LDC HARVILL INDUSTRIAL DEVELOPMENT

Drainage Study

APN: 317-160-037

Prepared For:

LDC INDUSTRIAL REALTY, LLC

555 N EL CAMINO REAL #A456

SAN CLEMENTE, CA 92672

949-226-4601

MAY 2024

Prepared By:

Kimley»Horn

401 B Street, Suite 600, San Diego CA 92101

This Drainage Report has been prepared by Kimley-Horn and Associates, Inc. under the direct supervision of the following Registered Civil engineer. The undersigned attests to the technical data contained in this study, and to the qualifications of technical specialists providing engineering computations upon which the recommendations and conclusions are based.

Joshua Bielik, PE 92259

05/7/2024

Date



Contents

1 Introduction 1–1

1.1 Project Description 1–1

2 Project Setting 2–1

2.1 Topography 2–1

2.2 Soil Types 2–1

3 Hydrologic Analysis 3–1

3.1 Methodology 3–1

3.2 Assumptions 3–2

3.3 Intensity and Time of Concentration 3–2

3.4 Existing Site Conditions 3–2

3.5 Proposed Conditions 3–3

4 Hydraulic Analysis 4–5

4.1 Storm Drain Design 4–5

Figures

Figure 1–1 Vicinity Map 1–1

Tables

Table 1: Summary of Existing Onsite Flow Rate 3–3

Table 2: Summary of Pre-Development and Post-Development Runoff Volumes 3–4

Table 3: Summary of Pre-Development and Post-Development Runoff Volumes 3–4

Table 4: Summary of BMP Storage Volume 3–4

Appendices

Appendix A Hydrology Calculations

Appendix B Hydraulic Calculations

Appendix C Onsite Civil Grading Plans

Appendix D Geotechnical Data

Appendix E Basin Routing Results

1 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Project known as LDC Harvill Industrial Development consists of approximately 4.79 acres and is bound by Harvill Avenue to the east, Patterson Avenue to the west, Cajalco Road to the north, and Rider Street to the south within the County of Riverside, California. The project will consist of a proposed +/- 100,190 square foot warehouse. See the vicinity map in **Figure 1.**

The purpose of this report is to present the hydrologic analysis and drainage calculations for the onsite design of the project.



Figure 1–1 Vicinity Map

2 PROJECT SETTING

2.1 TOPOGRAPHY

The project area is part of a primarily urban watershed that drains to the San Jacinto River and eventually to Lake Elsinore. The project site is an undeveloped vacant lot with elevations ranging from 1513' to 1520' with slopes varying from 2% to 7%. The southern side of the site slopes southwest toward Patterson Avenue, where overland runoff flows south along the east side of Patterson Avenue and ultimately to an existing ditch that flows east under the AT&SF railroad. The project site does not receive any offsite runoff in the existing condition.

The northern side of the site slopes northeast toward Harvill Avenue. Overland flow from this portion of the site is collected within the public right of way of Harvill Avenue and conveyed north in the roadside gutter to an existing storm drain inlet at the southwest corner of the Harvell Avenue and Cajalco Road intersection, which connects to Riverside County Flood Control & Water Conservation District (RCFC) Line E-8. The southern side of the site slopes partially to the east toward Harvill Avenue and partially to the west toward Patterson Avenue. Overland flow from this portion of the site is collected within the public right of way of Harvill Avenue and conveyed roughly 1700' south in the roadside gutter to an existing ditch that flows east under the AT&SF railroad before entering a RCFC facility.

2.2 SOIL TYPES

The type of soil and soil conditions are major factors affecting infiltration and resultant storm water runoff. The Natural Resources Conservation Service (NRCS) has classified soils into four general hydrologic soil groups for comparing infiltration and runoff rates. The groups are based on properties that influence runoff, such as water infiltration rate, texture, natural discharge, and moisture condition. The runoff potential is based on the amount of runoff at the end of a long duration storm that occurs after wetting and swelling of the soil not protected by vegetation.

Soil types were determined using the United States Department of Agriculture (USDA) Web Soil Survey. The project site predominantly consists of hydrologic soil group Type C with a very small portion of Type A. Type C soils typically have lower infiltration rates and have a moderately higher runoff potential. Infiltration tests of the site conducted by Southern California Geotechnical (SoCalGeo) indicate that the site contains soils with infiltration rates ranging from 0 to 1.0 inches per hour. Based on these results, soil infiltration is not considered feasible for this project. The Infiltration Report and Geotechnical Report prepared by SoCalGeo can be found in **Appendix D.** The USDA Web Soil Survey can also be found in **Appendix D.**

3 HYDROLOGIC ANALYSIS

3.1 METHODOLOGY

The Modified Rational Method was used to analyze the pre-development and post-development 10-year and 100-year flows for the project. This methodology is typically used for small basins less than 500 acres in size because a uniform rainfall distribution is assumed for the entire duration. Drainage calculations comply with the requirements outlined in the RCFC Hydrology Manual. Rational Method calculations are provided in the body of this report. The Unit Hydrograph Method was used to analyze the increase in site runoff volume in the proposed condition. Pre-development and post-development hydrographs were

developed in CivilD software and are provided in **Appendix A.** Manning's Equation was used to size the proposed storm drain pipes with Flowmaster software. These calculations are provided in **Appendix B**.

3.2 ASSUMPTIONS

Contour information for the site was provided with site survey by Kimley-Horn on March 7th, 2022. Contour information for the surrounding areas was obtained through aerial photographs, site observations, Perris Valley Master Drainage Plan (PVMDP) maps, and available as-builts. This information was used to delineate watershed boundary areas and drainage sub-basins for the project and applicable discharge to RCFC Line E-8.

3.3 INTENSITY AND TIME OF CONCENTRATION

For the pre-development Rational Method calculations provided in Sections 3.4 of this report, Tc values were obtained from RCFC Plate D-4.1. For the post-development calculations provided in Section 3.5, Tc values were conservatively assumed to be 5 minutes. Rainfall intensities for corresponding Tc values were obtained from RCFC Plate D-4.1. Intensity and Tc plates can be found in **Appendix A**. For the Unit Hydrograph calculations completed in CivilD, precipitation amounts for the 60-minute, 100-year rainfall event were obtained from NOAA Atlas 14. These depths were inputted directly into CivilD and Tc values were computed by the software. Unit Hydrograph Calculations are located in **Appendix A**. The existing site is undeveloped and a runoff coefficient of 0.30 was used for peak flow calculations. Runoff coefficients for the post-development condition were conservatively assumed to be 0.90.

3.4 EXISTING SITE CONDITIONS

The project site sits within the PVMDP. A Master Drainage Area Map is provided in **Appendix A**, which illustrates existing and proposed storm drain facilities per the PVMDP. An existing storm drain inlet at the southwest corner of the Harvell Avenue and Cajalco Road intersection is represented by node "POC EX1" on the Master Drainage Area Map. A tributary area for POC EX1 of 10.8 acres was assumed based on available contour data in the PVMDP and field topo survey on the project site. The total allowable 100-year flow to POC EX1 is 10cfs per the PVMDP.

The existing project site is divided into three distinct drainage management areas (DMA), which are detailed on the Existing Hydrology Map in **Appendix A**. DMA A1 sheet flows to Harvill Avenue and is conveyed in the existing gutter to POC EX1, which connects to RCFC line E-8. DMA B2 sheet flows southeast toward the west side of Harvill Avenue, where runoff is conveyed south in the curb and gutter in Harvill, ultimately discharging to a ditch that flows east alongside the AT&SF railroad. DMA B1 drains southwest toward the east side of Patterson Avenue. Runoff is collected in an existing ditch on the east side of Patterson Avenue and is conveyed south to an existing low spot north of the railroad. This low spot is the historical discharge point for stormwater runoff from Patterson Avenue. Runoff from DMA B1 and B2 is planned to be ultimately conveyed to future RCFC Line G-1 per the PVMDP. The post-development conditions for the project proposes to remove DMA B1 and B2 from the Line G-1 tributary area and instead convey runoff from the entire site area to Line E-8. This proposed drainage design is further discussed in Section 3.5 of this report. The total allowable 100-year flow from our site to POC EX1 was assumed to be proportional to the site's contributing drainage area to DMA EX1. This yields a total allowable 100-year flow from our site into POC EX1 of 3.33cfs. These calculations are provided on the Master Drainage Area Map in **Appendix A**.

Existing peak flows for the project have been analyzed using the Rational Method in accordance with the RCFC Hydrology Manual. **Table 1** summarizes the existing 1-hour peak flows from the project site.

Table 1: Summary of Existing Onsite Flow Rate

DMA	TC[1] (min)	c	10-yr intensity[1] (in/hr)	100-yr intensity[1] (in/hr)	Area (ac)	POC	Q_{10} (cfs)[2] ($c*i_{10}*A$)	Q_{100} (cfs)[2] ($c*i_{10}*A$)
A1	14	0.30	1.	2.69	3.6	A	2.03	2.91
B1	8	0.30	2.09	3.01	0.55	B1	0.34	0.50
B2	10	0.30	1.88	2.69	0.64	B2	0.36	0.52
						Total	2.74	3.92
						$Q_{100_Allowable}$ to Line E-8[3]	-	3.33

[1] *Tc and i values were obtained from RCFC Plates D-3 and D-4.1 in Appendix A.*

[2] *Flows have been calculated using the Rational Method (Q=ciA) using the inputs from columns 3 through 6.*

[3] *Refer to Master Drainage Area Map in Appendix A for $Q_{100_Allowable}$ calculations.*

3.5 PROPOSED CONDITIONS

In proposed condition, runoff generated from a portion of the site will be collected by onsite inlets, conveyed through an underground storm drain system, and will discharge into BMP 1, which is a bioretention area for both treatment and detention. Remaining runoff generated from the site will be collected by onsite inlets, conveyed through an underground storm drain system, conveyed through a proprietary biofiltration system for treatment (BMP 2), and will discharge into BMP 1 for detention. As part of the proposed improvements, this project will construct a 24" extension of the RCFC Line E-8 in Harvill Avenue. BMP 1 will discharge into this proposed 24" pipe, which will ultimately connect to Line E-8 at POC EX1.

The PVMDP shows runoff from 3.60 acres of project area being conveyed to Line E-8. The project development proposes to convey runoff from an additional 1.19 acres to Line E-8 that was previously planned for conveyance to Line G-1 in the PVMDP. This increase in the tributary area for POC EX1 will result in an increase in both the peak flow and the runoff volume that is discharging to Line E-8 in the post-development condition when compared to the pre-development condition. This increase in peak flow is mitigated for in the proposed on-site BMP 1, which is sized to adequately detain the net increase in site runoff volume. BMP 1 has an outlet control structure that will limit 100-year flows from the project site not to exceed the allowable 3.33 cfs. A project specific Water Quality Management Plan (WQMP) has been prepared, which analyzes the required water quality volume that will be captured by the bioretention area.

The project proposes street improvements in Patterson Avenue up to Cajalco Road. The improvements will taper back to the existing slopes at the southwest corner of the site to transition back and match existing. The proposed street improvements and taper will maintain the historical drainage patterns and historical discharge points. The street improvements will maintain the existing crown in Patterson Avenue. Runoff from the east side of the road will continue discharge to the east into a roadside ditch that will convey flows south down Patterson Avenue, ultimately discharging to the existing low point north of the railroad. Runoff from the west side of the road will continue to discharge west to a roadside ditch that conveys flows south down Patterson Avenue. Flows from the west side of the street are conveyed through an existing culvert that crosses beneath Patterson Avenue, conveying flows from the west side of the street to the existing low point north of the railroad on the east side of the street. This low spot is the historical discharge point for stormwater runoff from Patterson Avenue and will be maintained in the proposed condition. It is determined that the project site does not receive any offsite runoff in the proposed condition as a part of this project.

Proposed peak flows for the project have been analyzed using the Rational Method in accordance with the RCFC Hydrology Manual. **Table 2** summarizes the proposed 1-hour unmitigated peak flows from the project site for each DMA, and **Table 3** summarizes the proposed 1-hour unmitigated and mitigated peak flows from the project site as a whole. Refer to **Appendix A** for the Proposed Hydrology Map.

Table 2: Summary of Proposed Onsite Flow Rate

DMA	TC[1] (min)	c	10-yr intensity[1] (in/hr)	100-yr intensity[1] (in/hr)	Area (ac)	POC	Q_{10} (cfs)[2] ($c*i_{10}*A$)	Q_{100} (cfs)[2] ($c*i_{100}*A$)
C1	5	0.90	2.64	3.78	1.49	C	3.54	5.07
C2	5	0.90	2.64	3.78	1.28	C	3.04	4.35
C3	10	0.90	1.88	2.69	1.15	C	1.95	2.78
C4	10	0.90	1.88	2.69	0.30	C	0.51	0.73
C5	5	0.90	2.64	3.78	0.4	C	0.95	1.36
C6	5	0.90	2.64	3.78	0.17	C	0.40	0.58
						Total	11.38	16.30

[1] *Tc and i values were obtained from RCFC Plates D-3 and D-4.1 in Appendix A.*

[2] *Flows have been calculated using the Rational Method (Q=ciA) using the inputs from columns 3 through 6.*

Table 3: Summary of Proposed Onsite Flow Rate

DMA	TC[1] (min)	c	10-yr intensity[1] (in/hr)	100-yr intensity[1] (in/hr)	Area (ac)	POC	Q_{10}[2] (cfs)	Q_{100}[2] (cfs)	Mitigated[3] Q_{100} (cfs)
Major DMA	5	0.90	2.64	3.78	4.79	C	11.38	16.30	3.33

[1] *Tc and i values were obtained from RCFC Plates D-3 and D-4.1 in Appendix A.*

[2] *Flows have been calculated using the Rational Method (Q=ciA) using the inputs from columns 3 through 6.*

[3] *Refer to Master Drainage Area Map in Appendix A for $Q_{100_Allowable}$ calculations.*

The required storage volume provided by the BMP area was determined using the RCFC Unit Hydrograph Method in CivilD software. Post-development flows were compared against pre-development flows, and a net runoff volume was calculated. Site runoff volumes are summarized in **Table 4** and **Table 5** below. CivilD hydrograph calculations are provided in **Appendix A**. A stage-storage analysis was performed in HECHMS using the CivilD 100-year runoff hydrograph, the geometry of the basin, and an orifice sized to mitigate flow out of the basin to less than the allowable flow of 3.33 cfs. The max water surface elevation is below the designed top of basin, so the detention basin is adequately sized to mitigate the site runoff. See **Appendix E** for HECHMS results.

Table 4: Summary of Pre-Development and Post-Development Runoff Volumes

Site Condition	Runoff Volume (cf)	Runoff Volume (acre-ft)
Pre-Developed	7,836	0.18
Post-Developed	23,731	0.54
Total Required Storage Volume:	15,895	0.36

Table 5: Summary of BMP Storage Volume

BMP	Storage Volume (cf)	Storage Volume (acre-ft)
BMP 1 – Bioretention Area	17,527.05	0.40
Total Provided Storage Volume:	17,527.05	0.40

4 HYDRAULIC ANALYSIS

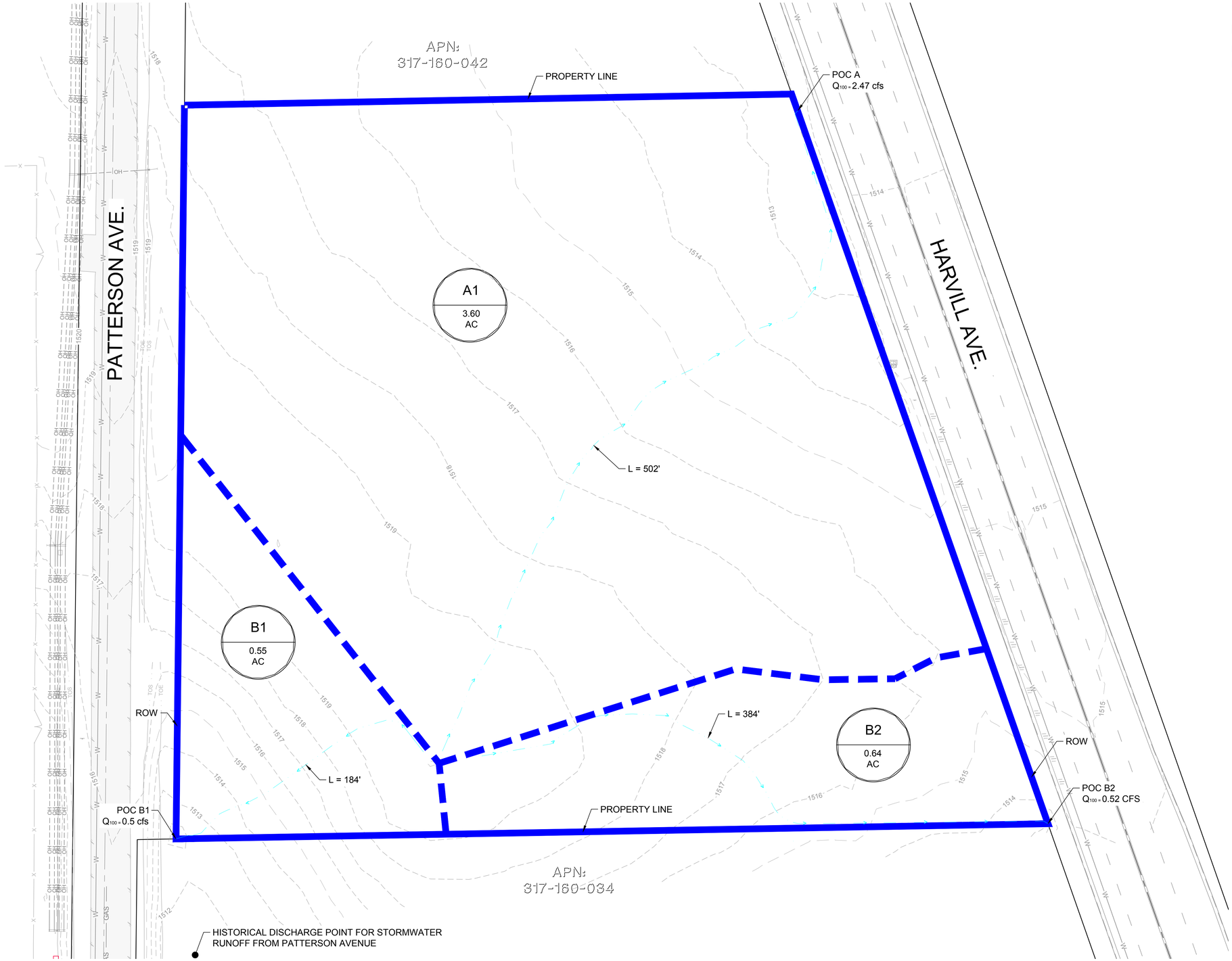
4.1 STORM DRAIN DESIGN

Tributary drainage areas were delineated for each proposed storm drain inlet based on the proposed grading of the project to determine the proposed flows within the onsite storm drains and inlets. In accordance with the RCFC Hydrology Manual, the Rational Method was used to determine the peak flows for the 1-hr, 10-year storm and the 1-hr, 100-year storm events for each DMA. These flows are calculated and summarized in Table 2. Hydraulic calculations were performed with Manning's Formula using calculated peak flows for the 1-hr, 100-year storm event with Flowmaster software. **Appendix A** contains the Proposed Hydrology Map displaying tributary DMAs and **Appendix B** contains the Proposed Onsite Hydraulic Map displaying the proposed storm network. **Appendix B** also contains the result worksheets from Flowmaster with sizes for all storm drain inlets and pipes.

APPENDICES

APPENDIX A

HYDROLOGY CALCULATIONS



LEGEND

- MAJOR DMA BOUNDARY
- MINOR DMA BOUNDARY
- FLOW PATH
- EXISTING STORM DRAIN
- DMA # / AREA AC — DRAINAGE AREA (AC)

Kimley»Horn

401 B STREET, SUITE 600,
SAN DIEGO, CA 92101
PHONE: 619-234-9411
WWW.KIMLEY-HORN.COM

LDC HARVILL

EXHIBIT:
EXISTING HYDROLOGY EXHIBIT

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

JOB NO.:	195404001
DATE:	10/17/2023

1 OF 1

THE DOCUMENT, TOGETHER WITH THE CONCEPTS AND DESIGNS PRESENTED HEREIN, AS AN INSTRUMENT OF SERVICE, IS INTENDED ONLY FOR THE SPECIFIC PURPOSE AND CLIENT FOR WHICH IT WAS PREPARED. REUSE OF AND IMPROPER RELIANCE ON THIS DOCUMENT WITHOUT WRITTEN AUTHORIZATION AND ADAPTATION BY KIMLEY-HORN AND ASSOCIATES, INC. SHALL BE WITHOUT LIABILITY TO KIMLEY-HORN AND ASSOCIATES, INC. COPYRIGHT KIMLEY-HORN AND ASSOCIATES, INC., 2023

X:\ENG_LDC\195404001 - LDC HARVILL\ENGINEER\DRAINAGE STUDY\EXHIBITS\EXISTING HYDROLOGY EXHIBIT.DWG

APN:
317-160-042

PROPERTY LINE

PROPOSED INLET

PROPOSED INLET

PROPOSED INLET

L = 542'

L = 164'

C1
1.49
AC

C2
1.28
AC

C6
0.17
AC

POC C
IE: 1505.1
Q_{100} = 16.30 CFS
$Q_{100_MITIGATED}$ = 3.33 CFS

L = 140'

HARVILL AVE.

PROPOSED BUILDING
± 97,000 SF

L = 149'

BMP 1
BIORETENTION BASIN
DCV= 2,339.90 CF = 0.054 AC-FT
$BOTTOM_{AREA}$: 1,829.7 SQFT
$BOTTOM_{ELEVATION}$ = 1509.60'
$TOP_{ELEVATION}$: 1513.75'
$V_{PROVIDED}$ = 17,527.05 CF = 0.40 AC-FT

PPT 220024

PATTERSON AVE.

C5
0.40
AC

PROPOSED 3' TALL FENCE

12' WIDE ACCESS ROAD CONSTRUCTED WITH 3" COMPACTED CLASS 2 AGGREGATE BASE MATERIAL.

ROW

C3
1.15
AC

C4
0.30
AC

PROPOSED INLET

L = 585'

L = 84'

PROPOSED INLET

ROW

PROPERTY LINE

APN:
317-160-034

HISTORICAL DISCHARGE POINT FOR STORMWATER RUNOFF FROM PATTERSON AVENUE

LEGEND

- MAJOR DMA BOUNDARY
- MINOR DMA BOUNDARY
- FLOW PATH
- SD — EXISTING STORM DRAIN
- DMA # / AREA AC — DRAINAGE AREA (AC)

SUMMARY OF PRE-DEVELOPMENT AND POST-DEVELOPMENT FLOWS

Site Condition	Runoff Volume (cf)	Runoff Volume (acre-ft)
Pre-Developed	7,836	0.18
Post-Developed	23,731	0.54
Total Required Storage Volume:	**15,895**	**0.36**

SUMMARY OF BMP STORAGE VOLUME

BMP	Storage Volume (cf)	Storage Volume (acre-ft)
BMP 1 – Bioretention Area	17,527.05	0.40
Total Provided Storage Volume:	**17,527.05**	0.40

Kimley»Horn
401 B STREET, SUITE 600,
SAN DIEGO, CA 92101
PHONE: 619-234-9411
WWW.KIMLEY-HORN.COM

LDC HARVILL

EXHIBIT:

PROPOSED HYDROLOGY EXHIBIT

NORTH

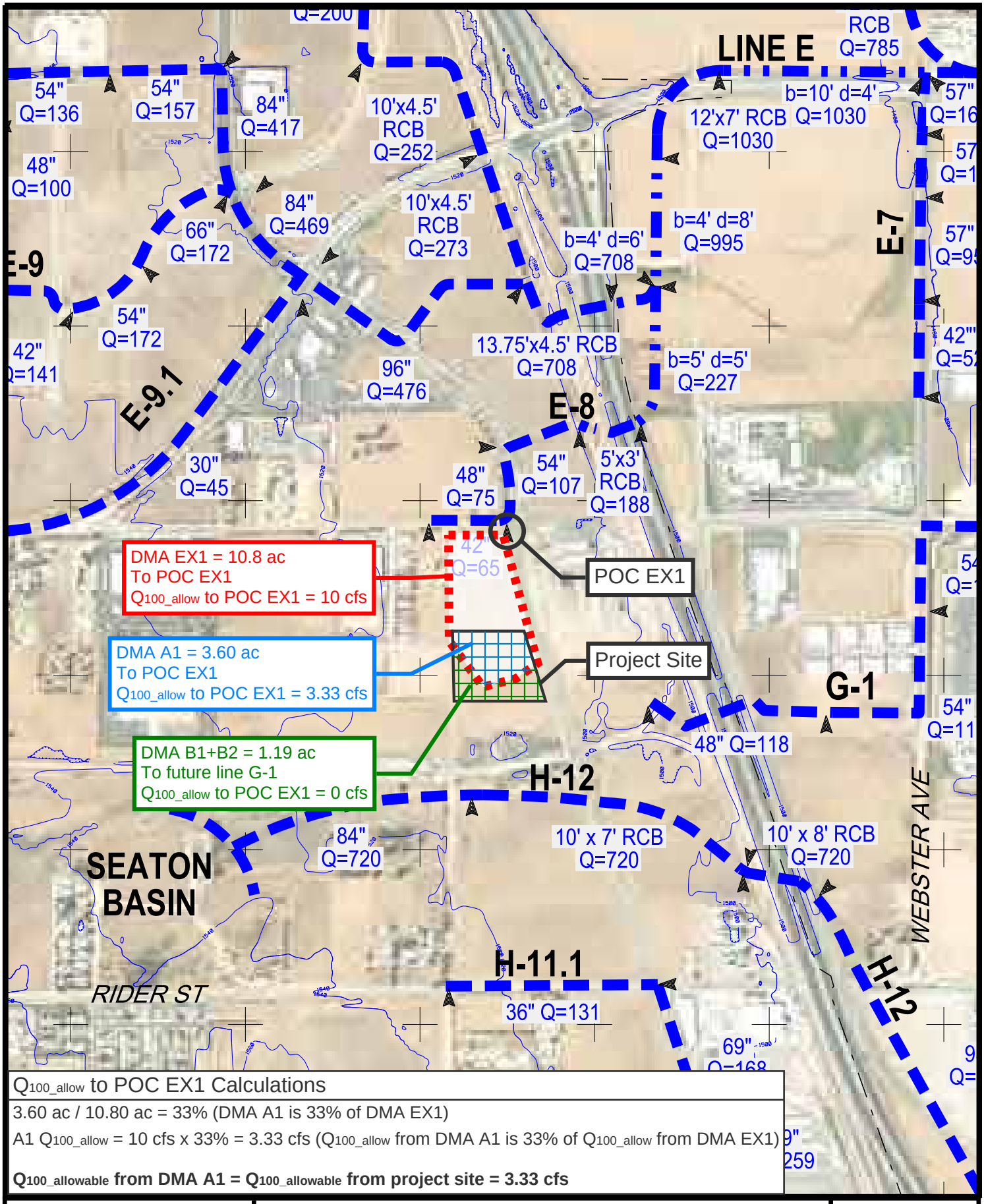
GRAPHIC SCALE IN FEET
0 15 30 60

JOB NO.: 195404001
DATE: 11/28/2023

1 OF 1

THE DOCUMENT, TOGETHER WITH THE CONCEPTS AND DESIGNS PRESENTED HEREIN, AS AN INSTRUMENT OF SERVICE, IS INTENDED ONLY FOR THE SPECIFIC PURPOSE AND CLIENT FOR WHICH IT WAS PREPARED. REUSE OF AND IMPROPER RELIANCE ON THIS DOCUMENT WITHOUT WRITTEN AUTHORIZATION AND ADAPTATION BY KIMLEY-HORN AND ASSOCIATES, INC. SHALL BE WITHOUT LIABILITY TO KIMLEY-HORN AND ASSOCIATES, INC. COPYRIGHT KIMLEY-HORN AND ASSOCIATES, INC., 2023

X:\DWG_LDC\195404001 - LDC HARVILL\DRAINAGE\DRAINAGE STUDY\EXHIBITS\HYDROLOGY EXHIBIT\PROPOSED HYDROLOGY.DWG



Q_{100_allow} to POC EX1 Calculations
3.60 ac / 10.80 ac = 33% (DMA A1 is 33% of DMA EX1)
A1 Q_{100_allow} = 10 cfs x 33% = 3.33 cfs (Q_{100_allow} from DMA A1 is 33% of Q_{100_allow} from DMA EX1)
$Q_{100_allowable}$ from DMA A1 = $Q_{100_allowable}$ from project site = 3.33 cfs

Kimley»Horn

MASTER DRAINAGE AREA MAP

PERRIS VALLEY MASTER DRAINAGE PLAN

NOT TO SCALE

Post-Development 1-hour, 100-year Unit Hydrograph

```
            U n i t   H y d r o g r a p h   A n a l y s i s

            Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                  Study date  04/28/22 File: prophavill1100.out


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      ----------------------------------------------------------------------
-----

      Riverside County Synthetic Unit Hydrology Method
      RCFC & WCD Manual date - April 1978


      Program License Serial Number 6443

      ----------------------------------------------------------------------
--
       English (in-lb) Input Units Used
       English Rainfall Data (Inches) Input Values Used

       English Units used in output format



      ----------------------------------------------------------------------
--
      Project: LDC Havrvill
      Name: Sanam Warsi
      Date: 04-28-2022

      ----------------------------------------------------------------------
-
      Drainage Area =       4.79(Ac.)  =      0.007 Sq. Mi.
      Drainage Area for Depth-Area Areal Adjustment =       4.79(Ac.)  =
0.007 Sq. Mi.
      Length along longest watercourse =     588.00(Ft.)
      Length along longest watercourse measured to centroid =
147.00(Ft.)
      Length along longest watercourse =      0.111 Mi.
      Length along longest watercourse measured to centroid =      0.028
Mi.
      Difference in elevation =       6.00(Ft.)
      Slope along watercourse =     53.8776 Ft./Mi.
      Average Manning's 'N' = 0.015
      Lag time =    0.019 Hr.
      Lag time =     1.13 Min.
      25% of lag time =     0.28 Min.
      40% of lag time =     0.45 Min.
      Unit time =     5.00 Min.
      Duration of storm = 1 Hour(s)
      User Entered Base Flow =     0.00(CFS)
```

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
4.79	0.46	2.18

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
4.79	1.37	6.56

STORM EVENT (YEAR) = 100.00
Area Averaged 2-Year Rainfall = 0.456(In)
Area Averaged 100-Year Rainfall = 1.370(In)

Point rain (area averaged) = 1.370(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 1.370(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
4.790	90.00	1.000

Total Area Entered = 4.79(Ac.)

RI AMC2	RI AMC-3	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
90.0	96.0	0.052	1.000	0.005	1.000	0.005
					Sum (F) =	0.005

Area averaged mean soil loss (F) (In/Hr) = 0.005
Minimum soil loss rate ((In/Hr)) = 0.003
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.100

Slope of intensity-duration curve for a 1 hour storm =0.5000

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)

```
          1   0.083        443.345          67.853              3.276
          2   0.167        886.689          32.147              1.552
                                    Sum = 100.000   Sum=        4.827
-------------------------------------------------------------------------


 The following loss rate calculations reflect use of the minimum
calculated loss
 rate subtracted from the Storm Rain to produce the maximum Effective
Rain value

  Unit Time   Pattern   Storm Rain     Loss rate(In./Hr)     Effective
       (Hr.)  Percent   (In/Hr)         Max   |   Low         (In/Hr)
    1   0.08     4.20      0.690          0.005    (  0.069)        0.685
    2   0.17     4.30      0.707          0.005    (  0.071)        0.702
    3   0.25     5.00      0.822          0.005    (  0.082)        0.817
    4   0.33     5.00      0.822          0.005    (  0.082)        0.817
    5   0.42     5.80      0.953          0.005    (  0.095)        0.948
    6   0.50     6.50      1.069          0.005    (  0.107)        1.063
    7   0.58     7.40      1.217          0.005    (  0.122)        1.211
    8   0.67     8.60      1.414          0.005    (  0.141)        1.409
    9   0.75    12.30      2.022          0.005    (  0.202)        2.017
   10   0.83    29.10      4.784          0.005    (  0.478)        4.779
   11   0.92     6.80      1.118          0.005    (  0.112)        1.113
   12   1.00     5.00      0.822          0.005    (  0.082)        0.817
             (Loss Rate Not Used)
      Sum =     100.0                                    Sum =    16.4
       Flood volume = Effective rainfall      1.36(In)
        times area       4.8(Ac.)/[(In)/(Ft.)] =       0.5(Ac.Ft)
       Total soil loss =      0.01(In)
       Total soil loss =     0.002(Ac.Ft)
       Total rainfall =      1.37(In)
       Flood volume =       23729.7 Cubic Feet
       Total soil loss =          90.4 Cubic Feet
       ---------------------------------------------------------------
-
        Peak flow rate of this hydrograph =     18.792(CFS)
       ---------------------------------------------------------------
-
       ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+
                          1 - H O U R    S T O R M
                     R u n o f f      H y d r o g r a p h
       ---------------------------------------------------------------
-
                    Hydrograph in   5   Minute intervals ((CFS))

       ---------------------------------------------------------------
-
  Time(h+m) Volume Ac.Ft   Q(CFS)  0        5.0      10.0      15.0
20.0
  ----------------------------------------------------------------------
    0+ 5       0.0155      2.25  |V  Q     |         |         |
|
```

```
    0+10       0.0386      3.36  | V   Q   |         |         |
|
    0+15       0.0646      3.77  |   V  Q  |         |         |
|
    0+20       0.0917      3.94  |     VQ  |         |         |
|
    0+25       0.1219      4.38  |       Q |         |         |
|
    0+30       0.1560      4.96  |        Q|V        |         |
|
    0+35       0.1947      5.62  |         |Q  V     |         |
|
    0+40       0.2395      6.50  |         | Q    V  |         |
|
    0+45       0.3001      8.80  |         |      Q  | V       |
|
    0+50       0.4295     18.79  |         |         |         |V     Q
|
    0+55       0.5057     11.07  |         |         | Q       |      V
|
    1+ 0       0.5360      4.40  |       Q |         |         |
V|
    1+ 5       0.5448      1.27  | Q       |         |         |
V
-------------------------------------------------------------------------
```

Total Runoff Volume

Pre-Development 1-hour, 100-year Unit Hydrograph

```
            U n i t   H y d r o g r a p h   A n a l y s i s

            Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2018, Version 9.0
                  Study date  04/28/22 File: exharvill1100.out


      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
+++++
      ----------------------------------------------------------------------
-----

      Riverside County Synthetic Unit Hydrology Method
      RCFC & WCD Manual date - April 1978


      Program License Serial Number 6443

      ----------------------------------------------------------------------
--
       English (in-lb) Input Units Used
       English Rainfall Data (Inches) Input Values Used

       English Units used in output format



      ----------------------------------------------------------------------
--
      Project: LDC HARVILL
      EXISTING CONDITIONS
      NAME: SANAM WARSI
      DATE: 04-28-2022
      ----------------------------------------------------------------------
-
      Drainage Area =       3.60(Ac.)  =      0.006 Sq. Mi.
      Drainage Area for Depth-Area Areal Adjustment =       3.60(Ac.)  =
0.006 Sq. Mi.
      Length along longest watercourse =     502.00(Ft.)
      Length along longest watercourse measured to centroid =
280.00(Ft.)
      Length along longest watercourse =      0.095 Mi.
      Length along longest watercourse measured to centroid =      0.053
Mi.
      Difference in elevation =       6.00(Ft.)
      Slope along watercourse =     63.1076 Ft./Mi.
      Average Manning's 'N' = 0.030
      Lag time =    0.044 Hr.
      Lag time =     2.63 Min.
      25% of lag time =     0.66 Min.
      40% of lag time =     1.05 Min.
      Unit time =     5.00 Min.
      Duration of storm = 1 Hour(s)
      User Entered Base Flow =     0.00(CFS)
```

2 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
3.60	0.46	1.64

100 YEAR Area rainfall data:

Area(Ac.)[1]	Rainfall(In)[2]	Weighting[1*2]
3.60	1.37	4.93

STORM EVENT (YEAR) = 100.00
Area Averaged 2-Year Rainfall = 0.456(In)
Area Averaged 100-Year Rainfall = 1.370(In)

Point rain (area averaged) = 1.370(In)
Areal adjustment factor = 100.00 %
Adjusted average point rain = 1.370(In)

Sub-Area Data:

Area(Ac.)	Runoff Index	Impervious %
3.600	10.00	0.000

Total Area Entered = 3.60(Ac.)

RI AMC2	RI AMC-3	Infil. Rate (In/Hr)	Impervious (Dec.%)	Adj. Infil. Rate (In/Hr)	Area% (Dec.)	F (In/Hr)
10.0	22.0	0.824	0.000	0.824	1.000	0.824
					Sum (F) =	0.824

Area averaged mean soil loss (F) (In/Hr) = 0.824
Minimum soil loss rate ((In/Hr)) = 0.412
(for 24 hour storm duration)
Soil low loss rate (decimal) = 0.900

Slope of intensity-duration curve for a 1 hour storm =0.5000

U n i t H y d r o g r a p h
VALLEY S-Curve

Unit Hydrograph Data

Unit time period (hrs)	Time % of lag	Distribution Graph %	Unit Hydrograph (CFS)

1	0.083	189.896	41.600		1.509
2	0.167	379.792	44.078		1.599
3	0.250	569.688	9.218		0.334
4	0.333	759.584	3.672		0.133
5	0.417	949.481	1.431		0.052
			Sum = 100.000	Sum=	3.628

The following loss rate calculations reflect use of the minimum calculated loss
rate subtracted from the Storm Rain to produce the maximum Effective Rain value

Unit	Time (Hr.)	Pattern Percent	Storm Rain (In/Hr)	Loss rate(In./Hr) Max	Low	Effective (In/Hr)
1	0.08	4.20	0.690	(0.824)	0.621	0.069
2	0.17	4.30	0.707	(0.824)	0.636	0.071
3	0.25	5.00	0.822	(0.824)	0.740	0.082
4	0.33	5.00	0.822	(0.824)	0.740	0.082
5	0.42	5.80	0.953	0.824	(0.858)	0.129
6	0.50	6.50	1.069	0.824	(0.962)	0.245
7	0.58	7.40	1.217	0.824	(1.095)	0.393
8	0.67	8.60	1.414	0.824	(1.272)	0.590
9	0.75	12.30	2.022	0.824	(1.820)	1.198
10	0.83	29.10	4.784	0.824	(4.305)	3.960
11	0.92	6.80	1.118	0.824	(1.006)	0.294
12	1.00	5.00	0.822	(0.824)	0.740	0.082

(Loss Rate Not Used)

Sum = 100.0 Sum = 7.2

Flood volume = Effective rainfall 0.60(In)
times area 3.6(Ac.)/[(In)/(Ft.)] = 0.2(Ac.Ft)
Total soil loss = 0.77(In)
Total soil loss = 0.231(Ac.Ft)
Total rainfall = 1.37(In)
Flood volume = 7834.8 Cubic Feet
Total soil loss = 10067.7 Cubic Feet

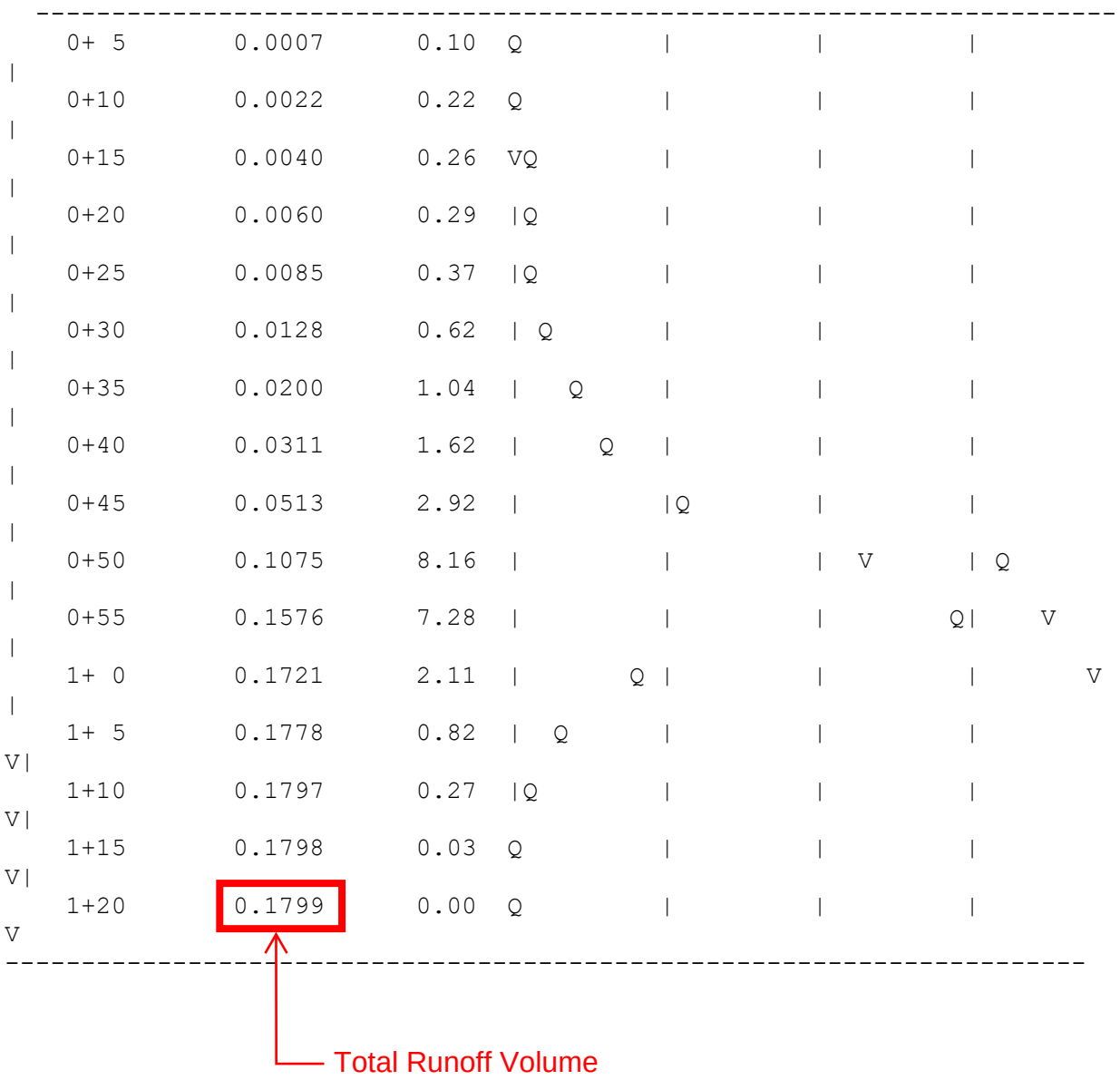
Peak flow rate of this hydrograph = 8.159(CFS)

++

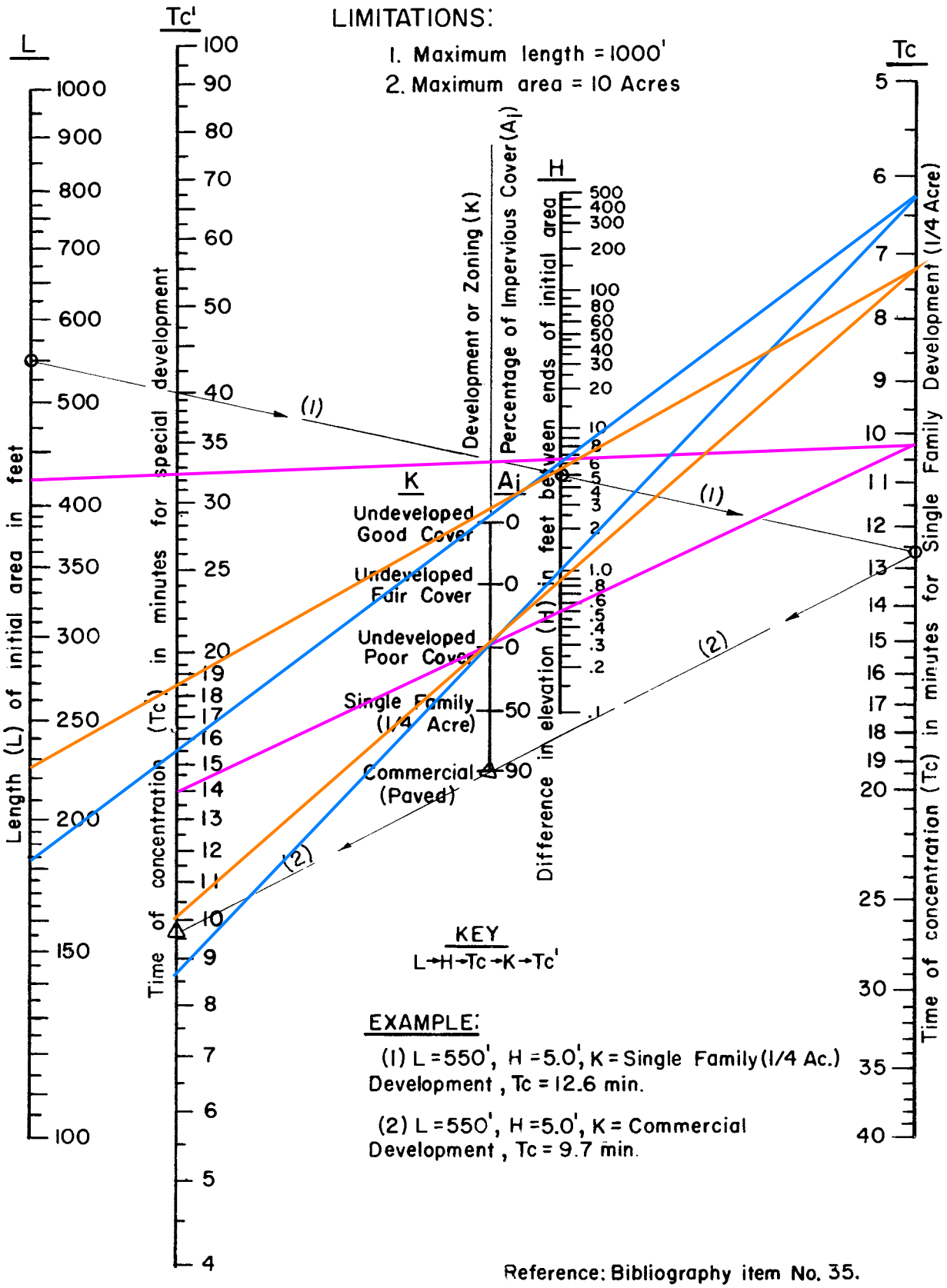
1 - H O U R S T O R M
R u n o f f H y d r o g r a p h

Hydrograph in 5 Minute intervals ((CFS))

Time(h+m) Volume Ac.Ft Q(CFS) 0 2.5 5.0 7.5 10.0


0+ 5 0.0007 0.10
0+10 0.0022 0.22
0+15 0.0040 0.26
0+20 0.0060 0.29
0+25 0.0085 0.37
0+30 0.0128 0.62
0+35 0.0200 1.04
0+40 0.0311 1.62
0+45 0.0513 2.92
0+50 0.1075 8.16
0+55 0.1576 7.28
1+ 0 0.1721 2.11
1+ 5 0.1778 0.82
1+10 0.1797 0.27
1+15 0.1798 0.03
1+20 0.1799 0.00
Total Runoff Volume

EXISTING CONDITIONS



Reference: Bibliography item No. 35.

RCFC & WCD

HYDROLOGY MANUAL

TIME OF CONCENTRATION FOR INITIAL SUBAREA

Pre DMA A1
Pre DMA B1
Pre DMA B2

PLATE D-3

RCFC & WCD

HYDROLOGY MANUAL

RAINFALL INTENSITY—INCHES PER HOUR

MIRA LOMA			MURRIETA - TEMECULA & RANCHO CALIFORNIA			NORCO			PALM SPRINGS			PERRIS VALLEY		
DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR	DURATION MINUTES	FREQUENCY 10 YEAR	100 YEAR
5	2.84	4.48	5	3.45	5.10	5	2.77	4.16	5	4.23	6.76	5	2.64	3.78
6	2.58	4.07	6	3.12	4.61	6	2.53	3.79	6	3.80	6.08	6	2.41	3.46
7	2.37	3.75	7	2.87	4.24	7	2.34	3.51	7	3.48	5.56	7	2.24	3.21
8	2.21	3.49	8	2.67	3.94	8	2.19	3.29	8	3.22	5.15	8	2.09	3.01
9	2.08	3.28	9	2.50	3.69	9	2.07	3.10	9	3.01	4.81	9	1.98	2.84
10	1.96	3.10	10	2.36	3.48	10	1.96	2.94	10	2.83	4.52	10	1.88	2.69
11	1.87	2.95	11	2.24	3.30	11	1.87	2.80	11	2.67	4.28	11	1.79	2.57
12	1.78	2.82	12	2.13	3.15	12	1.79	2.68	12	2.54	4.07	12	1.72	2.46
13	1.71	2.70	13	2.04	3.01	13	1.72	2.58	13	2.43	3.88	13	1.65	2.37
14	1.64	2.60	14	1.96	2.89	14	1.66	2.48	14	2.33	3.72	14	1.59	2.29
15	1.58	2.50	15	1.89	2.79	15	1.60	2.40	15	2.23	3.58	15	1.54	2.21
16	1.53	2.42	16	1.82	2.69	16	1.55	2.32	16	2.15	3.44	16	1.49	2.14
17	1.48	2.34	17	1.76	2.60	17	1.50	2.25	17	2.08	3.32	17	1.45	2.08
18	1.44	2.27	18	1.71	2.52	18	1.46	2.19	18	2.01	3.22	18	1.41	2.02
19	1.40	2.21	19	1.66	2.45	19	1.42	2.13	19	1.95	3.12	19	1.37	1.97
20	1.36	2.15	20	1.61	2.38	20	1.39	2.08	20	1.89	3.03	20	1.34	1.92
22	1.29	2.04	22	1.53	2.26	22	1.32	1.98	22	1.79	2.86	22	1.28	1.83
24	1.24	1.95	24	1.46	2.15	24	1.26	1.90	24	1.70	2.72	24	1.22	1.75
26	1.18	1.87	26	1.39	2.06	26	1.22	1.82	26	1.62	2.60	26	1.18	1.69
28	1.14	1.80	28	1.34	1.98	28	1.17	1.76	28	1.56	2.49	28	1.13	1.63
30	1.10	1.73	30	1.29	1.90	30	1.13	1.70	30	1.49	2.39	30	1.10	1.57
32	1.06	1.67	32	1.24	1.84	32	1.10	1.64	32	1.44	2.30	32	1.06	1.52
34	1.03	1.62	34	1.20	1.78	34	1.06	1.59	34	1.39	2.22	34	1.03	1.48
36	1.00	1.57	36	1.17	1.72	36	1.03	1.55	36	1.34	2.15	36	1.00	1.44
38	.97	1.53	38	1.13	1.67	38	1.01	1.51	38	1.30	2.09	38	.98	1.40
40	.94	1.49	40	1.10	1.62	40	.98	1.47	40	1.27	2.02	40	.95	1.37
45	.89	1.40	45	1.03	1.52	45	.92	1.39	45	1.18	1.89	45	.90	1.29
50	.84	1.32	50	.97	1.44	50	.88	1.31	50	1.11	1.78	50	.85	1.22
55	.80	1.26	55	.92	1.36	55	.84	1.25	55	1.05	1.68	55	.81	1.17
60	.76	1.20	60	.88	1.30	60	.80	1.20	60	1.00	1.60	60	.78	1.12
65	.73	1.15	65	.84	1.24	65	.77	1.15	65	.95	1.53	65	.75	1.08
70	.70	1.11	70	.81	1.19	70	.74	1.11	70	.91	1.46	70	.72	1.04
75	.68	1.07	75	.78	1.15	75	.72	1.07	75	.88	1.41	75	.70	1.00
80	.65	1.03	80	.75	1.11	80	.69	1.04	80	.85	1.35	80	.68	.97
85	.63	1.00	85	.73	1.07	85	.67	1.01	85	.82	1.31	85	.66	.94
SLOPE = .530			SLOPE = .550			SLOPE = .500			SLOPE = .580			SLOPE = .490		

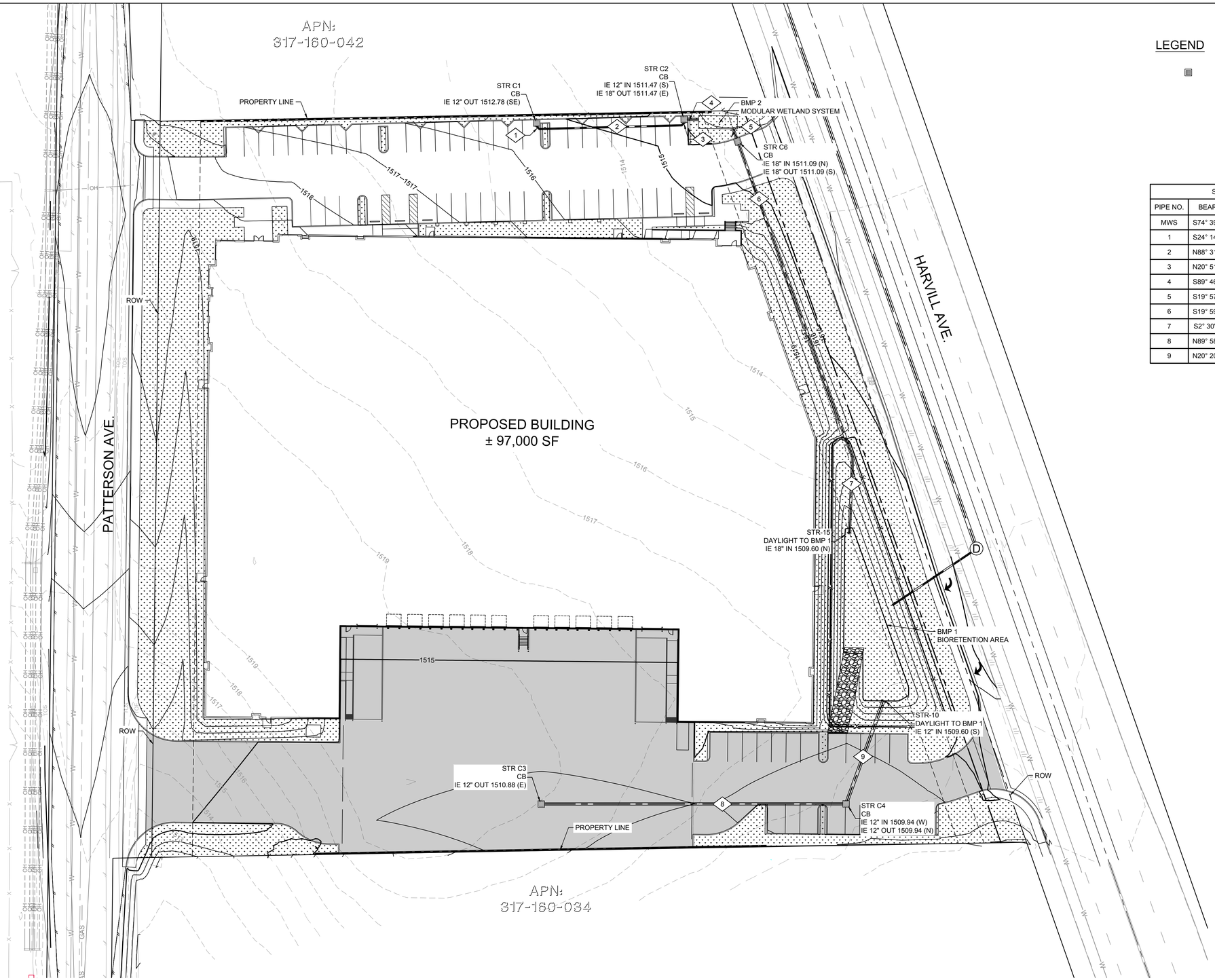
STANDARD INTENSITY-DURATION CURVES DATA

PLATE D-4.1 (4 of 6)

Pre DMA A1
Pre DMA B1
Pre DMA B2
Post-Development

APPENDIX B

HYDRAULIC CALCULATIONS



LEGEND

CATCH BASIN (CB)

STORM PIPE TABLE				
PIPE NO.	BEARING	LENGTH	SIZE	Slope
MWS	S74° 39' 50"E	22.10	18" RCP	0.00%
1	S24° 14' 01"E	4.01	12" RCP	1.37%
2	N88° 31' 36"E	87.98	12" RCP	1.37%
3	N20° 51' 30"E	3.94	12" RCP	1.37%
4	S89° 46' 11"E	8.94	18" RCP	2.47%
5	S19° 57' 19"E	8.25	18" RCP	1.97%
6	S19° 59' 23"E	207.76	18" RCP	0.58%
7	S2° 30' 42"W	46.53	18" RCP	0.58%
8	N89° 58' 18"E	188.26	12" RCP	0.50%
9	N20° 20' 35"E	68.32	12" RCP	0.50%

Kimley»Horn
401 B STREET, SUITE 600,
SAN DIEGO, CA 92101
PHONE: 619-234-9411
WWW.KIMLEY-HORN.COM

LDC HARVILL

EXHIBIT:

PROPOSED ONSITE HYDRAULIC EXHIBIT

NORTH

GRAPHIC SCALE IN FEET
0 15 30 60

JOB NO.: 195404001
DATE: 11/28/2023

1 OF 1

K:\SND_LDC\195404001 - LDC HARVILL\DRAINAGE\DRAINAGE STUDY\EXHIBIT\PDE EXHIBIT\PDE EXHIBIT.DWG

THE DOCUMENT, TOGETHER WITH THE CONCEPTS AND DESIGNS PRESENTED HEREIN, AS AN INSTRUMENT OF SERVICE, IS INTENDED ONLY FOR THE SPECIFIC PURPOSE AND CLIENT FOR WHICH IT WAS PREPARED. REUSE OF AND IMPROPER RELIANCE ON THIS DOCUMENT WITHOUT WRITTEN AUTHORIZATION AND ADAPTATION BY KIMLEY-HORN AND ASSOCIATES, INC. SHALL BE WITHOUT LIABILITY TO KIMLEY-HORN AND ASSOCIATES, INC. COPYRIGHT KIMLEY-HORN AND ASSOCIATES, INC., 2023

Inlet C1

Project Description	
Solve For	Spread

Input Data	
Discharge	5.07 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.035 ft/ft
Road Cross Slope	0.035 ft/ft
Grate Width	2.00 ft
Grate Length	2.0 ft
Local Depression	1.0 in
Local Depression Width	1.0 in
Grate Type	P-50 mm (P-1 -7/8")
Clogging	5.0 %

Results	
Spread	13.1 ft
Depth	5.5 in
Gutter Depression	0.0 in
Total Depression	1.0 in
Open Grate Area	3.4 ft²
Active Grate Weir Length	5.8 ft

Inlet C2

Project Description	
Solve For	Spread

Input Data	
Discharge	4.35 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.030 ft/ft
Road Cross Slope	0.030 ft/ft
Grate Width	2.00 ft
Grate Length	2.0 ft
Local Depression	1.0 in
Local Depression Width	1.0 in
Grate Type	P-50 mm (P-1 -7/8")
Clogging	5.0 %

Results	
Spread	13.6 ft
Depth	4.9 in
Gutter Depression	0.0 in
Total Depression	1.0 in
Open Grate Area	3.4 ft²
Active Grate Weir Length	5.8 ft

Inlet C3

Project Description	
Solve For	Spread

Input Data	
Discharge	2.78 cfs
Gutter Width	2.00 ft
Gutter Cross Slope	0.020 ft/ft
Road Cross Slope	0.020 ft/ft
Grate Width	2.00 ft
Grate Length	2.0 ft
Local Depression	1.0 in
Local Depression Width	1.0 in
Grate Type	P-50 mm (P-1 -7/8")
Clogging	5.0 %

Results	
Spread	14.7 ft
Depth	3.5 in
Gutter Depression	0.0 in
Total Depression	1.0 in
Open Grate Area	3.4 ft²
Active Grate Weir Length	5.8 ft

Inlet C4

Project Description	
Solve For	Spread

Input Data	
Discharge	0.73 cfs
Gutter Width	1.00 ft
Gutter Cross Slope	0.015 ft/ft
Road Cross Slope	0.015 ft/ft
Grate Width	1.00 ft
Grate Length	1.0 ft
Local Depression	1.0 in
Local Depression Width	1.0 in
Grate Type	P-50 mm (P-1 -7/8")
Clogging	5.0 %

Results	
Spread	11.6 ft
Depth	2.1 in
Gutter Depression	0.0 in
Total Depression	1.0 in
Open Grate Area	0.9 ft²
Active Grate Weir Length	2.9 ft

Inlet C6

Project Description	
Solve For	Spread

Input Data	
Discharge	0.58 cfs
Gutter Width	1.00 ft
Gutter Cross Slope	0.012 ft/ft
Road Cross Slope	0.012 ft/ft
Grate Width	1.00 ft
Grate Length	1.0 ft
Local Depression	1.0 in
Local Depression Width	1.0 in
Grate Type	P-50 mm (P-1 -7/8")
Clogging	5.0 %

Results	
Spread	12.0 ft
Depth	1.7 in
Gutter Depression	0.0 in
Total Depression	1.0 in
Open Grate Area	0.9 ft²
Active Grate Weir Length	2.9 ft

Pipe C1 to C2

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.014 ft/ft
Diameter	12.0 in
Discharge	5.07 cfs

Results	
Normal Depth	9.2 in
Flow Area	0.6 ft²
Wetted Perimeter	2.1 ft
Hydraulic Radius	3.6 in
Top Width	0.85 ft
Critical Depth	11.0 in
Percent Full	76.7 %
Critical Slope	0.010 ft/ft
Velocity	7.84 ft/s
Velocity Head	0.96 ft
Specific Energy	1.72 ft
Froude Number	1.582
Maximum Discharge	5.83 cfs
Discharge Full	5.42 cfs
Slope Full	0.012 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	76.7 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	9.2 in
Critical Depth	11.0 in
Channel Slope	0.014 ft/ft
Critical Slope	0.010 ft/ft

Pipe C2 to C6

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.011 ft/ft
Diameter	18.0 in
Discharge	9.42 cfs

Results	
Normal Depth	10.7 in
Flow Area	1.1 ft²
Wetted Perimeter	2.6 ft
Hydraulic Radius	5.0 in
Top Width	1.47 ft
Critical Depth	14.2 in
Percent Full	59.7 %
Critical Slope	0.005 ft/ft
Velocity	8.56 ft/s
Velocity Head	1.14 ft
Specific Energy	2.03 ft
Froude Number	1.744
Maximum Discharge	15.19 cfs
Discharge Full	14.12 cfs
Slope Full	0.005 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	59.7 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	10.7 in
Critical Depth	14.2 in
Channel Slope	0.011 ft/ft
Critical Slope	0.005 ft/ft

Pipe C6 to Basin

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.007 ft/ft
Diameter	18.0 in
Discharge	10.00 cfs

Results	
Normal Depth	13.0 in
Flow Area	1.4 ft²
Wetted Perimeter	3.1 ft
Hydraulic Radius	5.4 in
Top Width	1.34 ft
Critical Depth	14.6 in
Percent Full	72.5 %
Critical Slope	0.005 ft/ft
Velocity	7.29 ft/s
Velocity Head	0.83 ft
Specific Energy	1.91 ft
Froude Number	1.270
Maximum Discharge	12.29 cfs
Discharge Full	11.42 cfs
Slope Full	0.005 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	72.5 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	13.0 in
Critical Depth	14.6 in
Channel Slope	0.007 ft/ft
Critical Slope	0.005 ft/ft

Pipe C3 to C4

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.005 ft/ft
Diameter	12.0 in
Discharge	2.78 cfs

Results	
Normal Depth	8.5 in
Flow Area	0.6 ft²
Wetted Perimeter	2.0 ft
Hydraulic Radius	3.6 in
Top Width	0.91 ft
Critical Depth	8.6 in
Percent Full	70.8 %
Critical Slope	0.005 ft/ft
Velocity	4.68 ft/s
Velocity Head	0.34 ft
Specific Energy	1.05 ft
Froude Number	1.020
Maximum Discharge	3.52 cfs
Discharge Full	3.27 cfs
Slope Full	0.004 ft/ft
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	70.8 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	8.5 in
Critical Depth	8.6 in
Channel Slope	0.005 ft/ft
Critical Slope	0.005 ft/ft

Pipe C4 to Basin

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Roughness Coefficient	0.010
Channel Slope	0.005 ft/ft
Diameter	12.0 in
Discharge	3.51 cfs

Results	
Normal Depth	11.0 in
Flow Area	0.8 ft²
Wetted Perimeter	2.5 ft
Hydraulic Radius	3.5 in
Top Width	0.56 ft
Critical Depth	9.6 in
Percent Full	91.5 %
Critical Slope	0.006 ft/ft
Velocity	4.66 ft/s
Velocity Head	0.34 ft
Specific Energy	1.25 ft
Froude Number	0.708
Maximum Discharge	3.52 cfs
Discharge Full	3.27 cfs
Slope Full	0.006 ft/ft
Flow Type	Subcritical

GVF Input Data	
Downstream Depth	0.0 in
Length	0.0 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.0 in
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	41.7 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	11.0 in
Critical Depth	9.6 in
Channel Slope	0.005 ft/ft
Critical Slope	0.006 ft/ft

APPENDIX C

ONSITE CIVIL GRADING PLANS

APPENDIX D

GEOTECHNICAL DATA

GEOTECHNICAL INVESTIGATION
PROPOSED WAREHOUSE

Patterson Avenue, South of Cajalco Road
Riverside County (Perris), California
for
LDC Industrial Realty, LLC



SOUTHERN
CALIFORNIA
GEOTECHNICAL
A California Corporation

October 27, 2021

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

LDC Industrial Realty, LLC
555 N. El Camino Real, Suite A456
San Clemente, California 92672

Attention: Mr. Matthew Snyder

Project No.: **21G231-1**

Subject: **Geotechnical Investigation**
Proposed Warehouse
Patterson Avenue, South of Cajalco Road
Riverside County (Perris Area), California

Gentlemen:

In accordance with your request, we have conducted a geotechnical investigation at the subject site. We are pleased to present this report summarizing the conclusions and recommendations developed from our investigation.

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

Pablo Montes Jr.
Staff Engineer

Robert G. Trazo, GE 2655
Principal Engineer



Distribution: (1) Addressee

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 1

2.0 SCOPE OF SERVICES 3

3.0 SITE AND PROJECT DESCRIPTION 4

3.1 Site Conditions 4
3.2 Proposed Development 4

4.0 SUBSURFACE EXPLORATION 5

4.1 Scope of Exploration/Sampling Methods 5
4.2 Geotechnical Conditions 5

5.0 LABORATORY TESTING 7

6.0 CONCLUSIONS AND RECOMMENDATIONS 9

6.1 Seismic Design Considerations 9
6.2 Geotechnical Design Considerations 11
6.3 Site Grading Recommendations 13
6.4 Construction Considerations 16
6.5 Foundation Design and Construction 17
6.6 Floor Slab Design and Construction 18
6.7 Retaining Wall Design and Construction 19
6.8 Pavement Design Parameters 21

7.0 GENERAL COMMENTS 24

APPENDICES

A Plate 1: Site Location Map
Plate 2: Boring Location Plan
B Boring Logs
C Laboratory Test Results
D Grading Guide Specifications
E Seismic Design Parameters

1.0 EXECUTIVE SUMMARY

Presented below is a brief summary of the conclusions and recommendations of this investigation. Since this summary is not all inclusive, it should be read in complete context with the entire report.

Geotechnical Design Considerations

- Most of the boring locations encountered artificial fill materials, extending from the ground surface to depths of 2½ to 4½± feet. The fill soils possess varying strengths and densities, and are considered to represent undocumented fill. The near-surface alluvium possesses variable strengths and a minor potential for collapse when inundated with water. The artificial fill soils and the upper portion of the alluvium, in their present condition, are not considered suitable for support of the foundation loads of the new structure.

Site Preparation

- Remedial grading is recommended to be performed within the proposed building area in order to remove all of the undocumented fill soils in their entirety, the upper portion of the near-surface native alluvial soils, and any soils disturbed during the demolition process. The proposed building area should be overexcavated to a depth of at least 4 feet below existing grade and to a depth of 3 feet below proposed building pad subgrade elevation, whichever is greater. Within the foundation influence zones, the overexcavation should extend to a depth of at least 3 feet below proposed foundation bearing grade. The overexcavation should extend horizontally at least 5 feet beyond the building and foundation perimeters.
- After the overexcavation has been completed, the resulting subgrade soils should be evaluated by the geotechnical engineer to identify any additional soils that should be removed. The resulting subgrade should then be scarified to a depth of 12 inches and moisture conditioned (or air dried) to 2 to 4 percent above optimum. The previously excavated soils may then be replaced as compacted structural fill. All structural fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density.
- The new pavement and flatwork subgrade soils are recommended to be scarified to a depth of 12± inches, thoroughly moisture conditioned and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Building Foundations

- Conventional shallow foundations, supported in newly placed compacted fill.
- 2,500 lbs/ft^2 maximum allowable soil bearing pressure.
- Reinforcement consisting of at least four (4) No. 5 rebars (2 top and 2 bottom) in strip footings. Additional reinforcement may be necessary for structural considerations.

Building Floor Slab

- Conventional Slab-on-Grade: minimum 6 inches thick.
- Modulus of Subgrade Reaction: k = 150 psi/in.
- Reinforcement is not expected to be necessary for geotechnical considerations. The actual thickness and reinforcement of the floor slab should be determined by the structural engineer.

Pavements Design Recommendations

ASPHALT PAVEMENTS (R = 30)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	6	8	10	11	13
Compacted Subgrade	12	12	12	12	12

PORTLAND CEMENT CONCRETE PAVEMENTS (R = 30)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 5.0 to 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

2.0 SCOPE OF SERVICES

The scope of services performed for this project was in accordance with our Proposal No. 21P415, dated September 16, 2021. The scope of services included a visual site reconnaissance, subsurface exploration, field and laboratory testing, and geotechnical engineering analysis to provide criteria for preparing the design of the building foundations, building floor slab, and parking lot pavements along with site preparation recommendations and construction considerations for the proposed development. The evaluation of the environmental aspects of this site was beyond the scope of services for this geotechnical investigation.

3.0 SITE AND PROJECT DESCRIPTION

3.1 Site Conditions

The site is located at the on the east side of Patterson Avenue, 610± feet south of Cajalco Road in an unincorporated portion of Riverside County near Perris, California. The site is bounded to the north by a vacant lot, to the west by Patterson Avenue, to the south by a vacant lot, and to the east by Harvill Avenue. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site consists of a trapezoidal-shaped parcel, 4.79± acres in size. The site is presently vacant and undeveloped. The ground surface consists of exposed soils which appear to have been recently disced or tilled and stripped of any vegetation.

Detailed topographic information was not available at the time of this report. Based on our visual observations and topographic information obtained from Google Erath, the site topography appears to slope gently downward to the east at a gradient of approximately 1 percent.

3.2 Proposed Development

Based on the conceptual site plan (Scheme 1, dated September 1, 2021) prepared by HPA Architecture, the site will be developed with a new warehouse. The building will be 112,520± ft^2 in size, located in the central region of the property. Dock-high doors will be constructed along a portion of the southern building wall. The building is expected to be surrounded by asphaltic concrete in the automobile parking and driving lanes, with Portland cement concrete pavements in the truck court area, with limited areas of concrete flatwork and landscape planters.

Detailed structural information has not been provided. It is assumed that the new building will be a single-story structure of tilt-up concrete construction, supported on a conventional shallow foundation system with a concrete slab-on-grade floor. Based on the assumed construction, maximum column and wall loads are expected to be on the order of 100 kips and 4 to 7 kips per linear foot, respectively.

No significant amounts of below grade construction, such as basements or crawl spaces, are expected to be included in the proposed development. Based on the assumed topography, cuts and fills of up to 2 to 3± feet are expected to be necessary to achieve the proposed site grades.

4.0 SUBSURFACE EXPLORATION

4.1 Scope of Exploration/Sampling Methods

The subsurface exploration conducted for this project consisted of five (5) borings advanced to depths of 20 to 25± feet below the existing site grades. The borings were logged during drilling by a member of our staff.

The borings were advanced with hollow-stem augers, by a conventional truck-mounted drilling rig. Representative bulk and relatively undisturbed soil samples were taken during drilling. Relatively undisturbed soil samples were taken with a split barrel "California Sampler" containing a series of one inch long, 2.416± inch diameter brass rings. This sampling method is described in ASTM Test Method D-3550. In-situ samples were also taken using a 1.4± inch inside diameter split spoon sampler, in general accordance with ASTM D-1586. Both of these samplers are driven into the ground with successive blows of a 140-pound weight falling 30 inches. The blow counts obtained during driving are recorded for further analysis. Bulk samples were collected in plastic bags to retain their original moisture content. The relatively undisturbed ring samples were placed in molded plastic sleeves that were then sealed and transported to our laboratory.

The approximate locations of the borings are indicated on the Boring Location Plan, included as Plate 2 in Appendix A of this report. The Boring Logs, which illustrate the conditions encountered at the boring locations, as well as the results of some of the laboratory testing, are included in Appendix B.

4.2 Geotechnical Conditions

Artificial Fill

With the exception of Boring No. B-3, artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 2½ to 4½± feet below the existing site grades. The artificial fill soils consist of medium dense to very dense silty and clayey fine to coarse sands. These materials possess varying densities and a disturbed appearance (with some lamination), resulting in their classification as artificial fill.

Younger Alluvium

Native younger alluvium was encountered at the ground surface at Boring No. B-3, and beneath the artificial fill soils at Boring Nos. B-2 and B-4, extending to depths of 8 to 20± feet below the existing site grades. Boring No. B-2 was terminated within the younger alluvium at a depth of 20± feet. The younger alluvium generally consists of loose to dense silty sands and clayey sands. The younger alluvium possesses minor amounts of calcareous deposits.

Older Alluvium

With the exception of Boring No. B-2, older native alluvial soils were encountered beneath the artificial fill or beneath the younger alluvium at all of the boring locations, extending to at least the maximum depth explored of 25± feet below ground surface. The older alluvium generally consists of medium dense to dense silty fine sands, clayey fine sands, and fine sandy silts with varying medium to coarse sand.

Groundwater

Free water was not encountered during the drilling of any of the borings. Based on the moisture content of the recovered soil samples and the lack of free water in the borings, the static groundwater table is at a greater depth than 25± feet below existing site grades.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. One of the monitoring wells observed in the vicinity of the site is located 1.4 miles east of the subject site. Water level readings within this monitoring well indicates a high groundwater level of 79± feet below the ground surface in February 2015.

5.0 LABORATORY TESTING

The soil samples recovered from the subsurface exploration were returned to our laboratory for further testing to determine selected physical and engineering properties of the soils. The tests are briefly discussed below. It should be noted that the test results are specific to the actual samples tested, and variations could be expected at other locations and depths.

Classification

All recovered soil samples were classified using the Unified Soil Classification System (USCS), in accordance with ASTM D-2488. Field identifications were then supplemented with additional visual classifications and/or by laboratory testing. The USCS classifications are shown on the Boring Logs and are periodically referenced throughout this report.

Density and Moisture Content

The density has been determined for selected relatively undisturbed ring samples. These densities were determined in general accordance with the method presented in ASTM D-2937. The results are recorded as dry unit weight in pounds per cubic foot. The moisture contents are determined in accordance with ASTM D-2216, and are expressed as a percentage of the dry weight. These test results are presented on the Boring Logs.

Consolidation

Selected soil samples have been tested to determine their consolidation and collapse potential, in accordance with ASTM D-2435. The testing apparatus is designed to accept either natural or remolded samples in a one-inch high ring, approximately 2.416 inches in diameter. Each sample is then loaded incrementally in a geometric progression and the resulting deflection is recorded at selected time intervals. Porous stones are in contact with the top and bottom of the sample to permit the addition or release of pore water. The samples are typically inundated with water at an intermediate load to determine their potential for collapse or heave. The results of the consolidation testing are plotted on Plates C-1 through C-4 in Appendix C of this report.

Maximum Dry Density and Optimum Moisture Content

A representative bulk sample has been tested for its maximum dry density and optimum moisture content. The results have been obtained using the Modified Proctor procedure, per ASTM D-1557, and are presented on Plate C-5 in Appendix C of this report. These tests are generally used to with compare the dry densities of undisturbed field samples, and for later compaction testing. Additional testing of other soil types or soil mixes may be necessary at a later date.

Expansion Index

The expansion potential of the on-site soils was determined in general accordance with ASTM D-4829. The testing apparatus is designed to accept a 4-inch diameter, 1-in high, remolded sample. The sample is initially remolded to 50± 1 percent saturation and then loaded with a surcharge equivalent to 144 pounds per square foot. The sample is then inundated with water and allowed

to swell against the surcharge. The resultant swell or consolidation is recorded after a 24-hour period. The results of the EI testing are as follows:

Sample Identification	Expansion Index	Expansive Potential
B-4 @ 0 to 5 feet	31	Low

Soluble Sulfates

A representative sample of the near-surface soils was submitted to a subcontracted analytical laboratory for determination of soluble sulfate content. Soluble sulfates are naturally present in soils, and if the concentration is high enough, can result in degradation of concrete which comes into contact with these soils. The results of the soluble sulfate testing are presented below, and are discussed further in a subsequent section of this report.

Sample Identification	Soluble Sulfates (%)	Sulfate Classification
B-4 @ 0 to 5 feet	0.005	Not Applicable (S0)

Corrosivity Testing

One representative bulk sample of the near-surface soils was submitted to a subcontracted corrosion engineering laboratory to identify potentially corrosive characteristics with respect to common construction materials. The corrosivity testing included a determination of the electrical resistivity, pH, and chloride and nitrate concentrations of the soils, as well as other tests. The results of some of these tests are presented below.

Sample Identification	Saturated Resistivity (ohm-cm)	pH	Chlorides (mg/kg)	Nitrates (mg/kg)
B-4 @ 0 to 5 feet	3,720	7.7	9.5	3.3

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our review, field exploration, laboratory testing and geotechnical analysis, the proposed development is considered feasible from a geotechnical standpoint. The recommendations contained in this report should be taken into the design, construction, and grading considerations.

The recommendations are contingent upon all grading and foundation construction activities being monitored by the geotechnical engineer of record. The recommendations are provided with the assumption that an adequate program of client consultation, construction monitoring, and testing will be performed during the final design and construction phases to verify compliance with these recommendations. Maintaining Southern California Geotechnical, Inc., (SCG) as the geotechnical consultant from the beginning to the end of the project will provide continuity of services. The geotechnical engineering firm providing testing and observation services shall assume the responsibility of Geotechnical Engineer of Record.

The Grading Guide Specifications, included as Appendix D, should be considered part of this report, and should be incorporated into the project specifications. The contractor and/or owner of the development should bring to the attention of the geotechnical engineer any conditions that differ from those stated in this report, or which may be detrimental for the development.

6.1 Seismic Design Considerations

The subject site is located in an area which is subject to strong ground motions due to earthquakes. The performance of a site-specific seismic hazards analysis was beyond the scope of this investigation. However, numerous faults capable of producing significant ground motions are located near the subject site. Due to economic considerations, it is not generally considered reasonable to design a structure that is not susceptible to earthquake damage. Therefore, significant damage to structures may be unavoidable during large earthquakes. The proposed structures should, however, be designed to resist structural collapse and thereby provide reasonable protection from serious injury, catastrophic property damage and loss of life.

Faulting and Seismicity

Research of available maps indicates that the subject site is not located within an Alquist-Priolo Earthquake Fault Zone. Furthermore, SCG did not identify any evidence of faulting during the geotechnical investigation. Therefore, the possibility of significant fault rupture on the site is considered to be low.

The potential for other geologic hazards such as seismically induced settlement, lateral spreading, tsunamis, inundation, seiches, flooding, and subsidence affecting the site is considered low.

Seismic Design Parameters

The 2019 California Building Code (CBC) provides procedures for earthquake resistant structural design that include considerations for on-site soil conditions, occupancy, and the configuration of

the structure including the structural system and height. The seismic design parameters presented below are based on the soil profile and the proximity of known faults with respect to the subject site.

Based on standards in place at the time of this report, the proposed development is expected to be designed in accordance with the requirements of the 2019 edition of the California Building Code (CBC), which was adopted on January 1, 2020.

The 2019 CBC Seismic Design Parameters have been generated using the SEAOC/OSHPD Seismic Design Maps Tool, a web-based software application available at the website www.seismicmaps.org. This software application calculates seismic design parameters in accordance with several building code reference documents, including ASCE 7-16, upon which the 2019 CBC is based. The application utilizes a database of risk-targeted maximum considered earthquake (MCE_R) site accelerations at 0.01-degree intervals for each of the code documents. The tables below were created using data obtained from the application. The output generated from this program is included as Plate E-1 in Appendix E of this report.

The 2019 CBC requires that a site-specific ground motion study be performed in accordance with Section 11.4.8 of ASCE 7-16 for Site Class D sites with a mapped S_1 value greater than 0.2. However, Section 11.4.8 of ASCE 7-16 also indicates an exception to the requirement for a site-specific ground motion hazard analysis for certain structures on Site Class D sites. The commentary for Section 11 of ASCE 7-16 (Page 534 of Section C11 of ASCE 7-16) indicates that "In general, this exception effectively limits the requirements for site-specific hazard analysis to very tall and or flexible structures at Site Class D sites." **Based on our understanding of the proposed development, the seismic design parameters presented below were calculated assuming that the exception in Section 11.4.8 applies to the proposed structure at this site. However, the structural engineer should verify that this exception is applicable to the proposed structure.** Based on the exception, the spectral response accelerations presented below were calculated using the site coefficients (F_a and F_v) from Tables 1613.2.3(1) and 1613.2.3(2) presented in Section 16.4.4 of the 2019 CBC.

2019 CBC SEISMIC DESIGN PARAMETERS

Parameter		Value
Mapped Spectral Acceleration at 0.2 sec Period	S_S	1.500
Mapped Spectral Acceleration at 1.0 sec Period	S_1	0.558
Site Class	---	D
Site Modified Spectral Acceleration at 0.2 sec Period	S_{MS}	1.500
Site Modified Spectral Acceleration at 1.0 sec Period	S_{M1}	0.972
Design Spectral Acceleration at 0.2 sec Period	S_{DS}	1.000
Design Spectral Acceleration at 1.0 sec Period	S_{D1}	0.648

It should be noted that the site coefficient F_v and the parameters S_{M1} and S_{D1} were not included in the SEAOC/OSHPD Seismic Design Maps Tool output for the 2019 CBC. We calculated these parameters-based on Table 1613.2.3(2) in Section 16.4.4 of the 2019 CBC using the value of S_1

obtained from the Seismic Design Maps Tool, assuming that a site-specific ground motion hazards analysis is not required for the proposed buildings at this site.

Liquefaction

Liquefaction is the loss of strength in generally cohesionless, saturated soils when the pore-water pressure induced in the soil by a seismic event becomes equal to or exceeds the overburden pressure. The primary factors which influence the potential for liquefaction include groundwater table elevation, soil type and plasticity characteristics, relative density of the soil, initial confining pressure, and intensity and duration of ground shaking. The depth within which the occurrence of liquefaction may impact surface improvements is generally identified as the upper 50 feet below the existing ground surface. Liquefaction potential is greater in saturated, loose, poorly graded fine sands with a mean (d_{50}) grain size in the range of 0.075 to 0.2 mm (Seed and Idriss, 1971). Non-sensitive clayey (cohesive) soils which possess a plasticity index of at least 18 (Bray and Sancio, 2006) are generally not considered to be susceptible to liquefaction, nor are those soils which are above the historic static groundwater table.

The Riverside County GIS website indicates that the subject site is located within a zone of low liquefaction susceptibility. In addition, the subsurface conditions encountered at the boring locations are not considered to be conducive to liquefaction. These conditions consist of moderate to high strength younger and older native alluvial soils and no evidence of a long-term groundwater table within the depths explored by the borings. Based on these considerations, liquefaction is not considered to be a design concern for this project.

6.2 Geotechnical Design Considerations

General

The proposed building area is underlain by artificial fill soils, extending to depths of 2½ to 4½± feet below the existing site grades. No documentation regarding the placement and compaction of these materials is expected to be available. Therefore, these materials are considered to represent undocumented fill soils. These soils, in their present condition, are not considered suitable for support of the foundation loads of the new structure. Therefore, remedial grading is considered warranted within the proposed building area in order to remove the artificial fill soils in their entirety, and replace these materials as compacted structural fill soils. In order to provide a layer of uniform support beneath the new structure, an overexcavation of the upper portion of the native alluvial soils is also considered necessary.

Settlement

The recommended remedial grading will remove the artificial fill soils in their entirety, as well as the upper portion of the near-surface native alluvium, and replace these soils as compacted structural fill. The native soils that will remain in place below the recommended depth of overexcavation will not be subject to significant load increases from the foundations of the new structure. Provided that the recommended remedial grading is completed, the post-construction static settlements of the proposed structure is expected to be within tolerable limits.

Expansion

Laboratory testing performed on a representative sample of the near surface soils indicates that these materials possess a low expansion potential (EI = 31). Based on the presence of expansive soils at this site, care should be given to proper moisture conditioning of all building pad subgrade soils to a moisture content of 2 to 4 percent above the ASTM D-1557 optimum during site grading. In addition to adequately moisture conditioning the subgrade soils and fill soils during grading, special care must be taken to maintaining moisture content of these soils at 2 to 4 percent above the optimum moisture content. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather.

Soluble Sulfates

The results of the soluble sulfate testing indicated a sulfate concentration of approximately 0.005 percent for the selected sample of the near-surface soils. This concentration is considered to be "not applicable" (S0) with respect to the American Concrete Institute (ACI) Publication 318-14 Building Code Requirements for Structural Concrete and Commentary, Section 4.3. Therefore, specialized concrete mix designs are not considered to be necessary, with regard to sulfate protection purposes. It is, however, recommended that additional soluble sulfate testing be conducted at the completion of rough grading to verify the soluble sulfate concentrations of the soils which are present at pad grade within the building area.

Corrosion Potential

The results of laboratory testing indicate that the on-site soils possess a saturated resistivity of 3,720 ohm-cm, and a pH value of 7.7. These test results have been evaluated in accordance with guidelines published by the Ductile Iron Pipe Research Association (DIPRA). The DIPRA guidelines consist of a point system by which characteristics of the soils are used to quantify the corrosivity characteristics of the site. Resistivity and pH are two of the five factors that enter into the evaluation procedure. Redox potential, relative soil moisture content and sulfides are also included. Although sulfide testing was not part of the scope of services for this project, we have evaluated the corrosivity characteristics of the on-site soils using resistivity, pH and moisture content. Based on these factors, and utilizing the DIPRA procedure, the on-site soils are not considered to be corrosive to ductile iron pipe.

A relatively low concentration (9.5 mg/kg) of chlorides were detected in the sample submitted for corrosivity testing. In general, soils possessing chloride concentrations in excess of 500 parts per million (ppm) are considered to be corrosive with respect to steel reinforcement within reinforced concrete. Based on the lack of any significant chlorides in the tested sample, the site is considered to have a C1 chloride exposure in accordance with the American Concrete Institute (ACI) Publication 318 Building Code Requirements for Structural Concrete and Commentary. Therefore, a specialized concrete mix design for reinforced concrete for protection against chloride exposure is not considered warranted.

Nitrates present in soil can be corrosive to copper tubing at concentrations greater than 50 mg/kg. The tested sample possess a nitrate concentration of 3.3 mg/kg. Based on this test result, the on-site soils are not considered to be corrosive to copper pipe.

Since SCG does not practice in the area of corrosion engineering, we recommend that the client contact a corrosion engineer to provide a more thorough evaluation.

Shrinkage/Subsidence

Based on the results of the laboratory testing, removal and recompaction of the artificial fill and near-surface native alluvium will result in an average shrinkage of 0 to 5 percent. However, the estimated shrinkage of the individual soil layers at the site is highly variable, locally ranging from a minimum shrinkage value of 0 percent to a maximum shrinkage of 11 percent at varying sample depths and locations. It should be noted that the potential shrinkage estimate is based on dry density testing performed on small-diameter samples taken at the boring locations. If a more accurate and precise shrinkage estimate is desired, SCG can perform a shrinkage study involving several excavated test-pits where in-place densities are determined using in-situ testing methods instead of laboratory density testing on small-diameter samples. Please contact SCG for details and a cost estimate regarding a shrinkage study, if desired.

Minor ground subsidence is expected to occur in the soils below the zone of removal, due to settlement and machinery working. The subsidence is estimated to be 0.10 feet.

These estimates are based on previous experience and the subsurface conditions encountered at the boring locations. The actual amount of subsidence is expected to be variable and will be dependent on the type of machinery used, repetitions of use, and dynamic effects, all of which are difficult to assess precisely.

Grading and Foundation Plan Review

It is recommended that we be provided with copies of the finalized grading and foundation plans, when they become available, for review with regard to the conclusions, recommendations, and assumptions contained within this report.

6.3 Site Grading Recommendations

The grading recommendations presented below are based on the subsurface conditions encountered at the boring locations and our understanding of the proposed development. We recommend that all grading activities be completed in accordance with the Grading Guide Specifications included as Appendix D of this report, unless superseded by site-specific recommendations presented below.

Site Stripping

Initial site preparation should include stripping of any surficial vegetation and organic soils. Any organic topsoil and tree root masses should be removed during site stripping. Based on conditions encountered at the time of the subsurface exploration, removal of native grass and weed growth is not expected to be necessary based on the recent stripping at the site. The actual extent of site stripping should be determined in the field by the geotechnical engineer, based on the organic content and stability of the materials encountered.

Treatment of Existing Soils: Building Pad

Remedial grading should be performed within the proposed building pad area in order to remove the artificial fill soils in their entirety and the upper portion of the existing alluvial soils. At the boring locations the artificial fill soils extend to depths of 2½ to 4½± feet below the existing site grades. In order to provide a uniform layer of building support, it is recommended that the overexcavation extend to a depth of at least 4 feet below existing grade, and to a depth of at least 3 feet below proposed grade, whichever is greater. Within the influence zones of the new foundations, the overexcavation should extend to a depth of at least 3 feet below proposed foundation bearing grade.

The overexcavation areas should extend at least 5 feet beyond the building perimeters, and to an extent equal to the depth of fill below the new foundations. If the proposed structure incorporates any exterior columns (such as for a canopy or overhang) the area of overexcavation should also encompass these areas.

Following completion of the overexcavation, the subgrade soils within the overexcavation areas should be evaluated by the geotechnical engineer to verify their suitability to serve as the structural fill subgrade, as well as to support the foundation loads of the new structure. This evaluation should include proofrolling and probing to identify any soft, loose, or otherwise unstable soils that must be removed. Some localized areas of deeper excavation may be required if additional fill or loose, porous, or low-density native soils are encountered at the base of the overexcavation.

After a suitable overexcavation subgrade has been achieved, the exposed soils should be scarified to a depth of at least 12 inches and moisture conditioned or air dried to achieve a moisture content of 2 to 4 percent above optimum moisture content. The subgrade soils should then be recompacted to at least 90 percent of the ASTM D-1557 maximum dry density.

The building pad area may then be raised to grade with previously excavated soils or imported, very low expansive structural fill. All structural fill soils present within the proposed building area should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density.

Treatment of Existing Soils: Retaining Walls and Site Walls

The existing soils within the areas of proposed retaining and non-retaining site walls should be overexcavated to a depth of at least 2 feet below foundation bearing grade and replaced as compacted structural fill. Subgrades for erection pads for concrete tilt-up walls are considered to be a part of the foundation system and should also be overexcavated. The overexcavation subgrade soils should be evaluated by the geotechnical engineer prior to scarifying, moisture conditioning and recompacting the upper 12 inches of exposed subgrade soils. The previously excavated soils may then be replaced as compacted structural fill.

If the full lateral extent of overexcavation is not achievable for the proposed walls, the foundations should be redesigned using a lower bearing pressure. The geotechnical engineer of record should be contacted for recommendations pertaining to this type of condition.

Treatment of Existing Soils: Parking and Drive Areas

Based on economic considerations, overexcavation of the existing soils in the new parking and drive areas is not considered warranted, with the exception of areas where lower strength, or unstable soils are identified by the geotechnical engineer during grading.

Subgrade preparation in the new parking and drive areas should initially consist of removal of all soils disturbed during stripping. The geotechnical engineer should then evaluate the subgrade to identify any areas of additional unsuitable soils. The subgrade soils should then be scarified to a depth of 12± inches, moisture conditioned to 2 to 4 percent above optimum, and recompacted to at least 90 percent of the ASTM D-1557 maximum dry density. Based on the presence of variable strength soils throughout the site, it is expected that some isolated areas of additional overexcavation may be required to remove zones of lower strength, unsuitable soils.

The grading recommendations presented above for the proposed parking and drive areas assume that the owner and/or developer can tolerate minor amounts of settlement within the proposed parking areas. The grading recommendations presented above do not completely mitigate the extent of existing undocumented fill soils and low strength younger alluvium in the parking areas. As such, settlement and associated pavement distress could occur. Typically, repair of such distressed areas involves significantly lower costs than completely mitigating these soils at the time of construction. If the owner cannot tolerate the risk of such settlements, the parking and drive areas should be overexcavated to a depth of 2 feet below proposed pavement subgrade elevation, with the resulting soils replaced as compacted structural fill.

Fill Placement

- Fill soils should be placed in thin (6± inches), near-horizontal lifts, moisture conditioned to 2 to 4 percent above the optimum moisture content, and compacted.
- On-site soils may be used for fill provided they are cleaned of any debris to the satisfaction of the geotechnical engineer.
- All grading and fill placement activities should be completed in accordance with the requirements of the 2019 CBC and the grading code of the city of Perris and/or the county of Riverside.
- All fill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. Fill soils should be well mixed.
- Compaction tests should be performed periodically by the geotechnical engineer as random verification of compaction and moisture content. These tests are intended to aid the contractor. Since the tests are taken at discrete locations and depths, they may not be indicative of the entire fill and therefore should not relieve the contractor of his responsibility to meet the job specifications.

Imported Structural Fill

All imported structural fill should consist of very low expansive (EI < 20), well graded soils possessing at least 10 percent fines (that portion of the sample passing the No. 200 sieve). Additional specifications for structural fill are presented in the Grading Guide Specifications, included as Appendix D.

Utility Trench Backfill

In general, all utility trench backfill soils should be compacted to at least 90 percent of the ASTM D-1557 maximum dry density. As an alternative, a clean sand (minimum Sand Equivalent of 30) may be placed within trenches and compacted in place (jetting or flooding is not recommended). Compacted trench backfill should conform to the requirements of the local grading code, and more restrictive requirements may be indicated by the city of Perris and/or the county of Riverside. All utility trench backfills should be witnessed by the geotechnical engineer. The trench backfill soils should be compaction tested where possible; probed and visually evaluated elsewhere.

Utility trenches which parallel a footing, and extending below a 1h:1v plane projected from the outside edge of the footing should be backfilled with structural fill soils, compacted to at least 90 percent of the ASTM D-1557 standard. Pea gravel backfill should not be used for these trenches.

6.4 Construction Considerations

Excavation Considerations

The near-surface soils generally consist of moderate strength silty sands and clayey sands. These materials may be subject to minor to moderate caving within shallow excavations. Where caving does occur, flattened excavation slopes may be sufficient to provide excavation stability. On a preliminary basis, the inclination of temporary slopes should not exceed 1.5h:1v. Deeper excavations may require some form of external stabilization such as shoring or bracing. Maintaining adequate moisture content within the near-surface soils will improve excavation stability. All excavation activities on this site should be conducted in accordance with Cal-OSHA regulations.

Expansive Soils

Based on the results of laboratory testing, some of the near surface soils have been determined to possess a low potential for expansion. Therefore, care should be given to proper moisture conditioning of all building pad subgrade soils to a moisture content of 2 to 4 percent above the Modified Proctor optimum during site grading. All imported fill soils should have very low expansive characteristics. In addition to adequately moisture conditioning the subgrade soils and fill soils during grading, special care must be taken to maintain moisture content of these soils at 2 to 4 percent above the Modified Proctor optimum. This will require the contractor to frequently moisture condition these soils throughout the grading process, unless grading occurs during a period of relatively wet weather.

Other provisions, as determined by the landscape architect or civil engineer, may also be appropriate.

Moisture Sensitive Subgrade Soils

Most of the near surface soils possess appreciable silt and clay content and may become unstable if exposed to significant moisture infiltration or disturbance by construction traffic. In addition,

based on their granular content, some of the on-site soils will also be susceptible to erosion. The site should, therefore, be graded to prevent ponding of surface water and to prevent water from running into excavations.

Groundwater

The static groundwater table is considered to exist at a depth greater than 25± feet or more below existing grade. Therefore, groundwater is not expected to impact the grading or foundation construction activities.

6.5 Foundation Design and Construction

Based on the preceding grading recommendations, it is assumed that the new building pad will be underlain by newly placed structural fill soils extending to depths of at least 4 feet below foundation bearing grade. Based on this subsurface profile, the proposed structure may be supported on shallow foundations.

Foundation Design Parameters

New square and rectangular footings may be designed as follows:

- Maximum, net allowable soil bearing pressure: 2,500 lbs/ft^2.
- Minimum wall/column footing width: 14 inches/24 inches.
- Minimum longitudinal steel reinforcement within strip footings: Four (4) No. 5 rebars (2 top and 2 bottom). Due to the presence of expansive soils. Additional reinforcement may be necessary for structural considerations.
- Minimum foundation embedment: 12 inches into suitable structural fill soils, and at least 18 inches below adjacent exterior grade. Interior column footings may be placed immediately beneath the floor slab.
- It is recommended that the perimeter building foundations be continuous across all exterior doorways. Any flatwork adjacent to the exterior doors should be doweled into the perimeter foundations in a manner determined by the structural engineer.

The allowable bearing pressures presented above may be increased by 1/3 when considering short duration wind or seismic loads. The minimum steel reinforcement recommended above is based on standard geotechnical practice. Additional rigidity may be necessary for structural considerations. The actual design of the foundations should be determined by the structural engineer.

Foundation Construction

The foundation subgrade soils should be evaluated at the time of overexcavation, as discussed in Section 6.3 of this report. It is further recommended that the foundation subgrade soils be evaluated by the geotechnical engineer immediately prior to steel or concrete placement. Soils

suitable for direct foundation support should consist of newly placed structural fill compacted at least 90 percent of the ASTM D-1557 maximum dry density. Any unsuitable materials should be removed to a depth of suitable bearing compacted structural fill, with the resulting excavations backfilled with compacted fill soils. As an alternative, lean concrete slurry (500 to 1,500 psi) may be used to backfill such isolated overexcavations.

The foundation subgrade soils should also be properly moisture conditioned to 2 to 4 percent above the Modified Proctor optimum, to a depth of at least 12 inches below bearing grade. Since it is typically not feasible to increase the moisture content of the floor slab and foundation subgrade soils once rough grading has been completed, care should be taken to maintain the moisture content of the building pad subgrade soils throughout the construction process.

Estimated Foundation Settlements

Post-construction total and differential static settlements of shallow foundations designed and constructed in accordance with the previously presented recommendations are estimated to be less than 1.0 and 0.5 inches, respectively, under static conditions. Differential movements are expected to occur over a 50-foot span, thereby resulting in an angular distortion of less than 0.002 inches per inch.

Lateral Load Resistance

Lateral load resistance will be developed by a combination of friction acting at the base of foundations and slab and the passive earth pressure developed by footings below grade. The following friction and passive pressure may be used to resist lateral forces:

- Passive Earth Pressure: 300 lbs/ft^3
- Friction Coefficient: 0.30

These are allowable values, and include a factor of safety. When combining friction and passive resistance, the passive pressure component should be reduced by one-third. These values assume that footings will be poured directly against compacted structural fill soils. The maximum allowable passive pressure is 3,000 lbs/ft^2.

6.6 Floor Slab Design and Construction

Subgrades which will support new floor slab should be prepared in accordance with the recommendations contained in the ***Site Grading Recommendations*** section of this report. Based on the anticipated grading which will occur at this site, the floor of the proposed structure may be constructed as a conventional slab-on-grade, supported on newly placed structural fill (or densified existing soils), extending to a depth of at least 3 feet below finished pad grade. Based on geotechnical considerations, the floor slabs may be designed as follows:

- Minimum slab thickness: 6 inches.

- Modulus of Subgrade Reaction: 150 psi/in.

- Reinforcement is not expected to be required for geotechnical conditions. The actual floor slab reinforcement should be determined by the structural engineer, based upon the imposed loading.

- Slab underlayment: If moisture sensitive floor coverings will be used then minimum slab underlayment should consist of a moisture vapor barrier constructed below the entire slab area where such moisture sensitive floor coverings are expected. The moisture vapor barrier should meet or exceed the Class A rating as defined by ASTM E 1745-97 and have a permeance rating less than 0.01 perms as described in ASTM E 96-95 and ASTM E 154-88. A polyolefin material such as Stego® Wrap Vapor Barrier or equivalent will meet these specifications. The moisture vapor barrier should be properly constructed in accordance with all applicable manufacturer specifications. Given that a rock free subgrade is anticipated and that a capillary break is not required, sand below the barrier is not required. The need for sand and/or the amount of sand above the moisture vapor barrier should be specified by the structural engineer or concrete contractor. The selection of sand above the barrier is not a geotechnical engineering issue and hence outside our purview. Where moisture sensitive floor coverings are not anticipated, the vapor barrier may be eliminated.

- Moisture condition the floor slab subgrade soils to 2 to 4 percent above the Modified Proctor optimum moisture content, to a depth of 12 inches. The moisture content of the floor slab subgrade soils should be verified by the geotechnical engineer within 24 hours prior to concrete placement.

- Proper concrete curing techniques should be utilized to reduce the potential for slab curling or the formation of excessive shrinkage cracks.

The actual design of the floor slab should be completed by the structural engineer to verify adequate thickness and reinforcement.

6.7 Retaining Wall Design and Construction

Although not indicated on the site plan, some small (less than 6 feet in height) retaining walls may be required in truck court area and to facilitate the new site grades. The parameters recommended for use in the design of these walls are presented below.

Retaining Wall Design Parameters

Based on the soil conditions encountered at the boring locations, the following parameters may be used in the design of new retaining walls for this site. The following parameters assume that only the on-site soils will be utilized for retaining wall backfill. The near-surface soils generally consist of silty sands and clayey sands. Based on their classification, these materials are expected to possess a friction angle of at least 30 degrees when compacted to at least 90 percent of the ASTM D-1557 maximum dry density.

If desired, SCG could provide design parameters for an alternative select backfill material behind the retaining walls. The use of select backfill material could result in lower lateral earth pressures. In order to use the design parameters for the imported select fill, this material must be placed

within the entire active failure wedge. This wedge is defined as extending from the heel of the retaining wall upwards at an angle of approximately 60° from horizontal. If select backfill material behind the retaining wall is desired, SCG should be contacted for supplementary recommendations.

RETAINING WALL DESIGN PARAMETERS

Design Parameter		**Soil Type**
		On-Site Silty Sands and Clayey Sands
Internal Friction Angle (ϕ)		30°
Unit Weight		131 lbs/ft^3
Equivalent Fluid Pressure:	Active Condition (level backfill)	44 lbs/ft^3
	Active Condition (2h:1v backfill)	70 lbs/ft^3
	At-Rest Condition (level backfill)	66 lbs/ft^3

Regardless of the backfill type, the walls should be designed using a soil-footing coefficient of friction of 0.30 and an equivalent passive pressure of 300 lbs/ft^3. The structural engineer should incorporate appropriate factors of safety in the design of the retaining walls.

The active earth pressure may be used for the design of retaining walls that do not directly support structures or support soils that in turn support structures and which will be allowed to deflect. The at-rest earth pressure should be used for walls that will not be allowed to deflect such as those which will support foundation bearing soils, or which will support foundation loads directly.

Where the soils on the toe side of the retaining wall are not covered by a "hard" surface such as a structure or pavement, the upper 1 foot of soil should be neglected when calculating passive resistance due to the potential for the material to become disturbed or degraded during the life of the structure.

Seismic Lateral Earth Pressures

In accordance with the 2019 CBC, any retaining walls more than 6 feet in height must be designed for seismic lateral earth pressures. If walls 6 feet or more are required for this site, the geotechnical engineer should be contacted for supplementary seismic lateral earth pressure recommendations.

Retaining Wall Foundation Design

The retaining wall foundations should be supported within newly placed compacted structural fill, extending to a depth of at least 2 feet below proposed foundation bearing grade. Foundations to support new retaining walls should be designed in accordance with the general Foundation Design Parameters presented in a previous section of this report.

Backfill Material

On-site soils may be used to backfill the retaining walls. However, all backfill material placed within 3 feet of the back-wall face should have a particle size no greater than 3 inches. The retaining wall backfill materials should be well graded.

It is recommended that a properly installed prefabricated drainage composite such as the MiraDRAIN 6000XL (or approved equivalent), which is specifically designed for use behind retaining walls be used. If the drainage composite material is not covered by an impermeable surface, such as a structure or pavement, a 12-inch thick layer of a low permeability soil should be placed over the backfill to reduce surface water migration to the underlying soils. The drainage composite should be separated from the backfill soils by a suitable geotextile, approved by the geotechnical engineer.

All retaining wall backfill should be placed and compacted under engineering-controlled conditions in the necessary layer thicknesses to ensure an in-place density between 90 and 93 percent of the maximum dry density as determined by the Modified Proctor test (ASTM D1557). Care should be taken to avoid over-compaction of the soils behind the retaining walls, and the use of heavy compaction equipment should be avoided.

Subsurface Drainage

As previously indicated, the retaining wall design parameters are based upon drained backfill conditions. Consequently, some form of permanent drainage system will be necessary in conjunction with the appropriate backfill material. Subsurface drainage may consist of either:

- A weep hole drainage system typically consisting of a series of 2-inch diameter holes in the wall situated slightly above the ground surface elevation on the exposed side of the wall and at an approximate 10-foot on-center spacing. Alternatively, 4-inch diameter holes at an approximate 20-foot on-center spacing can be used for this type of drainage system. In addition, the weep holes should include a 2 cubic foot pocket of open graded gravel, surrounded by an approved geotextile fabric, at each weep hole location.

- A 4-inch diameter perforated pipe surrounded by 2 cubic feet of gravel per linear foot of drain placed behind the wall, above the retaining wall footing. The gravel layer should be wrapped in a suitable geotextile fabric to reduce the potential for migration of fines. The footing drain should be extended to daylight or tied into a storm drainage system. The actual design of this type of system should be determined by the civil engineer to verify that the drainage system possesses the adequate capacity and slope for its intended use.

6.8 Pavement Design Parameters

Site preparation in the pavement area should be completed as previously recommended in the ***Site Grading Recommendations*** section of this report. The subsequent pavement recommendations assume proper drainage and construction monitoring, and are based on either PCA or CALTRANS design parameters for a twenty (20) year design period. However, these designs also assume a routine pavement maintenance program to obtain the anticipated 20-year pavement service life.

Pavement Subgrades

It is anticipated that the new pavements will be primarily supported on a layer of compacted structural fill, consisting of scarified, thoroughly moisture conditioned and recompacted existing soils. The on-site soils generally consist of silty sands and clayey sands. These soils are generally considered to possess fair to good pavement support characteristics with estimated R-values of 30 to 40. Since R-value testing was outside the scope of services, the subsequent pavement design is therefore based upon an assumed R-value of 30. Any fill material imported to the site should have support characteristics equal to or greater than that of the on-site soils and be placed and compacted under engineering controlled conditions. It is recommended that R-value testing be performed after completion of rough grading. Depending upon the results of the R-value testing, it may be feasible to use thinner pavement sections in some areas of the site.

Asphaltic Concrete

Presented below are the recommended thicknesses for new flexible pavement structures consisting of asphaltic concrete over a granular base. The pavement designs are based on the traffic indices (TI's) indicated. The client and/or civil engineer should verify that these TI's are representative of the anticipated traffic volumes. If the client and/or civil engineer determine that the expected traffic volume will exceed the applicable traffic index, we should be contacted for supplementary recommendations. The design traffic indices equate to the following approximate daily traffic volumes over a 20 year design life, assuming six operational traffic days per week.

Traffic Index	**No. of Heavy Trucks per Day**
4.0	0
5.0	1
6.0	3
7.0	11
8.0	35
9.0	93

For the purpose of the traffic volumes indicated above, a truck is defined as a 5-axle tractor trailer unit with one 8-kip axle and two 32-kip tandem axles. All of the traffic indices allow for 1,000 automobiles per day.
automobiles per day.

ASPHALT PAVEMENTS (R=30)					
Materials	**Thickness (inches)**				
	Auto Parking and Auto Drive Lanes (TI = 4.0 to 5.0)	Truck Traffic			
		TI = 6.0	TI = 7.0	TI = 8.0	TI = 9.0
Asphalt Concrete	3	3½	4	5	5½
Aggregate Base	6	8	10	11	13
Compacted Subgrade	12	12	12	12	12

The aggregate base course should be compacted to at least 95 percent of the ASTM D-1557 maximum dry density. The asphaltic concrete should be compacted to at least 95 percent of the Marshall maximum density, as determined by ASTM D-2726. The aggregate base course may consist of crushed aggregate base (CAB) or crushed miscellaneous base (CMB), which is a recycled gravel, asphalt and concrete material. The gradation, R-Value, Sand Equivalent, and Percentage Wear of the CAB or CMB should comply with appropriate specifications contained in the current edition of the "Greenbook" Standard Specifications for Public Works Construction.

Portland Cement Concrete

The preparation of the subgrade soils within concrete pavement areas should be performed as previously described for proposed asphalt pavement areas. The minimum recommended thicknesses for the Portland Cement Concrete pavement sections are as follows:

PORTLAND CEMENT CONCRETE PAVEMENTS (R=30)				
Materials	**Thickness (inches)**			
	Autos and Light Truck Traffic (TI = 5.0 to 6.0)	Truck Traffic		
		TI = 7.0	TI = 8.0	TI = 9.0
PCC	5	5½	6½	8
Compacted Subgrade (95% minimum compaction)	12	12	12	12

The concrete should have a 28-day compressive strength of at least 3,000 psi. The maximum joint spacing within all of the PCC pavements is recommended to be equal to or less than 30 times the pavement thickness.

7.0 GENERAL COMMENTS

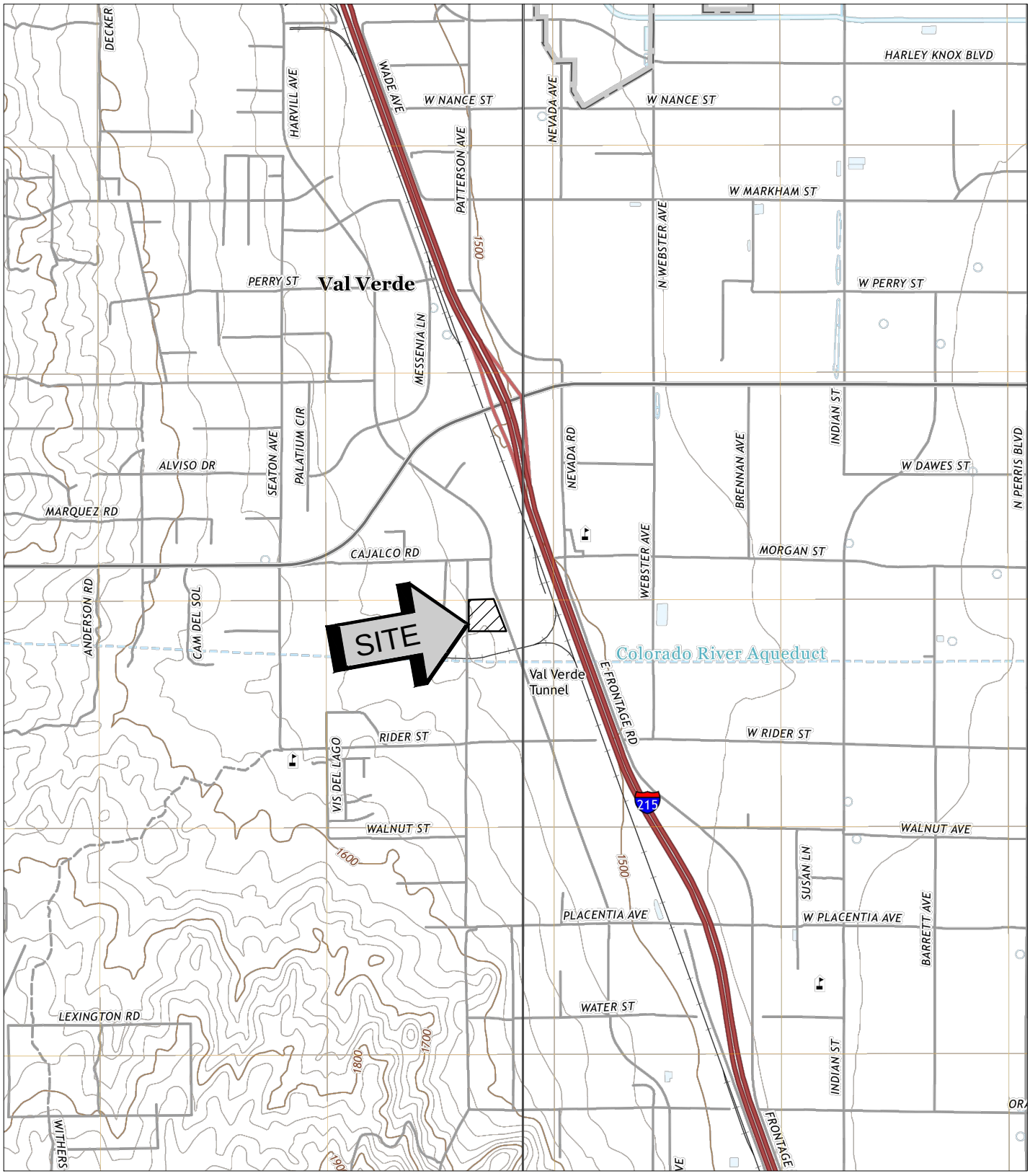
This report has been prepared as an instrument of service for use by the client, in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, civil engineer, and/or structural engineer. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur. The client(s)' reliance upon this report is subject to the Engineering Services Agreement, incorporated into our proposal for this project.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be representative of the total area, some variations should be expected between boring locations and sample depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted.

The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

APPENDIX A



SOURCE: USGS TOPOGRAPHIC MAP OF STEELE PEAK AND PERRIS QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2018.

SITE LOCATION MAP

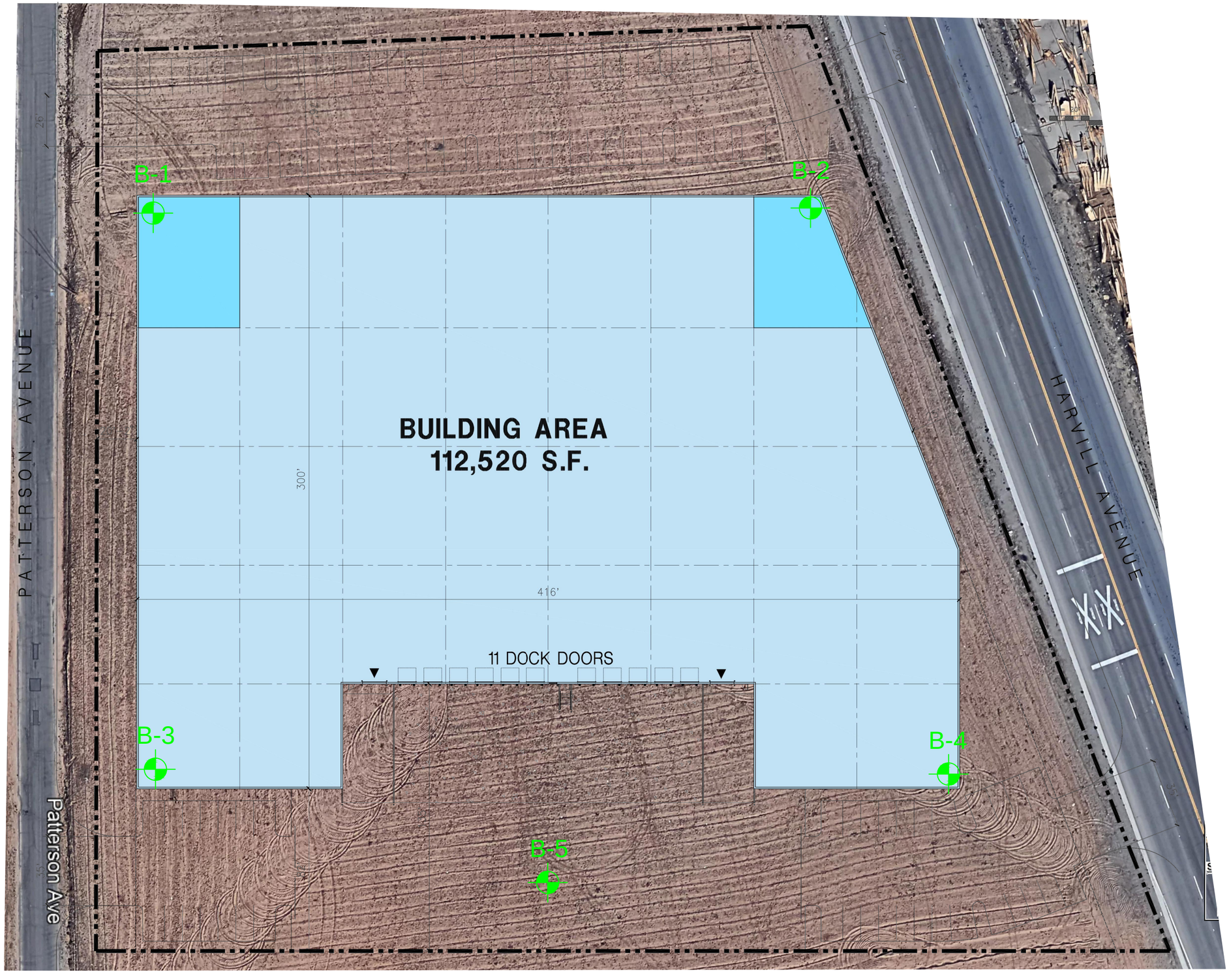
PROPOSED WAREHOUSE

RIVERSIDE COUNTY (PERRIS), CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: PM CHKD: RGT	
SCG PROJECT 21G231-1	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

PROPOSED BORING LOCATION

NOTE: CONCEPTUAL SITE PLAN (SCHEME 1) PREPARED BY HPA.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH

BORING LOCATION PLAN

PROPOSED WAREHOUSE

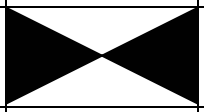
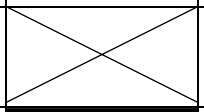
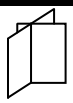
RIVERSIDE COUNTY (PERRIS), CALIFORNIA

SCALE: 1" = 50'	
DRAWN: PM CHKD: RGT	
SCG PROJECT 21G231-1	
PLATE 2	

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX B

BORING LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

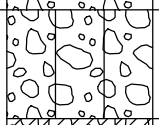
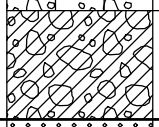
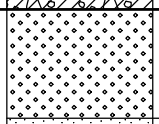
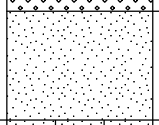
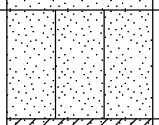
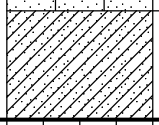
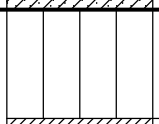
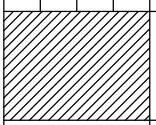
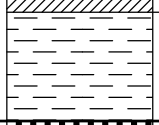
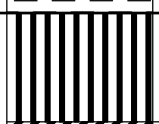
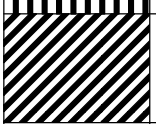
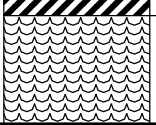
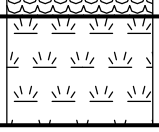
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	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
		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 MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% 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 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
	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
				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

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-1

JOB NO.: 21G231-1
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California

DRILLING DATE: 10/1/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 21 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		52			FILL: Light Brown Silty fine to coarse Sand, trace Clay, slightly cemented, laminated, dense-damp	125	6					
		66				124	6					
5		61			OLDER ALLUVIUM: Brown Silty fine Sand, little medium to coarse Sand, trace Calcareous veining, dense-damp	121	5					
		40			Brown fine Sandy Silt, extensive Calcareous nodules, trace medium to coarse Sand, medium dense to dense-damp	116	6					
10		47			@ 9 feet, moist to very moist	114	16					
		18			Brown Silty fine to medium Sand, trace coarse Sand, medium dense-damp		5					
15												
		26			Brown fine Sandy Silt, trace medium to coarse Sand, medium dense-moist to very moist		14					
20												
		18			Brown Silty fine Sand, trace medium to coarse Sand, medium dense-damp		7					
25					Boring Terminated at 25'							

TBL 21G231-1.GPJ SOCALGEO.GDT 10/27/21

TEST BORING LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-2

JOB NO.: 21G231-1
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California

DRILLING DATE: 10/1/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		22			FILL: Brown Clayey fine to medium Sand, little coarse Sand, little Silt, slightly cemented, medium dense-damp		6					
		9			ALLUVIUM: Brown Silty fine Sand, trace medium to coarse Sand, loose to medium dense-damp to moist		4					
5		19					7					
		28					9					
10												
		11			Brown Silty fine to medium Sand, trace coarse Sand, medium dense-damp		5					
15												
		34			@ 18½ feet, dense		7					
20					Boring Terminated at 20'							

TBL 21G231-1.GPJ SOCALGEO.GDT 10/27/21

TEST BORING LOG **PLATE B-2**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-3

JOB NO.: 21G231-1
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California

DRILLING DATE: 10/1/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 16 feet
READING TAKEN: At Completion

FIELD RESULTS					DESCRIPTION	LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		20			ALLUVIUM: Brown Silty fine to medium Sand, trace coarse Sand, trace Clay, medium dense to dense-damp		6					
		30					6					
5		14					7					
		33			OLDER ALLUVIUM: Brown Clayey fine Sand, dense-moist		8					
10												
		30			Brown SIlty fine to medium Sand, trace to little to coarse Sand, dense-moist		8					
15												
		68					8					
20					Boring Terminated at 20'							

TBL 21G231-1.GPJ SOCALGEO.GDT 10/27/21

TEST BORING LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-4

JOB NO.: 21G231-1
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California

DRILLING DATE: 10/1/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 19 feet
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		95/11'			FILL Light Red Brown Clayey fine to coarse Sand, very dense-damp	124	4					EI=31 @ 0-5'
		64			ALLUVIUM: Brown Silty fine to coarse Sand, trace Clay, little Calcareous veining, dense-damp	127	7					
5		57			Brown Clayey fine to coarse Sand, little to some Silt, dense-moist	120	8					
		13			Brown fine to coarse Sand, little Silt, loose-damp	108	3					
		31			OLDER ALLUVIUM: Brown Silty fine Sand, trace to little medium to coarse Sand, medium dense to dense-damp to moist	120	5					
10												
		58					10					
15												
		24					7					
20												
		24					8					
25					Boring Terminated at 25'							

TBL 21G231-1.GPJ SOCALGEO.GDT 10/27/21

TEST BORING LOG

PLATE B-4

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

BORING NO. B-5

JOB NO.: 21G231-1
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California

DRILLING DATE: 10/1/21
DRILLING METHOD: Hollow Stem Auger
LOGGED BY: Ryan Bremer

WATER DEPTH: Dry
CAVE DEPTH: 25 feet
READING TAKEN: At Completion

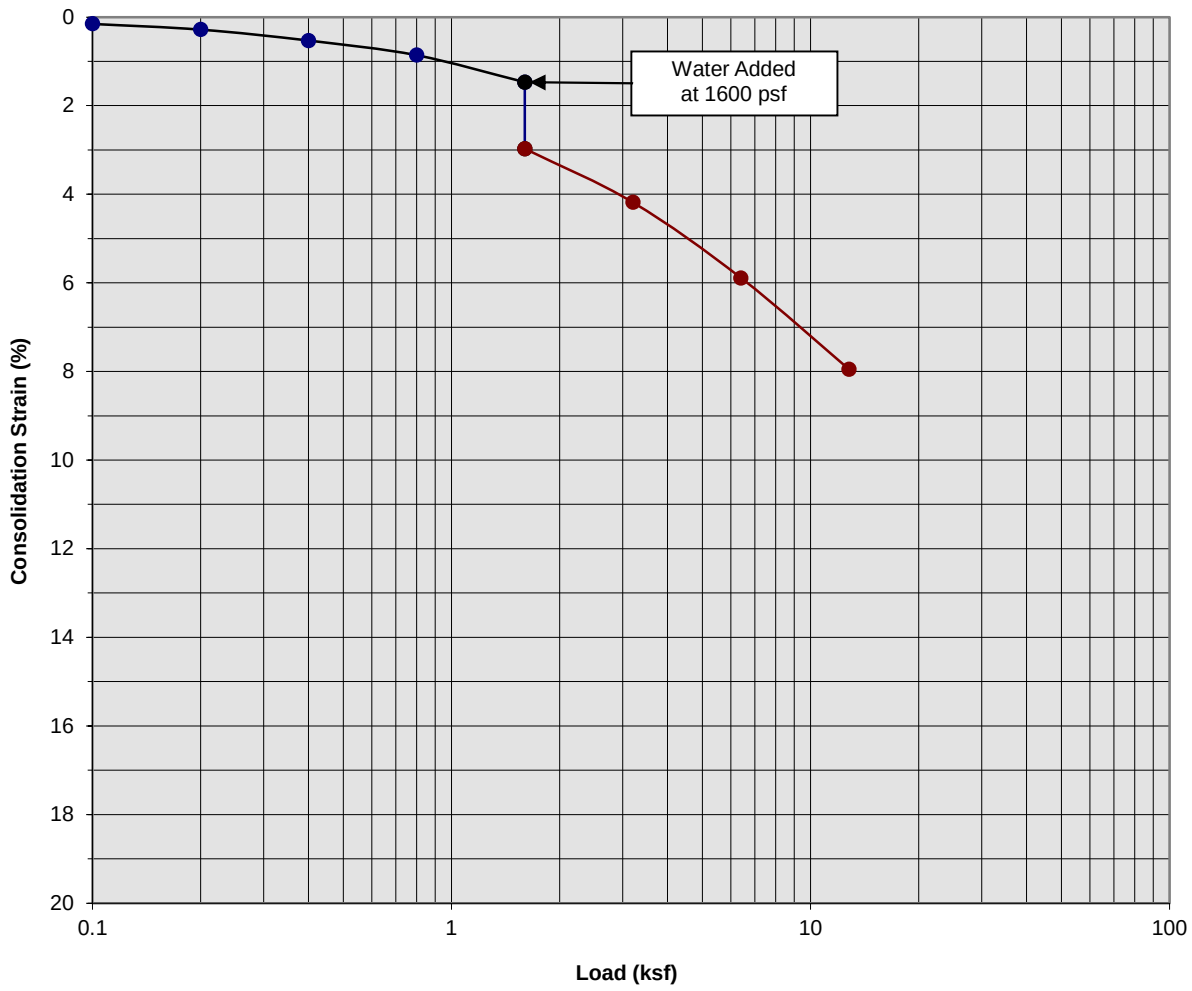
FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
		34			FILL: Brown Silty fine to medium Sand, trace coarse Sand, dense-damp		5					
		36			OLDER ALLUVIUM: Brown SIlty fine to coarse Sand, little Clay, dense-damp to moist		6					
5		31					4					
		43					7					
10												
		31					9					
15												
		36			Brown Silty fine Sand, trace medium to coarse Sand, trace Calcareous veining, dense-damp		7					
20					Boring Terminated at 20'							

TBL 21G231-1.GPJ SOCALGEO.GDT 10/27/21

TEST BORING LOG **PLATE B-5**

APPENDIX C

Consolidation/Collapse Test Results



Classification: Brown Silty fine to coarse Sand, trace Clay

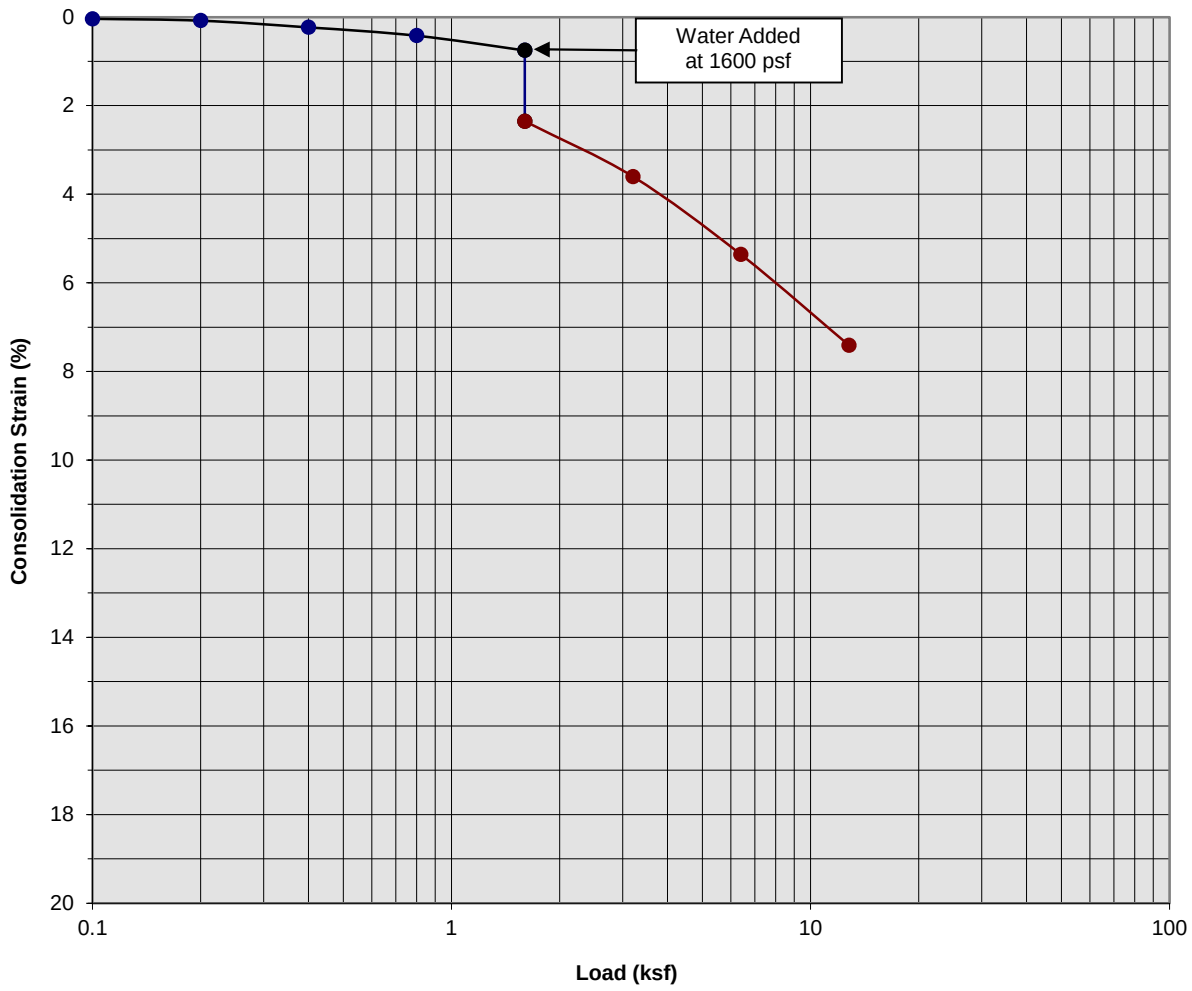
Boring Number:	B-4	Initial Moisture Content (%)	7
Sample Number:	---	Final Moisture Content (%)	12
Depth (ft)	3 to 4	Initial Dry Density (pcf)	127.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	137.6
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.50

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-1

PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Brown Clayey fine to coarse Sand, little to some Silt

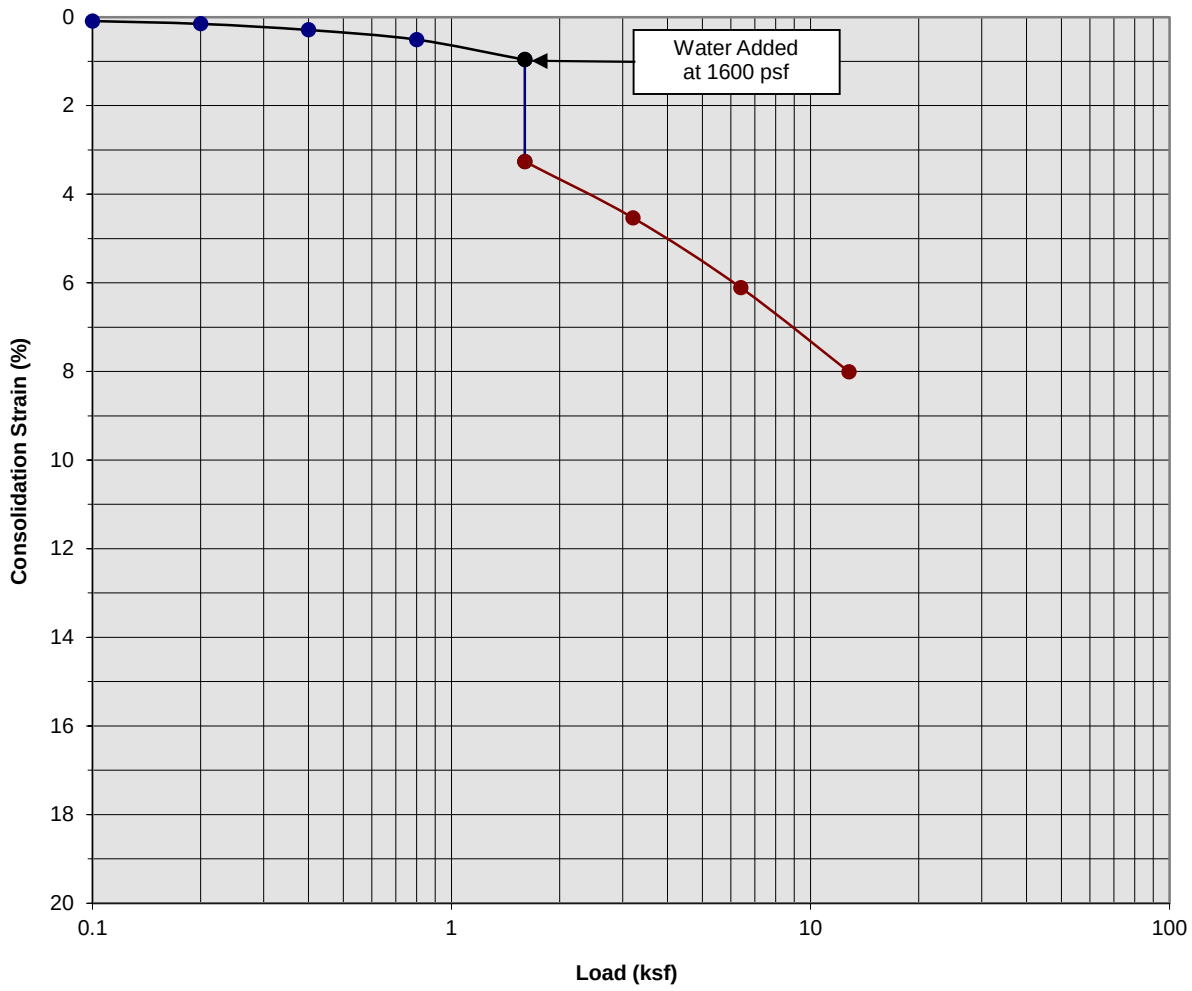
Boring Number:	B-4	Initial Moisture Content (%)	8
Sample Number:	---	Final Moisture Content (%)	14
Depth (ft)	4 to 5	Initial Dry Density (pcf)	120.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	129.4
Specimen Thickness (in)	1.0	Percent Collapse (%)	1.60

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-1

PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Brown fine to coarse Sand, little Silt

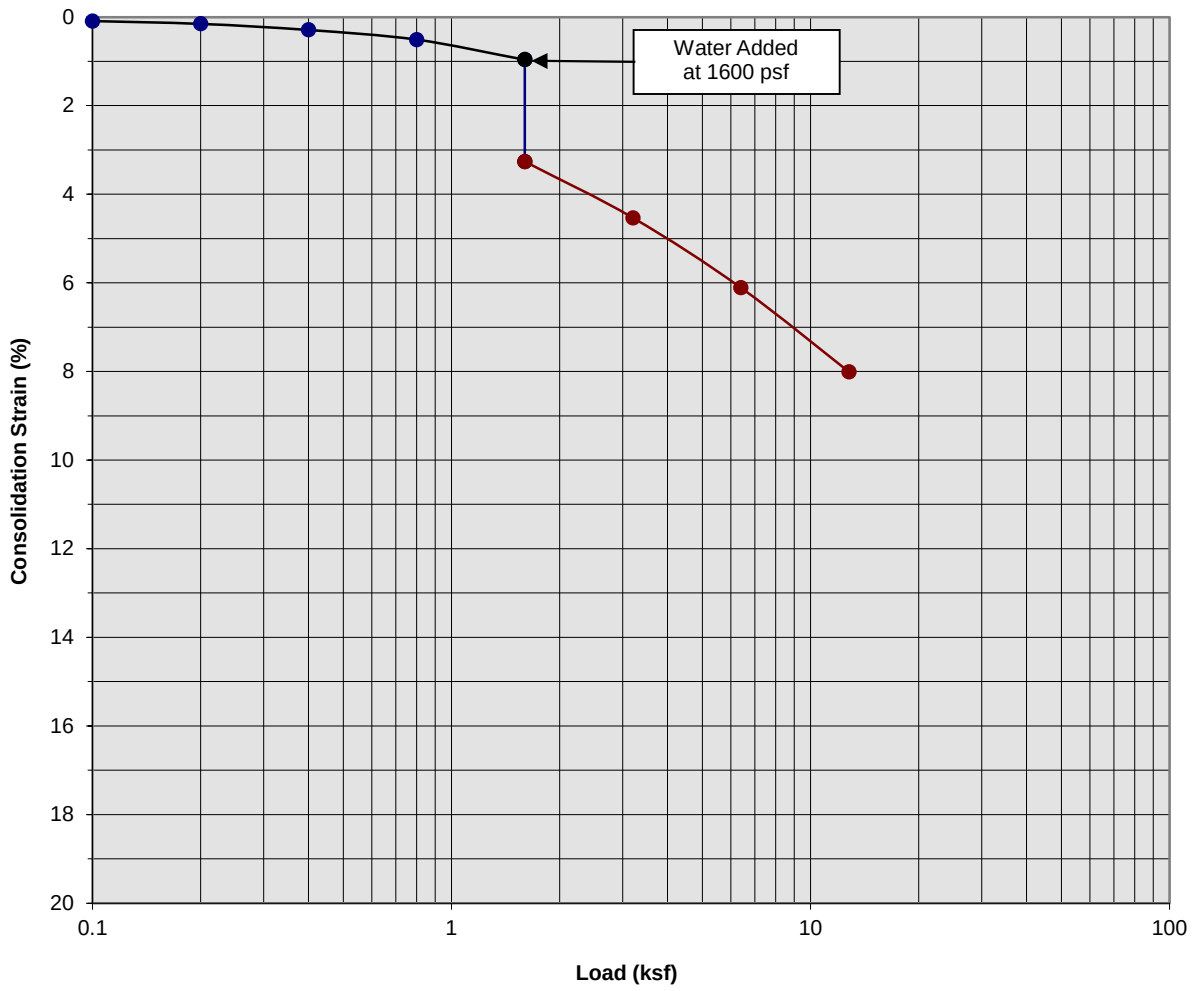
Boring Number:	B-4	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	7 to 8	Initial Dry Density (pcf)	108.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	117.2
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.30

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-1

PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Consolidation/Collapse Test Results



Classification: Brown Silty fine Sand, trace to little medium to coarse Sand

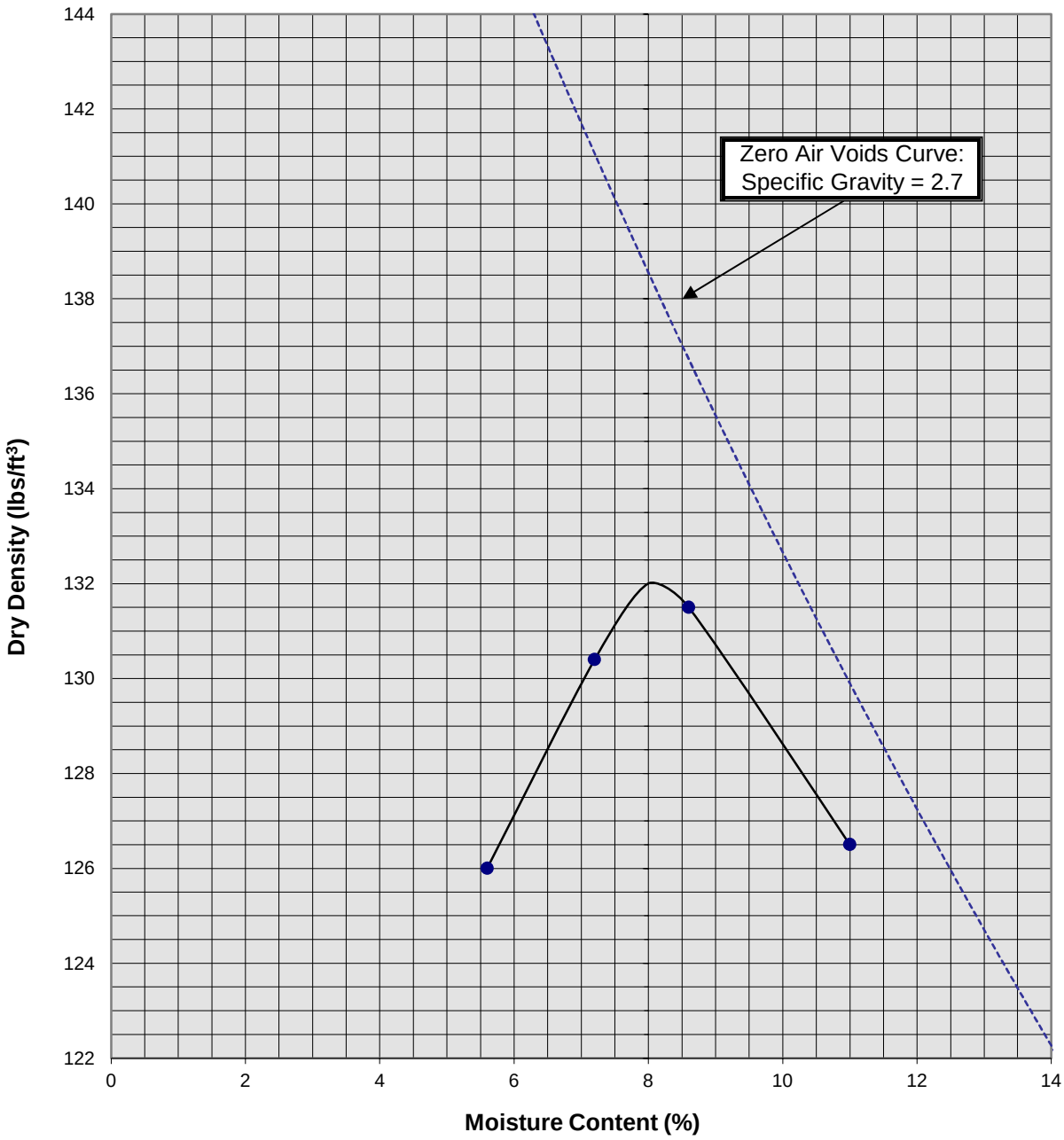
Boring Number:	B-4	Initial Moisture Content (%)	5
Sample Number:	---	Final Moisture Content (%)	16
Depth (ft)	9 to 10	Initial Dry Density (pcf)	120.0
Specimen Diameter (in)	2.4	Final Dry Density (pcf)	129.8
Specimen Thickness (in)	1.0	Percent Collapse (%)	2.30

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-1

PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Moisture/Density Relationship
ASTM D-1557



Soil ID Number	B-4 @ 0-5'
Optimum Moisture (%)	8
Maximum Dry Density (pcf)	132
Soil Classification	Light Red Brown Clayey fine to coarse Sand, trace to little Silt

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-1

PLATE C-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

APPENDIX D

GRADING GUIDE SPECIFICATIONS

These grading guide specifications are intended to provide typical procedures for grading operations. They are intended to supplement the recommendations contained in the geotechnical investigation report for this project. Should the recommendations in the geotechnical investigation report conflict with the grading guide specifications, the more site specific recommendations in the geotechnical investigation report will govern.

General

- The Earthwork Contractor is responsible for the satisfactory completion of all earthwork in accordance with the plans and geotechnical reports, and in accordance with city, county, and applicable building codes.

- The Geotechnical Engineer is the representative of the Owner/Builder for the purpose of implementing the report recommendations and guidelines. These duties are not intended to relieve the Earthwork Contractor of any responsibility to perform in a workman-like manner, nor is the Geotechnical Engineer to direct the grading equipment or personnel employed by the Contractor.

- The Earthwork Contractor is required to notify the Geotechnical Engineer of the anticipated work and schedule so that testing and inspections can be provided. If necessary, work may be stopped and redone if personnel have not been scheduled in advance.

- The Earthwork Contractor is required to have suitable and sufficient equipment on the job-site to process, moisture condition, mix and compact the amount of fill being placed to the approved compaction. In addition, suitable support equipment should be available to conform with recommendations and guidelines in this report.

- Canyon cleanouts, overexcavation areas, processed ground to receive fill, key excavations, subdrains and benches should be observed by the Geotechnical Engineer prior to placement of any fill. It is the Earthwork Contractor's responsibility to notify the Geotechnical Engineer of areas that are ready for inspection.

- Excavation, filling, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and proper control of erosion. Precipitation, springs, and seepage water encountered shall be pumped or drained to provide a suitable working surface. The Geotechnical Engineer must be informed of springs or water seepage encountered during grading or foundation construction for possible revision to the recommended construction procedures and/or installation of subdrains.

Site Preparation

- The Earthwork Contractor is responsible for all clearing, grubbing, stripping and site preparation for the project in accordance with the recommendations of the Geotechnical Engineer.

- If any materials or areas are encountered by the Earthwork Contractor which are suspected of having toxic or environmentally sensitive contamination, the Geotechnical Engineer and Owner/Builder should be notified immediately.

- Major vegetation should be stripped and disposed of off-site. This includes trees, brush, heavy grasses and any materials considered unsuitable by the Geotechnical Engineer.

- Underground structures such as basements, cesspools or septic disposal systems, mining shafts, tunnels, wells and pipelines should be removed under the inspection of the Geotechnical Engineer and recommendations provided by the Geotechnical Engineer and/or city, county or state agencies. If such structures are known or found, the Geotechnical Engineer should be notified as soon as possible so that recommendations can be formulated.

- Any topsoil, slopewash, colluvium, alluvium and rock materials which are considered unsuitable by the Geotechnical Engineer should be removed prior to fill placement.

- Remaining voids created during site clearing caused by removal of trees, foundations basements, irrigation facilities, etc., should be excavated and filled with compacted fill.

- Subsequent to clearing and removals, areas to receive fill should be scarified to a depth of 10 to 12 inches, moisture conditioned and compacted

- The moisture condition of the processed ground should be at or slightly above the optimum moisture content as determined by the Geotechnical Engineer. Depending upon field conditions, this may require air drying or watering together with mixing and/or discing.

Compacted Fills

- Soil materials imported to or excavated on the property may be utilized in the fill, provided each material has been determined to be suitable in the opinion of the Geotechnical Engineer. Unless otherwise approved by the Geotechnical Engineer, all fill materials shall be free of deleterious, organic, or frozen matter, shall contain no chemicals that may result in the material being classified as “contaminated,” and shall be very low to non-expansive with a maximum expansion index (EI) of 50. The top 12 inches of the compacted fill should have a maximum particle size of 3 inches, and all underlying compacted fill material a maximum 6-inch particle size, except as noted below.

- All soils should be evaluated and tested by the Geotechnical Engineer. Materials with high expansion potential, low strength, poor gradation or containing organic materials may require removal from the site or selective placement and/or mixing to the satisfaction of the Geotechnical Engineer.

- Rock fragments or rocks less than 6 inches in their largest dimensions, or as otherwise determined by the Geotechnical Engineer, may be used in compacted fill, provided the distribution and placement is satisfactory in the opinion of the Geotechnical Engineer.

- Rock fragments or rocks greater than 12 inches should be taken off-site or placed in accordance with recommendations and in areas designated as suitable by the Geotechnical Engineer. These materials should be placed in accordance with Plate D-8 of these Grading Guide Specifications and in accordance with the following recommendations:

    - Rocks 12 inches or more in diameter should be placed in rows at least 15 feet apart, 15 feet from the edge of the fill, and 10 feet or more below subgrade. Spaces should be left between each rock fragment to provide for placement and compaction of soil around the fragments.

    - Fill materials consisting of soil meeting the minimum moisture content requirements and free of oversize material should be placed between and over the rows of rock or

concrete. Ample water and compactive effort should be applied to the fill materials as they are placed in order that all of the voids between each of the fragments are filled and compacted to the specified density.

- Subsequent rows of rocks should be placed such that they are not directly above a row placed in the previous lift of fill. A minimum 5-foot offset between rows is recommended.

- To facilitate future trenching, oversized material should not be placed within the range of foundation excavations, future utilities or other underground construction unless specifically approved by the soil engineer and the developer/owner representative.

- Fill materials approved by the Geotechnical Engineer should be placed in areas previously prepared to receive fill and in evenly placed, near horizontal layers at about 6 to 8 inches in loose thickness, or as otherwise determined by the Geotechnical Engineer for the project.

- Each layer should be moisture conditioned to optimum moisture content, or slightly above, as directed by the Geotechnical Engineer. After proper mixing and/or drying, to evenly distribute the moisture, the layers should be compacted to at least 90 percent of the maximum dry density in compliance with ASTM D-1557-78 unless otherwise indicated.

- Density and moisture content testing should be performed by the Geotechnical Engineer at random intervals and locations as determined by the Geotechnical Engineer. These tests are intended as an aid to the Earthwork Contractor, so he can evaluate his workmanship, equipment effectiveness and site conditions. The Earthwork Contractor is responsible for compaction as required by the Geotechnical Report(s) and governmental agencies.

- Fill areas unused for a period of time may require moisture conditioning, processing and recompaction prior to the start of additional filling. The Earthwork Contractor should notify the Geotechnical Engineer of his intent so that an evaluation can be made.

- Fill placed on ground sloping at a 5-to-1 inclination (horizontal-to-vertical) or steeper should be benched into bedrock or other suitable materials, as directed by the Geotechnical Engineer. Typical details of benching are illustrated on Plates D-2, D-4, and D-5.

- Cut/fill transition lots should have the cut portion overexcavated to a depth of at least 3 feet and rebuilt with fill (see Plate D-1), as determined by the Geotechnical Engineer.

- All cut lots should be inspected by the Geotechnical Engineer for fracturing and other bedrock conditions. If necessary, the pads should be overexcavated to a depth of 3 feet and rebuilt with a uniform, more cohesive soil type to impede moisture penetration.

- Cut portions of pad areas above buttresses or stabilizations should be overexcavated to a depth of 3 feet and rebuilt with uniform, more cohesive compacted fill to impede moisture penetration.

- Non-structural fill adjacent to structural fill should typically be placed in unison to provide lateral support. Backfill along walls must be placed and compacted with care to ensure that excessive unbalanced lateral pressures do not develop. The type of fill material placed adjacent to below grade walls must be properly tested and approved by the Geotechnical Engineer with consideration of the lateral earth pressure used in the design.

Foundations

- The foundation influence zone is defined as extending one foot horizontally from the outside edge of a footing, and proceeding downward at a ½ horizontal to 1 vertical (0.5:1) inclination.

- Where overexcavation beneath a footing subgrade is necessary, it should be conducted so as to encompass the entire foundation influence zone, as described above.

- Compacted fill adjacent to exterior footings should extend at least 12 inches above foundation bearing grade. Compacted fill within the interior of structures should extend to the floor subgrade elevation.

Fill Slopes

- The placement and compaction of fill described above applies to all fill slopes. Slope compaction should be accomplished by overfilling the slope, adequately compacting the fill in even layers, including the overfilled zone and cutting the slope back to expose the compacted core

- Slope compaction may also be achieved by backrolling the slope adequately every 2 to 4 vertical feet during the filling process as well as requiring the earth moving and compaction equipment to work close to the top of the slope. Upon completion of slope construction, the slope face should be compacted with a sheepsfoot connected to a sideboom and then grid rolled. This method of slope compaction should only be used if approved by the Geotechnical Engineer.

- Sandy soils lacking in adequate cohesion may be unstable for a finished slope condition and therefore should not be placed within 15 horizontal feet of the slope face.

- All fill slopes should be keyed into bedrock or other suitable material. Fill keys should be at least 15 feet wide and inclined at 2 percent into the slope. For slopes higher than 30 feet, the fill key width should be equal to one-half the height of the slope (see Plate D-5).

- All fill keys should be cleared of loose slough material prior to geotechnical inspection and should be approved by the Geotechnical Engineer and governmental agencies prior to filling.

- The cut portion of fill over cut slopes should be made first and inspected by the Geotechnical Engineer for possible stabilization requirements. The fill portion should be adequately keyed through all surficial soils and into bedrock or suitable material. Soils should be removed from the transition zone between the cut and fill portions (see Plate D-2).

Cut Slopes

- All cut slopes should be inspected by the Geotechnical Engineer to determine the need for stabilization. The Earthwork Contractor should notify the Geotechnical Engineer when slope cutting is in progress at intervals of 10 vertical feet. Failure to notify may result in a delay in recommendations.

- Cut slopes exposing loose, cohesionless sands should be reported to the Geotechnical Engineer for possible stabilization recommendations.

- All stabilization excavations should be cleared of loose slough material prior to geotechnical inspection. Stakes should be provided by the Civil Engineer to verify the location and dimensions of the key. A typical stabilization fill detail is shown on Plate D-5.

- Stabilization key excavations should be provided with subdrains. Typical subdrain details are shown on Plates D-6.

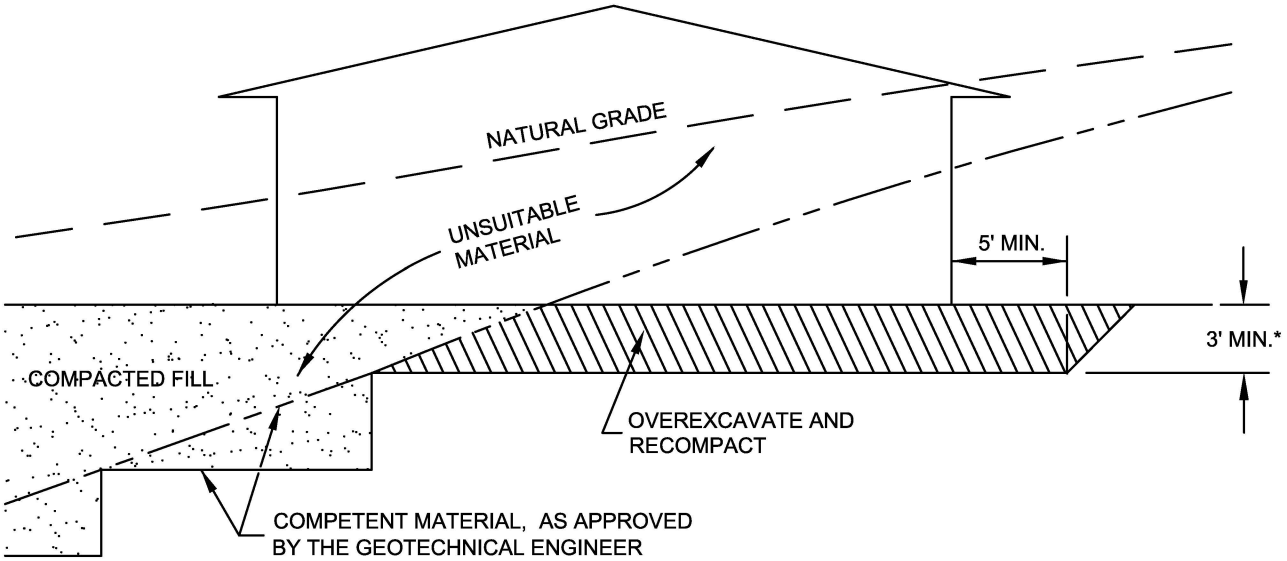
Subdrains

- Subdrains may be required in canyons and swales where fill placement is proposed. Typical subdrain details for canyons are shown on Plate D-3. Subdrains should be installed after approval of removals and before filling, as determined by the Soils Engineer.

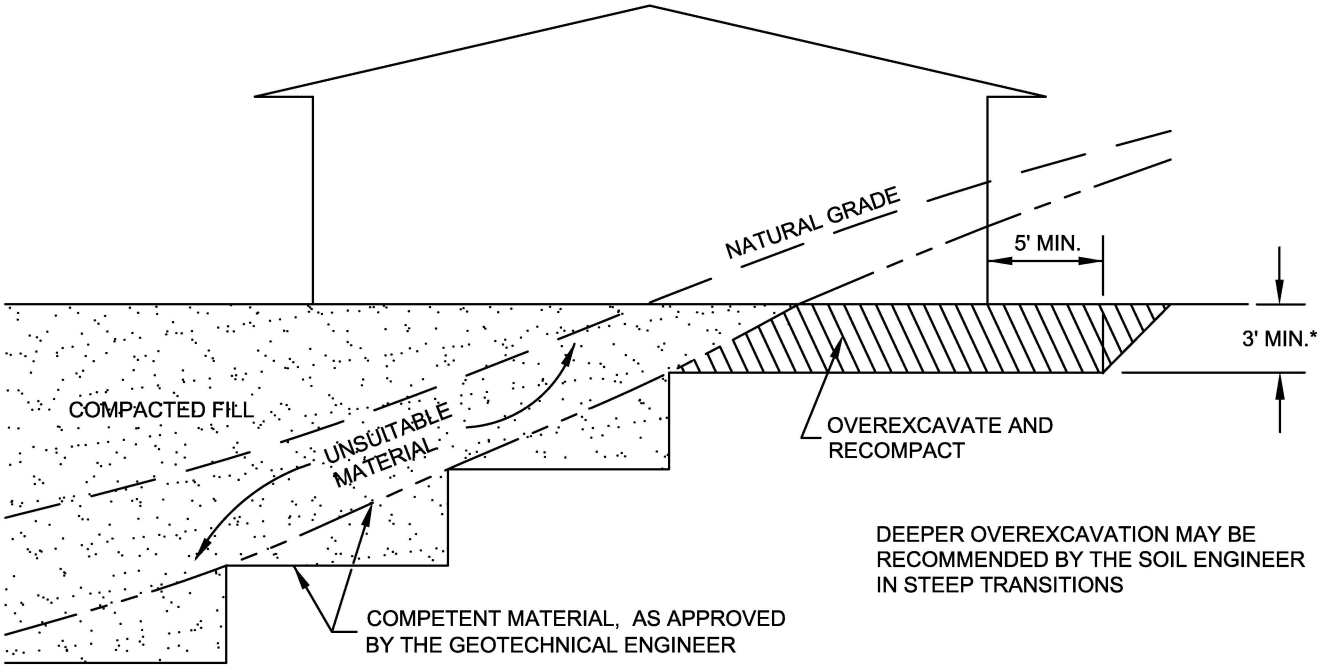
- Plastic pipe may be used for subdrains provided it is Schedule 40 or SDR 35 or equivalent. Pipe should be protected against breakage, typically by placement in a square-cut (backhoe) trench or as recommended by the manufacturer.

- Filter material for subdrains should conform to CALTRANS Specification 68-1.025 or as approved by the Geotechnical Engineer for the specific site conditions. Clean ¾-inch crushed rock may be used provided it is wrapped in an acceptable filter cloth and approved by the Geotechnical Engineer. Pipe diameters should be 6 inches for runs up to 500 feet and 8 inches for the downstream continuations of longer runs. Four-inch diameter pipe may be used in buttress and stabilization fills.

CUT LOT



CUT/FILL LOT (TRANSITION)



*SEE TEXT OF REPORT FOR SPECIFIC RECOMMENDATION. ACTUAL DEPTH OF OVEREXCAVATION MAY BE GREATER.

TRANSITION LOT DETAIL

GRADING GUIDE SPECIFICATIONS

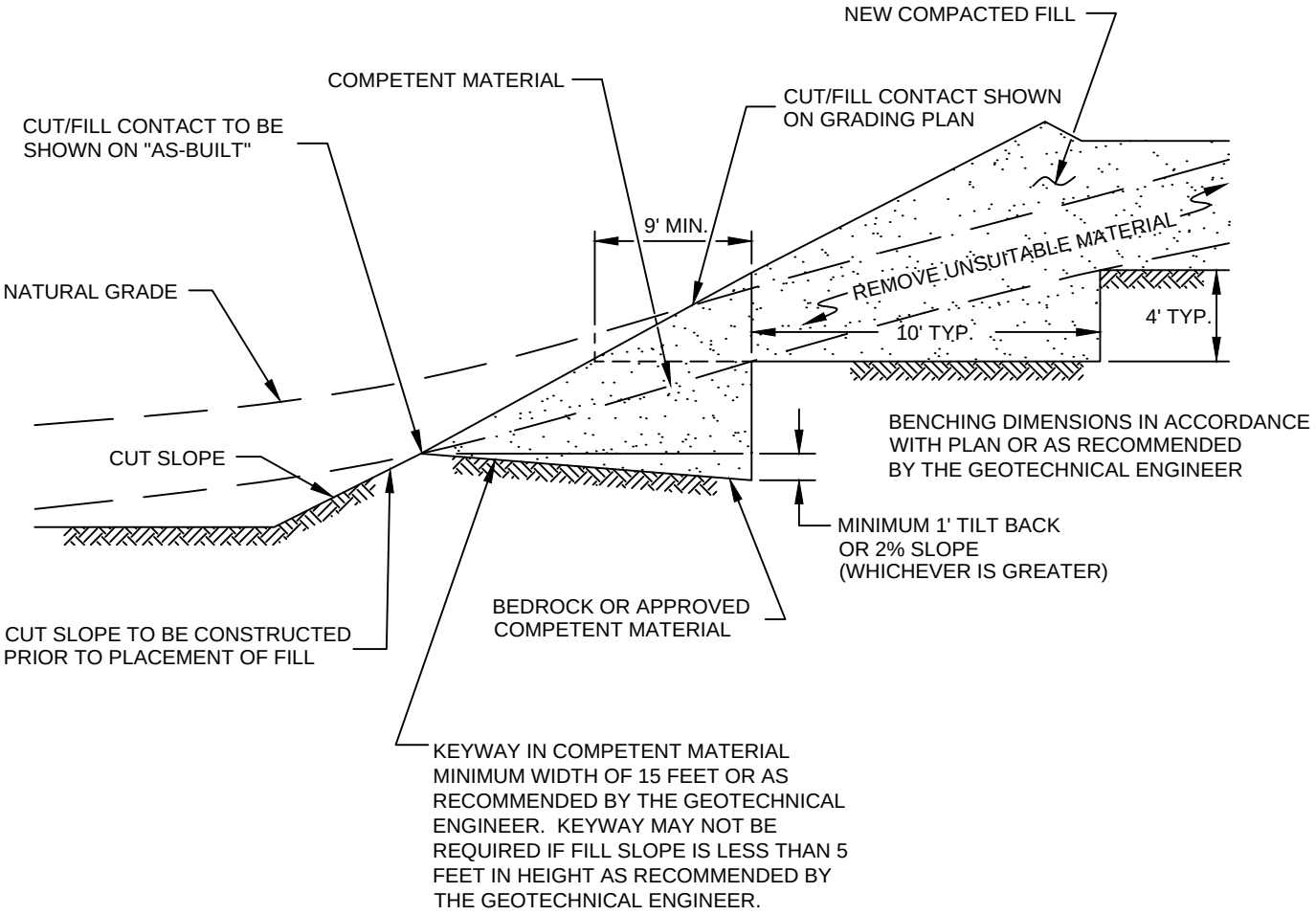
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-1

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



FILL ABOVE CUT SLOPE DETAIL

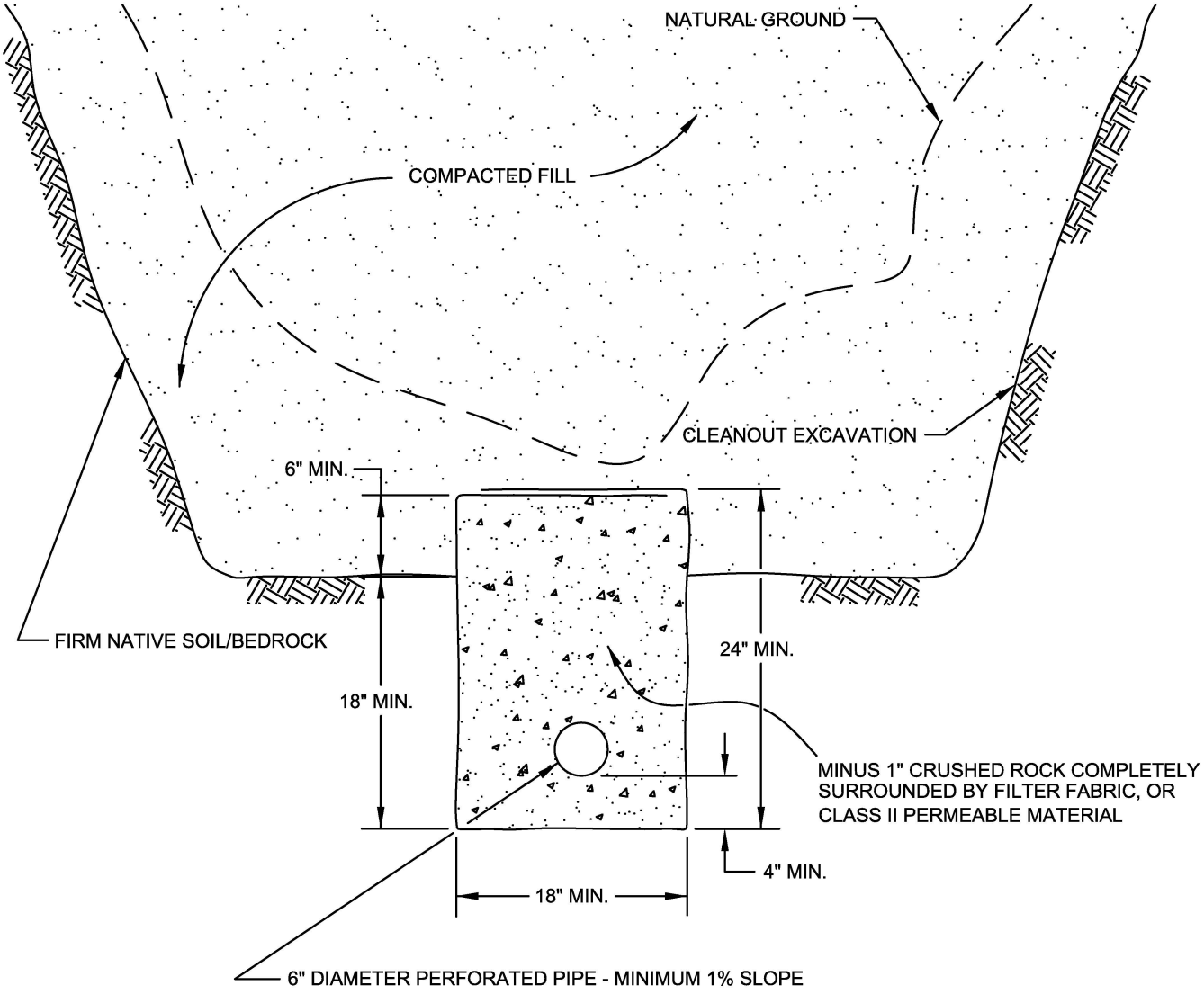
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



PIPE MATERIAL	DEPTH OF FILL OVER SUBDRAIN
ADS (CORRUGATED POLETHYLENE)	8
TRANSITE UNDERDRAIN	20
PVC OR ABS: SDR 35	35
SDR 21	100

SCHEMATIC ONLY
NOT TO SCALE

CANYON SUBDRAIN DETAIL

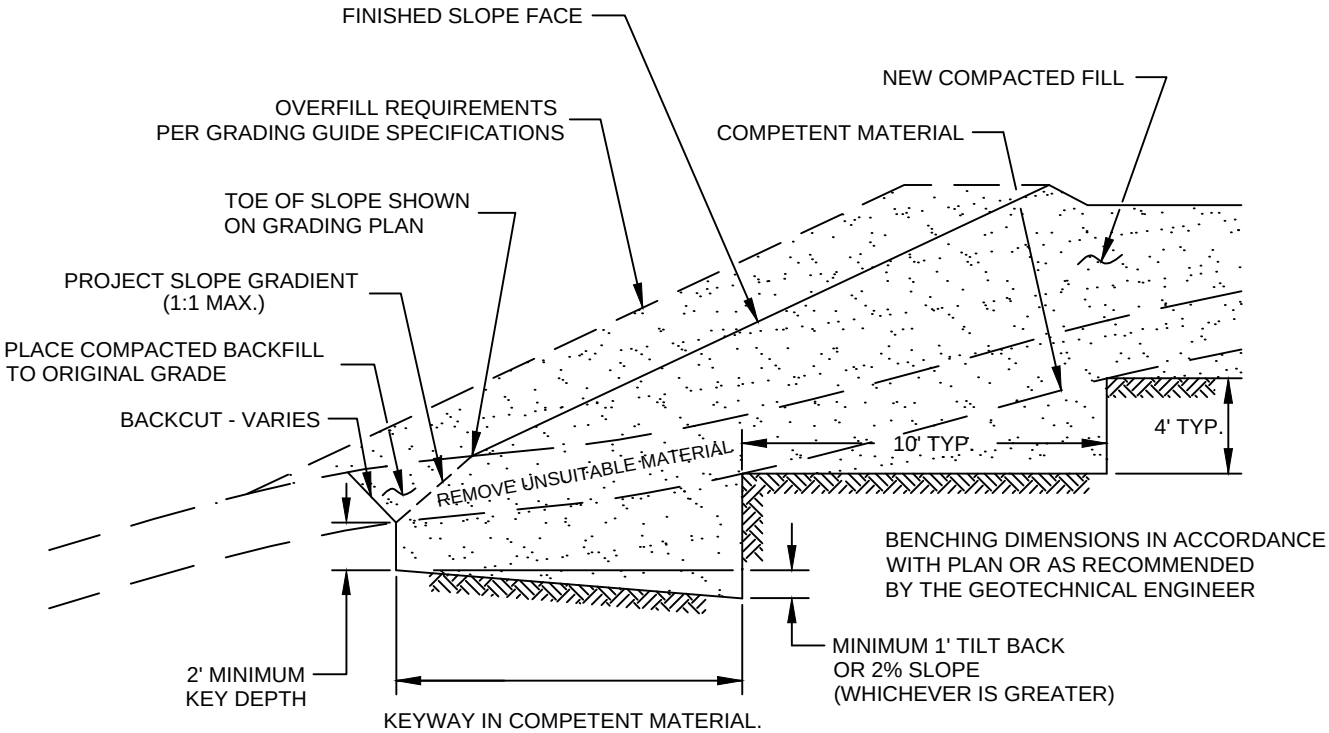
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



NOTE:
BENCHING SHALL BE REQUIRED WHEN NATURAL SLOPES ARE EQUAL TO OR STEEPER THAN 5:1 OR WHEN RECOMMENDED BY THE GEOTECHNICAL ENGINEER.

FILL ABOVE NATURAL SLOPE DETAIL

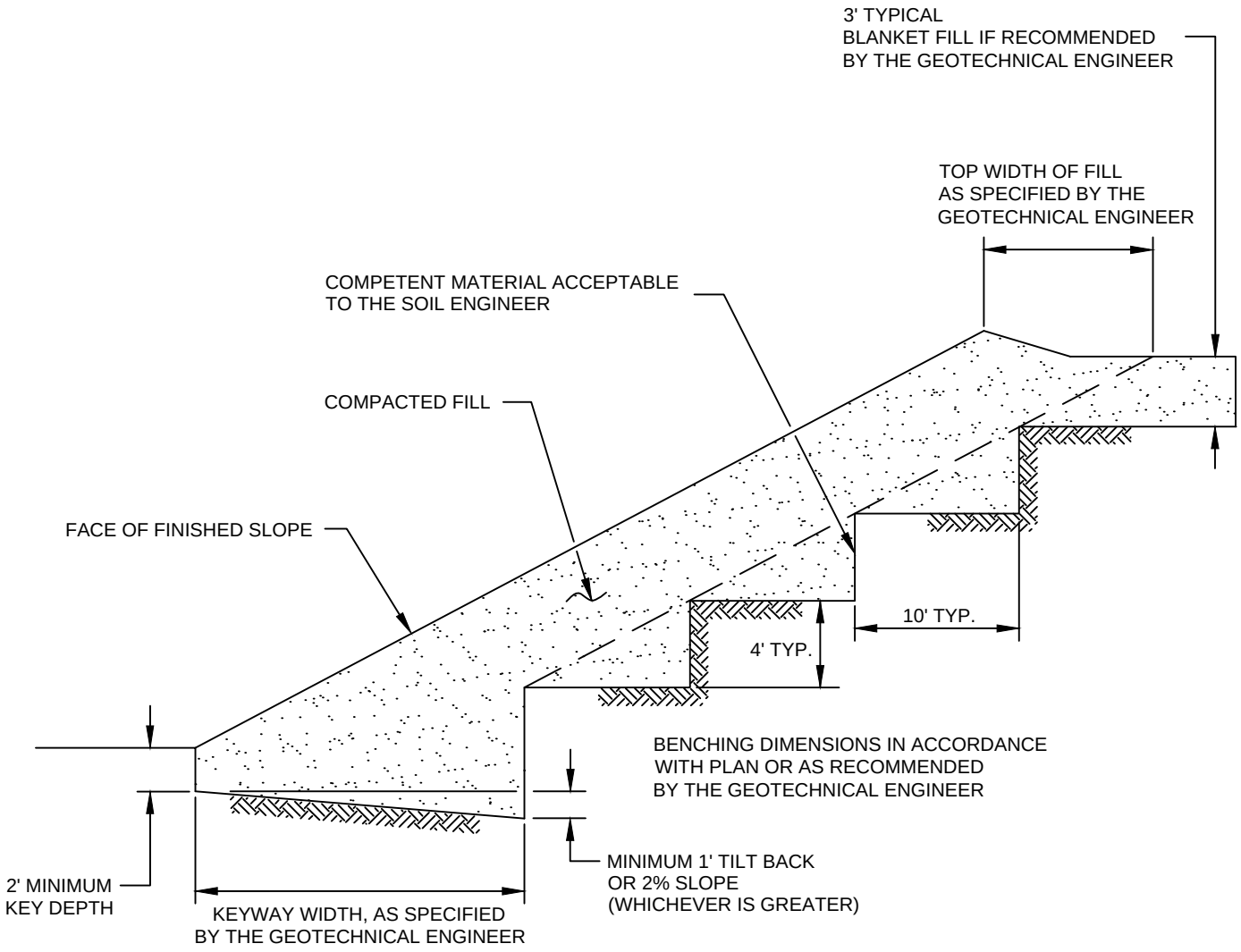
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



STABILIZATION FILL DETAIL

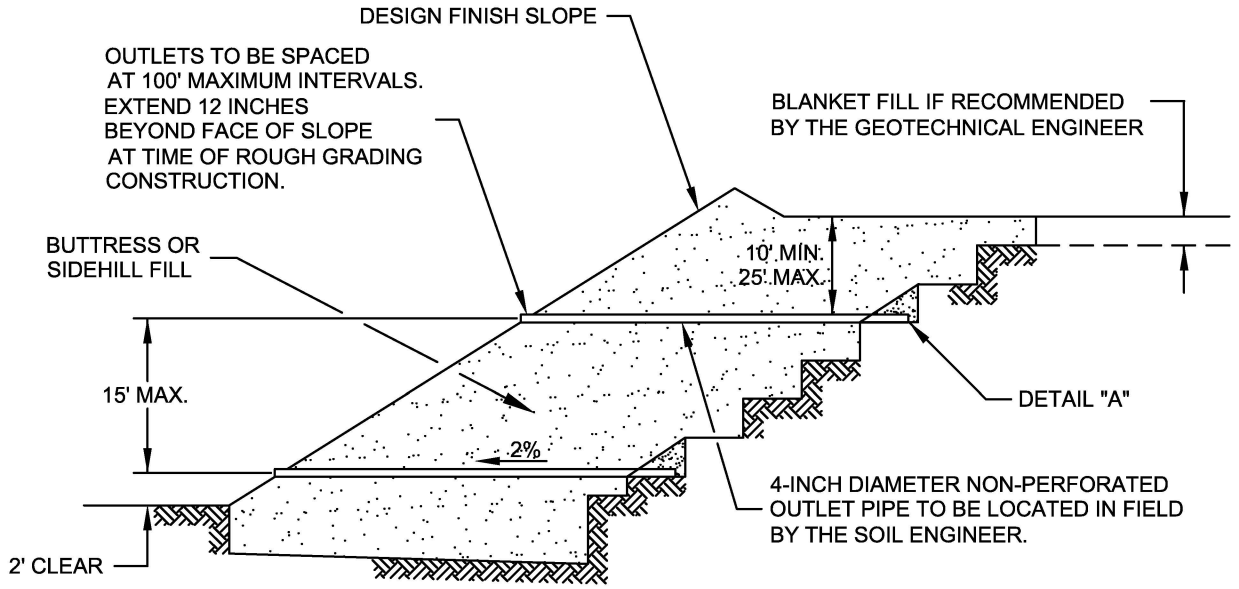
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-5

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



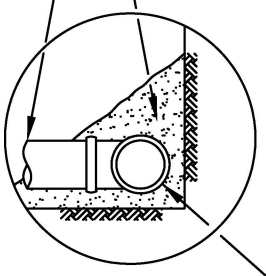
"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50



DETAIL "A"

NOTES:
1. TRENCH FOR OUTLET PIPES TO BE BACKFILLED WITH ON-SITE SOIL.

SLOPE FILL SUBDRAINS

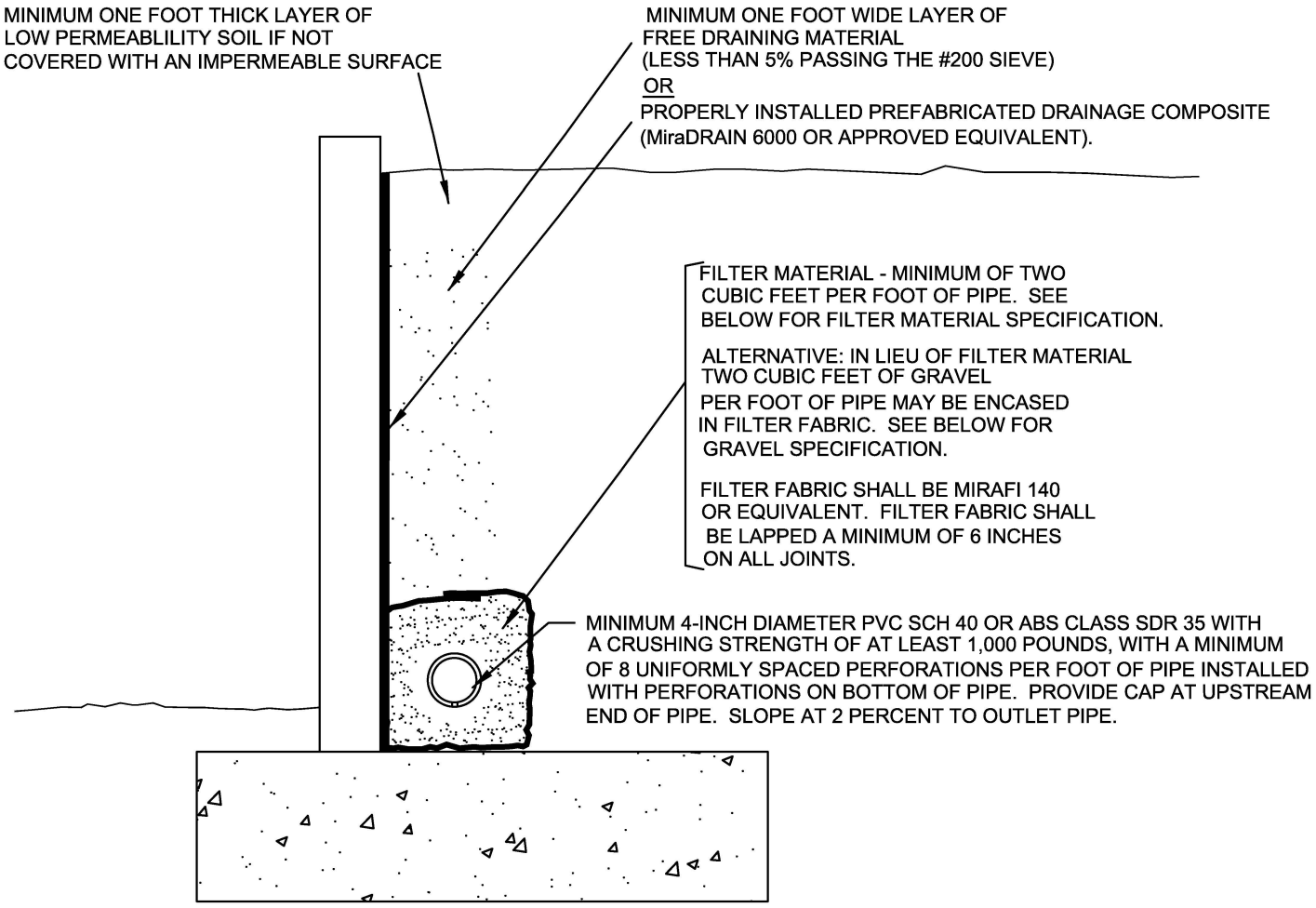
GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: JAS
CHKD: GKM

PLATE D-6

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL



"FILTER MATERIAL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT: (CONFORMS TO EMA STD. PLAN 323)

SIEVE SIZE	PERCENTAGE PASSING
1"	100
3/4"	90-100
3/8"	40-100
NO. 4	25-40
NO. 8	18-33
NO. 30	5-15
NO. 50	0-7
NO. 200	0-3

"GRAVEL" TO MEET FOLLOWING SPECIFICATION OR APPROVED EQUIVALENT:

SIEVE SIZE	MAXIMUM PERCENTAGE PASSING
1 1/2"	100
NO. 4	50
NO. 200	8

SAND EQUIVALENT = MINIMUM OF 50

RETAINING WALL BACKDRAINS

GRADING GUIDE SPECIFICATIONS

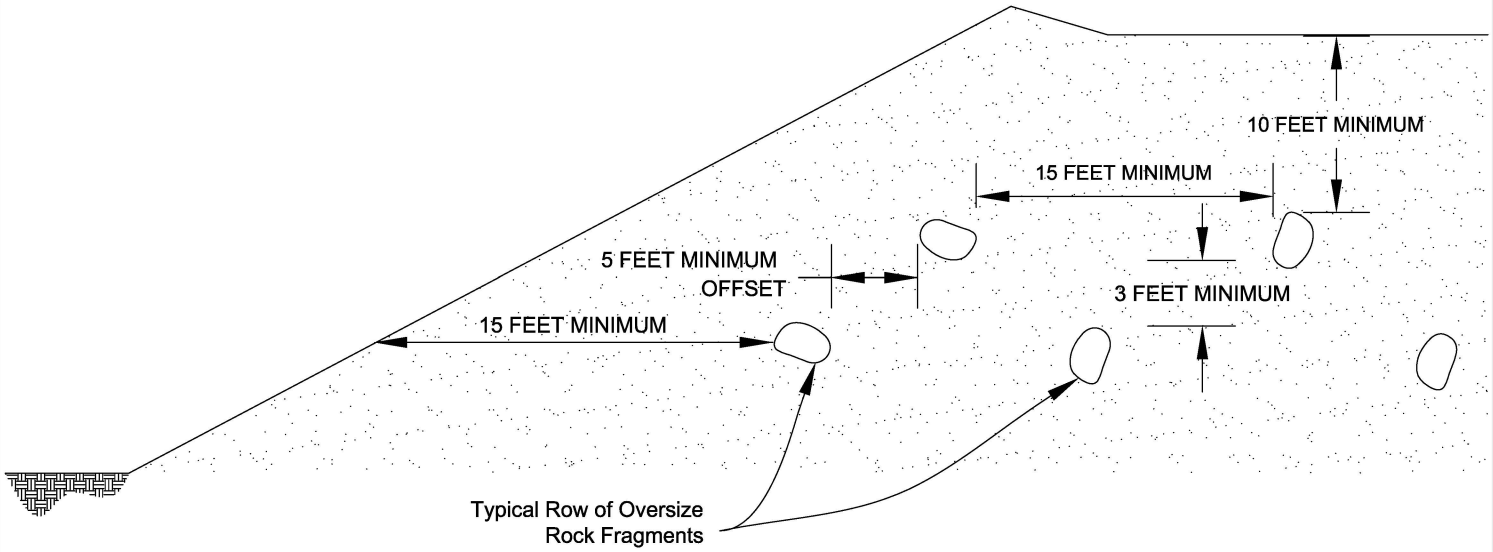
NOT TO SCALE

DRAWN: JAS
CHKD: GKM

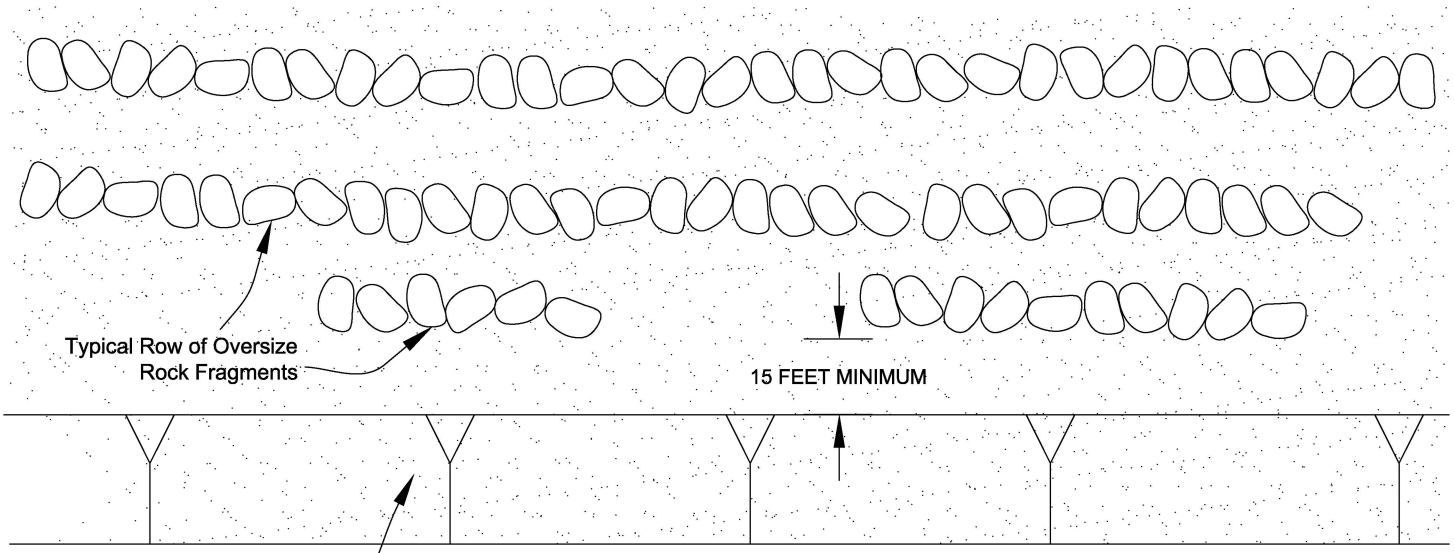
PLATE D-7

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



Section View



Plan View

PLACEMENT OF OVERSIZED MATERIAL

GRADING GUIDE SPECIFICATIONS

NOT TO SCALE

DRAWN: PM
CHKD: GKM

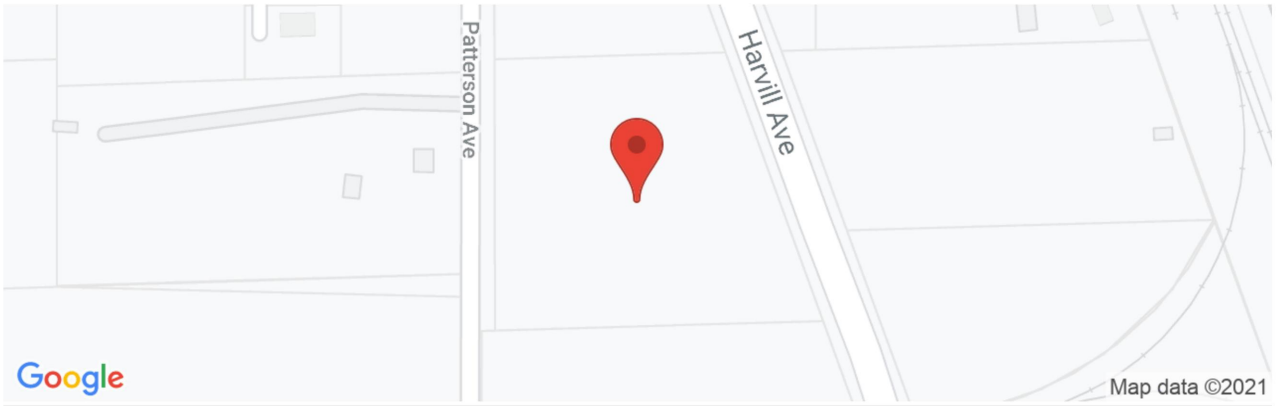
PLATE D-8

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL

APPENDIX E

Latitude, Longitude: 33.83515719, -117.25178527



Date	10/14/2021, 1:45:20 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.5	MCE_R ground motion. (for 0.2 second period)
S_1	0.558	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.5	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1	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	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.1	Site amplification factor at PGA
PGA_M	0.55	Site modified peak ground acceleration
T_L	8	Long-period transition period in seconds
SsRT	1.506	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.607	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	1.5	Factored deterministic acceleration value. (0.2 second)
S1RT	0.558	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.61	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	0.6	Factored deterministic acceleration value. (1.0 second)
PGAd	0.5	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.937	Mapped value of the risk coefficient at short periods
C_{R1}	0.916	Mapped value of the risk coefficient at a period of 1 s

SOURCE: SEAOC/OSHPD Seismic Design Maps Tool
<https://seismicmaps.org/>

SEISMIC DESIGN PARAMETERS - 2019 CBC

PROPOSED WAREHOUSE

RIVERSIDE COUNTY (PERRIS), CALIFORNIA

DRAWN: PM
CHKD: RGT

SCG PROJECT
21G231-1

PLATE E-1

SOUTHERN CALIFORNIA GEOTECHNICAL

October 29, 2021

LDC Industrial Realty, LLC
555 N. El Camino Real, Suite A456
San Clemente, California 92672

Attention: Mr. Matthew Snyder

Project No.: **21G231-2**

Subject: **Results of Infiltration Testing**
Proposed Warehouse
Patterson Avenue, South of Cajalco Road
Riverside County (Perris), California

Reference: Geotechnical Investigation, Proposed Warehouse, Patterson Avenue, South of Cajalco Road, Riverside County (Perris Area), California, prepared for LDC Industrial Realty, LLC, by Southern California Geotechnical, Inc. (SCG), SCG Project No. 21G231-1, dated October 27, 2021.

Mr. Snyder:

In accordance with your request, we have conducted infiltration testing at the subject site. We are pleased to present this report summarizing the results of the infiltration testing and our design recommendations.

Scope of Services

The scope of services performed for this project was in general accordance with our Proposal No. 21P415, dated September 16, 2021. The scope of services included site reconnaissance, subsurface exploration, field testing, and engineering analysis to determine the infiltration rates of the onsite soils. The infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Site and Project Description

The site is located at the on the east side of Patterson Avenue, 610± feet south of Cajalco Road in an unincorporated portion of Riverside County near Perris, California. The site is bounded to the north by a vacant lot, to the west by Patterson Avenue, to the south by a vacant lot, and to the east by Harvill Avenue. The general location of the site is illustrated on the Site Location Map, included as Plate 1 of this report.

The site consists of a trapezoidal-shaped parcel, 4.79± acres in size. The site is presently vacant and undeveloped. The ground surface consists of exposed soils which appear to have been recently disced or tilled and stripped of any vegetation.

Detailed topographic information was not available at the time of this report. Based on our visual observations and topographic information obtained from Google Earth, the site

topography appears to slope gently downward to the east at a gradient of approximately 1 percent.

Proposed Development

Based on the conceptual site plan (Scheme 1, dated September 1, 2021) prepared by HPA Architecture, the site will be developed with a new warehouse. The building will be 112,520± ft^2 in size, located in the central region of the property. Dock-high doors will be constructed along a portion of the southern building wall. The building is expected to be surrounded by asphaltic concrete in the automobile parking and driving lanes, with Portland cement concrete pavements in the truck court area, with limited areas of concrete flatwork and landscape planters.

The proposed development will include on-site storm water infiltration. Based on conversations with the project civil engineer, we understand that the infiltration system will consist of three below-grade chamber systems. One of the below-grade chamber systems will be located in the southern area of the site, the second chamber will be located in the southeastern area of the site, and the third chamber will be located in the northeastern area of the site. The bottom of the infiltration systems will range from 10 to 12± feet below the existing site grades.

Concurrent Study

SCG concurrently conducted a geotechnical investigation at the subject site, which is referenced above. As part of this study, five (5) borings were advanced to depths of 20 to 25± feet below existing site grades. With the exception of Boring No. B-3, artificial fill soils were encountered at the ground surface at all of the boring locations, extending to depths of 2½ to 4½± feet below the existing site grades. The artificial fill soils consist of medium dense to very dense silty and clayey fine to coarse sands. These materials possess varying densities and a disturbed appearance (with some lamination), resulting in their classification as artificial fill. Native younger alluvium was encountered at the ground surface at Boring No. B-3, and beneath the artificial fill soils at Boring Nos. B-2 and B-4, extending to depths of 8 to 20± feet below the existing site grades. Boring No. B-2 was terminated within the younger alluvium at a depth of 20± feet. The younger alluvium generally consists of loose to dense silty sands and clayey sands. The younger alluvium possesses minor amounts of calcareous deposits. With the exception of Boring No. B-2, older native alluvial soils were encountered beneath the artificial fill or beneath the younger alluvium at all of the boring locations, extending to at least the maximum depth explored of 25± feet below ground surface. The older alluvium generally consists of medium dense to dense silty fine sands, clayey fine sands, and fine sandy silts with varying medium to coarse sand.

Groundwater

Free water was not encountered during any of our subsurface explorations. Based on the lack of any water within the borings and the moisture contents of the recovered soil samples, the static groundwater table is considered to have existed at a depth in excess of 25± feet at the time of the subsurface exploration.

As part of our research, we reviewed available groundwater data in order to determine the historic high groundwater level for the site. The primary reference used to determine the

groundwater depths in this area is the California Department of Water Resources website, http://www.water.ca.gov/waterdatalibrary/. One of the monitoring wells observed in the vicinity of the site is located 1.4 miles east of the subject site. Water level readings within this monitoring well indicates a high groundwater level of 79± feet below the ground surface in February 2015.

Subsurface Exploration

Scope of Exploration

The subsurface exploration for the infiltration testing consisted of four (4) backhoe-excavated trenches, extending to a depth of 10± feet below existing site grades. The trenches were logged during excavation by a member of our staff. The approximate locations of the infiltration trenches (identified as I-1 through I-4) are indicated on the Infiltration Test Location Plan, enclosed as Plate 2 of this report.

Geotechnical Conditions

Artificial fill soils were encountered at the ground surface of all the trench locations, extending 2½ to 3½± feet below existing site grades. The artificial fill soils consist of medium dense to very dense silty and clayey fine to coarse sands. These materials possess varying densities and a disturbed appearance (with some lamination), resulting in their classification as artificial fill. Native alluvium was encountered beneath the artificial fill at two out of the four infiltration testing locations, extending to at least the maximum explored depth of 10± feet below existing site grades. The younger alluvium generally consists of dense silty sands with varying amounts of clays. With the exception of Trench Nos. B-3 and B-4, older native alluvial soils were encountered beneath the artificial fill or beneath the younger alluvium at all of the boring locations, extending to at least the maximum depth explored of 10± feet below ground surface. The older alluvium generally consists of dense to very dense silty fine sands, with varying medium to coarse sand. The Trench Logs, which illustrate the conditions encountered at the infiltration test locations, are presented in this report.

Infiltration Testing

We understand that the results of the testing will be used to prepare a preliminary design for the storm water infiltration system that will be used at the subject site. As previously mentioned, the infiltration testing was performed in general accordance with ASTM Test Method D-3385-03, Standard Test Method for Infiltration Rate of Soils in Field Using Double Ring Infiltrometer.

Two stainless steel infiltration rings were used for the infiltration testing. The outer infiltration ring is 2 feet in diameter and 20 inches in height. The inner infiltration ring is 1 foot in diameter and 20 inches in height. At the test locations, the outer ring was driven 3± inches into the soil at the base of each trench. The inner ring was centered inside the outer ring and subsequently driven 3± inches into the soil at the base of the trench. The rings were driven into the soil using a ten-pound sledge hammer. The soil surrounding the wall of the infiltration rings was only slightly disturbed during the driving process.

Infiltration Testing Procedure

Infiltration testing was performed at both of the trench locations. The infiltration testing consisted of filling the inner ring and the annular space (the space between the inner and outer rings) with water, approximately 3 to 4 inches above the soil. To prevent the flow of water from one ring to the other, the water level in both the inner ring and the annular space between the rings was maintained using constant-head float valves. The volume of water that was added to maintain a constant head in the inner ring and the annular space during each time interval was determined and recorded. A cap was placed over the rings to minimize the evaporation of water during the tests.

The schedule for readings was determined based on the observed soil type at the base of each backhoe-excavated trench. Based on the existing soils at the trench locations, the volumetric measurements were made at 20 and 30-minute increments. The water volume measurements are presented on the spreadsheets enclosed with this report. The infiltration rates for each of the timed intervals are also tabulated on these spreadsheets.

The infiltration rates for the infiltration tests are calculated in centimeters per hour and then converted to inches per hour. The rates are summarized below:

Infiltration Test No.	Depth (feet)	Soil Description	Infiltration Rate (inches/hour)
I-1	10	Brown to Dark Brown Silty fine to coarse Sand, trace Clay	0.0
I-2	10	Brown fine to coarse Sand, trace Silt, little Clay	1.0
I-3	10	Brown Silty fine to coarse Sand, trace Clay	1.0
I-4	10	Brown Silty fine to coarse Sand, trace Clay	0.0

Design Recommendations

Four (4) infiltration tests were performed at the subject site. As note above, the calculated infiltration rates at the infiltration test locations range from 0 to 1.0 inch per hour. The major factors affecting the lack of infiltration at these locations is the presence of dense to very dense older alluvium. **Based on the lack of infiltration at the depths tested, infiltration is not considered feasible for this site. Although an infiltration rate of 1.0 inch per hour was calculated, these areas are very likely to be underlain by much less permeable, denser older alluvium, which was encountered at the other boring and trench locations.**

Although infiltration is not considered feasible at the site, the client may desire to use storm water disposal systems that do not rely on infiltration at this site. The design of storm water disposal systems should be performed by the project civil engineer, in accordance with the City of Perris and/or County of Riverside guidelines. It is recommended any such systems be designed and constructed to facilitate removal of silt and clay, or other deleterious materials from any water that may enter the system. The presence of such materials would decrease the flow rates through the system. It should be noted that the recommended infiltration rates are

based on infiltration testing at four (4) discrete locations and that the overall infiltration rates of the proposed infiltration systems could vary considerably.

Location of Infiltration Systems

The use of on-site storm water infiltration systems carries a risk of creating adverse geotechnical conditions. Increasing the moisture content of the soil can cause the soil to lose internal shear strength and increase its compressibility, resulting in a change in the designed engineering properties. Overlying structures and pavements in the infiltration area could potentially be damaged due to saturation of the subgrade soils. **The proposed infiltration systems for this site should be located at least 25 feet away from any structures, including retaining walls.** Even with this provision of locating the infiltration system at least 25 feet from the building(s), it is possible that infiltrating water into the subsurface soils could have an adverse effect on the proposed or existing structures. It should also be noted that utility trenches which happen to collect storm water can also serve as conduits to transmit storm water toward the structure, depending on the slope of the utility trench. Therefore, consideration should also be given to the proposed locations of underground utilities which may pass near the proposed infiltration system.

The infiltration system designer should also give special consideration to the effect that the proposed infiltration systems may have on nearby subterranean structures, open excavations, or descending slopes. In particular, infiltration systems should not be located near the crest of descending slopes, particularly where the slopes are comprised of granular soils. Such systems will require specialized design and analysis to evaluate the potential for slope instability, piping failures and other phenomena that typically apply to earthen dam design. This type of analysis is beyond the scope of this infiltration test report, but these factors should be considered by the infiltration system designer when locating the infiltration systems.

General Comments

This report has been prepared as an instrument of service for use by the client in order to aid in the evaluation of this property and to assist the architects and engineers in the design and preparation of the project plans and specifications. This report may be provided to the contractor(s) and other design consultants to disclose information relative to the project. However, this report is not intended to be utilized as a specification in and of itself, without appropriate interpretation by the project architect, structural engineer, and/or civil engineer. The design of the proposed storm water infiltration system is the responsibility of the civil engineer. The role of the geotechnical engineer is limited to determination of infiltration rate only. By using the design infiltration rate contained herein, the civil engineer agrees to indemnify, defend, and hold harmless the geotechnical engineer for all aspects of the design and performance of the proposed storm water infiltration system. The reproduction and distribution of this report must be authorized by the client and Southern California Geotechnical, Inc. Furthermore, any reliance on this report by an unauthorized third party is at such party's sole risk, and we accept no responsibility for damage or loss which may occur.

The analysis of this site was based on a subsurface profile interpolated from limited discrete soil samples. While the materials encountered in the project area are considered to be

representative of the total area, some variations should be expected between boring locations and testing depths. If the conditions encountered during construction vary significantly from those detailed herein, we should be contacted immediately to determine if the conditions alter the recommendations contained herein.

This report has been based on assumed or provided characteristics of the proposed development. It is recommended that the owner, client, architect, structural engineer, and civil engineer carefully review these assumptions to ensure that they are consistent with the characteristics of the proposed development. If discrepancies exist, they should be brought to our attention to verify that they do not affect the conclusions and recommendations contained herein. We also recommend that the project plans and specifications be submitted to our office for review to verify that our recommendations have been correctly interpreted. The analysis, conclusions, and recommendations contained within this report have been promulgated in accordance with generally accepted professional geotechnical engineering practice. No other warranty is implied or expressed.

Closure

We sincerely appreciate the opportunity to be of service on this project. We look forward to providing additional consulting services during the course of the project. If we may be of further assistance in any manner, please contact our office.

Respectfully Submitted,

SOUTHERN CALIFORNIA GEOTECHNICAL, INC.

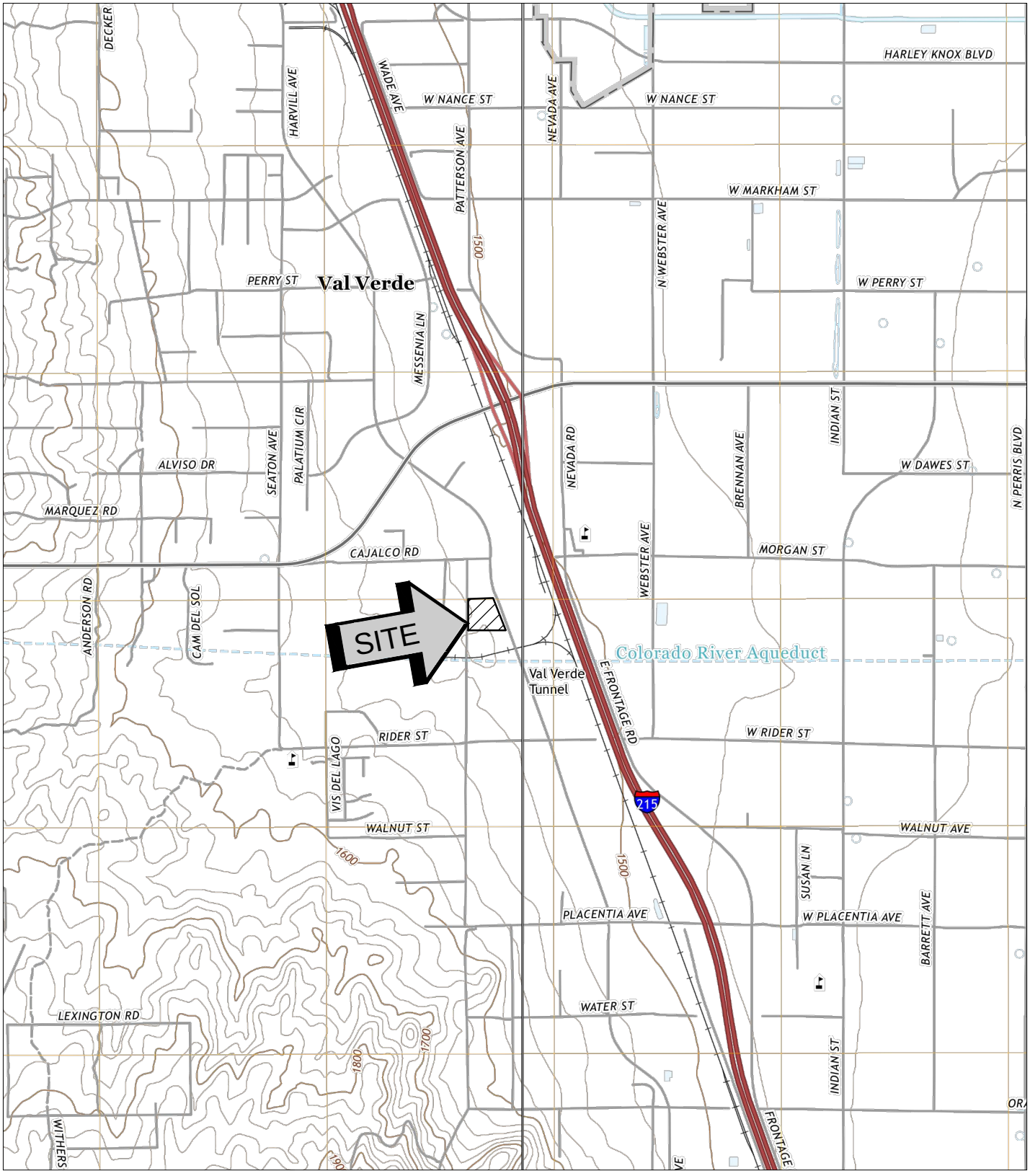
Oscar Sandoval
Staff Engineer

Robert G. Trazo, GE 2655
Principal Engineer



Distribution: (1) Addressee

Enclosures: Plate 1 - Site Location Map
Plate 2: Infiltration Test Location Plan
Trench Log Legend and Logs (6 pages)
Infiltration Test Results Spreadsheets (4 pages)
Grainsize Distribution Graphs (4 pages)



SOURCE: USGS TOPOGRAPHIC MAP OF STEELE PEAK AND PERRIS QUADRANGLES, RIVERSIDE COUNTY, CALIFORNIA, 2018.

SITE LOCATION MAP

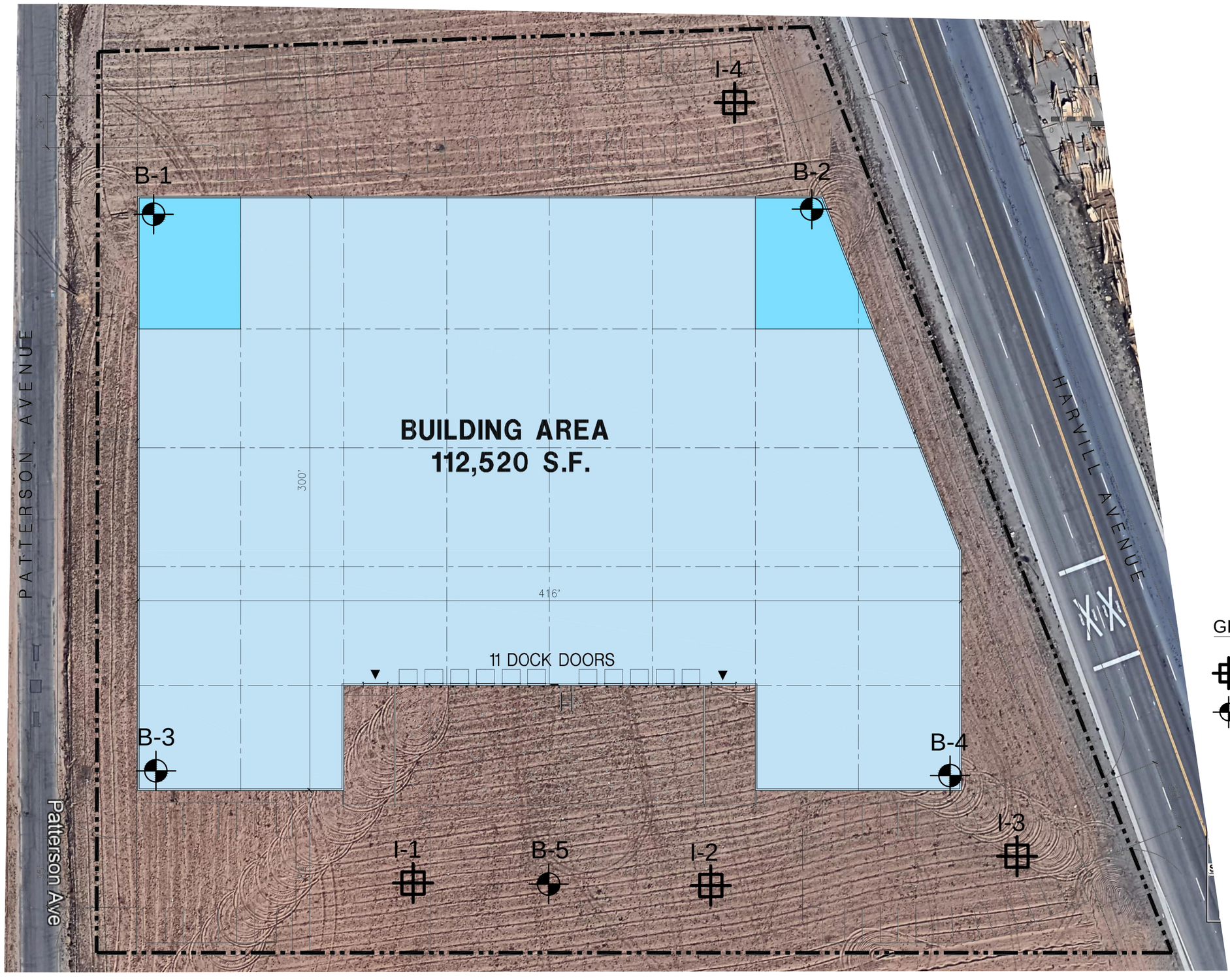
PROPOSED WAREHOUSE

RIVERSIDE COUNTY (PERRIS), CALIFORNIA

SCALE: 1" = 2000'	
DRAWN: PM CHKD: RGT	
SCG PROJECT 21G231-2	
PLATE 1	

SoCalGeo

SOUTHERN CALIFORNIA GEOTECHNICAL



GEOTECHNICAL LEGEND

- APPROXIMTE INFILTRATION LOCATION
- APPROXIMATE BORING LOCATION (SCG PROJECT NO 21G231-1)

NOTE: CONCEPTUAL SITE PLAN (SCHEME 1) PREPARED BY HPA.
AERIAL PHOTOGRAPH OBTAINED FROM GOOGLE EARTH

INFILTRATION TEST LOCATION PLAN

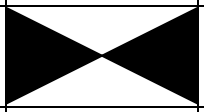
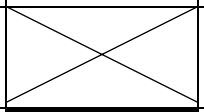
PROPOSED WAREHOUSE

RIVERSIDE COUNTY (PERRIS), CALIFORNIA

SCALE: 1" = 50'	
DRAWN: PM CHKD: RGT	
SCG PROJECT 21G231-1	
PLATE 2	

SOUTHERN CALIFORNIA GEOTECHNICAL

TRENCH LOG LEGEND

SAMPLE TYPE	GRAPHICAL SYMBOL	SAMPLE DESCRIPTION
AUGER		SAMPLE COLLECTED FROM AUGER CUTTINGS, NO FIELD MEASUREMENT OF SOIL STRENGTH. (DISTURBED)
CORE		ROCK CORE SAMPLE: TYPICALLY TAKEN WITH A DIAMOND-TIPPED CORE BARREL. TYPICALLY USED ONLY IN HIGHLY CONSOLIDATED BEDROCK.
GRAB		SOIL SAMPLE TAKEN WITH NO SPECIALIZED EQUIPMENT, SUCH AS FROM A STOCKPILE OR THE GROUND SURFACE. (DISTURBED)
CS		CALIFORNIA SAMPLER: 2-1/2 INCH I.D. SPLIT BARREL SAMPLER, LINED WITH 1-INCH HIGH BRASS RINGS. DRIVEN WITH SPT HAMMER. (RELATIVELY UNDISTURBED)
NSR		NO RECOVERY: THE SAMPLING ATTEMPT DID NOT RESULT IN RECOVERY OF ANY SIGNIFICANT SOIL OR ROCK MATERIAL.
SPT		STANDARD PENETRATION TEST: SAMPLER IS A 1.4 INCH INSIDE DIAMETER SPLIT BARREL, DRIVEN 18 INCHES WITH THE SPT HAMMER. (DISTURBED)
SH		SHELBY TUBE: TAKEN WITH A THIN WALL SAMPLE TUBE, PUSHED INTO THE SOIL AND THEN EXTRACTED. (UNDISTURBED)
VANE		VANE SHEAR TEST: SOIL STRENGTH OBTAINED USING A 4 BLADED SHEAR DEVICE. TYPICALLY USED IN SOFT CLAYS-NO SAMPLE RECOVERED.

COLUMN DESCRIPTIONS

DEPTH: Distance in feet below the ground surface.

SAMPLE: Sample Type as depicted above.

BLOW COUNT: Number of blows required to advance the sampler 12 inches using a 140 lb hammer with a 30-inch drop. 50/3" indicates penetration refusal (>50 blows) at 3 inches. WH indicates that the weight of the hammer was sufficient to push the sampler 6 inches or more.

POCKET PEN.: Approximate shear strength of a cohesive soil sample as measured by pocket penetrometer.

GRAPHIC LOG: Graphic Soil Symbol as depicted on the following page.

DRY DENSITY: Dry density of an undisturbed or relatively undisturbed sample in lbs/ft^3.

MOISTURE CONTENT: Moisture content of a soil sample, expressed as a percentage of the dry weight.

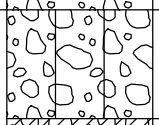
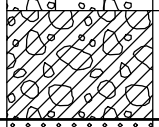
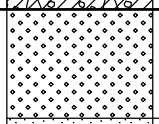
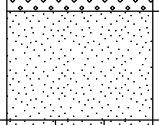
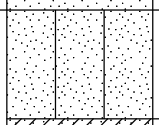
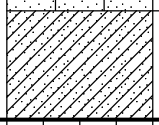
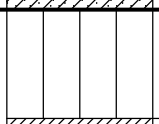
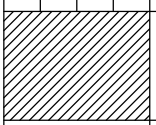
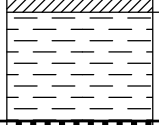
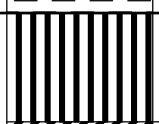
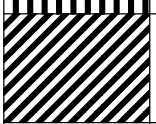
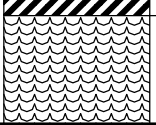
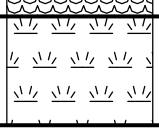
LIQUID LIMIT: The moisture content above which a soil behaves as a liquid.

PLASTIC LIMIT: The moisture content above which a soil behaves as a plastic.

PASSING #200 SIEVE: The percentage of the sample finer than the #200 standard sieve.

UNCONFINED SHEAR: The shear strength of a cohesive soil sample, as measured in the unconfined state.

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS		TYPICAL DESCRIPTIONS
			GRAPH	LETTER	
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	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
		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 MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% 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 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
	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
				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

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-1

JOB NO.: 21G231-2
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California
EXCAVATION DATE: 10/11/21
EXCAVATION METHOD: Backhoe
LOGGED BY: Oscar Sandoval
WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine to medium Sand, trace fine root fibers, medium dense to dense-dry							
					OLDER ALLUVIUM: Brown to Dark Brown Silty fine to coarse Sand, trace Clay, dense to very dense-damp to moist							
5												
							9			37		
10					Trench Terminated at 10'							

TBL 21G231-2.GPJ SOCALGEO.GDT 10/29/21

TEST TRENCH LOG

PLATE B-1

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-2

JOB NO.: 21G231-2
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California
EXCAVATION DATE: 10/6/21
EXCAVATION METHOD: Backhoe
LOGGED BY: Oscar Sandoval
WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Brown Silty fine Sand, trace Clay, trace medium to coarse Sand, trace fine Gravel, very dense-dry							
					OLDER ALLUVIUM: Brown fine to coarse Sand, trace Silt, little Clay, dense to very dense-dry							
5												
							3			9		
10					Trench Terminated at 10'							

TBL 21G231-2.GPJ SOCALGEO.GDT 10/29/21

TEST TRENCH LOG **PLATE B-2**

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-3

JOB NO.: 21G231-2
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California

EXCAVATION DATE: 10/6/21
EXCAVATION METHOD: Backhoe
LOGGED BY: Oscar Sandoval

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL: Dark brown Clayey fine to coarse Sand, trace Silt, trace fine root fibers, porous, very dense-dry							
					ALLUVIUM: Brown Silty fine Sand, trace medium to coarse Sand, dense-dry to damp							
5												
					OLDER ALLUVIUM: Brown Silty fine to coarse Sand, trace Clay, dense to very dense-damp							
							6			26		
10					Boring Terminated at 10'							

TBL 21G231-2.GPJ SOCALGEO.GDT 10/29/21

TEST TRENCH LOG

PLATE B-3

SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

TRENCH NO. I-4

JOB NO.: 21G231-2
PROJECT: Proposed Warehouse
LOCATION: Riverside County (Perris), California

EXCAVATION DATE: 10/11/21
EXCAVATION METHOD: Backhoe
LOGGED BY: Oscar Sandoval

WATER DEPTH: Dry
CAVE DEPTH: ---
READING TAKEN: At Completion

FIELD RESULTS						LABORATORY RESULTS						
DEPTH (FEET)	SAMPLE	BLOW COUNT	POCKET PEN. (TSF)	GRAPHIC LOG	DESCRIPTION SURFACE ELEVATION: --- MSL	DRY DENSITY (PCF)	MOISTURE CONTENT (%)	LIQUID LIMIT	PLASTIC LIMIT	PASSING #200 SIEVE (%)	ORGANIC CONTENT (%)	COMMENTS
					FILL Light Brown Clayey fine Sand, trace medium to coarse Sand, trace fine root fibers, dense-dry							
					ALLUVIUM: Brown Silty fine to coarse Sand, trace Clay, dense-moist							
5												
							11			43		
10					Boring Terminated at 10'							

TBL 21G231-2.GPJ SOCALGEO.GDT 10/29/21

TEST TRENCH LOG **PLATE B-4**

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Riverside County (Perris), California
Project Number	21G231-2
Engineer	Oscar Sandoval

Infiltration Test No: I-1

Constants

	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	9:25 AM	30	0	200	0	3600	0.55	3.29	0.22	1.30
	Final	9:55 AM	**30**	200		3600					
2	Initial	9:55 AM	30	0	0	0	2800	0.00	2.56	0.00	1.01
	Final	10:25 AM	**60**	0		2800					
3	Initial	10:25 AM	30	0	0	0	2700	0.00	2.47	0.00	0.97
	Final	10:55 AM	**90**	0		2700					
4	Initial	10:55 AM	30	0	0	0	2600	0.00	2.38	0.00	0.94
	Final	11:25 AM	**120**	0		2600					

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Riverside County (Perris), California
Project Number	21G231-2
Engineer	Oscar Sandoval

Infiltration Test No: I-2

Constants

	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	11:55 AM	20	0	900	0	3500	3.70	4.80	1.46	1.89
	Final	12:15 PM	**20**	900		3500					
2	Initial	12:15 PM	20	0	950	0	4000	3.91	5.48	1.54	2.16
	Final	12:35 PM	**40**	950		4000					
3	Initial	12:35 PM	20	8	692	0	3900	2.85	5.35	1.12	2.10
	Final	12:55 PM	**60**	700		3900					
4	Initial	12:55 PM	20	0	600	0	3700	2.47	5.07	0.97	2.00
	Final	1:15 PM	**80**	600		3700					
5	Initial	1:15 PM	20	0	600	0	3400	2.47	4.66	0.97	1.83
	Final	1:35 PM	**100**	600		3400					

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Riverside County (Perris), California
Project Number	21G231-2
Engineer	Oscar Sandoval

Infiltration Test No: I-3

Constants

	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Ring Flow (cm^3)	Annular Ring (ml)	Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Annular Space* (cm/hr)	Inner Ring* (in/hr)	Annular Space* (in/hr)
1	Initial	9:15 AM	20	0	850	0	3900	3.49	5.35	1.38	2.10
	Final	9:35 AM	**20**	850		3900					
2	Initial	9:35 AM	20	0	700	0	3700	2.88	5.07	1.13	2.00
	Final	9:55 AM	**40**	700		3700					
3	Initial	9:55 AM	20	8	642	0	3600	2.64	4.93	1.04	1.94
	Final	10:15 AM	**60**	650		3600					
4	Initial	10:15 AM	20	0	650	0	3400	2.67	4.66	1.05	1.83
	Final	10:35 AM	**80**	650		3400					
5	Initial	10:35 AM	20	0	650	0	3300	2.67	4.52	1.05	1.78
	Final	10:55 AM	**100**	650		3300					

INFILTRATION CALCULATIONS

Project Name	Proposed Warehouse
Project Location	Riverside County (Perris), California
Project Number	21G231-2
Engineer	Oscar Sandoval

Infiltration Test No: I-4

Constants

	Diameter (ft)	Area (ft^2)	Area (cm^2)
Inner	1	0.79	730
Anlr. Spac	2	2.36	2189

*Note: The infiltration rate was calculated based on current time interval

Test Interval		Time (hr)	Interval **Elapsed** (min)	Flow Readings: Inner Ring (ml)	Flow Readings: Ring Flow (cm^3)	Flow Readings: Annular Ring (ml)	Flow Readings: Space Flow (cm^3)	Infiltration Rates: Inner Ring* (cm/hr)	Infiltration Rates: Annular Space* (cm/hr)	Infiltration Rates: Inner Ring* (in/hr)	Infiltration Rates: Annular Space* (in/hr)
1	Initial	11:35 AM	20	0	0	0	4800	0.00	6.58	0.00	2.59
	Final	11:55 AM	**20**	0		4800					
2	Initial	11:55 AM	20	0	0	0	4600	0.00	6.30	0.00	2.48
	Final	12:15 PM	**40**	0		4600					
3	Initial	12:15 PM	20	0	0	0	4500	0.00	6.17	0.00	2.43
	Final	12:35 PM	**60**	0		4500					
4	Initial	12:35 PM	20	0	0	0	4100	0.00	5.62	0.00	2.21
	Final	12:55 PM	**80**	0		4100					

Grain Size Distribution

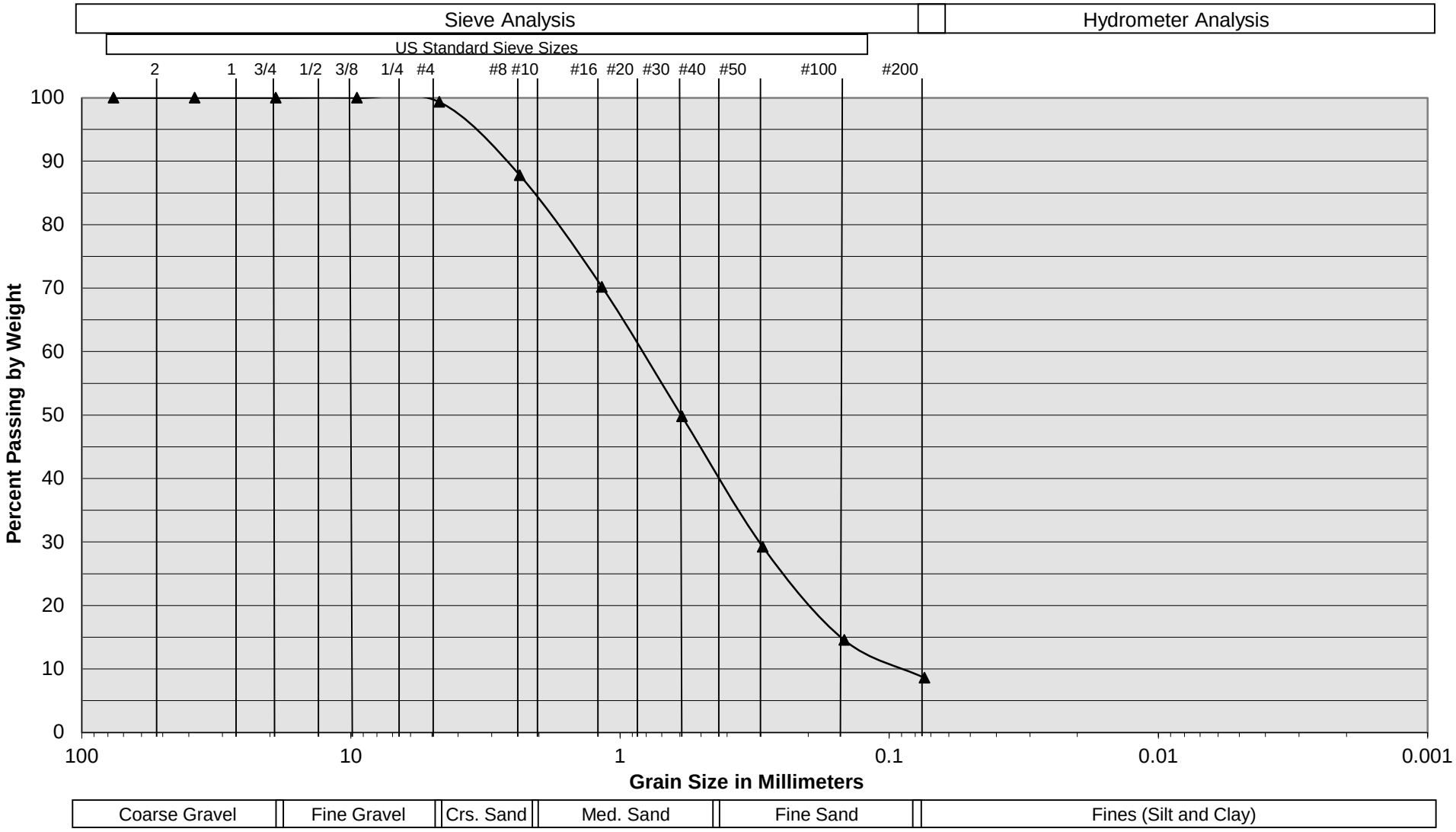


Sample Description	I-1 @ 9'
Soil Classification	Brown to Dark Brown Silty fine to coarse Sand, trace Clay

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-2
PLATE C- 1

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

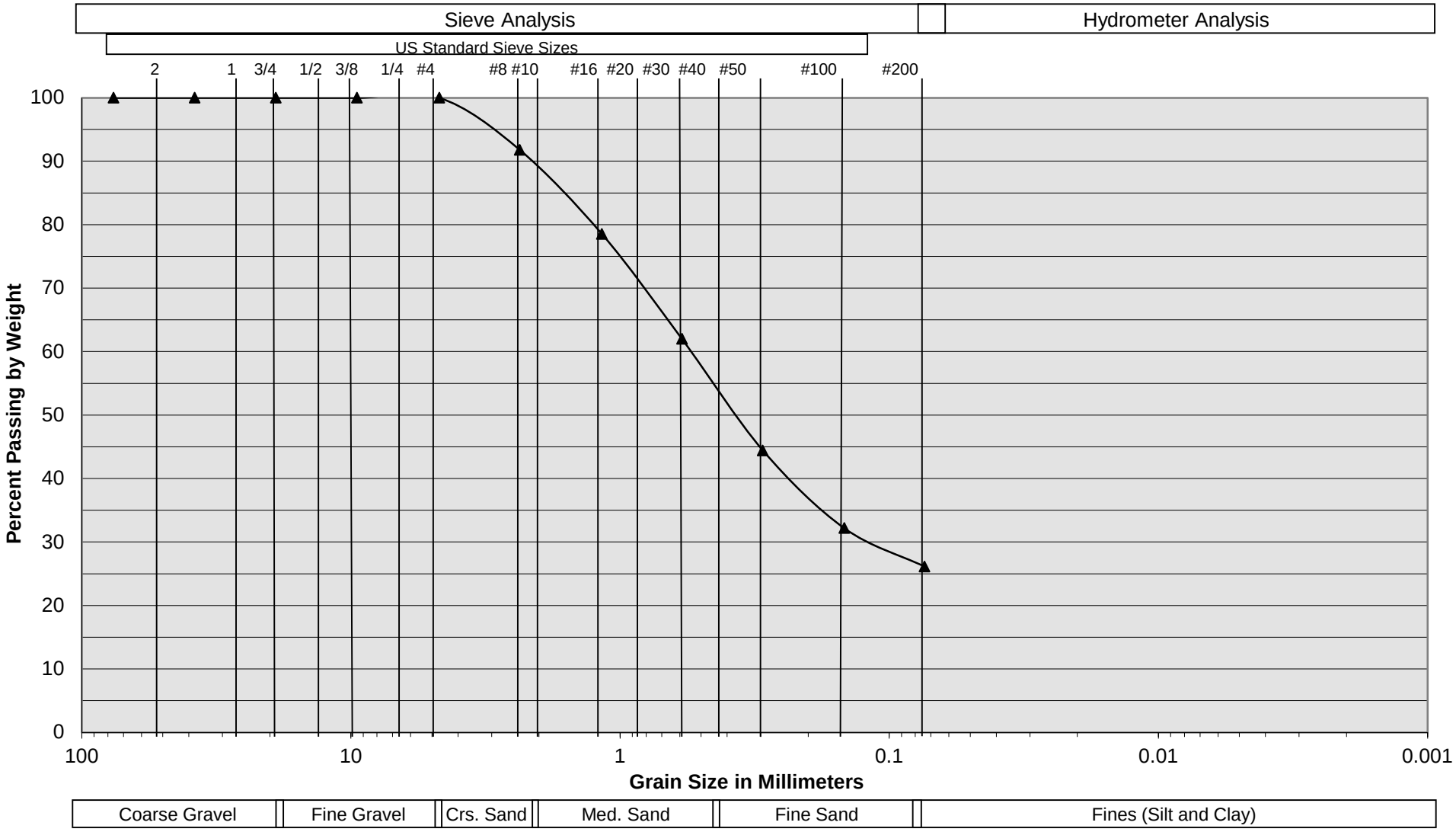


Sample Description	I-2 @ 9'
Soil Classification	Brown fine to coarse Sand, trace Silt, little Clay

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-2
PLATE C- 2

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution

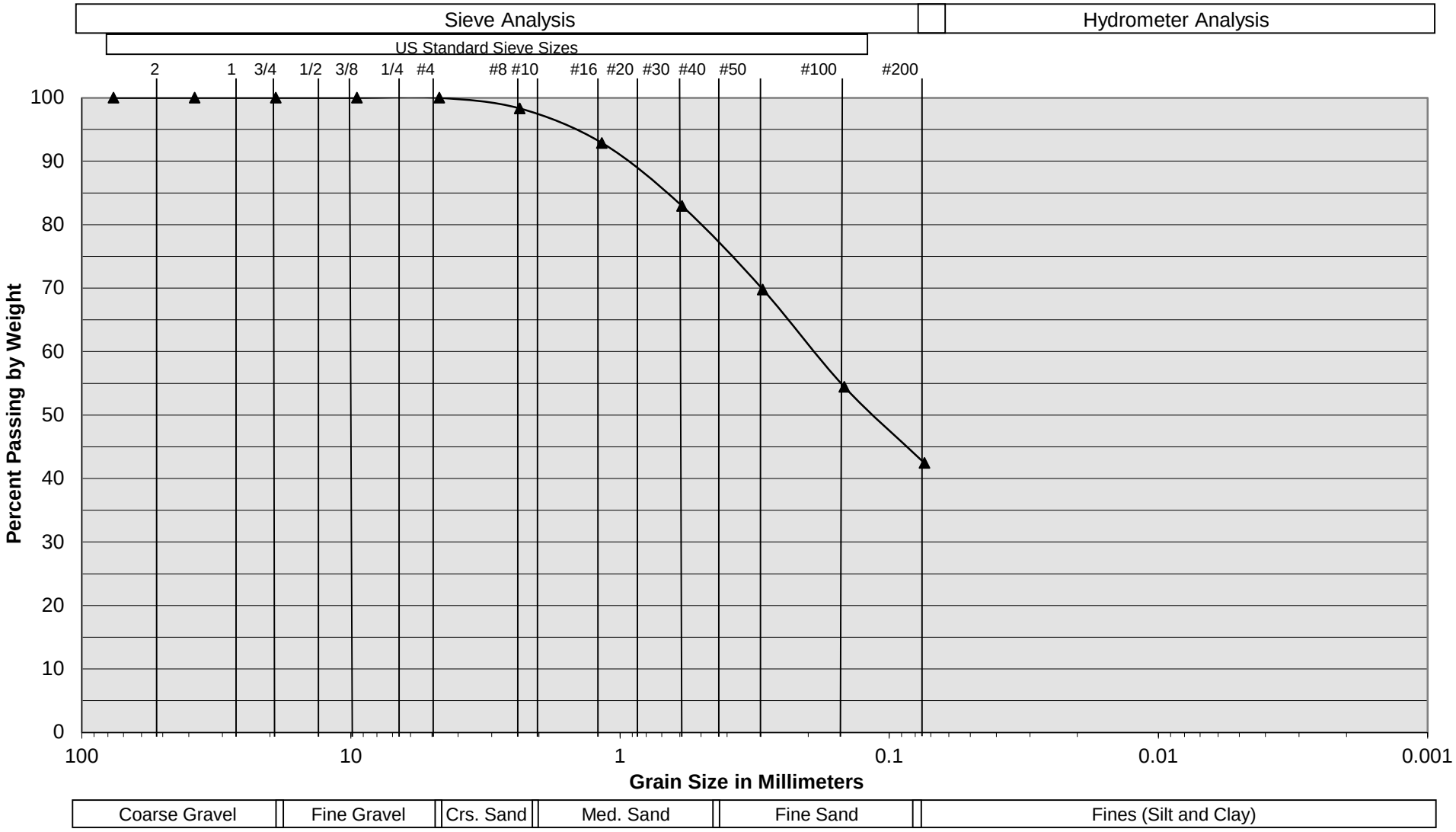


Sample Description	I-3 @ 9'
Soil Classification	Brown Silty fine to coarse Sand, trace Clay

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-2
PLATE C- 3

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

Grain Size Distribution



Sample Description	I-4 @ 9'
Soil Classification	Brown Silty fine to coarse Sand, trace Clay

Proposed Warehouse
Riverside County (Perris), CA
Project No. 21G231-2
PLATE C- 4

SoCalGeo
SOUTHERN CALIFORNIA GEOTECHNICAL
A California Corporation

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Western Riverside Area, California



April 21, 2022

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Preface.....2
How Soil Surveys Are Made.....5
Soil Map.....8
Soil Map.....9
Legend.....10
Map Unit Legend.....11
Map Unit Descriptions.....11
Western Riverside Area, California.....13
EpC2—Exeter sandy loam, deep, 2 to 8 percent slopes, eroded.....13
GyC2—Greenfield sandy loam, 2 to 8 percent slopes, eroded.....14
MmC2—Monserate sandy loam, 5 to 8 percent slopes, eroded.....15
RaB2—Ramona sandy loam, 2 to 5 percent slopes, eroded.....17
Soil Information for All Uses.....19
Soil Reports.....19
AOI Inventory.....19
Map Unit Description (Brief, Generated) (Peterson Ave & Harvill Ave).....19
References.....24

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,330 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:15,800.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Western Riverside Area, California
Survey Area Data: Version 14, Sep 13, 2021

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 23, 2020—Feb 6, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
EpC2	Exeter sandy loam, deep, 2 to 8 percent slopes, eroded	1.0	16.2%
GyC2	Greenfield sandy loam, 2 to 8 percent slopes, eroded	0.1	0.8%
MmC2	Monserate sandy loam, 5 to 8 percent slopes, eroded	2.5	40.4%
RaB2	Ramona sandy loam, 2 to 5 percent slopes, eroded	2.7	42.6%
Totals for Area of Interest		**6.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Western Riverside Area, California

EpC2—Exeter sandy loam, deep, 2 to 8 percent slopes, eroded

Map Unit Setting

National map unit symbol: hctl
Elevation: 300 to 700 feet
Mean annual precipitation: 7 to 15 inches
Mean annual air temperature: 64 degrees F
Frost-free period: 250 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Exeter and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Exeter

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 16 inches: sandy loam
H2 - 16 to 37 inches: sandy clay loam
H3 - 37 to 50 inches: indurated
H4 - 50 to 60 inches: stratified sandy loam to silt loam

Properties and qualities

Slope: 2 to 8 percent
Depth to restrictive feature: 35 to 60 inches to duripan
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Ramona
Percent of map unit: 5 percent
Hydric soil rating: No

Monserate
Percent of map unit: 5 percent
Hydric soil rating: No

Greenfield
Percent of map unit: 5 percent
Hydric soil rating: No

GyC2—Greenfield sandy loam, 2 to 8 percent slopes, eroded

Map Unit Setting
National map unit symbol: hcvw
Elevation: 100 to 3,500 feet
Mean annual precipitation: 9 to 20 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 200 to 300 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition
Greenfield and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Greenfield

Setting
Landform: Terraces, alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile
H1 - 0 to 26 inches: sandy loam
H2 - 26 to 43 inches: fine sandy loam
H3 - 43 to 60 inches: loam
H4 - 60 to 72 inches: stratified loamy sand to sandy loam

Properties and qualities
Slope: 2 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Moderate (about 8.3 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Hanford

Percent of map unit: 3 percent
Hydric soil rating: No

Pachappa

Percent of map unit: 3 percent
Hydric soil rating: No

Arlington

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 3 percent
Hydric soil rating: No

Ramona

Percent of map unit: 3 percent
Hydric soil rating: No

MmC2—Monserate sandy loam, 5 to 8 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcx5
Elevation: 700 to 2,500 feet
Mean annual precipitation: 10 to 18 inches
Mean annual air temperature: 63 to 64 degrees F
Frost-free period: 220 to 280 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Monserate and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Monserate

Setting

Landform: Alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 10 inches: sandy loam
H2 - 10 to 28 inches: sandy clay loam
H3 - 28 to 45 inches: indurated
H4 - 45 to 57 inches: cemented
H5 - 57 to 70 inches: loamy coarse sand

Properties and qualities

Slope: 5 to 8 percent
Depth to restrictive feature: 20 to 39 inches to duripan
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 to 0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Tujunga

Percent of map unit: 3 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 3 percent
Hydric soil rating: No

Ramona

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 3 percent
Hydric soil rating: No

Hanford

Percent of map unit: 3 percent
Hydric soil rating: No

RaB2—Ramona sandy loam, 2 to 5 percent slopes, eroded

Map Unit Setting

National map unit symbol: hcy5
Elevation: 250 to 3,500 feet
Mean annual precipitation: 10 to 20 inches
Mean annual air temperature: 63 degrees F
Frost-free period: 230 to 320 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Ramona and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ramona

Setting

Landform: Terraces, alluvial fans
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from granite

Typical profile

H1 - 0 to 14 inches: sandy loam
H2 - 14 to 23 inches: fine sandy loam
H3 - 23 to 68 inches: sandy clay loam
H4 - 68 to 74 inches: gravelly sandy loam

Properties and qualities

Slope: 2 to 5 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 1 percent
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R019XD029CA - LOAMY
Hydric soil rating: No

Minor Components

Hanford

Percent of map unit: 4 percent
Hydric soil rating: No

Arlington

Percent of map unit: 4 percent
Hydric soil rating: No

Greenfield

Percent of map unit: 4 percent
Hydric soil rating: No

Tujunga

Percent of map unit: 3 percent
Hydric soil rating: No

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

AOI Inventory

This folder contains a collection of tabular reports that present a variety of soil information. Included are various map unit description reports, special soil interpretation reports, and data summary reports.

Map Unit Description (Brief, Generated) (Peterson Ave & Harvill Ave)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, provide information on the composition of map units and properties of their components.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous

areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated) (Peterson Ave & Harvill Ave)

Western Riverside Area, California

Map Unit: EpC2—Exeter sandy loam, deep, 2 to 8 percent slopes, eroded

Component: Exeter (85%)

The Exeter component makes up 85 percent of the map unit. Slopes are 2 to 8 percent. This component is on alluvial fans. The parent material consists of alluvium derived from granite. Depth to a root restrictive layer, duripan, is 35 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R019XD029CA Loamy (1975) ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 1 percent.

Component: Ramona (5%)

Generated brief soil descriptions are created for major soil components. The Ramona soil is a minor component.

Component: Monserate (5%)

Generated brief soil descriptions are created for major soil components. The Monserate soil is a minor component.

Component: Greenfield (5%)

Generated brief soil descriptions are created for major soil components. The Greenfield soil is a minor component.

Map Unit: GyC2—Greenfield sandy loam, 2 to 8 percent slopes, eroded

Component: Greenfield (85%)

The Greenfield component makes up 85 percent of the map unit. Slopes are 2 to 8 percent. This component is on alluvial fans, terraces. The parent material consists of alluvium derived from granite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R019XD029CA Loamy (1975) ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

Component: Hanford (3%)

Generated brief soil descriptions are created for major soil components. The Hanford soil is a minor component.

Component: Pachappa (3%)

Generated brief soil descriptions are created for major soil components. The Pachappa soil is a minor component.

Component: Arlington (3%)

Generated brief soil descriptions are created for major soil components. The Arlington soil is a minor component.

Component: Unnamed (3%)

Generated brief soil descriptions are created for major soil components. The Unnamed soil is a minor component.

Component: Ramona (3%)

Generated brief soil descriptions are created for major soil components. The Ramona soil is a minor component.

Map Unit: MmC2—Monserate sandy loam, 5 to 8 percent slopes, eroded

Component: Monserate (85%)

The Monserate component makes up 85 percent of the map unit. Slopes are 5 to 8 percent. This component is on alluvial fans. The parent material consists of alluvium derived from granite. Depth to a root restrictive layer, duripan, is 20 to 39 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low. Available water to a depth of 60 inches (or restricted depth) is low. Shrink-swell potential is moderate. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R019XD029CA

Loamy (1975) ecological site. Nonirrigated land capability classification is 4e. Irrigated land capability classification is 3e. This soil does not meet hydric criteria.

Component: Tujunga (3%)

Generated brief soil descriptions are created for major soil components. The Tujunga soil is a minor component.

Component: Greenfield (3%)

Generated brief soil descriptions are created for major soil components. The Greenfield soil is a minor component.

Component: Ramona (3%)

Generated brief soil descriptions are created for major soil components. The Ramona soil is a minor component.

Component: Unnamed (3%)

Generated brief soil descriptions are created for major soil components. The Unnamed soil is a minor component.

Component: Hanford (3%)

Generated brief soil descriptions are created for major soil components. The Hanford soil is a minor component.

Map Unit: RaB2—Ramona sandy loam, 2 to 5 percent slopes, eroded

Component: Ramona (85%)

The Ramona component makes up 85 percent of the map unit. Slopes are 2 to 5 percent. This component is on alluvial fans, terraces. The parent material consists of alluvium derived from granite. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches (or restricted depth) is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R019XD029CA Loamy (1975) ecological site. Nonirrigated land capability classification is 3e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 1 percent.

Component: Hanford (4%)

Generated brief soil descriptions are created for major soil components. The Hanford soil is a minor component.

Component: Arlington (4%)

Generated brief soil descriptions are created for major soil components. The Arlington soil is a minor component.

Component: Greenfield (4%)

Generated brief soil descriptions are created for major soil components. The Greenfield soil is a minor component.

Component: Tujunga (3%)

Generated brief soil descriptions are created for major soil components. The Tujunga soil is a minor component.

References

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. Classification of wetlands and deep-water habitats of the United States. U.S. Fish and Wildlife Service FWS/OBS-79/31.

Federal Register. July 13, 1994. Changes in hydric soils of the United States.

Federal Register. September 18, 2002. Hydric soils of the United States.

Hurt, G.W., and L.M. Vasilas, editors. Version 6.0, 2006. Field indicators of hydric soils in the United States.

National Research Council. 1995. Wetlands: Characteristics and boundaries.

Soil Survey Division Staff. 1993. Soil survey manual. Soil Conservation Service. U.S. Department of Agriculture Handbook 18. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_054262

Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service, U.S. Department of Agriculture Handbook 436. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053577

Soil Survey Staff. 2010. Keys to soil taxonomy. 11th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053580

Tiner, R.W., Jr. 1985. Wetlands of Delaware. U.S. Fish and Wildlife Service and Delaware Department of Natural Resources and Environmental Control, Wetlands Section.

United States Army Corps of Engineers, Environmental Laboratory. 1987. Corps of Engineers wetlands delineation manual. Waterways Experiment Station Technical Report Y-87-1.

United States Department of Agriculture, Natural Resources Conservation Service. National forestry manual. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/home/?cid=nrcs142p2_053374

United States Department of Agriculture, Natural Resources Conservation Service. National range and pasture handbook. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/rangepasture/?cid=stelprdb1043084

United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/scientists/?cid=nrcs142p2_054242

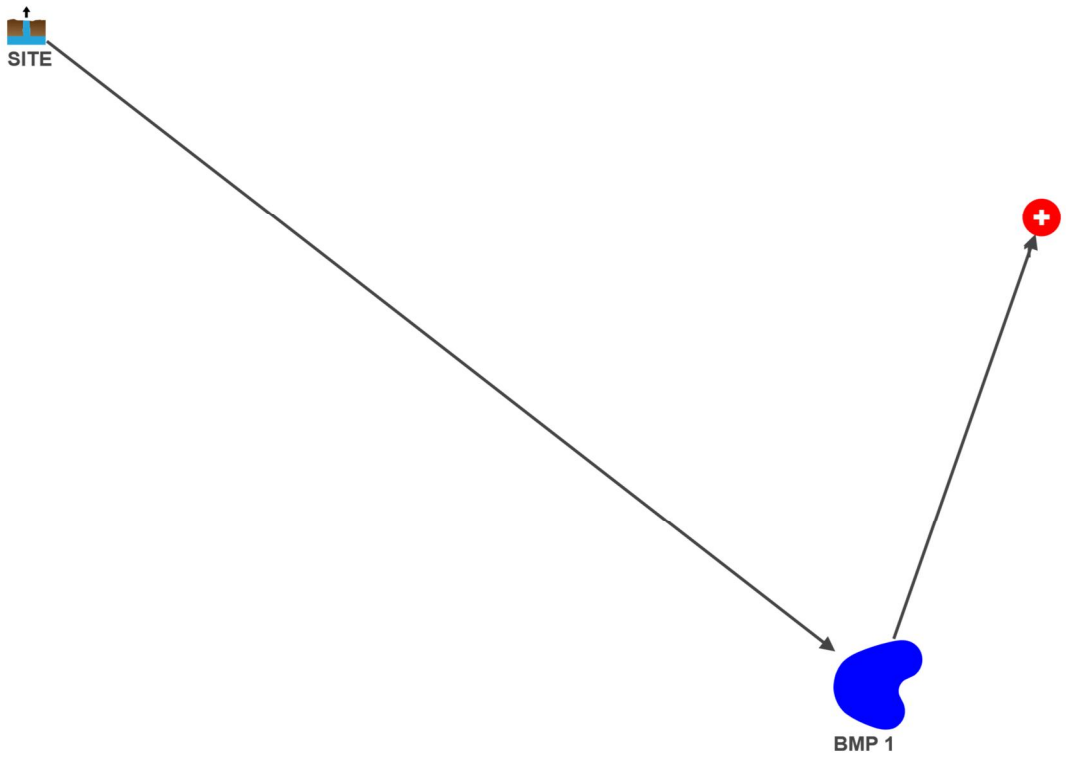
United States Department of Agriculture, Natural Resources Conservation Service. 2006. Land resource regions and major land resource areas of the United States, the Caribbean, and the Pacific Basin. U.S. Department of Agriculture Handbook 296. http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/soils/?cid=nrcs142p2_053624

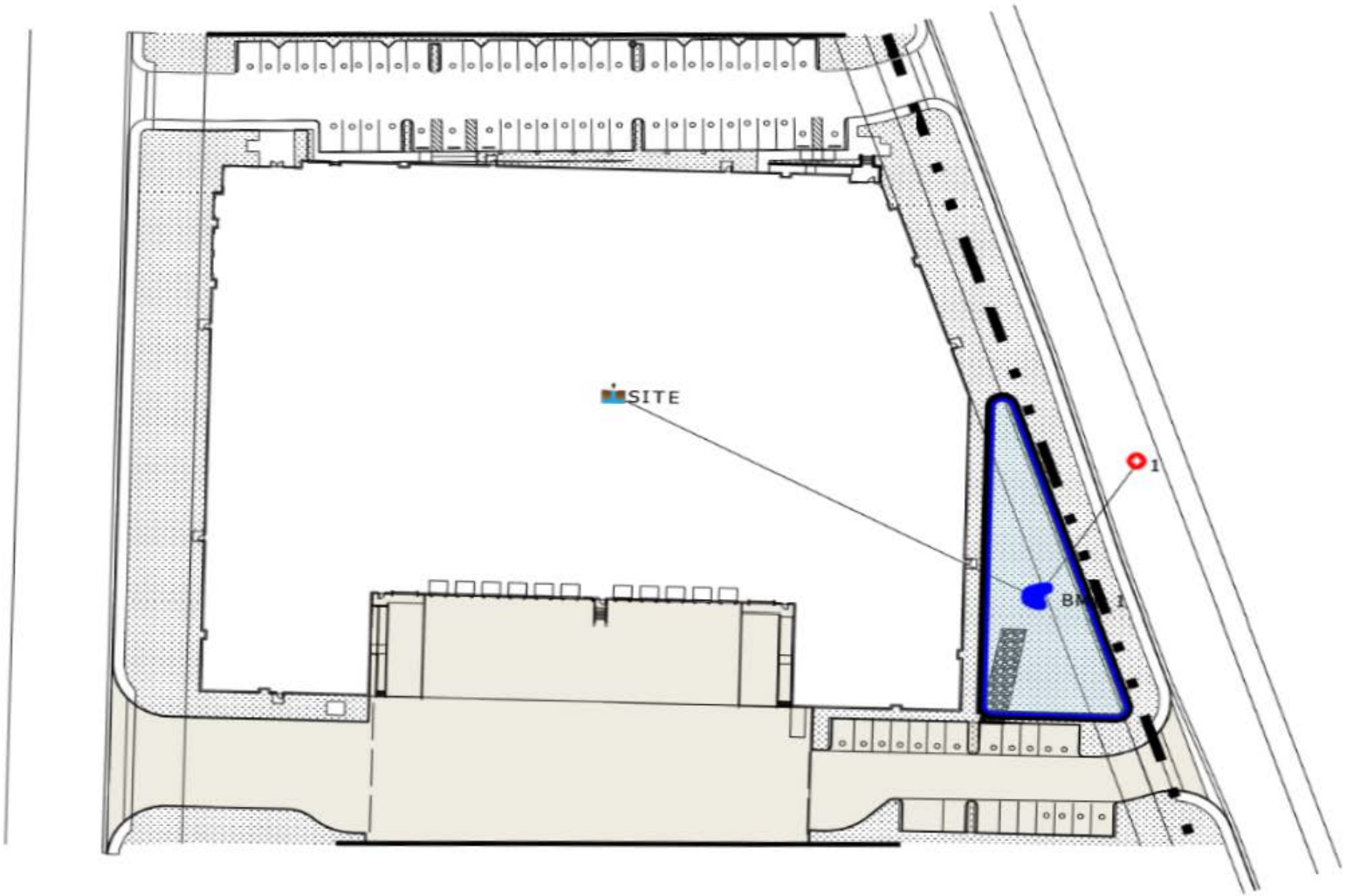
United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. U.S. Department of Agriculture Handbook 210. http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052290.pdf

APPENDIX E

BASIN ROUTING RESULTS

Watershed Routing Diagram

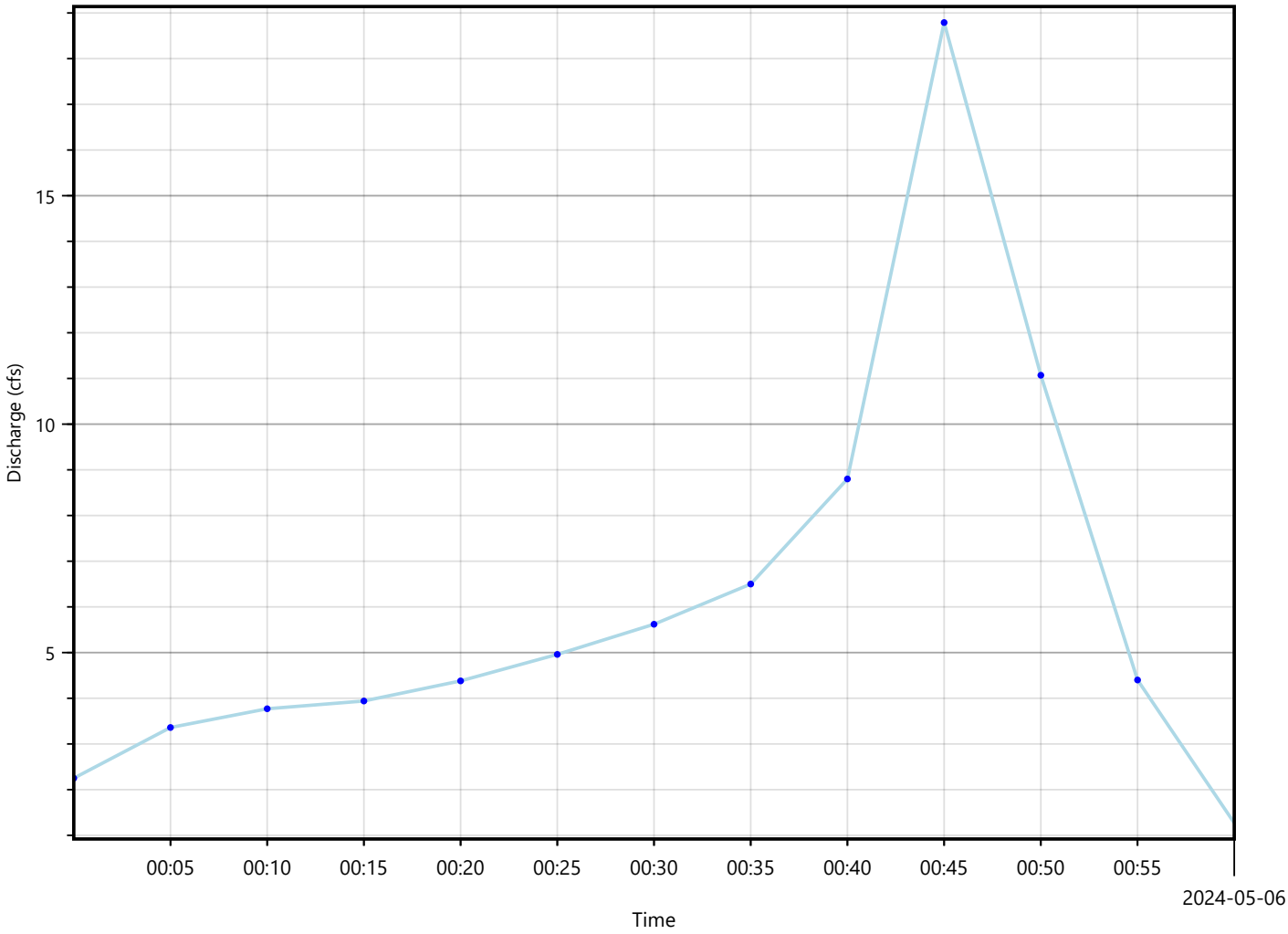




Created with GeoHECHMS v1.2.0.2260

SOURCE 1 - DISCHARGE HYDROGRAPH

Time (ddMMMYYYY, HH:mm)	Discharge (cfs)
06May2024, 00:00	2.25
06May2024, 00:05	3.36
06May2024, 00:10	3.77
06May2024, 00:15	3.94
06May2024, 00:20	4.38
06May2024, 00:25	4.96
06May2024, 00:30	5.62
06May2024, 00:35	6.5
06May2024, 00:40	8.8
06May2024, 00:45	18.79
06May2024, 00:50	11.07
06May2024, 00:55	4.4
06May2024, 01:00	1.27



BMP 1 - ELEVATION-AREA SUMMARY

Elevation (ft)	Storage Area (acres)
1509.60	0.042
1510.00	0.050
1511.00	0.075
1512.00	0.102
1513.00	0.134
1513.75	0.163

BMP 1 - ORIFICE SUMMARY

Number Orifices	Flow Direction	Barrel Center Elevation (ft)	Orifice Cross Sectional Area (ft^2)	Orifice Discharge Coefficient
1	Main	1509.60	0.32	0.61

Storage Areas

These are the storage areas that are defined:

Storage Area ID:	BMP 1		
Scenario:	Default Scenario		
Peak storage:	0.37 ac-ft		
Peak elevation:	1,513.53 ft	Peak Volume	Time of Peak
Peak inflow:	18.79 cfs	0.53 ac-ft	06May2024, 00:45
Peak outflow:	3.10 cfs	0.17 ac-ft	06May2024, 00:55

