REVISED GEOTECHNICAL INVESTIGATION

Proposed Office/Warehouse Development
NWC of Agua Mansa Road and Hall Avenue
County of Riverside, California

City of Jurupa Valley Case No. MA 18008

The Carson Companies
100 Bayview Circle
Newport Beach, California 92660

Attn: Dan Darnell

Project Number 16800-13
February 17, 2020

NorCal Engineering

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS
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February 17, 2020

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The Carson Companies
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Newport Beach, California 92660

Attn: Dan Darnell

RE: **REVISED GEOTECHNICAL INVESTIGATION** - Proposed Office/Warehouse Development - Located at the Northwest Corner of Agua Mansa Road and Hall Avenue, in the County of Riverside, California

Dear Mr. Darnell:

Pursuant to your request, this firm is providing this revised Geotechnical Investigation for the above referenced project. The purpose of this investigation is to evaluate the geotechnical conditions of the subject site and to provide recommendations for the proposed development. This geotechnical engineering report presents the findings of our study along with conclusions and recommendations for development.

This report incorporates all previous information from our Geotechnical Investigation report dated May 28, 2013 and subsequent reports and addenda, as listed in the References page of this report.

1.0 STRUCTURAL CONSIDERATIONS

1.1 Proposed Development

It is proposed to construct two new concrete tilt-up industrial buildings and associated pavement areas and a retention basin on the 23.44-acre site, as shown on Figure 2. Grading for the future development will include cut and fill procedures on the order of 25 and 15 feet, respectively. Retaining walls may be installed in areas in the north and northeast, as needed. Final building plans shall be reviewed by this firm prior to submittal for city approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 SITE DESCRIPTION

2.1 **Location:** The property is located at the northwesterly corner of Agua Mansa Road and Hall Avenue, in the County of Riverside, as shown on Figure 1.

2.2 **Existing Improvements:** The property is currently vacant and covered with sparse to heavy low vegetation growth. Scattered debris was also observed across the site from past dumping.

Various reported water wells and a possible old/dry cistern, 13 feet in diameter and in excess of 60 feet in depth, are located in the eastern portion of the site. In addition, an apparent concrete structure of unknown size was found in a depressed area along Agua Mansa Road near Hand Auger HA-2. This structure appears to be at least 6 feet in depth; however proper assessment of the entire structure could not be made due to unstable plywood over the top.

2.3 **Topography/Drainage:** The site topography in the south and southwesterly areas is relatively flat. Topography on the eastern portion of the site undulates and steps up in elevation with total relief of the property on the order of 45 feet. Drainage is via sheetflow generally in a southwesterly direction with localized flow in other directions due to topography.

3.0 SEISMICITY EVALUATION

The following seismic design parameters for the project are provided and are based upon the 2016 California Building Code (CBC). The updated criteria are included in Appendix A.

2016 CBC Seismic Design Criteria

Site Location – Region 1	Latitude	34.0308°
	Longitude	-117.3764°
Seismic Use Group	II	
Site Class	D	
Risk Category	I/II/III	
Maximum Spectral Response Acceleration	S_S	1.504g
	S_1	0.634g
Adjusted Maximum Acceleration	S_{MS}	1.504g
	S_{M1}	0.951g
Design Spectral Response Acceleration Parameters	S_{DS}	1.002g
	S_{D1}	0.634g

The site is located within a seismically active area and a maximum horizontal ground acceleration of 0.58g may occur from a Magnitude 6.7 earthquake along the San Jacinto (San Bernardino) fault zone, which is located approximately 6 kilometers from the subject property.

4.0 FIELD INVESTIGATION

4.1 Site Exploration

The purpose of the investigation was to explore the subsurface conditions and to provide preliminary geotechnical engineering design parameters for evaluation of the site with respect to the proposed development.

The investigation consisted of the placement of eighteen subsurface exploratory borings and excavations by hollow-stem auger drill rig with 8-inch outside diameter continuous flight augers, backhoe and hand auger to a maximum depth of 51.5 feet below current ground elevations. The explorations were placed at accessible locations on the site. Existing topography limited the placement of test explorations.

The explorations were visually classified and logged by a field engineer with locations of the subsurface borings and excavations shown on the attached Figure 3. Detailed descriptions of the subsurface conditions are listed on the boring/excavation logs in Appendix B. It should be noted that the transition from one soil type to another as shown on the logs is approximate and may in fact be a gradual transition. The soils encountered are described as follows:

Fill Soils – Fill soils classifying as silty SAND with some gravel were encountered in the borings to depths ranging from approximately 1 to 9 feet below existing surface. These soils were noted to be loose to medium dense and damp.

Native Soils – Native soils generally classifying as silty SAND to sandy SILT with some clay were encountered beneath the upper fill soils. These soils were noted to be medium dense/stiff and damp. Sand, silt and clay content varied with depth of explorations.

4.2 Groundwater

Groundwater was *not* encountered in our test explorations which extended to a maximum depth of 51.5 feet. The depth of groundwater in the vicinity is expected to be 50 feet or greater, based on review of ground water maps of the Upper Santa Ana River Basin. (Carson and Matti, 1973-1979). The exposed sidewalls of our test pits also did not reveal any evidence (mottling, etc.) that groundwater had been near the surface.

5.0 LABORATORY TESTS

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one-inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils.

Standard penetration tests were obtained by driving a steel sampler lined with six-inch long brass rings with an inside diameter of 1.5 inches into the soils. This standard penetrometer sampler was driven a total of 18 inches with blow counts tallied every 6 inches. Blow count data is given on the Boring Logs in Appendix B.

Bulk bag samples were obtained in the upper soils for expansion index tests, corrosion tests and maximum density tests. Wall loadings on the order of 4,000 lbs./lin.ft. and maximum compression loads on the order of 100 kips were utilized for testing and design purposes. All test results are included in Appendix C, unless otherwise noted.

5.1 **Field moisture content** (ASTM:D 2216-10) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

5.2 **Maximum density tests** (ASTM: D-1557-12) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

5.3 **Expansion index tests** (ASTM: D-4829-11) were performed on remolded samples of the upper soils to determine the expansive characteristics and to provide any necessary recommendations for reinforcement of the slabs-on-grade and the foundations. Results of these tests are provided on Table II and are discussed later in this report.

5.4 **Sieve analyses** and the percent by weight of soil finer than the No. 200 sieve (ASTM: 1140-00) were performed on selected soil samples. These results are detailed later in this report along with discussion of the liquefaction potential at the site.

5.5 **Direct shear tests** (ASTM: D-3080-11) were performed on undisturbed and disturbed samples of the subsurface soils. These tests were performed to determine parameters for the calculation of the safe bearing capacity. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plates A-B.

5.6 **Consolidation tests** (ASTM: D-2435-11) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates C-D.

5.7 **Soluble sulfate, pH, Resistivity and Chloride tests** to determine potential corrosive effects of soils on concrete and metal structures were performed in the laboratory. Test results are given in Tables III - VI.

5.8 **Resistance 'R' Value tests** (CA 301) were conducted on a representative soil sample to determine preliminary pavement section design for the proposed pavement areas. Test results are provided in Table VII and recommended pavement sections are provided later within the text of this report.

6.0 LIQUEFACTION EVALUATION

The property lies within areas mapped as potentially liquefiable by the State of California Seismic Hazards Mapping Act. Therefore the liquefaction potential of the underlying soils has been evaluated with findings from our deep boring.

The site is expected to experience ground shaking and earthquake activity that is typical of Southern California area. It is during severe ground shaking that loose, granular soils below the groundwater table can liquefy. A review of the exploratory boring log B-1 and the laboratory test results on selected soil samples obtained indicate the following soil classifications, field blowcounts and amounts of fines passing through the No. 200 sieve.

Field Blowcount and Gradation Data – *Boring B-1*

Location	Classification	Blowcounts (blows/ft)*	Relative Density	% Passing No. 200 Sieve*
B-1 @ 5'	SW	12	Very Dense	5
B-1 @ 10'	SW	14	Very Dense	7
B-1 @ 15'	SW	16	Dense	6
B-1 @ 20'	SW	22	Very Dense	5
B-1 @ 25'	SM	16	Med. Dense	20
B-1 @ 30'	ML	25	Very Stiff	64
B-1 @ 35'	ML	25	Stiff	74
B-1 @ 40'	CL	22	Med. Stiff	89
B-1 @ 45'	ML	29	Stiff	67
B-1 @ 50'	CL	34	Very Stiff	86

*Wash Sieve Test

Our liquefaction evaluation indicates the potential for liquefaction at this site is low due to a historic high groundwater level at 50 feet or greater below grade and stiff, fine-grained soils encountered with depth. Based on a Magnitude 6.7 earthquake with a peak ground acceleration (PGA_M) of 0.58g at the site, seismic-induced settlements should be on the order of less than one inch. These settlements should occur rather uniformly across the lot with differential settlements on the order of less than one-half inch over a 50 feet (horizontal) distance in the building pad area.

7.0 DRY SETTLEMENT ANALYSIS

A dry settlement evaluation was performed by this firm using a Peak Ground Acceleration (PGA_M) of 0.58g from a local Magnitude 6.7 earthquake. Based on a groundwater level of 50 feet, the dry soil dynamic settlement of the10 soil layers would be on the order of ½ to 5/8 inch with our calculation given in Appendix D. Differential seismic settlements would be on the order of 3/8 inch over a 50 feet (horizontal) distance in the building pad area.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures and grading will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed grading and development shall meet all requirements of the City/County Building Ordinance and will not impose any adverse effect on existing adjacent land or structures.

The following recommendations are based upon soil conditions encountered in our field investigation; these near-surface soil conditions could vary across the site. Variations in the soil conditions may not become evident until the commencement of grading operations for the proposed development and revised recommendations from the soils engineer may be necessary based upon the conditions encountered.

8.1 Site Grading Recommendations

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. Any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

Any vegetation shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached *Specifications for Placement of Compacted Fill*.

8.1.1 **Removal and Recompaction Recommendations - Building**

The upper 1 to 9 feet of existing fill soils shall be removed to competent native materials (85% or greater relative compaction), the exposed surface scarified to a depth of 8 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557-12) prior to placement of any additional compacted fill soils and pavement and hardscape. The upper 12 inches of soils beneath building slabs shall be compacted to a minimum of 95% relative compaction. Grading shall extend a minimum of 5 horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

It is likely that isolated areas of undiscovered fill, subsurface structures and utility lines not described in this report or materials disturbed during demolition operations will be encountered during site grading. If found, these areas should be excavated and backfilled as discussed earlier. If encountered, any structures and lines shall be either removed or properly abandoned prior to the proposed construction. Abandonment procedures will be provided once underground structures are encountered.

If placement of slabs-on-grade and pavement is not performed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the soils engineer as to the suitability of the supporting soils may be needed.

8.1.2 **Fill Blanket Recommendations**

Due to the medium density of the upper native soils and the potential for differential settlement of structures supported on both compacted fill and native soils, it is recommended that all foundations be underlain by a uniform compacted fill blanket at least 3 feet in thickness. The fill blanket shall extend a minimum of 5 horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

8.1.3 **Recompaction Recommendations – Pavement & Hardscape**

In non-structural areas (pavement, hardscape) client may elect to not remove/recompact all fill soils. This firm recommends a minimum of two feet of compacted fill underlie these areas where existing fill soils extend deeper. Some maintenance of pavement and hardscape may be required over the life of the project due to minimal settlements of existing uncompacted fill soils.

8.1.4 **Backfill of Subsurface Structures**

Any existing subsurface structure shall be properly abandoned in-place or completely removed and the resultant excavation backfilled with fill soils compacted to a minimum of 90% relative compaction. The following guidelines during abandonment shall also be followed:

- Any water wells shall be either protected in place or abandoned in accordance with the local controlling authorities. Abandoned wells shall be properly capped and cut off a minimum of 5 feet below pad and foundation grades, as necessary.

- The existing cistern may be backfilled with clean ¾-inch diameter gravel materials or cement slurry to within 5 feet of building pad, pavement or bottom of new foundation. Any portion of structure remaining above the gravel shall be removed. The top of gravel backfill shall be overlain with a filter fabric and the remaining area backfilled with compacted fill soils.

- The existing concrete structure near HA-2 and Agua Mansa Road shall be excavated to determine limits and depth of the structure. The structure should be completely removed or possibly abandoned depending on location and planned improvements. Final recommendations for removal/abandonment of this structure will be provided in the field.

8.1.5 **Slope Construction Recommendations**

Permanent cut and fill slopes at the site shall be constructed at an inclination of 2:1 (horizontal to vertical) inclination or flatter. Fill slopes shall be properly keyed and benched as depicted on the attached Figure 6. All fill soils within the slope and the surface of the slope shall be compacted to a minimum of 90% relative compaction, as verified by the soil engineer.

Calculations reveal that slopes constructed at a 2:1 inclination or flatter will be stable up to 32 feet in height. Calculations are included in Appendix E.

8.2 Temporary Excavations and Shoring Design

Temporary unsurcharged excavations including utility trenches less than 4 feet in height may be excavated at vertical inclinations. Excavations over 4 feet in height in the existing site materials may be trimmed at a 1 to 1 (horizontal to vertical) gradient for the entire height of the cut. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring, slot-cutting, or flatter excavations may be required.

The temporary cut slope gradients given above do not preclude local raveling and sloughing. All excavations shall be made in accordance with the requirements of the soils engineer, CAL-OSHA and other public agencies having jurisdiction.

Temporary shoring design may utilize an active earth pressure of 25 pcf without any surcharge due to adjacent traffic, equipment or structures. The passive fluid pressures of 250 pcf may be doubled to 500 pcf for temporary design.

8.3 Foundation Design

All foundations may be designed utilizing the following allowable soil bearing capacities for embedded depths of 18 inches into dense compacted fill materials with the corresponding widths. Footings shall not traverse from compacted fill to native soils due to the potential for differential settlement of structures.

Allowable Soil Bearing Capacity (psf)

Width (ft)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2075	2575
4.0	2375	2875
6.0	2675	3175

The bearing value may be increased by 500 psf for each additional foot of depth in excess of the 18-inch minimum depth, up to a maximum of 3,500 psf. Property line screen wall foundations extended a minimum of 18 inches in depth and at least 8 inches into medium dense native soils may be designed using a reduced allowable soil bearing capacity of 1,200 psf. A one-third increase may be used when considering short term loading from wind and seismic forces. Steel reinforcement due to soil expansion or proposed loadings may be necessary and shall be determined by the project engineers and/or architect. A representative of this firm shall observe foundation excavations prior placement of concrete.

8.4 **Settlement Analysis**

Resultant pressure curves for the consolidation tests are shown on Plates C and D. Computations utilizing these curves and the recommended allowable soil bearing capacities reveal that the foundations will experience normal (not seismically induced) settlements on the order of 3/4 inch and differential settlements of less than 1/4 inch.

8.5 **Lateral Resistance**

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction - 0.40
Equivalent Passive Fluid Pressure = 250 lbs./cu.ft.
Maximum Passive Pressure = 2,500 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils or competent native ground.

8.6 **Retaining Wall Design Parameters**

Active earth pressures against retaining walls will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls. If fine-grained soils are exposed behind retaining walls, revised recommendations may be required.

Surface Slope of Retained Materials (Horizontal to Vertical)	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the above lateral pressure values. All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system similar to that shown on the attached Figure 7.

8.7 Floor Slab Design

Concrete floor slabs-on-grade shall be a minimum of 4 and 6 inches in thickness in office and warehouse areas, respectively, and may be placed upon fill soils compacted to a minimum of 95% relative compaction in the upper 12 inches. Additional reinforcement requirements and an increase in thickness of the slabs-on-grade may be necessary based upon soils expansion potential and proposed loading conditions in the structures and should be evaluated further by the project engineers and/or architect.

A vapor retarder should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs.* The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs.*

The moisture retarder may be placed directly upon compacted subgrade, although 1 to 2 inches of sand beneath the membrane is desirable. The subgrade upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

Subgrade soils shall be moistened to at or slightly above optimum moisture levels immediately prior to pouring of concrete. All concrete slab areas to receive floor coverings should be moisture tested to meet all manufacturer requirements prior to placement.

8.8 Expansive Soil

The upper soils at the site are very low (Expansion Index = 0-20) in expansion potential. Sites with expansive soils (Expansion Index >20) require special attention during project design and maintenance. The attached *Expansive Soil Guidelines* should be reviewed by the engineers, architects, owner, maintenance personnel and other interested parties and considered during the design of the project and future property maintenance.

8.9 Utility Trench and Excavation Backfill

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded and shaded with clean sand having a sand equivalency rating of 30 or more. This material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

Trenches may require sloped sides and/or shoring in order to maintain safe working conditions.

8.10 Corrosion Design Criteria

Representative samples of the surficial soils revealed negligible sulfate concentrations and no special concrete design recommendations are deemed necessary at this time. It is recommended that additional sulfate tests be performed at the completion of rough grading to assure that the as graded conditions are consistent with the recommendations stated in this design. Sulfate test results may be found on the attached Table III.

Tests were also conducted on a random representative sample of soils to determine the potential corrosive effects on buried metallic structures. Tests for pH, resistivity and chloride are included on Tables IV – VI. Soil pH indicates a relatively neutral condition. Resistivity was measured at 6,171 ohm-centimeters, a condition which may be considered mildly corrosive to metallic structures. Chloride content tested at 225 ppm.

8.11 **Preliminary Pavement Design**

The table below provides a preliminary pavement design based upon an R-Value of 54 for the proposed pavement areas. Final pavement design should be based on R-Value testing of the subgrade soils near the conclusion of rough grading to assure that the as-graded conditions are consistent with those used in this preliminary design.

On-Site Flexible (Asphaltic) Pavement Section Design

Type of Traffic	Traffic Index	Inches Asphalt	Inches Base
Auto Parking/Circulation	5.0	3.0	3.0
Truck	7.0	3.5	5.0

Subgrade soils to receive base material shall be compacted to a minimum of 90% relative compaction; base material shall be compacted to at least 95%. Any concrete slab-on-grade in pavement areas shall be a minimum of 6 inches in thickness and may be placed on subgrade soils compacted to at least 95% relative compaction. An increase in slab thickness and placement of steel reinforcement due to loading conditions and soil expansion may be necessary and should be reviewed by the structural engineer.

The above recommendations are based upon estimated traffic loadings. Client should submit anticipated traffic loadings for the pavement areas to the soils engineer, when available, so that pavement sections may be reviewed to determine adequacy to support the proposed loadings.

9.0 INFILTRATION TESTING

The infiltration test consisted of the double ring infiltration test per ASTM Method D 3385. The double ring infiltrometer method consists of driving two open cylinders, one inside the other, into the ground, partially filling the ring with water, and then maintaining the liquid at a constant level. The volume of liquid added to the inner ring, to maintain the liquid level constant is the measure of the volume of liquid that infiltrates into the soil.

The volume infiltrated during timed intervals is converted to an incremental infiltration velocity, usually expressed in centimeters per hour or inches per hour and plotted verses elapsed time. The maximum-steady state or average incremental infiltration velocity, depending on the purpose/application of the test is equivalent to the infiltration rate.

Water levels were maintained at a constant level in both the inner ring and annular space between rings throughout the test, to prevent flow of water from one ring to the other.

The volume of liquid used during each measured time interval was converted into an incremental infiltration velocity of both the inner ring in the annular space using the following equations:

For the inner ring calculated as follows:

$Vir=\Delta Vir/(Air\Delta t)$

where:

Vir = inner ring incremental infiltration velocity, cm/hr

ΔVir = volume of water used during time interval to maintain constant head in the inner ring, cm^3

Air = internal area of the inner ring, cm^2

Δt = time interval, hr

An average of the final readings obtained was used for design purposes in each of the basins. The testing data sheets are attached in Appendix B and summarized below.

The use of on-site disposal system by means of retention/infiltration basins appears to be geotechnically feasible for future development. The field infiltration rates given below may be utilized in the final basin design with a safety factor of 2.0 or greater.

Test No.*	Depth (feet bgs)	Soil Type	Infiltration Rate (cm/hr)	Infiltration Rate (in/hr)
IT-11	6.0	clayey SILT	1.6	0.7
IT-12	7.0	clayey sandy SILT	2.0	0.8
IT-13	10.0	silty Sand	74.0	30.0
IT-14	10.0	silty Sand	49.0	20.0
IT-15	12.0	silty Sand	81.0	32.0

Test results in T-11 and T-12 (attached Appendix F) resulted in very low infiltration rates. Thus, client requested three additional tests (T-13 to T-15) to further evaluate infiltration rates at deeper elevations. It is our opinion that the soils in test excavations T-13 to T-15 have favorable infiltration rates and are suitable for infiltration without increasing the potential of settlement of proposed and existing structures or adversely affecting retaining/basement walls located either on or adjacent to the subject site. In addition, the potential for hydro-consolidation and the susceptibility for any ground settlements are considered low. All systems shall meet the California Regional Water Quality Control Board (CRWQCB) requirements.

10.0 CLOSURE

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

This firm should have the opportunity to review the final plans (72 hours for review required) to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

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

Respectfully submitted,
NORCAL ENGINEERING

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/2020
GEOTECHNICAL
STATE OF CALIFORNIA

Keith D. Tucker
Project Engineer
R.G.E. 841

Mark A. Burkholder
Project Manager

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation
Any existing low density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Soils Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-12).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure. Verification of elevations during grading operations will be the responsibility of the owner or his designated representative.

Material For Fill
The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Soils Engineering firm a minimum of 72 hours prior to importation of site.

Placement of Compacted Fill Soils
The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557-12) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Soils Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Soils Engineering firm.

Grading Observations
The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24-hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Soils Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.

EXPANSIVE SOIL GUIDELINES

The following expansive soil guidelines are provided for your project. The intent of these guidelines is to inform you, the client, of the importance of proper design and maintenance of projects supported on expansive soils. ***You, as the owner or other interested party, should be warned that you have a duty to provide the information contained in the soil report including these guidelines to your design engineers, architects, landscapers and other design parties in order to enable them to provide a design that takes into consideration expansive soils.***

In addition, you should provide the soil report with these guidelines to any property manager, lessee, property purchaser or other interested party that will have or assume the responsibility of maintaining the development in the future.

Expansive soils are fine-grained silts and clays which are subject to swelling and contracting. The amount of this swelling and contracting is subject to the amount of fine-grained clay materials present in the soils and the amount of moisture either introduced or extracted from the soils. Expansive soils are divided into five categories ranging from "very low" to "very high". Expansion indices are assigned to each classification and are included in the laboratory testing section of this report. *If the expansion index of the soils on your site, as stated in this report, is 21 or higher, you have expansive soils.* The classifications of expansive soils are as follows:

Classification of Expansive Soil*

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

*From Table 18A-I-B of California Building Code (1988)

When expansive soils are compacted during site grading operations, care is taken to place the materials at or slightly above optimum moisture levels and perform proper compaction operations. Any subsequent excessive wetting and/or drying of expansive soils will cause the soil materials to expand and/or contract. These actions are likely to cause distress of foundations, structures, slabs-on-grade, sidewalks and pavement over the life of the structure. ***It is therefore imperative that even after construction of improvements, the moisture contents are maintained at relatively constant levels, allowing neither excessive wetting or drying of soils.***

Evidence of excessive wetting of expansive soils may be seen in concrete slabs, both interior and exterior. Slabs may lift at construction joints producing a trip hazard or may crack from the pressure of soil expansion. Wet clays in foundation areas may result in lifting of the structure causing difficulty in the opening and closing of doors and windows, as well as cracking in exterior and interior wall surfaces. In extreme wetting of soils to depth, settlement of the structure may eventually result. Excessive wetting of soils in landscape areas adjacent to concrete or asphaltic pavement areas may also result in expansion of soils beneath pavement and resultant distress to the pavement surface.

Excessive drying of expansive soils is initially evidenced by cracking in the surface of the soils due to contraction. Settlement of structures and on-grade slabs may also eventually result along with problems in the operation of doors and windows.

Projects located in areas of expansive clay soils will be subject to more movement and "hairline" cracking of walls and slabs than similar projects situated on non-expansive sandy soils. There are, however, measures that developers and property owners may take to reduce the amount of movement over the life the development. The following guidelines are provided to assist you in both design and maintenance of projects on expansive soils:

- Drainage away from structures and pavement is essential to prevent excessive wetting of expansive soils. Grades of at least 3% should be designed and maintained to allow flow of irrigation and rain water to approved drainage devices or to the street. Any "ponding" of water adjacent to buildings, slabs and pavement after rains is evidence of poor drainage; the installation of drainage devices or regrading of the area may be required to assure proper drainage. Installation of rain gutters is also recommended to control the introduction of moisture next to buildings. Gutters should discharge into a drainage device or onto pavement which drains to roadways.

- Irrigation should be strictly controlled around building foundations, slabs and pavement and may need to be adjusted depending upon season. This control is essential to maintain a relatively uniform moisture content in the expansive soils and to prevent swelling and contracting. Over-watering adjacent to improvements may result in damage to those improvements. NorCal Engineering makes no specific recommendations regarding landscape irrigation schedules.

- Planting schemes for landscaping around structures and pavement should be analyzed carefully. Plants (including sod) requiring high amounts of water may result in excessive wetting of soils. Trees and large shrubs may actually extract moisture from the expansive soils, thus causing contraction of the fine-grained soils.

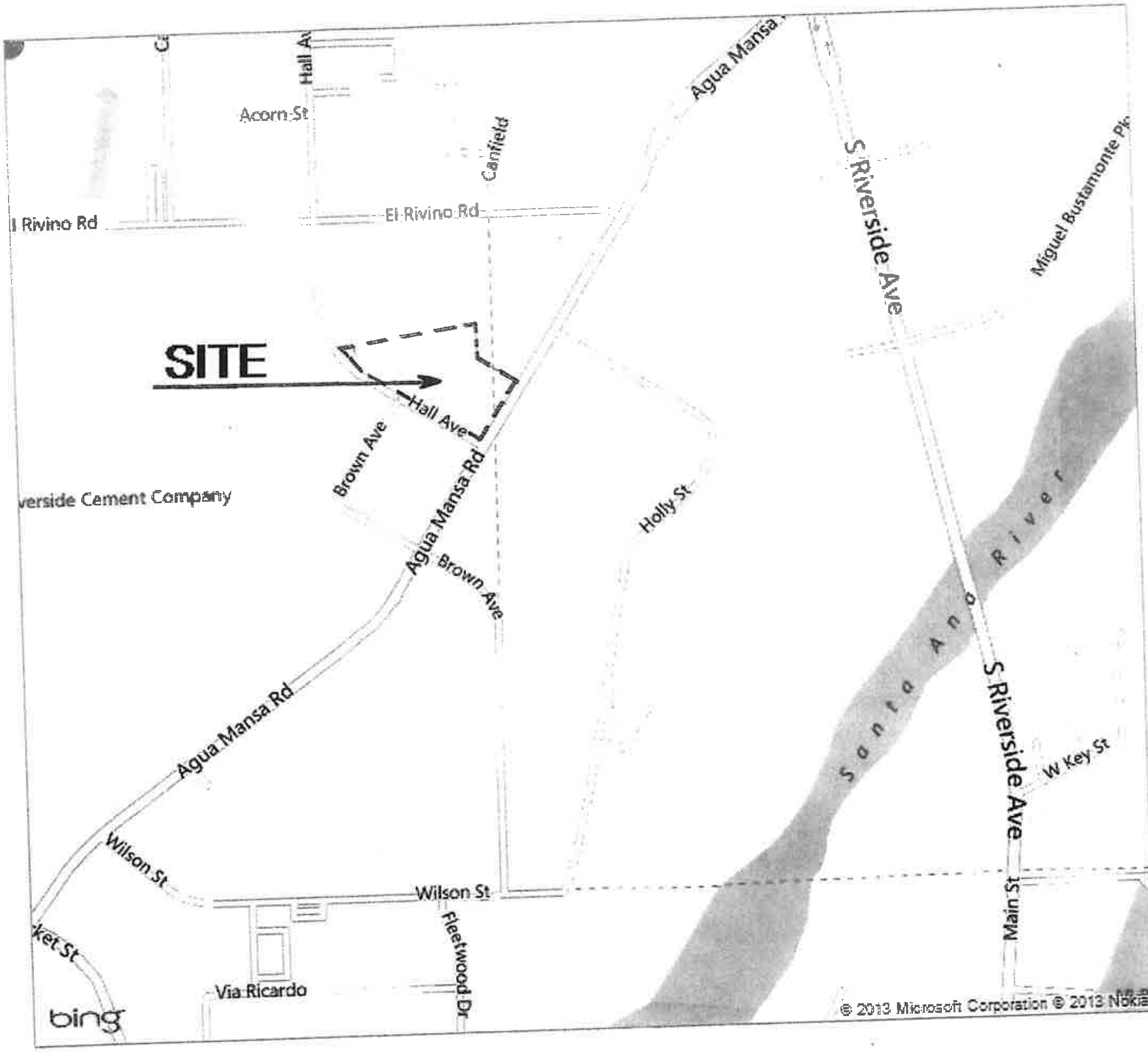
- Thickened edges on exterior slabs will assist in keeping excessive moisture from entering directly beneath the concrete. A six-inch thick or greater deepened edge on slabs may be considered. Underlying interior and exterior slabs with 6 to 12 inches or more of non-expansive soils and providing presaturation of the underlying clayey soils as recommended in the soil report will improve the overall performance of on-grade slabs.

- Increase the amount of steel reinforcing in concrete slabs, foundations and other structures to resist the forces of expansive soils. The precise amount of reinforcing should be determined by the appropriate design engineers and/or architects.

- Recommendations of the soil report should always be followed in the development of the project. Any recommendations regarding presaturation of the upper subgrade soils in slab areas should be performed in the field and verified by the Soil Engineer.

REFERENCES

1) California Building Code, 2010
2) California Division of Mines and Geology, Guidelines for Evaluating and Mitigating Seismic Hazards in California: Special Publication 117, 2008
3) International Conference of Building Officials, Uniform Building Code UBC, 2009.
4) ACI Building Code Requirements for Structural Concrete (ACI 318-05) and Commentary (ACI 318R-05), 2005.
5) Morton & Miller USGS Preliminary Geologic Map of the 30' x 60' San Bernardino and Santa Ana Quadrangles, California, 2006.
6) NorCal Engineering, Response to Third Party CEQA Review dated January 7, 2020, Project No. 16800-13, January 20, 2020.
7) NorCal Engineering, Response to Interoffice Memorandum dated May 21, 2019, Project No. 16800-13, June 14, 2019.
8) NorCal Engineering, Response to Interoffice Memorandum dated February 20, 2019, Project No. 16800-13, April 3, 2019.
9) NorCal Engineering, Response to Geotechnical Report Review Comments, Project No. 16800-13, December 31, 2018.
10) NorCal Engineering, Supplemental Soil Infiltration Study, Project No. 16800-13, September 6, 2018.
11) NorCal Engineering, Updated Geotechnical Investigation, Project No. 16800-13, July 19, 2018.
12) NorCal Engineering, Soil Conditions along Agua Mansa Road, Project No. 16800-13, July 19, 2018.
13) NorCal Engineering, Soil Infiltration Study, Project No. 16800-13, May 21, 2013.
14) NorCal Engineering, Geotechnical Investigation, Project No. 16800-13, May 28, 2013.

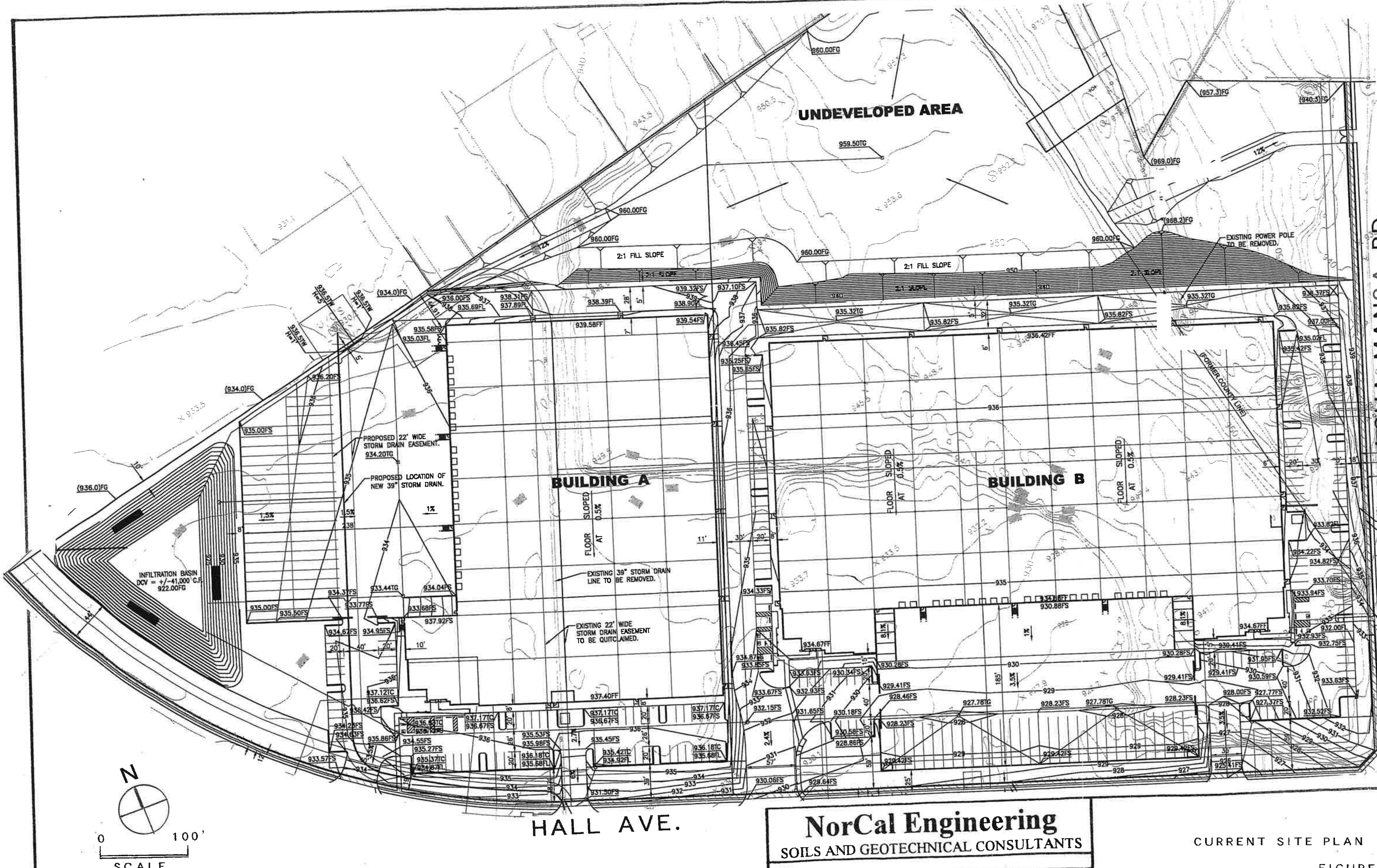


NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 16800-13 | DATE MAY 2013

VICINITY MAP

FIGURE 1



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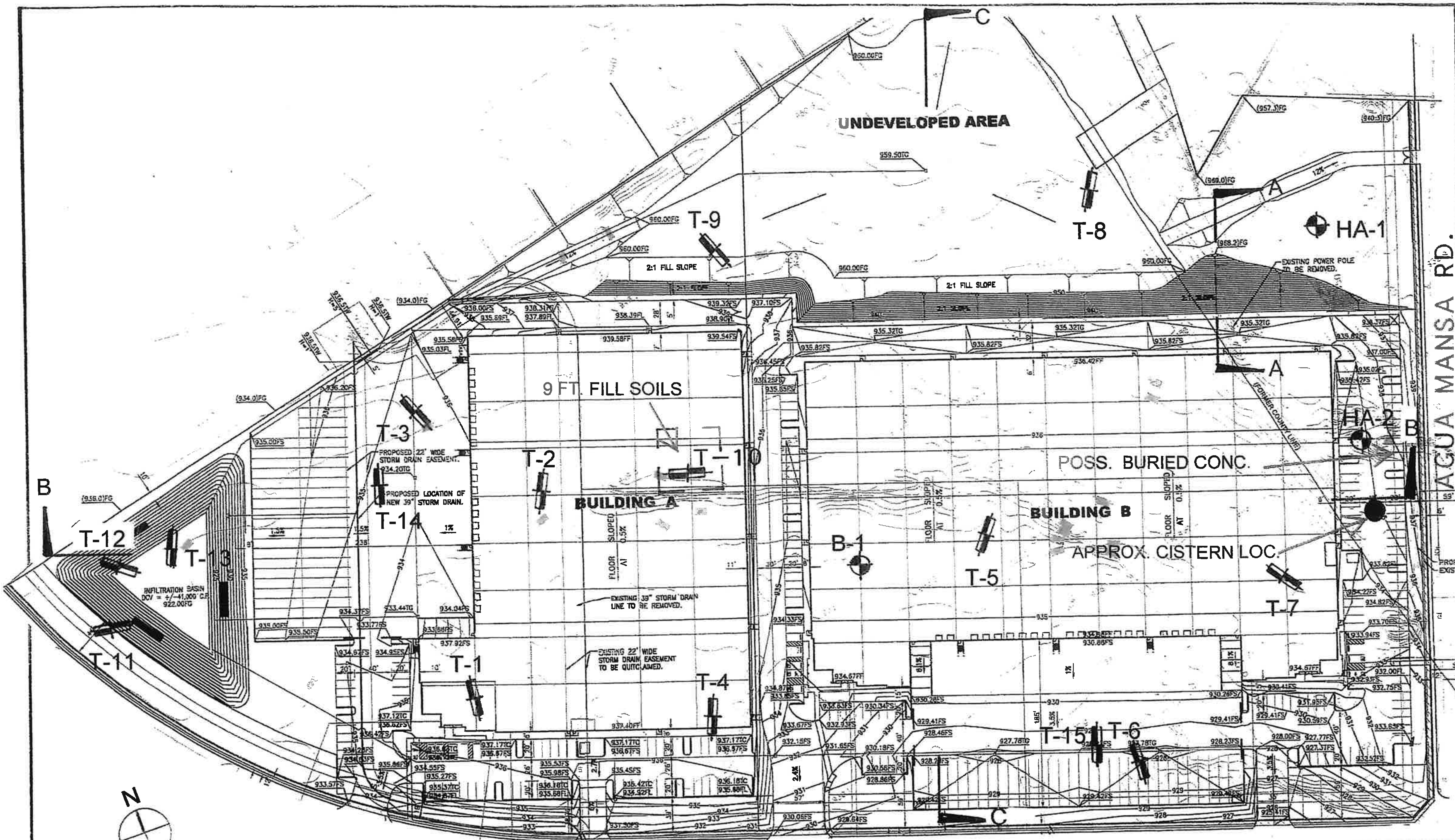
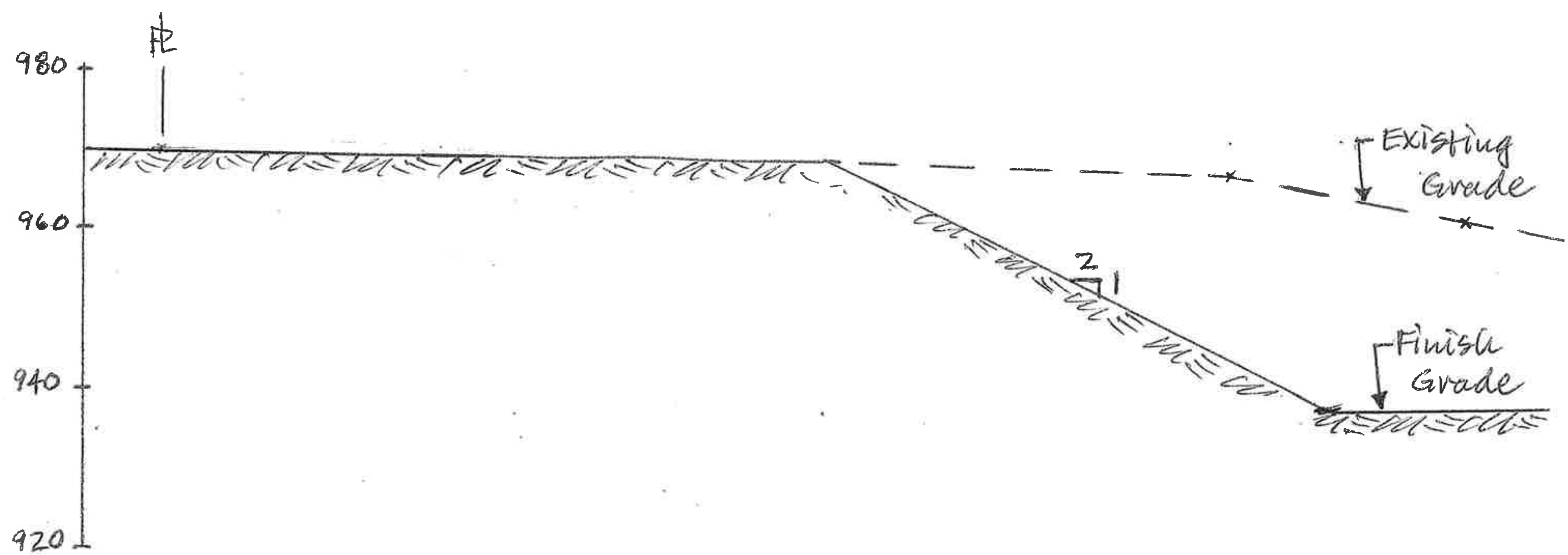
PROJECT 16800-13 | DATE 11/2018

CURRENT SITE PLAN

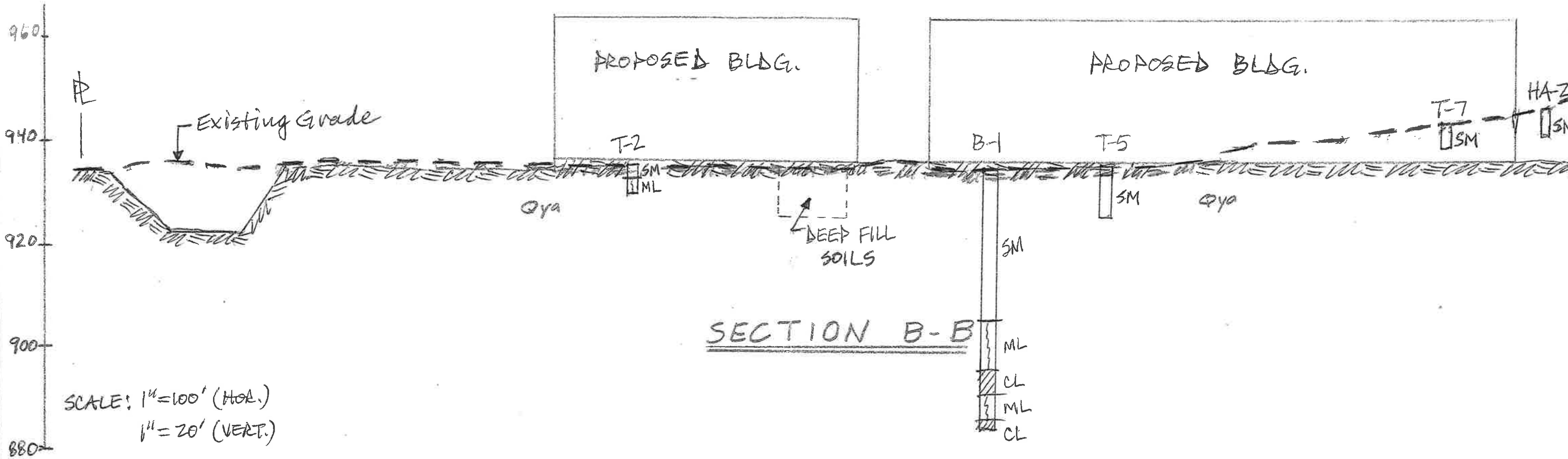
FIGURE 2

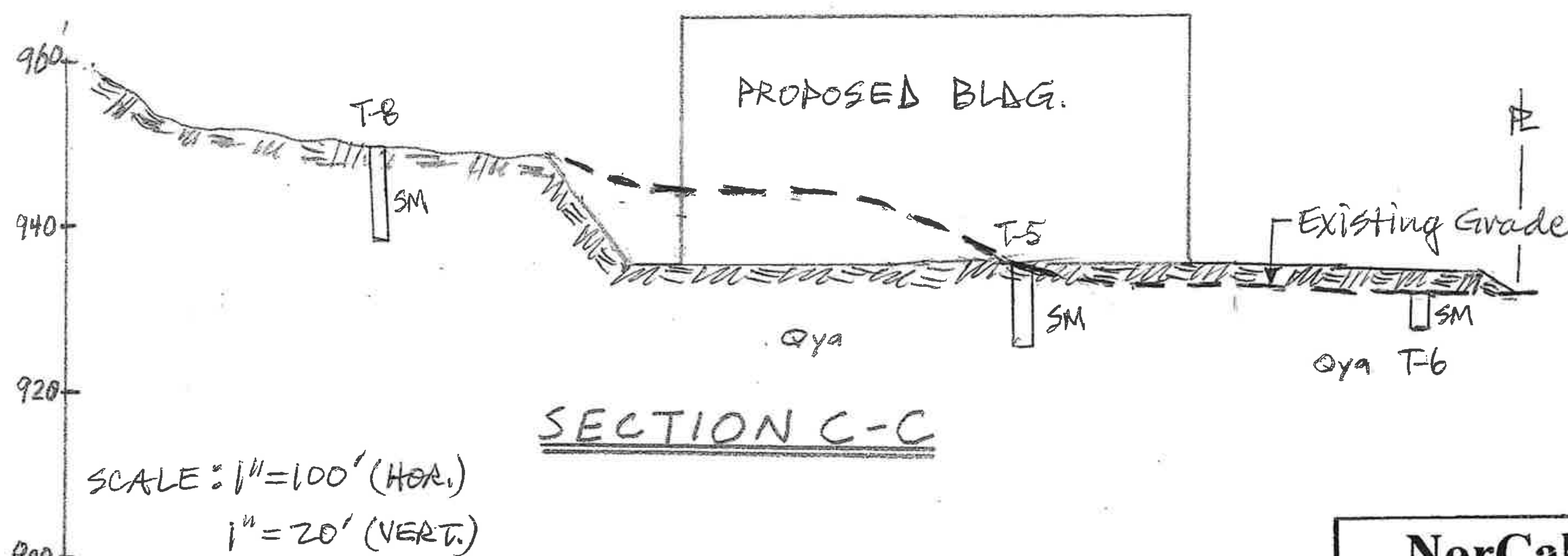


NorCal Engineering SOILS AND GEOTECHNICAL CONSULTANTS	GEOTECHNICAL MAP
PROJECT 16800-13 DATE 11/2018	FIGURE 3



NorCal Engineering SOILS AND GEOTECHNICAL CONSULTANTS	SECTION A-A
PROJECT 16800-13 DATE 12/2018	FIGURE 4





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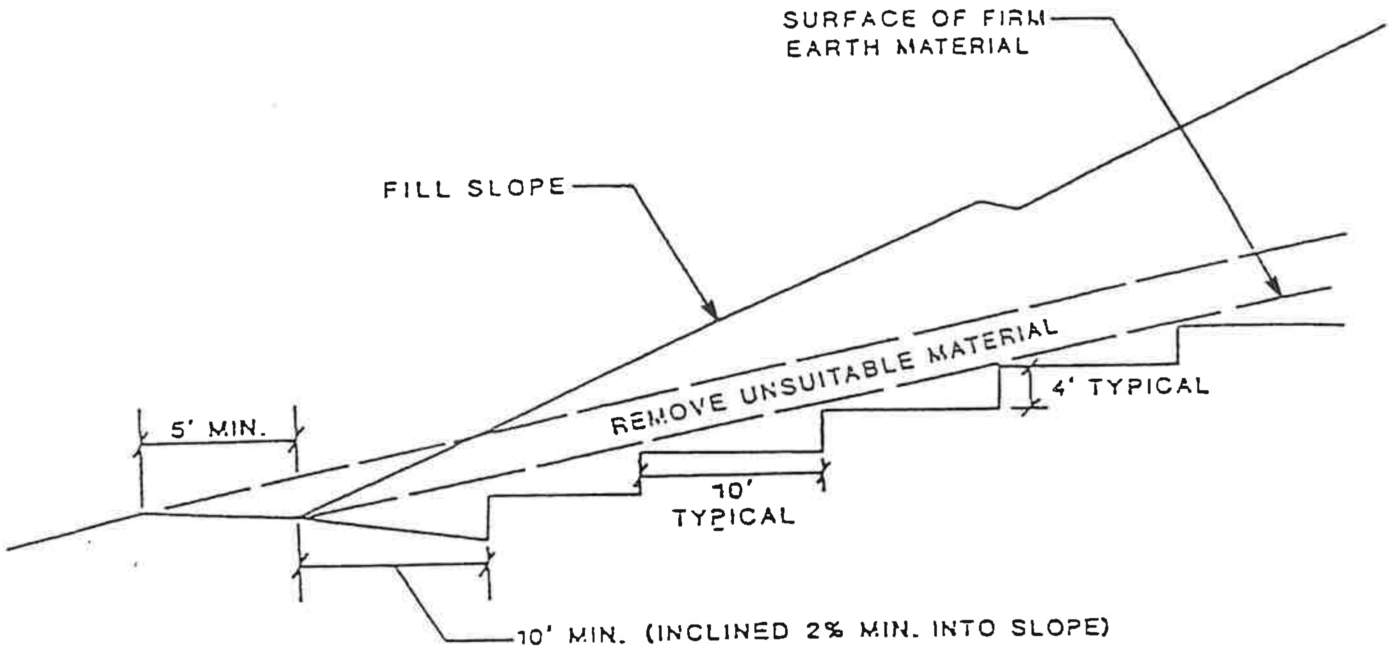
SECTIONS B-B AND C-C

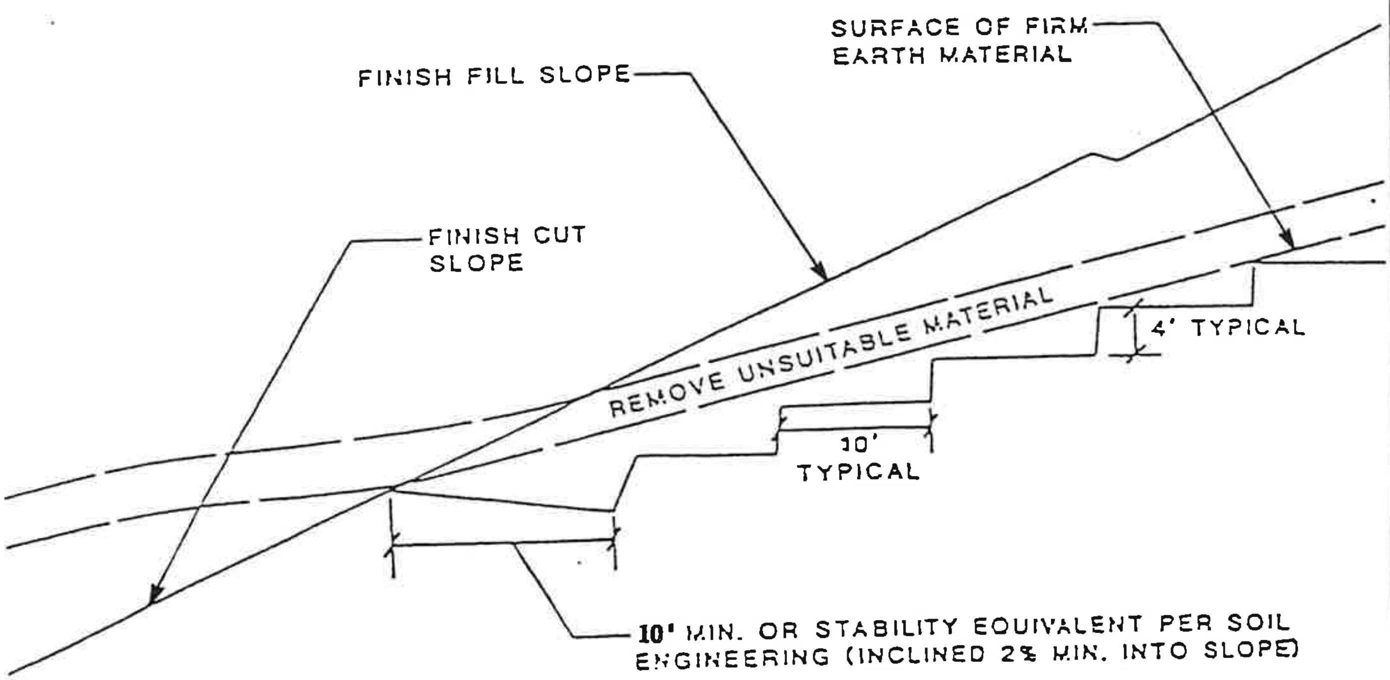
FIGURE 5

PROJECT 16800-13 | DATE 12/2018

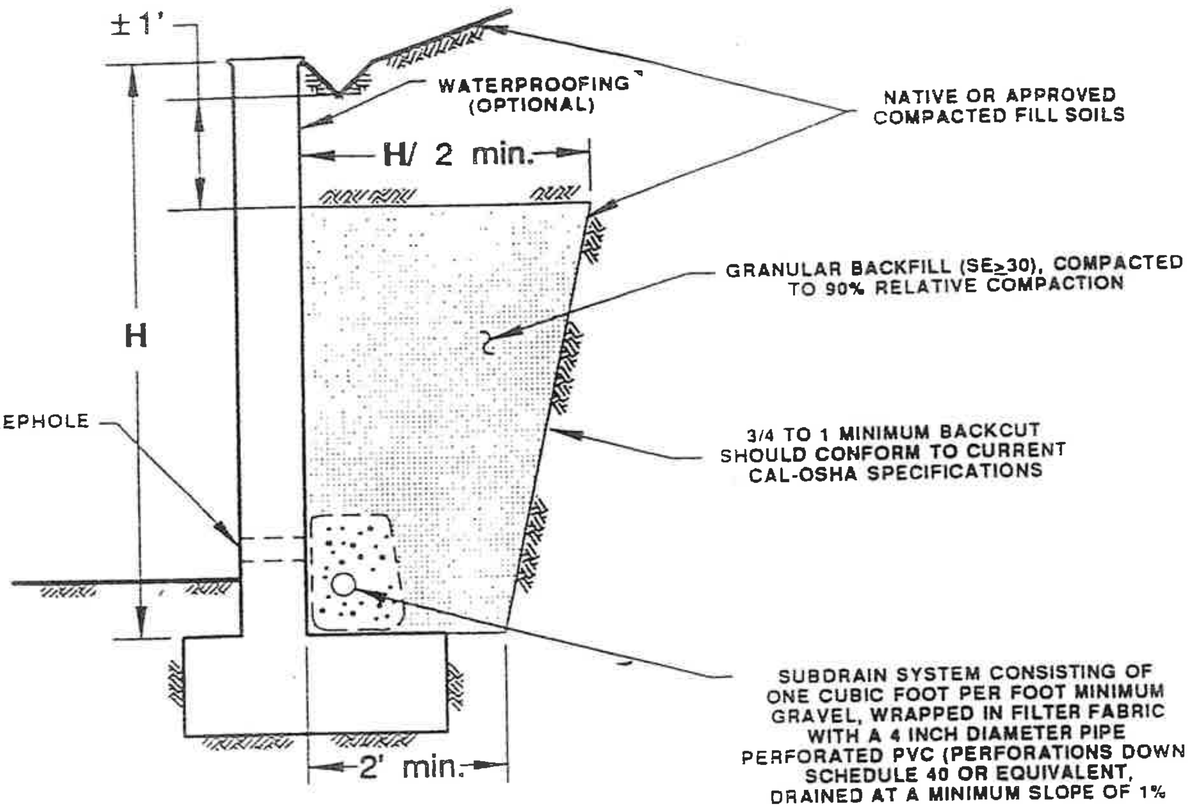
BENCHING FILL OVER NATURAL



BENCHING FILL OVER CUT



NorCal Engineering SOILS AND GEOTECHNICAL CONSULTANTS	BENCHING FOR COMPACTED FILL
PROJECT 16800-13 DATE MAY 2013	FIGURE 6



INFORMATION DEPLICTED ON THIS DETAIL IS FOR TYPICAL CONDITIONS AND ARE SUBJECT TO CHANGE BY THE GEOTECHNICAL CONSULTANT

NorCal Engineering SOILS AND GEOTECHNICAL CONSULTANTS		RETAINING WALL DETAIL
PROJECT 16800-13	DATE MAY 2013	FIGURE 7

APPENDICES

(In order of appearance)

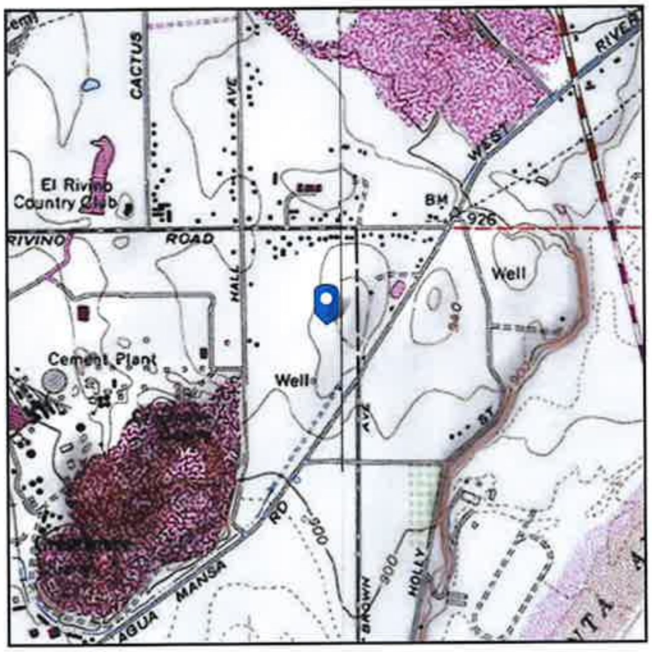
APPENDIX A

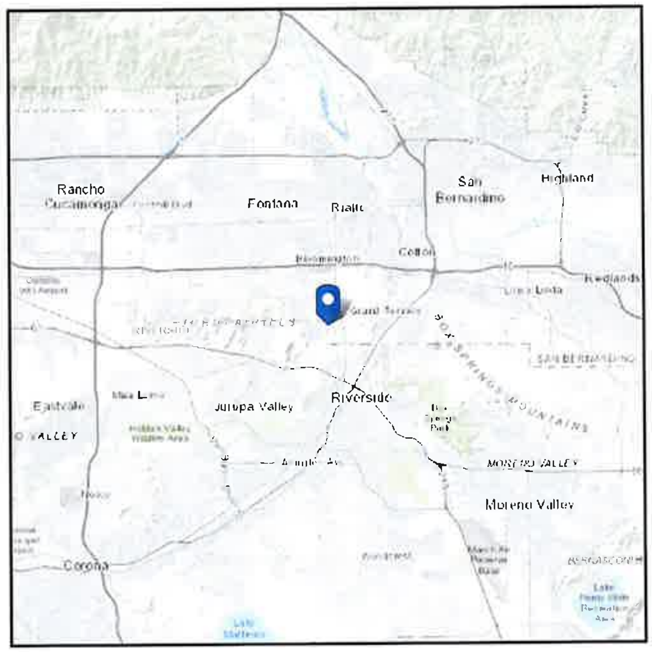
ASCE 7 Hazards Report

Address:
No Address at This Location

Standard: ASCE/SEI 7-10
Risk Category: III
Soil Class: D - Stiff Soil

Elevation: 957.03 ft (NAVD 88)
Latitude: 34.0308
Longitude: -117.3764





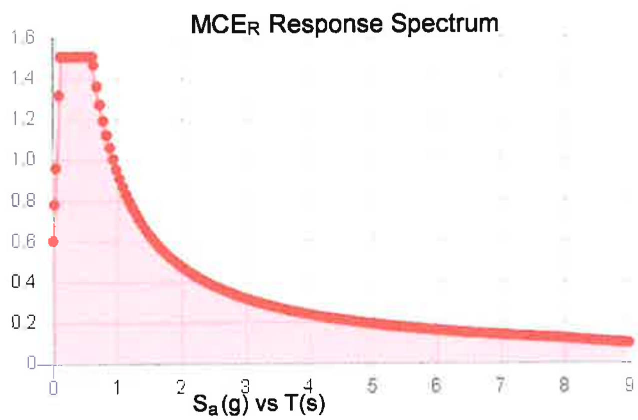
Seismic

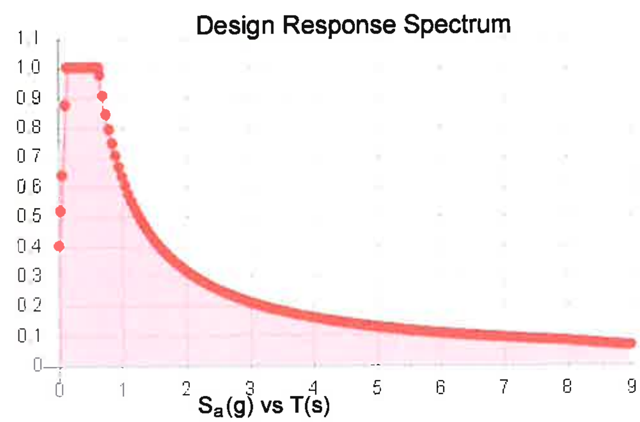
Site Soil Class: D - Stiff Soil

Results:

S_S :	1.504	S_{DS} :	1.002
S_1 :	0.634	S_{D1} :	0.634
F_a :	1	T_L :	8
F_v :	1.5	PGA :	0.584
S_{MS} :	1.504	PGA_M :	0.584
S_{M1} :	0.951	F_{PGA} :	1
		I_e :	1.25

Seismic Design Category D





Data Accessed: Mon Feb 17 2020

Date Source: USGS Seismic Design Maps based on ASCE/SEI 7-10, incorporating Supplement 1 and errata of March 31, 2013, and ASCE/SEI 7-10 Table 1.5-2. Additional data for site-specific ground motion procedures in accordance with ASCE/SEI 7-10 Ch. 21 are available from USGS.

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APPENDIX B

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL. SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SAND (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE				SP	POORLY-GRADED SANDS, GRAVEL-LY SANDS, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

Indicates 2.5-inch Inside Diameter. Ring Sample.

Indicates 2-inch OD Split Spoon Sample (SPT).

Indicates Shelby Tube Sample.

Indicates No Recovery.

Indicates SPT with 140# Hammer 30 in. Drop.

Indicates Bulk Sample.

Indicates Small Bag Sample.

Indicates Non-Standard

Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Log of Boring B-1

Project The Carson Companies

Date of Drilling: 5/11/13 | **Groundwater Depth:** None Encountered

Drilling Method: Simco 2800HS

Hammer Weight: 140 lbs | **Drop:** 30"

Surface Elevation Not Measured

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
0	FILL SOILS Silty SAND with rootlets and weeds Brown, loose, dry						
	NATURAL SOILS Silty SAND Brown, medium dense, damp						
5				4/5/7	3.8		5
10				10/6/8	2.9		7
15				7/7/9	3.5		6
20				8/8/14	3.4		5
25				4/5/11	4.1		20
30	Sandy clayey SILT Brown, stiff, moist			8/11/14	9.4		64
35							

Log of Boring B-1

Project	The Carson Companies
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Simco 2800HS	
Hammer Weight: 140 lbs	Drop: 30"

Depth (feet)	Geotechnical Description	Lith-ology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
35	Sandy clayey SILT Brown, stiff, moist			6/10/15	18.4		74
40	Silty CLAY Brown, stiff, very moist			4/8/14	25.3		89
45	Clayey SILT with sand Brown, stiff, moist			9/12/17	15.5		67
50	Silty CLAY Brown, stiff, very moist			9/16/18	22.4		86
	Boring completed at depth of 51.5'						
55							
60							
65							
70							

Log of Excavation T-1

Project The Carson Companies

Date of Drilling: 5/11/13 | **Groundwater Depth:** None Encountered

Drilling Method: Backhoe

Hammer Weight: | **Drop:**

Surface Elevation Not Measured

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
0	SURFICIAL FILL SOILS Silty SAND with roots, weeds Brown, loose, dry						
			■		6.8	103.0	
	NATURAL SOILS Silty SAND Light brown, medium dense, damp		■		6.3	106.5	
5	Sandy SILT with some clay Brown, medium stiff, damp						
	Slightly silty to silty SAND Brown, medium dense, damp		■		3.3	111.2	
10							
			■		2.0	105.7	
	Boring completed at depth of 13'						
15							
20							
25							
30							
35							

Log of Excavation T-2

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Depth (feet)	Geotechnical Description	Lith-ology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	SURFICIAL FILL SOILS Silty SAND with roots, weeds Light brown, loose, dry						
	NATURAL SOILS Silty SAND Light brown, medium dense, damp						
5	Sandy SILT with some clay Brown, medium stiff, damp						
	Clayey SILT Grey-brown, stiff, damp						
	Boring completed at depth of 5'						
10							
15							
20							
25							
30							
35							

Log of Excavation T-3

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Depth (feet)	Geotechnical Description	Lith-ology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	SURFICIAL FILL SOILS Silty SAND with rootlets Light brown, loose, dry						
	NATURAL SOILS Silty SAND Light brown, medium dense, damp				5.9	111.4	
5	Boring completed at depth of 5.5'						
10							
15							
20							
25							
30							
35							

SuperLog v2.2 CivilTech Software www.civiltech.com

Log of Excavation T-4

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	SURFICIAL FILL SOILS Silty SAND with rootlets, minor debris Light brown, loose, dry						
	NATURAL SOILS Silty SAND Light brown, medium dense, damp						
5	Some clay noted with depth						
	Boring completed at depth of 5.5'						
10							
15							
20							
25							
30							
35							

Log of Excavation T-5

Project The Carson Companies	
Date of Drilling: 5/11/13	**Groundwater Depth:** None Encountered
Drilling Method: Backhoe	
Hammer Weight:	**Drop:**

Depth (feet)	Geotechnical Description	Lith-ology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	SURFICIAL FILL SOILS Silty SAND with roots, minor debris						
	NATURAL SOILS Silty SAND Brown, medium dense, damp Decrease in silt content with depth Caving occurred below 7'		■		2.3	102.4	
5			■		1.9	100.0	
			■		1.6	95.4	
10	Boring completed at depth of 10'						
15							
20							
25							
30							
35							

Log of Excavation T-6

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Surface Elevation Not Measured

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
0	SURFICIAL FILL SOILS Silty SAND with roots, gravel Brown, loose, dry						
	NATURAL SOILS Silty SAND Light brown, medium dense, damp						
5	Boring completed at depth of 4.5'						
10							
15							
20							
25							
30							
35							

Log of Excavation T-7

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Depth (feet)	Geotechnical Description	Lith-ology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	FILL SOILS Silty SAND with rootlets, gravel Light brown, loose, dry						
	NATURAL SOILS Silty SAND Light brown, medium dense, damp						
5	Boring completed at depth of 4.5'						
10							
15							
20							
25							
30							
35							

Log of Excavation T-8

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Depth (feet)	Geotechnical Description	Lith-ology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	SURFICIAL FILL SOILS Silty SAND with rootlets Light brown, loose, dry		■		2.2	107.1	
	NATURAL SOILS Silty SAND Brown, medium dense, damp Heavy caving below 8'						
5			■		3.2	105.0	
			■		3.8	103.5	
10			■		3.8	103.2	
	Boring completed at depth of 11'						
15							
20							
25							
30							
35							

Log of Excavation T-9

Project The Carson Companies	
Date of Drilling: 5/11/13	**Groundwater Depth:** None Encountered
Drilling Method: Backhoe	
Hammer Weight:	**Drop:**

Surface Elevation Not Measured

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
0	SURFICIAL FILL SOILS Silty SAND with organics Brown, loose, dry		▽				
	NATURAL SOILS Silty SAND Brown, medium dense, damp		■		5.6	111.8	
5			■		5.6	113.9	
	Boring completed at depth of 8'						
10							
15							
20							
25							
30							
35							

Log of Excavation T-10

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	FILL SOILS Silty SAND with organics, gravel, glass pieces Brown, loose to medium dense, damp		■		5.3	117.2	
5							
	NATURAL SOILS Silty SAND Brown, medium dense, damp		■		2.4	106.1	
10							
	Boring completed at depth of 12.5'						
15							
20							
25							
30							
35							

Log of Excavation T-11

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Surface Elevation Not Measured

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
0	DISTURBED TOPSOILS Silty SAND with organics Light brown, loose, dry						
	NATURAL SOILS Silty SAND Light brown, medium dense, damp						
5	Sandy SILT with some clay Brown, medium stiff, damp						
	Clayey SILT Grey-brown, very stiff, damp						
	Boring completed at depth of 6'						
10							
15							
20							
25							
30							
35							

Log of Excavation T-12

Project: The Carson Companies	
Date of Drilling: 5/11/13	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:

Surface Elevation Not Measured

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
0	DISTURBED TOPSOILS Silty SAND with organics Light brown, loose, dry						
	NATURAL SOILS Silty SAN D Light brown, medium dense, damp						
5	Sandy clayey SILT Brown, medium stiff, damp						
	Boring completed at depth of 7'						
10							
15							
20							
25							
30							
35							

The Carson Companies
16800-13

Log of Trench T-13

Boring Location: NWC Agua Mansa & Hall, Riverside	
Date of Drilling: 9/5/18	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL SOILS Silty SAND with rootlets Brown, loose, dry					
		NATURAL SOILS Silty SAND Brown, medium dense, dry to damp					
5	GWT not encountered						
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

NorCal Engineering

The Carson Companies
16800-13

Log of Trench T-14

Boring Location: NWC Agua Mansa & Hall, Riverside

Date of Drilling: 9/5/18 | Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight: | Drop:

Surface Elevation: Not Measured

Depth (feet)	Lithology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0		FILL SOILS Silty SAND with occasional gravel and rootlets Brown, upper 8 inches loose to medium dense, dry					
		NATURAL SOILS Silty SAND Brown, medium dense, damp					
5		Sandy SILT Grey-brown, medium dense, damp					
10		Silty SAND Brown, medium dense, damp					
		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

GWT not encountered

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\16800-13.log Date: 2/18/2020

NorCal Engineering

The Carson Companies 16800-13	Log of Trench T-15

Boring Location: NWC Agua Mansa & Hall, Riverside	
Date of Drilling: 9/5/18	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Fines Content %
0–5		GWT not encountered	FILL SOILS Silty SAND with occasional gravel, some asphalt, plastic pipe pieces Brown, loose to medium dense, dry to damp					
5–10			NATURAL SOILS Sandy SILT to Silty SAND Brown, medium stiff to dense, damp					
10–12			Silty SAND Brown, medium dense, damp					
			Trench completed at depth of 12'					

Depth scale (feet): 0, 5, 10, 15, 20, 25, 30, 35

NorCal Engineering

Log of Boring HA-1

Project The Carson Companies	
Date of Drilling: 5/22/13	**Groundwater Depth:** None Encountered
Drilling Method: Hand Auger	
Hammer Weight:	**Drop:**

Depth (feet)	Geotechnical Description	Lithology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	FILL SOILS Silty SAND with concrete pieces, organics Brown, loose, dry						
	NATURAL SOILS Silty SAND Brown, medium dense, damp						
5	Boring completed at depth of 5'						
10							
15							
20							
25							
30							
35							

Log of Boring HA-2

Project: The Carson Companies	
Date of Drilling: 5/22/13	Groundwater Depth: None Encountered
Drilling Method: Hand Auger	
Hammer Weight:	Drop:

Depth (feet)	Geotechnical Description	Lith-ology	Samples: Type	Samples: Blow Counts	Laboratory: Moisture (%)	Laboratory: Dry Density (pcf)	Laboratory: % Passing 200 Sieve
	Surface Elevation Not Measured						
0	FILL SOILS Silty SAND with gravel Brown, loose, dry						
	NATURAL SOILS Silty SAND Brown, medium dense, damp						
5	Boring completed at depth of 5'						
10							
15							
20							
25							
30							
35							

APPENDIX C

TABLE I
MAXIMUM DENSITY TESTS
(ASTM: D-1557-07)

Sample	Classification	Optimum Moisture	Maximum Dry Density (lbs./cu.ft.)
T-3 @ 1-2'	silty SAND	10.5	122.5
T-3 @ 4.5-5.5'	silty SAND	10.0	128.5

TABLE II
EXPANSION INDEX TESTS
(ASTM: D-4829-07)

Sample	Classification	Expansion Index
T-3 @ 1-2'	silty SAND	02

TABLE III
SOLUBLE SULFATE TESTS
(CT 417)

Sample	Sulfate Concentration (%)
T-1 @ 1-2'	.0006

TABLE IV
pH TESTS

Sample	pH
T-1 @ 1-2'	6.8

TABLE V
RESISTIVITY TESTS
(CT 643)

Sample	Resistivity (ohm-cm)
TB-1 @ 1-2’	6,171

TABLE VI
CHLORIDE TESTS
(CT 422))

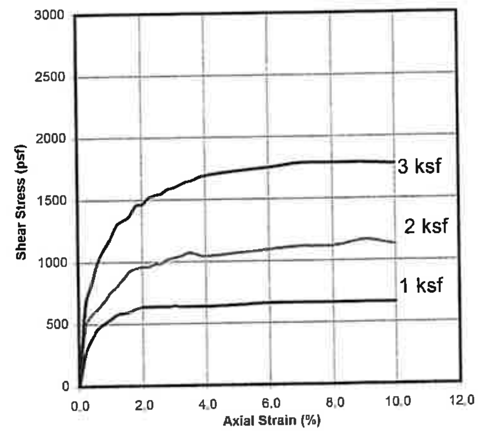
Sample	Concentration (ppm)
T-1 @ 1-2’	225

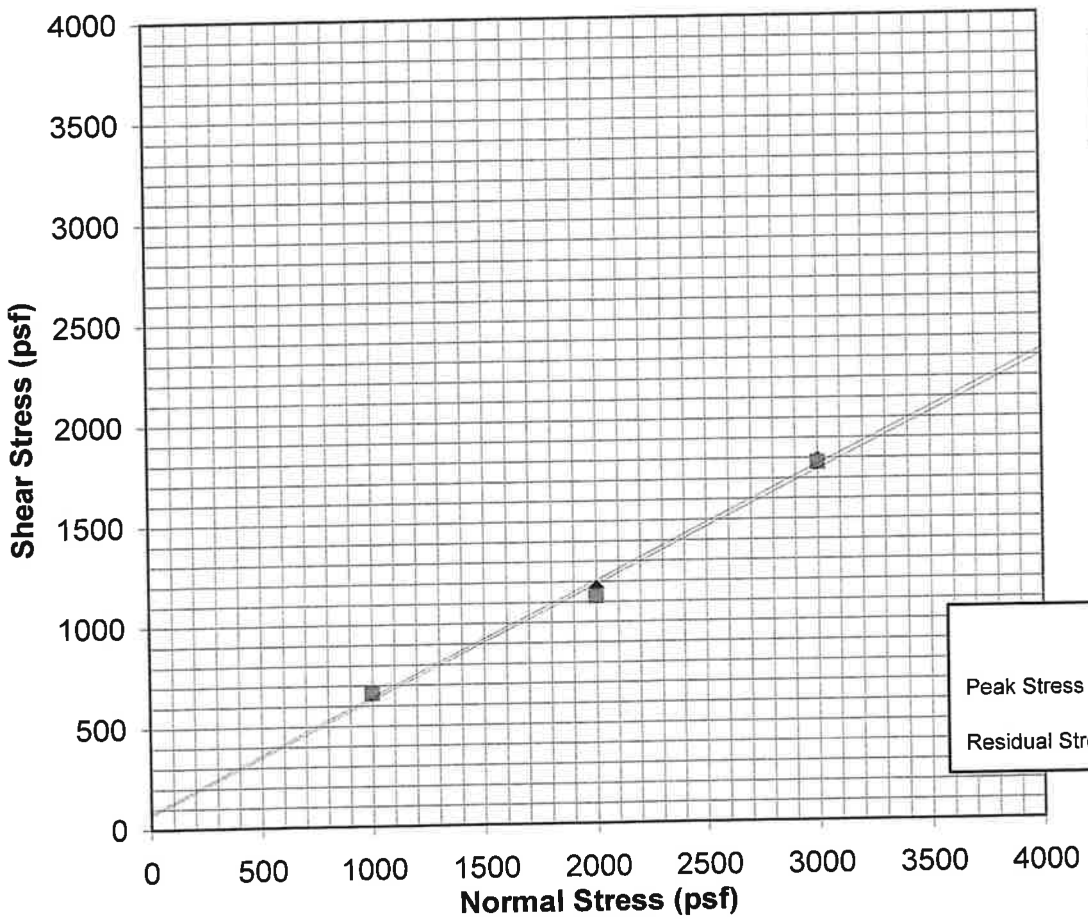
TABLE VII
RESISTANCE ‘R’ VALUE TESTS
(CA 301))

Sample	‘R’ Value
T-4 @ 2-3’	54

Sample No.	T3@1'			
Sample Type:	Remolded-Saturated			
Soil Description:	Fine-Medium Grained Sand w/ Some Silt			

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	660	1164	1788
Displacement	(in.)	0.150	0.225	0.175
Residual Stress	(psf)	660	1128	1776
Displacement	(in.)	0.250	0.250	0.250
Initial Dry Density	(pcf)	110.3	110.3	110.3
Initial Water Content	(%)	10.5	10.5	10.5
Strain Rate	(in./min.)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	29	80
Residual Stress	29	70

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The Carson Companies

PROJECT NUMBER: 16800-13 DATE: 5/24/2013

DIRECT SHEAR TEST

ASTM D3080

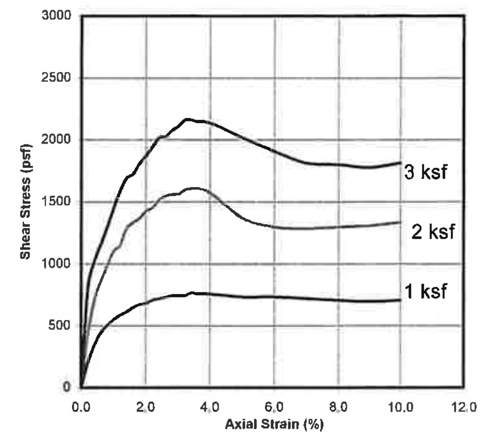
Plate A

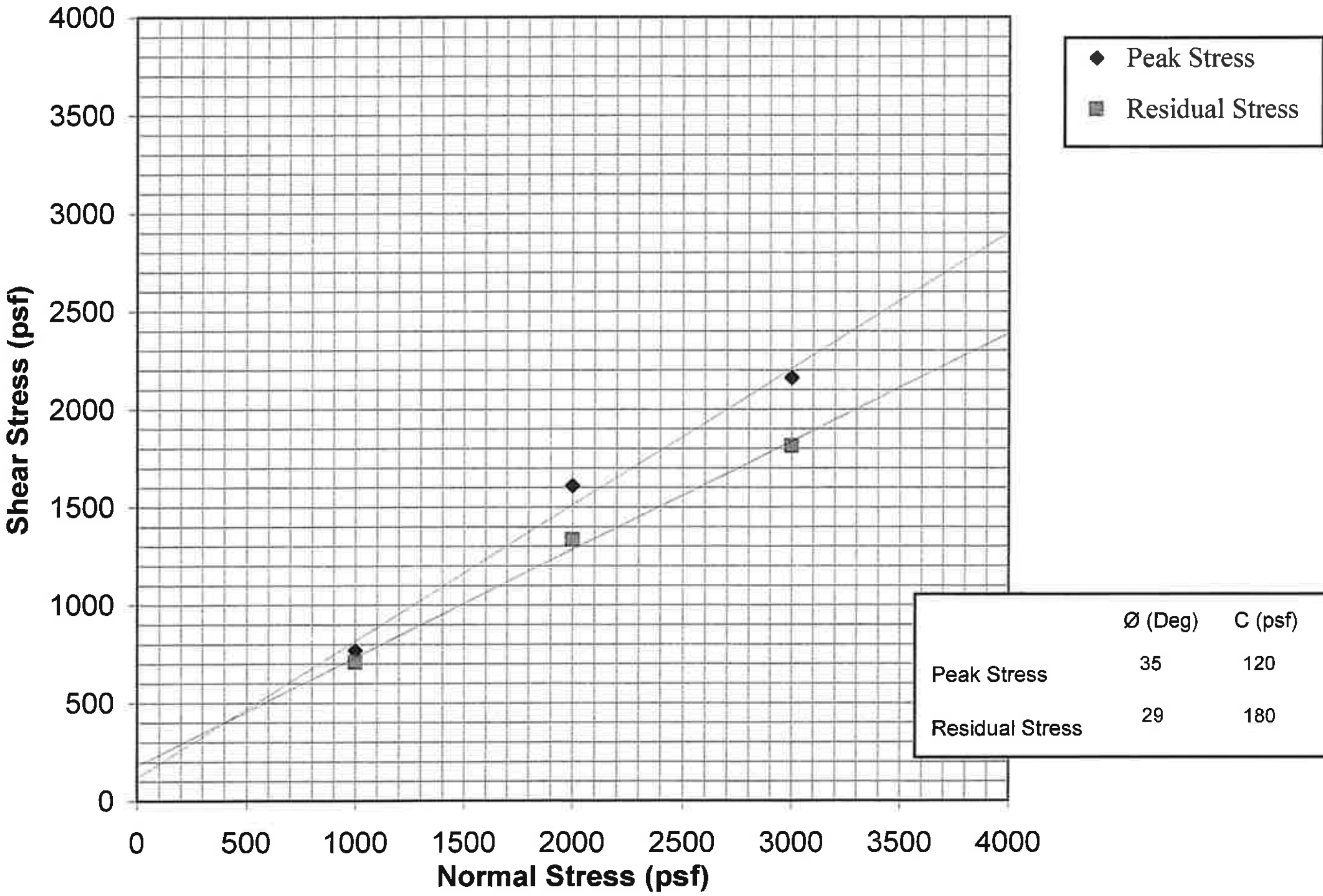
Sample No. T9@6'

Sample Type: Undisturbed-Saturated

Soil Description: Fine-Medium Grained Sand w/ Some Silt

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	768	1608	2160
Displacement	(in.)	0.085	0.085	0.080
Residual Stress	(psf)	708	1332	1812
Displacement	(in.)	0.250	0.250	0.250
Initial Dry Density	(pcf)	113.9	113.9	113.9
Initial Water Content	(%)	5.6	5.6	5.6
Strain Rate	(in./min.)	0.020	0.020	0.020





	Ø (Deg)	C (psf)
Peak Stress	35	120
Residual Stress	29	180

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PROJECT NUMBER: 16800-13 DATE: 5/24/2013

DIRECT SHEAR TEST

ASTM D3080

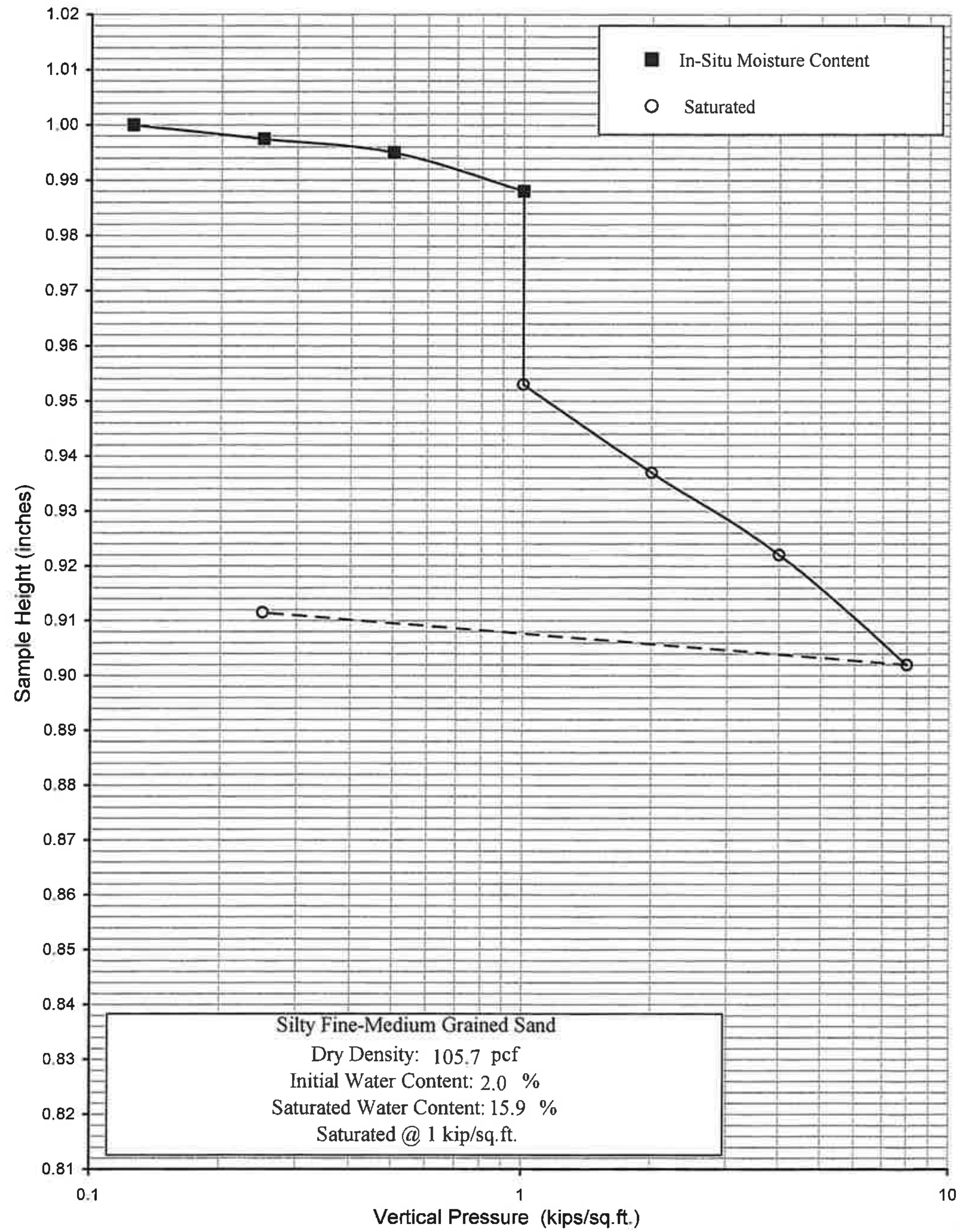
Plate B

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	Sample No.	T1	Depth 12'	Date 5/24/2013

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9975	0.2
0.5	0.9950	0.5
1	0.9880	1.2
1	0.9530	4.7
2	0.9370	6.3
4	0.9220	7.8
8	0.9020	9.8
0.25	0.9115	8.9

Saturated

Date Tested: 5/22/2013
Sample: T1
Depth: 12'



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PROJECT NUMBER: 16800-13 DATE: 5/24/2013

CONSOLIDATION TEST

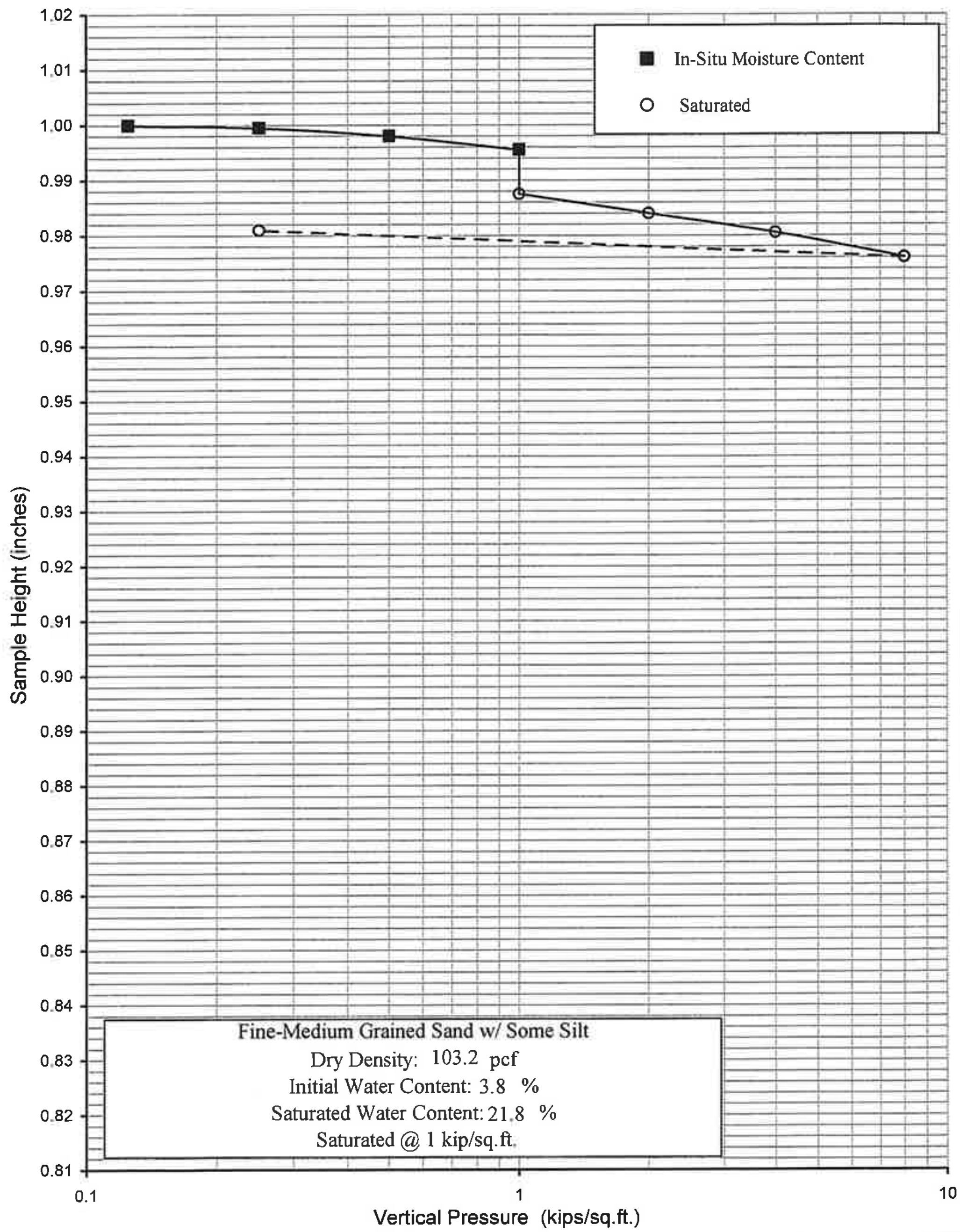
ASTM D2435

Plate C

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	Sample No.	T8	Depth 10'	Date 5/24/2013

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)	
0.125	1.0000	0.0	
0.25	0.9995	0.0	
0.5	0.9980	0.2	
1	0.9955	0.4	
1	0.9875	1.3	Saturated
2	0.9840	1.6	Saturated
4	0.9805	2.0	Saturated
8	0.9760	2.4	Saturated
0.25	0.9810	1.9	Saturated

Date Tested: 5/22/2013
Sample: T8
Depth: 10'



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The Carson Companies

PROJECT NUMBER: 16800-13 DATE: 5/24/2013

CONSOLIDATION TEST

ASTM D2435

Plate D

APPENDIX D

SITE LOCATION:

GEOTECHNICAL REPORT:

GEOLOGY REPORT:

DEPTH TO WATER TABLE = >50'

EARTHQUAKE MAGNITUDE = 6.7

PEAK GROUND ACCELERATION = 0.58g

DEPTH BELOW FINAL GRADE (FEET)	MOIST DENSITY (PCF)	σ_o TOTAL STRESS (PSF)	$\bar{\sigma}_o$ EFFECTIVE STRESS (PSF)	$\sigma_o/\bar{\sigma}_o$ (-)	r_d (-)	① $\tau_h/\bar{\sigma}_o$ (-)	N VALUE (BLOWS/FT)	RELATIVE DENSITY (%)	C_N (-)	C_E (-)	C_B (-)	C_R (-)	C_S (-)	$(N_1)_{60}$ (Blows/ft)	FINES (%)	CRR M=7.5	MSF (-)	CRR M=6.7	LIQ. F.S.
5	110	550	Same	1.00	0.99	0.38	12	75	>1.6	1.00	1.05	0.70	1.20	>17	5	>0.19	1.4	>0.27	>0.7
10		1100			0.96	0.37	14	75	1.3			0.75		17	7	0.20		0.28	0.8
15		1650			0.92	0.35	16	70	1.1			0.85		19	6	0.22		0.31	0.9
20		2200			0.87	0.33	22	75	0.95			0.90		24	5	0.27		0.38	1.1
25		2750			0.80	0.30	16	65	0.88			0.95		17	20	0.26		0.36	1.2
30	120	3350			0.74	0.28	25	70	0.81			1.00		25.5	64	>0.50		>0.70	>2.5
35		3950			0.68	0.26	25	70	0.76					24	74	>0.50		>0.70	>2.7
40		4550			0.64	0.24	22	60	0.70					19.5	89	>0.36		>0.50	>2.1
45		5150			0.61	0.23	29	65	0.67					24.5	67	>0.50		>0.70	>3.0
50		5750			0.58	0.22	34	70	0.63					27	86	>0.50		>0.70	>3.2

① INDUCED CYCLIC STRESS RATIO = $\tau_{ave}/\bar{\sigma}_o = 0.65 \cdot \frac{a_{max}}{g} \cdot \frac{\sigma_o}{\bar{\sigma}_o} \cdot r_d$

- C_E = Corr. - Energy Ratio = Energy Ratio/60%
- C_B = Corr. - Borehole Dia. = 1.15 for 8" dia. borehole
- C_R = Corr. - Rod Length
- C_S = Corr. - Sampling Method

Actual Energy Ratio = 0.67-1.17 (Safety Hammer)
= 0.50-1.00 (Donut Hammer)

Sampling Method = 1.0 Standard sampler
~~= 1.2 Sampler W/o liners~~

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SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 16800-13 DATE 12/2018

EVALUATION OF LIQUEFACTION POTENTIAL

EQ Magnitude = 6.7, Hor. Ground Acceleration = 0.58g, Groundwater Level ≥ 50'

Depth (ft)	σ_o (psf)	r_d (-)	τ_{ave} (psf)	$N_{1,60}$ (Blows/ft)	Dr (%)	G_{max} (ksf)	$\gamma_{eff} \times [G_{eff}/G_{max}]$ (-)	γ_{eff} (in/in)	ϵ_{c15} (%)	ϵ_c (%)	Settlement (ft)	Settlement (in)	FINES (%)
5	550	0.99	209	>17	75	1206	1.73×10^{-4}	3×10^{-4}	0.03	0.06		0.04	5
10	1100	0.96	401	17	75	1705	2.35	6	0.08	0.16		0.10	7
15	1650	0.92	578	19	70	2168	2.67	6	0.08	0.16		0.10	6
20	2200	0.87	726	24	75	2706	2.68	5	0.04	0.08		0.05	5
25	2750	0.80	825	17	65	2697	3.06	5	0.08	0.16		0.10	20
30	3350	0.74	938	25.5	70	3407	2.75	4	0.03	0.06		0.04	64
35	3950	0.68	1027	24	70	3627	2.83	4	0.03	0.06		0.04	74
40	4550	0.64	1092	19.5	60	3631	3.01	5	0.05	0.10		0.06	89
45	5150	0.61	1185	24.5	65	4168	2.84	5	0.03	0.06		0.04	67
50	5750	0.58	1265	27	70	4549	2.78	4	0.02	0.04		0.02	86

$\Sigma S = 0.59''$

Say $\Delta_{EQ} = 1/2 - 5/8''$

$\tau_{ave} = (0.65)\, a_{max}/g \cdot \sigma_o \cdot r_d$ [ksf],

$G_{max} = 20 (N_1)^{1/3} (\sigma_o')^{1/2}$ [ksf]

$\gamma_{eff} = \dfrac{\tau_{ave}}{G_{max}\,[G_{eff}/G_{max}]}$

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16800-13 DATE 12/2018

DRY SEISMIC SETTLEMENT

APPENDIX E

SLOPE STABILITY ANALYSIS

(1) Soil Design Parameters

a) Friction Angle = $\phi = 35°$

b) Unit Cohesion = $C = 120$ psf

c) Moist Density = $\gamma_m = 110$ pcf

d) Soil Type ⇒ Silty Sand

(2) Slope Configuration

a) Slope Height = $H = 32'$

b) Slope Angle = $\alpha = 27°$ (2 to 1)

c) Surcharge Loads = $q = \emptyset$

(3) Stability Analysis

a) With no tension cracks or groundwater above the toe of slope, $P_d = \frac{\gamma \cdot H + q}{\mu_q} = P_e = \frac{(110\,pcf)(32') + q}{1.0}$

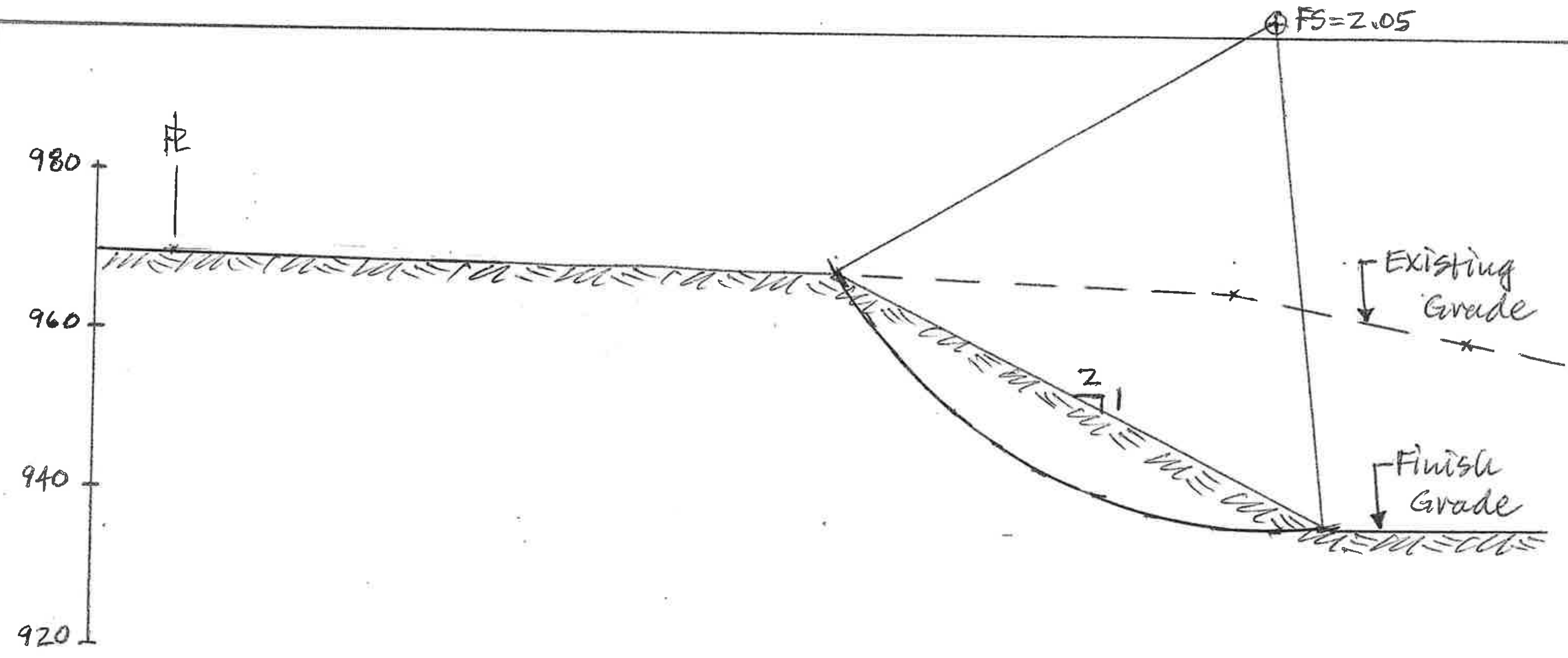
b) $\lambda_{c\phi} = \frac{P_e \cdot \tan\phi}{c} = \frac{(3520\,psf)(\tan 35°)}{120\,psf}$ $P_d = P_e = 3520$ psf

c) $N_{cf} = 60$ $\lambda_{c\phi} = 20.5$

d) $FS = \frac{N_{cf} \cdot C}{P_d} = \frac{(60)(120\,psf)}{3520\,psf} = 2.05 > 1.50$ ✓

e) $X_o = (x)H = (0.3)(32') = 9.6'$

f) $Y_o = (y)H = (2.0)(32') = 64.0'$



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SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 16800-13 | DATE 12/2018

SECTION A-A

FIGURE 3

APPENDIX F

Project: The Carson Companies
Project No.: 16800-13
Date: 5/11/2013
Test No. T-11
Depth: 6'
Tested By: J.S. / P.L.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (mln)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
9:25			129.5								
9:40	15	15	130.7	1.2					4.8		
9:40			130.7								
9:55	15	30	131.8	1.1					4.4		
9:55			131.8								
10:10	15	45	131.9	0.1					0.4		
10:10			131.9								
10:25	15	60	132.4	0.5					0.2		
10:25			128.7								
10:42	15	75	129.5	0.8					3.2		
10:42			129.5								
10:57	15	90	129.9	0.4					1.6		
10:57			129.9								
11:12	15	105	130.3	0.4					1.6		
11:12			130.3								
11:30	15	120	130.8	0.5					2.0		
11:30			127.3								
11:45	15	135	128.0	0.7					2.8		
11:45			128.0								
12:00	15	150	128.4	0.4					1.6		
12:00			128.4								
12:15	15	165	128.7	0.3					1.2		
12:15			128.7								
12:30	15	180	129.1	0.4					1.6		

Average = 1.6 cm/hr

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SOILS AND GEOTECHNICAL CONSULTANTS

Project: The Carson Companies
Project No.: 16800-13
Date: 5/11/2013
Test No. T-12
Depth: 7'
Tested By: P.L.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
12:47			130.5								
1:02	15	15	132.2	1.7					6.8		
1:02			132.2								
1:17	15	30	133.6	1.4					5.6		
1:17			133.6								
1:32	15	45	135.0	1.4					5.6		
1:32			135.0								
1:47	15	60	135.9	0.9					3.6		
1:47			131.3								
2:02	15	75	132.2	0.9					3.6		
2:02			132.2								
2:17	15	90	132.9	0.7					2.8		
2:17			132.9								
2:32	15	105	133.5	0.6					2.4		
2:32			133.5								
2:47	15	120	134.1	0.6					2.4		
2:47			130.3								
3:02	15	135	131.0	0.7					2.8		
3:02			131.0								
3:17	15	150	131.7	0.7					2.8		
3:17			131.7								
3:32	15	165	132.2	0.5					2.0		
3:32			132.2								
3:47	15	180	132.7	0.5					2.0		

Average = 2.0 cm/hr

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: The Carson Companies
Project No.: 16800-13
Date: 5/11/2013
Test No. T-13
Depth: 10'
Tested By: J.S

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
8:53			98.2			43.0					
8:56	3	3	103.6	5.4		49.6	6.6				
8:56			98.1			42.8					
8:59	3	6	102.1	4.0		48.4	5.6				
8:59			98.4			41.7					
9:02	3	9	102.0	3.6		47.0	5.3				
9:02			97.7			43.2					
9:05	3	12	101.5	3.8		48.2	5.0				
9:05			99.4			42.5					
9:08	3	15	103.0	3.6		48.0	5.5				
9:08			98.4			42.3					
9:11	3	18	102.2	3.8		48.2	5.9				
9:11			98.4			42.8					
9:14	3	21	102.1	3.7		48.0	5.2		74	104	
9:14			98.0			42.7					
9:17	3	24	101.6	3.6		47.7	5.0		72	100	
9:17			98.4			43.1					
9:20	3	27	102.2	3.8		48.1	5.0		76	100	
9:20			98.2			42.7					
9:23	3	30	102.0	3.8		47.8	5.1		76	102	
9:23			97.9			43.0					
9:26	3	33	101.4	3.5		48.2	5.2		70	104	
9:26			97.8			42.6					
9:29	3	36	101.5	3.7		47.8	5.2		74	104	

Average = 74 / 102 cm/hr

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: The Carson Companies
Project No.: 16800-13
Date: 5/11/2013
Test No. T-14
Depth: 10'
Tested By: J.S.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
11:10			99.2			44.1					
11:20	10	10	107.8	8.6		53.0	8.9				
11:20			97.3			41.0					
11:30	10	20	106.1	8.8		49.8	8.8				
11:30			97.8			39.9					
11:40	10	30	106.3	8.5		49.3	9.4				
11:40			97.7			39.8					
11:50	10	40	105.9	8.2		49.2	9.4				
11:50			98.0			40.0					
12:00	10	50	106.1	8.1		49.2	9.2				
12:00			98.3			41.8					
12:10	10	60	106.5	8.2		50.8	9.0				
12:10			98.4			40.7					
12:20	10	70	106.5	8.1		50.3	9.6		48.6	57.6	
12:20			98.3			40.0					
12:30	10	80	106.3	8.0		48.8	8.8		48.0	52.8	
12:30			97.7			39.9					
12:40	10	90	106.2	8.5		49.0	9.1		51.0	54.6	
12:40			98.5			41.5					
12:50	10	100	106.8	8.3		50.2	8.7		49.8	52.2	
12:50			98.5			42.0					
1:00	10	110	106.6	8.1		50.5	8.5		48.6	51.0	
1:00			97.9			40.0					
1:10	10	120	106.0	8.1		48.5	8.5		48.6	51.0	

Average = 49.0 / 53.0 cm/hr

NORCAL ENGINEERING

SOILS AND GEOTECHNICAL CONSULTANTS

Project: The Carson Companies
Project No.: 16800-13
Date: 5/11/2013
Test No. T-15
Depth: 12'
Tested By: J.S.

TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
2:05			98.4			41.3					
2:10	5	5	105.9	7.5		51.4	10.1				
2:10			98.2			40.5					
2:15	5	10	105.2	7.0		51.3	9.8				
2:15			99.5			49.6					
2:20	5	15	106.3	6.8		52.8	8.8				
2:20			98.7			40.8					
2:25	5	20	105.4	6.7		50.0	9.2				
2:25			98.3			41.2					
2:30	5	25	104.7	6.4		50.3	9.1				
2:30			98.0			41.4					
2:35	5	30	105.1	7.1		50.2	8.8				
2:35			98.2			42.5					
2:40	5	35	105.0	6.2		51.3	8.8		81.6	105.6	
2:40			98.2			41.2					
2:45	5	40	105.2	7.0		50.2	9.2		84.0	110.4	
2:45			97.6			42.5					
2:50	5	45	104.5	6.9		51.3	9.5		82.8	114.0	
2:50			98.3			41.3					
2:55	5	50	105.0	6.7		50.5	9.2		80.4	110.4	
2:55			98.5			40.9					
3:00	5	55	105.1	6.6		49.5	8.6		79.2	103.2	
3:00			98.1			40.4					
3:05	5	60	104.8	6.7		49.2	8.8		80.4	105.6	

Average = 81.0 / 108.0 cm/hr