CITY OF ANAHEIM CALIFORNIA
FOUNDED 1857

Lincoln Colony Apartments Project

Appendix C

Soil and Foundation Evaluation Report, March 2021

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soil PACIFIC INC.

Geotechnical and Environmental Services

Project No. A-7075up-20
December 21, 2021

Mr. Jerry Zomoredian
914 West Lincoln Avenue
Anaheim, California

Subject: **Clarification Letter**
Proposed Apartment Building
914 West Lincoln Avenue, Anaheim, California

Dear Sir;

Pursuant to the City of Anaheim Public Works Division inquiries we are please to submit our clarification letter.

Item 1: P. 5. Section 1.1, 2nd paragraph. This report is dated March 28, 2021, and the existing structures were demolished in 2019. However, the report still states that the Project Site comprises of building structures and conventional parking lot. The inconsistency should be reconciled.

Response: During the soil report update the matter that the existing building is demolished has not bot been properly addressed. At the present time the site is vacant.

Item2: P. 5. Section 1.1, 3rd paragraph. It states that the site access is from Lincoln Avenue and Illinois Street. The site is accessed from Lincoln Avenue and Ohio Street.

Response: We agree with the reviewer that the site access is through Lincoln Avenue and Ohio Street.

The opportunity to be of service is appreciated. Should any question arise concerning this clarification letter please contact this office for further clarification.

Respectfully submitted,

SOIL PACIFIC, INC.

Hoss Eftekhari
RCE

REGISTERED PROFESSIONAL ENGINEER
HOSS EFTEKHARI
No. C50121
EXP. 6-30-23
CIVIL
STATE OF CALIFORNIA

675 N. Eckhoff, Suite A, Orange, CA 92868 ○Tel (714) 879-1203 ○Fax (714) 879-4812

soil PACIFIC INC.

Geotechnical and Environmental Services

Revised on March 28, 2020
Project No. A-7075-19

Mr. Mike Bastani, MBA,
One League, No. 61000
Irvine, CA 92604

Subject: **Soil and Foundation Evaluation Report Update**
Proposed Apartment Building
898, 900 and 914 West Lincoln Avenue, Anaheim, California

Dear Sir;

Pursuant to the City of Anaheim Plan Checker request, we are pleased to submit our revised report for the subject project. Our evaluation was conducted in November 2019. This evaluation consists of field exploration; sub-surface soil sampling; laboratory testing; engineering evaluation and preparation of the following report containing a summary of our conclusions and recommendations.

The opportunity to be of service is appreciated. Should any questions arise pertaining to any portion of this report, please contact this firm in writing for further clarification.

Respectfully submitted,

Soil Pacific, Inc.

Yones Kabir
President

Hoss Eftekhari
RCE

HOSS EFTEKHARI
No. C50121
EXP. 6-30-21

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Soil and Foundation Evaluation Report Update
Proposed Apartment Building
898, 900 and 914 West Lincoln Avenue, Anaheim, California

Prepared For:

Mr. Mike Bastani, MBA,
One League, No. 61000
Irvine, CA 92604

DEPARTMENT OF PUBLIC WORKS
DEVELOPMENT SERVICES
APPROVED
Cesar Morales, Associate Engineer
5/17/2021, 11:06:30 AM
ANAH-OTH2021-01364
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Prepared by:

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March 28, 2021
Project No. A-7075-19

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898, 900 and 914 West Lincoln Avenue, Anaheim, California

LIMITATIONS

Between exploratory excavations and/or field testing locations, all subsurface deposits, consequent of their anisotropic and heterogeneous characteristics, can and will vary in many important geotechnical properties. The results presented herein are based on the information in part furnished by others and as generated by this firm, and represent our best interpretation of that data benefiting from a combination of our earthwork related construction experience, as well as our overall geotechnical knowledge. Hence, the conclusions and recommendations expressed herein are our professional opinions about pertinent project geotechnical parameters which influence the understood site use; therefore, no other warranty is offered or implied.

All the findings are subject to field modification as more subsurface exposures become available for evaluations. Before providing bids, contractors shall make thorough explorations and findings. Soil Pacific Inc., is not responsible for any financial gains or losses accrued by persons/firms or third party from this project.

In the event the contents of this report are not clearly understood, due in part to the usage of technical terms or wording, please contact the undersigned in writing for clarification.

SECTION 1.0
PRELIMINARY EVALUATION

1.1 Site Description

The area covered by our investigation consists of parcels identified as 898, 900 and 914 West Lincoln Avenue, Anaheim, California, in a residential zone of the City of Anaheim.

The property is located about ½ a mile east of 5 interstate freeway, and one mile south of 91 freeway. The item property is a developed mixed use parcel rectangular in shape with an elongated axis in east-west direction. It comprises of building structures and conventional parking lot.

Adjacent properties are mixed use commercial and residential properties at the east, and south sides. Site access is from Lincoln Avenue and Illinois Street. The site elevation is in the order of 150 feet above MSL with a sheet flow toward the south-southwest.

1.2 Planned Land Use

It is understood that the proposed construction will consist of a newly designed multi- family (Apartment) building structure with associated garages and conventional driveway areas.

1.3 Field Exploration

A subsurface exploration program was performed under the direction of our staff engineer from SPI in November 2019. The exploration involved the excavation of four (4) exploratory borings (B-1, B-2, B-3 and B-4). Borings were limited to 12-15 feet below grade. The borings were advanced utilizing a truck-mounted, auger drill rig. Earth materials encountered within the exploratory borings were classified and logged by the field engineer in accordance with the visual-manual procedures of the Unified Soil Classification System (USCS), ASTM Test Standard D2488. Following our exploration, borings were loosely backfilled with the soil cuttings. The approximate locations of the exploratory borings are shown on the Exploration Location Map Figure A-1-1. Descriptive boring logs are presented in Appendix A.

1.4 Laboratory Testing

1.4.1. Classification

Soils were classified visually according to the Unified Soil Classification System. Moisture content and dry density determinations were made for the samples taken at various depths in the exploratory excavations. Results of moisture-density and dry-density determinations, together with classifications, are shown on the boring logs, Appendix A.

1.4.2 Expansion

An expansion index test was performed on a representative sample in accordance with the ASTM D-4829-21. A null expansion potential (EI=0) is anticipated for the encountered soils at the proposed sub-grade elevation (2-5 feet).

1.4.3 Direct Shear

Shear strength parameters are determined by means of strain-controlled, double plain, direct shear tests performed in general accordance with ASTM D-3080. Generally, three or more specimens are tested, each under a different normal load, to determine the effects upon shear resistance and displacement, and strength properties such as Mohr strength envelopes . The direct shear test is suited to the relatively rapid determination of consolidated drained strength properties because the drainage paths through the test specimen are short, thereby allowing excess pore pressure to be dissipated more rapidly than with other drained stress tests. The rate of deformation is determined from the time required for the specimen to achieve fifty percent consolidation at a given normal stress. The test can be made on all soil materials and undisturbed, remolded or compacted materials. There is however, a limitation on maximum particle size. Sample displacement during testing may range from 10 to 20 percent of the specimen’s original diameter or length.

The sample’s initial void ratio, water content, dry unit weight, degree of saturation based on the specific gravity, and mass of the total specimen may also be computed. The shear test results are plotted on the attached shear test diagrams and unless otherwise noted on the shear test diagram, all tests are performed on undisturbed, saturated samples.

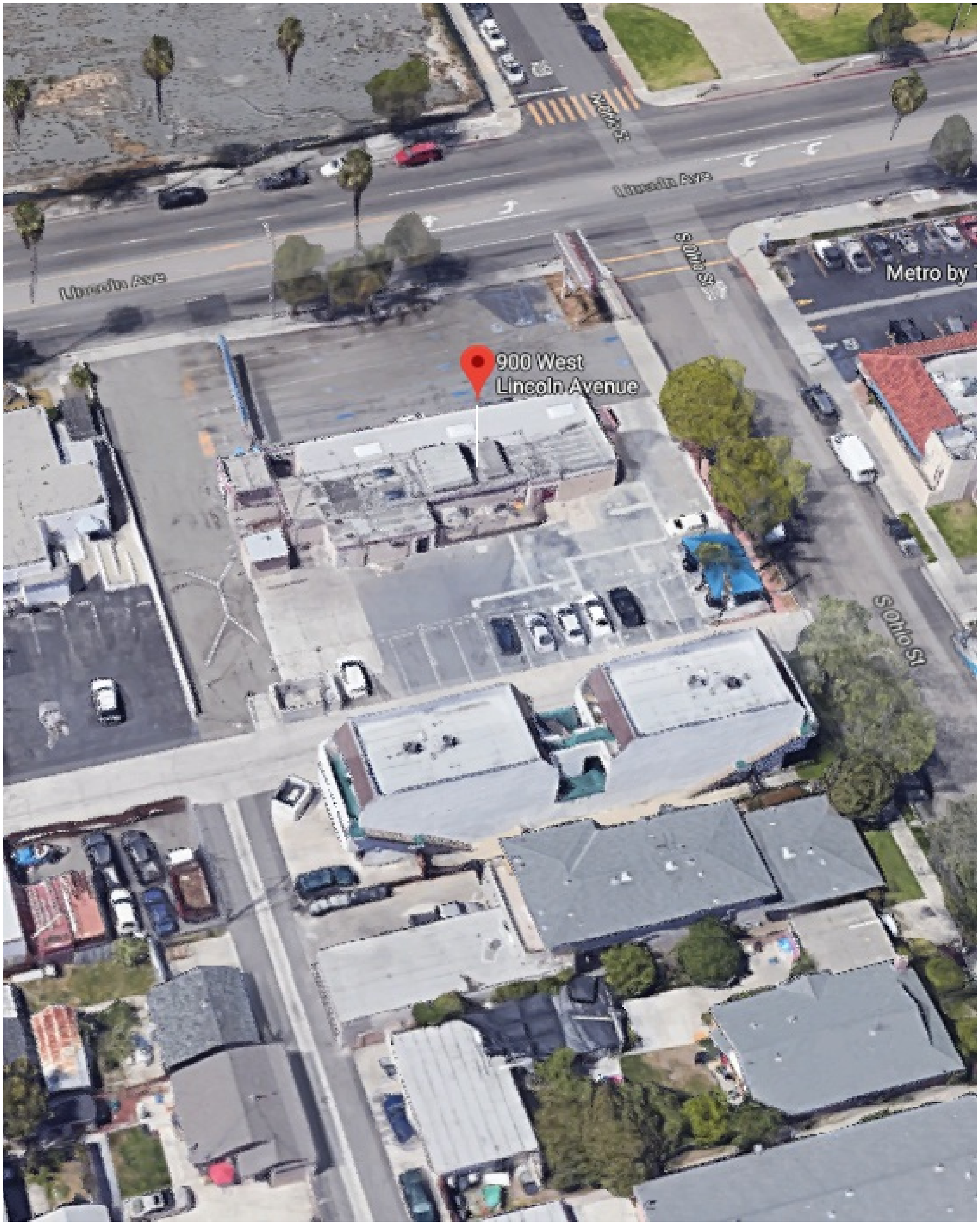

Fig. 1: Site aerial photo.

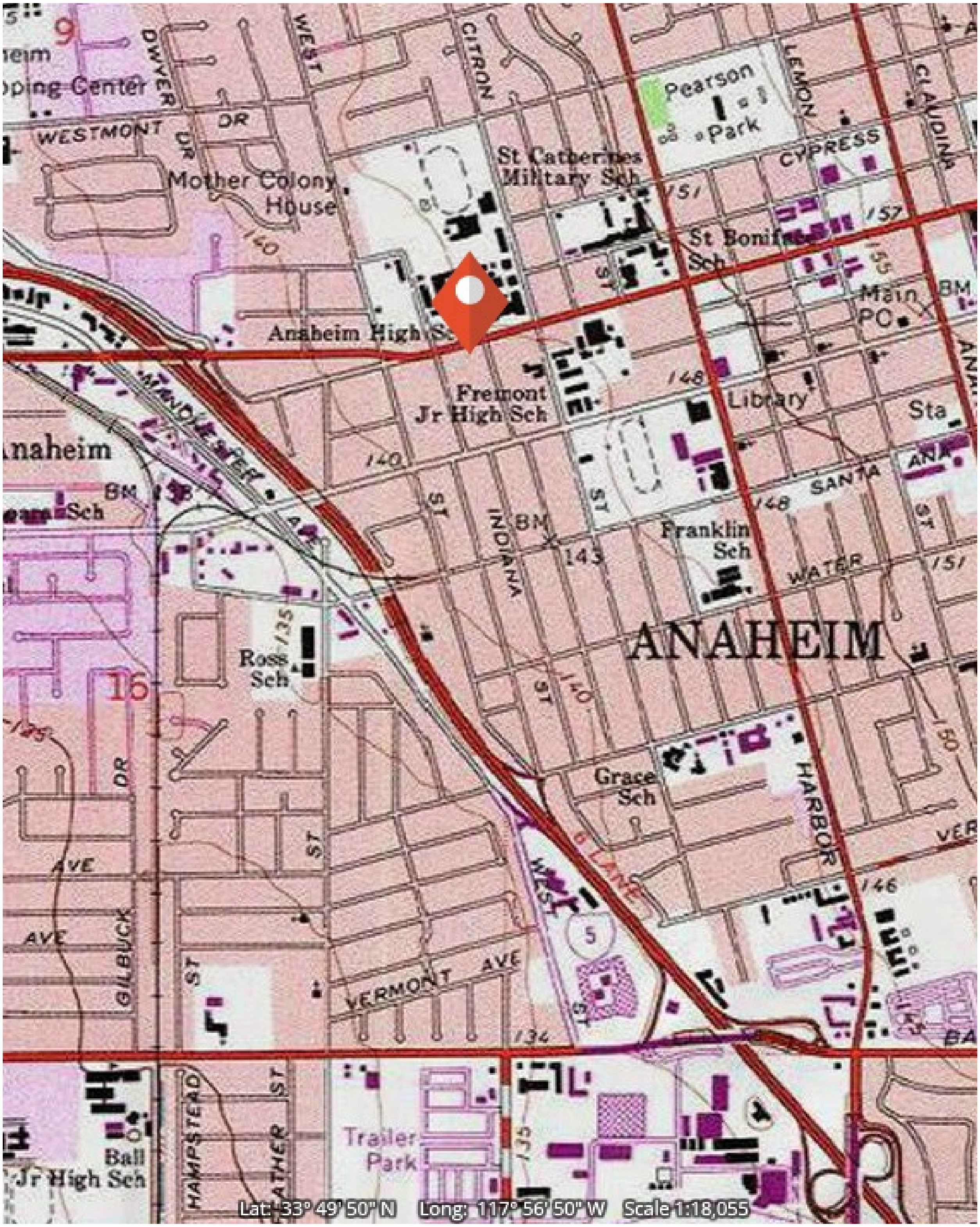

Figure 2: Site Topographic Map (USGS AAGS)

Figure 3: Geologic Map by USGS, AAGS

Section 2.0
Conclusions

The proposed construction is considered feasible from a soils engineering standpoint. All earthwork should be performed in accordance with applicable engineering recommendations presented herein or applicable Agency Codes, whichever are the most stringent.

2. 1 Earth Materials

The project site is a developed parcel. Our sub-surface exploration were limited to an accessible area, therefore, most of them were placed within paved parking areas. Encountered materials during our sub-surface exploration of B-1, B-2, B-3 and B-4 were mainly similar. Sub-surface boring exposed a paved section composed of 4 inches of asphalt over 2 inches of aggregate base underlain by a thin fill mantel to a maximum of 1.5 feet. Sandy native materials underline the fill blanket. Fill mantel was light grayish brown silty sand to sandy silt with fine sand and some silt.

Underlying the fill soils, native alluvial soils were explored to a maximum depth of 15 feet. These soils are classified as Holocene aged fan deposits (Qyf). Holocene aged soils in the area are in association with the Santa Ana River and Santiago Creek alluvial systems.

Native soils at this site were light brown, brown silty sand to sand with fine to medium grained. Encountered soil at about 10 feet depth indicated thin layer of wet sandy silt. Descriptions of subsurface soil profile are presented in the field exploration logs (Appendix A).

2.2 Foundations

The newly designed isolated pad or continuous foundation must be embedded into the firm and approved soils. The upper 3 feet of surficial soils were removed and recompacted. The certified fill soils will support the newly designed foundation. Cut and fill transition is not allowed.

2.3 Bearing Materials

The surficial soils to a depth of 2.5 feet are considered disturbed (Demolishing the existing foundation will disturb on-site soils). Such materials are not recommended to be used bearing materials.

2.4 Groundwater

The site is located within the Orange County Coastal Plain, (California Department of Water Resources, [CDWR], 2018). Groundwater depth varies within the area and flow direction beneath the subject site is toward the south-southwest. No groundwater wells were listed on the property; however, several groundwater wells are listed in the site vicinity.

During our investigation, no groundwater was encountered within 15 feet depth of sub-surface exploration. The depth of groundwater may fluctuate depending upon the time and period of the year.

2.5 CBC Seismic Design Parameters

Earthquake loads on earthen structures and buildings are a function of ground acceleration, which may be determined from the site-specific acceleration response spectrum. To provide the design team with the parameters necessary to construct the site-specific acceleration response spectrum for this project, we used two computer applications that are available on the United States Geological Survey (USGS) website, http://geohazards.usgs.gov/.

Specifically, the Design Maps website http://geohazards.usgs.gov/designmaps/us/application.php was used to calculate the ground motion parameters. And, the 2008 PSHA Interactive Deaggregation website http://geohazards.usgs.gov/deaggint/2008/ was used to determine the appropriate earthquake magnitude.

The printout attached in Appendix C provides parameters required to construct the site-specific acceleration response spectrum based on the 2018 CBC guidelines.

2.6 Chemical Contents

Chemical testing for detection of hydrocarbon or other potential contamination is beyond the scope of this report.

2.7 Liquefaction Study/ Secondary Seismic Hazard Zonation

Based on our review of the published Anaheim 7.5-minute quadrangle Hazard maps, the subject site is not located within an area having a potential for Liquefaction susceptibility. Liquefaction occurs when seismically-induced dynamic loading of a saturated sand or silt causes pore water pressures to increase to levels where grain-to-grain contact pressure is significantly decreased and the soil material temporarily behaves as a viscous fluid. Liquefaction can cause settlement of the ground surface, settlement and tilting of engineered structures, flotation of buoyant buried structures and fissuring of the ground surface. A common manifestation of liquefaction is the formation of sand boils (short-lived fountains of soil and water emerges from fissures or vents and leave freshly deposited conical mounds of sand or silt on the ground surface). Lateral spreading can also occur when liquefaction occurs adjacent to a free face such as a slope or stream embankment.

The types of seismically induced flooding that may be considered as potential hazards to a particular site normally includes flooding due to a tsunami (seismic sea wave), a seiche, or failure of a major reservoir or other water retention structure upstream of the site. The subjcet site has an average elevation of approximately 150 feet above sea level, and is not close to an enclosed body of water, the probability of flooding from a tsunami or seiche is considered to be low.

Section 3.0
Recommendations

Based on our exploration, and experience with similar projects, the proposed construction is considered feasible from a soils engineering standpoint providing the following recommendations are made part of the plans and are implemented during construction.

3.1 Clearing and Site Preparation

The existing building structure will be demolished and a newly designed slab-on-grade structure will be constructed. The following recommendation will be used in design of project grading plan by the Civil Engineer.

1. The areas to receive compacted fill should be stripped of all vegetation, construction debris and trashes, non engineered fill, left in place incompetent material up to approved soils. If soft spots are encountered, a project soil engineer will evaluate the site conditions and will provide necessary recommendations.

2. The exposed grade should then be overexcavated to a minimum of 3 feet. The excavated area should be scarified to a minimum of 8 inches, adjusted to optimum moisture content, and reworked to achieve a minimum of 90 percent relative compaction. Overexcavation within 5 feet of the adjacent buildings or public way require shoring or slot cut method A, B, and C.

3. Compacted fill should extend at least 5 feet beyond all perimeter footings or to a distance equal to the depth of the certified compacted fill, whichever is the greatest and feasible.

4. Compacted fill, consisting of on-site soil shall be placed in lifts not exceeding 6 inches in uncompacted thickness. The excavated onsite materials are considered satisfactory for reuse in the fill if the moisture content is near optimum. All organic material and construction debris should be removed and shall be segregated. Any imported fill should be observed, tested, and approved by the soils engineer prior to use as fill. Rocks larger than 6 inches in diameter should not be used in the fill.

5. The fill should be compacted to at least 90 percent of the maximum dry density for the material. The maximum density should be determined by ASTM Test Designation D 1557-00.

6. Field observation and compaction testing during the grading should be performed by a representative of Soil Pacific Inc. to assist the contractor in obtaining the required degree of compaction and the proper moisture content. Where compaction is less than required, additional compaction effort should be made with adjustment of the moisture content, as necessary, until a minimum of 90 percent relative compaction is obtained. The contractor is encouraged to survey the

adjacent building wall and note any existing distress on the walls or building if there are any. In such case, the contractor must note the observed distress and notify the owner or occupant of adjacent buildings' owner/s in writing.

Slot Cut

As recommended the maximum recommended height of R and R is about 3 feet below the existing grade. Surcharged excavations may cause distress or damage to the adjacent property fence wall when the proposed grading extend below a 1: 1 (45 degree) surcharge plane projected downward from the base of the existing residence foundations. In order to control any possible damages due to overexcvation, on-soil removal within 5 feet of the property boundary line shall be slot cut and fill.

In areas where existing structures are not undermined by the excavations, a temporary shoring device or slot-cutting will be employed. Where the surcharged excavation condition is present, we recommend that the proposed grading for R&R to be preceded by application of 'A, B and C' slot-cutting method having a maximum width of 6 foot. Maximum slot-cut depth will not exceed 4 feet in total height. In addition, we recommend that any slot-cut excavations be conducted under direct observation of this office representative. If any adverse conditions were encountered during excavations, additional remedial recommendations will be provided.

3.2 Site Preparation and Excavations

If any unanticipated subsurface improvements (pipe lines, irrigation lines, etc.) are encountered during earthwork construction, this office should be informed and appropriate remedial recommendations would subsequently be provided. During earthwork construction, all remedial removals, and the general grading and construction procedures of the contractor should be observed, and the fill selectively tested by a representative of this office. If unusual or unexpected conditions are exposed in the field, they should be reviewed by this office and if warranted, additional recommendations will be offered.

3.3 Stability of Temporary Cuts

The stability of temporary cuts required during removal process depends on many factors, including the slope angle, the shearing strength of the underlying materials, and the height of the cut and the length of time the excavation remains open and exposed to equipment vibrations and rainfall. The geotechnical consultant should be present to observe all temporary excavations at the site. The possibility of temporary excavations failing may be minimized by:

1) keeping the time between cutting and filling operations to a minimum;
2) limiting excavation length exposed at any one time; and,
3) cutting no steeper than a 1: 1 (h:v) inclination for cuts in excess of 4 feet in height.
4) or shoring prior to cut.

3.4 Foundations

The following recommendations may be used in preparation of the design and construction of the foundation system.

3.4.1 Bearing Value

Encountered soils are stiff and dense in place. The conventional footings, having a minimum width of 24 inches of embedment into approved materials should not exceed 2000 pounds per square foot. It can be increased to a maximum of 4000 psf . This bearing value may be increased by one-third for short duration (wind or seismic) loading.

3.4.2 Isolated Square Pad Footings

The minimum embedment for individual pad footings should be 24 inches below the lowest adjacent grade. Allowable bearing value is 2000 psf to a maximum of 4000 psf. The bearing value may be increased by 1/3 when considering short duration seismic or wind loads. In order to reduce the liquefaction potential at the site it is recommended that the slab to be tied to the foundation structurally per structural engineer justification.

3.4.3 Foundation Settlement

Based upon anticipated structural loads, the maximum total static settlement for the proposed foundation is not expected to exceed 1 inch at design load. Differential settlement between adjacent footings and lateral displacement of lateral resisting elements should not exceed 1/2 inch.

3.4.4 Concrete Type

Based on experience with similar projects in the area, Type II concrete should be used.

3.4.5 Slabs-on-grade

If slabs-on-grade is designed then it should be a minimum of 6 inches thickness. Slab areas that are to be carpeted or tiled, or where the intrusion of moisture is objectionable, should be underlain by a moisture barrier consisting of 15-mil Visqueen, properly protected from the puncture by four inches of gravel per Calgreen requirements. The slab should be reinforced by rebars no. 4 at 18 inches on center and shall be tied to the foundation.

3.5 Utility Trench Backfill

Utility trenches backfill should be placed in accordance with Appendix D. It is the owners' and contractors' responsibility to inform subcontractors of these requirements and to notify Soil Pacific when backfill placement is to begin.

3.6 Seismic Design and Construction

Construction should be in conformance with seismic design parameters of the latest edition of California Building Code (C.B.C. 2016) Please refer to the following table for related seismic design parameters.

SS (0.2 sec)	S1 (1.0 sec)	Soil Site Class	SDS (0.2 sec)	Fa	PGAm	Seismic Design Cat
1.87	.525	D	1.19	1.2	.758	II

3.7 Surface and Sub-surface Drainage Provisions

Proper surface drainage gradients are helpful in conveying water away from foundations and other improvements. Subsurface drainage provisions are considered essential in order to reduce pore-pressure build-up behind retaining structures. Ponding of water enhances infiltration of water into the local soils, and should not be allowed anywhere on the pad.

3.8 Conventional Retaining Wall

Retaining wall design and construction is not anticipated for the site. If a conventional retaining wall proposed then the following design criteria can be used for design of wall not exceeding 6 feet in total height. Any wall in excess of 6 feet should incorporate the seismic active load into the design.

1) Where a free standing structure is proposed, a minimum equivalent fluid pressure, for lateral soil loads, of 40 pounds per cubic foot may be used for design for onsite non expansive granular soils conditions and level backfill (10:1 or less). If the wall is restrained against free movement (= ± 1% of wall height) then the wall should be designed for lateral soil loads approaching the at-rest condition. Thus, for restrained conditions, the above value should be increased to 60 pcf. In addition, all retaining structures should include the appropriate allowances for any anticipated surcharge loads.

2) An allowable soil bearing pressure of 2000 lbs. per square foot may be used in design for footings imbedded a minimum of 24 inches below the lowest adjacent competent grade.

3) A friction coefficient of 0.35 between concrete and natural or compacted soil and a passive bearing value of 370 lbs. per square foot per foot of depth, up to a maximum of 2000 pounds per square foot at the bottom excavation level may be employed to resist lateral loads.

4) Back drain system will consisted of free-draining material consisting of at least 1 cubic foot of 3/4-inch crushed rock/ gravel should be utilized around pipe drains. If an open space greater than

1 foot exists between the back of the wall and the soil face, gravel backfill should be compacted by vibration. An impervious soil cap should be provided at the top of the wall backfill to prevent infiltration of surface waters into the back drain system. The cap may be a combination of concrete and/or compacted fine grained soils. The compacted backfill soil cap should be at least 1 foot thick when used in conjunction with a concrete slab type cap and at least 2 feet thick when used exclusively.

5) Any surcharges such as traffic and adjacent building loads shall be computed and adhered into the design by the structural engineer justification.

3.9 Concrete Driveway

1. The subgrade soils for all flatwork should be checked to have a minimum moisture content of 2 percentage points above the optimum moisture content to a depth of at least 18 inches. Paver design may be preferable. On site soils are expansive soils and will tend to react to the precipitation or landscaping water.

2. Local irrigation and drainage should be diverted from all flatwork areas. Area drains and swales should be utilized to reduce the amount of subsurface water intrusion beneath the foundation and flatwork areas. Planter boxes adjacent to buildings should be sealed on the bottom and edges to retard intrusion of water beneath the structure.

3. The concrete flatwork should have enough cold joints to prevent cracking. Adequate reinforcement considering the expansion potential is required. A minimum of rebar no. 4 placed at 18 inches on center must be used.

4. Surface and shrinkage cracking of the finished slab may be significantly reduced if a low slump and water-cement ratio is maintained during concrete placement. Excessive water added to concrete prior to placement is likely to cause shrinkage cracking.

5. Construction joints and saw cuts should be designed and implemented by the concrete contractor or design engineer based on the medium expansive soil conditions. Maximum joint spacing should not exceed 8 feet in any direction.

6. Patio or driveway subgrade soil should be compacted to a minimum of 90 percent to a depth of 18 inches. All run-off should be gathered in gutters and conducted off site in a non-erosive manner. Planters located adjacent to footings should be sealed, and leach water intercepted.

3.10 Pavement Section

Based on experience with the similar project, the pavement section for the light traffic having a traffic index of less than 5 can be design using a section including 4 inches asphalt concrete over 5 inches aggregate base II. As an alternative, 6 inches of reinforced concrete slab over 4 inches aggregate base will be adequate.

3.11 Drainage Control

Positive drainage should be provided around the perimeter of all structures to minimize water infiltrating into the underlying soils. Finish sub-grade adjacent to exterior footings should be sloped down and away to facilitate surface drainage. All drainage should be directed off-site to the street via non-erosive devices.

All roof run-off should be gathered in gutters and conducted, off site in a non-erosive manner. Planters located adjacent to footings should be sealed, and leach water intercepted.

3.12 On site Filtration

A boring shaft was used for on-site infiltration testing. Encountered materials are mainly sandy soils. On-site infiltration at the site is in excess of 5 inches an hour, where tested. A design rate of 2.5 inches per hour can be used to design an on-site infiltration basin.

3.13 Final Grading and Foundation Plan Review

Final design grading and foundation plans should be made available for review by this office. We urge that we are retained to review any modified portions of the plans and specifications that pertain to earthwork and foundations to determine whether they are consistent with our recommendations. In addition, we are available to observe construction, particularly the compaction of structural backfill and preparation of footing foundations, and such other field observations as may be necessary.

3.14 Observation and Testing

All grading and earthwork including trench backfill should be performed under the observation and testing of the consulting engineer for proper sub-grade preparation, selection of satisfactory materials, placement and compaction of all structural fill. Sufficient notification prior to stripping and earthwork construction is essential in order that the work will be adequately observed and tested.

Prior to initiation of grading, a meeting should be arranged by the developer and should be attended by representatives of the governmental agencies, contractors, consultants and the developer. Construction should be inspected at the following stages by the Geotechnical Consultant.

It is recommended that representative of **Soil Pacific, Inc.** be present to observe and test during the following stages of construction:

☐ Site grading to confirm proper removal of unsuitable materials and to observe and test the placement of fill.

☐ Inspection of all foundation excavations prior to placement of steel or concrete.

❒ During the placement of retaining wall subdrain and backfill materials.

❒ Inspection of all slab-on-grade areas prior to placement of sand, Visqueen.

❒ After trenches have been properly backfilled and compacted.

❒ When any unusual conditions are encountered.

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12. Varnes, David J., 1978, Slope Movement and Types and Processes in Landslides: Analysis and Control, Transportation Research Board, National Academy of Sciences, Wash D. C., Sp. Rpt. 176, Chap. 2.

13. Websites
   a. CDMG
   b. USGS. Earthquakes in Southern California
   c. ASCE
   d. AAGS

14. Anaheim 7.5 m Quadrangle | Seismic hazard zones map Anaheim Quadrangle, "Released: April 15, 1998.

15. Preliminary Digital Geological Map of the 30' X 60' Santa Ana Quadrangle, Southern California, version 2.0, Compiled by D. M. Morton.

APPENDIX A

Field Exploration

Log of Sub-surface Exploration

B-1

Std. Pen
Bulk/Bag
Ring
Elev. (feet)
Drive Wt:
Drop:
USCS Letter
Graphic
Laboratory

Equipment Type: D-7700		Boring # B-1
Diameter: 4"	Logged by:S.A	Date:11/25/19
Depth: 15 feet	G.water: - feet	Backfilled:Y

SPT N	M%	D.D.	USCS Letter	Description of Earth Materials
15			SM	Dark gray, brown fine grained silty sand with some gravel. Damp, Topsoil.
	10.5	110.5		
	8.6	109.9	SM	Dark brown, gray fine to medium grained silty sand/ sand with some silt, moderately dense, dense. Damp, Native.
18				
24	9.8	111.4		Gray, dark gray to brown, fine grained sand, silty sand. Dense and damp.
			SM	
			ML	Gray, light gray to brown fine grained sandy silt, wet to moist.
26	9.0	112.3	SM	
				Light brown, fine to corase grained sand, moist and dense.
				End of Boring 15 feet. Ground water not encountered.

Elev. (feet): 5 - 10 - 15 - 20 - 25 - 30 - 35 - 40 -

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.
Geotechnical and Environmental Services

Project Name:898-900-914 W. Lincoln, Anaheim, CA

Project Number: A-7075-19

Report Date:

Figure:

Log of Sub-surface Exploration

B-2

Std. Pen
Bulk/Bag
Ring
Drive Wt:
Drop:
USCS Letter
Graphic

Equipment Type: D-7700		Boring # B-2
Diameter: 4"	Logged by:S.A	Date:11/25/19
Depth: 15 feet	G.water: - feet	Backfilled:Y

Elev. (feet)	SPT N	Laboratory M%	Laboratory D.D.	USCS Letter	**Description of Earth Materials**
				SM	Dark gray, brown fine grained silty sand with some gravel. Damp, Topsoil.
	10 17	12.1 8.6	108.5 110.0	SM	Dark brown, gray fine to medium grained silty sand/ sand with some silt, moderately dense, dense. Damp, Native.
5	16	10.4	111.4	SM	Gray, dark gray to brown, fine grained sand, silty sand. Dense and damp.
				ML	Gray, light gray to brown fine grained sandy silt, wet to moist.
10	21	11.4	110.1	SM	Light brown, fine to corase grained sand, moist and dense.
15					
					End of Boring 15 feet. Ground water not encountered.
20					
25					
30					
35					
40					

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.
Geotechnical and Environmental Services

Project Name:898-900-914 W. Lincoln, Anaheim, CA

Project Number: A-7075-19

Report Date:

Figure:

Log of Sub-surface Exploration

B-3

Equipment Type: D-7700			Boring # B-3
Diameter: 4"		Logged by:S.A	Date:11/25/19
Depth: 12 feet		G.water: - feet	Backfilled:Y

Std. Pen Bulk/Bag Ring Elev. (feet)	Drive Wt: Drop: SPT N	Laboratory M%	Laboratory D.D.	USCS Letter	Graphic	Description of Earth Materials
				SM		Dark gray, brown fine grained silty sand with some gravel. Damp, Topsoil.
5				SM		Dark brown, gray fine to medium grained silty sand/ sand with some silt, moderately dense, dense. Damp, Native.
				SM		Gray, dark gray to brown, fine grained sand, silty sand. Dense and damp.
10				SM		Light brown, fine to corase grained sand, moist and dense.
15						
20						End of Boring 12 feet. Ground water not encountered.
25						
30						
35						
40						

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.
Geotechnical and Environmental Services

Project Name:898-900-914 W. Lincoln, Anaheim, CA

Project Number: A-7075-19

Report Date:

Figure:

Log of Sub-surface Exploration

B-4

Equipment Type: D-7700			Boring # B-4
Diameter: 4"	Logged by:S.A		Date:11/25/19
Depth: 12 feet	G.water: - feet		Backfilled:Y

Std. Pen Bulk/Bag Ring Elev. (feet)	Drive Wt: Drop: SPT N	Laboratory M%	Laboratory D.D.	USCS Letter	Graphic	**Description of Earth Materials**
				SM		Dark gray, brown fine grained silty sand with some gravel. Damp, Topsoil.
				SM		Dark brown, gray fine to medium grained silty sand/ sand with some silt, moderately dense, dense. Damp, Native.
5						
				SM		Gray, dark gray to brown, fine grained sand, silty sand. Dense and damp.
10				SM		Light brown, fine to corase grained sand, moist and dense.
15						
						End of Boring 12 feet. Ground water not encountered.
20						
25						
30						
35						
40						

Log depicts conditions at the time and location drilled.

Soil Pacific Inc.
Geotechnical and Environmental Services

Project Name:898-900-914 W. Lincoln, Anaheim, CA

Project Number: A-7075-19

Report Date:

Figure:

APPENDIX B

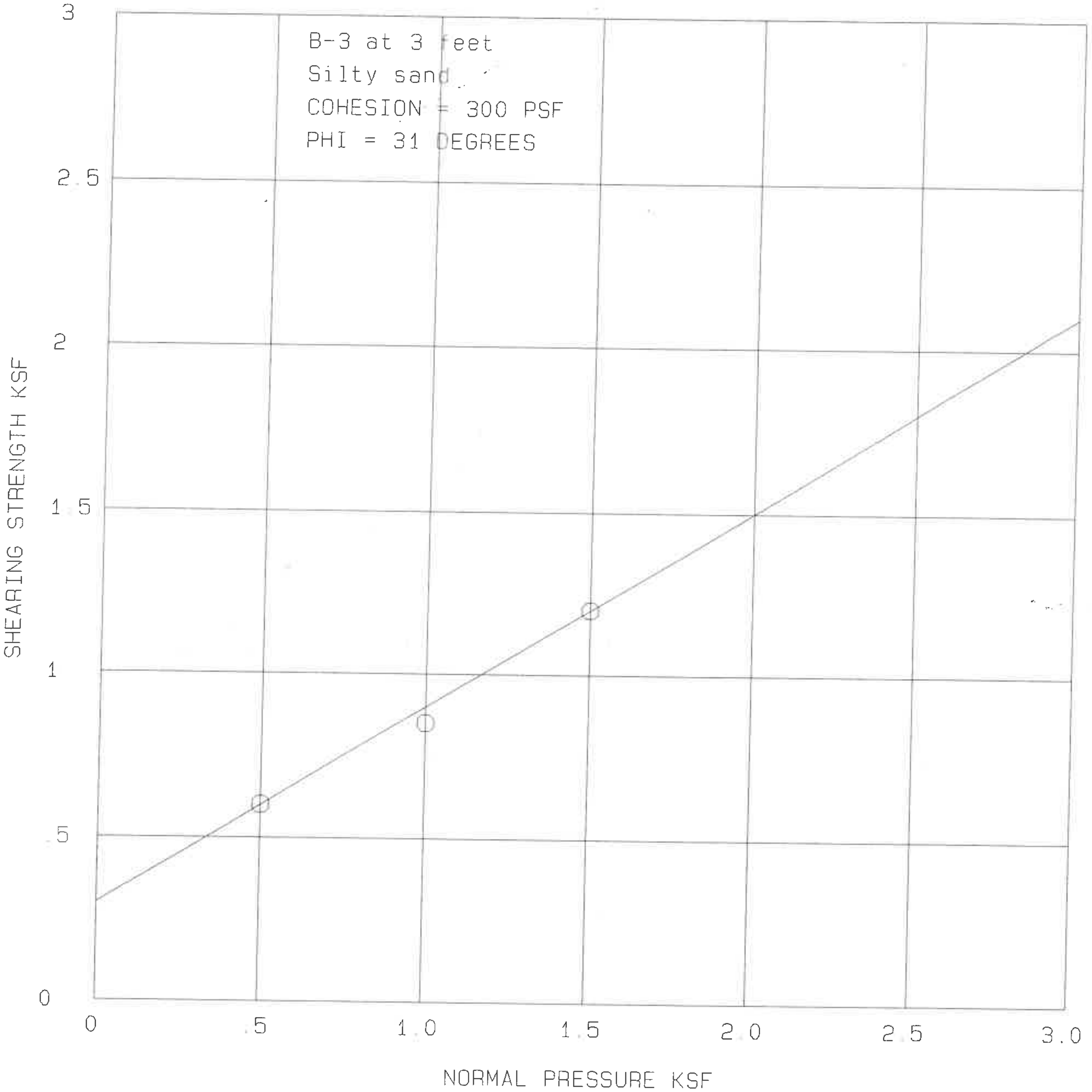
Laboratory

APPENDIX

SHEAR TEST DIAGRAM

J.O. A-7075-19

DATE 11/25/19



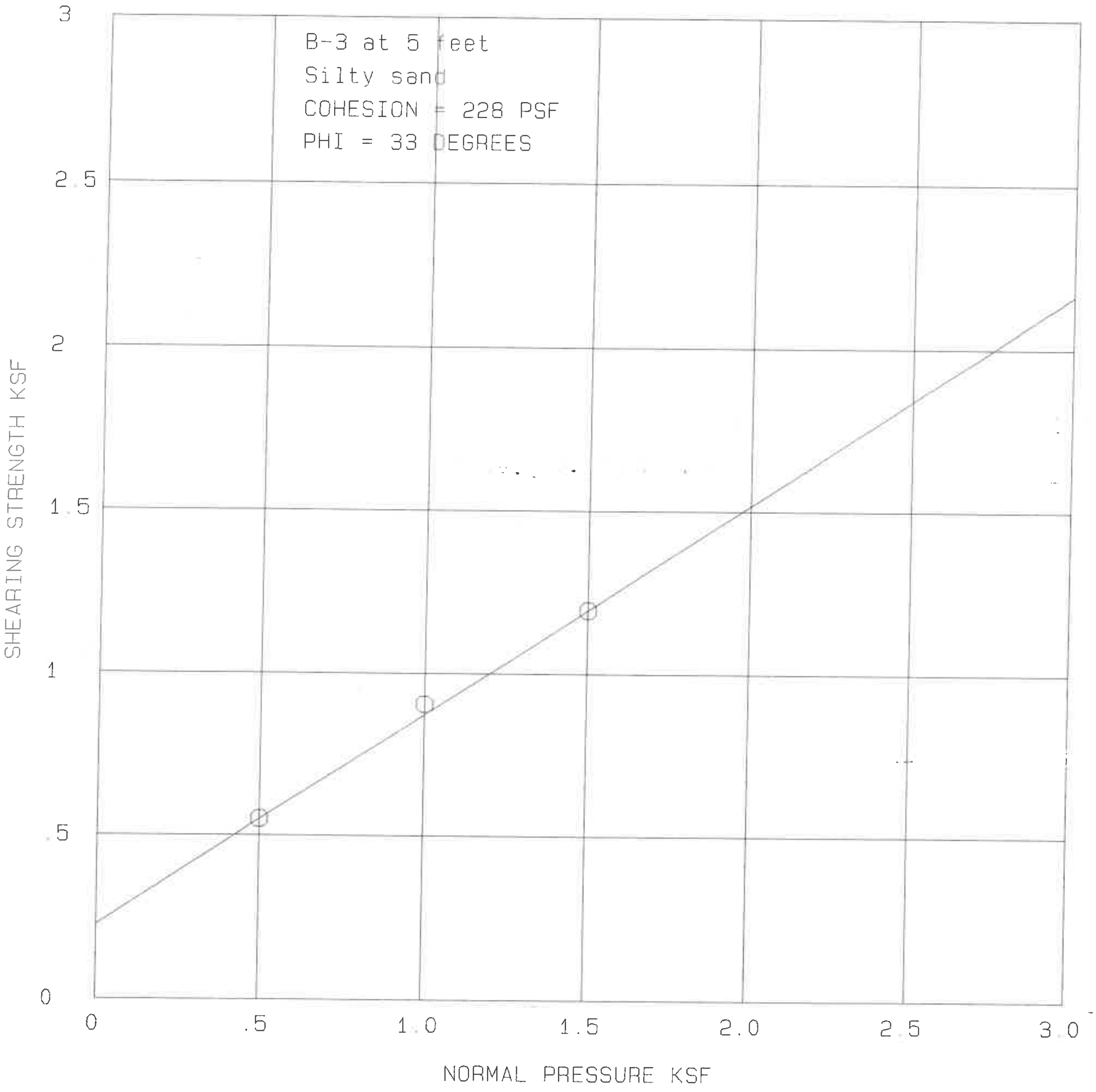
PLATE

APPENDIX

SHEAR TEST DIAGRAM

J.O. A-7075-19

DATE 11/25/19



PLATE

APPENDIX

BEARING VALUE ANALYSIS

J.O. A-7075-19

DATE 11/25/19

COHESION = 300 PSF GAMA = 120 PCF PHI = 31 DEGREES

DEPTH OF FOOTING = 1.5 FEET

BREADTH OF FOOTING = 1.25 FEET

FOOTING TYPE = CONTINUOUS

BEARING CAPACITY FACTORS

Nc = 32.7 Nq = 20.6 Ng = 21.6

FOOTING COEFFICIENTS

K1 = 1 K2 = .5

REFERENCE: TERZAGHI & PECK; 1967; 'SOIL MECHANICS IN ENGINEERING PRACTICE'. PAGES 217 TO 225.

FORMULA

ULIMATE BEARING = (K1 * Nc * C) + (K2 * GA * Ng * B) + (Nq * GA * D) = 15136.8

$$\text{ALLOWABLE BEARING} = \frac{\text{ULTIMATE BEARING}}{3} = 5045.6$$

THE ALLOWABLE BEARING VALUE SHOULD NOT EXCEED 5045.6 PSF. DESIGN SHOULD CONSIDER EXPANSION INDEX.

PLATE

APPENDIX

BEARING VALUE ANALYSIS

J.O. A-7075-19

DATE 11/25/19

COHESION = 300 PSF GAMA = 120 PCF PHI = 31 DEGREES

DEPTH OF FOOTING = 2 FEET

BREADTH OF FOOTING = 2 FEET

FOOTING TYPE = SQUARE

BEARING CAPACITY FACTORS

Nc = 32.7 Nq = 20.6 Ng = 21.6

FOOTING COEFFICIENTS

K1 = 1.2 K2 = .4

REFERENCE: TERZAGHI & PECK; 1967; 'SOIL MECHANICS IN ENGINEERING PRACTICE'; PAGES 217 TO 225.

FORMULA

ULTIMATE BEARING = (K1 * Nc * C) + (K2 * GA * Ng * B) + (Nq * GA * D) = 18789.1

ALLOWABLE BEARING = $\frac{\text{ULTIMATE BEARING}}{3}$ = 6263

THE ALLOWABLE BEARING VALUE SHOULD NOT EXCEED 6263 PSF. DESIGN SHOULD CONSIDER EXPANSION INDEX.

PLATE

APPENDIX

TEMPORARY BACKCUT STABILITY

J.O. A-7075-19

DATE 11/25/19

COHESION = 300 PSF GAMA = 120 PCF PHI = 31 DEGREES

CUT HEIGHT = 4 FEET

SOIL TYPE = Silty sand

BACKFILL ASSUMED TO BE LEVEL

PORE PRESSURE NOT CONSIDERED

FORMULA

$$\text{SAFETY FACTOR} = \frac{(C * L) + (GA * AREA * COS(Z) * TAN(PHI))}{GA * AREA * SIN(Z)} = 3.26$$

$$Z = 45 + (PHI/2)$$

SINCE THE SAFETY FACTOR OF 3.26 IS GREATER THAN THE REQUIRED 1.25, THE TEMPORARY EXCAVATION IS CONSIDERED TO BE STABLE. THIS IS WITH A LEVEL AREA EQUAL TO THE LENGTH OF THE VERTICAL CUT ABOVE THE CUT.

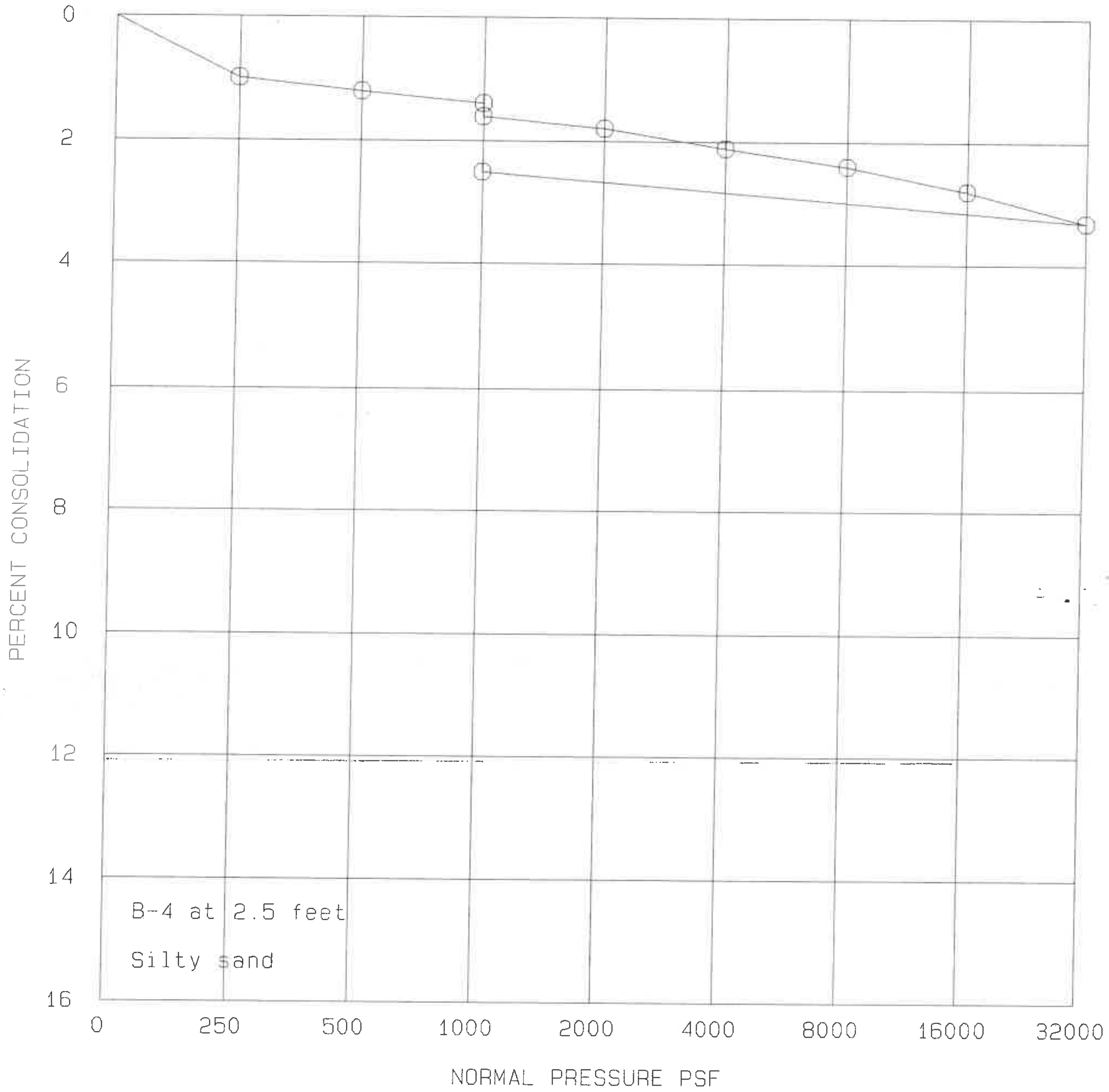
PLATE

SOFTWARE

CONSOLIDATION PRESSURE CURVE

J.O. A-7075-19

DATE 11/25/19



PLATE

Earth Pressure Calculations

Soil Strength Parameters:

$\phi := 31$

$\gamma := 120$

Active :

$$Ka := \tan\left[\left(45 - \frac{\phi}{2}\right) \cdot \left(\frac{\pi}{180}\right)\right]^2$$

Active earth Presure

$Ka = 0.32$

$Pa := Ka \cdot \gamma$

slope angle range, degrees

$Pa = 38.412$	LEVEL BACKFILL BEHIND WALL		$Pa = 38.412$
$Pa18 := Pa \cdot 1.08$	5:1	BACKFILL BEHIND WALL	$Pa18 = 41.485$
$Pa18 := Pa \cdot 1.22$	3:1	BACKFILL BEHIND WALL	$Pa18 = 46.862$
$Pa39 := Pa \cdot 1.48$	2:1	BACKFILL BEHIND WALL	$Pa39 = 56.85$

Passive

$$Kp := \tan\left[\left(45 + \frac{\phi}{2}\right) \cdot \left(\frac{\pi}{180}\right)\right]^2$$

$Kp = 3.124$

Pasive Earth Presure

$Pp := Kp \cdot \gamma$

$Pp = 374.884$

Atrest

$$Kat := 1 - \sin\left(\phi \cdot \frac{\pi}{180}\right)$$

$Kat = 0.485$

$Pat := Kat \cdot \gamma$

$Pat = 58.195$

Expansion Index ASTM D4829

Project No. A-7075-20
Depth 2-3 fee
Soil Type
SM

Molded Specimen

Wt of wet soil + contn. $Wtcws := 281$

Wt of dry soil + contn. $Wtcds := 266$

Wt of Container $Wtc := 81$

Wt of lost water $Wtw := Wtcws - Wtcds$

$Moisture1 := \frac{(Wtcws - Wtcds) \cdot 100}{Wtcds - Wtc}$ $Moisture1 = 8.108$ Percent

Wt of wet soil + ring $Wtwr := 618$

Wt of ring $Wtr := 206$

Wt of wet soil in the ring $Wtws := Wtwr - Wtr$

$$WTdensity := \frac{\frac{Wtws}{453.59}}{.00726}$$

$WTdensity = 125.111$

$SG := 2.7$

$$Drydensity := \frac{WTdensity}{1 + \frac{Moisture1}{100}}$$

$Drydensity = 115.728$

$$Saturation := \frac{(Moisture1 \cdot SG \cdot Drydensity)}{(SG \cdot 62.4) - Drydensity}$$

$Saturation = 48.027$

Mold (ring) AfterTest

Wt of ring and soil $Wtwm := 654$ Wt of ring plus dry soil ater test $Wtdm := 570$

$$Moisture2 := \frac{[(Wtwm - Wtr) - (Wtdm - Wtr)] \cdot 100}{(Wtwm - Wtr)}$$

$Moisture2 = 18.75$

Dial Reading Before $DialRB := 11$

$DialRfinal := 11$

Expansion index $EI := 0$

Porchet Method, Aka Inverse Borehole Method

$\Delta T := 40$ Time Interval 10 Minutes

$D0 := 10$ Initial Depth to Water, (inch)

$Df := 134$ Final Depth to Water, (inch)

$Dr := 144$ Total Depth of the Test Hole

$r := 4$ Test Hole Redius, Inch

$H0 := Dr - D0$ Initial height of water at the selected time interval

$H0 = 134$

$Hf := Dr - Df$ Final height of water at the selected time interval

$Hf = 10$

$\Delta H := H0 - Hf$ ΔH=ΔDChange in height over the time interval

$\Delta H = 124$

$$Havg := \frac{(H0 + Hf)}{2}$$

$Havg = 72$

The Conversion Equation is used:

$$It := \frac{\Delta H \cdot (60 \cdot r)}{\Delta T \cdot (r + 2Havg)}$$

$It = 5.027$

$$PRate := \frac{It}{2}$$

$PRate = 2.514$ inch /Hour

CALCULATION FOR SLOT CUT STABILITY

$c := .3$

$\phi := 31 \cdot deg$

$b := 4.77$

$\alpha := 45$

$\gamma := .120$

$H := 4$ height of cut

$d := 6$ width of cut

$q := 1$ surchrge

HC or depth of tension crack verfication (b)

$$HC := \frac{c}{(1.5) \cdot \gamma \cdot \sin(\alpha) \cdot \cos(\alpha) - \gamma \cdot \cos(\alpha)^2 \cdot \tan(\phi)}$$

$HC = 4.954$

$K := 1 - \sin(\phi)$ $S := \frac{1}{3}(\gamma) H K \cdot \tan(\phi) + c$ $A := \frac{(H \cdot b)}{2}$

$W := (A \cdot \gamma + q)$ $W = 2.145$

$S = 0.347$ $A = 9.54$

$\Delta F := A \cdot S$ $\Delta F = 3.307$

$$RF := d \cdot \left(W \cdot \cos(\alpha)^2 \cdot \tan(\phi) + c \cdot b\right) + 2 \cdot \Delta F$$

$$AF := d \cdot W \cdot \sin(\alpha) \cdot \cos(\alpha)$$

$$FS := \frac{RF}{AF}$$

$FS = 3.013$

Project No. A-7075-19

CALCULATION FOR SLOT CUT STABILITY

$c := .3$

$\phi := 31 \cdot \mathrm{deg}$

$b := 4.77$

$\alpha := 45$

$\gamma := .120$

$H := 4$ height of cut

$d := 6$ width of cut

$q := 1$ surchrge

HC or depth of tension crack verfication (b)

$$HC := \frac{c}{(1.5) \cdot \gamma \cdot \sin(\alpha) \cdot \cos(\alpha) - \gamma \cdot \cos(\alpha)^2 \cdot \tan(\phi)}$$

$HC = 4.954$

$K := 1 - \sin(\phi)$

$S := \frac{1}{3}(\gamma) H K \cdot \tan(\phi) + c$

$A := \frac{(H \cdot b)}{2}$

$W := (A \cdot \gamma + q)$ $W = 2.145$

$S = 0.347$ $A = 9.54$

$\Delta F := A \cdot S$ $\Delta F = 3.307$

$RF := d \cdot \left(W \cdot \cos(\alpha)^2 \cdot \tan(\phi) + c \cdot b\right) + 2 \cdot \Delta F$

$AF := d \cdot W \cdot \sin(\alpha) \cdot \cos(\alpha)$

$$FS := \frac{RF}{AF}$$

$FS = 3.013$

Project No. A-7075-19

CEM LAB

January 18, 2020 File No. CEM2020-103

Mr. Mike Bastani
1 League, No 61000
Anaheim, CA 92805

Subject: **FIRST REVIEW – PROPOSED MULTI FAMILY BUILDING (APARTMENT) AT:**
898-900-914 W. Lincoln Avenue, Anaheim, California
OTH2019-01234, A PDF copy of report submitted by email

Reference: **SOIL & FOUNDATION EVALUATION REPORT**
By Soil Pacific, Inc. Dated November 24, 2019
Project Number: A-7075-19

Dear Mr. Bastani,

CEM Laboratory Corporation reviewed the referenced report update on behalf of the City of Anaheim Building & Safety Division, for compliance with applicable codes, guidelines, and standards of practice.

Based on information provided in the report, we understand the proposed construction comprised of a multi-family (Apartment) building(s) with associated appurtenances such as garages, parking/driveways, trash enclosure etc. The construction will be of wood frame structures with conventional slab on grade, shallow/spread foundation system. All existing structures at the site to be completely demolished/removed.

The project site is relatively flat and is not located within a State of California Seismic Hazard Zone for liquefaction, earthquake-induced landslides or an earthquake fault zone (Formerly known as Alquist-Priolo Fault Zone).

Based upon a review of the referenced report, the Geotechnical Consultant is advised to adequately address the following peer review comments:

1. Referring to Page 6 under section 1.4.2 Expansion.
   "An expansion index test was performed on a representative sample of onsite soils at the proposed grade in accordance with the California Building Code." Please provide a reference (chapter & section) addressing procedural test method for determination of expansion index in accordance with the California Building Code.

2. Referring to Page 6 under section 1.4.2 Expansion.
   Please provide detailed/tabulated data for the expansion index testing performed. It should be mathematically substantiated per ASTM D 4829-11 and industry standards.

3. Referring to Geotechnical Plan (Figure A-1-1)
   Please discuss and provide a procedure for slot cutting delineated along the south and westerly property line. Moreover, discuss the adverse impact of the proposed development during and after the construction on adjacent properties.

4. The referenced report prepared by the consultant is dated November 24, 2019. However, the boring logs are dated
   November 25, 2019.

5. The referenced report prepared by the consultant is dated November 24, 2019. However, the engineering analysis and laboratory testing (direct shear, consolidation) are dated November 25, 2019

6. The referenced report prepared by the consultant is dated November 24, 2019. However, the ASCE/SEI 7-16 Hazards output Report is dated November 25, 2019

7. Referring to the boring log No. 3 and No. 4
   Evidently, bulk or undisturbed samples were not retrieved from the borings No. 3 and No. 4. In absence of necessary samples, please justify how laboratory testing such as direct shear tests and consolidation test were conducted a day after the report date?

8. Referring to the boring log No. 3 and No. 4
   We noticed the following discrepancies: Boring Depth: 15 ft, End of boring 12 ft which corresponds to 19 ft on the left column (elevation).

9. Referring to Appendix C (References)
   During our review, we were unable to locate the list of references. Per requirements of Appendix A, Guidelines by the City of Anaheim, all general and site-specific materials reviewed in conjunction with the report preparation should be referenced in the report.

10. Referring to page 11, section 2.5 Seismic Design Parameters
    The printout attached is per ASCE/SEI 7-16 standard superseding 2016 CBC

11. Referring to page 18, section 3.12 Onsite Filtration
    Please provide detailed/tabulated data for the percolation testing performed. It should be mathematically substantiated per industry standards in accordance with the applicable technical guidance.

Should you have any questions, please do not hesitate to contact us at your earliest convenience.

Respectfully submitted,
C.E.M. Laboratory Corporation

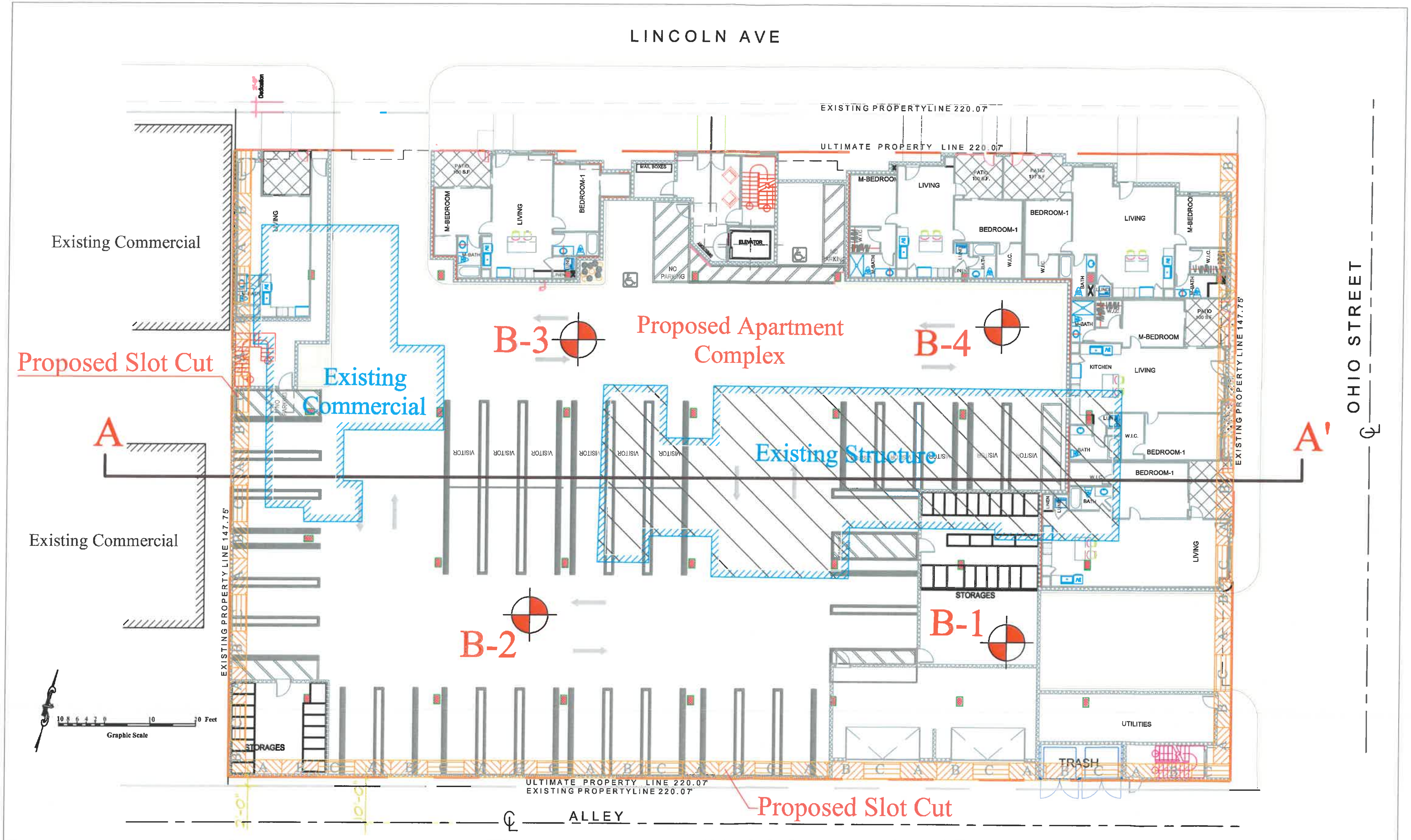
Reviewed By: A. Wahab Noori., P.E.

Limitations:

Our review is intended to determine if the submitted report(s) comply with City of Anaheim Codes and generally accepted geotechnical practices within the local area. The scope of our services for this third party review has been limited to a brief review of the above referenced report and associated documents, as supplied by the City of Anaheim. Re-analysis of reported data and/ or calculations and preparation of amended construction or design recommendations are specifically not included within our scope of services. Our review should not be considered as a certification, approval or acceptance of the consultant's work, nor is it meant as an acceptance of liability for final design or construction recommendations made by the geotechnical consultant of record or the project designers or engineers.

APPENDIX C

References



LEGEND

⊕ Soil Boring Location

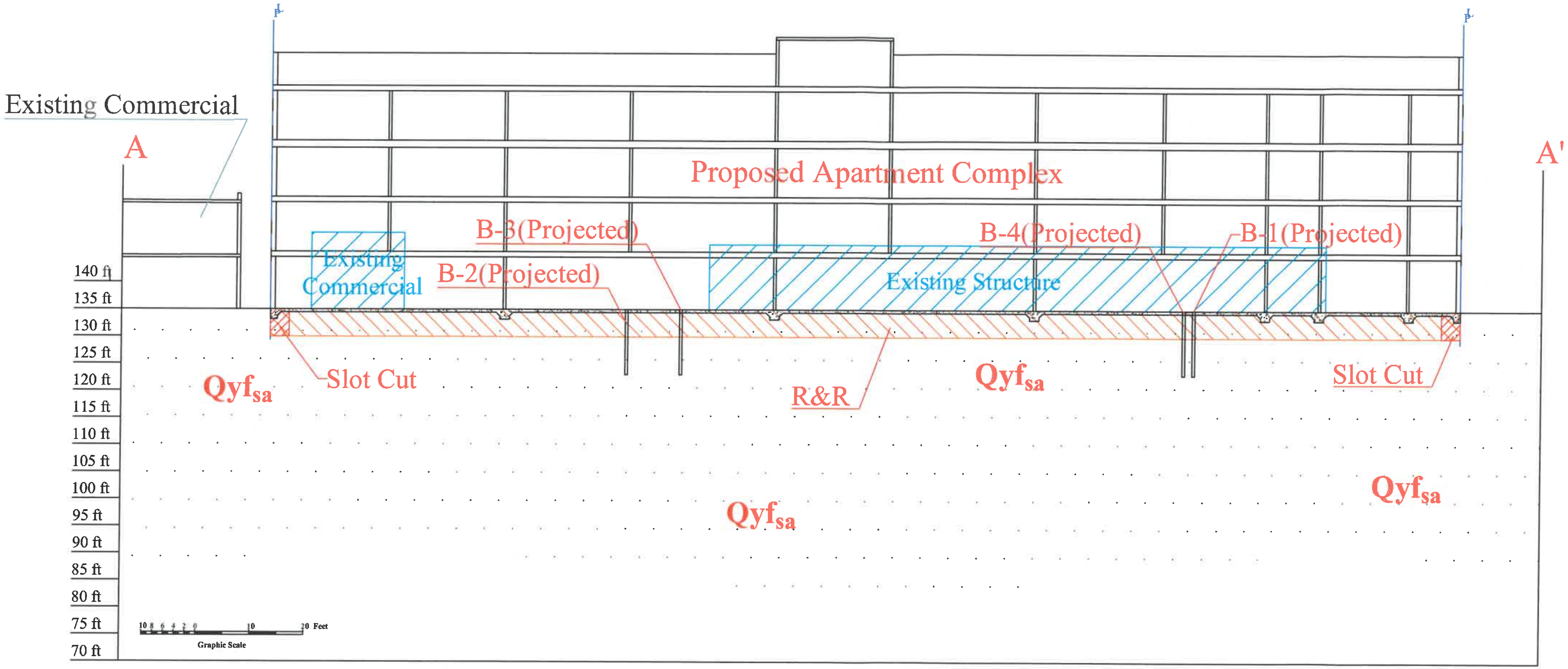
soil PACIFIC Inc.
Geotechnical & Environmental Services
675 N. Eckhoff, Suite # A
Orange, CA 92868

Project Location:
898, 900, 914 W Lincoln Ave,
Anahein, CA

GEOTECHNICAL PLAN

FIGURE-A-1-1 | PROJECT NO.:A-7075-19

DATE :11/21/2019 | SCALE: 1"=20'



LEGEND

Qyf_{sa} Young alluvial fan deposits
(Silty Sand)

soil PACIFIC Inc.
Geotechnical & Environmental Services
675 N. Eckhoff, Suite # A
Orange, CA 92868

Project Location:
898, 900, 914 W Lincoln Ave,
Anahein, CA

CROSS SECTION A-A'

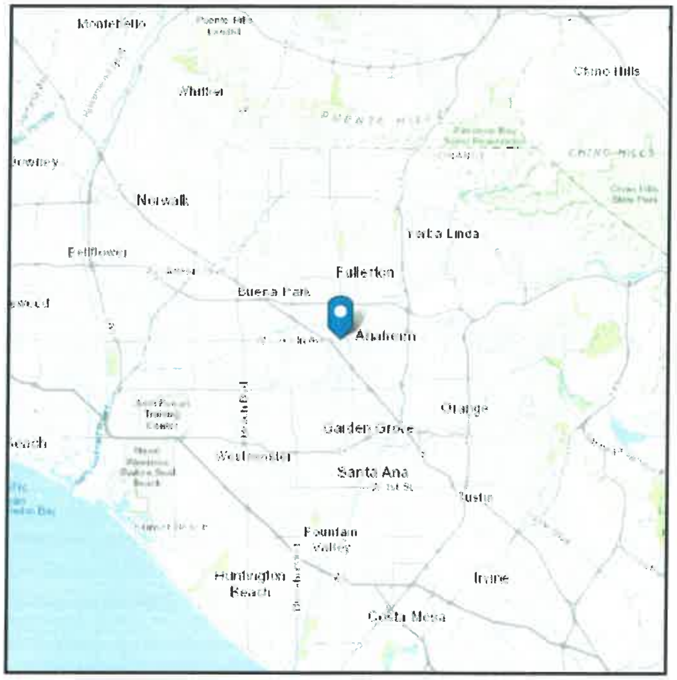
FIGURE-A-1-2
PROJECT NO.:A-7075-19
DATE :11/21/2019
SCALE: 1"=20'

ASCE 7 Hazards Report

Address:
914 W Lincoln Ave
Anaheim, California
92805

Standard: ASCE/SEI 7-16
Risk Category: II
Soil Class: D - Default (see Section 11.4.3)

Elevation: 147.49 m (NAVD 88)
Latitude: 33.832634
Longitude: -117.924805



Seismic

Site Soil Class: D - Default (see Section 11.4.3)

Results:

S_S :	1.487	S_{D1} :	N/A
S_1 :	0.525	T_L :	8
F_a :	1.2	PGA :	0.632
F_v :	N/A	PGA_M :	0.758
S_{MS} :	1.784	F_{PGA} :	1.2
S_{M1} :	N/A	I_e :	1
S_{DS} :	1.19	C_v :	1.397

Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8.

Data Accessed: Sun Mar 28 2021

Date Source: USGS Seismic Design Maps

The ASCE 7 Hazard Tool is provided for your convenience, for informational purposes only, and is provided “as is” and without warranties of any kind. The location data included herein has been obtained from information developed, produced, and maintained by third party providers; or has been extrapolated from maps incorporated in the ASCE 7 standard. While ASCE has made every effort to use data obtained from reliable sources or methodologies, ASCE does not make any representations or warranties as to the accuracy, completeness, reliability, currency, or quality of any data provided herein. Any third-party links provided by this Tool should not be construed as an endorsement, affiliation, relationship, or sponsorship of such third-party content by or from ASCE.

ASCE does not intend, nor should anyone interpret, the results provided by this Tool to replace the sound judgment of a competent professional, having knowledge and experience in the appropriate field(s) of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the contents of this Tool or the ASCE 7 standard.

In using this Tool, you expressly assume all risks associated with your use. Under no circumstances shall ASCE or its officers, directors, employees, members, affiliates, or agents be liable to you or any other person for any direct, indirect, special, incidental, or consequential damages arising from or related to your use of, or reliance on, the Tool or any information obtained therein. To the fullest extent permitted by law, you agree to release and hold harmless ASCE from any and all liability of any nature arising out of or resulting from any use of data provided by the ASCE 7 Hazard Tool.

APPENDIX D

General Grading Specifications

GENERAL EARTHWORK AND GRADING SPECIFICATIONS

1. GENERAL INTENT

These specifications present general procedures and requirements for grading and earthwork as shown on the approved grading plans, including preparation of areas to be filled, placement of fill, installation of subdrains, and excavations. The recommendations contained in the geotechnical report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict. Evaluations performed by the consultant during the course of grading may result in new recommendations of the geotechnical report.

2.EARTHWORK OBSERVATION AND TESTING

Prior to the commencement of grading, a qualified geotechnical consultant (soils engineer and engineering geologist, and their representatives) shall be employed for the purpose of observing earthwork and testing the fills for conformance with the recommendations of the geotechnical report and these specifications. It will be necessary that the consultant provide adequate testing and observation so that he may determine that the work was accomplished as specified. It shall be the responsibility of the contractor to assist the consultant and keep him apprised of work schedules and changes so that he may schedule his personnel accordingly.

It shall be the sole responsibility of the contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If in the opinion of the consultant, unsatisfactory conditions, such as questionable soil, poor moisture condition, inadequate compaction, adverse weather, etc., are resulting in a quality of work less than required in these specifications, the consultant will be empowered to reject the work and recommend that construction be topped until the conditions are rectified. Maximum dry density tests used to determine the degree of compaction will be performed in accordance with the American Society of Testing and Materials tests method ASTM D 1557-00.

3.0 PREPARATION OF AREAS TO BE FILLED

3.1 Clearing and Grubbing: All brush, vegetation and debris shall be removed or piled and otherwise disposed of.

3.2 Processing: The existing ground which is determined to be satisfactory for support of fill shall be scarified to a minimum depth of 6 inches. Existing ground which is not satisfactory shall be overexcavated as specified in the following section. Scarification shall continue until the soils are broken down and free of large clay lumps or clods and until the working surface is reasonably uniform and free of uneven features which would inhibit uniform compaction.

3.3 Overexcavation: Soft, dry, spongy, highly fractured or otherwise unsuitable ground, extending to such a depth that the surface processing cannot adequately improve the condition, shall be overexcavated down to firm ground, approved by the consultant.

3.4 Moisture Conditioning: Overexcavated and processed soils shall be watered, dried-back, blended, and/or mixed, as required to attain a uniform moisture content near optimum.

3.5 Recompaction: Overexcavated and processed soils which have been properly mixed and moisture- conditioned shall be recompacted to a minimum relative compaction of 90 percent.

3.6 Benching: Where fills are to be placed on ground with slopes steeper than 5: 1 (horizontal to vertical units), the ground shall be stepped or benched. The lowest bench shall be a minimum of 15 feet wide, shall be at least 2 feet deep, shall expose firm material, and shall be approved by the consultant. Other benches shall be excavated in firm material for a minimum width of 4 feet. Ground sloping flatter than 5 : 1 shall be benched or otherwise overexcavated when considered necessary by the consultant.

3.7 Approval: All areas to receive fill, including processed areas, removal areas and toe-of-fill benches shall be approved by the consultant prior to fill placement.

4.0 FILL MATERIAL

4.1 General: Material to be placed as fill shall be free of organic matter and other deleterious substances, and shall be approved by the consultant. Soils of poor gradation, expansion, or strength characteristics shall be placed in areas designated by consultant or shall be mixed with other soils to serve as satisfactory fill material.

4.2 Oversize: Oversize material defined as rock, or other irreducible material with a maximum dimension greater than 12 inches, shall not be buried or placed in fills, unless the location, materials, and disposal methods are specifically approved by the consultant. Oversize disposal operations shall be such that nesting of oversize material does not occur, and such that the oversize material is completely surrounded by compacted or densified fill. Oversize material shall not be placed within 10 feet vertically of finish grade or within the range of future utilities or underground construction, unless specifically approved by the consultant.

4.3 Import: If importing of fill material is required for grading, the import material shall meet the requirements of Section 4. 1.

5.0 FILL PLACEMENT AND COMPACTION

5.1 Fill Lifts: Approved fill material shall be placed in areas prepared to receive fill in near-horizontal layers not exceeding 6 inches in compacted thickness. The consultant may approve thicker lifts if testing indicates the grading procedures are such that adequate compaction is being achieved with lifts of greater thickness. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to attain uniformity of material and moisture in each layer.

5.2 Fill Moisture: Fill layers at a moisture content less than optimum shall be watered and mixed, and wet fill layers shall be aerated by scarification or shall be blended with drier material. Moisture-conditioning and mixing of fill layers shall continue until the fill material is at a uniform moisture content or near optimum.

5.3 Compaction of Fill: After each layer has been evenly spread, moisture conditioned, and mixed, it shall be uniformly compacted to not less than 90 percent of maximum dry density. Compaction equipment shall be adequately sized and shall be either specifically designed for soil compaction or of proven reliability, to efficiently achieve the specified degree of compaction.

5.4 Fill Slopes: Compaction of slopes shall be accomplished, in addition to normal compacting procedures, by backfilling of slopes with sheepsfoot rollers at frequent increments of 2 to 3 feet in fill elevation gain, or by other methods producing satisfactory results. At the completion of grading, the relative compaction of the slope out to the slope face shall be at least 90 percent.

5.5 Compaction Testing: Field tests to check the fill moisture and degree of compaction will be performed by the consultant. The location and frequency of tests shall be at the consultant's discretion. In general, the tests will be taken at an interval not exceeding 2 feet in vertical rise and/or 1,000 cubic yards of embankment.

6.0 SUBDRAIN INSTALLATION

Subdrain systems, if required, shall be installed in approved ground to conform to the approximate alignment and details shown on the plans or herein. The subdrain location or materials shall not be changed or modified without the approval of the consultant. The consultant, however, may recommend and upon approval, direct changes in subdrain line, grade or material. All subdrains should be surveyed for line and grade after installation, and sufficient time shall be allowed for the surveys, prior to commencement of filling over the subdrains.

7.0 EXCAVATION

Excavation and cut slopes will be examined during grading. If directed by the consultant, further excavation or overexcavation and refilling of cut areas shall be performed, and/or remedial grading of cut slopes shall be performed. Where fill-over-cut slopes are to be graded, unless otherwise approved, the cut portion of the slope shall made and approved by the consultant prior to placement of materials for construction of the fill portion of the slope.

8.0 TRENCH BACKFILLS

8.1 Supervision: Trench excavations for the utility pipes shall be backfilled under engineering supervision.

8.2 Pipe Zone: After the utility pipe has been laid, the space under and around the pipe shall be backfilled with clean sand or approved granular soil to a depth of at least one foot over the top of the pipe. The sand backfill shall be uniformly jetted into place before the controlled backfill is placed over the sand.

8.3 Fill Placement:'The onsite materials, or other soils approved by the engineer, shall be watered and mixed as necessary prior to placement in lifts over the sand backfill.

8.4 Compaction: The controlled backfill shall be compacted to at least 90 percent of the maximum laboratory density as determined by the ASTM compaction method described above.

8.5 Observation and 'Testing: Field density tests and inspection of the backfill procedures shall be made by the soil engineer during backfilling to see that the proper moisture content and uniform compaction is being maintained. The contractor shall provide test holes and exploratory pits as required by the soil engineer to enable sampling and testing.