@20' SAND with gravel, dense, light brown, moist, coarse sand, subrounded, nonplastic, 1" gravel max	
530	25		S-6	40 50/4"			GW-SW	@25' SAND and GRAVEL, very dense, light brown, moist, coarse sand, angular, nonplastic, 1.5" gravel max	
525	30								

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

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

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DRAFT

GEOTECHNICAL BORING LOG LB-11

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	554'
Location	see Figure 2	**Sampled By**	BER

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-7	50/6"			SW	@30' SAND with gravel, light brown, moist, coarse sand, angular, nonplastic, 1" gravel max, only 4" of recovery	
520	35								Total depth of 30.5 feet No groundwater encountered Backfilled soil cuttings on 11/6/15 Moved over 5 feet and straight drilled to 10 feet for infiltration testing, backfilled on 11/9/15	
515	40									
510	45									
505	50									
500	55									
495	60									

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

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

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

GEOTECHNICAL BORING LOG LB-12

DRAFT

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	551'
Location	see Figure 2	**Sampled By**	BER

Elevation Feet	Depth Feet	Graphic Log (N / S)	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0			B-3					@surface: 3.5" asphalt over 5" base	EI, MD, CR
550				R-1	4 5 8	106	5	SM	**Alluvium (Qal)** @2.5' SILTY SAND, medium dense, dark brown, slightly moist, nonplastic, 25% fines (field estimate)	PP
545	5			R-2	3 4 7	106	9	SM	@5' same as above, medium dense	PP
540	10			R-3	7 8 10	110	7	SM	@10' same as above, medium dense, 14% fines, trace gravel, 1" gravel max	-200, PP
535	15			R-4	9 17 27	124	3	SM	@15' SILTY SAND with gravel, dense, brown, moist, subrounded, nonplastic, 20% fines (field estimate), 1" gravel max	PP
530	20			S-5	5 4 5			ML	@20' SILT, stiff, brown, moist, nonplastic	
									material started getting real hard to drill, contactor added water to boring	
525	25			S-6	10 11 11			ML	@25' SILT with gravel, very stiff, brown, moist, no to low plasticity, 1" gravel max	
	30									

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

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

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

GEOTECHNICAL BORING LOG LB-12

DRAFT

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	551'
Location	see Figure 2	**Sampled By**	BER

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
520	30			S-7	7 10 10			ML	@30' SILT, very stiff, brown, moist, no to low plasticity	
515	35			S-8	4 5 9			ML	@35' SANDY SILT, stiff, brown, slightly moist, nonplastic, 20% sand (field estimate)	
510	40			S-9	3 5 6			ML	@40' SILT, stiff, moist, 10% sand (field estimate), water from driller in sample	
505	45			S-10	6 9 15			SM	@45' SILTY SAND, medium dense, brown, moist, subrounded, nonplastic, 33% fines, 1" gravel max	-200
500	50			S-10	29 39 50			SW	@50' SAND with gravel, very dense, light brown, moist, coarse sand, angular, nonplastic, 1.5" gravel max	
495	55								Total depth of 51.5 feet No groundwater encountered Backfilled with soil cuttings on 11/6/15 Moved over 5 feet and straight drilled to 10 feet for infiltration testing, backfilled on 11/9/15	
	60									

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

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

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GEOTECHNICAL BORING LOG LB-13

Project No.	11176.001	**Date Drilled**	11-6-15
Project	Hassen Covina	**Logged By**	BER
Drilling Co.	2R Drilling	**Hole Diameter**	10"
Drilling Method	Hollow Stem Auger - 140lb - Autohammer - 30" Drop	**Ground Elevation**	551'
Location	see Figure 2	**Sampled By**	BER

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.

Graphic Log: N S

Elevation Feet	Depth Feet	Attitudes	Sample No.	Blows Per 6 Inches	Dry Density pcf	Moisture Content, %	Soil Class. (U.S.C.S.)	SOIL DESCRIPTION	Type of Tests
	0							@surface: 2.5" asphalt over 5.5" base	
550									
			R-1	3 5 6	102	6	SM	**Alluvium (Qal)** @2.5' SILTY SAND, medium dense, dark brown, moist, nonplastic, 25% fines (field estimate)	PP
	5		R-2	7 11 15	117	2	SP	@5' SAND with gravel, medium dense, brown, moist, coarse sand, angular, nonplastic, 2" gravel max	PP
545									
	10		R-3	8 13 15				@10' no recovery, medium dense	
540									
	15		R-4	20 21 29	121	3	SW	@15' SAND with gravel, very dense, brown, moist, subangular, nonplastic, 2.5" gravel max	PP
535									
	20		S-5	5 6 7			SW ML	@20' SAND with gravel, medium dense, light brown, moist, coarse sand, nonplastic, 1" gravel max @20.6' SILT, stiff, dark brown, slightly moist, nonplastic	
530								Total depth of 21.5 feet No groundwater encountered Backfilled with soil cuttings on 11/6/15	
	25								
525									
	30								

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

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

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Results of Well Permeameter, from USBR 7300-89 Method.

Leighton

Project: Hassen Covina #11176.001

Exploration #/Location: **LB-2**

Depth Boring drilled to (ft): 10

Tested by: BER

USCS Soil Type:

Weather (start to finish) Overcast

Liquid Used/pH: Hydrant Water

Diameter of barrel (in.): 22.5

No. of Supply barrels: 1

Measured boring diameter 10 in.

Approx Depth to GW below GS 100 ft

Well Prep: Straight drill

397.4 Total Area of barrels (in.^2):

5 Well Radius, "r"

Approx Ht from water surface to top of float assembly (in.): #N/A

Approx float assem length (w/out extension), in.: #N/A

	a.*	b.*
Initial estimated Depth to Water Surface (in.):	**#N/A**	#N/A
Initial est. depth of water in well, "h" (in.):	**#N/A**	#N/A
approx. h/r (prelim):	#N/A	#N/A
Tu (Fig. 8):	#N/A	
Tu>3h?:	#N/A	

*a. Est. by measurements from top of float assm.

*b. Est. by measurements from top of sand

	ft	in.	(total)			
Depth to Bot of well (or top of soil over Bentonite)	**9. ft**	**6. in.**	114			
Depth to top of dry sand before casing install	9. ft		108		6	sand thickness
Length of casing			0			
Casing stickup (+ is above ground)			0		52	sand thickness
Depth to Top of Sand from top of casing	5. ft	2. in.	62	62	0	check by casing length
Pilot Tube stickup (+ is above ground)	1. ft	**2. in.**	14			
Depth to top of float assembly from top of pilot tube	5. ft	0.5 in.	60.5	46.5 Depth below GS (in.)		
Float Assembly ID	C					
Float assembly Extension length (in.)		34				

Field Data / **Calculations**

Date	Time	**Water Level in Supply Barrel (in.)**	**Depth to WL in Boring (measured from top of pilot tube)** ft	in.	Water Temp (deg F)	Comments (or "y" for DL interpre-tation)	Δt (min)	Total Elapsed Time (min.)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from barrels	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	**Infiltration Rate [flow/surf area] (in./hr) (FS=1)**
Start Date 11/9/2015	Start time: 8:56 AM																			
-									**#N/A**	**#N/A**	**<--est. from setup measurements**									
11/9/15	8:56	27.5	6.90		**62**			0	68.8	45.2										
11/9/15	9:48	25.625	6.75		62		52	52	67.0	47.0	1.8	46	745	-64	681	13	786	1.1	0.12	**0.55**
11/9/15	10:49	24.5	6.85		64		61	113	68.2	45.8	-1.2	46	447	43	490	8	482	1.0	0.08	**0.33**
11/9/15	11:28	23.75	6.72		65		39	152	66.6	47.4	1.56	47	298	-56	242	6	373	1.0	0.05	**0.25**
11/9/15	12:21	23	6.76		67		53	205	67.1	46.9	-0.48	47	298	17	315	6	357	1.0	0.05	**0.23**
11/9/15	12:42	22.625	6.78		67		21	226	67.4	46.6	-0.24	47	149	9	158	8	450	1.0	0.07	**0.29**
11/9/15	15:16	20.375	6.77		70		154	380	67.2	46.8	0.12	47	894	-4	890	6	347	0.9	0.05	**0.21**

DRAFT

Results of Well Permeameter, from USBR 7300-89 Method.

Leighton

Project: Hassen Covina #11176.001

Exploration #/Location: ***LB-5***

Depth Boring drilled to (ft): 10

Tested by: BER

USCS Soil Type:

Weather (start to finish) Overcast

Liquid Used/pH: Hydrant Water

Diameter of barrel (in.): 22.5

No. of Supply barrels: 1

Measured boring diameter 10 in.

Approx Depth to GW below GS 100 ft

Well Prep: Straight drill

397.4 Total Area of barrels (in.^2):

5 Well Radius, "r"

Approx Ht from water surface to top of float assembly (in.): #N/A

Approx float assem length (w/out extension), in.: #N/A

	*a.**	*b.**
Initial estimated Depth to Water Surface (in.):	**#N/A**	#N/A
Initial est. depth of water in well, "h" (in.):	**#N/A**	#N/A
approx. h/r (prelim):	#N/A	#N/A

Tu (Fig. 8): #N/A

Tu>3h?: #N/A

*a. Est. by measurements from top of float assm.

*b. Est. by measurements from top of sand

	ft	in.	(total)		
Depth to Bot of well (or top of soil over Bentonite)	9. ft	6. in.	114		
Depth to top of dry sand before casing install	8. ft	3. in.	99	15	sand thickness
Length of casing			0		
Casing stickup (+ is above ground)			0	40	sand thickness
Depth to Top of Sand from top of casing	6. ft	2. in.	74	74	0 check by casing length
Pilot Tube stickup (+ is above ground)	1. ft	9.5 in.	21.5		
Depth to top of float assembly from top of pilot tube	5. ft	3.5 in.	63.5	42	Depth below GS (in.)
Float Assembly ID	E				
Float assembly Extension length (in.)		30			

Field Data | **Calculations**

Date	Time	Water Level in Supply Barrel (in.)	Depth to WL in Boring (measured from top of pilot tube) ft	in.	Water Temp (deg F)	Comments (or "y" for DL interpre-tation)	Δt (min)	Total Elapsed Time (min.)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from barrels	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 11/9/2015	Start time: 8:40 AM																			
-									#N/A	#N/A	<--est. from setup measurements									
11/9/15	8:40	27.5	7.25		**62**			0	65.5	48.5										
11/9/15	9:45	24.25	7.07		62		65	65	63.3	50.7	2.16	50	1292	-77	1215	19	1121	1.1	0.16	**0.73**
11/9/15	10:45	22.375	7.09		63		60	125	63.6	50.4	-0.24	51	745	9	754	13	754	1.1	0.10	**0.48**
11/9/15	11:25	21.25	7.09		65		40	165	63.6	50.4	0	50	447	0	447	11	671	1.0	0.09	**0.41**
11/9/15	12:18	19.75	7.07		67		53	218	63.3	50.7	0.24	51	596	-9	588	11	665	1.0	0.09	**0.40**
11/9/15	12:39	19.125	7.07		66		21	239	63.3	50.7	0	51	248	0	248	12	710	1.0	0.09	**0.43**
11/9/15	14:57	15.25	7.1		69		138	377	63.7	50.3	-0.36	50	1540	13	1553	11	675	1.0	0.09	**0.39**

DRAFT

Results of Well Permeameter, from USBR 7300-89 Method.

Leighton

Project: Hassen Covina #11176.001

Exploration #/Location:	*LB-9*
Depth Boring drilled to (ft):	10
Tested by:	BER
USCS Soil Type:	
Weather (start to finish)	Overcast
Liquid Used/pH:	Hydrant Water
Diameter of barrel (in.):	22.5
No. of Supply barrels:	1
Measured boring diameter	10 in.
Approx Depth to GW below GS	100 ft
Well Prep:	Straight drill

397.4 Total Area of barrels (in.^2):

5 Well Radius, "r"

	a.*	b.*
Approx Ht from water surface to top of float assembly (in.):	#N/A	
Approx float assem length (w/out extension), in.:	#N/A	
Initial estimated Depth to Water Surface (in.):	**#N/A**	#N/A
Initial est. depth of water in well, "h" (in.):	**#N/A**	#N/A
approx. h/r (prelim):	#N/A	#N/A
Tu (Fig. 8):	#N/A	
Tu>3h?:	#N/A	

*a. Est. by measurements from top of float assm.

*b. Est. by measurements from top of sand

	ft	in.	(total)		
Depth to Bot of well (or top of soil over Bentonite)	9. ft	3. in.	111		
Depth to top of dry sand before casing install	8. ft	6. in.	102	9	sand thickness
Length of casing			0		
Casing stickup (+ is above ground)			0	50	sand thickness
Depth to Top of Sand from top of casing	5. ft	1. in.	61	61 / 0	check by casing length
Pilot Tube stickup (+ is above ground)	3. ft	3. in.	39		
Depth to top of float assembly from top of pilot tube	6. ft	8. in.	80	41	Depth below GS (in.)
Float Assembly ID	D				
Float assembly Extension length (in.)		34			

Field Data / **Calculations**

Date	Time	Water Level in Supply Barrel (in.)	Depth to WL in Boring (measured from top of pilot tube) ft	in.	Water Temp (deg F)	Comments (or "y" for DL interpretation)	Δt (min)	Total Elapsed Time (min.)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from barrels	from Δh	Total	Flow (in^3/min)	q, Flow (in^3/hr)	V (Fig 9)	K20, Coef. Of Permeability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 11/9/2015	Start time: 9:22 AM																			
-									#N/A	#N/A	<--est. from setup measurements									
11/9/15	9:22	23	8.75		62			0	66.0	45.0										
11/9/15	10:02	0					40	40	66.0	45.0	0	45	9140	0	9140	229	13711	1.1	2.31	**9.84**
11/9/15	10:06	29.5	8.7		62			44	65.4	45.6										
11/9/15	10:19	18.375	8.65		63		13	57	64.8	46.2	0.6	46	4421	-21	4400	338	20307	1.1	3.22	**14.08**
11/9/15	10:29	9.5	8.65		63		10	67	64.8	46.2	0	46	3527	0	3527	353	21162	1.1	3.36	**14.58**
11/9/15	10:33	30.75	8.66		62			71	64.9	46.1										
11/9/15	10:53	14.5	8.71		63		20	91	65.5	45.5	-0.6	46	6458	21	6479	324	19438	1.1	3.18	**13.51**
11/9/15	10:57	30.25	8.65		62			95	64.8	46.2										
11/9/15	11:58	0	0				61	156	-39.0	150.0	103.8	98	12022	-3699	8322	136	8186	1.1	0.17	**2.77**
11/9/15	12:02	30.125	8.66		70			160	64.9	46.1										
11/9/15	12:24	12.25	8.67		69		22	182	65.0	46.0	-0.12	46	7104	4	7108	323	19385	1.0	2.84	**12.24**
11/9/15	12:28	30.125	8.65		70			186	64.8	46.2										
11/9/15	12:45	19.5	8.65		70		17	203	64.8	46.2	0	46	4222	0	4222	248	14903	2.9	6.49	**28.14**
11/9/15	12:57	9.375	8.61		71		12	215	64.3	46.7	0.48	46	4024	-17	4007	334	20033	0.9	2.77	**12.18**
11/9/15	1:01	30.75	8.65		70			0	64.8	46.2										
11/9/15	1:25	13.625	8.65		72		24	0	64.8	46.2	0	46	6806	0	6806	284	17014	0.9	2.36	**10.25**

DRAFT

Results of Well Permeameter, from USBR 7300-89 Method.

Leighton

Project:	Hassen Covina #11176.001	Approx Ht from water surface to top of float assembly (in.):	#N/A
Exploration #/Location:	*LB-11*	Approx float assem length (w/out extension), in.:	#N/A
Depth Boring drilled to (ft):	10		
Tested by:	BER		
USCS Soil Type:			
Weather (start to finish)	Overcast		
Liquid Used/pH:	Hydrant Water		
Diameter of barrel (in.):	22.5		
No. of Supply barrels:	1	397.4 Total Area of barrels (in.^2):	
Measured boring diameter	10 in.	5 Well Radius, "r"	
Approx Depth to GW below GS	100 ft		
Well Prep:	Straight drill		

	*a.**	*b.**
Initial estimated Depth to Water Surface (in.):	**#N/A**	#N/A
Initial est. depth of water in well, "h" (in.):	**#N/A**	#N/A
approx. h/r (prelim):	#N/A	#N/A
Tu (Fig. 8):	#N/A	
Tu>3h?:	#N/A	

*a. Est. by measurements from top of float assm.
*b. Est. by measurements from top of sand

	ft	in.	(total)			
Depth to Bot of well (or top of soil over Bentonite)	9. ft	1. in.	109			
Depth to top of dry sand before casing install	8. ft	5. in.	101		8	sand thickness
Length of casing			0			
Casing stickup (+ is above ground)			0		45	sand thickness
Depth to Top of Sand from top of casing	5. ft	4. in.	64	64	0	check by casing length
Pilot Tube stickup (+ is above ground)	2. ft	11.5 in.	35.5			
Depth to top of float assembly from top of pilot tube	6. ft	5. in.	77	41.5 Depth below GS (in.)		
Float Assembly ID	F					
Float assembly Extension length (in.)		34				

Field Data / **Calculations**

Date	Time	Water Level in Supply Barrel (in.)	Depth to WL in Boring (measured from top of pilot tube) ft	in.	Water Temp (deg F)	Comments (or "y" for DL interpre-tation)	Δt (min)	Total Elapsed Time (min.)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from barrels	from Δh	Total	Flow (in^3/ min)	q, Flow (in^3/ hr)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 11/9/2015	Start time: 7:55 AM																			
-									#N/A	#N/A	<--est. from setup measurements									
11/9/15	7:55	30.5	11.33		62			0	100.5	8.5										
11/9/15	9:29	10.5	9.02		62		94	94	72.7	36.3	27.72	22	7948	-988	6960	74	4443	1.1	0.81	**6.08**
11/9/15	9:33	30.875	9.02		62			98	72.7	36.3										
11/9/15	10:10	22.875	9				37	135	72.5	36.5	0.24	36	3179	-9	3171	86	5142	1.1	1.19	**4.51**
11/9/15	10:37	17.125	8.98		63		27	162	72.3	36.7	0.24	37	2285	-9	2277	84	5059	1.1	1.14	**4.34**
11/9/15	11:01	12	8.98		64		24	186	72.3	36.7	0	37	2037	0	2037	85	5092	1.0	1.13	**4.29**
11/9/15	11:07	29.625	8.97		62			192	72.1	36.9										
11/9/15	12:06	17.625	9.05		69		59	251	73.1	35.9	-0.96	36	4769	34	4803	81	4884	1.0	1.05	**3.85**
11/9/15	12:32	12.375	9.05		69		26	277	73.1	35.9	0	36	2086	0	2086	80	4815	1.0	1.03	**3.84**

DRAFT

Results of Well Permeameter, from USBR 7300-89 Method.

Leighton

Project:	Hassen Covina #11176.001		Approx Ht from water surface to top of float assembly (in.):	#N/A
Exploration #/Location:	LB-12		Approx float assem length (w/out extension), in.:	#N/A
Depth Boring drilled to (ft):	10			
Tested by:	BER			
USCS Soil Type:				
Weather (start to finish)	Overcast			
Liquid Used/pH:	Hydrant Water		Tu (Fig. 8):	#N/A
Diameter of barrel (in.):	22.5		Tu>3h?:	#N/A
No. of Supply barrels:	1	397.4 Total Area of barrels (in.^2):	*a. Est. by measurements from top of float assm.	
Measured boring diameter	10 in.	5 Well Radius, "r"	*b. Est. by measurements from top of sand	
Approx Depth to GW below GS	100 ft			
Well Prep:	Straight drill			

	a.*	b.*
Initial estimated Depth to Water Surface (in.):	**#N/A**	#N/A
Initial est. depth of water in well, "h" (in.):	**#N/A**	#N/A
approx. h/r (prelim):	#N/A	#N/A

	ft	in.	(total)			
Depth to Bot of well (or top of soil over Bentonite)	9. ft	3. in.	111			
Depth to top of dry sand before casing install	8. ft	8. in.	104		7	sand thickness
Length of casing			0			
Casing stickup (+ is above ground)			0		48	sand thickness
Depth to Top of Sand from top of casing	5. ft	3. in.	63	63	0	check by casing length
Pilot Tube stickup (+ is above ground)	1. ft	6. in.	18			
Depth to top of float assembly from top of pilot tube	4. ft	7.5 in.	55.5	37.5 Depth below GS (in.)		
Float Assembly ID	A					
Float assembly Extension length (in.)		30				

Field Data / **Calculations**

Date	Time	Water Level in Supply Barrel (in.)	Depth to WL in Boring (measured from top of pilot tube) ft	in.	Water Temp (deg F)	Comments (or "y" for DL interpre-tation)	Δt (min)	Total Elapsed Time (min.)	Depth to WL in well (in.)	h, Height of Water in Well (in.)	Δh (in.)	Avg. h	Vol Change (in.^3) from barrels	from Δh	Total	Flow (in^3/min)	q, Flow (in^3/ hr)	V (Fig 9)	K20, Coef. Of Perme-ability at 20 deg C (in./hr)	Infiltration Rate [flow/surf area] (in./hr) (FS=1)
Start Date 11/9/2015	Start time: 8:16 AM																			
-									**#N/A**	**#N/A**	**<--est. from setup measurements**									
11/9/15	8:16	26.5	7.05		**62**			0	66.6	44.4										
11/9/15	9:36	10.5	6.96		62		80	80	65.5	45.5	1.08	45	6359	-38	6320	79	4740	1.1	0.78	**3.41**
11/9/15	9:40	30.625	6.99		62			84	65.9	45.1										
11/9/15	10:14	25.125	6.88				34	118	64.6	46.4	1.32	46	2186	-47	2139	63	3774	1.1	0.60	**2.66**
11/9/15	10:40	21.125	7.18		63		26	144	68.2	42.8	-3.6	45	1590	128	1718	66	3964	1.1	0.72	**2.82**
11/9/15	11:09	16.75	6.95		63		29	173	65.4	45.6	2.76	44	1739	-98	1640	57	3394	1.1	0.54	**2.44**
11/9/15	12:09	7.875	7.1		65		60	233	67.2	43.8	-1.8	45	3527	64	3591	60	3591	1.0	0.61	**2.48**
11/9/15	12:14	31.25	6.8		69			238	63.6	47.4										
11/9/15	12:35	28	7.04		68		21	259	66.5	44.5	-2.88	46	1292	103	1394	66	3983	1.0	0.63	**2.56**
11/9/15	14:31	11.125	7.14		70		116	375	67.7	43.3	-1.2	44	6706	43	6749	58	3491	0.9	0.56	**2.27**

DRAFT

APPENDIX C

LABORATORY TEST RESULTS

DRAFT

Boring No.	LB-2	LB-5	LB-1	LB-12
Sample No.	S-5	R-4	R-3	S-10
Depth (ft.)	20.0	15.0	10.0	45.0
Sample Type	SPT	Ring	Ring	SPT
Soil Identification	Olive brown silty sand with gravel (SM)g	Brown silty sand (SM)	Brown silty sand (SM)	Olive brown silty sand with gravel (SM)g
Moisture Correction				
Wet Weight of Soil + Container (g)	0.00	0.00	0.00	0.00
Dry Weight of Soil + Container (g)	0.00	0.00	0.00	0.00
Weight of Container (g)	1.00	1.00	1.00	1.00
Moisture Content (%)	0.00	0.00	0.00	0.00
Sample Dry Weight Determination				
Weight of Sample + Container (g)	644.2	703.8	495.8	964.5
Weight of Container (g)	107.2	251.8	138.6	108.2
Weight of Dry Sample (g)	537.0	451.9	357.2	856.3
Container No.:				
After Wash				
Method (A or B)	B	B	B	B
Dry Weight of Sample + Cont. (g)	506.0	633.7	447.3	683.5
Weight of Container (g)	107.2	251.8	138.6	108.2
Dry Weight of Sample (g)	398.8	381.9	308.7	575.3
% Passing No. 200 Sieve	**25.7**	**15.5**	**13.6**	**32.8**
% Retained No. 200 Sieve	74.3	84.5	86.4	67.2

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PERCENT PASSING
No. 200 SIEVE
ASTM D 1140

Project Name: Hassen Covina
Project No.: 11176.001
Client Name: Hassen Development Corporation
Tested By: SF/ACS Date: 11/30/15

Leighton

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name: Hassen Covina
Tested By: GB/ACS
Date: 11/22/15

Project No.: 11176.001
Data Input By: J. Ward
Date: 12/04/15

Boring No.: LB-2

Sample No.: R-3
Depth (feet): 10.0

Soil Identification: Brown sandy silt s(ML)

		Soil Type
% Gravel	**0**	**s(ML)**
% Sand	**46**	
% Fines	**54**	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	168.98	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	168.55	165.11
Wt.of Air-Dry Soil + Cont. (g)	636.80	Wt. of Container No.___ (g)	1.00	77.78	136.78
Wt. of Container	76.10	Moisture Content (%)	0.00	0.47	
Dry Wt. of Soil (g)	560.70	Wt. of Dry Soil (g)			28.33

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	0.00	100.0
No. 4	0.50	99.9
No. 10	2.00	99.6
Pan		

Sieve after Hydrometer & Wet Sieve

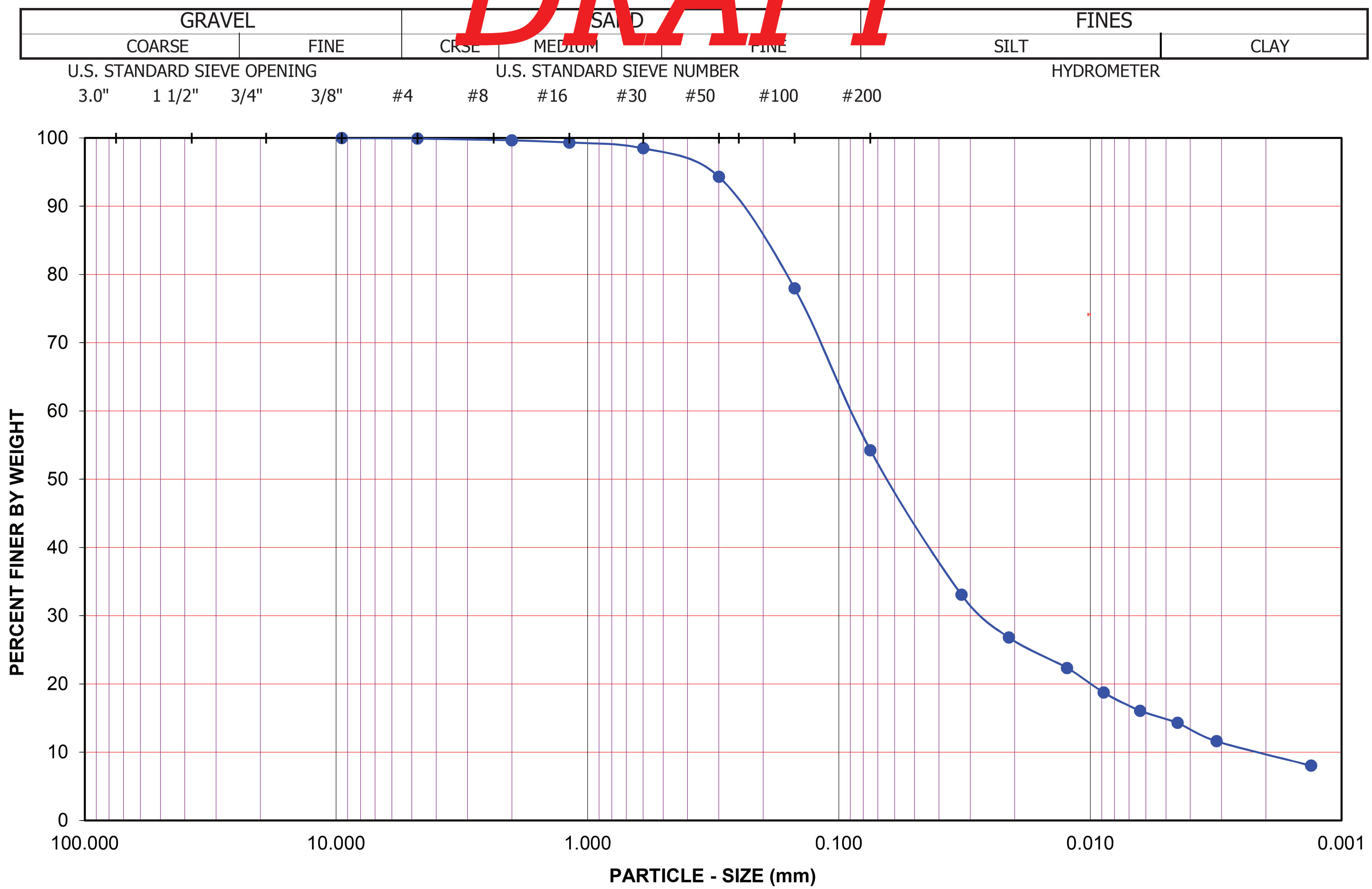
U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	99.6
No. 16	0.17	99.7	99.3
No. 30	0.64	98.8	98.5
No. 50	2.96	94.6	94.3
No. 100	12.02	78.3	78.0
No. 200	25.17	54.5	54.3
Pan			

Hydrometer

Wt. of Air-Dry Soil (g): 55.53
Wt. of Dry Soil (g): 55.27

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
24-Nov-15	9:33	0		7.5			
	9:35	2	21.6	7.5	26.0	33.1	0.0325
	9:38	5	21.6	7.5	22.5	26.8	0.0211
	9:48	15	21.5	7.5	20.0	22.4	0.0124
	10:03	30	21.6	7.5	18.0	18.8	0.0088
	10:33	60	21.5	7.5	16.5	16.1	0.0063
	11:33	120	21.5	7.5	15.5	14.3	0.0045
	13:43	250	21.4	7.5	14.0	11.6	0.0031
25-Nov-15	9:33	1440	21.2	7.5	12.0	8.0	0.0013



Project Name: Hassen Covina

Project No.: 11176.001

Leighton

PARTICLE - SIZE DISTRIBUTION
ASTM D 422

Boring No.: LB-2   Sample No.: R-3

Depth (feet): 10.0   Soil Type : s(ML)

Soil Identification: Brown sandy silt s(ML)

GR:SA:FI : (%)   0 : 46 : 54

12/04/15

SA & Hyd LB-2, R-3 @ 10

Leighton

DRAFT

PARTICLE-SIZE ANALYSIS OF SOILS

ASTM D 422

Project Name:	Hassen Covina	Tested By:	G. Bathala	Date:	11/23/15
Project No.:	11176.001	Data Input By:	J. Ward	Date:	12/04/15
Boring No.:	LB-5				
Sample No.:	R-3	Depth (feet):	10.0		
Soil Identification:	Brown silty sand (SM)				

		Soil Type
% Gravel	**1**	**SM**
% Sand	**52**	
% Fines	**47**	

			Moisture Content of Total Air-Dry Soil	Moisture Content of Air-Dry Soil Passing #10	After Hydrometer & Wet Sieve ret. in #200 Sieve
Specific Gravity (Assumed)	2.70	Wt.of Air-Dry Soil + Cont.(g)	0.00	155.06	
Correction for Specific Gravity	0.99	Dry Wt. of Soil + Cont. (g)	0.00	154.64	163.70
Wt.of Air-Dry Soil + Cont. (g)	931.20	Wt. of Container No.___ (g)	1.00	71.73	133.15
Wt. of Container	75.70	Moisture Content (%)	0.00	0.51	
Dry Wt. of Soil (g)	855.50	Wt. of Dry Soil (g)			30.55

Coarse Sieve

U.S. Sieve	Cumulative Wt. Of Dry Soil Retained (g)	% Passing
3"	0.00	100.0
1½"	0.00	100.0
3/4"	0.00	100.0
3/8"	6.20	99.3
No. 4	8.00	99.1
No. 10	11.00	98.7
Pan		

Sieve after Hydrometer & Wet Sieve

U.S. Sieve Size	Cumulative Wt. Of Dry Soil Retained (g)	% Passing	% Total Sample
No. 10	0.00	100.0	98.7
No. 16	0.29	99.5	98.2
No. 30	0.96	98.3	97.0
No. 50	4.41	92.0	90.8
No. 100	15.44	72.0	71.1
No. 200	28.61	48.1	47.5
Pan			

Hydrometer Wt. of Air-Dry Soil (g) 55.39 Wt. of Dry Soil (g) 55.11

Deflocculant 125 cc of 4% Solution

Date	Time	Elapsed Time (min)	Water Temperature (°C)	Composite Correction 152H	Actual Hydrometer Readings	% Total Sample (%)	Soil Particle Diameter (mm)
24-Nov-15	9:37	0		7.5			
	9:39	2	21.5	7.5	24.5	30.2	0.0329
	9:42	5	21.5	7.5	22.0	25.8	0.0212
	9:52	15	21.6	7.5	19.0	20.4	0.0125
	10:07	30	21.6	7.5	17.5	17.8	0.0089
	10:37	60	21.6	7.5	16.0	15.1	0.0063
	11:37	120	21.4	7.5	15.0	13.3	0.0045
	13:47	250	21.3	7.5	14.0	11.5	0.0031
25-Nov-15	9:37	1440	21.1	7.5	11.5	7.1	0.0013

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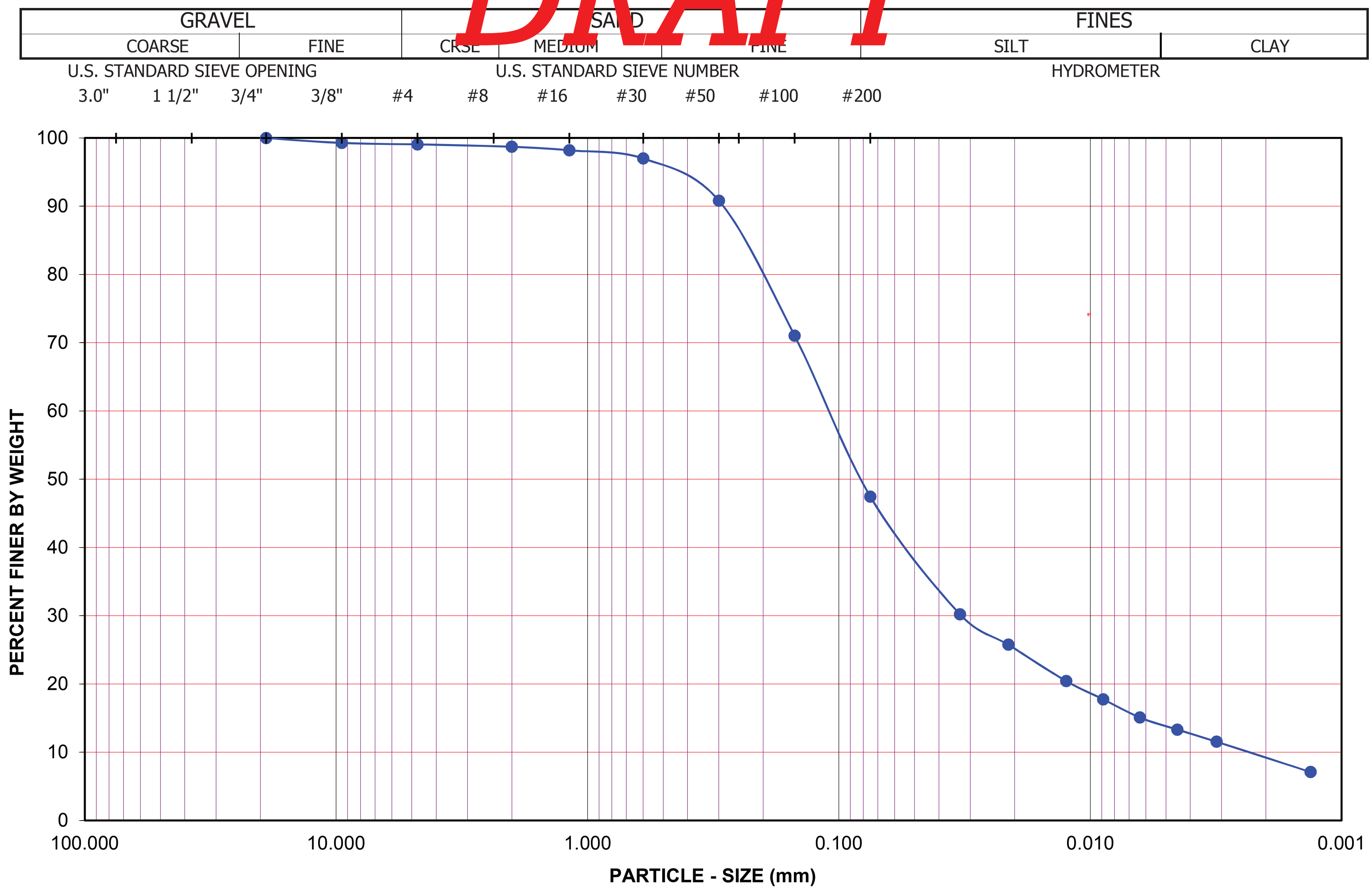


Project Name: Hassen Covina

Project No.: 11176.001

Boring No.: LB-5 | Sample No.: R-3

Depth (feet): 10.0 | Soil Type : SM

Soil Identification: Brown silty sand (SM)

GR:SA:FI : (%) 1 : 52 : 47

Leighton

PARTICLE - SIZE DISTRIBUTION ASTM D 422

12/04/15

DRAFT

Leighton

ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS
ASTM D 4546

Project Name:	Hassen Covina	Tested By:	G. Bathala
Project No.:	11176.001	Checked By:	J. Ward
Boring No.:	LB-1	Sample Type:	Ring
Sample No.:	R-4	Depth (ft.)	15.0
Sample Description:	Brown silty sand (SM), two 1-inch gravel noted		

Date: 11/30/15
Date: 12/04/15

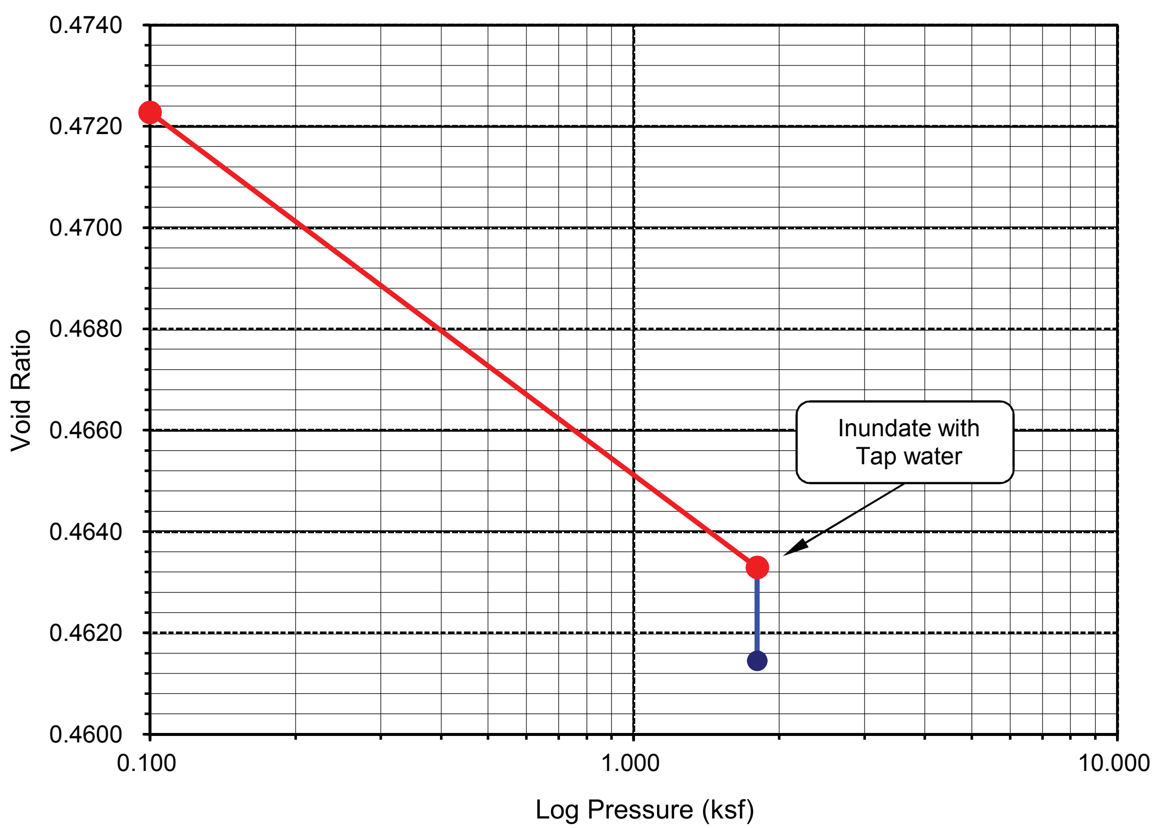
Initial Dry Density (pcf):	114.5
Initial Moisture (%):	8.12
Initial Length (in.):	1.0000
Initial Dial Reading:	0.2859
Diameter(in):	2.415

Final Dry Density (pcf):	115.3
Final Moisture (%) :	14.6
Initial Void Ratio:	0.4726
Specific Gravity(assumed):	2.70
Initial Saturation (%)	46.4

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.2857	0.9998	0.00	-0.02	0.4723	-0.02
1.800	0.2764	0.9905	0.32	-0.95	0.4633	-0.63
H2O	0.2752	0.9893	0.32	-1.08	0.4615	-0.76

Percent Swell (+) / Settlement (-) After Inundation = -0.13

Void Ratio - Log Pressure Curve



Leighton

DRAFT

ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS
ASTM D 4546

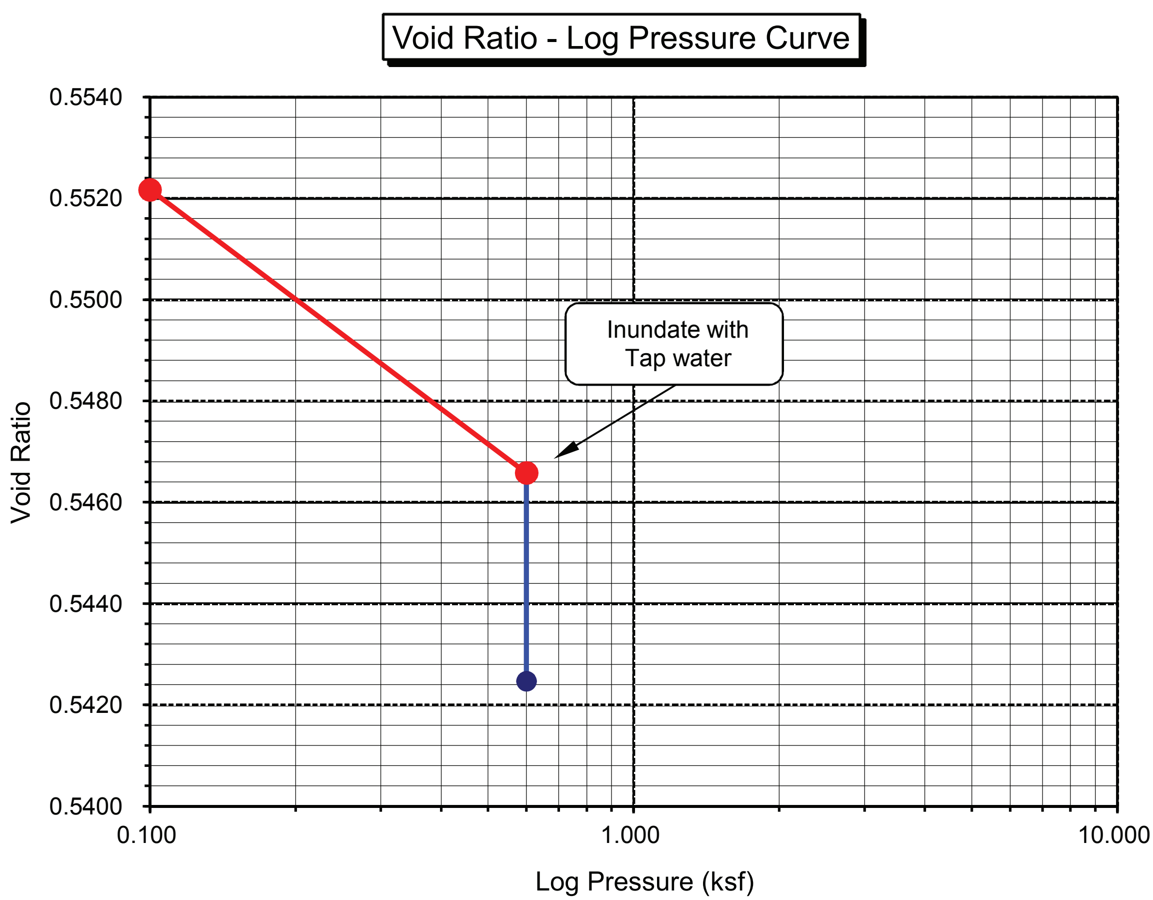
Project Name:	Hassen Covina	Tested By:	G. Bathala	Date:	11/30/15
Project No.:	11176.001	Checked By:	J. Ward	Date:	12/04/15
Boring No.:	LB-2	Sample Type:	Ring		
Sample No.:	R-2	Depth (ft.)	5.0		
Sample Description:	Dark brown sandy silt s(ML)				

Initial Dry Density (pcf):	108.6
Initial Moisture (%):	8.74
Initial Length (in.):	1.0000
Initial Dial Reading:	0.2980
Diameter(in):	2.415

Final Dry Density (pcf):	109.3
Final Moisture (%) :	17.3
Initial Void Ratio:	0.5526
Specific Gravity(assumed):	2.70
Initial Saturation (%)	42.7

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.2977	0.9998	0.00	-0.02	0.5522	-0.02
0.600	0.2928	0.9949	0.13	-0.51	0.5466	-0.38
H_2O	0.2902	0.9922	0.13	-0.78	0.5425	-0.65

Percent Swell (+) / Settlement (-) After Inundation = -0.27



DRAFT

ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS
ASTM D 4546

Leighton

Project Name:	Hassen Covina	Tested By:	G. Bathala
Project No.:	11176.001	Checked By:	J. Ward
Boring No.:	LB-5	Sample Type:	Ring
Sample No.:	R-3	Depth (ft.)	10.0
Sample Description:	Brown silty sand (SM)		

Date: 11/22/15
Date: 12/04/15

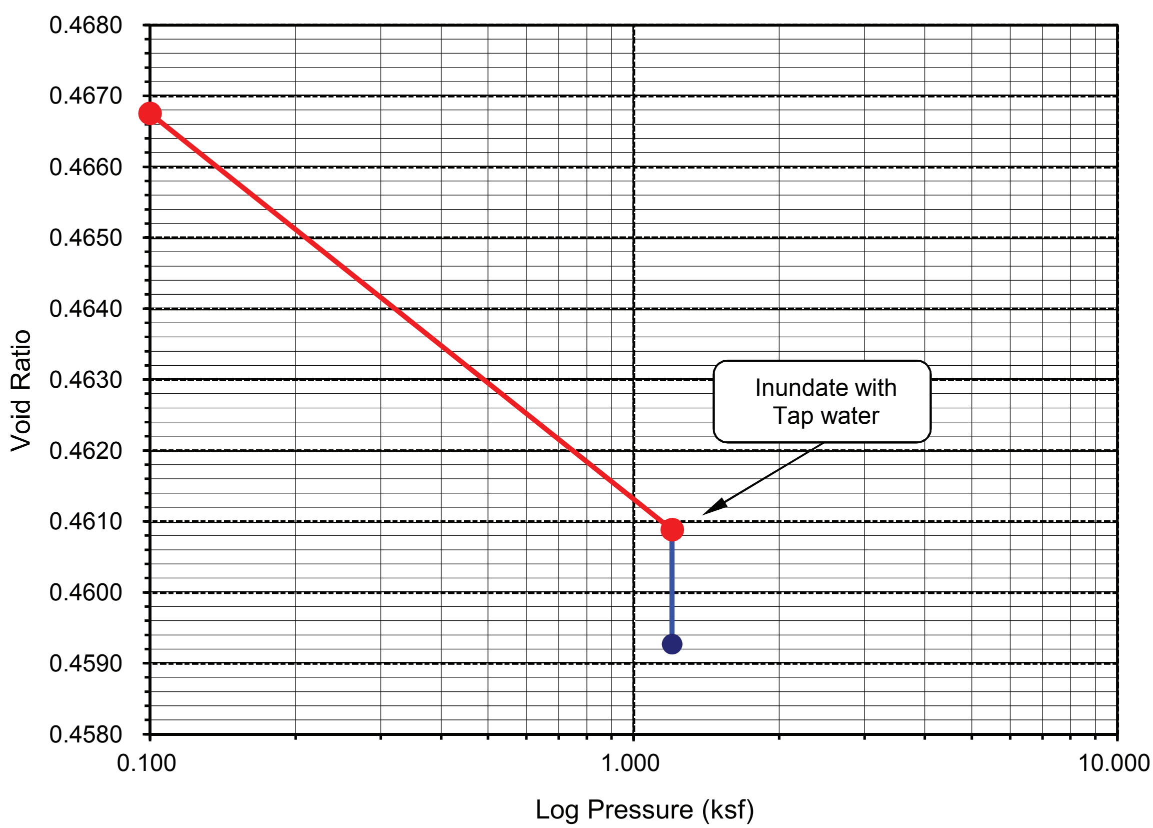
Initial Dry Density (pcf):	114.9
Initial Moisture (%):	10.12
Initial Length (in.):	1.0000
Initial Dial Reading:	0.3188
Diameter(in):	2.415

Final Dry Density (pcf):	115.5
Final Moisture (%) :	14.7
Initial Void Ratio:	0.4673
Specific Gravity(assumed):	2.70
Initial Saturation (%)	58.4

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.3184	0.9996	0.00	-0.04	0.4668	-0.04
1.200	0.3124	0.9936	0.20	-0.64	0.4609	-0.44
H2O	0.3113	0.9925	0.20	-0.75	0.4593	-0.55

Percent Swell (+) / Settlement (-) After Inundation = -0.11

Void Ratio - Log Pressure Curve



Leighton

DRAFT

ONE-DIMENSIONAL SWELL OR SETTLEMENT POTENTIAL OF COHESIVE SOILS

ASTM D 4546

Project Name: Hassen Covina
Project No.: 11176.001
Boring No.: LB-11
Sample No.: R-3
Sample Description: Brown sandy lean clay s(CL)

Tested By: G. Bathala Date: 11/30/15
Checked By: J. Ward Date: 12/04/15
Sample Type: Ring
Depth (ft.) 10.0

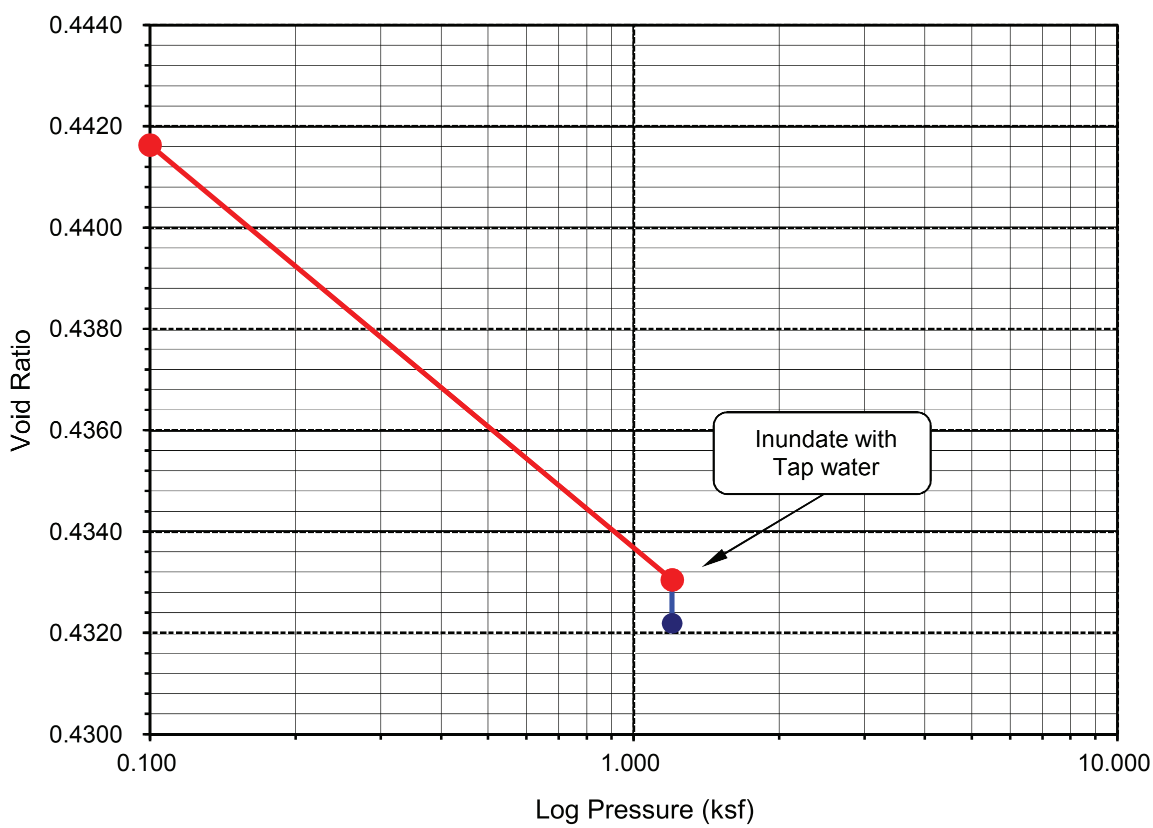
Initial Dry Density (pcf):	116.9
Initial Moisture (%):	12.72
Initial Length (in.):	1.0000
Initial Dial Reading:	0.2998
Diameter(in):	2.415

Final Dry Density (pcf):	117.7
Final Moisture (%) :	13.9
Initial Void Ratio:	0.4420
Specific Gravity(assumed):	2.70
Initial Saturation (%)	77.7

Pressure (p) (ksf)	Final Reading (in)	Apparent Thickness (in)	Load Compliance (%)	Swell (+) Settlement (-) % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.100	0.2996	0.9998	0.00	-0.03	0.4416	-0.03
1.200	0.2917	0.9919	0.19	-0.81	0.4331	-0.62
H2O	0.2911	0.9913	0.19	-0.87	0.4322	-0.68

Percent Swell (+) / Settlement (-) After Inundation = -0.06

Void Ratio - Log Pressure Curve



DRAFT

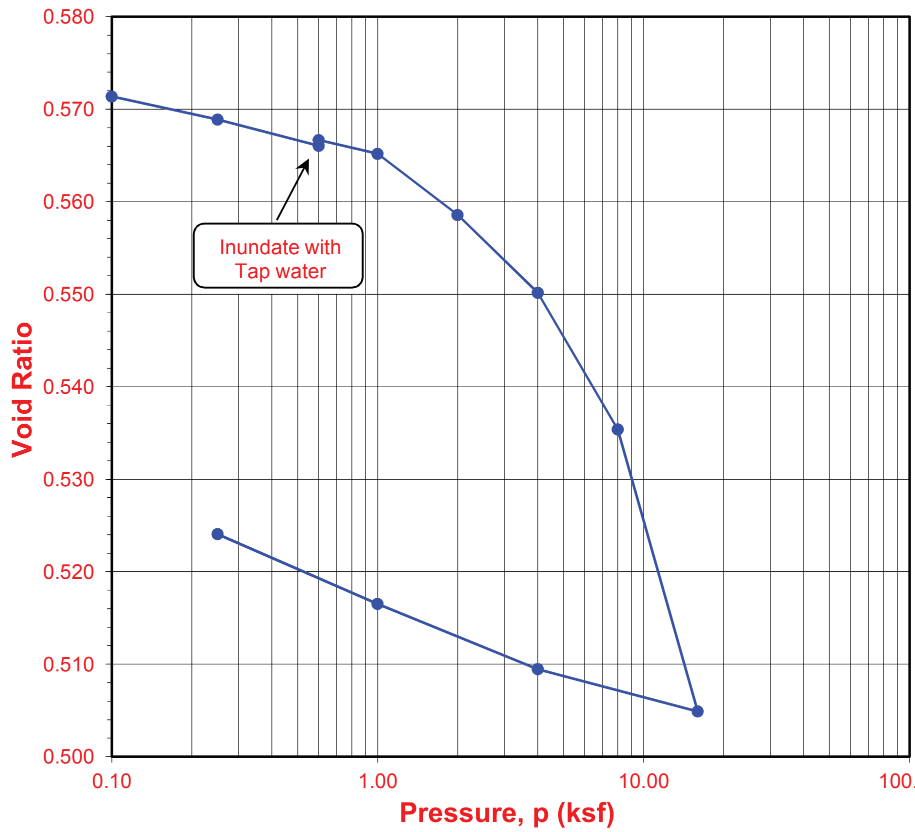
Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Project Name:	Hassen Covina	Tested By:	G. Bathala	Date:	11/23/15
Project No.:	11176.001	Checked By:	J. Ward	Date:	12/04/15
Boring No.:	LB-1	Depth (ft.):	5.0		
Sample No.:	R-2	Sample Type:	Ring		
Soil Identification:	Brown silt (ML)				

Sample Diameter (in.)	2.415
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	185.73
Weight of Ring (g)	42.67
Height after consol. (in.)	0.9695
Before Test	
Wt.Wet Sample+Cont. (g)	166.56
Wt.of Dry Sample+Cont. (g)	153.83
Weight of Container (g)	37.68
Initial Moisture Content (%)	11.0
Initial Dry Density (pcf)	107.2
Initial Saturation (%)	52
Initial Vertical Reading (in.)	0.3238
After Test	
Wt.of Wet Sample+Cont. (g)	232.15
Wt. of Dry Sample+Cont. (g)	208.79
Weight of Container (g)	37.61
Final Moisture Content (%)	18.18
Final Dry Density (pcf)	110.2
Final Saturation (%)	93
Final Vertical Reading (in.)	0.2901
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43



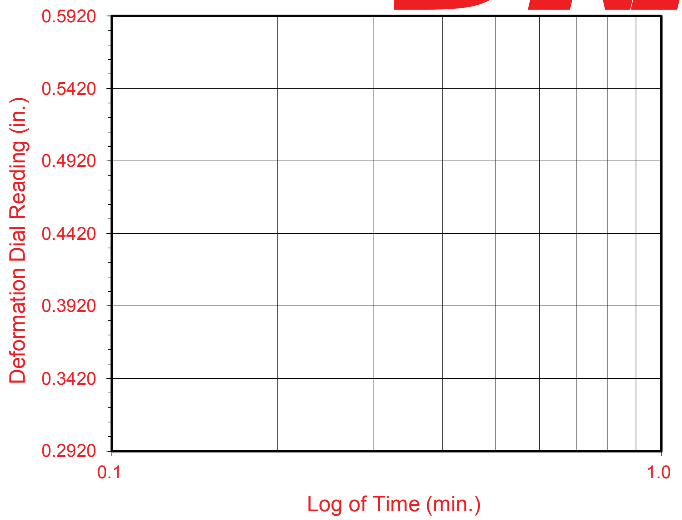
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.3234	0.9996	0.00	0.04	0.571	0.04
0.25	0.3212	0.9974	0.06	0.26	0.569	0.20
0.60	0.3181	0.9943	0.19	0.57	0.566	0.38
0.60	0.3185	0.9947	0.19	0.53	0.567	0.34
1.00	0.3164	0.9926	0.31	0.74	0.565	0.43
2.00	0.3106	0.9868	0.47	1.33	0.559	0.85
4.00	0.3035	0.9797	0.64	2.03	0.550	1.39
8.00	0.2924	0.9686	0.81	3.14	0.535	2.33
16.00	0.2711	0.9473	1.00	5.27	0.505	4.27
4.00	0.2761	0.9523	0.79	4.77	0.509	3.98
1.00	0.2830	0.9592	0.55	4.08	0.517	3.53
0.25	0.2901	0.9663	0.32	3.37	0.524	3.05

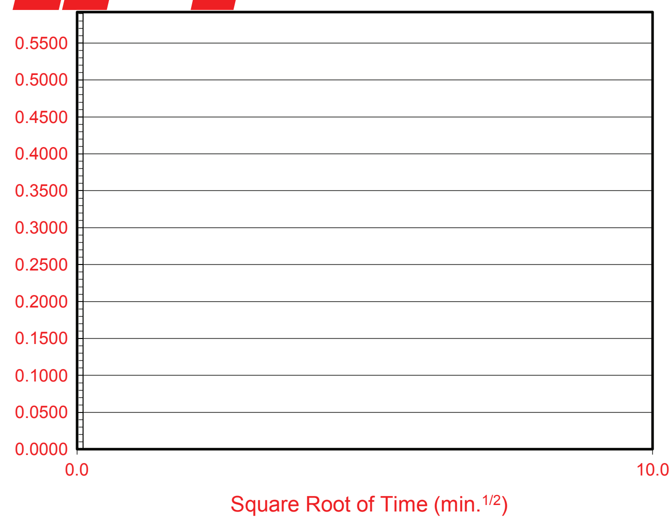
No Time Readings

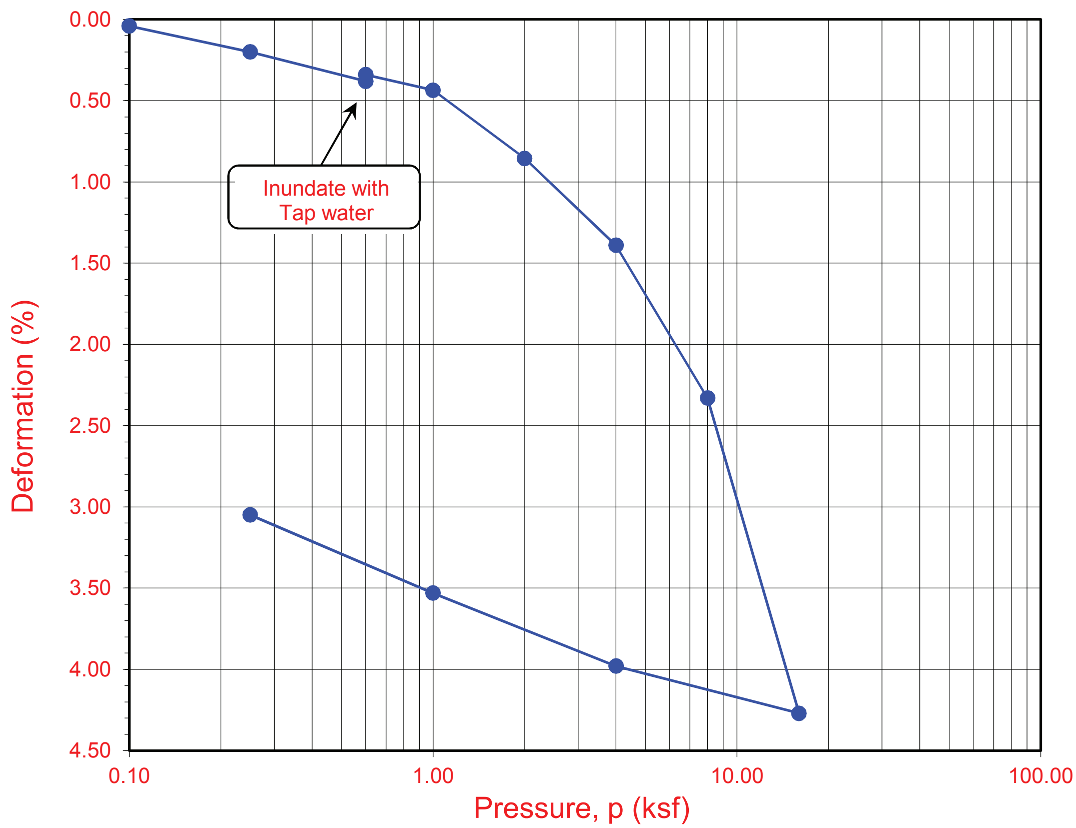
Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

DRAFT

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-1	**R-2**	**5.0**	**11.0**	**18.2**	**107.2**	**110.2**	**0.572**	**0.524**	**52**	**93**

Soil Identification: Brown silt (ML)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11176.001

Hassen Covina

12-15

DRAFT

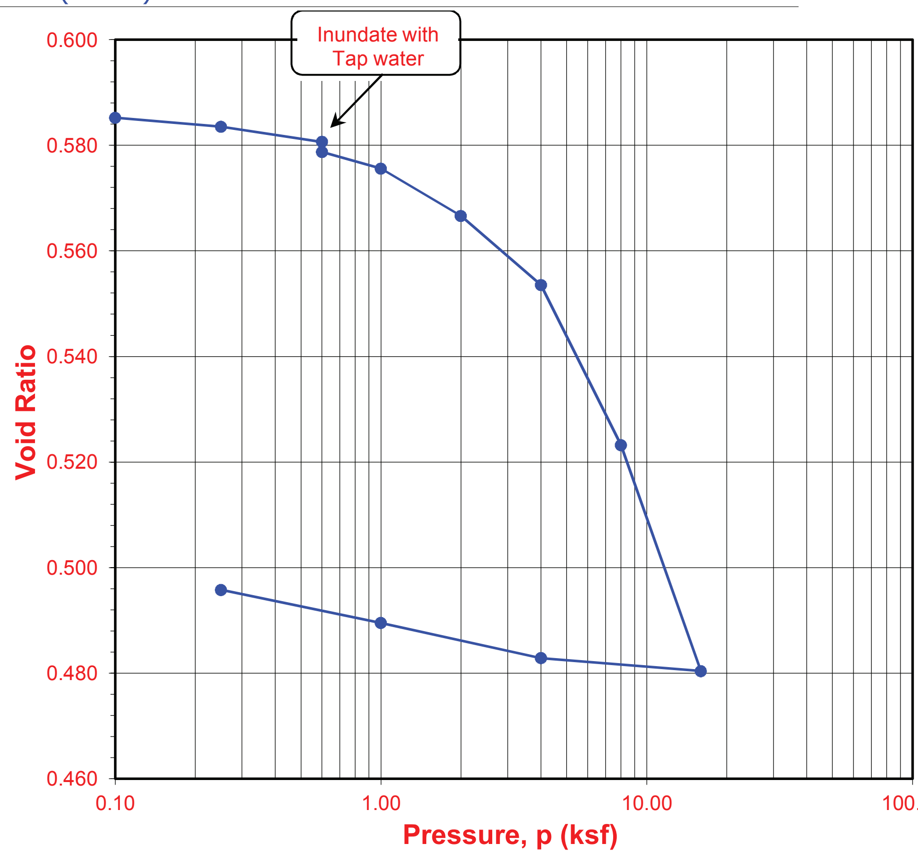
ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS

ASTM D 2435

Leighton

Project Name:	Hassen Covina	Tested By: G. Bathala	Date:	11/23/15
Project No.:	11176.001	Checked By: J. Ward	Date:	12/04/15
Boring No.:	LB-11	Depth (ft.): 5.0		
Sample No.:	R-2	Sample Type:	Ring	
Soil Identification:	Brown silty, clayey sand (SC-SM)			

Sample Diameter (in.)	2.415
Sample Thickness (in.)	1.000
Wt. of Sample + Ring (g)	183.46
Weight of Ring (g)	43.30
Height after consol. (in.)	0.9430
Before Test	
Wt.Wet Sample+Cont. (g)	170.71
Wt.of Dry Sample+Cont. (g)	159.01
Weight of Container (g)	38.28
Initial Moisture Content (%)	9.7
Initial Dry Density (pcf)	106.3
Initial Saturation (%)	45
Initial Vertical Reading (in.)	0.3435
After Test	
Wt.of Wet Sample+Cont. (g)	231.30
Wt. of Dry Sample+Cont. (g)	210.77
Weight of Container (g)	39.26
Final Moisture Content (%)	16.01
Final Dry Density (pcf)	113.1
Final Saturation (%)	88
Final Vertical Reading (in.)	0.2825
Specific Gravity (assumed)	2.70
Water Density (pcf)	62.43

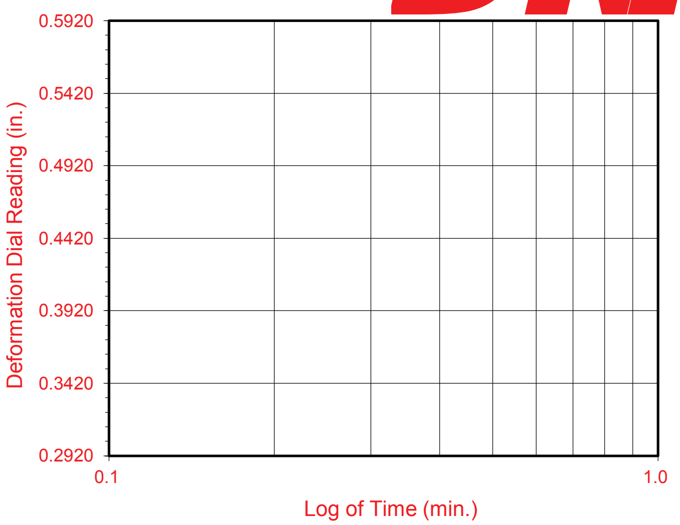


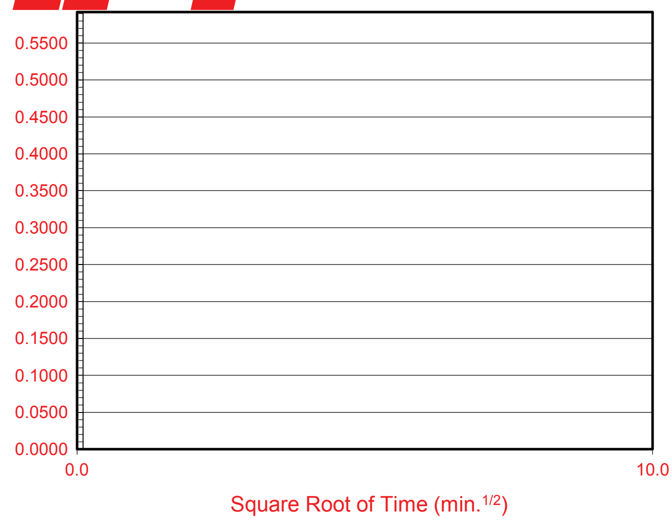
Pressure (p) (ksf)	Final Reading (in.)	Apparent Thickness (in.)	Load Compliance (%)	Deformation % of Sample Thickness	Void Ratio	Corrected Deformation (%)
0.10	0.3429	0.9994	0.00	0.06	0.585	0.06
0.25	0.3414	0.9979	0.04	0.21	0.584	0.17
0.60	0.3383	0.9948	0.17	0.52	0.581	0.35
0.60	0.3371	0.9936	0.17	0.64	0.579	0.47
1.00	0.3340	0.9905	0.28	0.95	0.576	0.67
2.00	0.3265	0.9830	0.47	1.71	0.567	1.24
4.00	0.3162	0.9727	0.67	2.73	0.554	2.06
8.00	0.2948	0.9513	0.90	4.87	0.523	3.97
16.00	0.2650	0.9215	1.18	7.85	0.480	6.67
4.00	0.2696	0.9261	0.88	7.40	0.483	6.52
1.00	0.2763	0.9328	0.63	6.73	0.490	6.10
0.25	0.2825	0.9390	0.40	6.10	0.496	5.70

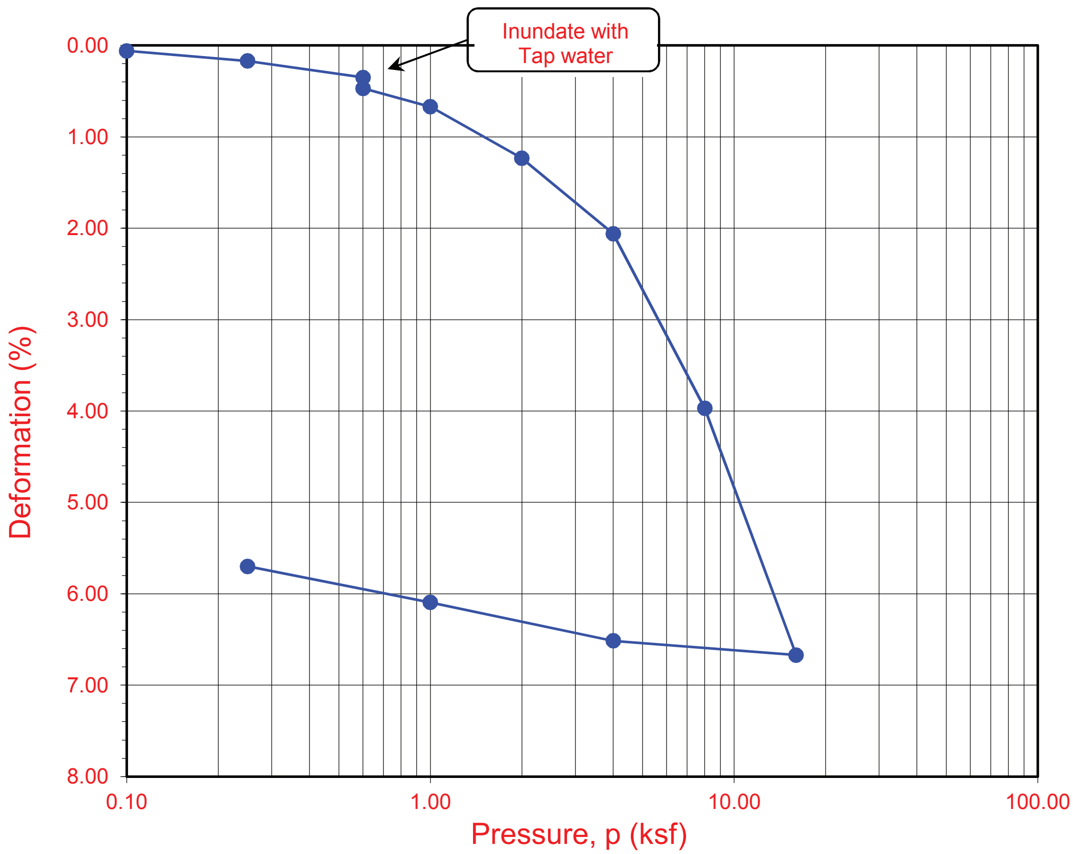
No Time Readings

Date	Time	Elapsed Time (min)	Square Root of Time	Dial Rdgs. (in.)

No Time Readings







Boring No.	Sample No.	Depth (ft.)	Moisture Content (%)		Dry Density (pcf)		Void Ratio		Degree of Saturation (%)	
			Initial	Final	Initial	Final	Initial	Final	Initial	Final
LB-11	**R-2**	**5.0**	**9.7**	**16.0**	**106.3**	**113.1**	**0.586**	**0.496**	**45**	**88**

Soil Identification: Brown silty, clayey sand (SC-SM)

Leighton

ONE-DIMENSIONAL CONSOLIDATION PROPERTIES of SOILS
ASTM D 2435

Project No.: 11176.001

Hassen Covina

12-15

Leighton

EXPANSION INDEX of SOILS
ASTM D 4829

Project Name:	Hassen Covina	Tested By:	S. Felter	Date:	11/30/15
Project No.:	11176.001	Checked By:	J. Ward	Date:	12/04/15
Boring No.:	LB-1	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Dark brown silty sand (SM)				

Dry Wt. of Soil + Cont. (g)	1000.00
Wt. of Container No. (g)	0.00
Dry Wt. of Soil (g)	1000.00
Weight Soil Retained on #4 Sieve	0.00
Percent Passing # 4	100.00

MOLDED SPECIMEN	Before Test	After Test
Specimen Diameter (in.)	4.01	4.01
Specimen Height (in.)	1.0000	1.0090
Wt. Comp. Soil + Mold (g)	587.70	448.29
Wt. of Mold (g)	165.40	0.00
Specific Gravity (Assumed)	2.70	2.70
Container No.	O	O
Wet Wt. of Soil + Cont. (g)	852.50	613.69
Dry Wt. of Soil + Cont. (g)	792.30	557.82
Wt. of Container (g)	0.00	165.40
Moisture Content (%)	7.60	14.24
Wet Density (pcf)	127.4	134.0
Dry Density (pcf)	118.4	117.3
Void Ratio	0.424	0.437
Total Porosity	0.298	0.304
Pore Volume (cc)	61.6	63.5
Degree of Saturation (%) [S_{meas}]	**48.4**	88.0

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

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
11/30/15	13:05	1.0	0	0.1190
11/30/15	13:15	1.0	10	0.1190
Add Distilled Water to the Specimen				
11/30/15	14:05	1.0	50	0.1270
12/01/15	6:14	1.0	1019	0.1280
12/01/15	8:25	1.0	1150	0.1280

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**9**

Leighton

EXPANSION INDEX of SOILS
ASTM D 4829

Project Name:	Hassen Covina	Tested By:	S. Felter	Date:	11/24/15
Project No.:	11176.001	Checked By:	J. Ward	Date:	12/04/15
Boring No.:	LB-12	Depth (ft.):	0-5		
Sample No.:	B-3				
Soil Identification:	Dark brown silty sand (SM)				

Dry Wt. of Soil + Cont.	(g)	1000.00
Wt. of Container No.	(g)	0.00
Dry Wt. of Soil	(g)	1000.00
Weight Soil Retained on #4 Sieve		0.00
Percent Passing # 4		100.00

MOLDED SPECIMEN		Before Test	After Test
Specimen Diameter	(in.)	4.01	4.01
Specimen Height	(in.)	1.0000	1.0015
Wt. Comp. Soil + Mold	(g)	567.10	423.83
Wt. of Mold	(g)	163.70	0.00
Specific Gravity (Assumed)		2.70	2.70
Container No.		O	O
Wet Wt. of Soil + Cont.	(g)	806.50	587.53
Dry Wt. of Soil + Cont.	(g)	735.90	531.75
Wt. of Container	(g)	0.00	163.70
Moisture Content	(%)	9.59	15.16
Wet Density	(pcf)	121.7	127.7
Dry Density	(pcf)	111.0	110.9
Void Ratio		0.518	0.521
Total Porosity		0.341	0.342
Pore Volume	(cc)	70.7	71.0
Degree of Saturation (%) [S_{meas}]		**50.0**	78.6

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

Date	Time	Pressure (psi)	Elapsed Time (min.)	Dial Readings (in.)
11/24/15	8:43	1.0	0	0.0735
11/24/15	8:53	1.0	10	0.0735
Add Distilled Water to the Specimen				
11/24/15	13:22	1.0	269	0.0750
11/25/15	6:25	1.0	1292	0.0750
11/25/15	8:00	1.0	1387	0.0750

Expansion Index (EI_{meas}) = ((Final Rdg - Initial Rdg) / Initial Thick.) x 1000	**2**

Leighton

MODIFIED PROCTOR COMPACTION TEST
ASTM D1557

Project Name:	Hassen Covina	Tested By:	O. Figueroa	Date:	11/24/15
Project No.:	11176.001	Input By:	J. Ward	Date:	12/04/15
Boring No.:	LB-1	Depth (ft.):	0-5		
Sample No.:	B-1				
Soil Identification:	Dark brown silty sand (SM)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

Preparation Method:	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	
#3/8	5.3
#4	

Rammer Weight (lb.) = 10.0

Height of Drop (in.) = 18.0

Mold Volume (ft³) 0.03340

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3848	3965	4034	3936		
Weight of Mold (g)	1851	1851	1851	1851		
Net Weight of Soil (g)	1997	2114	2183	2085		
Wet Weight of Soil + Cont. (g)	420.5	424.4	438.4	467.2		
Dry Weight of Soil + Cont. (g)	406.4	401.5	406.5	424.6		
Weight of Container (g)	39.0	38.4	38.8	38.8		
Moisture Content (%)	3.84	6.31	8.68	11.04		
Wet Density (pcf)	131.8	139.5	144.1	137.6		
Dry Density (pcf)	126.9	131.3	132.6	123.9		

Maximum Dry Density (pcf)	**133.0**	**Optimum Moisture Content (%)**	**8.0**
Corrected Dry Density (pcf)	**134.5**	**Corrected Moisture Content (%)**	**7.5**

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

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

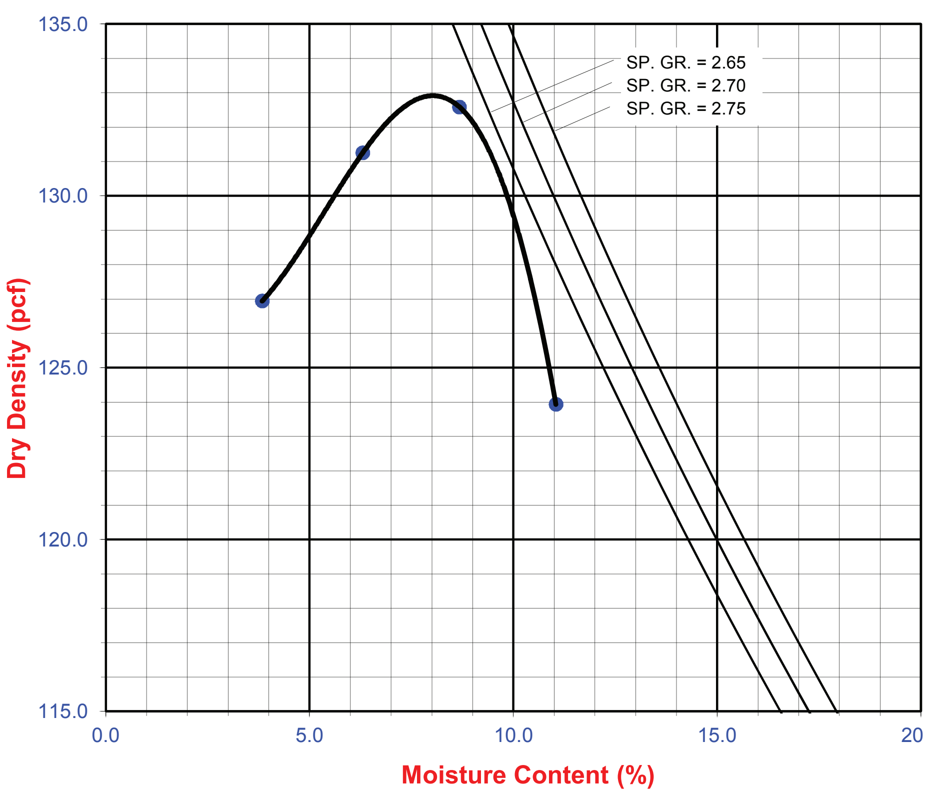
☐ **Procedure C**
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



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Leighton

MODIFIED PROCTOR COMPACTION TEST

ASTM D1557

Project Name:	Hassen Covina	Tested By:	O. Figueroa	Date:	11/23/15
Project No.:	11176.001	Input By:	J. Ward	Date:	12/04/15
Boring No.:	LB-12	Depth (ft.):	0-5		
Sample No.:	B-3				
Soil Identification:	Dark brown silty sand (SM)				

Note: Corrected dry density calculation assumes specific gravity of 2.70 and moisture content of 1.0% for oversize particles

Preparation Method:	X	Moist
		Dry
Compaction Method	X	Mechanical Ram
		Manual Ram

Scalp Fraction (%)	
#3/4	
#3/8	
#4	5.4

Rammer Weight (lb.) = 10.0

Height of Drop (in.) = 18.0

Mold Volume (ft³) 0.03340

TEST NO.	1	2	3	4	5	6
Wt. Compacted Soil + Mold (g)	3760	3868	3944	3886		
Weight of Mold (g)	1851	1851	1851	1851		
Net Weight of Soil (g)	1909	2017	2093	2035		
Wet Weight of Soil + Cont. (g)	324.0	412.0	425.1	449.3		
Dry Weight of Soil + Cont. (g)	310.4	386.0	390.0	403.7		
Weight of Container (g)	38.2	39.3	38.6	39.2		
Moisture Content (%)	5.00	7.50	9.99	12.51		
Wet Density (pcf)	126.0	133.1	138.1	134.3		
Dry Density (pcf)	120.0	123.8	125.6	119.4		

Maximum Dry Density (pcf)	**125.5**	**Optimum Moisture Content (%)**	**9.5**
Corrected Dry Density (pcf)	**127.5**	**Corrected Moisture Content (%)**	**9.0**

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

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

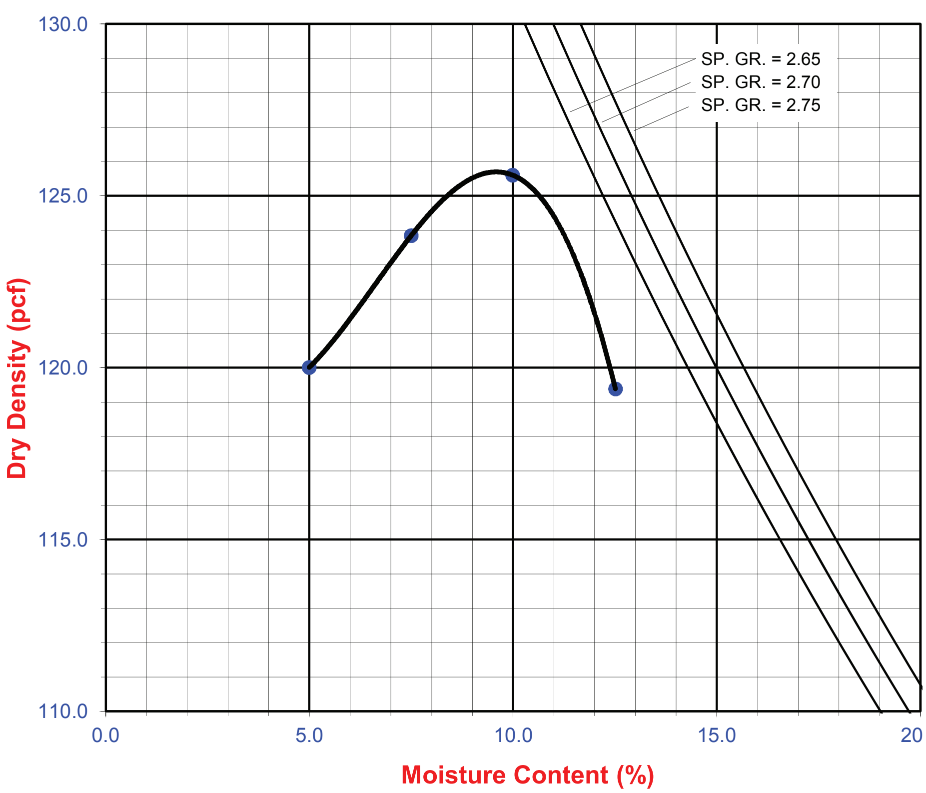
Procedure C
Soil Passing 3/4 in. (19.0 mm) Sieve
Mold : 6 in. (152.4 mm) diameter
Layers : 5 (Five)
Blows per layer : 56 (fifty-six)
Use if +3/8 in. is >20% and +¾ in. is <30%

Particle-Size Distribution:

GR:SA:FI

Atterberg Limits:

LL,PL,PI



Leighton

TESTS for SULFATE CONTENT CHLORIDE CONTENT and pH of SOILS

Project Name:	Hassen Covina	Tested By :	G. Berdy	Date:	11/23/15
Project No. :	11176.001	Data Input By:	J. Ward	Date:	12/04/15

Boring No.	LB-1	LB-12		
Sample No.	B-1	B-3		
Sample Depth (ft)	0-5	0-5		
Soil Identification:	Dark brown SM	Dark brown SM		
Wet Weight of Soil + Container (g)	213.81	146.13		
Dry Weight of Soil + Container (g)	208.84	145.03		
Weight of Container (g)	58.38	60.69		
Moisture Content (%)	3.30	1.30		
Weight of Soaked Soil (g)	100.11	100.05		

SULFATE CONTENT, DOT California Test 417, Part II

Beaker No.	36	51		
Crucible No.	15	29		
Furnace Temperature (°C)	880	880		
Time In / Time Out	10:30/11:10	10:30/11:10		
Duration of Combustion (min)	45	45		
Wt. of Crucible + Residue (g)	20.3287	20.7517		
Wt. of Crucible (g)	20.3261	20.7493		
Wt. of Residue (g) (A)	0.0026	0.0024		
PPM of Sulfate (A) x 41150	106.99	98.76		
PPM of Sulfate, Dry Weight Basis	**111**	**100**		

CHLORIDE CONTENT, DOT California Test 422

ml of Extract For Titration (B)	15	30		
ml of AgNO3 Soln. Used in Titration (C)	0.4	0.5		
PPM of Chloride (C -0.2) * 100 * 30 / B	40	30		
PPM of Chloride, Dry Wt. Basis	**41**	**30**		

pH TEST, DOT California Test 643

pH Value	**7.88**	**7.28**		
Temperature °C	20.2	20.2		

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SOIL RESISTIVITY TEST
DOT CA TEST 643

Project Name:	Hassen Covina	Tested By :	G. Berdy Date: 12/01/15
Project No. :	11176.001	Data Input By:	J. Ward Date: 12/04/15
Boring No.:	LB-1	Depth (ft.) :	0-5
Sample No. :	B-1		

Soil Identification:* Dark brown SM

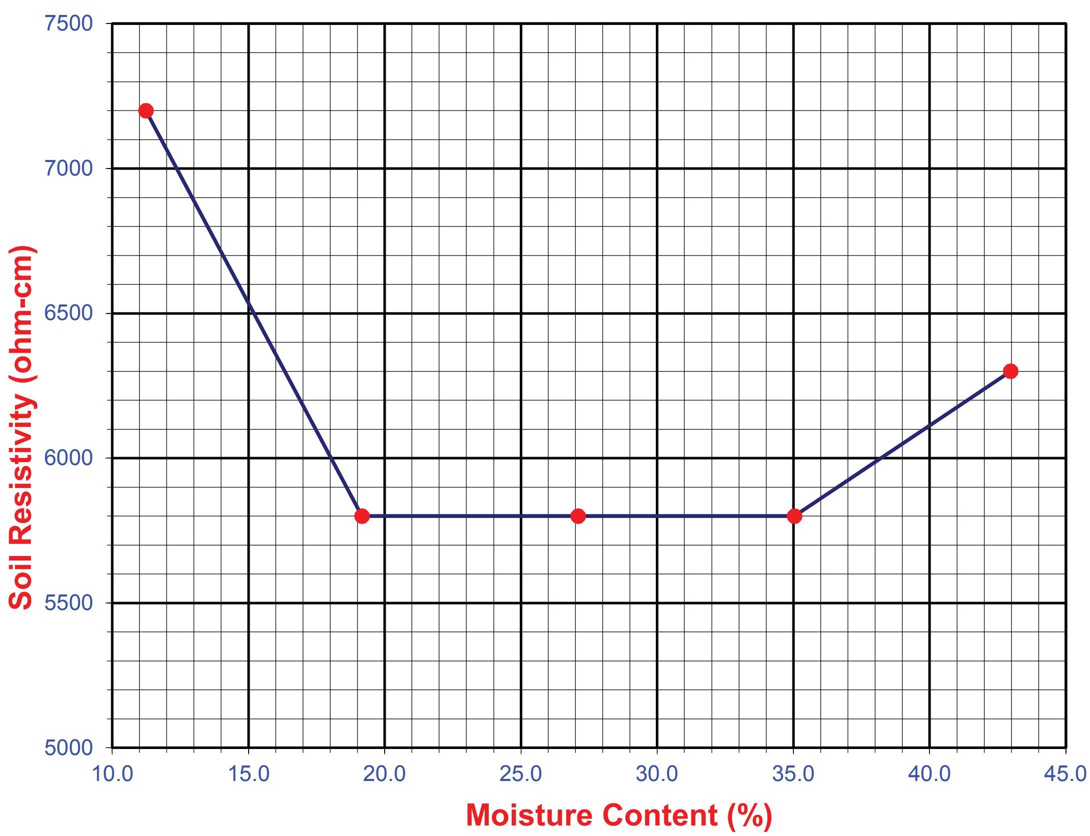
*California Test 643 requires soil specimens to consist only of portions of samples passing through the No. 8 US Standard Sieve before resistivity testing. Therefore, this test method may not be representative for coarser materials.

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	10	11.24	7200	7200
2	20	19.17	5800	5800
3	30	27.10	5800	5800
4	40	35.04	5800	5800
5	50	42.97	6300	6300

Moisture Content (%) (MCi)	3.30
Wet Wt. of Soil + Cont. (g)	213.81
Dry Wt. of Soil + Cont. (g)	208.84
Wt. of Container (g)	58.38
Container No.	
Initial Soil Wt. (g) (Wt)	130.21
Box Constant	1.000

MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
5800	**27.1**	**111**	**41**	**7.88**	**20.2**



Leighton

SOIL RESISTIVITY TEST
DOT CA TEST 643

Project Name:	Hassen Covina	Tested By :	G. Berdy	Date:	12/01/15
Project No. :	11176.001	Data Input By:	J. Ward	Date:	12/04/15
Boring No.:	LB-12	Depth (ft.) :	0-5		
Sample No. :	B-3				

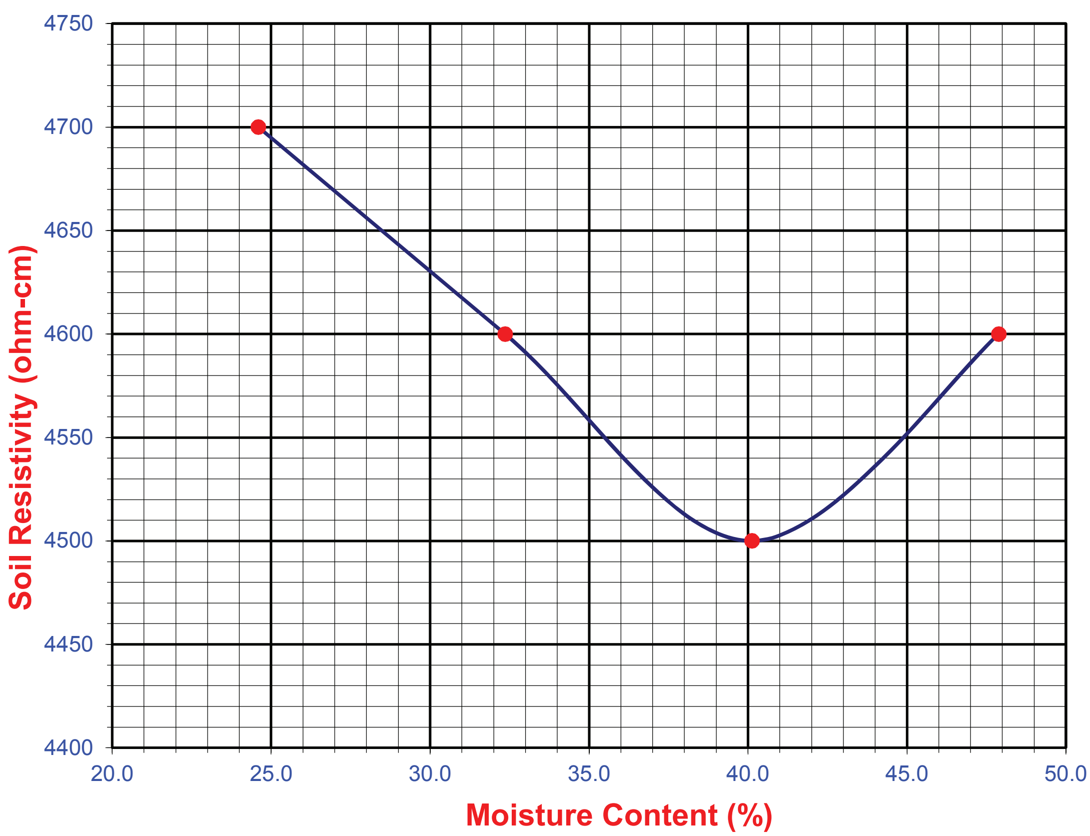
Soil Identification:* Dark brown SM

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

Specimen No.	Water Added (ml) (Wa)	Adjusted Moisture Content (MC)	Resistance Reading (ohm)	Soil Resistivity (ohm-cm)
1	30	24.60	4700	4700
2	40	32.36	4600	4600
3	50	40.13	4500	4500
4	60	47.89	4600	4600
5				

Moisture Content (%) (MCi)	1.30
Wet Wt. of Soil + Cont. (g)	146.13
Dry Wt. of Soil + Cont. (g)	145.03
Wt. of Container (g)	60.69
Container No.	
Initial Soil Wt. (g) (Wt)	130.47
Box Constant	1.000
MC =(((1+Mci/100)x(Wa/Wt+1))-1)x100	

Min. Resistivity (ohm-cm)	Moisture Content (%)	Sulfate Content (ppm)	Chloride Content (ppm)	Soil pH	
				pH	Temp. (°C)
DOT CA Test 643		DOT CA Test 417 Part II	DOT CA Test 422	DOT CA Test 643	
4500	**40.1**	**100**	**30**	**7.28**	**20.2**



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Hassen Covina
11176.001

Summary of Pocket Penetrometer Test Results
Prepared by JHW, 12-04-15

LB-1	R-1	3.50
	R-2	3.00/>4.50
	R-3	4.00
	R-4	>4.50
LB-2	R-1	4.25
	R-2	3.50/>4.50
	R-3	>4.50
	R-4	4.00
LB-3	R-1	3.00
	R-2	>4.50
	R-3	1.25
	R-4	0.00
LB-4	R-1	3.50
	R-2	>4.50
	R-3	>4.50
	R-4	>4.50
LB-5	R-1	2.50
	R-2	4.00
	R-3	>4.50
	R-4	3.75
LB-6	R-1	2.00
	R-2	3.00
	R-3	3.50
	R-4	0.00
LB-7	R-1	2.00
	R-2	2.50
	R-3	>4.50
	R-4	>4.50
LB-8	R-1	3.00
	R-2	>4.50
	R-3	2.50
	R-4	>4.50
LB-9	R-1	2.75
	R-2	0.00
	R-3	>4.50
	R-4	0.00
LB-10	R-1	1.75
	R-3	3.00
LB-11	R-1	1.75
	R-2	3.75/>4.50
	R-3	>4.50
	R-4	0.00
LB-12	R-1	3.00
	R-2	>4.50
	R-3	4.25
	R-4	>4.50
LB-13	R-1	1.75
	R-2	0.00
	R-4	3.75

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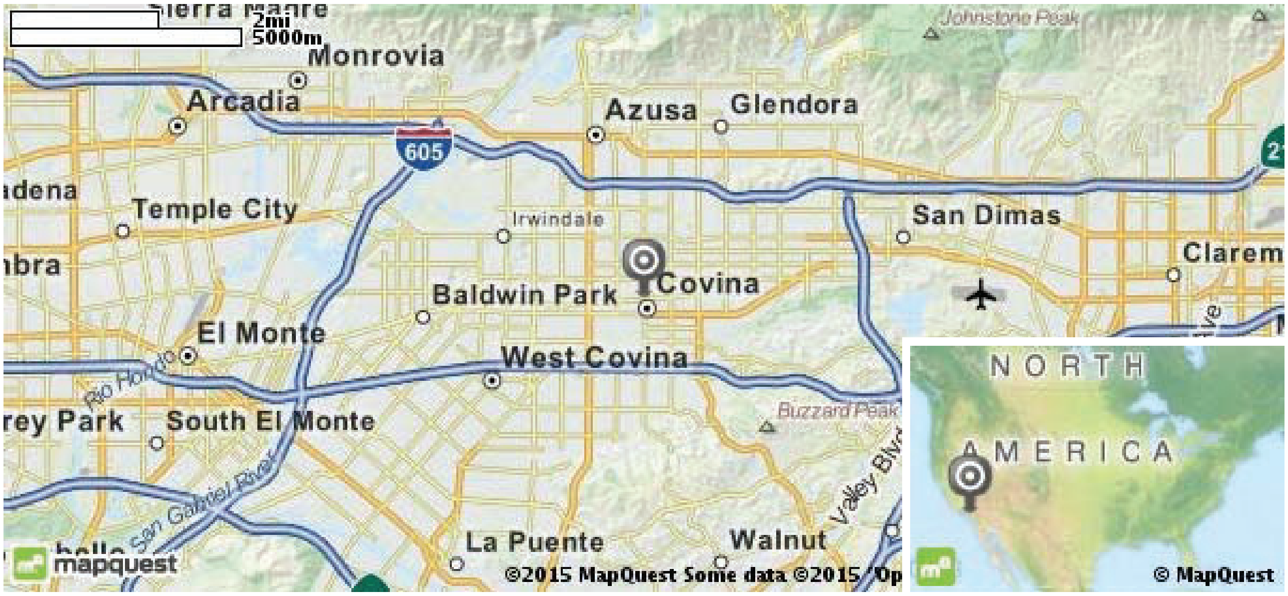
APPENDIX D

SUMMARY OF SECONDARY SEISMIC HAZARD ANALYSIS

Design Maps Summary Report

User–Specified Input

Report Title	Hassen Covina Tue November 17, 2015 21:53:23 UTC
Building Code Reference Document	ASCE 7-10 Standard (which utilizes USGS hazard data available in 2008)
Site Coordinates	34.0904°N, 117.8905°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

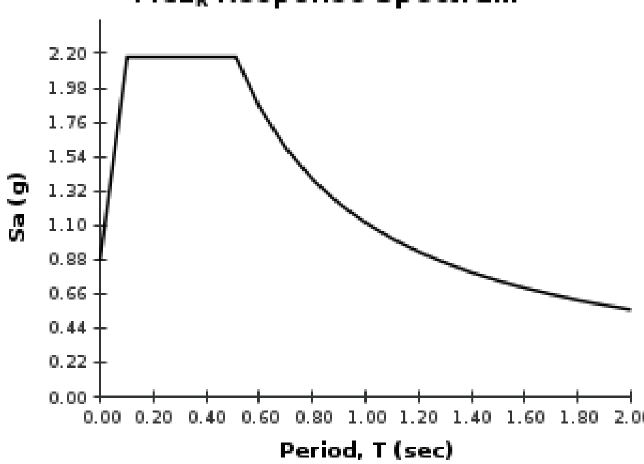


USGS–Provided Output

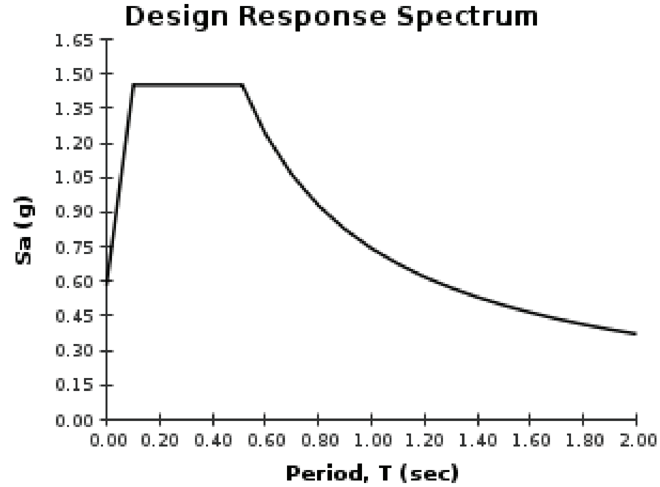
$S_S =$ 2.178 g	$S_{MS} =$ 2.178 g	$S_{DS} =$ 1.452 g
$S_1 =$ 0.743 g	$S_{M1} =$ 1.115 g	$S_{D1} =$ 0.743 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

MCE_R Response Spectrum



Design Response Spectrum



For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

Design Maps Detailed Report

ASCE 7-10 Standard (34.0904°N, 117.8905°W)

Site Class D – "Stiff Soil", Risk Category I/II/III

Section 11.4.1 — Mapped Acceleration Parameters

Note: Ground motion values provided below are for the direction of maximum horizontal spectral response acceleration. They have been converted from corresponding geometric mean ground motions computed by the USGS by applying factors of 1.1 (to obtain S_S) and 1.3 (to obtain S_1). Maps in the 2010 ASCE-7 Standard are provided for Site Class B. Adjustments for other Site Classes are made, as needed, in Section 11.4.3.

From Figure 22-1 [1]	S_S = 2.178 g
From Figure 22-2 [2]	S_1 = 0.743 g

Section 11.4.2 — Site Class

The authority having jurisdiction (not the USGS), site-specific geotechnical data, and/or the default has classified the site as Site Class D, based on the site soil properties in accordance with Chapter 20.

Table 20.3–1 Site Classification

Site Class	$\bar{v}_s$	$\bar{N}$ or $\bar{N}_{ch}$	$\bar{s}_u$
A. Hard Rock	>5,000 ft/s	N/A	N/A
B. Rock	2,500 to 5,000 ft/s	N/A	N/A
C. Very dense soil and soft rock	1,200 to 2,500 ft/s	>50	>2,000 psf
D. Stiff Soil	600 to 1,200 ft/s	15 to 50	1,000 to 2,000 psf
E. Soft clay soil	<600 ft/s	<15	<1,000 psf
	Any profile with more than 10 ft of soil having the characteristics: • Plasticity index PI > 20, • Moisture content $w \geq 40\%$, and • Undrained shear strength $\bar{s}_u$ < 500 psf		
F. Soils requiring site response analysis in accordance with Section 21.1	See Section 20.3.1		

For SI: 1ft/s = 0.3048 m/s 1lb/ft² = 0.0479 kN/m²

Section 11.4.3 — Site Coefficients and Risk–Targeted Maximum Considered Earthquake (MCE_R) Spectral Response Acceleration Parameters

Table 11.4–1: Site Coefficient F_a

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at Short Period				
	$S_S \leq 0.25$	$S_S = 0.50$	$S_S = 0.75$	$S_S = 1.00$	$S_S \geq 1.25$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	$\boxed{1.0}$
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_S

For Site Class = D and S_S = 2.178 g, F_a = 1.000

Table 11.4–2: Site Coefficient F_v

Site Class	Mapped MCE $_R$ Spectral Response Acceleration Parameter at 1–s Period				
	$S_1 \leq 0.10$	$S_1 = 0.20$	$S_1 = 0.30$	$S_1 = 0.40$	$S_1 \geq 0.50$
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	$\boxed{1.5}$
E	3.5	3.2	2.8	2.4	2.4
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of S_1

For Site Class = D and S_1 = 0.743 g, F_v = 1.500

Equation (11.4–1): $S_{MS} = F_a S_S = 1.000 \times 2.178 = 2.178$ g

Equation (11.4–2): $S_{M1} = F_v S_1 = 1.500 \times 0.743 = 1.115$ g

Section 11.4.4 — Design Spectral Acceleration Parameters

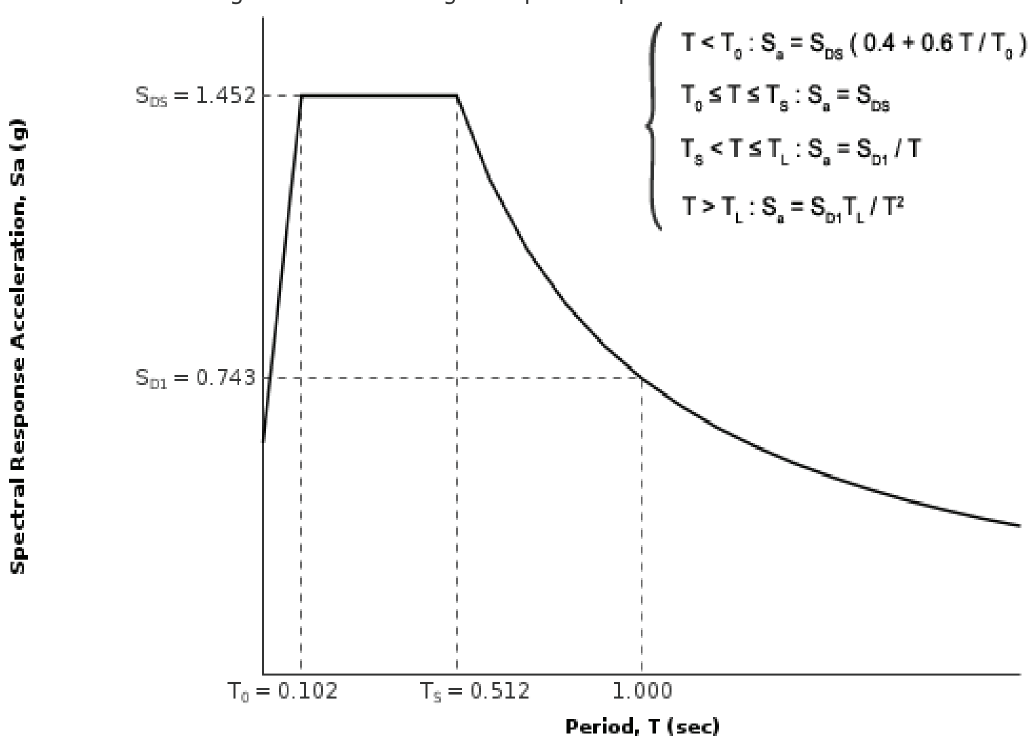
Equation (11.4–3): $S_{DS} = ⅔\ S_{MS} = ⅔ \times 2.178 = 1.452$ g

Equation (11.4–4): $S_{D1} = ⅔\ S_{M1} = ⅔ \times 1.115 = 0.743$ g

Section 11.4.5 — Design Response Spectrum

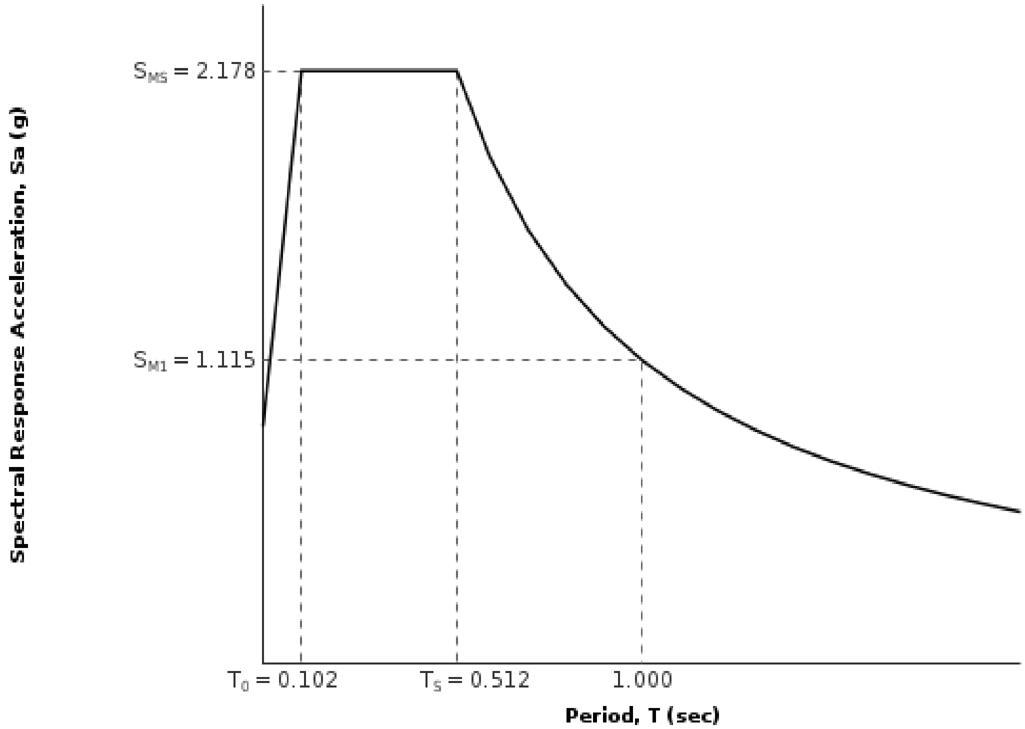
From Figure 22-12 [3] $T_L = 8$ seconds

Figure 11.4–1: Design Response Spectrum



Section 11.4.6 — Risk-Targeted Maximum Considered Earthquake (MCE_R) Response Spectrum

The MCE_R Response Spectrum is determined by multiplying the design response spectrum above by 1.5.



Section 11.8.3 — Additional Geotechnical Investigation Report Requirements for Seismic Design Categories D through F

From Figure 22-7 [4]	PGA = 0.762
Equation (11.8–1):	$PGA_M = F_{PGA}PGA = 1.000 \times 0.762 = 0.762$ g

Table 11.8–1: Site Coefficient F_{PGA}

Site Class	Mapped MCE Geometric Mean Peak Ground Acceleration, PGA				
	PGA ≤ 0.10	PGA = 0.20	PGA = 0.30	PGA = 0.40	PGA ≥ 0.50
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	See Section 11.4.7 of ASCE 7				

Note: Use straight–line interpolation for intermediate values of PGA

For Site Class = D and PGA = 0.762 g, F_{PGA} = 1.000

Section 21.2.1.1 — Method 1 (from Chapter 21 – Site-Specific Ground Motion Procedures for Seismic Design)

From Figure 22-17 [5]	$C_{RS} = 1.020$
From Figure 22-18 [6]	$C_{R1} = 1.031$

Section 11.6 — Seismic Design Category

Table 11.6-1 Seismic Design Category Based on Short Period Response Acceleration Parameter

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \le S_{DS} < 0.33g$	B	B	C
$0.33g \le S_{DS} < 0.50g$	C	C	D
$0.50g \le S_{DS}$	D	D	D

For Risk Category = I and S_{DS} = 1.452 g, Seismic Design Category = D

Table 11.6-2 Seismic Design Category Based on 1-S Period Response Acceleration Parameter

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \le S_{D1} < 0.133g$	B	B	C
$0.133g \le S_{D1} < 0.20g$	C	C	D
$0.20g \le S_{D1}$	D	D	D

For Risk Category = I and S_{D1} = 0.743 g, Seismic Design Category = D

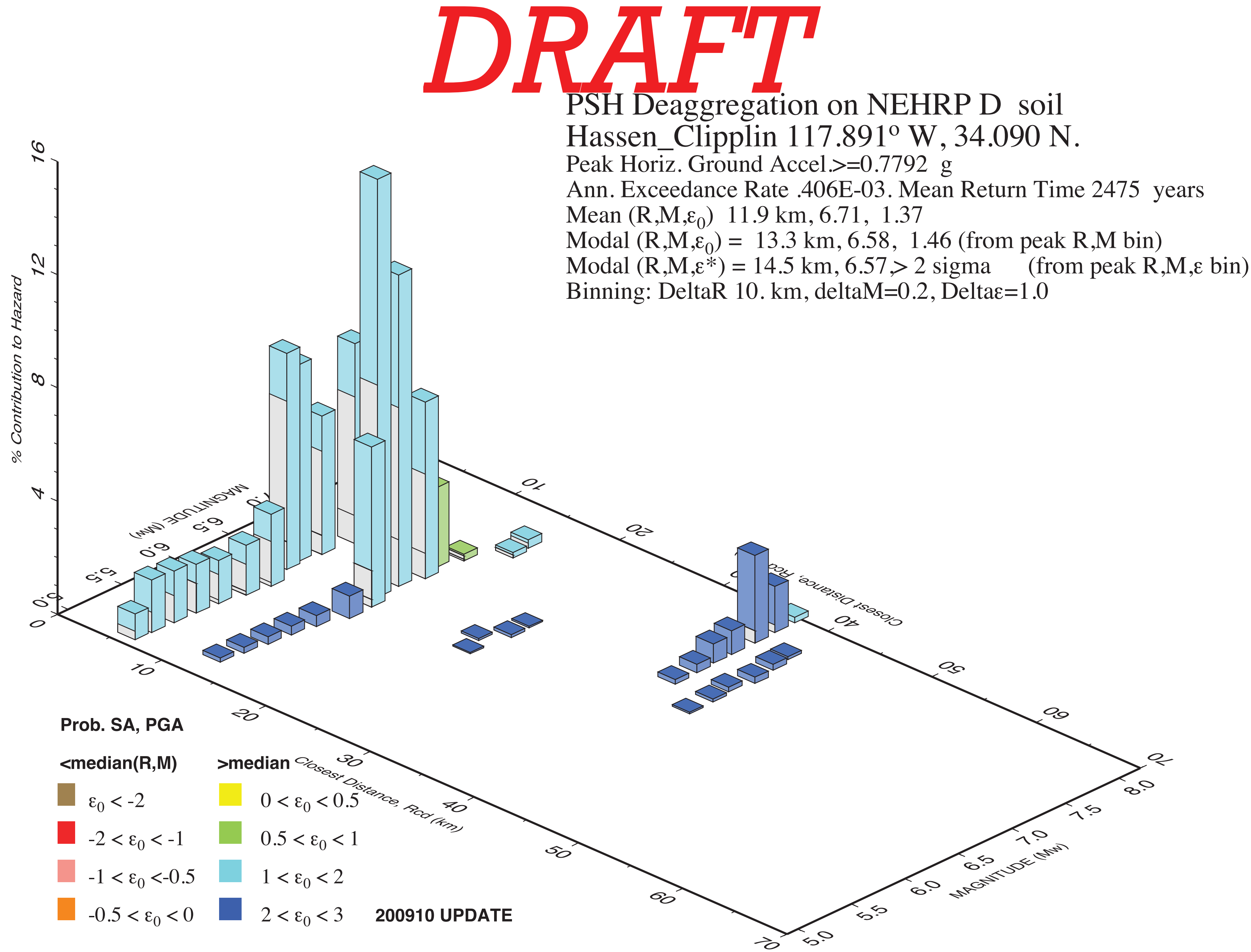
Note: When S_1 is greater than or equal to 0.75g, the Seismic Design Category is **E** for buildings in Risk Categories I, II, and III, and **F** for those in Risk Category IV, irrespective of the above.

Seismic Design Category ≡ "the more severe design category in accordance with Table 11.6-1 or 11.6-2" = D

Note: See Section 11.6 for alternative approaches to calculating Seismic Design Category.

References

1. *Figure 22-1*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-1.pdf
2. *Figure 22-2*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-2.pdf
3. *Figure 22-12*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-12.pdf
4. *Figure 22-7*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-7.pdf
5. *Figure 22-17*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-17.pdf
6. *Figure 22-18*: http://earthquake.usgs.gov/hazards/designmaps/downloads/pdfs/2010_ASCE-7_Figure_22-18.pdf



GMT 2015 Nov 11 23:03:14 Distance (R), magnitude (M), epsilon (E0,E) deaggregation for a site on soil with average vs= 275. m/s top 30 m. USGS CGHT PSHA2008 UPDATE Bins with lt 0.05% contrib. omitted

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*                     *
*   E Q F A U L T     *
*                     *
*   Version 3.00      *
*                     *
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DETERMINISTIC ESTIMATION OF
PEAK ACCELERATION FROM DIGITIZED FAULTS

JOB NUMBER: 11176.001

DATE: 11-17-2015

JOB NAME: Hassen Clippinger

CALCULATION NAME: Test Run Analysis

FAULT-DATA-FILE NAME: CDMGFLTE.DAT

SITE COORDINATES:
SITE LATITUDE: 34.0900
SITE LONGITUDE: 117.8910

SEARCH RADIUS: 100 mi

ATTENUATION RELATION: 20) Sadigh et al. (1997) Horiz. - Soil
UNCERTAINTY (M=Median, S=Sigma): M Number of Sigmas: 0.0
DISTANCE MEASURE: clodis
SCOND: 0
Basement Depth: 5.00 km Campbell SSR: Campbell SHR:
COMPUTE PEAK HORIZONTAL ACCELERATION

FAULT-DATA FILE USED: CDMGFLTE.DAT

MINIMUM DEPTH VALUE (km): 0.0

EQFAULT SUMMARY

DETERMINISTIC SITE PARAMETERS

Page 1

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT: MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
SAN JOSE	3.2(5.2)	6.5	0.483	X
SIERRA MADRE	4.0(6.4)	7.0	0.499	X
RAYMOND	8.5(13.6)	6.5	0.283	IX
CLAMSHELL-SAWPIT	8.5(13.7)	6.5	0.281	IX
CHINO-CENTRAL AVE. (Elsinore)	9.0(14.5)	6.7	0.294	IX
WHITTIER	9.4(15.2)	6.8	0.231	IX
CUCAMONGA	9.5(15.3)	7.0	0.320	IX
ELYSIAN PARK THRUST	11.2(18.0)	6.7	0.249	IX
VERDUGO	14.7(23.6)	6.7	0.197	VIII
HOLLYWOOD	19.5(31.4)	6.4	0.121	VII
COMPTON THRUST	20.5(33.0)	6.8	0.150	VIII
ELSINORE-GLEN IVY	21.9(35.2)	6.8	0.109	VII
SAN ANDREAS - 1857 Rupture	22.9(36.9)	7.8	0.183	VIII
SAN ANDREAS - Mojave	22.9(36.9)	7.1	0.125	VII
SAN JACINTO-SAN BERNARDINO	24.4(39.3)	6.7	0.091	VII
NEWPORT-INGLEWOOD (L.A.Basin)	25.0(40.2)	6.9	0.101	VII
SAN ANDREAS - San Bernardino	25.6(41.2)	7.3	0.126	VIII
SAN ANDREAS - Southern	25.6(41.2)	7.4	0.133	VIII
SIERRA MADRE (San Fernando)	26.5(42.6)	6.7	0.106	VII
SAN GABRIEL	27.3(43.9)	7.0	0.098	VII
CLEGHORN	28.8(46.4)	6.5	0.065	VI
SANTA MONICA	29.6(47.7)	6.6	0.086	VII
PALOS VERDES	31.9(51.3)	7.1	0.087	VII
NORTHRIDGE (E. Oak Ridge)	32.4(52.2)	6.9	0.096	VII
NEWPORT-INGLEWOOD (Offshore)	34.5(55.5)	6.9	0.069	VI
MALIBU COAST	36.9(59.4)	6.7	0.071	VI
SAN JACINTO-SAN JACINTO VALLEY	37.8(60.8)	6.9	0.062	VI
NORTH FRONTAL FAULT ZONE (West)	38.0(61.1)	7.0	0.085	VII
SANTA SUSANA	38.2(61.4)	6.6	0.063	VI
ELSINORE-TEMECULA	43.8(70.5)	6.8	0.048	VI
HOLSER	43.8(70.5)	6.5	0.048	VI
ANACAPA-DUME	46.5(74.9)	7.3	0.082	VII
OAK RIDGE (Onshore)	51.7(83.2)	6.9	0.053	VI
SIMI-SANTA ROSA	53.7(86.5)	6.7	0.043	VI
SAN ANDREAS - Carrizo	55.0(88.5)	7.2	0.048	VI
SAN CAYETANO	55.3(89.0)	6.8	0.045	VI
HELENDALE - S. LOCKHARDT	56.4(90.8)	7.1	0.043	VI
CORONADO BANK	56.8(91.4)	7.4	0.054	VI
SAN JACINTO-ANZA	60.8(97.8)	7.2	0.042	VI
NORTH FRONTAL FAULT ZONE (East)	63.0(101.4)	6.7	0.034	V

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TEST.OUT

DETERMINISTIC SITE PARAMETERS

ABBREVIATED FAULT NAME	APPROXIMATE DISTANCE mi (km)	ESTIMATED MAX. EARTHQUAKE EVENT		
		MAXIMUM EARTHQUAKE MAG.(Mw)	PEAK SITE ACCEL. g	EST. SITE INTENSITY MOD.MERC.
SANTA YNEZ (East)	66.9(107.6)	7.0	0.031	V
PINTO MOUNTAIN	66.9(107.6)	7.0	0.031	V
LENWOOD-LOCKHART-OLD WOMAN SPRGS	70.2(113.0)	7.3	0.038	V
ELSINORE-JULIAN	70.3(113.2)	7.1	0.032	V
GARLOCK (West)	71.0(114.2)	7.1	0.031	V
ROSE CANYON	71.5(115.1)	6.9	0.026	V
VENTURA - PITAS POINT	73.7(118.6)	6.8	0.030	V
JOHNSON VALLEY (Northern)	75.5(121.5)	6.7	0.021	IV
PLEITO THRUST	76.5(123.1)	7.2	0.039	V
GRAVEL HILLS - HARPER LAKE	76.7(123.4)	6.9	0.024	IV
LANDERS	76.9(123.7)	7.3	0.033	V
OAK RIDGE(Blind Thrust Offshore)	76.9(123.8)	6.9	0.030	V
M.RIDGE-ARROYO PARIDA-SANTA ANA	77.5(124.8)	6.7	0.025	V
CHANNEL IS. THRUST (Eastern)	78.8(126.8)	7.4	0.045	VI
MONTALVO-OAK RIDGE TREND	80.1(128.9)	6.6	0.022	IV
BIG PINE	81.4(131.0)	6.7	0.018	IV
BLACKWATER	81.6(131.4)	6.9	0.022	IV
SAN ANDREAS - Coachella	82.1(132.2)	7.1	0.026	V
RED MOUNTAIN	82.3(132.5)	6.8	0.025	V
GARLOCK (East)	82.9(133.4)	7.3	0.030	V
EMERSON So. - COPPER MTN.	83.3(134.0)	6.9	0.021	IV
CALICO - HIDALGO	83.3(134.1)	7.1	0.025	V
WHITE WOLF	84.9(136.6)	7.2	0.034	V
BURNT MTN.	85.1(136.9)	6.4	0.013	III
EUREKA PEAK	85.7(137.9)	6.4	0.013	III
SAN JACINTO-COYOTE CREEK	90.4(145.5)	6.8	0.017	IV
SANTA CRUZ ISLAND	93.2(150.0)	6.8	0.021	IV
PISGAH-BULLION MTN.-MESQUITE LK	94.4(152.0)	7.1	0.021	IV
EARTHQUAKE VALLEY	97.7(157.3)	6.5	0.012	III
So. SIERRA NEVADA	98.5(158.6)	7.1	0.025	V

-END OF SEARCH- 70 FAULTS FOUND WITHIN THE SPECIFIED SEARCH RADIUS.

THE SAN JOSE FAULT IS CLOSEST TO THE SITE.
IT IS ABOUT 3.2 MILES (5.2 km) AWAY.

LARGEST MAXIMUM-EARTHQUAKE SITE ACCELERATION: 0.4988 g

DRAFT

Field Blow Count Correction for Induced Seismic Settlement Analysis

Hassen Clippinger

Point ID	Depth	Approx Fines %	Soil Classification	Number	Type	Blows 1st	Blows 2nd	Blows 3rd	Raw Field Blow Count/ft	Ring>>SPT Correction Factor	Cs*	Corr Field N
LB- 1	2.5	35	SM	R-1	RING S	9	8	8	16	0.65	1	10.4
LB- 1	5	70	ML	R-2	RING S	3	2	5	7	0.65	1	4.55
LB- 1	10	70	ML	R-3	RING S	7	8	10	18	0.65	1	11.7
LB- 1	15	30	SM	R-4	RING S	5	6	11	17	0.65	1	11.05
LB- 1	20	5	SP	S-5	SPT SA	7	5	5	10	1	1.2	12
LB- 2	2.5	50	CL	R-1	RING S	5	10	13	23	0.65	1	14.95
LB- 2	5	75	ML	R-2	RING S	3	3	5	8	0.65	1	5.2
LB- 2	10	54	ML	R-3	RING S	6	8	10	18	0.65	1	11.7
LB- 2	15	20	SM	R-4	RING S	7	8	12	20	0.65	1	13
LB- 2	20	26	SM	S-5	SPT SA	3	6	3	9	1	1.2	10.8
LB- 2	25	0	SP	S-6	SPT SA	15	18	50	68	1	1.2	81.6
LB- 2	30	50	ML	S-7	SPT SA	6	8	10	18	1	1.2	21.6
LB- 3	2.5	50	ML	R-1	RING S	1	3	4	7	0.65	1	4.55
LB- 3	5	50	ML	R-2	RING S	4	6	8	14	0.65	1	9.1
LB- 3	10	0	SW	R-3	RING S	7	8	15	23	0.65	1	14.95
LB- 3	15	10	SM	R-4	RING S	6	12	33	45	0.65	1	29.25
LB- 3	20	0	SW	S-5	SPT SA	38	40	25	65	1	1.2	78
LB- 4	2.5	50	ML	R-1	RING S	3	4	7	11	0.65	1	7.15
LB- 4	5	50	ML	R-2	RING S	6	8	9	17	0.65	1	11.05
LB- 4	10	50	ML	R-3	RING S	5	7	9	16	0.65	1	10.4
LB- 4	15	75	ML	R-4	RING S	7	25	50	75	0.65	1	48.75
LB- 4	20	0	SW	S-5	SPT SA	25	50/5"		100	1	1.2	120
LB-5	2.5	50	ML	R-1	RING S	3	3	3	6	0.65	1	3.9
LB-5	5	50	ML	R-2	RING S	3	4	6	10	0.65	1	6.5
LB-5	10	47	ML	R-3	RING S	5	5	8	13	0.65	1	8.45
LB-5	15	16	ML	R-4	RING S	5	6	9	15	0.65	1	9.75
LB-5	20	0	SW	S-5	SPT SA	28	20	18	38	1	1.2	45.6
LB-5	25	0	SW	S-6	SPT SA	28	40	38	78	1	1.2	93.6
LB-5	30	80	ML	S-7	SPT SA	5	10	12	22	1	1.2	26.4
LB-5	35	0	SW	S-8	SPT SA	30	50/6"		100	1	1.2	120
LB-5	40	0	SW	S-9	SPT SA	50/4"			100	1	1.2	120
LB-5	45	0	SW	S-10	SPT SA	22	24	28	52	1	1.2	62.4
LB-5	50	0	SW	S-11	SPT SA	31	50/6"		100	1	1.2	120
LB- 6	2.5	30	SM	R-1	RING S	2	2	2	4	0.65	1	2.6
LB- 6	5	0	SP	R-2	RING S	5	8	15	23	0.65	1	14.95
LB- 6	10	0	SW	R-3	RING S	10	18	22	40	0.65	1	26
LB- 6	15	0	SW	R-4	RING S	15	27	40	67	0.65	1	43.55
LB- 6	20	0	SW	S-5	SPT SA	27	40	30	70	1	1.2	84
LB- 7	2.5	50	ML	R-1	RING S	3	2	3	5	0.65	1	3.25
LB- 7	5	90	ML	R-2	RING S	2	3	5	8	0.65	1	5.2
LB- 7	10	25	SM	R-3	RING S	7	18	15	33	0.65	1	21.45
LB- 7	15	20	SM	R-4	RING S	8	11	15	26	0.65	1	16.9
LB- 7	20	0	SW	S-5	SPT SA	13	23	18	41	1	1.2	49.2

LB- 8	2.5	80	ML	[illegible]	RING S	[illegible]	[illegible]	5	[illegible]	0.65	1	6.5
LB- 8	5	80	ML	R-2	RING S	3	4	6	10	0.65	1	6.5
LB- 8	10	35	SM	R-3	RING S	6	9	10	19	0.65	1	12.35
LB- 8	15	80	ML	R-4	RING S	6	8	24	32	0.65	1	20.8
LB- 8	20	5	SW	S-5	SPT SA	16	14	17	31	1	1.2	37.2
LB-9	2.5	30	SM	R-1	RING S	3	5	5	10	0.65	1	6.5
LB-9	5	0	SW	R-2	RING S	3	5	8	13	0.65	1	8.45
LB-9	10	90	ML	R-3	RING S	8	9	15	24	0.65	1	15.6
LB-9	15	0	SW	R-4	RING S	19	36	50	86	0.65	1	55.9
LB-9	20	0	SP	S-5	SPT SA	18	13	16	29	1	1.2	34.8
LB-9	25	0	SW	S-6	SPT SA	21	36	48	84	1	1.2	100.8
LB-9	30	0	SW	S-7	SPT SA	14	18	25	43	1	1.2	51.6
LB-9	35	0	SW	S-8	SPT SA	18	35	47	82	1	1.2	98.4
LB-9	40	0	SW	S-9	SPT SA	41	50/6"		100	1	1.2	120
LB- 10	2.5	15	SM	R-1	RING S	4	6	7	13	0.65	1	8.45
LB- 10	5			R-2	RING S	6	10	14	24	0.65	1	15.6
LB- 10	10	25	SM	R-3	RING S	10	14	26	40	0.65	1	26
LB- 10	15			R-4	RING S	24	50/6"		100	0.65	1	65
LB- 10	20	0	SW	S-5	SPT SA	19	14	19	33	1	1.2	39.6
LB-11	2.5	0	SW	R-1	RING S	5	4	4	8	0.65	1	5.2
LB-11	5	20	SM	R-2	RING S	3	5	5	10	0.65	1	6.5
LB-11	10	65	ML	R-3	RING S	5	6	8	14	0.65	1	9.1
LB-11	15	0	GW-SW	R-4	RING S	12	20	22	42	0.65	1	27.3
LB-11	20	0	SW	S-5	SPT SA	12	19	25	44	1	1.2	52.8
LB-11	25	0	GW-SW	S-6	SPT SA	40	50/4"		100	1	1.2	120
LB-11	30	0	SW	S-7	SPT SA	50/6"			100	1	1.2	120
LB-12	2.5	25	SM	R-1	RING S	4	5	8	13	0.65	1	8.45
LB-12	5	25	SM	R-2	RING S	3	4	7	11	0.65	1	7.15
LB-12	10	14	SM	R-3	RING S	7	8	10	18	0.65	1	11.7
LB-12	15	20	SM	R-4	RING S	9	17	27	44	0.65	1	28.6
LB-12	20	50	ML	S-5	SPT SA	5	4	5	9	1	1.2	10.8
LB-12	25	50	ML	S-6	SPT SA	10	11	11	22	1	1.2	26.4
LB-12	30	50	ML	S-7	SPT SA	7	10	10	20	1	1.2	24
LB-12	35	80	ML	S-8	SPT SA	4	5	9	14	1	1.2	16.8
LB-12	40	90	ML	S-9	SPT SA	3	5	6	11	1	1.2	13.2
LB-12	45	33	SM	S-10	SPT SA	6	9	15	24	1	1.2	28.8
LB-12	50	0	SW	S-11	SPT SA	29	39	50	89	1	1.2	106.8
LB- 13	2.5	25	SM	R-1	RING S	3	5	6	11	0.65	1	7.15
LB- 13	5	0	SP	R-2	RING S	7	11	15	26	0.65	1	16.9
LB- 13	10	0		R-3	RING S	8	13	15	28	0.65	1	18.2
LB- 13	15	0	SW	R-4	RING S	20	21	29	50	0.65	1	32.5
LB- 13	20	30	SW to ML	S-5	SPT SA	5	6	7	13	1	1.2	15.6

DRAFT

Liquefaction Susceptibility Analysis: SPT Method

Based on Youd and Idriss (2001), Martin and Lew (1999).

Project: Hassen Covina

Project No.: 11176.001

Dec 2015

Leighton

General Boring Information:

Boring No.	Existing GW Depth (ft)	Design GW Depth (ft)	Design Fill Height (ft)	Ground Surface Elev (ft)	
LB- 1	100	100			-100
LB- 2	100	100			-100
LB- 3	100	100			-100
LB- 4	100	100			-100
LB-5	100	100			
LB- 6	100	100			
LB- 7	100	100			
LB- 8	100	100			
LB-9	100	100			
LB- 10	100	100			
LB-11	100	100			
LB-12	100	100			
LB- 13	100	100			

General Parameters:		
a_{max} =	0.76g	(PGA_M)
M_W =	6.6	
MSF eq:	1	(Idriss, 2001)
MSF =	1.39	
Hammer Efficiency =	82	%
C_E =	1.37	
C_B =	1	
$C_{S(SPT)}$ =	1.2	
$C_{S(ring)}$ =	1	
Rod Stickup (feet) =	3	
Ring sample correction =	0.65	

Summary of Liquefaction Susceptibility Analysis: SPT Method

Liquefaction Method: Youd and Idriss (2001). Seismic Settlement Method: Tokimatsu and Seed (1987) and Martin and Lew (1999).

Project: Hassen Covina

Project No.: 11176.001

Leighton 0.762 (PGA_M)

Boring No.	Approx. Layer Depth (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	N_m or B (blows/ft)	Sampler Type (enter 2 if mod CA Ring)	Cs	N_m (corrected for Cs and ring->SPT) (blows/ft)	Exist σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	$(N_1)_{60CS}$ (for Settle-ment) (blows/ft)	Dry Sand Strain (%) (Tok/ Seed 87) (%)	Sat Sand Strain (%) (Tok/ Seed 87) (%)	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB- 1	0 to 4	2.5	4	overex	35	120	35		1.2	42.0	300	73.2	92.8	>Range	300	0.49	0.36	**NonLiq**	92.8	0.01		0.00	1.4
LB- 1	4 to 8	5	4	overex	70	120	35		1.2	42.0	600	73.2	92.8	>Range	600	0.49	0.35	**NonLiq**	92.8	0.02		0.01	1.4
LB- 1	8 to 13	10	5		70	120	18	2	1	11.7	1200	17.9	26.5	0.326	1200	0.48	0.35	**NonLiq**	26.5	0.43		0.26	1.4
LB- 1	13 to 18	15	5		30	120	17	2	1	11.1	1800	13.8	20.7	0.224	1800	0.48	0.34	**NonLiq**	20.7	0.38		0.23	1.1
LB- 1	18 to 22	20	5		5	120	10		1.2	12.0	2400	14.5	14.5	0.155	2400	0.47	0.34	**NonLiq**	14.5	1.67		0.90	0.9
LB- 2	0 to 4	2.5	4	overex	50	120	35		1.2	42.0	300	73.2	92.8	>Range	300	0.49	0.36	**NonLiq**	92.8	0.01		0.00	1.2
LB- 2	4 to 8	5	4	overex	75	120	35		1.2	42.0	600	73.2	92.8	>Range	600	0.49	0.35	**NonLiq**	92.8	0.02		0.01	1.2
LB- 2	8 to 13	10	5		54	120	18	2	1	11.7	1200	17.9	26.5	0.326	1200	0.48	0.35	**NonLiq**	26.5	0.43		0.26	1.2
LB- 2	13 to 18	15	5		20	120	20	2	1	13.0	1800	16.3	21.2	0.231	1800	0.48	0.34	**NonLiq**	21.2	0.37		0.22	0.9
LB- 2	18 to 23	20	5		26	120	9		1.2	10.8	2400	13.1	19.1	0.204	2400	0.47	0.34	**NonLiq**	19.1	0.97		0.58	0.7
LB- 2	23 to 28	25	5		0	120	68		1.2	81.6	3000	88.4	88.4	>Range	3000	0.47	0.34	**NonLiq**	88.4	0.03		0.02	0.1
LB- 2	28 to 32	30	5		50	120	18		1.2	21.6	3600	22.5	32.0	>Range	3600	0.46	0.33	**NonLiq**	32.0	0.15		0.08	0.1
LB- 3	0 to 4	2.5	4	overex	50	120	35		1.2	42.0	300	73.2	92.8	>Range	300	0.49	0.36	**NonLiq**	92.8	0.01		0.00	0.4
LB- 3	4 to 8	5	4	overex	50	120	35		1.2	42.0	600	73.2	92.8	>Range	600	0.49	0.35	**NonLiq**	92.8	0.02		0.01	0.4
LB- 3	8 to 13	10	5		0	120	23	2	1	15.0	1200	22.9	22.9	0.256	1200	0.48	0.35	**NonLiq**	22.9	0.49		0.29	0.4
LB- 3	13 to 18	15	5		10	120	45	2	1	29.3	1800	36.6	38.3	>Range	1800	0.48	0.34	**NonLiq**	38.3	0.10		0.06	0.1
LB- 3	18 to 22	20	5		0	120	65		1.2	78.0	2400	94.5	94.5	>Range	2400	0.47	0.34	**NonLiq**	94.5	0.02		0.01	0.0
LB- 4	0 to 4	2.5	4	overex	50	120	35		1.2	42.0	300	73.2	92.8	>Range	300	0.49	0.36	**NonLiq**	92.8	0.01		0.00	0.3
LB- 4	4 to 8	5	4	overex	50	120	35		1.2	42.0	600	73.2	92.8	>Range	600	0.49	0.35	**NonLiq**	92.8	0.02		0.01	0.3
LB- 4	8 to 13	10	5		50	120	16	2	1	10.4	1200	15.9	24.1	0.276	1200	0.48	0.35	**NonLiq**	24.1	0.46		0.28	0.3
LB- 4	13 to 18	15	5		75	120	75	2	1	48.8	1800	61.0	78.2	>Range	1800	0.48	0.34	**NonLiq**	78.2	0.02		0.01	0.0
LB- 4	18 to 22	20	5		0	120	100		1.2	120.0	2400	145.3	145.3	>Range	2400	0.47	0.34	**NonLiq**	145.3	0.02		0.01	0.0
LB-5	0 to 4	2.5	4	overex	50	120	35		1.2	42.0	300	73.2	92.8	>Range	300	0.49	0.36	**NonLiq**	92.8	0.01		0.00	1.0
LB-5	4 to 8	5	4	overex	50	120	35		1.2	42.0	600	73.2	92.8	>Range	600	0.49	0.35	**NonLiq**	92.8	0.02		0.01	1.0
LB-5	8 to 13	10	5		47	120	13	2	1	8.5	1200	12.9	20.5	0.222	1200	0.48	0.35	**NonLiq**	20.5	0.54		0.32	1.0
LB-5	13 to 18	15	5		16	120	15	2	1	9.8	1800	12.2	15.6	0.166	1800	0.48	0.34	**NonLiq**	15.6	0.87		0.52	0.7
LB-5	18 to 23	20	5		0	120	38		1.2	45.6	2400	55.2	55.2	>Range	2400	0.47	0.34	**NonLiq**	55.2	0.03		0.02	0.2
LB-5	23 to 28	25	5		0	120	78		1.2	93.6	3000	101.4	101.4	>Range	3000	0.47	0.34	**NonLiq**	101.4	0.03		0.02	0.1
LB-5	28 to 33	30	5		80	120	22		1.2	26.4	3600	27.5	38.0	>Range	3600	0.46	0.33	**NonLiq**	38.0	0.12		0.07	0.1
LB-5	33 to 38	35	5		0	120	100		1.2	120.0	4200	115.6	115.6	>Range	4200	0.44	0.32	**NonLiq**	115.6	0.02		0.01	0.1
LB-5	38 to 43	40	5		0	120	100		1.2	120.0	4800	108.2	108.2	>Range	4800	0.42	0.30	**NonLiq**	108.2	0.02		0.01	0.0
LB-5	43 to 48	45	5		0	120	52		1.2	62.4	5400	53.0	53.0	>Range	5400	0.40	0.29	**NonLiq**	53.0	0.03		0.02	0.0
LB-5	48 to 52	50	5		0	120	100		1.2	120.0	6000	96.7	96.7	>Range	6000	0.38	0.27	**NonLiq**	96.7	0.02		0.01	0.0
LB- 6	0 to 4	2.5	4	overex	30	120	35		1.2	42.0	300	73.2	89.2	>Range	300	0.49	0.36	**NonLiq**	89.2	0.01		0.00	0.1
LB- 6	4 to 8	5	4	overex	0	120	35		1.2	42.0	600	73.2	73.2	>Range	600	0.49	0.35	**NonLiq**	73.2	0.02		0.01	0.1
LB- 6	8 to 13	10	5		0	120	40	2	1	26.0	1200	39.8	39.8	>Range	1200	0.48	0.35	**NonLiq**	39.8	0.17		0.10	0.1
LB- 6	13 to 18	15	5		0	120	67	2	1	43.6	1800	54.5	54.5	>Range	1800	0.48	0.34	**NonLiq**	54.5	0.02		0.01	0.0
LB- 6	18 to 22	20	5		0	120	70		1.2	84.0	2400	101.7	101.7	>Range	2400	0.47	0.34	**NonLiq**	101.7	0.02		0.01	0.0
LB- 7	0 to 4	2.5	4	overex	50	120	35		1.2	42.0	300	73.2	92.8	>Range	300	0.49	0.36	**NonLiq**	92.8	0.01		0.00	0.2
LB- 7	4 to 8	5	4	overex	90	120	35		1.2	42.0	600	73.2	92.8	>Range	600	0.49	0.35	**NonLiq**	92.8	0.02		0.01	0.2
LB- 7	8 to 13	10	5		25	120	33	2	1	21.5	1200	32.9	40.9	>Range	1200	0.48	0.35	**NonLiq**	40.9	0.05		0.03	0.2
LB- 7	13 to 18	15	5		20	120	26	2	1	16.9	1800	21.1	26.4	0.324	1800	0.48	0.34	**NonLiq**	26.4	0.26		0.16	0.2
LB- 7	18 to 22	20	5		0	120	41		1.2	49.2	2400	59.6	59.6	>Range	2400	0.47	0.34	**NonLiq**	59.6	0.03		0.02	0.0
LB- 8	0 to 4	2.5	4	overex	80	120	35		1.2	42.0	300	73.2	92.8	>Range	300	0.49	0.36	**NonLiq**	92.8	0.01		0.00	0.3
LB- 8	4 to 8	5	4	overex	80	120	35		1.2	42.0	600	73.2	92.8	>Range	600	0.49	0.35	**NonLiq**	92.8	0.02		0.01	0.3
LB- 8	8 to 13	10	5		35	120	19	2	1	12.4	1200	18.9	27.7	0.360	1200	0.48	0.35	**NonLiq**	27.7	0.41		0.25	0.3
LB- 8	13 to 18	15	5		80	120	32	2	1	20.8	1800	26.0	36.2	>Range	1800	0.48	0.34	**NonLiq**	36.2	0.10		0.06	0.1
LB- 8	18 to 22	20	5		5	120	31		1.2	37.2	2400	45.0	45.0	>Range	2400	0.47	0.34	**NonLiq**	45.0	0.04		0.02	0.0
LB-9	0 to 4	2.5	4	overex	30	120	35		1.2	42.0	300	73.2	89.2	>Range	300	0.49	0.36	**NonLiq**	89.2	0.01		0.00	0.2
LB-9	4 to 8	5	4	overex	0	120	35		1.2	42.0	600	73.2	73.2	>Range	600	0.49	0.35	**NonLiq**	73.2	0.02		0.01	0.2

Boring No.	Approx. Layer Depth (ft)	SPT Depth (ft)	Approx Layer Thick-ness (ft)	Plasticity ("n"=non susc. to liq.)	Estimated Fines Cont (%)	γ_t (pcf)	or B (blows/ft)	Sampler Type (enter 2 i[illegible] Ring)	Cs	(co[illegible]cted [illegible]nd ring->SPT) (blows/ft)	E[illegible] σ_{vo}' (psf)	$(N_1)_{60}$	$(N_1)_{60CS}$	**$CRR_{7.5}$**	Design σ_{vo}' (psf)	$CSR_{7.5}$	CSR_M	**Liquefaction Factor of Safety**	$(N_1)_{60CS}$ (for Settle-ment) (blows/ft)	Dry Sand Strain (%) (Tok/ Seed 87) (%)	Sat Sand Strain (%) (Tok/ Seed 87) (%)	Seismic Sett. of Layer (in.)	**Cummulative Seismic Settlement** (in.)
LB-9	8 to 13	10	5		90	120	24	2	1	15.6	1200	23.9	33.7	>Range	1200	0.48	0.35	**NonLiq**	33.7	0.20		0.12	0.2
LB-9	13 to 18	15	5		0	120	86	2	1	55.9	1800	69.9	69.9	>Range	1800	0.48	0.34	**NonLiq**	69.9	0.02		0.01	0.1
LB-9	18 to 23	20	5		0	120	29		1.2	34.8	2400	42.1	42.1	>Range	2400	0.47	0.34	**NonLiq**	42.1	0.05		0.03	0.1
LB-9	23 to 28	25	5		0	120	84		1.2	100.8	3000	109.2	109.2	>Range	3000	0.47	0.34	**NonLiq**	109.2	0.02		0.01	0.1
LB-9	28 to 33	30	5		0	120	43		1.2	51.6	3600	53.7	53.7	>Range	3600	0.46	0.33	**NonLiq**	53.7	0.03		0.02	0.0
LB-9	33 to 38	35	5		0	120	82		1.2	98.4	4200	94.8	94.8	>Range	4200	0.44	0.32	**NonLiq**	94.8	0.02		0.01	0.0
LB-9	38 to 42	40	5		0	120	100		1.2	120.0	4800	108.2	108.2	>Range	4800	0.42	0.30	**NonLiq**	108.2	0.02		0.01	0.0
LB- 10	0 to 4	2.5	4	overex	15	120	35		1.2	42.0	300	73.2	79.2	>Range	300	0.49	0.36	**NonLiq**	79.2	0.01		0.00	0.1
LB- 10	4 to 8	5	4	overex		120	35		1.2	42.0	600	73.2	73.2	>Range	600	0.49	0.35	**NonLiq**	73.2	0.02		0.01	0.1
LB- 10	8 to 13	10	5		25	120	40	2	1	26.0	1200	39.8	48.7	>Range	1200	0.48	0.35	**NonLiq**	48.7	0.04		0.03	0.1
LB- 10	13 to 18	15	5			120	100	2	1	65.0	1800	81.3	81.3	>Range	1800	0.48	0.34	**NonLiq**	81.3	0.02		0.01	0.0
LB- 10	18 to 22	20	5		0	120	33		1.2	39.6	2400	48.0	48.0	>Range	2400	0.47	0.34	**NonLiq**	48.0	0.04		0.02	0.0
LB-11	0 to 4	2.5	4	overex	0	120	35		1.2	42.0	300	73.2	73.2	>Range	300	0.49	0.36	**NonLiq**	73.2	0.01		0.00	0.4
LB-11	4 to 8	5	4	overex	20	120	35		1.2	42.0	600	73.2	82.6	>Range	600	0.49	0.35	**NonLiq**	82.6	0.02		0.01	0.4
LB-11	8 to 13	10	5		65	120	14	2	1	9.1	1200	13.9	21.7	0.238	1200	0.48	0.35	**NonLiq**	21.7	0.51		0.31	0.4
LB-11	13 to 18	15	5		0	120	42	2	1	27.3	1800	34.2	34.2	>Range	1800	0.48	0.34	**NonLiq**	34.2	0.11		0.06	0.1
LB-11	18 to 23	20	5		0	120	44		1.2	52.8	2400	63.9	63.9	>Range	2400	0.47	0.34	**NonLiq**	63.9	0.03		0.02	0.0
LB-11	23 to 28	25	5		0	120	100		1.2	120.0	3000	130.0	130.0	>Range	3000	0.47	0.34	**NonLiq**	130.0	0.02		0.01	0.0
LB-11	28 to 32	30	5		0	120	100		1.2	120.0	3600	124.9	124.9	>Range	3600	0.46	0.33	**NonLiq**	124.9	0.02		0.01	0.0
LB-12	0 to 4	2.5	4	overex	25	120	35		1.2	42.0	300	73.2	85.9	>Range	300	0.49	0.36	**NonLiq**	85.9	0.01		0.00	1.8
LB-12	4 to 8	5	4	overex	25	120	35		1.2	42.0	600	73.2	85.9	>Range	600	0.49	0.35	**NonLiq**	85.9	0.02		0.01	1.8
LB-12	8 to 13	10	5		14	120	18	2	1	11.7	1200	17.9	20.9	0.227	1200	0.48	0.35	**NonLiq**	20.9	0.53		0.32	1.8
LB-12	13 to 18	15	5		20	120	44	2	1	28.6	1800	35.8	42.2	>Range	1800	0.48	0.34	**NonLiq**	42.2	0.03		0.02	1.5
LB-12	18 to 23	20	5		50	120	9		1.2	10.8	2400	13.1	20.7	0.224	2400	0.47	0.34	**NonLiq**	20.7	0.62		0.37	1.5
LB-12	23 to 28	25	5		50	120	22		1.2	26.4	3000	28.6	39.3	>Range	3000	0.47	0.34	**NonLiq**	39.3	0.24		0.14	1.1
LB-12	28 to 33	30	5		50	120	20		1.2	24.0	3600	25.0	35.0	>Range	3600	0.46	0.33	**NonLiq**	35.0	0.13		0.08	1.0
LB-12	33 to 38	35	5		80	120	14		1.2	16.8	4200	16.2	24.4	0.281	4200	0.44	0.32	**NonLiq**	24.4	0.39		0.23	0.9
LB-12	38 to 43	40	5		90	120	11		1.2	13.2	4800	11.9	19.3	0.207	4800	0.42	0.30	**NonLiq**	19.3	0.92		0.55	0.7
LB-12	43 to 48	45	5		33	120	24		1.2	28.8	5400	24.5	33.8	>Range	5400	0.40	0.29	**NonLiq**	33.8	0.17		0.10	0.1
LB-12	48 to 52	50	5		0	120	89		1.2	106.8	6000	86.1	86.1	>Range	6000	0.38	0.27	**NonLiq**	86.1	0.02		0.01	0.0
LB- 13	0 to 4	2.5	4	overex	25	120	35		1.2	42.0	300	73.2	85.9	>Range	300	0.49	0.36	**NonLiq**	85.9	0.01		0.00	0.5
LB- 13	4 to 8	5	4	overex	0	120	35		1.2	42.0	600	73.2	73.2	>Range	600	0.49	0.35	**NonLiq**	73.2	0.02		0.01	0.5
LB- 13	8 to 13	10	5		0	120	28	2	1	18.2	1200	27.9	27.9	0.366	1200	0.48	0.35	**NonLiq**	27.9	0.41		0.25	0.5
LB- 13	13 to 18	15	5		0	120	50	2	1	32.5	1800	40.7	40.7	>Range	1800	0.48	0.34	**NonLiq**	40.7	0.03		0.02	0.3
LB- 13	18 to 22	20	5		30	120	13		1.2	15.6	2400	18.9	26.5	0.325	2400	0.47	0.34	**NonLiq**	26.5	0.47		0.26	0.3

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SPT CAL

SPT HAMMER ENERGY MEASUREMENTS

Prepared by;

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2R Drilling, Inc.
3968 Chino Ave.
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Project Title: 2R Drilling Rig 3
Project Description: Ontario, CA

Rig 3
Energy Transfer Ratio = 82.0% at 55.8 blows per minute

Testing was performed on March 12, 2015 in Ontario, California

Hammer Energy Measurements performed in accordance to ASTM D4633 using an approved and calibrated SPT Analyzer from Pile Dynamics, Inc.

Depth	ETR%	BPM
30	82.9	55.1
35	81.6	55.9
40	81.5	56.1
45	81.0	55.7
50	83.2	56.3
	82.0	55.8

Thank you very much. It was a pleasure to work with you and your drill crews.

Sincerely yours,

Brian Serl
Calibration Engineer
SPTCAL.COM

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PRESENTATION OF SPT ANALYZER TEST DATA

1. Introduction

This report presents the results of SPT Hammer Energy Measurements recorded with an SPT Analyzer from Pile Dynamics carried out on March 12, 2015 in Ontario, CA.

2. Field Equipment and Procedures

The drill used is referred to at 2R Drilling as Rig 3. CME 75. It has an attached CME Auto Hammer

The CME Auto Hammer uses a 140 lb. weight dropped 30” on to an anvil above the bore hole. AWJ drill rod connects the anvil to a split spoon type soil sampler inside an 8” o.d. hollow stem auger at the designated sample depth. After a seeding blow the sampler is driven 18”. The number of blows required to penetrate the last 12" is referred to as the “N value”, which is related to soil strength.

The first recording was taken at 30' below ground surface and then every 5' to final recording at 50'.

3. Instrumentation

An SPT Analyzer from Pile Dynamics was used to record and the process the data. The raw data was stored directly in the SPT Analyzer computer with subsequent analysis in the office with PDA-W and PDIPlot software. The measurements and analysis were conducted in general accordance with ASTM D4945 and ASTM D6066 test standards.

The SPT Analyzer is fully compliant with the minimum digital sampling frequency requirements of ASTM D4633-05 (50 kHz) and EN ISO 22476-3:2005 (100 kHz), as well as with the low pass filter, (cutoff frequency of 5000 Hz instead of 3000 Hz) requirements of ASTM D4633-05. All equipment and analysis also conform to ASTM D6066.

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A 2' instrumented section of AWJ rod, with two sets of accelerometers and strain transducers mounted on opposite sides of the drill rod, was placed below the anvil. It measured strain and acceleration of every hammer blow. The SPT Analyzer then calculates the amount of energy transferred to the rod by force and velocity measurements.

4. Observations

The drill rig motor is diesel fueled. The throttle control is electronically controlled. The 55.8 blows per minute average were very consistent for every blow. The drill and sample equipment looked to be well operated and maintained.

5. Results

Results from the SPT Hammer Energy Measurements are summarized below. It shows the Energy Transfer Ratio (ETR) at each sampling depth. ETR is the ratio of the measured maximum transferred energy to rated energy of the hammer which is the product of the weight of the hammer times the height of the fall. 140 lb x 30” = 4200 lb-in = 0.350 kip-ft.

Depth	ETR%	BPM
30	82.9	55.1
35	81.6	55.9
40	81.5	56.1
45	81.0	55.7
50	83.2	56.3
	82.0	55.8

If you have any questions please do not hesitate to call or email.

Thank you,

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APPENDIX E

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

LEIGHTON AND ASSOCIATES, INC.

GENERAL EARTHWORK AND GRADING SPECIFICATIONS FOR ROUGH GRADING

Table of Contents

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 the Geotechnical Consultant of Record (Geotechnical Consultant). The Geotechnical Consultants 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 than 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. Subsurface areas to be geotechnically observed, mapped, elevations recorded, and/or tested include natural ground after it has been cleared for receiving fill but before fill is placed, bottoms of all "remedial removal" areas, all key bottoms, and benches made on sloping ground to receive fill.

The Geotechnical Consultant shall observe the moisture-conditioning and processing of the subgrade and fill materials and perform relative compaction testing of fill to determine the attained level of compaction. 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 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 "spreads" 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 observations and tests can be planned and accomplished. 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.

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 1 percent of organic materials (by volume). No fill lift shall contain more than 5 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 spillage of these fluids onto the ground may constitute a misdemeanor, punishable by fines and/or imprisonment, and shall not be allowed.

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 large clay lumps or clods 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. Please see the Standard Details for a graphic illustration. 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 8 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 3.1. 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 (per Section 3.0) 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 a relatively uniform moisture content at or slightly over optimum. Maximum density and optimum soil moisture content tests shall be performed in accordance with the American Society of Testing and Materials (ASTM Test Method 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 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 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), the grading plan, and the Standard Details. 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 <u>Safety</u>: The Contractor shall follow all OHSA and Cal/OSHA requirements for safety of trench excavations.

7.2 <u>Bedding and Backfill</u>: 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.

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

7.3 <u>Lift Thickness</u>: 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.

7.4 <u>Observation and Testing</u>: The jetting of the bedding around the conduits shall be observed by the Geotechnical Consultant.