RIDGELINE ENGINEERING

SOILS INVESTIGATION REPORT

SELF-STORAGE SITE DEVELOPMENT

PROJECT NO: 22E-050
LOCATION: 12050 Itoya Vista Rd
Apple Valley, CA 92308

December 27, 2022

PREPARED FOR:
Stephanie Davis
RKAA Architects, Inc.
2233 E Thomas Road
Phoenix, AZ 85016

PREPARED BY:
Ridgeline Engineering
2769 Boeing Way
Stockton, California 95206
(209) 955-0110

SELF-STORAGE SITE DEVELOPMENT
12050 ITOYA VISTA RD
APPLE VALLEY, CA 92308

TABLE OF CONTENTS

I. INTRODUCTION

Ridgeline Engineering (RLE) has completed a site soils investigation in preparation of a new commercial building, located on 12050 Itoya Vista Rd in Apple Valley, CA. The purpose of the investigation was to explore the existing site conditions and to provide recommendations as they relate to the proposed development.

A. SCOPE OF WORK

The agreed upon scope of services for this project are as follows:

1. review of site conditions and records
2. subsurface exploration by means of drilling and sampling at three locations
3. laboratory testing of samples, analysis of results, and report preparation

B. PROJECT INTENT

It is understood that the project will consist of the design and construction a new building. The building is assumed to primarily consist of a bearing wall system with strip footings and some isolated column footings. The remainder of the site will consist of flatwork, landscaping, and driveway.

The site is relatively flat with bushes. Excavations and fills are expected to be less three feet.

II. FINDINGS

A. SITE OVERVIEW

The subject site is located on Bear Valley Rd in Apple Valley, CA. (Figure 1). The site is bounded on the Itoya Vista Rd on the east and Bear Valley Rd to the north. At the time of the field exploration on August 11th, 2022, the site had a few bushes scattered around the site.

B. HISTORICAL RECORDS REVIEW

A review of available historical records indicates the site conditions have not changed since the earliest aerial photographic evidence taken in 1946. Based on the available historical records, there is no evidence found of any existing foundation or building previously on the site.

C. SUBSURFACE CONDITIONS

Three exploratory borings were drilled at the site on August 11th, 2022. The borings were taken at the locations shown on the attached Site Map (Figure 2). At the completion of drilling, the borings were backfilled.

Groundwater was not encountered during the subsurface explorations.

III. CONCLUSIONS

A. SOIL BEARING CAPABILITY

It is RLE's opinion that the native soils will have the ability to adequately support the proposed development. However, proper compaction and moisture conditioning of the surface and near-surface soils will be necessary to provide sufficient support to the building foundation and surrounding flatwork and pavement sections. Use of engineered fill may also be acceptable, when approved as needed.

B. SEISMIC DESIGN CRITERIA

The following seismic parameters are based on criteria identified in the American Society of Civil Engineers (ASCE) Standard 7-16 for seismic design and were determined using the site latitude and longitude and data obtained by the United States Geological Survey (USGS):

SITE LOCATION			
Latitude:	38.25508264	Longitude:	-120.35343432
Factor/Coefficient		**Table/Figure**	**Value**
Short-Period MCE at 0.2 seconds	S_s	Figure 22-1	1.205 g
1.0 second Period MCE	S_1	Figure 22-2	0.459 g
Soil Class	Site Class	Table 20.3-1	Null
Site Coefficient	F_a	Table 11.4-1	1.2
Site Coefficient	F_v	Table 11.4-2	Null
Adjusted MCE Spectral Response Parameters	S_{MS}	Equation 11.4-1	1.446 g
	S_{M1}	Equation 11.4-2	Null
Design Spectral Acceleration Parameters	S_{DS}	Equation 11.4-3	0.964
	S_{D1}	Equation 11.4-4	Null
Seismic Design Category	Risk Category (I to IV)	Table 11.6-1	II
	Risk Category (I to IV)	Table 11.6-2	II

Notes: MCE – Maximum Considered Earthquake; g- gravity

Table 1: ASCE 7-16 SEISMIC DEISGN PARAMETERS

IV. RECOMMENDATIONS

A. GENERAL

The recommendations in this report assume that excavations and fills will be less than three feet and that construction will occur in the dry months (late spring to fall).

A representative from RLE should be present during all site preparation operations and foundation construction to ensure compliance with our recommendations.

B. SUBGRADE PREPARATION

The site should be cleared of all debris and the surface should be stripped of all vegetation.

For the budling foundation native soil should be over excavated by 12 inches in depth extended 5 feet from the perimeter, scarified, moisture conditioned, and compacted at 90% of the maximum dry density. All compacted soil shall have less than 2" aggregate size. Depth of scarification of subgrade may vary depending on seasonal fluctuations. The moisture content and compaction of the subgrade should be maintained as described above until the construction of the foundation is complete. Any imported fill and native subgrade soil should be evenly brought to optimum moisture content and uniformly compacted per ASTM D1557 in 6-inch lifts. A minimum of 4-inch layer of ¾-1 inch crushed rock should be placed over the compacted soils. A moisture/vapor barrier consisting of polyolefin at least 15 mil thick should be placed over the crushed rock. It is essential that the polyolefin sheet is overlapped 6 inches or more with no heavy traffic allowed on the prepared pad prior to pour. Efforts to prevent punctures through the polyolefin sheet shall be made and patch any holes created.

The upper 6 inches of the flatwork subgrades should be evenly brought to optimum moisture content and uniformly compacted to no less than 90% of the maximum dry density. The subgrade should be kept in a moist condition and final compaction should be

performed just before placement of aggregate base. A minimum of 2 inches of aggregate base should be placed for all surrounding flatwork. Aggregate bases shall be compacted to no less than 95% of the maximum dry density.

C. FOUNDATION DESIGN

Foundations that are bearing on existing compacted soil may be designed for a maximum allowable soil bearing pressure of 1,600 pounds per square foot (psf) for gravity load combinations and 2,000 psf for lateral load combinations. All footings should extend at least 18 inches below the lowest adjacent pad grade and have a width no less than 16 inches. Slab should be a minimum of 4 inch thick and contain appropriate reinforcement (min. ratio of 0.003) and joints to control cracking and should be placed over a vapor barrier over at least a 4-inch-thick layer of ¾-1 inch crushed rock.

D. EXTERIOR FLATWORK

All flatwork should be at least 3.5 inches thick, should contain appropriate reinforcement and joints to control cracking, and should be placed over at least a 2-inch-thick layer of gravel.

Standard practices, set forth by the Portland Cement Association (PCA), should be followed for the placement, curing, joint depth spacing, construction, and placement of concrete during exterior flatwork construction.

E. SITE DRAINAGE

Grades should slope away from the building with a minimum slope of 2% for at least 5 feet to prevent moisture collection adjacent to and beneath the foundation.

V. LIMITATIONS

The conclusions and recommendations provided in this report are based on the project intent, publicly available records, and results obtained from laboratory testing of the collected samples. This information is assumed to be representative of the entire site as it is not feasible to test every location of the site at every depth. Any conditions encountered that are contrary to the findings and recommendations in this report should be reported to RLE immediately. Although every effort has been made to provide a thorough investigation, no warranty is given.

This report will expire in 3 years and will need to be updated if construction has not been completed by that time.

A. GENERAL INFORMATION

The geotechnical engineering report for the proposed building to be constructed on12050 Itoya Vista Rd, California was authorized by RKAA Architects, Inc. This authorization was for the investigation described in the proposal letter sent to RKAA Architects, Inc.

B. FIELD EXPLORATION

On August 11th, 2022, three borings were hand drilled at locations indicated on the site map attached to this report (Figure 2). A disturbed sample was recovered from boring 1 due to loose soil conditions. Relatively undisturbed samples were recovered from boring 2 and boring 3 using a 2-inch inside diameter sample puller. ASTM D1452 utilizes a sample extractor that was driven by a 10-pound hammer free falling from 3 feet. The number of blows of the hammer required to drive the sampler each was recorded. The penetration resistance or “blow count” is found to be the sum of the blows required to drive the sampler the 6-inchs the length of the sample chamber.

The samples were stored in 2-inch diameter by 6-inch long thin-walled plastic tube. Following standard operating procedures, the soils were visually classified by the field engineer and ends of the tubes were sealed immediately. All samples were then taken to the laboratory for additional soil classification and testing.

Boring logs describing the soils found in each boring location can be found in Figures 3, 4, and 5. The California Department of Transportation's Unified Soil Classification System that was used can be found in Figure 6.

C. LABORATORY TESTING

Per ASTM D4959, relatively undisturbed samples were tested to determine the natural moisture content and the dry unit weight.

Per ASTM D422, a soil sample was subjected to particle size distribution testing for soil classification.

Per ASTM 1452, soil samples were hand augured and extracted relatively undisturbed.

Per ASTM D4318, Standard Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils

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Respectfully,

Jordan Baldwin, PE,
Principal Engineer

FIGURES

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P.209.955.0110 | F.209.955.0220

LOG OF TEST BORING

Figure 3

Borehole: 1

PROJECT NUMBER: 22E-050
DATE DRILLED: 8/11/22
PROJECT NAME: Self-Storage Truck Parking Lot
GROUND SURFACE ELEVATION: 0.0 Feet
LOCATION: Apple Valley, CA 92308

Depth, ft.	Sample	Sampling Method	Water Content, %	Dry Density, pcf	Blow Counts	Blow Count Histogram 10 LB@5'	Ground Water	Soil Lithology	Soil Lithology Description	Notes
0										
1										
2		CM	6.6		70				SP: Poorly graded sand, gravelly sands, little or no fines	LL = 20.90
3										
4										
5										
6										
7										
8										
9										

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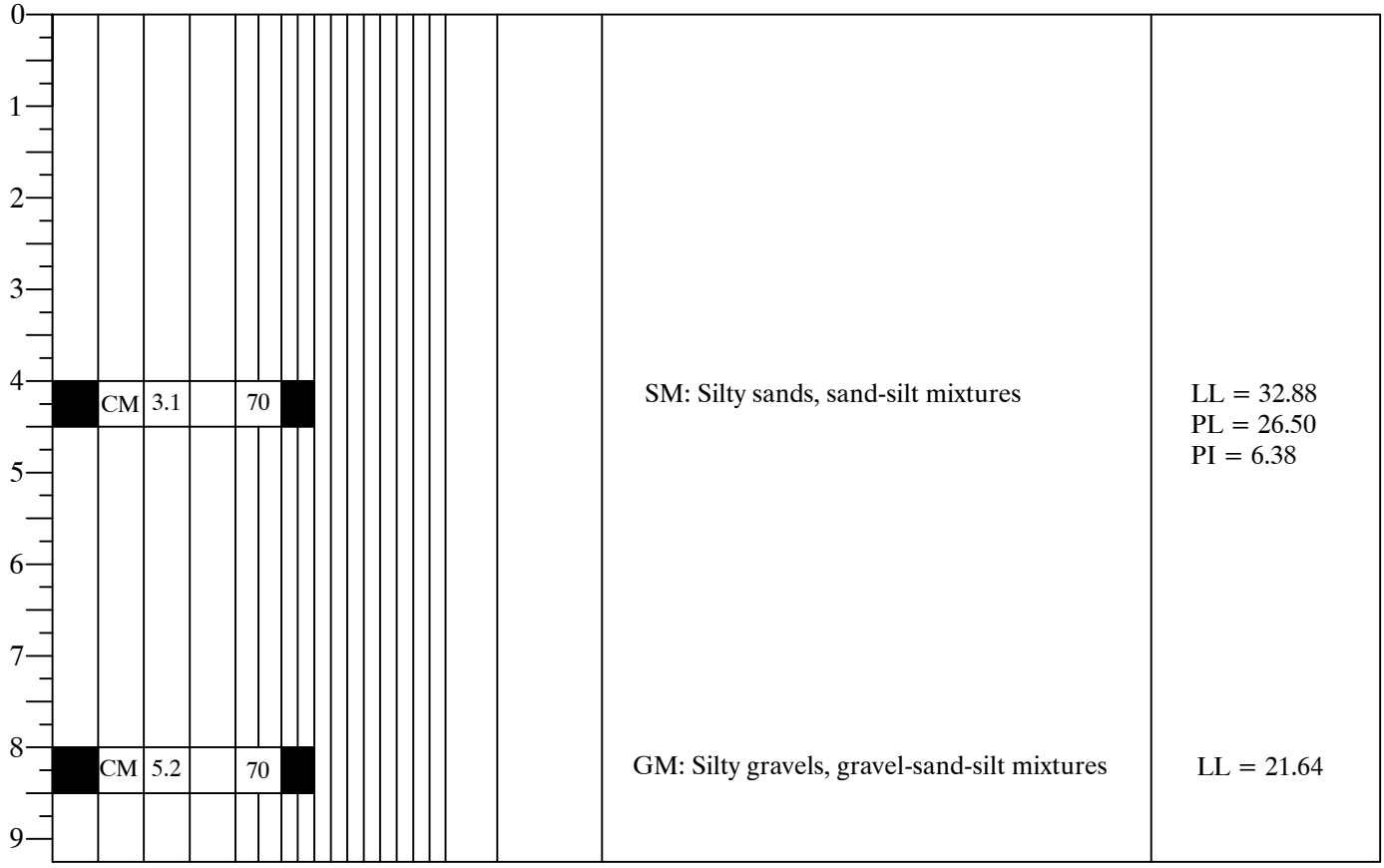
LOG OF TEST BORING

Figure 4

Borehole: 2

PROJECT NUMBER: 22E-050
DATE DRILLED: 8/11/22
PROJECT NAME: Self-Storage Truck Parking Lot
GROUND SURFACE ELEVATION: 0.0 Feet
LOCATION: Apple Valley, CA 92308



Depth, ft.	Sample	Sampling Method	Water Content, %	Dry Density, pcf	Blow Counts	Blow Count Histogram 10 LB@5'	Ground Water	Soil Lithology	Soil Lithology Description	Notes
4		CM	3.1		70				SM: Silty sands, sand-silt mixtures	LL = 32.88 PL = 26.50 PI = 6.38
8		CM	5.2		70				GM: Silty gravels, gravel-sand-silt mixtures	LL = 21.64

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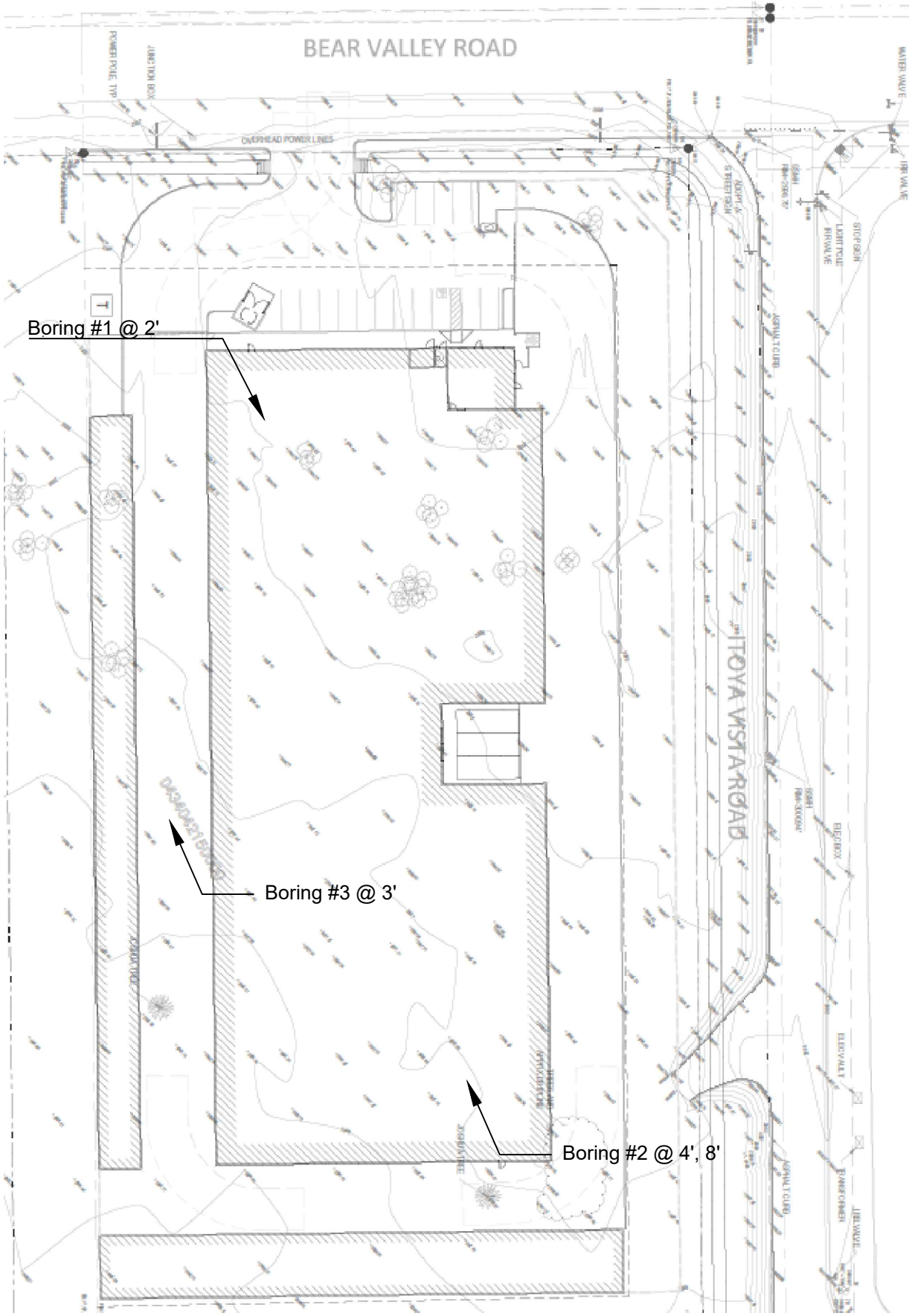
LOG OF TEST BORING

Figure 5

Borehole: 3

PROJECT NUMBER: 22E-050
DATE DRILLED: 8/11/22
PROJECT NAME: Self-Storage Truck Parking Lot
GROUND SURFACE ELEVATION: 0.0 Feet
LOCATION: Apple Valley, CA 92308

Depth, ft.	Sample	Sampling Method	Water Content, %	Dry Density, pcf	Blow Counts	Blow Count Histogram 10 LB@5'	Ground Water	Soil Lithology	Soil Lithology Description	Notes
0										
1										
2										
3	■	CM	7.8		70	■			SW: Well-graded sands, gravelly sands, little or no fines	LL = 31.59
4										
5										
6										
7										
8										
9										



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SITE-STORAGE TRUCK PARKING LOT

SITE MAP

12050 ITOYA VISTA ROAD, APPLE VALLEY, CA 92308

PROJECT NO.:	22E–050
DATE:	09/01/2022

FIGURE 2

10.7.2022

22E–050 Figures.dwg

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SITE-STORAGE TRUCK PARKING LOT

VICINITY MAP

12050 ITOYA VISTA ROAD, APPLE VALLEY, CA 92308

PROJECT NO.:	22E–050
DATE:	09/01/2022

FIGURE 1

CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)			
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)	SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)			
SILTS AND CLAYS Liquid limit less than 50%		ML	Inorganic silts and very fine sands, rock flour, silty of 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
SILTS AND CLAYS Liquid limit 50% or greater		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS		PT	Peat and other highly organic soils

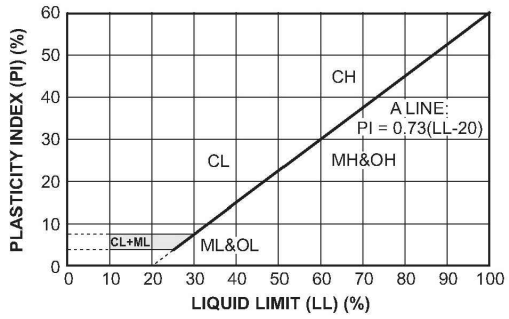
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP
More than 12 percent ..... GM, GC, SM, SC
5 to 12 percent ..... Borderline cases requiring dual symbols

PLASTICITY CHART



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SITE-STORAGE TRUCK PARKING LOT

CALTRANS USCS

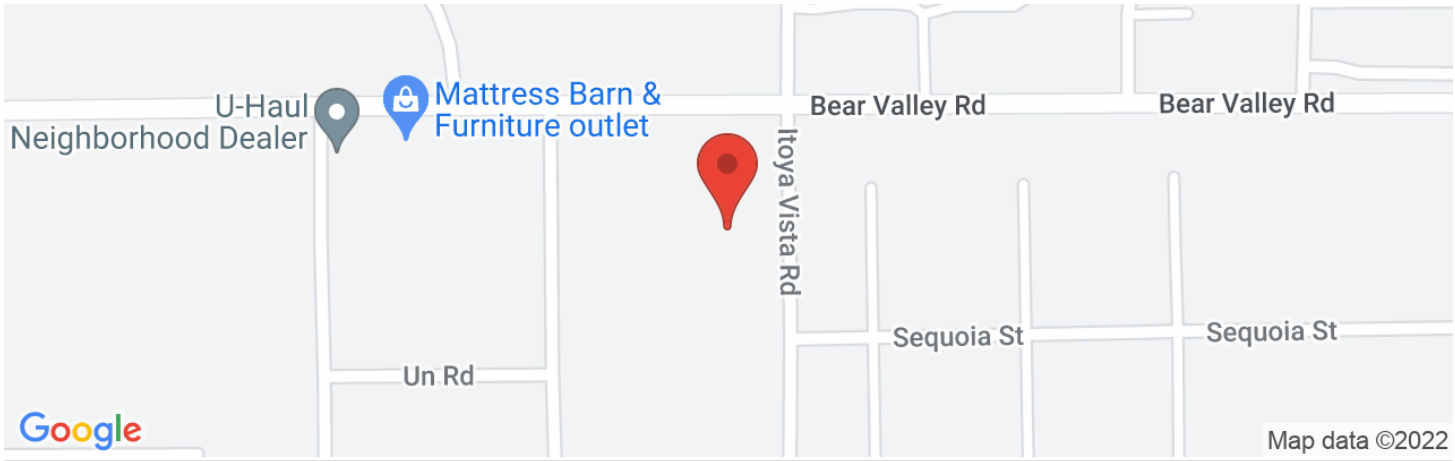
12050 ITOYA VISTA ROAD, APPLE VALLEY, CA 92308

PROJECT NO.:	22E–050
DATE:	09/01/2022

FIGURE 5

12050 Itoya Vista Rd, Apple Valley, CA 92308, USA

Latitude, Longitude: 34.470421, -117.217029



Date	9/1/2022, 11:49:20 AM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.205	MCE_R ground motion. (for 0.2 second period)
S_1	0.459	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.446	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	0.964	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.517	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.62	Site modified peak ground acceleration
T_L	12	Long-period transition period in seconds
SsRT	1.205	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.287	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.571	Factored deterministic acceleration value. (0.2 second)
S1RT	0.459	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.499	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.645	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA_{UH}	0.517	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C_{RS}	0.936	Mapped value of the risk coefficient at short periods

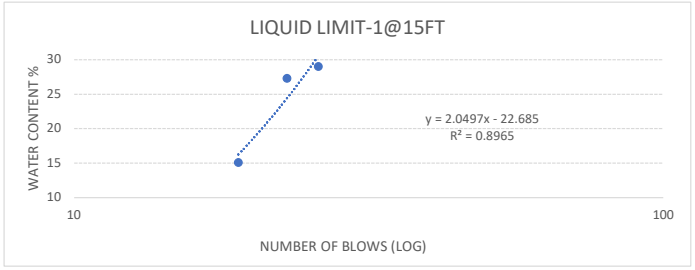
Project No.: 22E-050
Date: 12/5/2022

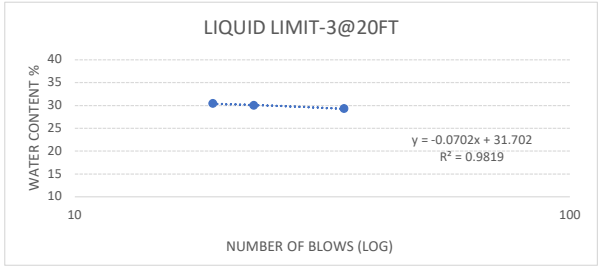
PROJECT DESCRIPTION

SELF-STORAGE TRUCK PARKING LOT
12050 ITOYA VISTA RD
APPLE VALLEY, CA 92308

ATTERBERG LIMITS

		Liquid Limit												Plastic Limit						
		1				2				3				4			5			
BORING #	BORING DEPTH (FT)	BLOW COUNT	Wet Sample	Dry Sample	Moisture %	BLOW COUNT	Wet Sample	Dry Sample	Moisture %	BLOW COUNT	Wet Sample	Dry Sample	Moisture %	Wet Sample	Dry Sample	Moisture %	Wet Sample	Dry Sample	Moisture %	AVERAGE
3	3	32	37.8	29.3	29.01	27	36.6	27.8	31.65	8	33.8	25.2	34.13	0	0	#DIV/0!	0	0	0.00	0.00
											Liquid Limit, LL =		31.59				Plasticity Index, PI =		0.00	
2	4	20	32.8	24.7	32.79	28	31.2	23.6	32.20	19	39.7	29.7	33.67	3.2	2.5	28.00	3	2.4	25.00	26.50
											Liquid Limit, LL =		32.88				Plasticity Index, PI =		6.38	
2	8	12	44.2	36.1	22.44	29	47.3	39.2	20.66	14	35.7	29.3	21.84	0	0	#DIV/0!	0	0	0.00	0.00
											Liquid Limit, LL =		21.64				Plasticity Index, PI =		0.00	
1	2	8	40.6	33.3	21.92	14	34	28.2	20.57	28	35.1	29.2	20.21	0	0	#DIV/0!	0	0	0.00	0.00
											Liquid Limit, LL =		20.90				Plasticity Index, PI =		0.00	





Project No.: 22E-050
Date: 12/27/2022

PROJECT DESCRIPTION

12050 Itoya Vista Rd Self Storage Apple Valley

ULTIMATE BEARING CAPACITY-TERZAGHI STRIP FOOTING

Silty sand @4 FT

$Qu=cNc+\gamma DNq+.5\gamma BN_\gamma$

γ_{uc}:	0	psf				
c:	0	psf	N_C:	37.2	Φ:	30 °
γ_{WET}:	110	pcf	N_Q:	22.5	FS:	4
			N_γ:	19.7	SPT:	4

FOOTING DIMENSIONS

Depth, D:	2	ft
Width, B:	1.5	ft

Q_u: 6575 psf Q_a: 1644 psf

ULTIMATE BEARING CAPACITY-TERZAGHI SQUARE FOOTING

Silty sand @4 FT

$Qu=1.3cNc+\gamma DNq+.4\gamma BN_\gamma$

γ_{uc}:	0	psf				
c:	0	psf	N_C:	37.2	Φ:	30 °
γ_{WET}:	110	pcf	N_Q:	22.5	FS:	4
			N_γ:	19.7	SPT:	4

FOOTING DIMENSIONS

Depth, D:	2	ft
Width, B:	2	ft

Q_u: 6684 psf Q_a: 1671 psf