MORONGO BAND OF MISSION INDIANS
A SOVEREIGN NATION

MORONGO COMBINED HEATING & POWER (CHP) PROJECT

STRUCTURAL DESIGN CALCULATION DESIGN REPORT

PHASE II

Prepared by:
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Checked by:
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August 4, 2026

PacRim Engineering	PREPARED BY	DATE	REVIEWED BY	DATE
	B. Mu	7/29/2026	S. Gu	7/31/2026
	Morongo Phase II			SHEET
Job No. 511				

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1.0 Design Specifications:

1.1 Design Criteria

For station buildings:

1. California Building Code (CBC), 2022
2. American Society of Civil Engineers (ASCE) 7-19 Minimum Design Loads on Buildings and Other Structures
3. American Concrete Institute (ACI) 318-19
4. Building Code Requirements for Masonry Structures, TMS 402-16
5. American Institute of Steel Construction (AISC) Specifications for Structural Steel Buildings, AISC 360-16

1.2 Dead Load

Generally, self-weight of all structural elements is automatically calculated in Enercalc. Some elements such as architectural concrete or conduit weight are applied manually as a superimposed dead load.

Item	Load
Roof Dead Load	20 psf
Floor/Mezzanine Dead Load	60 psf
Mechanical Equipment	Provided by Manufacturer

1.3 Live Load

Live loads are summarized here as per TP 9.3 and 9.4

Area	Load
Floor/Mezzanine Live Load - Light Storage	125 psf
Roof Live Load	20 psf

1.4 Earth Load

From geotechnical report:

Prepared By: ENGEO Incorporated
Date: 9/10/2025
Project No.: 28791.000.001

Soil Bearing Pressure	3000 psf
Coefficient of Friction	0.3
Passive Earth Pressure	350 pcf
Active Earth Pressure	3:1 slope : 50 pcf

1.5 Wind Load

Per ASCE 7 – Risk Category II:

Wind Design Parameters				
Exposure	Basic Wind Speed, V	Topographic Factor, K_{zt}	Directionality Factor, K_d	Gust Factor, G
C	96 mph	1.2	0.75	0.85

1.6 Earthquake Load

Per ASCE 7:

Seismic Design Parameters				
Site Class	Seismic Design Category	S_{DS}	S_{D1}	I_e
D	D	1.44	1.03	1.25

1.7 Serviceability Requirements

Per IBC Table 1604.3:

Construction	L or Lr	W	D+L
Roof members	$l/240$	$l/240$	$l/180$
Floor members	$l/360$	-	$l/240$
Exterior walls w/ brittle finishes	-	$l/240$	-
Interior partitions w/ brittle finishes	$l/240$	-	-

1.2 Load Combinations

1.2.1 LRFD Combinations

1 1.4 D
2 1.2D + 1.6 L + 0.5(Lr or S or R)
3 1.2D + 1.6(Lr or S or R) + (L or 0.5W)
4 1.2D + 1.6 L + 0.5(Lr or S or R)
5 0.9D + 1.0W
6 1.2D + Ev + Eh + L + 0.2S
7 1.2D - Ev + Eh

1.2.2 ASD Combinations

1 D
2 D + L
3 D + (Lr or S or R)
4 D + 0.75L + 0.75(Lr or S or R)
5 D + 0.6W
6 D + 0.75L + 0.75(Lr or S or R)g
7 0.6D + 0.6W
8 D + 0.7 Ev + 0.7Eh
9 D + 0.525Ev + 0.525Eh + 0.75L + 0.75S
10 0.6D - 0.7Ev + 0.7Eh

1.2.3 Material Design Requirements (TP Section 9.5)

Steel

Element	Type and Grade
Reinforcing steel	ASTM A615 or A706 Grade 60, deformed type
Steel channel, angles, MC shape	ASTM A36
W shape	ASTM A992
W shape – aerial structure	ASTM A709, Gr 50
Steel tube	ASTM A500 Gr B
Steel pipe	ASTM A53 Gr B
Bolts	ASTM F3125
For uses requiring higher steel strengths or where economically justifiable	ASTM A242, A441, A514, A572, A588

Concrete : f’c = 4000 psi
CMU : f’m = 2000 psi

1.2.4 Computer Software

- Enercalc
- Microsoft Excel Spreadsheet 2024

EARTHQUAKE LAOD

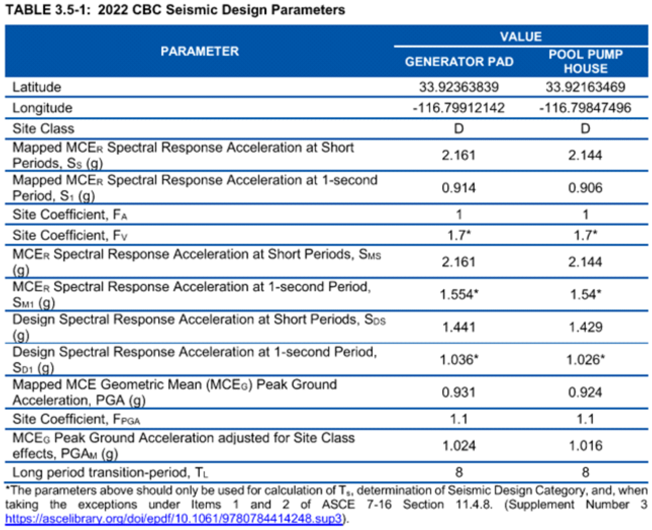
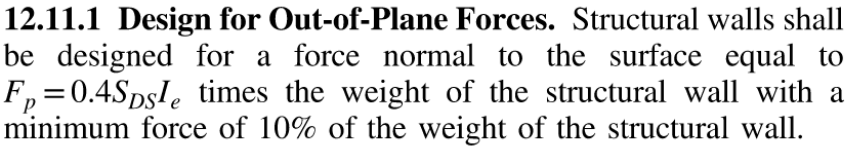


TABLE 3.5-1: 2022 CBC Seismic Design Parameters

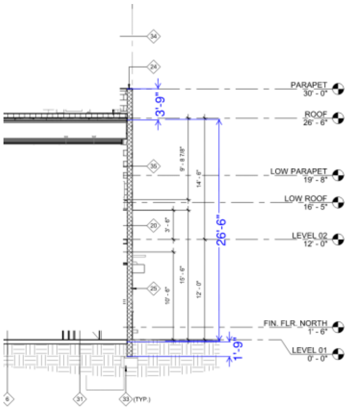
PARAMETER	VALUE	
	GENERATOR PAD	POOL PUMP HOUSE
Latitude	33.92363839	33.92163469
Longitude	-116.79912142	-116.79847496
Site Class	D	D
Mapped MCE$_R$ Spectral Response Acceleration at Short Periods, S_S (g)	2.161	2.144
Mapped MCE$_R$ Spectral Response Acceleration at 1-second Period, S_1 (g)	0.914	0.906
Site Coefficient, F_A	1	1
Site Coefficient, F_V	1.7*	1.7*
MCE$_R$ Spectral Response Acceleration at Short Periods, S_{MS} (g)	2.161	2.144
MCE$_R$ Spectral Response Acceleration at 1-second Period, S_{M1} (g)	1.554*	1.54*
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	1.441	1.429
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	1.036*	1.026*
Mapped MCE Geometric Mean (MCE$_G$) Peak Ground Acceleration, PGA (g)	0.931	0.924
Site Coefficient, F_{PGA}	1.1	1.1
MCE$_G$ Peak Ground Acceleration adjusted for Site Class effects, PGA$_M$ (g)	1.024	1.016
Long period transition-period, T_L	8	8

*The parameters above should only be used for calculation of T_s, determination of Seismic Design Category, and, when taking the exceptions under Items 1 and 2 of ASCE 7-16 Section 11.4.8. (Supplement Number 3 https://ascelibrary.org/doi/epdf/10.1061/9780784414248.sup3).

z(ft):	0
Wall h (ft):	26
Parapet hp (ft)	4
S_{DS}=	1.44
Wp(psf)=	125



12.11.1 Design for Out-of-Plane Forces. Structural walls shall be designed for a force normal to the surface equal to $F_p = 0.4 S_{DS} I_e$ times the weight of the structural wall with a minimum force of 10% of the weight of the structural wall.



Fp=0.4*SDS*Ie*Wp= 0.4$1.44*1.0*125= 72 psf

Wall anchorage force (ASCE 7-16, 12.11.2.1)

Ka= 1.0 + Lf/100= 0.4*1.44*1.78*1.0*125= 128 psf

For the diaphragm seismic design force (ASCE 7-16, 12.10.1.1)

Fp,max=0.4*SDS*Ie*Wp= 0.4*1.44*1.0*125= 72 psf

For high roof, distribution wall height= 4' + 26.5'/2= 17.25'

F=17.25' * 72 psf= 1242 lb/ft

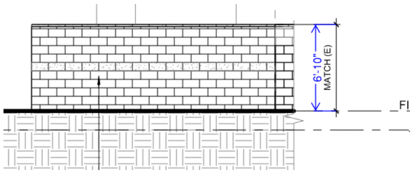
For low roof, distribution wall height= 4.5' +14'/2=11.5'

F=11.5'*72psf=828 lb/ft

For max 6'-10" yard fence wall (Ground supported cantilever wall)

Cs=0.8*S1/(R/Ie)= 0.8*0.914/1.25/1.0= 0.585

Fp=Cs*Wp= 0.585*86= 51 psf



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LIVE LAOD

Roof LL, Lr (PSF):	20	
Floor/Mazzanine LL, L (PSF): (Light Storage)	125	

DEAD LAOD

Floor/Mazzanine DL, D (PSF):	73	3" Deck X 18 Ga w/4" normal weight concrete
Roof Dead Load:		
3" deep X 18 gage steel toof deck (PSF)	4	
Roof slab dead load, D (PSF)	94	6" normal weight concrete on top of 3" deep x 18 gage steel roof deck where there is roof top equipment
Roof Superimposed Dead Load, DW (PSF):	17	
Total DL (PSF):	115	
Roof insulation dead load, D (PSF):	33	Insulation and 3" deep X 18 gage steel roof deck where there is no equipment
Roof superimposed dead load, DW (PSF):	17	
Total DL (PSF):	50	

CMU	fm' (psi):	2000	
	Em(ksi) = 700 fm'=	1400	(For Siesmic)
	Gm(ksi) = 0.4Em=	560	

Design Wind Loads (W)

Exposure Category: C

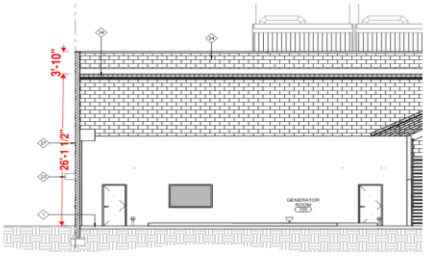
Wind Loads on Building MWFRS: Chapter 28, Part 2, ASCE 7-10

Enclosure Classification: Building is Enclosed **Structure**

V	=	*110*	mph	(basic wind speed)
z	=	*26.00*	ft	(height of the structure)
K_1	=	0.29		
K_2	=	1.00		
K_3	=	1.00		
K_{zt}	=	1.00	Flat ground	
λ	=	1.400		
p_{s30} (PSF)	=	17.70	Horizontal on wall	(Govern)
		-37.30	Vertical up on roof	
		-52.30	Overhangs if any	

ps (PSF) =$\lambda K_{zt}\, p_{s30}$ =	25.0	Horizontal on wall
	-16.0	Vertical on roof
	32.3	Overhangs if any

Direction	Wall Height (ft)	Wall Length (ft)	Horiz W (kips)
N-S	14	60	21.0
E-W	14	43.5	15.2



Wind Loads on Building CMU Wall (C&C): Chapter 30, Part 2, ASCE 7-10

Wall h (ft)	26
Parapet hp (ft)	4
Total Horix Wind Load (lb/ft) =h/2 + hp =	425

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APPENDIX

ENERCALC Outputs

Masonry Slender Wall

Project File: morongo 2 cmu wall SG.ec6

DESCRIPTION: SG: 12" CMU WALL H=26', out-of-plane SG

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : TMS 402-16
Load Combinations Used : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

Construction Type : Grouted Hollow Concrete Masonry

F'm = 2.0 ksi
Fy - Yield = 60.0 ksi
Fr - Rupture = 61.0 psi
Em = f'm * = 900.0
Max % of ρ bal. = 0.008965
Grout Density = 140 pcf
Block Weight Normal Weight
Wall Weight = 132.0 psf
Wall is Solid Grouted

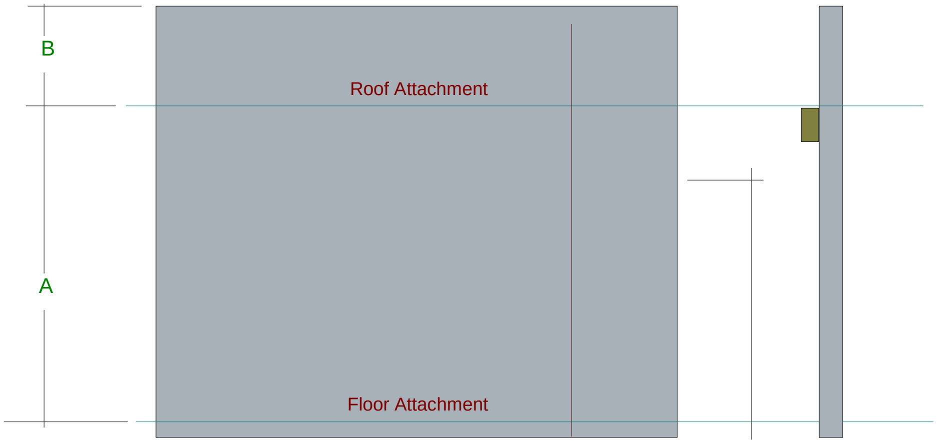
Nom. Wall Thickness 12 in
Actual Thickness 11.625 in
Rebar "d" distance 8.50 in
Lower Level Rebar . . .
Bar Size # 6
Bar Spacing 16 in

Temp Diff across thickness = deg F
Min Allow Out-of-plane Defl Ra = 0.0
Minimum Vertical Steel % = 0.0020

One-Story Wall Dimensions

A Clear Height = 26.0 ft
B Parapet height = 5.250 ft

Wall Support Condition Top Pinned, Bottom F



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Widt

			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind	
Ledger Load	Eccentricity	6.0 in	3.50	0.520				k/ft
Concentric Load			0.020	0.020				k/ft

Lateral Loads

Wind Loads :
Full area WIND load 25.0 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 72.0 psf

Fp 1.0 = 72.0 psf

DESCRIPTION: SG: 12" CMU WALL H=26', out-of-plane SG

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +0.7820D+E	Maximum Bending Stress Rat	**0.4851**		
		Max Mu	-6.270 k-ft	Phi * Mn	12.925 k-ft
PASS	Service Deflection Check E Only	Actual Defl. Ratio L/	751	Allowable Defl. Ratio	150.0
		Max. Deflection	0.4153 in		
PASS	Axial Load Check +1.318D+E	Max Pu / Ag	72.194 psi	Max. Allow. Defl.	2.080 in
		Location	0.4333 ft	0.2 * f'm	400.0 psi
PASS	Reinforcing Limit Check	Actual ρ	0.003235	Max Allow ρ	0.007769

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	1.148 k
Base Horizontal	E Only	1.102 k
Vertical Reaction	+D+Lr	8.185 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	 0.2*f'm*b*t k	Moment Values Mcr k-ft	 Mu k-ft	 Phi	 Phi Mn k-ft	 As in^2	ρ Actual	ρ Max Allow	Bar 'd'
+1.40D at 25.13 to 26.00	6.059	55.824	1.37	2.45	0.90	12.95	0.330	0.0032	0.0085	8.50
+1.20D+0.50Lr at 25.13 to 26.00	5.463	55.824	1.37	2.23	0.90	12.75	0.330	0.0032	0.0086	8.50
+1.20D at 25.13 to 26.00	5.193	55.824	1.37	2.10	0.90	12.65	0.330	0.0032	0.0087	8.50
+1.20D+1.60Lr at 25.13 to 26.00	6.057	55.824	1.37	2.52	0.90	12.95	0.330	0.0032	0.0085	8.50
+1.20D+1.60Lr+0.50W at 25.13 to 26.	6.057	55.824	1.37	2.34	0.90	12.95	0.330	0.0032	0.0085	8.50
+1.20D+1.60Lr-0.50W at 25.13 to 26.(	6.057	55.824	1.37	2.69	0.90	12.95	0.330	0.0032	0.0085	8.50
+1.20D+0.50W at 0.00 to 0.87	9.174	55.824	1.37	2.05	0.90	14.02	0.330	0.0032	0.0080	8.50
+1.20D-0.50W at 25.13 to 26.00	5.193	55.824	1.37	2.27	0.90	12.65	0.330	0.0032	0.0087	8.50
+1.20D+0.50Lr+W at 0.00 to 0.87	9.444	55.824	1.37	3.05	0.90	14.11	0.330	0.0032	0.0080	8.50
+1.20D+0.50Lr-W at 25.13 to 26.00	5.463	55.824	1.37	2.57	0.90	12.75	0.330	0.0032	0.0086	8.50
+1.20D+W at 0.00 to 0.87	9.174	55.824	1.37	2.98	0.90	14.02	0.330	0.0032	0.0080	8.50
+1.20D-W at 25.13 to 26.00	5.193	55.824	1.37	2.44	0.90	12.65	0.330	0.0032	0.0087	8.50
+0.90D+W at 0.00 to 0.87	6.880	55.824	1.37	2.66	0.90	13.24	0.330	0.0032	0.0084	8.50
+0.90D-W at 25.13 to 26.00	3.895	55.824	1.37	1.92	0.90	12.19	0.330	0.0032	0.0089	8.50
+1.318D+E at 0.00 to 0.87	10.075	55.824	1.37	6.91	0.90	14.32	0.330	0.0032	0.0079	8.50
+1.318D-E at 0.00 to 0.87	10.076	55.824	1.37	4.28	0.90	14.32	0.330	0.0032	0.0079	8.50
+0.7820D+E at 0.00 to 0.87	5.978	55.824	1.37	6.27	0.90	12.93	0.330	0.0032	0.0085	8.50
+0.7820D-E at 0.00 to 0.87	5.978	55.824	1.37	4.72	0.90	12.93	0.330	0.0032	0.0085	8.50

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	 Mactual k-ft	Stiffness I gross in^4	 I cracked in^4	 I effective in^4	Deflections Deflection in	 Defl. Ratio
D Only at 17.33 to 18.20	5.357	1.37	0.92	1,571.00	305.44	1571.000	0.029	10,836.6
+D+Lr at 18.20 to 19.07	5.783	1.37	1.15	1,571.00	309.43	1571.000	0.037	8,358.1
+D+0.750Lr at 17.33 to 18.20	5.762	1.37	1.01	1,571.00	309.24	1571.000	0.035	8,918.5
+D+0.60W at 16.47 to 17.33	5.471	1.37	1.49	1,571.00	306.51	473.529	0.074	4,212.9
+D+0.750Lr+0.450W at 17.33 to 18.20	5.762	1.37	1.49	1,571.00	309.24	477.500	0.069	4,504.8
+D+0.450W at 16.47 to 17.33	5.471	1.37	1.32	1,571.00	306.51	1571.000	0.054	5,739.1
+0.60D+0.60W at 15.60 to 16.47	3.351	1.37	1.12	1,571.00	286.30	1571.000	0.038	8,244.7
+D+0.70E at 15.60 to 16.47	5.586	1.37	2.99	1,571.00	307.59	314.327	0.339	921.6
+D+0.5250E at 15.60 to 16.47	5.586	1.37	2.44	1,571.00	307.59	321.693	0.241	1,292.1

DESCRIPTION: SG: 12" CMU WALL H=26', out-of-plane SG

+0.60D+0.70E at 14.73 to 15.60	3.420	1.37	2.62	1,571.00	286.96	297.183	0.292	1,070.1
Lr Only at 16.47 to 17.33	0.540	1.37	0.12	1,571.00	258.48	1571.000	0.004	78,645.5
W Only at 13.87 to 14.73	0.000	1.37	1.13	1,571.00	253.00	1571.000	0.038	8,196.2
E Only at 13.87 to 14.73	0.000	1.37	3.08	1,571.00	253.00	258.258	0.415	751.3

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.1 k	0.10 k	7.645 k
+D+Lr	0.1 k	0.12 k	8.185 k
+D+0.750Lr	0.1 k	0.11 k	8.050 k
+D+0.60W	0.3 k	0.14 k	7.645 k
+D+0.750Lr+0.450W	0.3 k	0.07 k	8.050 k
+D+0.450W	0.3 k	0.08 k	7.645 k
+0.60D+0.60W	0.3 k	0.18 k	4.587 k
+D+0.70E	0.9 k	0.70 k	7.645 k
+D+0.5250E	0.7 k	0.50 k	7.645 k
+0.60D+0.70E	0.8 k	0.74 k	4.587 k
Lr Only	0.0 k	0.02 k	0.540 k
W Only	0.4 k	0.40 k	0.000 k
E Only	1.1 k	1.15 k	0.000 k

Restrained Retaining Wall

DESCRIPTION: SG: 12 in CMU Wall H=26', out-of-plane Footing

Code References

Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

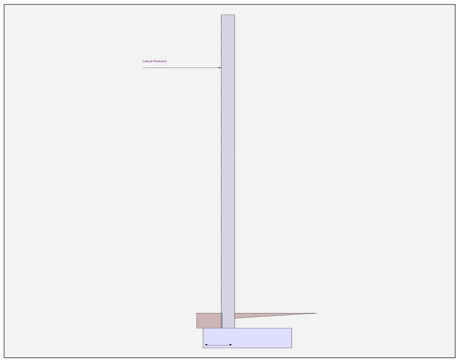
Retained Height = 1.50 ft
Wall height above soil = 30.0 ft
Total Wall Height = 31.50 ft

Top Support Height = 26.0 ft

Slope Behind Wal = 0
Height of Soil over Toe = 18.0 in

Soil Data

Allow Soil Bearing = 3,000.0 psf
Equivalent Fluid Pressure Method
At-Rest Heel Pressure = 65.0 psf/ft
= 0.0 psf/ft
Passive Pressure = 200.0 psf/ft
Soil Density = 110 pcf
Footing || Soil Frictic = 0.4
Soil height to ignore
for passive pressure = 12 in



Surcharge Loads

Surcharge Over Heel = psf
>>>Used To Resist Sliding & Overturning
Surcharge Over Toe = psf
Used for Sliding & Overturning

Axial Load Applied to Stem

Axial Dead Load = 0.020 lbs
Axial Live Load = 0.020 lbs
Axial Load Eccentricity = in

Uniform Lateral Load Applied to Stem

Lateral Load = #/ft
...Height to Top = ft
...Height to Bottom = ft
Load Type = Wind (W)
(Service Level)
Wind on Exposed Stem = 30.00 psf
(Strength Level)
Wind acts left-to-right toward retention side.

Adjacent Footing Load

Adjacent Footing Load = lbs
Footing Width = ft
Eccentricity = in
Wall to Ftg CL Dist = ft
Footing Type Line Load
Base Above/Below Soil
at Back of Wall = ft
Poisson's Ratio = 0.3

Earth Pressure Seismic Load

K_h Soil Density Multiplier = 0.10 g Added seismic per unit area = 26.950 psf

Design Summary

Total Bearing Load = 6,996.04 lbs
...resultant ecc. = 0.0 in

Soil Pressure @ Toe = 999.43 psf OK
Soil Pressure @ Heel = 999.43 psf OK
Allowable = psf
Soil Pressure Less Than Allowable
ACI Factored @ Toe = 1,199.32 psf
ACI Factored @ Heel = 1,199.32 psf
Footing Shear @ Toe = 3.899 psi OK
Footing Shear @ Heel = -9.511 psi OK
Allowable = 82.158 psi
Reaction at Top = 287.409 lbs
Reaction at Bottom = 688.26 lbs

Sliding Calcs
Lateral Sliding Force = 688.26 lbs

Masonry Stem Construction

Thickness = 12.00 in f'm = 2,000.0 psi
Wall Weight = 124.0 psf Fs = 32,000 psi
Stem is FIXED to top of footing
Block Type = Medium Weight
Design Method = ASD
Solid Grouted

		@ Top Support	Mmax Between Top & Base	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	26.0 ft	15.454 ft	0.00 ft
Rebar Size	=	# 5	# 5	# 5
Rebar Spacing	=	16.00 in	16.00 in	16.00 in
Rebar Placed at	=	Center	Center	Center
Rebar Depth 'd'	=	5.813 in	5.813 in	5.813 in
Design Data				
fb/FB + fa/Fa	=			
Moment....Actual	=	272.250 ft-#	744.27 ft-#	1,429.37 ft-#
Moment.....Allowable	=	3,269.32 ft-#	3,269.32 ft-#	3,269.32 ft-#
Shear Force @ this height	=	191.289 lbs		363.261 lbs
Anet	=	139.50 in2		139.50 in2
Shear.....Actual	=	1.371 psi		2.604 psi
Shear.....Allowable	=	50.562 psi		50.562 psi

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Restrained Retaining Wall

DESCRIPTION: SG: 12 in CMU Wall H=26', out-of-plane Footing

Footing Strengths & Dimensions

Toe Width = 1.50 ft
Heel Width = 5.50
Total Footing Width = 7.0
Footing Thickness = 24.0 in

f'c = 3,000 psi Fy = 60000 psi
Footing Concrete Density = 150 pcf
Min. As % = 0.0018
Cover @ Top = 2 in @ Btm.= 3 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,199.32	1,199.32	psf
Mu' : Upward	=	1,836.46		ft-#
Mu' : Downward	=	854.44		ft-#
Mu: Design	=	982	6,295	ft-#
Actual 1-Way Shear	=	3.899	-9.511	psi
Allow 1-Way Shear	=	43.818	43.818	psi

Other Acceptable Sizes & Spacings:

Toe: # 7 @ 18.00 in -or- phiMn = phi * 5 * lambda * sqrt(fc) * Sm
Heel: None Spec'd -or- phiMn = phi * 5 * lambda * sqrt(fc) * Sm

Min footing T&S reinf Area 3.63 in2
Min footing T&S reinf Area per foot 0.52 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 4.63 in	#4@ 9.26 in
#5@ 7.18 in	#5@ 14.35 in
#6@ 10.19 in	#6@ 20.37 in

Summary of Forces on Footing : Slab is NOT providing sliding, stem is FIXED at footing

Forces acting on footing for sliding & soil pressure....

Sliding Forces

Stem Shear @ Top of Footing	=	363.261	lbs
Heel Active Pressure	=	325.0	
Key Active Pressure	=	0.0	
Sliding Force	**=**	**688.26**	**lbs**

Stem is specified to be fixed to footing, and top restraint is assumed to react out any tendency for moment at the footing/soil interface, so uniform soil pressure is assumed.

Load & Moment Summary For Footing : For Soil Pressure Calcs

Moment @ Top of Footing Applied from Stem			=	-1,429.37 ft-#
Surcharge Over Heel		0.0	0.0	0.0
Adjacent Footing Load	=	0.0 lbs	0.0 ft	0.0 ft-#
Axial Dead Load on Stem	=	0.020 lbs	2.0 ft	0.040 ft-#
Axial Live Load on Stem	=	0.020 lbs	2.0 ft	0.040 ft-#
Soil Over Toe	=	247.50 lbs	0.750 ft	185.625 ft-#
Surcharge Over Toe	=	0.0 lbs	0.0 ft	0.0 ft-#
Stem Weight	=	3,906.0 lbs	2.0 ft	7,812.0 ft-#
Soil Over Heel	=	742.50 lbs	4.750 ft	3,526.88 ft-#
Footing Weight	=	2,100.0 lbs	3.50 ft	7,350.0 ft-#
Total Vertical Force	=	6,996.04 lbs	Base Moment =	17,445.2 ft-#

Summary of Sliding Forces

	FS = 1.0	FS = 1.5
Lateral Force @ Base of Footing	688.26 lbs	1,032.39 lbs
less Passive Pressure Force	- 1,125.0 lbs	- 1,125.0 lbs
less Friction Force	- 2,798.41 lbs	- 2,798.41 lbs
Added Resisting Force Required	0.0 lbs	
Added Resisting Force Required for 1.5 Factor of Safety		0.00 lbs

Sliding Factor of Safety = 5.70: 1.00

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

DESCRIPTION: SG: 12 in CMU Wall H=26', out-of-plane Footing

Rebar Lap & Embedment Lengths Information

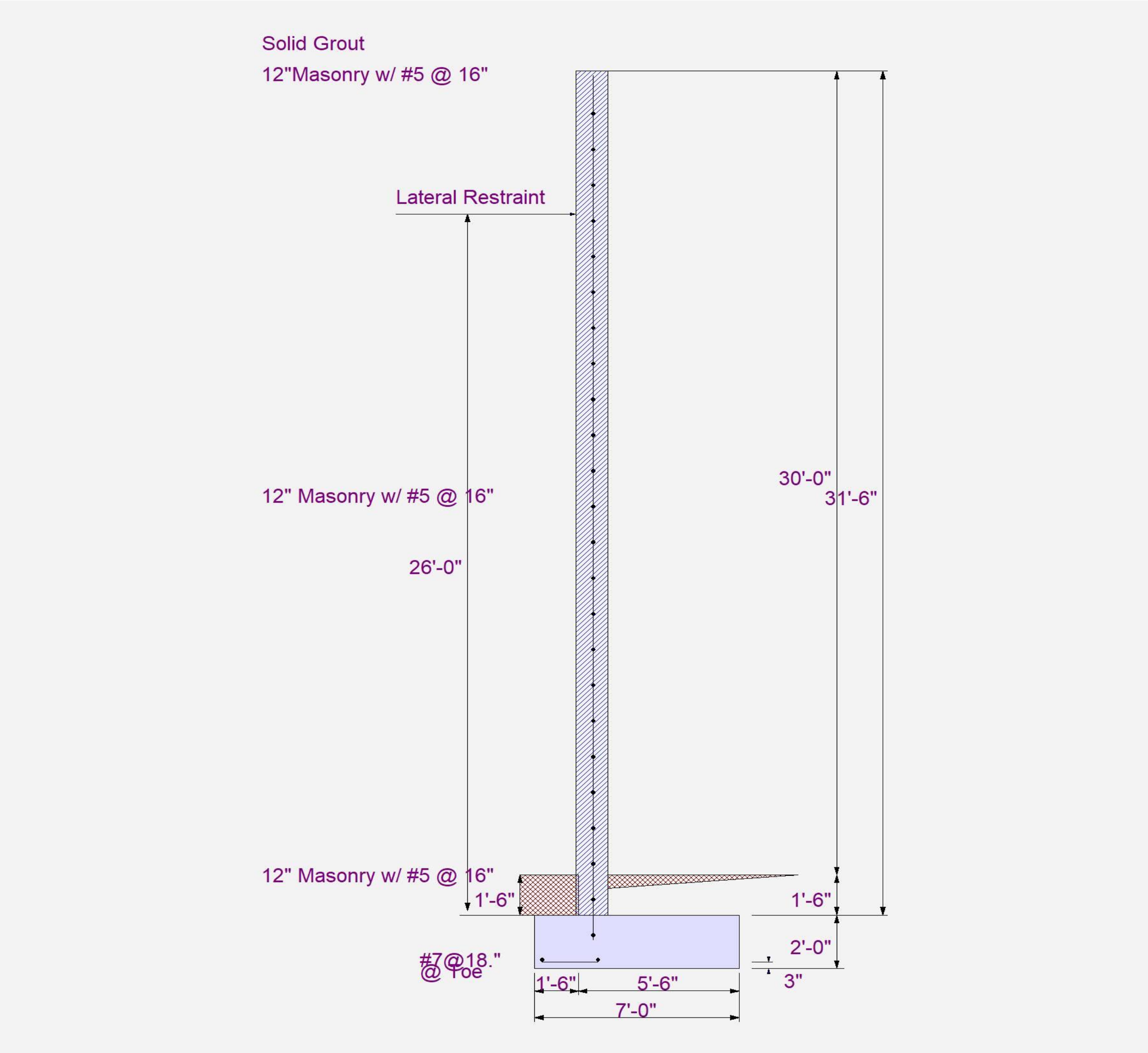
Project Title:
Engineer:
Project ID:
Project Descr:

Restrained Retaining Wall

Project File: Morongo 2 Building Design.ec6

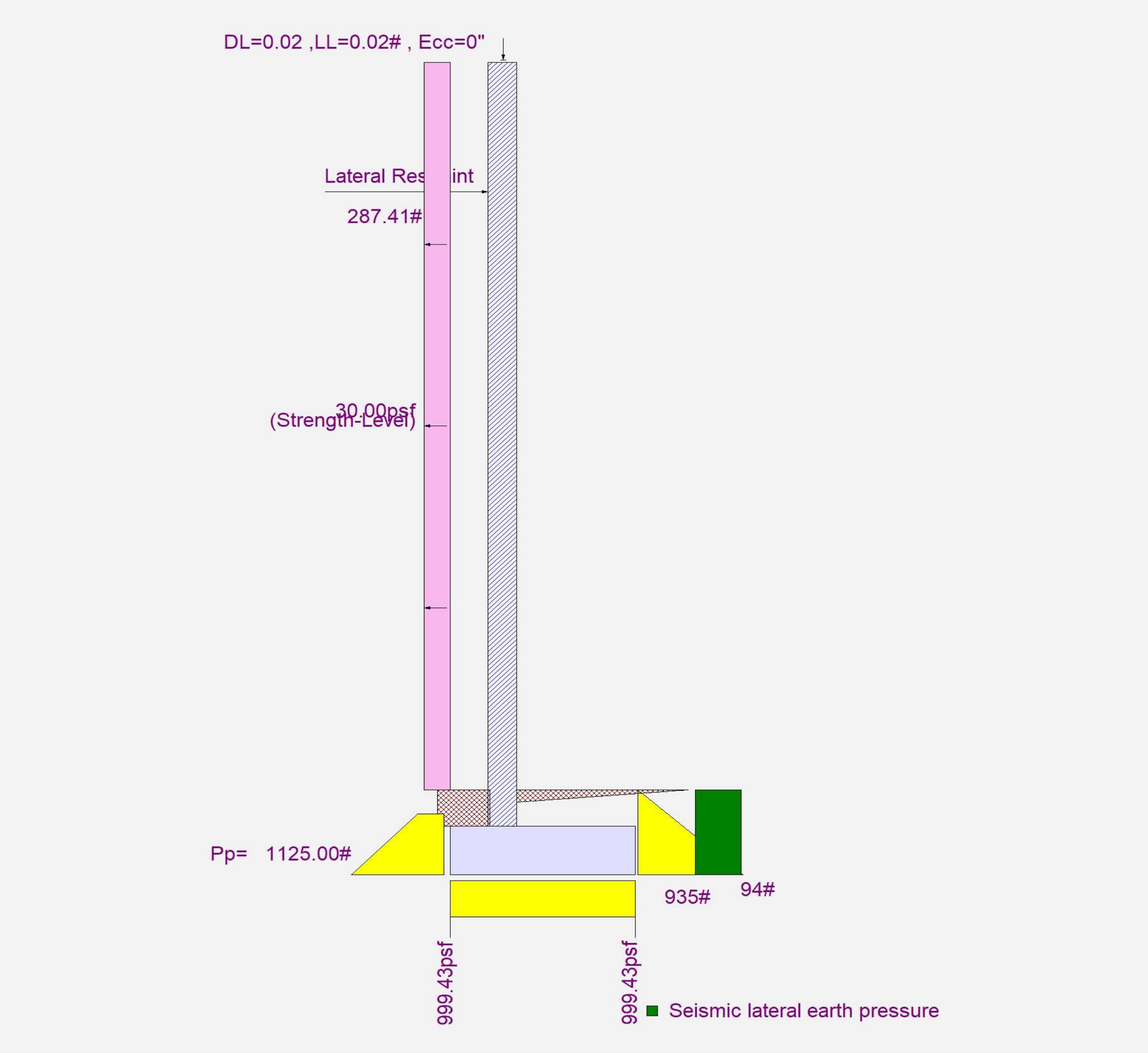
LIC# : KW-06015569, Build:20.25.08.20 PACRIM (c) ENERCALC, LLC 1982-2026

DESCRIPTION: SG: 12 in CMU Wall H=26', out-of-plane Footing



Restrained Retaining Wall

DESCRIPTION: SG: 12 in CMU Wall H=26', out-of-plane Footing



Steel Column

Project File: Morongo 2 BM-03.05.2026.ec6

LIC# : KW-06015569, Build:20.25.08.20 PACRIM

DESCRIPTION: SG: Col support Grid 3 Beam which CMU wall on top

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combinations Used : IBC 2021

General Information

Steel Section Name :	**HSS5x5x3/8**	
Analysis Method :	Load Resistance Factor	
Steel Stress Grade		
Fy : Steel Yield	46.0	ksi
E : Elastic Bending Modulus	29,000.0	ksi

Overall Column Height	10.5 ft
Top & Bottom Fixity	Top & Bottom Pinned
Brace condition :	

Unbraced Length for buckling ABOUT X-X Axis = 13 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 13 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 234.885 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 10.50 ft, D = 47.50, LR = 2.0, L = 14.0 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	0.5036	: 1
	Load Combination	+1.20D+0.50Lr+1.60L	
	Location of max.above base	0.0	ft
	At maximum location values are . . .		
	Pu	80.682	k
	0.9 * Pn	160.206	k
	Mu-x	0.0	k-ft
	0.9 * Mn-x :	36.570	k-ft
	Mu-y	0.0	k-ft
	0.9 * Mn-y :	36.570	k-ft
PASS	Maximum Shear Stress Rati	0.0	: 1
	Load Combination	0.0	
	Location of max.above base	0.0	ft
	At maximum location values are . . .		
	Vu : Applied	0.0	k
	Vn * Phi : Allowable	0.0	k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.0 k
Bottom along Y-Y	0.0 k

Maximum Load Deflections . . .

Along Y-Y 0.0 in at 0.0ft above base
for load combination :

Along X-X 0.0 in at 0.0ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios Stress Ratio	Status	Location
+1.40D	0.417	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+1.20D+0.50Lr+1.60L	0.504	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+1.20D+1.60L	0.497	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+1.20D+1.60Lr+0.50L	0.421	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+1.20D+1.60Lr	0.378	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+1.20D+0.50L	0.401	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+1.20D	0.358	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+1.20D+0.50Lr+0.50L	0.407	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft
+0.90D	0.268	PASS	0.00 ft	1.00	1.00	83.42	83.42	0.000	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	@ Top	Ry (k) @ Base	@ Top	Mx (k-ft) @ Base	@ Top	My (k-ft) @ Base	@ Top
D Only	47.735								
+D+L	61.735								
+D+Lr	49.735								
+D+0.750Lr+0.750L	59.735								
+D+0.750L	58.235								
+0.60D	28.641								

DESCRIPTION: SG: Col support Grid 3 Beam which CMU wall on top

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top
Lr Only	2.000								
L Only	14.000								

Extreme Reactions

Item	Extreme Value	Axial (k) @ Base	Rx (k) @ Base	Rx (k) @ Top	Ry (k) @ Base	Ry (k) @ Top	Mx (k-ft) @ Base	Mx (k-ft) @ Top	My (k-ft) @ Base	My (k-ft) @ Top
Axial, Base Max		61.735								
Axial, Base Min		2.000								
Rx, Base Max										
Rx, Base Min										
Rx, Top Max										
Rx, Top Min										
Ry, Base Max										
Ry, Base Min										
Ry, Top Max										
Ry, Top Min										

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+Lr	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750Lr+0.750L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.000 in	0.000 ft
Lr Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : **HSS5x5x3/8**

Depth = 5.000 in
Design Thick = 0.349 in
Width = 5.000 in
Wall Thick = 0.375 in
Area = 6.180 in^2
Weight = 22.370 plf

I xx = 21.70 in^4
S xx = 8.68 in^3
R xx = 1.870 in
Zx = 10.600 in^3
I yy = 21.700 in^4
S yy = 8.680 in^3
R yy = 1.870 in

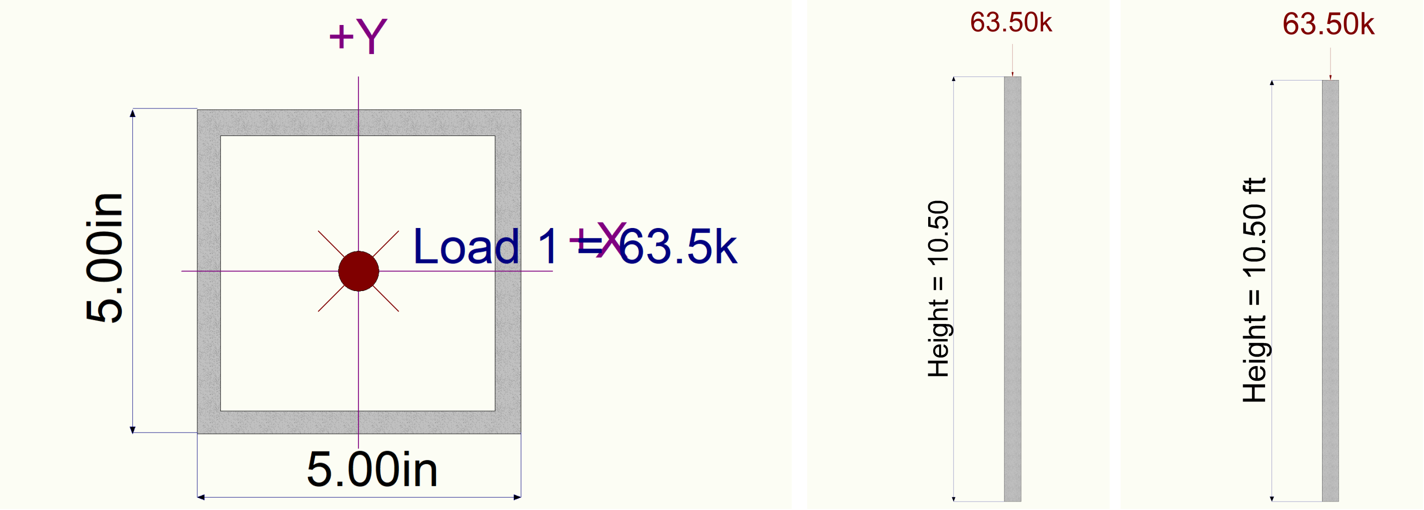
J = 36.100 in^4
C = 14.900 in^3

Ycg = 0.000 in

Steel Column

DESCRIPTION: SG: Col support Grid 3 Beam which CMU wall on top

Sketches



DESCRIPTION: SG: Footing for Col Grid 3 Beam support CMU wall

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : IBC 2021

General Information

Material Properties

f'c : Concrete 28 day strength = 4.0 ksi
fy : Rebar Yield = 60.0 ksi
Ec : Concrete Elastic Modulus = 3,122.0 ksi
Concrete Density = 145.0 pcf
φ Values Flexure = 0.90
Shear = 0.750

Analysis Settings

Min Steel % Bending Reinf. =
Min Allow % Temp Reinf. =
Min. Overturning Safety Factor = 1.0 : 1
Min. Sliding Safety Factor = 1.0 : 1
Add Ftg Wt for Soil Pressure : Yes
Use ftg wt for stability, moments & shears : Yes
Add Pedestal Wt for Soil Pressure : No
Use Pedestal wt for stability, mom & shear : No

Soil Design Values

Allowable Soil Bearing = 3.0 ksf
Soil Density = 110.0 pcf
Increase Bearing By Footing Weight = Yes
Soil Passive Resistance (for Sliding) = 250.0 pcf
Soil/Concrete Friction Coeff. = 0.30

Increases based on footing Depth

Footing base depth below soil surface = 2.0 ft
Allow press. increase per foot of depth = ksf
when footing base is below = ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth = ksf
when max. length or width is greater than = ft

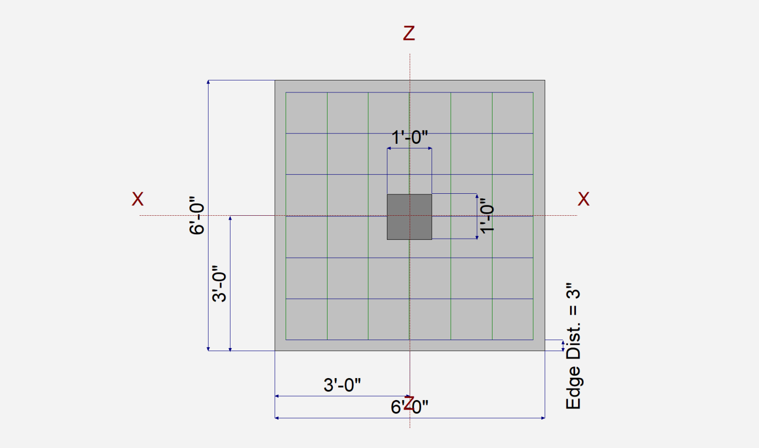
Dimensions

Width parallel to X-X Axis = 6.0 ft
Length parallel to Z-Z Axis = 6.0 ft
Footing Thickness = 24.0 in

Pedestal dimensions...
px : parallel to X-X Axis = 12.0 in
pz : parallel to Z-Z Axis = 12.0 in
Height = 12.0 in

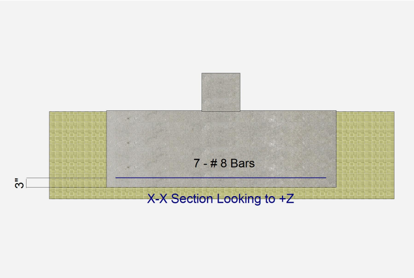
Bandwidth Distribution Check (ACI 15.4.4.2)

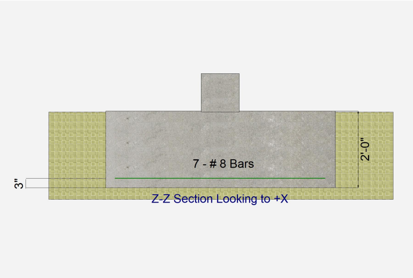
Direction Requiring Closer Separation n/a
Bars required within zone n/a
Bars required on each side of zone n/a



Bottom Reinforcing

Bars parallel to X-X Axis (resisting Z Flexure)
Number of Bars = 7.0
Reinforcing Bar Size = # 8
Bars parallel to Z-Z Axis (resisting X Flexure)
Number of Bars = 7.0
Reinforcing Bar Size = # 8
Rebar Centerline to Edge of Concrete...
at Bottom of footing = 3.0 in





Top Reinforcing

Bars parallel to X-X Axis (resisting Z Flexure)
Number of Bars = 7.0
Reinforcing Bar Size = 6
Bars parallel to Z-Z Axis (resisting X Flexure)
Number of Bars = 7.0
Reinforcing Bar Size = 6
Rebar Centerline to Edge of Concrete...
at Top of footing = 3.0 in

General Footing

DESCRIPTION: SG: Footing for Col Grid 3 Beam support CMU wall

Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	48.0	2.0	14.0					k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6116	Soil Bearing	2.012 ksf	3.290 ksf	+D+L
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.1002	Z Flexure (+X) Bot Tens	8.443 k-ft/ft	84.287 k-ft/ft	+1.20D+0.50Lr+1.60L
PASS	0.1002	Z Flexure (-X) Bot Tens	8.443 k-ft/ft	84.287 k-ft/ft	+1.20D+0.50Lr+1.60L
PASS	0.562	Min Steel X Flexure Bottom	0.518 in2/ft	0.922 in2/ft	n/a
PASS	0.1002	X Flexure (+Z) Bot Tens	8.443 k-ft/ft	84.287 k-ft/ft	+1.20D+0.50Lr+1.60L
PASS	0.1002	X Flexure (-Z) Bot Tens	8.443 k-ft/ft	84.287 k-ft/ft	+1.20D+0.50Lr+1.60L
PASS	0.562	Min Steel Z Flexure Bottom	0.518 in2/ft	0.922 in2/ft	n/a
PASS	0.0	Z Flexure (+X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	Z Flexure (-X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel X Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.0	X Flexure (+Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	X Flexure (-Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel Z Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.1320	1-way Shear (+X)	7.720 psi	58.466 psi	+1.20D+0.50Lr+1.60L
PASS	0.1430	1-way Shear (-X)	8.363 psi	58.466 psi	+1.20D+0.50Lr+1.60L
PASS	0.1320	1-way Shear (+Z)	7.720 psi	58.466 psi	+1.20D+0.50Lr+1.60L
PASS	0.1430	1-way Shear (-Z)	8.363 psi	58.466 psi	+1.20D+0.50Lr+1.60L
PASS	0.1402	2-way Punching	26.601 psi	189.737 psi	+1.20D+0.50Lr+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom Left	Top Left	Top Right	Bottom Right	Actual / Allow Ratio
, D Only								0.000
, 0.0 deg CCW	3.290	0.0	0.0	1.623	1.623	1.623	1.623	0.493
, +D+L								0.000
, 0.0 deg CCW	3.290	0.0	0.0	2.012	2.012	2.012	2.012	0.612
, +D+Lr								0.000
, 0.0 deg CCW	3.290	0.0	0.0	1.679	1.679	1.679	1.679	0.510
, +D+0.750Lr+0.750L								0.000
, 0.0 deg CCW	3.290	0.0	0.0	1.957	1.957	1.957	1.957	0.595
, +D+0.750L								0.000
, 0.0 deg CCW	3.290	0.0	0.0	1.915	1.915	1.915	1.915	0.582
, +0.60D								0.000
, 0.0 deg CCW	3.290	0.0	0.0	0.9740	0.9740	0.9740	0.9740	0.296

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

All units k

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

General Footing

DESCRIPTION: SG: Footing for Col Grid 3 Beam support CMU wall

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	7.386	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.40D	7.386	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+0.50Lr+1.60L	8.443	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+0.50Lr+1.60L	8.443	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+1.60L	8.353	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+1.60L	8.353	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+1.60Lr+0.50L	7.251	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+1.60Lr+0.50L	7.251	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+1.60Lr	6.619	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+1.60Lr	6.619	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+0.50L	6.963	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+0.50L	6.963	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D	6.331	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D	6.331	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+0.50Lr+0.50L	7.053	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +1.20D+0.50Lr+0.50L	7.053	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +0.90D	4.748	+Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
X-X, +0.90D	4.748	-Z	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.40D	7.386	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.40D	7.386	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+0.50Lr+1.60L	8.443	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+0.50Lr+1.60L	8.443	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+1.60L	8.353	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+1.60L	8.353	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+1.60Lr+0.50L	7.251	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+1.60Lr+0.50L	7.251	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+1.60Lr	6.619	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+1.60Lr	6.619	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+0.50L	6.963	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+0.50L	6.963	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D	6.331	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D	6.331	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+0.50Lr+0.50L	7.053	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +1.20D+0.50Lr+0.50L	7.053	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +0.90D	4.748	-X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK
Z-Z, +0.90D	4.748	+X	Bottom	0.5184	ACI 7.6.1.1	0.9217	84.287	OK

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	7.32 psi	6.75 psi	7.32 psi	58.47 psi	0.13	OK
+1.20D+0.50Lr+1.60L	8.36 psi	7.72 psi	8.36 psi	58.47 psi	0.14	OK
+1.20D+1.60L	8.27 psi	7.64 psi	8.27 psi	58.47 psi	0.14	OK
+1.20D+1.60Lr+0.50L	7.18 psi	6.63 psi	7.18 psi	58.47 psi	0.12	OK
+1.20D+1.60Lr	6.56 psi	6.05 psi	6.56 psi	58.47 psi	0.11	OK
+1.20D+0.50L	6.90 psi	6.37 psi	6.90 psi	58.47 psi	0.12	OK
+1.20D	6.27 psi	5.79 psi	6.27 psi	58.47 psi	0.11	OK
+1.20D+0.50Lr+0.50L	6.99 psi	6.45 psi	6.99 psi	58.47 psi	0.12	OK
+0.90D	4.70 psi	4.34 psi	4.70 psi	58.47 psi	0.08	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	7.32 psi	6.75 psi	7.32 psi	58.47 psi	0.13	OK
+1.20D+0.50Lr+1.60L	8.36 psi	7.72 psi	8.36 psi	58.47 psi	0.14	OK
+1.20D+1.60L	8.27 psi	7.64 psi	8.27 psi	58.47 psi	0.14	OK
+1.20D+1.60Lr+0.50L	7.18 psi	6.63 psi	7.18 psi	58.47 psi	0.12	OK
+1.20D+1.60Lr	6.56 psi	6.05 psi	6.56 psi	58.47 psi	0.11	OK
+1.20D+0.50L	6.90 psi	6.37 psi	6.90 psi	58.47 psi	0.12	OK
+1.20D	6.27 psi	5.79 psi	6.27 psi	58.47 psi	0.11	OK
+1.20D+0.50Lr+0.50L	6.99 psi	6.45 psi	6.99 psi	58.47 psi	0.12	OK
+0.90D	4.70 psi	4.34 psi	4.70 psi	58.47 psi	0.08	OK

DESCRIPTION: SG: Footing for Col Grid 3 Beam support CMU wall

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	23.27 psi	189.74 psi	0.12	OK
+1.20D+0.50Lr+1.60L	26.60 psi	189.74 psi	0.14	OK
+1.20D+1.60L	26.32 psi	189.74 psi	0.14	OK
+1.20D+1.60Lr+0.50L	22.85 psi	189.74 psi	0.12	OK
+1.20D+1.60Lr	20.86 psi	189.74 psi	0.11	OK
+1.20D+0.50L	21.94 psi	189.74 psi	0.12	OK
+1.20D	19.95 psi	189.74 psi	0.11	OK
+1.20D+0.50Lr+0.50L	22.22 psi	189.74 psi	0.12	OK
+0.90D	14.96 psi	189.74 psi	0.08	OK

Cantilevered Retaining Wall

DESCRIPTION: SG: Footing of 8" CMU Wall H=6'-10" @ YARD

Code Reference

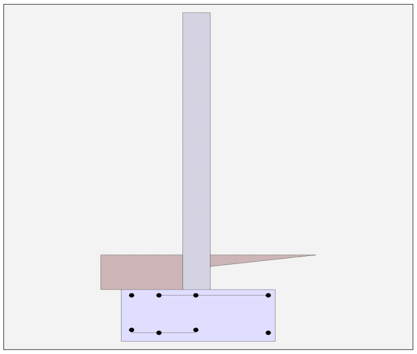
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	1.00 ft
Wall height above soil	=	7.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	12.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	4,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	45.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Seismic (E) (Strength Level)
Wind on Exposed Stem (Strength Level)	=	51.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

DESCRIPTION: SG: Footing of 8" CMU Wall H=6'-10" @ YARD

Design Summary

Wall Stability Ratios

Overturning	=	1.72	OK
Sliding	=	3.98	OK
Global Stability	=	6.42	

Total Bearing Load	=	1,235	lbs
...resultant ecc.	=	12.64	in

Eccentricity outside middle third

Soil Pressure @ Toe	=	1,003	psf OK
Soil Pressure @ Heel	=	0	psf OK
Allowable	=	4,000	psf

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,344	psf
ACI Factored @ Heel	=	0	psf
Footing Shear @ Toe	=	4.2	psi OK
Footing Shear @ Heel	=	3.7	psi OK
Allowable	=	82.2	psi

Sliding Calcs

Lateral Sliding Force	=	354.8 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom Stem OK	
Design Height Above Ftg	ft =	0.00	
Wall Material Above "Ht"	=	Masonry	
Design Method	=	ASD	SD
Thickness	=	8.00	
Rebar Size	=	# 6	
Rebar Spacing	=	16.00	
Rebar Placed at	=	Center	
Design Data			
fb/FB + fa/Fa	=	**0.545**	
Total Force @ Section			
Service Level	lbs =	236.7	
Strength Level	lbs =		
Moment....Actual			
Service Level	ft-# =	971.4	
Strength Level	ft-# =		
Moment.....Allowable	=	1,782.1	
Shear.....Actual			
Service Level	psi =	2.6	
Strength Level	psi =		
Shear.....Allowable	psi =	43.6	
Anet (Masonry)	in2 =	91.50	
Wall Weight	psf =	0.0	
Rebar Depth 'd'	in =	3.81	
Masonry Data			
f'm	psi =	1,500	
Fs	psi =	20,000	
Solid Grouting	=	Yes	
Modular Ratio 'n'	=	21.48	
Equiv. Solid Thick.	in =	7.63	
Masonry Block Type	=		
Masonry Design Method	=	ASD	
Concrete Data			
f'c	psi =		
Fy	psi =		

Summary of Sliding Forces

	FS = 1.0	FS = 1.5
Lateral Force @ Base of Footing	354.83 lbs	532.24 lbs
less 100% Passive Force	- 918.75 lbs	- 918.75 lbs
less 100% Friction Force	- 494.06 lbs	- 494.06 lbs
Added Resisting Force Required	0.0 lbs	
Added Resisting Force Required for 1.5 Factor of Safety		0.00 lbs

Sliding Factor of Safety = 3.982: 1.00

Cantilevered Retaining Wall

DESCRIPTION: SG: Footing of 8" CMU Wall H=6'-10" @ YARD

Footing Data

Toe Width = 1.50 ft
Heel Width = 2.25
Total Footing Width = 3.75
Footing Thickness = 18.00 in

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,344	0	psf
Mu' : Upward	=	1,205	2	ft-#
Mu' : Downward	=	553	742	ft-#
Mu: Design	=	653	740	ft-#
φ Mn	=	25,030	26,800	ft-#
Actual 1-Way Shear	=	4.22	3.74	psi
Allow 1-Way Shear	=	42.78	41.86	psi

Toe Reinforcing = # 5 @ 9.57 in
Heel Reinforcing = # 5 @ 9.56 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 1.46 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

DESCRIPTION: SG: Footing of 8" CMU Wall H=6'-10" @ YARD

Summary of Overturning & Resisting Forces & Moments

.....OVERTURNING.....				
Item		**Force** lbs	**Distance** ft	**Moment** ft-#
HL Act Pres (ab water tbl)		140.6	0.83	117.2
HL Act Pres (be water tbl)				
Hydrostatic Force				
Buoyant Force	=			
Surcharge over Heel	=			
Surcharge Over Toe	=			
Adjacent Footing Load	=			
Added Lateral Load	=			
Load @ Stem Above Soil	=	214.2	6.00	1,285.2
	=			
Total	=	354.8	**O.T.M.** =	1,402.4

Resisting/Overturning Ratio = **1.72**
Vertical Loads used for Soil Pressure = 1,235.1 lbs

.....RESISTING.....				
		Force lbs	**Distance** ft	**Moment** ft-#
Soil Over HL (ab. water tbl)		174.2	2.96	515.2
Soil Over HL (bel. water tbl)			2.96	515.2
Water Table				
Sloped Soil Over Heel	=			
Surcharge Over Heel	=			
Adjacent Footing Load	=			
Axial Dead Load on Stem	=			
* Axial Live Load on Stem	=			
Soil Over Toe	=	165.0	0.75	123.8
Surcharge Over Toe	=			
Stem Weight(s)	=			
Earth @ Stem Transitions	=			
Footing Weight	=	843.8	1.88	1,582.0
Key Weight	=			
Vert. Component	=	52.2	3.75	195.9
Total =		1,235.1 lbs	**R.M.=**	2,416.9

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.059	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

DESCRIPTION: SG: Footing of 8" CMU Wall H=6'-10" @ YARD

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Calculated Rebar Stress, fs = 10785.62 psi

Lap Splice length for #6 bar specified in this stem design segment (25.4.2.4a) =	30.00 in
Development length for #6 bar specified in this stem design segment =	16.18 in
Hooked embedment length into footing for #6 bar specified in this stem design segment =	6.90 in
As Provided =	0.3300 in2/ft
As Required =	0.1724 in2/ft

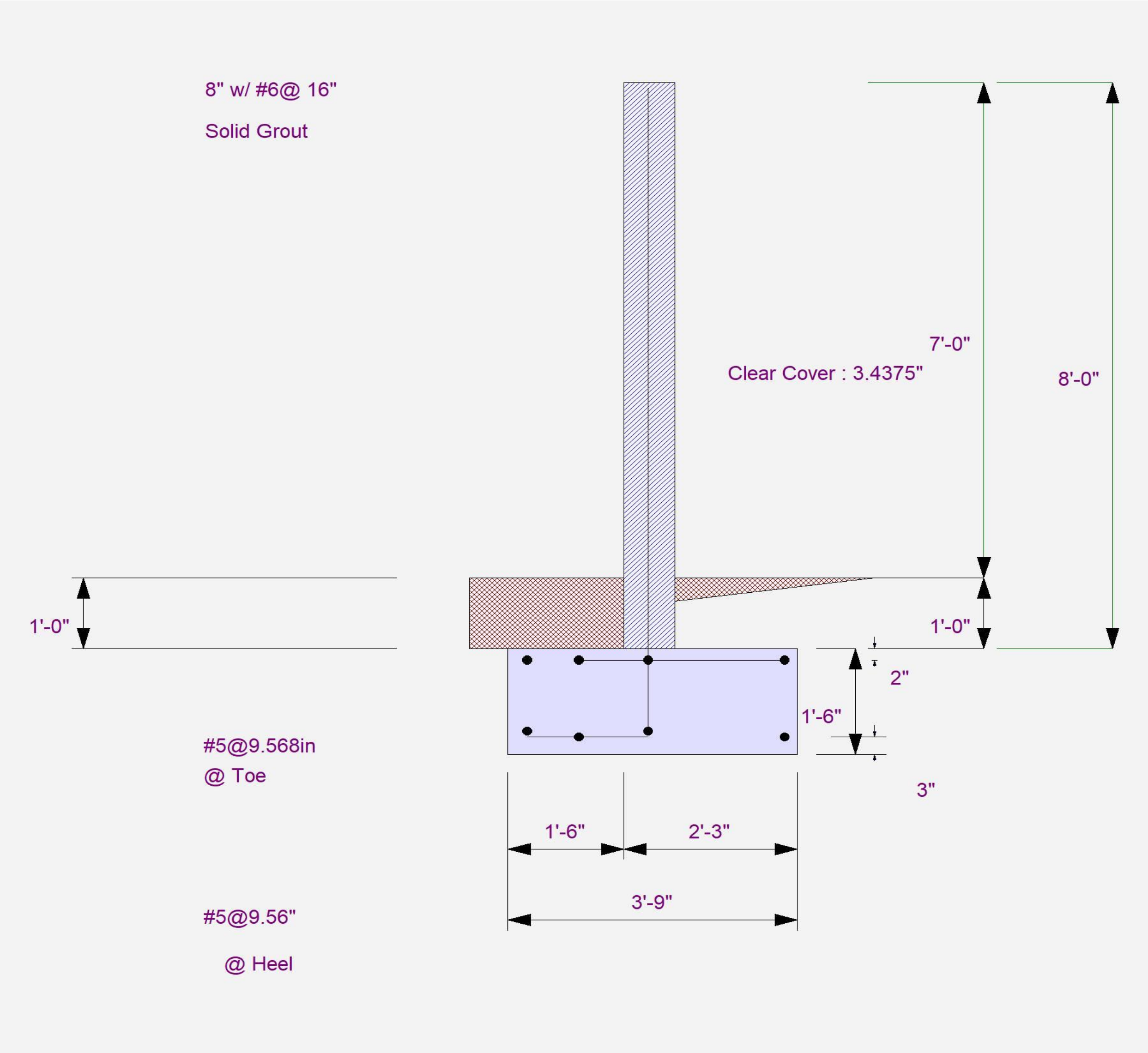
Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: morongo 2 cmu wall SG.ec6

LIC# : KW-06015569, Build:20.25.08.20 PACRIM (c) ENERCALC, LLC 1982-2026

DESCRIPTION: SG: Footing of 8" CMU Wall H=6'-10" @ YARD



Project Title:
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Project Descr:

Cantilevered Retaining Wall

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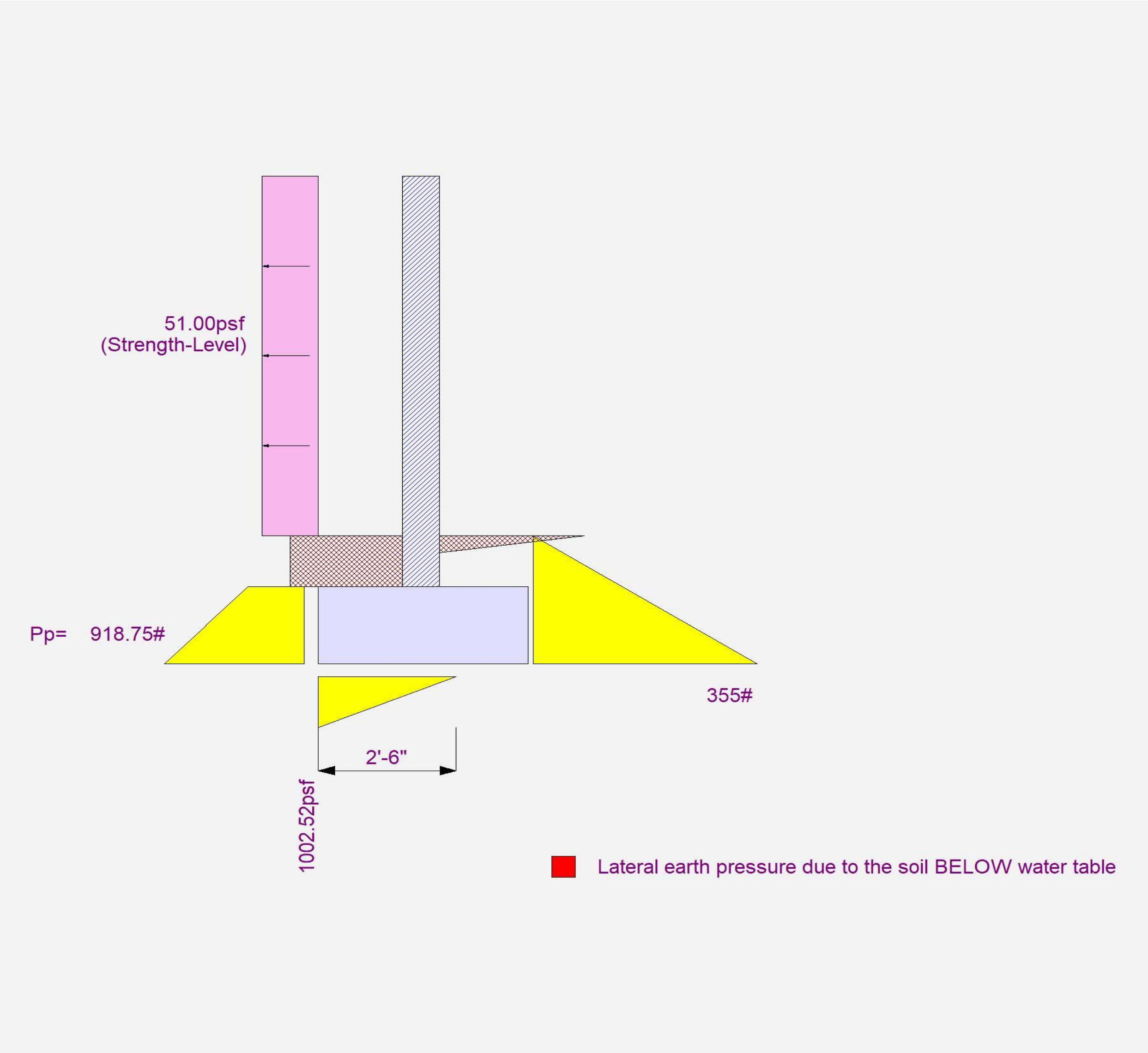


Masonry Beam

Project File: Morongo 2 BM-03.05.2026.ec6

DESCRIPTION: SG: Grid 4- 6'-8" Span CMU Lintel Beam

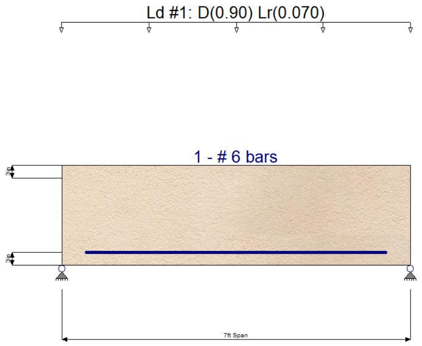
Code References

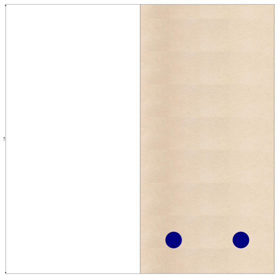
Governing Code : IBC 2021
Referenced Design Standard(s) : TMS 402-16
Load Combinations Used : IBC 2021

General Information

f'm	2,000.0 psi	Clear Span	7.0 ft	Rebar Size	6.0
fy	60,000.0 psi	Beam Depth	2.0 ft	# Bars E/F	1
Em = f'm *	900.0	Thickness	12 in	Top Clear	3.0 in
Wall Wt Mult.	1.0	End Fixity	Pin-Pin	Btm Clear	3.0 in
Block Type	Normal Wt	Equiv. Solid Thick	11.60 in	# Bar Sets	1
Lateral Wind Load	25.0 psf	Wall Weight	132.0 psf	Bar Spacing	6.0 in
Beam is Fully Braced ?	Yes	E	1,800.0 ksi		
Lateral Wall Weight Seismic Factor	0.770	n	16.111		
Calculate vertical beam weight ?	Yes				

Note! Shear calculated at "d/2" from edge of bea





Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake	
#1	ft	ft	0.90		0.070				k/ft
#2	ft	ft							k/ft
#3	ft	ft							k/ft
#4	ft	ft							k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
Mu / Phi*Mn	0.1103	0.07420	**0.1330** : 1.00
Vu / Phi*Vn	0.1914	0.0	**0.1914** : 1.00

	Actual	Allowable
Maximum Tension As	0.880 in^2	2.324 in^2

Minimum Mn = 1.3 * Fcr * S = 12.090 k-ft

Vertical Strength

As - (per bar set at one side of beam) 0.880 in^2
Phi * Mn 77.545 k-ft

Note! Strength uses two bottom bar sets.

Maximum Moment

	Actual	Allowable
Vertical Loads	9.981 k-ft	77.545 k-ft
for Load Combination +1.40D		
Lateral Loads	1.245 k-ft	16.773
for Load Combination +1.20D+E		

Maximum Shear

	Actual	Allowable
Vertical Loads	15.405 psi	80.498 psi
for Load Combination +1.40D		
Lateral Loads	3.364 psi	80.498 psi
for Load Combination +1.20D+E		

Lateral Strength (Checking lateral bending for span)

As - (all bar sets at one side of beam) 0.440 in^2
Phi * Mn 16.773 k-ft

Note! Strength uses bar set on each side of beam.

DESCRIPTION: SG: Grid 4- 6'-8" Span CMU Lintel Beam

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv : Vert psi	Fv : Vert psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
+1.40D	9.98	77.54	15.41	80.50	0.00	16.77	0.00	80.50
+1.20D+0.50Lr	8.77	77.54	13.54	80.50	0.00	16.77	0.00	80.50
+1.20D	8.56	77.54	13.20	80.50	0.00	16.77	0.00	80.50
+1.20D+1.60Lr	9.24	77.54	14.26	80.50	0.00	16.77	0.00	80.50
+1.20D+1.60Lr+0.50W	9.24	77.54	14.26	80.50	0.15	16.77	0.41	80.50
+1.20D+0.50W	8.56	77.54	13.20	80.50	0.15	16.77	0.41	80.50
+1.20D+0.50Lr+W	8.77	77.54	13.54	80.50	0.31	16.77	0.83	80.50
+1.20D+W	8.56	77.54	13.20	80.50	0.31	16.77	0.83	80.50
+1.20D+E	8.56	77.54	13.20	80.50	1.24	16.77	3.36	80.50
+0.90D+W	6.42	77.54	9.90	80.50	0.31	16.77	0.83	80.50
+0.90D+E	6.42	77.54	9.90	80.50	1.24	16.77	3.36	80.50

DESCRIPTION: SG: Grid A 16.75' for 16' span opening.

Code References

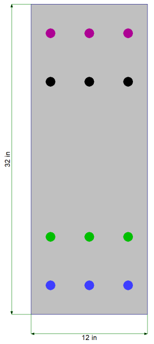
Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19
Load Combination Set : IBC 2021

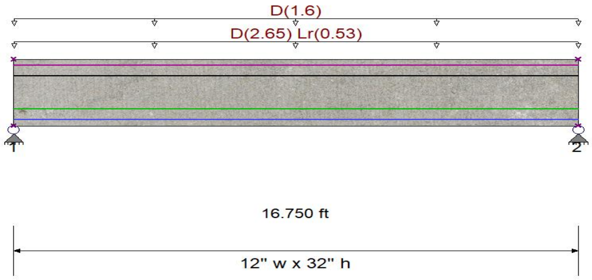
General Information

f'c = 4.0 ksi
fr =7.5 * λ * f'c$^{1/2}$ = 474.342 psi
ψ Density = 145.0 pcf
λ LtWt Factor = 1.0
Elastic Modulus = 3,122.0 ksi
fy - Main Rebar = 60.0
E - Main Rebar = 29,000.0 ksi

ϕ Phi Values Flexure : 0.90
Shear : 0.750
β 1 = 0.850
Fy - Stirrups 40.0 ksi
E - Stirrups = 29,000.0 ksi
Stirrup Bar Size # 3
Number of Resisting Legs Per Stirrup = 2

Seismic Design Category = A





Cross Section & Reinforcing Details

Rectangular Section, Width = 12.0 in, Height = 32.0 in
Span #1 Reinforcing....

3-#8 at 3.0 in from Bottom, from 0.0 to 16.750 ft in this span
3-#8 at 3.0 in from Top, from 0.0 to 16.750 ft in this span
3-#8 at 8.0 in from Bottom, from 0.0 to 16.750 ft in this
3-#8 at 8.0 in from Top, from 0.0 to 16.750 ft in this spa

Beam self weight calculated and added to loads
Load for Span Number 1

Uniform Load : D = 2.650, Lr = 0.530 k/ft, Tributary Width = 1.0 ft, (High Roof Beam W24x162: 17.2k/6.5', 2)

Uniform Load : D = 1.60 ksf, Tributary Width = 1.0 ft, (12" CMU Wall H=12'-9")

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.436** : 1
Section used for this span **Typical Section**
Mu : Applied 227.652 k-ft
Mn * Phi : Allowable 522.67 k-ft
Location of maximum on span 8.390 ft
Span # where maximum occurs Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.009 in	Ratio =	21912	>=360.0	Lr Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	Lr Only
Max Downward Total Deflection	0.159 in	Ratio =	1267	>=180.0	Span: 1 : +D+Lr
Max Upward Total Deflection	0.000 in	Ratio =	0	<180.0	Span: 1 : +D+Lr

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	43.271	43.271

DESCRIPTION: SG: Grid A 16.75' for 16' span opening.

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from Load Combinations	43.271	43.271
Max Upward from Load Cases	38.832	38.832
D Only	38.832	38.832
+D+Lr	43.271	43.271
+D+0.750Lr	42.161	42.161
+0.60D	23.299	23.299
Lr Only	4.439	4.439

Shear Stirrup Requirements

Between 0.00 to 0.52 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 5 in
Between 0.55 to 1.01 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 6 in
Between 1.04 to 1.37 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 7 in
Between 1.40 to 1.68 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 8 in
Between 1.71 to 1.89 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 9 in
Between 1.92 to 6.59 ft, Max spacing per 9.7.6.2.2, use #3 stirrups spaced at 10 in
Between 6.62 to 10.13 ft, Ties Not Req'd, Stirrups are not required.
Between 10.16 to 14.83 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 10 in
Between 14.86 to 15.04 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 9 in
Between 15.07 to 15.35 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 8 in
Between 15.38 to 15.71 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 7 in
Between 15.74 to 16.20 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 6 in
Between 16.23 to 16.72 ft, Reqd Vs per 22.5.8.1, use #3 stirrups spaced at 5 in

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.40D	1	0.00	20.33	54.36	Yes	5.19	28.49	25.87	54.36	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	0.18	20.33	53.18	Yes	5.44	28.49	24.68	53.18	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	0.37	20.33	51.99	Yes	5.71	28.49	23.50	51.99	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	0.55	20.33	50.80	Yes	6.02	28.49	22.31	50.80	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	0.73	20.33	49.61	Yes	6.35	28.49	21.12	49.61	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	0.92	20.33	48.42	Yes	6.73	28.49	19.93	48.42	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	1.10	20.33	47.24	Yes	7.16	28.49	18.74	47.24	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	1.28	20.33	46.05	Yes	7.64	28.49	17.55	46.05	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	1.46	20.33	44.86	Yes	8.20	28.49	16.37	44.86	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	1.65	20.33	43.67	Yes	8.84	28.49	15.18	43.67	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	1.83	20.33	42.48	Yes	9.59	28.49	13.99	42.48	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	2.01	20.33	41.29	Yes	10.17	28.49	13.20	41.69	0.990	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	2.20	20.33	40.11	Yes	10.17	28.49	13.20	41.69	0.962	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	2.38	20.33	38.92	Yes	10.17	28.49	13.20	41.69	0.933	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	2.56	20.33	37.73	Yes	10.17	28.49	13.20	41.69	0.905	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	2.75	20.33	36.54	Yes	10.17	28.49	13.20	41.69	0.876	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	2.93	20.33	35.35	Yes	10.17	28.49	13.20	41.69	0.848	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	3.11	20.33	34.16	Yes	10.17	28.49	13.20	41.69	0.819	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	3.30	20.33	32.98	Yes	10.17	28.49	13.20	41.69	0.791	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	3.48	20.33	31.79	Yes	10.17	28.49	13.20	41.69	0.762	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	3.66	20.33	30.60	Yes	10.17	28.49	13.20	41.69	0.734	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	3.84	20.33	29.41	Yes	10.17	28.49	13.20	41.69	0.705	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	4.03	20.33	28.22	Yes	10.17	28.49	13.20	41.69	0.677	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	4.21	20.33	27.03	Yes	10.17	28.49	13.20	41.69	0.648	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	4.39	20.33	25.85	Yes	10.17	28.49	13.20	41.69	0.620	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	4.58	20.33	24.66	Yes	10.17	28.49	13.20	41.69	0.591	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	4.76	20.33	23.47	Yes	10.17	28.49	13.20	41.69	0.563	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	4.94	20.33	22.28	Yes	10.17	28.49	13.20	41.69	0.534	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	5.13	20.33	21.09	Yes	10.17	28.49	13.20	41.69	0.506	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	5.31	20.33	19.90	Yes	10.17	28.49	13.20	41.69	0.477	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	5.49	20.33	18.72	Yes	10.17	28.49	13.20	41.69	0.449	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	5.67	20.33	17.53	Yes	10.17	28.49	13.20	41.69	0.420	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	5.86	20.33	16.34	Yes	10.17	28.49	13.20	41.69	0.392	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	6.04	20.33	15.15	Yes	10.17	28.49	13.20	41.69	0.363	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	6.22	20.33	13.96	Yes	10.17	28.49	13.20	41.69	0.335	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	6.41	20.33	12.77	Yes	10.17	28.49	13.20	41.69	0.306	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	6.59	20.33	11.59	Yes	10.17	28.49	13.20	41.69	0.278	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	6.77	20.33	10.40	No	N/A	23.14	0.00	23.14	0.449	Eqn (c)	Ties Not Req'd
+1.40D	1	6.96	20.33	9.21	No	N/A	23.14	0.00	23.14	0.398	Eqn (c)	Ties Not Req'd
+1.40D	1	7.14	20.33	8.02	No	N/A	23.14	0.00	23.14	0.347	Eqn (c)	Ties Not Req'd

DESCRIPTION: SG: Grid A 16.75' for 16' span opening.

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.40D	1	7.32	20.33	6.83	No	N/A	23.14	0.00	23.14	0.295	Eqn (c)	Ties Not Req'd
+1.40D	1	7.51	20.33	5.64	No	N/A	23.14	0.00	23.14	0.244	Eqn (c)	Ties Not Req'd
+1.40D	1	7.69	20.33	4.46	No	N/A	23.14	0.00	23.14	0.193	Eqn (c)	Ties Not Req'd
+1.40D	1	7.87	20.33	3.27	No	N/A	23.14	0.00	23.14	0.141	Eqn (c)	Ties Not Req'd
+1.40D	1	8.05	20.33	2.08	No	N/A	23.14	0.00	23.14	0.090	Eqn (c)	Ties Not Req'd
+1.40D	1	8.24	20.33	0.89	No	N/A	23.14	0.00	23.14	0.039	Eqn (c)	Ties Not Req'd
+1.40D	1	8.42	20.33	-0.30	No	N/A	23.14	0.00	23.14	0.013	Eqn (c)	Ties Not Req'd
+1.40D	1	8.60	20.33	-1.49	No	N/A	23.14	0.00	23.14	0.064	Eqn (c)	Ties Not Req'd
+1.40D	1	8.79	20.33	-2.67	No	N/A	23.14	0.00	23.14	0.116	Eqn (c)	Ties Not Req'd
+1.40D	1	8.97	20.33	-3.86	No	N/A	23.14	0.00	23.14	0.167	Eqn (c)	Ties Not Req'd
+1.40D	1	9.15	20.33	-5.05	No	N/A	23.14	0.00	23.14	0.218	Eqn (c)	Ties Not Req'd
+1.40D	1	9.34	20.33	-6.24	No	N/A	23.14	0.00	23.14	0.270	Eqn (c)	Ties Not Req'd
+1.40D	1	9.52	20.33	-7.43	No	N/A	23.14	0.00	23.14	0.321	Eqn (c)	Ties Not Req'd
+1.40D	1	9.70	20.33	-8.62	No	N/A	23.14	0.00	23.14	0.372	Eqn (c)	Ties Not Req'd
+1.40D	1	9.89	20.33	-9.80	No	N/A	23.14	0.00	23.14	0.424	Eqn (c)	Ties Not Req'd
+1.40D	1	10.07	20.33	-10.99	No	N/A	23.14	0.00	23.14	0.475	Eqn (c)	Ties Not Req'd
+1.40D	1	10.25	20.33	-12.18	Yes	10.17	28.49	13.20	41.69	0.292	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	10.43	20.33	-13.37	Yes	10.17	28.49	13.20	41.69	0.321	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	10.62	20.33	-14.56	Yes	10.17	28.49	13.20	41.69	0.349	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	10.80	20.33	-15.75	Yes	10.17	28.49	13.20	41.69	0.378	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	10.98	20.33	-16.93	Yes	10.17	28.49	13.20	41.69	0.406	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	11.17	20.33	-18.12	Yes	10.17	28.49	13.20	41.69	0.435	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	11.35	20.33	-19.31	Yes	10.17	28.49	13.20	41.69	0.463	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	11.53	20.33	-20.50	Yes	10.17	28.49	13.20	41.69	0.492	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	11.72	20.33	-21.69	Yes	10.17	28.49	13.20	41.69	0.520	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	11.90	20.33	-22.87	Yes	10.17	28.49	13.20	41.69	0.549	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	12.08	20.33	-24.06	Yes	10.17	28.49	13.20	41.69	0.577	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	12.27	20.33	-25.25	Yes	10.17	28.49	13.20	41.69	0.606	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	12.45	20.33	-26.44	Yes	10.17	28.49	13.20	41.69	0.634	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	12.63	20.33	-27.63	Yes	10.17	28.49	13.20	41.69	0.663	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	12.81	20.33	-28.82	Yes	10.17	28.49	13.20	41.69	0.691	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	13.00	20.33	-30.00	Yes	10.17	28.49	13.20	41.69	0.720	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	13.18	20.33	-31.19	Yes	10.17	28.49	13.20	41.69	0.748	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	13.36	20.33	-32.38	Yes	10.17	28.49	13.20	41.69	0.777	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	13.55	20.33	-33.57	Yes	10.17	28.49	13.20	41.69	0.805	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	13.73	20.33	-34.76	Yes	10.17	28.49	13.20	41.69	0.834	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	13.91	20.33	-35.95	Yes	10.17	28.49	13.20	41.69	0.862	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	14.10	20.33	-37.13	Yes	10.17	28.49	13.20	41.69	0.891	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	14.28	20.33	-38.32	Yes	10.17	28.49	13.20	41.69	0.919	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	14.46	20.33	-39.51	Yes	10.17	28.49	13.20	41.69	0.948	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	14.64	20.33	-40.70	Yes	10.17	28.49	13.20	41.69	0.976	Eqn (b)	Max spacing per 9.7.6.2
+1.40D	1	14.83	20.33	-41.89	Yes	10.02	28.49	13.40	41.89	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	15.01	20.33	-43.08	Yes	9.20	28.49	14.58	43.08	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	15.19	20.33	-44.26	Yes	8.51	28.49	15.77	44.26	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	15.38	20.33	-45.45	Yes	7.91	28.49	16.96	45.45	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	15.56	20.33	-46.64	Yes	7.39	28.49	18.15	46.64	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	15.74	20.33	-47.83	Yes	6.94	28.49	19.34	47.83	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	15.93	20.33	-49.02	Yes	6.54	28.49	20.53	49.02	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	16.11	20.33	-50.21	Yes	6.18	28.49	21.71	50.21	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	16.29	20.33	-51.39	Yes	5.86	28.49	22.90	51.39	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	16.48	20.33	-52.58	Yes	5.57	28.49	24.09	52.58	1.000	Eqn (b)	Reqd Vs per 22.5.8.1
+1.40D	1	16.66	20.33	-53.77	Yes	5.31	28.49	25.28	53.77	1.000	Eqn (b)	Reqd Vs per 22.5.8.1

Maximum Forces & Stresses for Load Combinations

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	 Phi*Mnx	 Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	16.750	227.65	522.67	0.44
+1.40D					
Span # 1	1	16.750	227.65	522.67	0.44
+1.20D+0.50Lr					
Span # 1	1	16.750	204.42	522.67	0.39
+1.20D					
Span # 1	1	16.750	195.13	522.67	0.37
+1.20D+1.60Lr					

DESCRIPTION: SG: Grid A 16.75' for 16' span opening.

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
Span # 1	1	16.750	224.87	522.67	0.43
+0.90D					
Span # 1	1	16.750	146.35	522.67	0.28

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
1	+D+Lr	0.1586	8.375		0.0000	0.000

Masonry Slender Wall

DESCRIPTION: SG: H=6'-10", 8" Yard CMU WALL out-of-plane design

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : TMS 402-16
Load Combinations Used : ASCE 7-22 / IBC 2024 (L<=100psf)

General Information

Construction Type : Grouted Hollow Concrete Masonry

F'm = 2.0 ksi
Fy - Yield = 60.0 ksi
Fr - Rupture = 61.0 psi
Em = f'm * = 900.0
Max % of ρ bal. = 0.009510
Grout Density = 140 pcf
Block Weight Normal Weight
Wall Weight = 86.0 psf
Wall is Solid Grouted

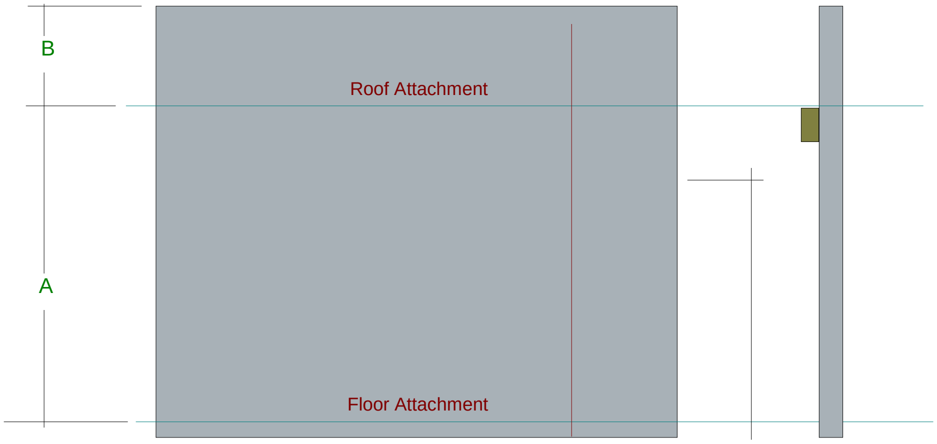
Nom. Wall Thickness 8 in
Actual Thickness 7.625 in
Rebar "d" distance 3.8125 in
Lower Level Rebar . . .
Bar Size # 6
Bar Spacing 16 in

Temp Diff across thickness = deg F
Min Allow Out-of-plane Defl Ra = 0.0
Minimum Vertical Steel % = 0.0020

One-Story Wall Dimensions

A Clear Height = 9.0 ft
B Parapet height = ft

Wall Support Condition Top Free, Bottom Fix



Lateral Loads

Wind Loads :
Full area WIND load 25.0 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 51.0 psf

Fp 1.0 = 51.0 psf

Masonry Slender Wall

Project File: morongo 2 cmu wall SG.ec6

DESCRIPTION: SG: H=6'-10", 8" Yard CMU WALL out-of-plane design

DESIGN SUMMARY

Results reported for "Strip Width" of 12.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	**0.4475**		
	+0.7820D+E	Max Mu	-2.078 k-ft	Phi * Mn	4.644 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	344	Allowable Defl. Ratio	150.0
	E Only	Max. Deflection	0.6286 in		/2 for Cantilever
PASS	Axial Load Check	Max Pu / Ag	11.139 psi	Max. Allow. Defl.	1.440 in
	+1.318D+E	Location	0.150 ft	0.2 * f'm	400.0 psi
PASS	Reinforcing Limit Check	Actual ρ	0.007213	Max Allow ρ	0.009123

Maximum Reactions	*for Load Combination...*	
Top Horizontal		0.0 k
Base Horizontal	E Only	0.4590 k
Vertical Reaction	+D+0.5250E	0.7740 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	 0.2*f'm*b*t k	 Mcr k-ft	 Mu k-ft	Moment Values Phi	 Phi Mn k-ft	 As in^2	ρ Actual	ρ Max Allow	Bar 'd'
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
	0.000	0.000	0.00	0.00	0.00	0.00	0.000	0.0000	0.0000	0.00
+1.20D+0.50W at 0.00 to 0.30	0.929	36.624	0.59	0.51	0.90	4.71	0.330	0.0072	0.0092	3.81
+1.20D-0.50W at 0.00 to 0.30	0.929	36.624	0.59	0.51	0.90	4.71	0.330	0.0072	0.0092	3.81
+1.20D+W at 0.00 to 0.30	0.929	36.624	0.59	1.02	0.90	4.71	0.330	0.0072	0.0092	3.81
+1.20D-W at 0.00 to 0.30	0.929	36.624	0.59	1.02	0.90	4.71	0.330	0.0072	0.0092	3.81
+0.90D+W at 0.00 to 0.30	0.697	36.624	0.59	1.02	0.90	4.66	0.330	0.0072	0.0093	3.81
+0.90D-W at 0.00 to 0.30	0.697	36.624	0.59	1.02	0.90	4.66	0.330	0.0072	0.0093	3.81
+1.318D+E at 0.00 to 0.30	1.020	36.624	0.59	2.09	0.90	4.73	0.330	0.0072	0.0091	3.81
+1.318D-E at 0.00 to 0.30	1.020	36.624	0.59	2.09	0.90	4.73	0.330	0.0072	0.0091	3.81
+0.7820D+E at 0.00 to 0.30	0.605	36.624	0.59	2.08	0.90	4.64	0.330	0.0072	0.0093	3.81
+0.7820D-E at 0.00 to 0.30	0.605	36.624	0.59	2.08	0.90	4.64	0.330	0.0072	0.0093	3.81

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	 Mactual k-ft	 I gross in^4	Stiffness I cracked in^4	 I effective in^4	Deflections Deflection in	 Defl. Ratio
	0.000	0.00	0.00	0.00	0.00	0.000	0.000	0.0
+D+0.60W at 8.70 to 9.00	0.026	0.59	0.00	443.30	41.91	443.300	0.027	7,889.3
+D+0.450W at 8.70 to 9.00	0.026	0.59	0.00	443.30	41.91	443.300	0.020	11,043.3
+0.60D+0.60W at 8.70 to 9.00	0.016	0.59	0.00	443.30	41.89	443.300	0.027	7,895.3
+D+0.70E at 8.70 to 9.00	0.027	0.59	0.00	443.30	41.91	443.300	0.332	649.8
+D+0.5250E at 8.70 to 9.00	0.026	0.59	0.00	443.30	41.91	443.300	0.172	1,252.4
+0.60D+0.70E at 8.70 to 9.00	0.016	0.59	0.00	443.30	41.89	443.300	0.333	647.9
W Only at 8.70 to 9.00	0.000	0.59	0.00	443.30	41.87	443.300	0.144	1,497.7
E Only at 8.70 to 9.00	0.003	0.59	0.00	443.30	41.87	443.300	0.629	343.6

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.00 k	0.774 k
+D+0.60W	0.1 k	0.00 k	0.774 k
+D+0.450W	0.1 k	0.00 k	0.774 k
+0.60D+0.60W	0.1 k	0.00 k	0.464 k

+D+0.70E	0.3 k	0.00 k	0.774 k
+D+0.5250E	0.2 k	0.00 k	0.774 k
+0.60D+0.70E	0.3 k	0.00 k	0.464 k
W Only	0.2 k	0.00 k	0.000 k
E Only	0.5 k	0.00 k	0.000 k

Steel Beam

Project File: Morongo 2 BM-03.05.2026.ec6

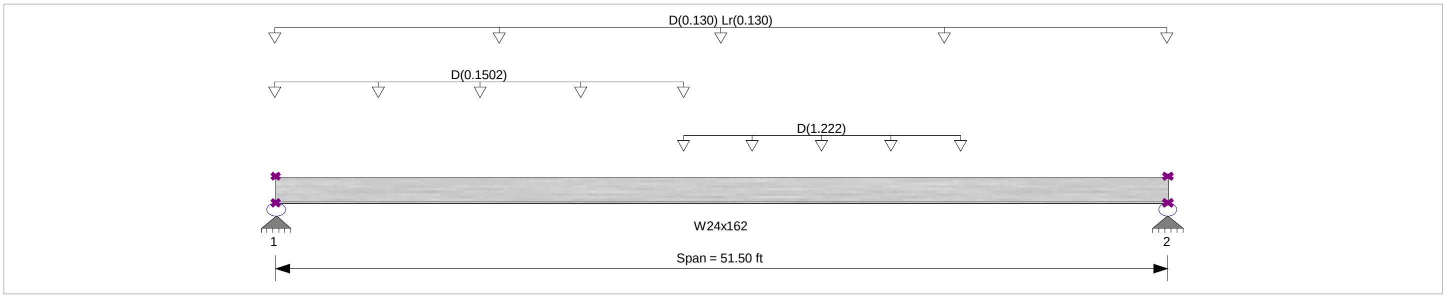
DESCRIPTION: SG: High Roof Beam for Roof Top Equip W24x162

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Load for Span Number 1
Uniform Load : D = 0.1880 ksf, Extent = 23.50 -->> 39.50 ft, Tributary Width = 6.50 ft, (17k/12'/6.5'/2 + 6.5"x145PCF/12"=0.
Uniform Load : D = 0.02310 ksf, Extent = 0.0 -->> 23.50 ft, Tributary Width = 6.50 ft, (150plf)
Uniform Load : D = 0.020, Lr = 0.020 ksf, Tributary Width = 6.50 ft, (D=20psf, Lr=20psf)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.551** : 1
Section used for this span **W24x162**
Mu : Applied 446.713 k-ft
Mn * Phi : Allowable 810.735 k-ft
Load Combination +1.20D+1.60Lr
Span # where maximum occurs Span # 1

Maximum Shear Stress Ratio = **0.056** : 1
Section used for this span **W24x162**
Vu : Applied 29.696 k
Vn * Phi : Allowable 528.75 k
Load Combination +1.20D+1.60Lr
Location of maximum on span 51.500 ft
Span # where maximum occurs Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.138 in	Ratio =	4,482	>=360	Span: 1 : Lr Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	1.092 in	Ratio =	566	>=180	Span: 1 : +D+Lr
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 51.50 ft	1	0.540	0.054	441.49		441.49	908.19	817.37	1.19	1.00	28.40	528.75	528.75
+1.20D+0.50Lr													
Dsgn. L = 51.50 ft	1	0.490	0.049	399.74		399.74	905.57	815.01	1.18	1.00	26.01	528.75	528.75
+1.20D													
Dsgn. L = 51.50 ft	1	0.463	0.046	378.42		378.42	908.19	817.37	1.19	1.00	24.34	528.75	528.75
+1.20D+1.60Lr													
Dsgn. L = 51.50 ft	1	0.551	0.056	446.71		446.71	900.82	810.73	1.18	1.00	29.70	528.75	528.75
+0.90D													
Dsgn. L = 51.50 ft	1	0.347	0.035	283.81		283.81	908.19	817.37	1.19	1.00	18.25	528.75	528.75

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+Lr	1.0919	26.339		0.0000	0.000

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	21.183	23.631

Steel Beam

Project File: Morongo 2 BM-03.05.2026.ec6

LIC# : KW-06015569, Build:20.25.08.20 PACRIM

DESCRIPTION: SG: High Roof Beam for Roof Top Equip W24x162

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from Load Combinations	21.183	23.631
Max Upward from Load Cases	17.835	20.283
D Only	17.835	20.283
+D+Lr	21.183	23.631
+D+0.750Lr	20.346	22.794
+0.60D	10.701	12.170
Lr Only	3.348	3.348

Steel Column

Project File: Morongo 2 BM-03.05.2026.ec6

DESCRIPTION: SG: HSS10X10X1/2 POST, New

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combinations Used : IBC 2021

General Information

Steel Section Name : **HSS10x10x1/2**
Analysis Method : Load Resistance Factor
Steel Stress Grade
Fy : Steel Yield 46.0 ksi
E : Elastic Bending Modulus 29,000.0 ksi

Overall Column Height 12.0 ft
Top & Bottom Fixity Top & Bottom Pinned
Brace condition :
Unbraced Length for buckling ABOUT X-X Axis = 13 ft, K = 1.0
Unbraced Length for buckling ABOUT Y-Y Axis = 13 ft, K = 1.0

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Column self weight included : 749.52 lbs * Dead Load Factor
AXIAL LOADS . . .
Axial Load at 12.0 ft, D = 5.0, LR = 2.0, L = 8.0 k

DESIGN SUMMARY

Bending & Shear Check Results

PASS	Max. Axial+Bending Stress Ratio =	**0.03245**	: 1
	Load Combination	+1.20D+0.50Lr+1.60L	
	Location of max.above base	0.0	ft
	At maximum location values are . . .		
	Pu	20.699	k
	0.9 * Pn	637.99	k
	Mu-x	0.0	k-ft
	0.9 * Mn-x :	209.415	k-ft
	Mu-y	0.0	k-ft
	0.9 * Mn-y :	209.415	k-ft
PASS	Maximum Shear Stress Rati	**0.0**	: 1
	Load Combination	0.0	
	Location of max.above base	0.0	ft
	At maximum location values are . . .		
	Vu : Applied	0.0	k
	Vn * Phi : Allowable	0.0	k

Maximum Load Reactions . .

Top along X-X	0.0 k
Bottom along X-X	0.0 k
Top along Y-Y	0.0 k
Bottom along Y-Y	0.0 k

Maximum Load Deflections . . .

Along Y-Y 0.0 in at 0.0ft above base
for load combination :

Along X-X 0.0 in at 0.0ft above base
for load combination :

Load Combination Results

Load Combination	Maximum Axial + Bending Stress Ratios Stress Ratio	Status	Location	Cbx	Cby	KxLx/Rx	KyLy/Ry	Maximum Shear Ratios Stress Ratio	Status	Location
+1.40D	0.013	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+1.20D+0.50Lr+1.60L	0.032	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+1.20D+1.60L	0.031	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+1.20D+1.60Lr+0.50L	0.022	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+1.20D+1.60Lr	0.016	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+1.20D+0.50L	0.017	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+1.20D	0.011	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+1.20D+0.50Lr+0.50L	0.019	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft
+0.90D	0.008	PASS	0.00 ft	1.00	1.00	40.41	40.41	0.000	PASS	0.00 ft

Maximum Reactions

Note: Only non-zero reactions are listed.

Load Combination	Axial (k) @ Base	Rx (k) @ Base	@ Top	Ry (k) @ Base	@ Top	Mx (k-ft) @ Base	@ Top	My (k-ft) @ Base	@ Top
D Only	5.750								
+D+L	13.750								
+D+Lr	7.750								
+D+0.750Lr+0.750L	13.250								
+D+0.750L	11.750								
+0.60D	3.450								

Steel Column

DESCRIPTION: SG: HSS10X10X1/2 POST, New

Maximum Reactions

Note: Only non-zero reactions are listed.

	Axial (k)	Rx (k)		Ry (k)		Mx (k-ft)		My (k-ft)	
Load Combination	@ Base	@ Base	@ Top	@ Base	@ Top	@ Base	@ Top	@ Base	@ Top
Lr Only	2.000								
L Only	8.000								

Extreme Reactions

		Axial (k)	Rx (k)		Ry (k)		Mx (k-ft)		My (k-ft)	
Item	Extreme Value	@ Base	@ Base	@ Top	@ Base	@ Top	@ Base	@ Top	@ Base	@ Top
Axial, Base Max		13.750								
Axial, Base Min		2.000								
Rx, Base Max										
Rx, Base Min										
Rx, Top Max										
Rx, Top Min										
Ry, Base Max										
Ry, Base Min										
Ry, Top Max										
Ry, Top Min										

Maximum Deflections for Load Combinations

Load Combination	Max. Deflection in X dir	Distance	Max. Deflection in Y dir	Distance
D Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+Lr	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750Lr+0.750L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.000 in	0.000 ft
Lr Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : **HSS10x10x1/2**

Depth	=	10.000	in	I xx	=	256.00	in^4	J	=	412.000	in^4
Design Thick	=	0.465	in	S xx	=	51.20	in^3				
Width	=	10.000	in	R xx	=	3.860	in				
Wall Thick	=	0.500	in	Zx	=	60.700	in^3				
Area	=	17.200	in^2	I yy	=	256.000	in^4	C	=	84.200	in^3
Weight	=	62.460	plf	S yy	=	51.200	in^3				
				R yy	=	3.860	in				

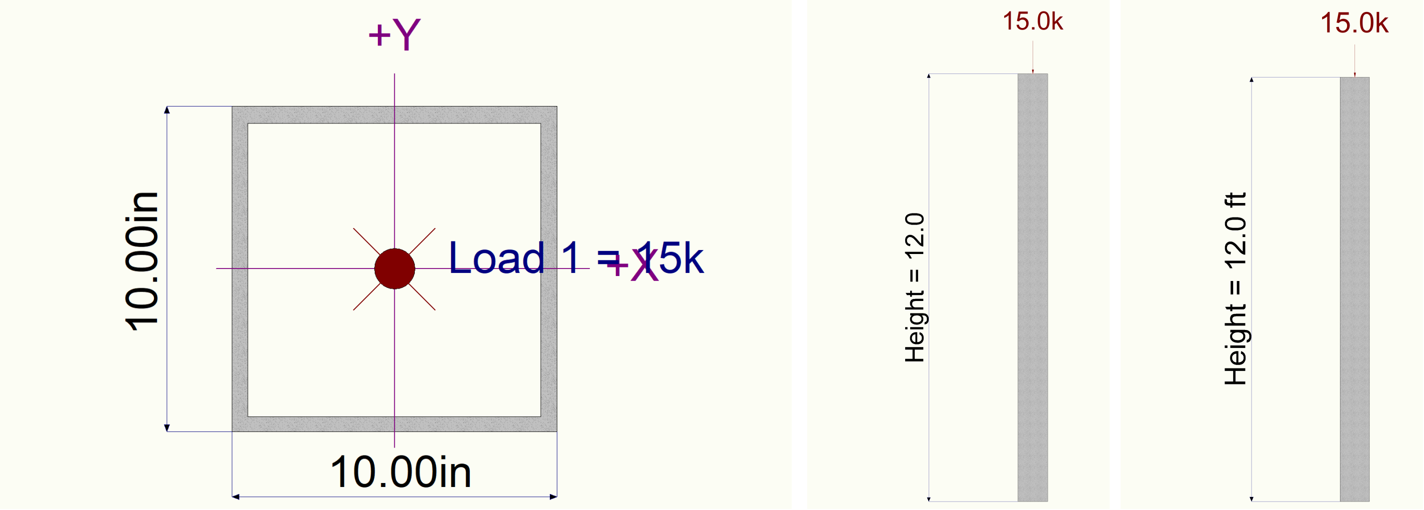
Ycg = 0.000 in

Steel Column

Project File: Morongo 2 BM-03.05.2026.ec6

DESCRIPTION: SG: HSS10X10X1/2 POST, New

Sketches



Steel Beam

Project File: Morongo 2 BM-03.05.2026.ec6

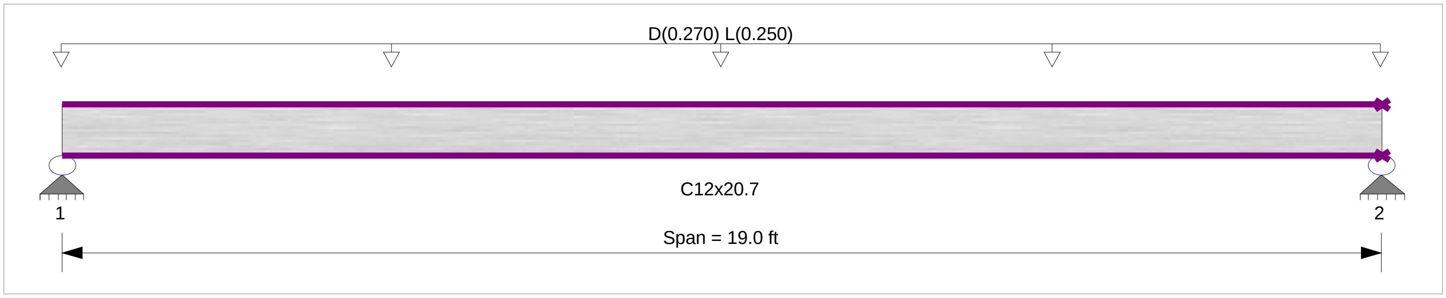
DESCRIPTION: SG: Mezzanine and roof steel floor joist

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.1350, L = 0.1250 ksf, Tributary Width = 2.0 ft, (FLOOR)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.352** : 1
Section used for this span **C12x20.7**
Mu : Applied 33.791 k-ft
Mn * Phi : Allowable 96.000 k-ft
Load Combination +1.20D+1.60L
Span # where maximum occurs Span # 1

Maximum Shear Stress Ratio = **0.078** : 1
Section used for this span **C12x20.7**
Vu : Applied 7.114 k
Vn * Phi : Allowable 91.368 k
Load Combination +1.20D+1.60L
Location of maximum on span 0.000 ft
Span # where maximum occurs Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.197 in	Ratio =	1,158	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.426 in	Ratio =	536	>=180	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 19.00 ft	1	0.191	0.042	18.36		18.36	106.67	96.00	1.00	1.00	3.87	101.52	91.37
+1.20D+1.60L													
Dsgn. L = 19.00 ft	1	0.352	0.078	33.79		33.79	106.67	96.00	1.00	1.00	7.11	101.52	91.37
+1.20D+0.50L													
Dsgn. L = 19.00 ft	1	0.223	0.049	21.38		21.38	106.67	96.00	1.00	1.00	4.50	101.52	91.37
+1.20D													
Dsgn. L = 19.00 ft	1	0.164	0.036	15.74		15.74	106.67	96.00	1.00	1.00	3.31	101.52	91.37
+0.90D													
Dsgn. L = 19.00 ft	1	0.123	0.027	11.81		11.81	106.67	96.00	1.00	1.00	2.49	101.52	91.37

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.4257	9.554		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2		
Max Upward from all Load Conditions	5.137	5.137	19.752	-6.956
Max Upward from Load Combinations	5.137	5.137	19.752	-6.956
Max Upward from Load Cases	2.762	2.762	19.752	-6.956
Max Downward from all Load Conditions (Resisting Uplift)			19.752	-6.956

Steel Beam

Project File: Morongo 2 BM-03.05.2026.ec6

DESCRIPTION: SG: Mezzanine and roof steel floor joist

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2		
Max Downward from Load Combinations (Resisting Uplift)			19.752	-6.956
Max Downward from Load Cases (Resisting Uplift)			19.752	-6.956
D Only	2.762	2.762	19.752	-6.956
+D+L	5.137	5.137	19.752	-6.956
+D+0.750L	4.543	4.543	19.752	-6.956
+0.60D	1.657	1.657	19.752	-6.956
L Only	2.375	2.375	19.752	-6.956

Steel Beam

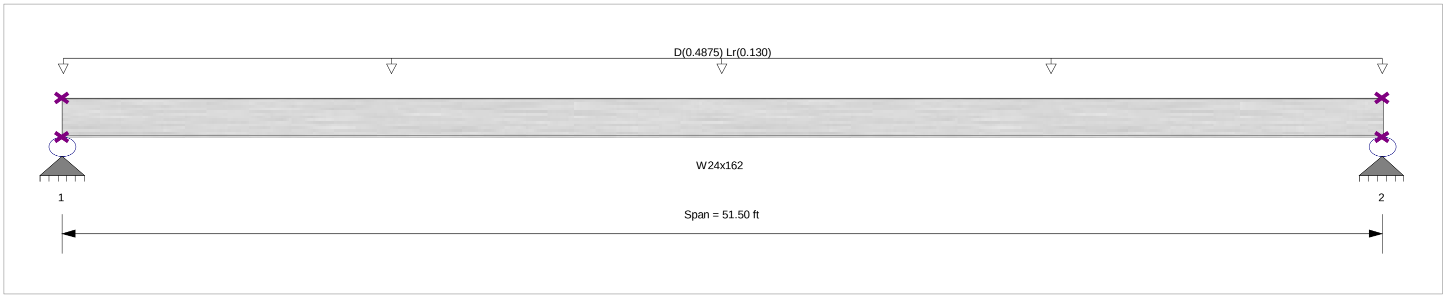
DESCRIPTION: SG: Typical High Roof Beam W24x162

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : IBC 2021
Rho (or Omega) = 1.00

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.0750, Lr = 0.020 ksf, Tributary Width = 6.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.419** : 1
Section used for this span **W24x162**
Mu : Applied 327.354 k-ft
Mn * Phi : Allowable 781.671 k-ft
Load Combination +1.20D+1.60Lr
Span # where maximum occurs Span # 1

Maximum Shear Stress Ratio = **0.048** : 1
Section used for this span **W24x162**
Vu : Applied 25.426 k
Vn * Phi : Allowable 528.75 k
Load Combination +1.20D+1.60Lr
Location of maximum on span 0.000 ft
Span # where maximum occurs Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.138 in	Ratio =	4,482	>=360	Span: 1 : Lr Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.827 in	Ratio =	748	>=180	Span: 1 : +D+Lr
Max Upward Total Deflection	0 in	Ratio =	0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 51.50 ft	1	0.386	0.044	301.46		301.46	868.52	781.67	1.14	1.00	23.41	528.75	528.75
+1.20D+0.50Lr													
Dsgn. L = 51.50 ft	1	0.358	0.041	279.94		279.94	868.52	781.67	1.14	1.00	21.74	528.75	528.75
+1.20D													
Dsgn. L = 51.50 ft	1	0.331	0.038	258.40		258.40	868.52	781.67	1.14	1.00	20.07	528.75	528.75
+1.20D+1.60Lr													
Dsgn. L = 51.50 ft	1	0.419	0.048	327.35		327.35	868.52	781.67	1.14	1.00	25.43	528.75	528.75
+0.90D													
Dsgn. L = 51.50 ft	1	0.248	0.028	193.80		193.80	868.52	781.67	1.14	1.00	15.05	528.75	528.75

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+Lr	0.8266	25.897		0.0000	0.000

Vertical Reactions

Support notation : Far left is #: Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	20.072	20.072
Max Upward from Load Combinations	20.072	20.072
Max Upward from Load Cases	16.725	16.725
D Only	16.725	16.725

DESCRIPTION: SG: Typical High Roof Beam W24x162

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
+D+Lr	20.072	20.072
+D+0.750Lr	19.235	19.235
+0.60D	10.035	10.035
Lr Only	3.348	3.348

Steel Beam

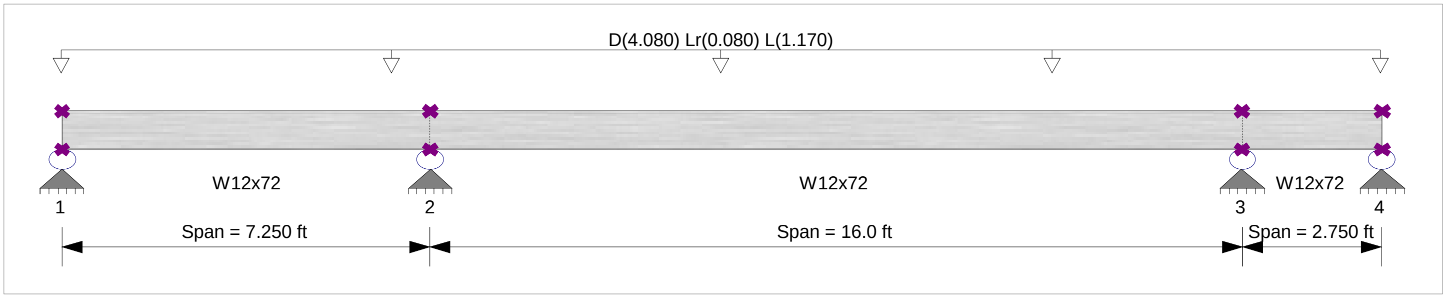
DESCRIPTION: SG: W12x72 Grid 3 beam support 12" CMU wall

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Loads on all spans...
Uniform Load on ALL spans : D = 4.080, Lr = 0.080, L = 1.170 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.343 : 1	Maximum Shear Stress Ratio =	0.378 : 1
Section used for this span	**W12x72**	Section used for this span	**W12x72**
Mu : Applied	138.789 k-ft	Vu : Applied	59.949 k
Mn * Phi : Allowable	405.000 k-ft	Vn * Phi : Allowable	158.670 k
Load Combination	+1.20D+0.50Lr+1.60L	Load Combination	+1.20D+0.50Lr+1.60L
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 2	Span # where maximum occurs	Span # 3

Maximum Deflection

Max Downward Transient Deflection	0.030 in	Ratio =	6,361	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.003 in	Ratio =	30,383	>=360	Span: 1 : L Only
Max Downward Total Deflection	0.137 in	Ratio =	1398	>=180	Span: 2 : +D+L
Max Upward Total Deflection	-0.013 in	Ratio =	6680	>=180	Span: 1 : +D+L

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 7.25 ft	1	0.246	0.219	4.62	-99.65	99.65	450.00	405.00	2.79	1.00	34.82	158.67	158.67
Dsgn. L = 16.00 ft	2	0.289	0.300	77.77	-117.02	117.02	450.00	405.00	1.87	1.00	47.59	158.67	158.67
Dsgn. L = 2.75 ft	3	0.289	0.319		-117.02	117.02	450.00	405.00	1.76	1.00	50.54	158.67	158.67
+1.20D+0.50Lr+1.60L													
Dsgn. L = 7.25 ft	1	0.292	0.260	5.48	-118.19	118.19	450.00	405.00	2.79	1.00	41.29	158.67	158.67
Dsgn. L = 16.00 ft	2	0.343	0.356	92.25	-138.79	138.79	450.00	405.00	1.87	1.00	56.44	158.67	158.67
Dsgn. L = 2.75 ft	3	0.343	0.378		-138.79	138.79	450.00	405.00	1.76	1.00	59.95	158.67	158.67
+1.20D+1.60L													
Dsgn. L = 7.25 ft	1	0.290	0.259	5.44	-117.51	117.51	450.00	405.00	2.79	1.00	41.06	158.67	158.67
Dsgn. L = 16.00 ft	2	0.341	0.354	91.71	-137.98	137.98	450.00	405.00	1.87	1.00	56.11	158.67	158.67
Dsgn. L = 2.75 ft	3	0.341	0.376		-137.98	137.98	450.00	405.00	1.76	1.00	59.60	158.67	158.67
+1.20D+1.60Lr+0.50L													
Dsgn. L = 7.25 ft	1	0.241	0.215	4.52	-97.64	97.64	450.00	405.00	2.79	1.00	34.11	158.67	158.67
Dsgn. L = 16.00 ft	2	0.283	0.294	76.20	-114.65	114.65	450.00	405.00	1.87	1.00	46.63	158.67	158.67
Dsgn. L = 2.75 ft	3	0.283	0.312		-114.65	114.65	450.00	405.00	1.76	1.00	49.52	158.67	158.67
+1.20D+1.60Lr													
Dsgn. L = 7.25 ft	1	0.216	0.193	4.06	-87.61	87.61	450.00	405.00	2.79	1.00	30.61	158.67	158.67
Dsgn. L = 16.00 ft	2	0.254	0.264	68.38	-102.88	102.88	450.00	405.00	1.87	1.00	41.84	158.67	158.67
Dsgn. L = 2.75 ft	3	0.254	0.280		-102.88	102.88	450.00	405.00	1.76	1.00	44.44	158.67	158.67
+1.20D+0.50L													

DESCRIPTION: SG: W12x72 Grid 3 beam support 12" CMU wall

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
Dsgn. L = 7.25 ft	1	0.236	0.210	4.42	-95.45	95.45	450.00	405.00	2.79	1.00	33.35	158.67	158.67
Dsgn. L = 16.00 ft	2	0.277	0.287	74.49	-112.08	112.08	450.00	405.00	1.87	1.00	45.58	158.67	158.67
Dsgn. L = 2.75 ft	3	0.277	0.305		-112.08	112.08	450.00	405.00	1.76	1.00	48.41	158.67	158.67
+1.20D													
Dsgn. L = 7.25 ft	1	0.211	0.188	3.96	-85.42	85.42	450.00	405.00	2.79	1.00	29.84	158.67	158.67
Dsgn. L = 16.00 ft	2	0.248	0.257	66.66	-100.30	100.30	450.00	405.00	1.87	1.00	40.79	158.67	158.67
Dsgn. L = 2.75 ft	3	0.248	0.273		-100.30	100.30	450.00	405.00	1.76	1.00	43.32	158.67	158.67
+1.20D+0.50Lr+0.50L													
Dsgn. L = 7.25 ft	1	0.237	0.212	4.45	-96.13	96.13	450.00	405.00	2.79	1.00	33.59	158.67	158.67
Dsgn. L = 16.00 ft	2	0.279	0.289	75.03	-112.88	112.88	450.00	405.00	1.87	1.00	45.91	158.67	158.67
Dsgn. L = 2.75 ft	3	0.279	0.307		-112.88	112.88	450.00	405.00	1.76	1.00	48.76	158.67	158.67
+0.90D													
Dsgn. L = 7.25 ft	1	0.158	0.141	2.97	-64.06	64.06	450.00	405.00	2.79	1.00	22.38	158.67	158.67
Dsgn. L = 16.00 ft	2	0.186	0.193	50.00	-75.22	75.22	450.00	405.00	1.87	1.00	30.59	158.67	158.67
Dsgn. L = 2.75 ft	3	0.186	0.205		-75.22	75.22	450.00	405.00	1.76	1.00	32.49	158.67	158.67

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+D+L	-0.0130	4.978
2	+D+L	0.1373	7.893		0.0000	4.978
3		0.0000	7.893	+D+L	-0.0049	1.155

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Max Upward from all Load Conditions	6.708	73.459	89.846	
Max Upward from Load Combinations	6.708	73.459	89.846	
Max Upward from Load Cases	5.233	57.310	70.094	
Max Downward from all Load Conditions (Resisting Uplift)				-31.641
Max Downward from Load Combinations (Resisting Uplift)				-31.641
Max Downward from Load Cases (Resisting Uplift)				-24.685
D Only	5.233	57.310	70.094	-24.685
+D+L	6.708	73.459	89.846	-31.641
+D+Lr	5.334	58.414	71.444	-25.160
+D+0.750Lr+0.750L	6.415	70.250	85.921	-30.258
+D+0.750L	6.339	69.422	84.908	-29.902
+0.60D	3.140	34.386	42.056	-14.811
Lr Only	0.101	1.104	1.351	-0.476
L Only	1.475	16.149	19.752	-6.956

Steel Beam

Project File: Morongo 2 BM-03.05.2026.ec6

LIC# : KW-06015569, Build:20.25.08.20 PACRIM

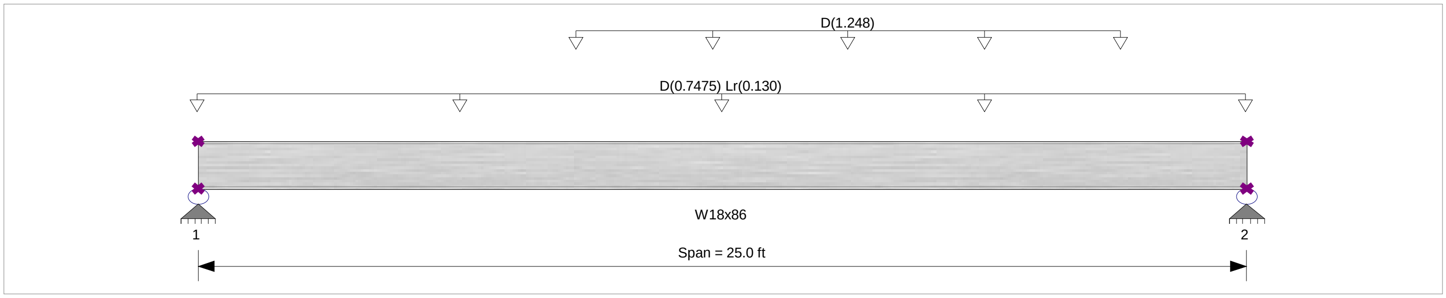
DESCRIPTION: SG W18x86 Low Roof Girder Mech Load

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : IBC 2021

Material Properties

Analysis Method :	Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing :	Completely Unbraced	E: Modulus :	29,000.0 ksi
Bending Axis :	Major Axis Bending		



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight calculated and added to loading
Uniform Load : D = 0.1150, Lr = 0.020 ksf, Tributary Width = 6.50 ft, (Roof Slab)
Uniform Load : D = 0.1920 ksf, Extent = 9.0 -->> 22.0 ft, Tributary Width = 6.50 ft, (Mech Unit)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.336** : 1	Maximum Shear Stress Ratio =	**0.108** : 1
Section used for this span	**W18x86**	Section used for this span	**W18x86**
Mu : Applied	189.438 k-ft	Vu : Applied	28.669 k
Mn * Phi : Allowable	563.054 k-ft	Vn * Phi : Allowable	264.960 k
Load Combination	+1.40D	Load Combination	+1.40D
		Location of maximum on span	25.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.026 in	Ratio = 11,596	>=360	Span: 1 : Lr Only
Max Upward Transient Deflection	0 in	Ratio = 0	<360	n/a
Max Downward Total Deflection	0.361 in	Ratio = 831	>=180	Span: 1 : +D+Lr
Max Upward Total Deflection	0 in	Ratio = 0	<180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
Segment Length	Span #	M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.40D													
Dsgn. L = 25.00 ft	1	0.336	0.108	189.44		189.44	625.62	563.05	1.16	1.00	28.67	264.96	264.96
+1.20D+0.50Lr													
Dsgn. L = 25.00 ft	1	0.298	0.096	167.43		167.43	625.10	562.59	1.16	1.00	25.39	264.96	264.96
+1.20D													
Dsgn. L = 25.00 ft	1	0.288	0.093	162.38		162.38	625.62	563.05	1.16	1.00	24.57	264.96	264.96
+1.20D+1.60Lr													
Dsgn. L = 25.00 ft	1	0.318	0.103	178.55		178.55	624.07	561.67	1.16	1.00	27.17	264.96	264.96
+0.90D													
Dsgn. L = 25.00 ft	1	0.216	0.070	121.78		121.78	625.62	563.05	1.16	1.00	18.43	264.96	264.96

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+Lr	0.3611	12.786		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2		
Max Upward from all Load Conditions	18.209	22.103	19.752	-6.956
Max Upward from Load Combinations	18.209	22.103	19.752	-6.956
Max Upward from Load Cases	16.584	20.478	19.752	-6.956

DESCRIPTION: SG W18x86 Low Roof Girder Mech Load

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2		
Max Downward from all Load Conditions (Resisting Uplift)			19.752	-6.956
Max Downward from Load Combinations (Resisting Uplift)			19.752	-6.956
Max Downward from Load Cases (Resisting Uplift)			19.752	-6.956
D Only	16.584	20.478	19.752	-6.956
+D+Lr	18.209	22.103	19.752	-6.956
+D+0.750Lr	17.803	21.696	19.752	-6.956
+0.60D	9.950	12.287	19.752	-6.956
Lr Only	1.625	1.625	19.752	-6.956

PacRim Engineering	PREPARED BY	DATE	REVIEWED BY	DATE
	B. Mu	7/29/2026	S. Gu	7/31/2026
	Morongo Phase II			SHEET
Job No. 511				B

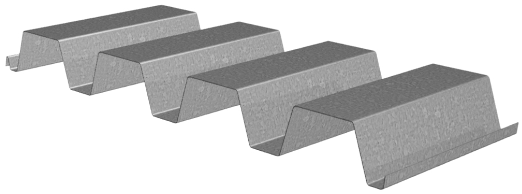
Roof Deck Capacity

PLN3™-32/HSN3™-32 ROOF DECKS
GRADE 50 STEEL

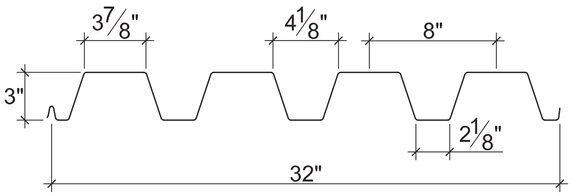
LRFD

N3 ROOF DECKS

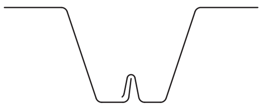
- **PLN3-32 Deck used with PunchLok® II System**
- **HSN3-32 Deck used with TSWs or BPs**
- **HSN3-32-NS Deck used with Side-lap Screws**
- **HSN3-32-SS Deck used with Side-lap Screws**



Nominal Dimensions

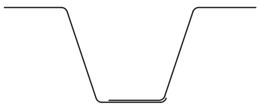


PLN3-32 or HSN3-32



Standard
Interlocking
Side-lap

HSN3-32-NS



Nested
Side-lap

HSN3-32-SS

Screw Fastened
Side-lap

Section Properties

Deck Gage	Deck Weight w_{dd} (psf)	Base Metal Thickness t (in.)	Yield Strength F_y (ksi)	Effective Moment of Inertia at Service Load $I_d = (2I_e+I_g)/3$ I_d+ (in⁴/ft)	I_d- (in⁴/ft)	Effective Section Modulus at F_y = 50 ksi S_e+ (in³/ft)	S_e- (in³/ft)	Vertical Web Shear $øV_n$ (lb/ft)
22	2.0	0.0299	50	0.721	0.785	0.353	0.405	3566
20	2.4	0.0359	50	0.890	0.953	0.452	0.509	5821
18	3.1	0.0478	50	1.229	1.273	0.671	0.722	10371
16	3.9	0.0598	50	1.570	1.587	0.883	0.932	13843

Design Reactions at Supports Based on Web Crippling, $øR_n$ (lb/ft)

Bearing Length of Webs

Deck Gage	One-Flange Loading						Two-Flange Loading					
	End Bearing				Interior Bearing		End Bearing				Interior Bearing	
	1½"	2"	3"	4"	4"	8"	1½"	2"	3"	4"	4"	8"
22	860	945	1087	1208	1843	2152	821	885	991	1080	2154	2539
20	1215	1331	1525	1690	2584	3203	1241	1332	1485	1614	3072	3861
18	2079	2266	2581	2846	4374	5476	2325	2484	2749	2973	5315	6763
16	3155	3427	3882	4266	6586	8173	3752	3992	4393	4731	8115	10239

Standard Features

- ASTM A653 SS GR50 Min., with G60 or G90, white or gray primer optional
- ASTM A1008 SS GR50 Min. with gray primer
- Standard lengths – 6’-0” to 40’-0”
- IAPMO UES ER-2018, UL, and FM Listed
- Tables conform to ANSI/SDI RD-2017

Optional Features

- Inquire regarding cost and lead times for:
  - -Short cuts < 6’-0”
  - -Sheet Lengths > 40’-0”
  - -Alternative metallic and painted finishes
- Web and Fully Perforated Acoustical Versions

PLN3™-32/HSN3™-32 ROOF DECKS
GRADE 50 STEEL

Inward Uniform Design Loads, LRFD (psf)

Deck Gage	Spans	Criteria	Span (ft-in.) 4'-0"	6'-0"	8'-0"	9'-0"	10'-0"	11'-0"	12'-0"	14'-0"	16'-0"	18'-0"	20'-0"
22	Single	øW_n	662	294	165	131	106	88	74	54	41	33	26
		L/240	739	219	92	65	47	36	27	17	12	8	6
	Double	øW_n	670	318	184	146	119	99	83	61	47	37	30
		L/240	1937	574	242	170	124	93	72	45	30	21	15
	Triple	øW_n	800	388	226	180	147	122	103	76			
		L/240	1518	450	190	133	97	73	56	35			
20	Single	øW_n	847	377	212	167	136	112	94	69	53	42	34
		L/240	912	270	114	80	58	44	34	21	14	10	7
	Double	øW_n	883	409	234	185	151	125	105	77	59	47	38
		L/240	2351	697	294	206	150	113	87	55	37	26	19
	Triple	øW_n	1071	504	290	230	187	155	131	96			
		L/240	1843	546	230	162	118	89	68	43			
18	Single	øW_n	1258	559	315	249	201	166	140	103	79	62	50
		L/240	1259	373	157	111	81	61	47	29	20	14	10
	Double	øW_n	1287	588	334	265	215	178	150	110	84	67	54
		L/240	3141	931	393	276	201	151	116	73	49	34	25
	Triple	øW_n	1576	728	415	329	267	222	186	137			
		L/240	2462	729	308	216	158	118	91	57			
16	Single	øW_n	1656	736	414	327	265	219	184	135	103	82	66
		L/240	1608	476	201	141	103	77	60	38	25	18	13
	Double	øW_n	1666	760	431	342	277	230	193	142	109	86	70
		L/240	3916	1160	489	344	251	188	145	91	61	43	31
	Triple	øW_n	2043	941	537	425	346	286	241	177			
		L/240	3069	909	384	269	196	148	114	72			

Note:

1. Table does not account for web crippling. Required bearing should be determined based on specific span conditions.

Hilti Calculation for Anchor Bolt Embedded to the CMU Wall

Company:	PacRim Engineering	Page:	1
Address:	312 East 1st St. Los Angeles, CA	Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Masonry - Mar 13, 2026	Date:	3/15/2026
Fastening point:			

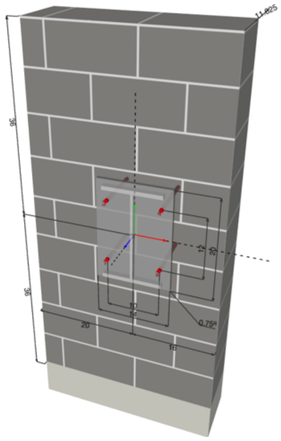
Specifier's comments:

1 Input data

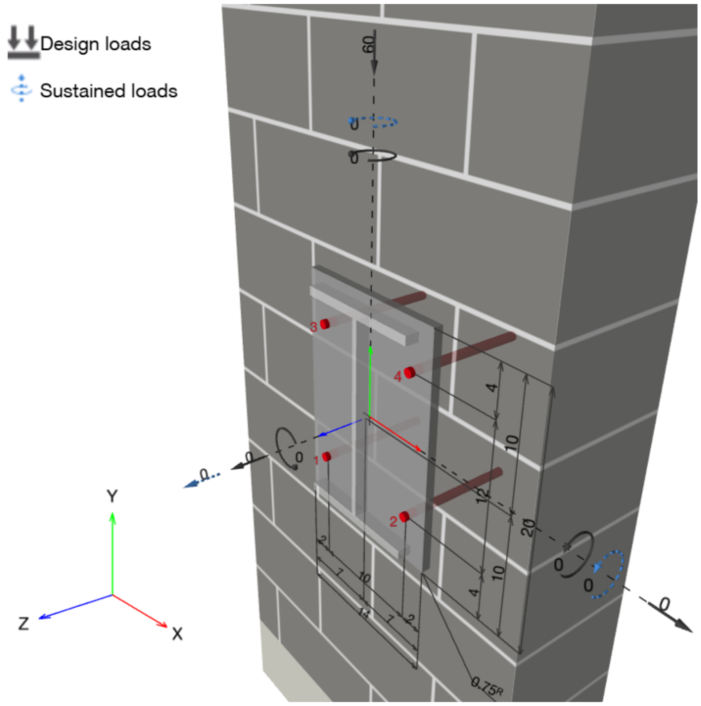
Anchor type and diameter:	**HY 100 + HAS-V-36 3/4**
Item number:	2198031 HAS-V-36 3/4"x12" (element) / 2078494 HIT-HY 100 (adhesive)
Specification text:	Hilti ∅ 3/4 HY 100 + HAS-V-36 with 9 in nominal embedment depth per IAPMO ER-547 , Hammer drilled installation per MPII Low Roof W18X86 to CMU WALL
Effective embedment depth:	h_{ef} = 9.000 in.
Material:	ASTM F1554 Grade 36
Evaluation Service Report:	ER-547
Issued I Valid:	6/2/2025 | 5/31/2026
Proof:	Design Method LRFD (AC58) Masonry + ACI 318-19
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.750 in.
Anchor plate^R :	l_x x l_y x t = 14.000 in. x 20.000 in. x 0.750 in.; (Recommended plate thickness: not calculated)
Profile:	W shape (AISC), W18X86; (L x W x T x FT) = 18.400 in. x 11.100 in. x 0.480 in. x 0.770 in.
Base material:	cracked Grout-filled CMU, f=2000, f = 1,999 psi, L x W x H: 16.000 in. x 12.000 in. x 8.000 in.; Solid Head Joint: no; open ended unit: no
Temp. short/long:	32 °F / 32 °F Joints: vertical: 0.375 in.; horizontal: 0.375 in.
Installation:	Face installation, Drill hole: Hammer drilled, Installation condition: Dry

^{R} - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.]



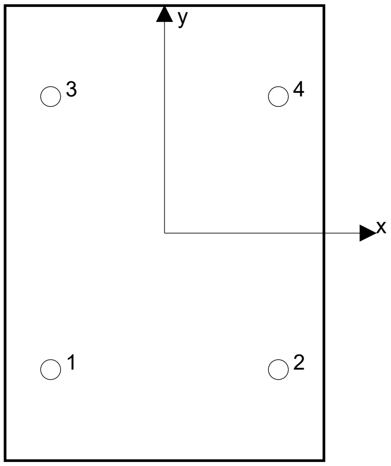
Geometry [in.] & Loading [lb, in.lb]



1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	$N = 0; V_x = 0; V_y = -60;$ $M_x = 0; M_y = 0; M_z = 0;$ $N_{sus} = 0; M_{x,sus} = 0; M_{y,sus} = 0;$	no	2

2 Load case/Resulting anchor forces



Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0	15	0	-15
2	0	15	0	-15
3	0	15	0	-15
4	0	15	0	-15

Max. concrete compressive strain:	0.00 [‰]
Max. concrete compressive stress:	0 [psi]
Resulting tension force in (x/y)=(-/-):	0 [lb]
Resulting compression force in (x/y)=(-/-):	0 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Shear load

	Load [lb]	Capacity [lb]	Utilization β_V [%]	Status
Steel	15	7,566	1	OK
Pryout cone	30	6,618	1	OK
Masonry crushing strength	15	4,449	1	OK
Masonry breakout in direction y-	30	1,615	2	OK

3.1 Steel strength

V_{sa} = ESR value refer to ICC-ES ER-547

$\phi \ V_{sa} \geq V_{ua}$ AC58 Table 3.2 + ACI 318-19 Table 17.5.2

V_{sa} [lb]	ϕ	$\phi \ V_{sa}$ [lb]	V_{ua} [lb]
11,639	0.650	7,566	15

3.2 Pryout strength (Masonry breakout strength controls)

$V_{mpg} = k_{cp} \cdot N_{mbg}$

$\phi \ V_{mpg} \geq V_{ua}$ AC58 Table 3.2 + ACI 318-19 Table 17.5.2

A_{Nm} see ACI 318-19, Section 17.6.2.1, Fig. R 17.6.2.1(b)

$A_{Nm0} = 9 \ h_{ef}^2$ ACI 318-19 Eq. (17.6.2.2.1)

$\psi_{\text{ec1,N,m}} = \left(\frac{1}{1 + \frac{e_{c1,N}}{c_{Na}}}\right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.3.1)

$\psi_{\text{ec1,N,m}} = \left(\frac{1}{1 + \frac{e_{c2,N}}{c_{Na}}}\right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.3.1)

$\psi_{\text{ed,N,m}} = 0.7 + 0.3 \left(\frac{c}{c_{cr,N}}\right) \leq 1.0$ ACI 318-19 Eq. (17.6.2.4.1b)

$N_{b,m} = k_m \ \lambda_a \ \sqrt{f'_c} \ h_{ef}^{1.5}$ ACI 318-19 Eq. (17.6.2.2.1)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
2	9.000	0.000	0.000	2.813	1.000

k_m	λ_a
12	1.000

Calculations

A_{Nm} [in.^{2}]	A_{Nm0} [in.^{2}]	$\psi_{ec1,N,m}$	$\psi_{ec2,N,m}$	$\psi_{ed,N}$	$N_{b,m}$ [lb]
312.00	729.00	1.000	1.000	0.762	14,485

Results

V_{mpg} [lb]	$\phi_{concrete}$	$\phi \ V_{mpg}$ [lb]	V_{ua} [lb]
9,454	0.700	6,618	30

3.3 Masonry crushing strength

$\phi \ V_{mc} \ \geq V_{ua}$ AC58 Table 3.2

$V_{mc} = 1750 \cdot \left(f'_m \cdot A_{se,V}\right)^{\frac{1}{4}}$ AC58 Eq. 3-1

Variables

f'_m [psi]	$A_{se,v}$ [in.^{2}]
1,999	0.33

Results

V_{mc} [lb]	ϕ	$\phi \ V_{mc}$ [lb]	V_{ua} [lb]
8,899	0.500	4,449	15

3.4 Masonry breakout strength y-

$V_{mbg} = \left(\frac{A_{Vm}}{A_{Vm0}}\right) \psi_{ec,V,m} \ \psi_{ed,V,m} \ \psi_{m,V} \ \psi_{h,V,m} \ \psi_{parallel,V} \ V_{b,m}$ ACI 318-19 Eq. (17.7.2.1b)

$\phi \ V_{mbg} \ \geq V_{ua}$ AC58 Table 3.2 + ACI 318-19 Table 17.5.2

A_{Vm} see ACI 318-19 , Section 17.7.2.1, Fig. R 17.7.2.1(b)

$A_{Vm0} = 4.5 \ c_{a1}^2$ ACI 318-19 Eq. (17.7.2.1.3)

$\psi_{ec,V,m} = \left(\frac{1}{1 + \frac{2e'_v}{3c_{a1}}}\right) \leq 1.0$ ACI 318-19 Eq. (17.7.2.3.1)

$\psi_{ed,V,m} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-19 Eq. (17.7.2.4.1b)

$\psi_{h,V,m} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-19 Eq. (17.7.2.6.1)

$V_{b,m} = \left(7 \left(\frac{l_e}{d_a}\right)^{0.2} \sqrt{d_a}\right) \lambda_a \ \sqrt{f'_m} \ c_{a1}^{1.5}$ ACI 318-19 Eq. (17.7.2.2.1a)

Variables

l_e [in.]	d_a [in.]	c_{a1} [in.]	c_{a2} [in.]	A_{Vm} [in.^{2}]	A_{Vm0} [in.^{2}]	f'_m [psi]
6.000	0.750	7.750	2.813	93.00	270.28	1,999

Calculations

$\psi_{ed,V,m}$	$\psi_{parallel,V}$	$e_{c,V}$ [in.]	$\psi_{ec,V,m}$	$\psi_{m,V}$	$\psi_{h,V,m}$
0.773	1.000	0.000	1.000	1.000	1.000

Results

$V_{b,m}$ [lb]	ϕ	$\phi \ V_{mbg}$ [lb]	V_{ua} [lb]
8,681	0.700	1,615	30

4 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, AS5216, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- The min. sizes of the bricks, the masonry compressive strength, the type / strength of the mortar and the grout (in case of fully grouted CMU walls) has to fulfill the requirements given in the relevant ESR-approval or in the PTG.
- Only the local load transfer from the anchor(s) to the wall is considered, a further load transfer in the wall is not covered by PROFIS!
- Wall is assumed as being perfectly aligned vertically – checking required(!): Noncompliance can lead to significantly different distribution of forces and higher tension loads than those calculated by PROFIS. Masonry wall must not have any damages (neither visible nor not visible)! While installation, the positioning of the anchors needs to be maintained as in the design phase i.e. either relative to the brick or relative to the mortar joints.
- The effect of the joints on the compressive stress distribution on the plate / bricks was not taken into consideration.
- If no significant resistance is felt over the entire depth of the hole when drilling (e.g. in unfilled butt joints), the anchor should not be set at this position or the area should be assessed and reinforced. Hilti recommends the anchoring in masonry always with sieve sleeve. Anchors can only be installed without sieve sleeves in solid bricks when it is guaranteed that it has not any hole or void.
- The accessories and installation remarks listed on this report are for the information of the user only. In any case, the instructions for use provided with the product have to be followed to ensure a proper installation.
- The compliance with current standards (e.g. 2018, 2015, 2012, 2009 and 2006 IBC) is the responsibility of the user.
- Drilling method (hammer, rotary) to be in accordance with the approval!
- Masonry should be built according to industry standards.

Fastening meets the design criteria!

Company:	PacRim Engineering	Page:	7
Address:	312 East 1st St. Los Angeles, CA	Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Masonry - Mar 13, 2026	Date:	3/15/2026
Fastening point:			

5 Installation data

Anchor plate, steel: ASTM A36; E = 29,000,001 psi; f_{yk} = 36,000 psi

Profile: W shape (AISC), W18X86; (L x W x T x FT) = 18.400 in. x 11.100 in. x 0.480 in. x 0.770 in.

Hole diameter in the fixture: d_f = 0.875 in.

Plate thickness (input): 0.750 in.

Recommended plate thickness: not calculated

Drilling method: Drilled in hammer mode

Cleaning: No cleaning of the drilled hole is required

Anchor type and diameter: HY 100 + HAS-V-36 3/4

Item number: 2198031 HAS-V-36 3/4"x12" (element) / 2078494 HIT-HY 100 (adhesive)

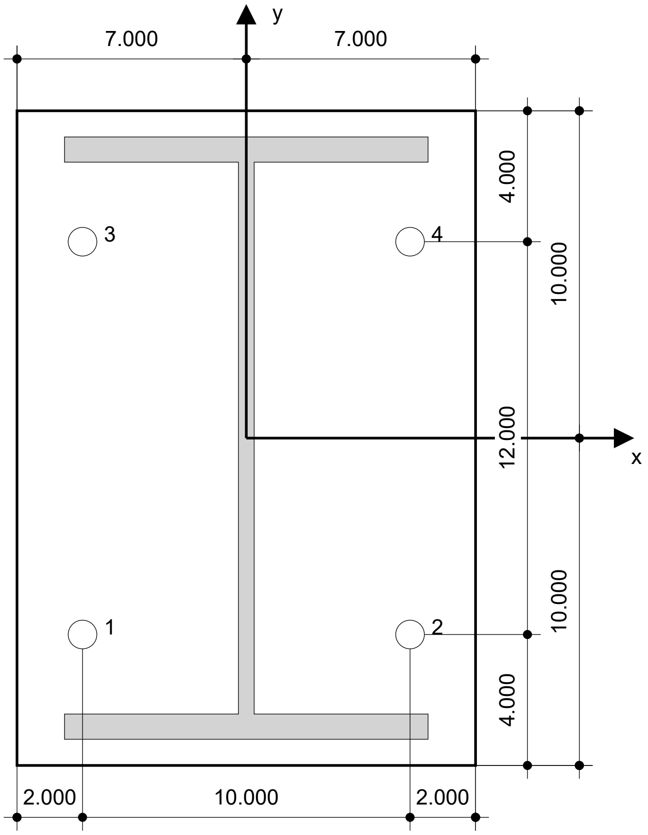
Maximum installation torque: 1,200 in.lb

Hole diameter in the base material: 0.875 in.

Hole depth in the base material: 9.000 in.

Minimum thickness of the base material: 11.625 in.

Hilti ∅ 3/4 HY 100 + HAS-V-36 with 9 in nominal embedment depth per IAPMO ER-547 , Hammer drilled installation per MPII



Coordinates Anchor [in.]

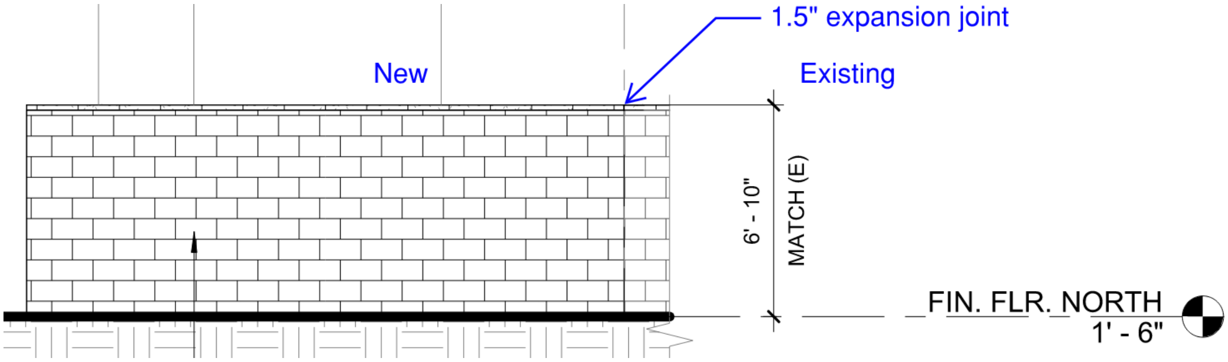
Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-5.000	-6.000	15.000	21.000	30.000	42.000
2	5.000	-6.000	25.000	11.000	30.000	42.000
3	-5.000	6.000	15.000	21.000	42.000	30.000
4	5.000	6.000	25.000	11.000	42.000	30.000

6 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

CMU Yard Wall Deflection Check

The CMU yard wall elevation view is shown below:



For CMU yard wall deflection, refer to ASCE 7-16 Table 12.12-1

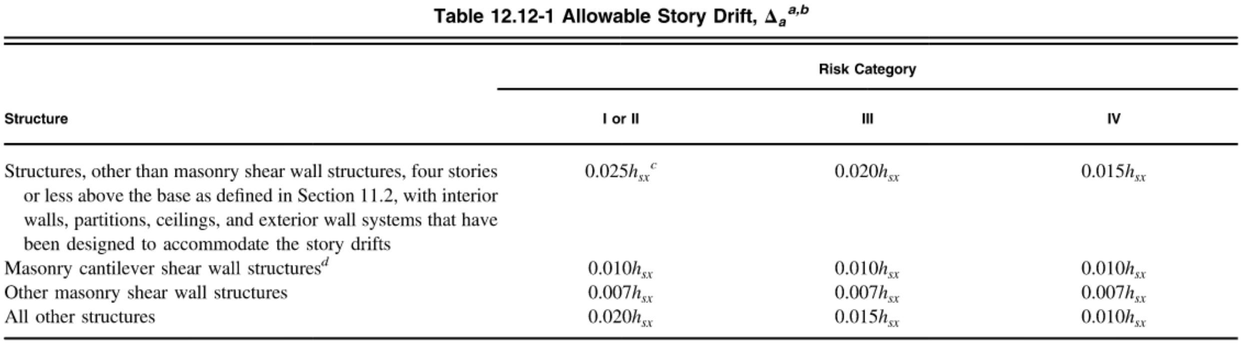


Table 12.12-1 Allowable Story Drift, Δ_a[a,b]

	Risk Category		
Structure	I or II	III	IV
Structures, other than masonry shear wall structures, four stories or less above the base as defined in Section 11.2, with interior walls, partitions, ceilings, and exterior wall systems that have been designed to accommodate the story drifts	$0.025h_{sx}$[c]	$0.020h_{sx}$	$0.015h_{sx}$
Masonry cantilever shear wall structures[d]	$0.010h_{sx}$	$0.010h_{sx}$	$0.010h_{sx}$
Other masonry shear wall structures	$0.007h_{sx}$	$0.007h_{sx}$	$0.007h_{sx}$
All other structures	$0.020h_{sx}$	$0.015h_{sx}$	$0.010h_{sx}$

CMU yard wall height:

$$h_{sx} = 82"$$

CMU yard wall out-of-plane drift:

$$\Delta_1 = 0.01h_{sx} = 0.82"$$

CMU yard wall in-plane drift:

$$\Delta_1 = 0.007h_{sx} = 0.57"$$

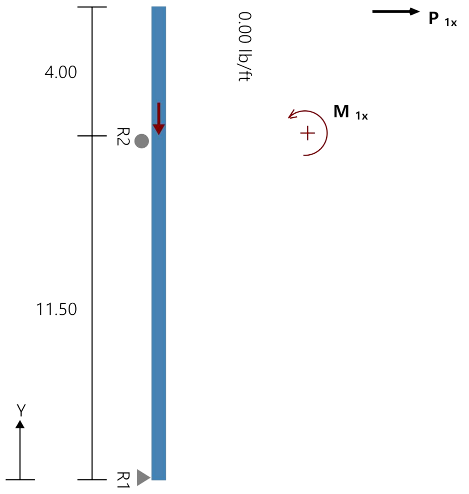
CMU yard wall minimum gap:

$$\Delta_{max} = \sqrt{\Delta_1^2 + \Delta_2^2} = 1.00"$$

$$\Delta_{max} < 1.5" \quad OK$$

PacRim Engineering	PREPARED BY	DATE	REVIEWED BY	DATE
	B. Mu	7/29/2026	S. Gu	7/31/2026
	Morongo Phase II			SHEET
Job No. 511				E

Stud Bearing Wall Design



Section : 600S162-54 (50 ksi) @ 24" o.c. Single C Stud (punched)
Maxo = 2313.4 ft-lb **Va =** 2822.9 lb **I =** 2.86 in^4

Loads have not been modified for strength checks
Loads have not been modified for deflection calculations

Bridging Connectors - Design Method =AISI S100

Span	**Axial KyLy, KtLt**	**Flexual, Distortional**	**Connector**	**Stress Ratio**
Top Cant.	None, 0.0"	None, 48.0"	N/A	-
Span	60.0", 60.0"	60.0", 138.0"	LSUBH3.25 (Min)	0.35

Web Crippling

Support	**Load (lb)**	**Bearing (in)**	**Pa (lb)**	**M (ft-lbs)**	**Max Int.**	**Stiffener?**
P1x	-200.00	1.50	679.1	0.0	0.15	NO
R2	-192.26	--Shear Connection w/ clip--				NO
R1	-7.74	--Stud/Track Design, Ref Connectors--				NO

Gravity Load

Type	**Load (lb)**
Uniform	
P1y	2667.00lb @ 11.50ft

Point Loads	**P1x**
Load(lb)	-200.00
Y-Dist.(ft)	15.50

Moments	**M1**
Load(ft-lb)	889.00
Y-Dist.(ft)	11.50

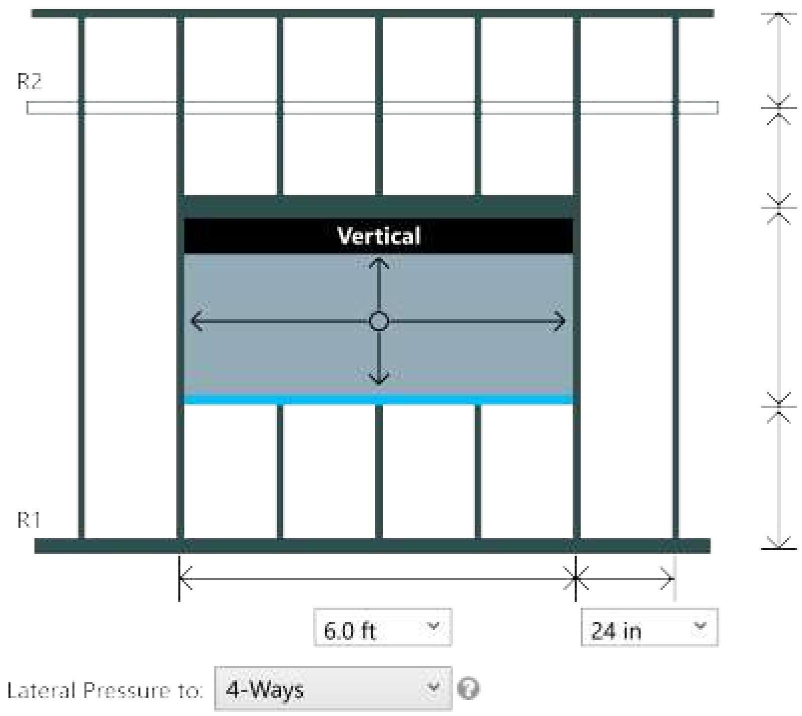
	Code Check	**Required**	**Allowed**	**Interaction**	**Notes**
Top Cant.	Max. Axial, lbs	0.0(t)	-	0%	KΦ=0.00 lb-in/in Max KL/r = N/A
	Max. Shear, lbs	200.0	1947.4	10%	Shear (Punched)
	Max. Moment (MaFy, Ma-dist), ft-lbs	799.2	1930.2	41%	Ma-dist (control),KΦ=0.00 lb-in/in
	Moment Stability, ft-lbs	639.2	2211.4	29%	
	Shear/Moment	0.36	1.00	36%	Shear 200.0, Moment 799.2
	Axial/Moment	0.41	1.00	41%	Axial 0.0(c), Moment 799.2
	Deflection Cant.	L/1619	-	-	2 x Cant.,Δ=0.0593″
Span	Max. Axial, lbs	2667.0(c)	4478.9(c)	60%	KΦ=0.00 lb-in/in Max KL/r = 105
	Max. Shear, lbs	7.7	1947.4	0%	Shear (Punched)
	Max. Moment (MaFy, Ma-dist), ft-lbs	89.0	1930.2	5%	Ma-dist (control),KΦ=0.00 lb-in/in
	Moment Stability, ft-lbs	71.1	1788.3	4%	
	Shear/Moment	0.04	1.00	4%	Shear 7.7, Moment 89.0
	Axial/Moment	0.65	1.00	65%	Axial 2667.0(c), Moment 88.9
	Deflection Span	L/8925	-	-	Δ= 0.0155″

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie Connector	Connector Interaction	Anchor Interaction
R2	-192.3	0.0	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	27.27 %	17.24 %
R1	-7.7	2667.0	600T125-33 (33) & (1) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	1.12 %	3.51 %

* Reference catalog for connector and anchor requirement notes as well as screw placement requirements

Project Name: Bearing Stud Wall with opening-BM
Model: 1-Span Opening -1
Code: IBC 2021(AISI S100-16 w/S2-20)

Date: 08/07/2026
Simpson Strong-Tie® CFS Designer™ 6.2.0.0



Lateral Pressure to: 4-Ways

Design Loads

Wall Lateral Pressure : **3 psf**
Parapet Lateral Pressure : **17 psf**
RO Lateral Pressure : **4-Ways**
Lateral element force multiplier
Strength : **1.0**
Deflection : **1**
Header: **Box (lateral top, bottom)**
Gravity Load at Header: **9 psf**
Cant. Deflection: **2 x Cantilever**
Lateral Deflection Limit: **240**
Gravity Deflection Limit: **360**
Additional Pt. Load ea. Stud : **4000 lbs**

Brace Settings

Component(s)	Members(s)	Flexural Bracing	Axial KyLy	Axial KtLt	Distortional K-Phi(lb-in/in)	Distortional Lm	Interconnection Spacing
Wall Studs	600S162-54(50), Single@24 in o/c	48 in	48 in	48 in	0	None	N/A
Jamb Studs	600S162-54(50), Boxed	48 in	48 in	48 in	0	None	12 in
Vertical Header	600S200-97(50), Boxed	Full	N/A	N/A	0	None	N/A
Lat. Top Head	600S125-54(50), Single	Full	N/A	N/A	0	None	N/A
Lat. Bottom Head	600T125-54(50), Single	Full	N/A	N/A	0	None	N/A
Sill	600T125-54(50), Single	Full	N/A	N/A	0	None	N/A

Analysis Results

Component(s)	Members(s)	Axial Load (lb)	Max KL/r	Max. Moment (ft-lb)	Max. Shear (lb)	Bottom Reaction (lb)	Top or End Reaction (lb)
Wall Studs	600S162-54(50), Single@24 in o/c	4000.0	84	272.0	136.0	10.9	194.2
Jamb Studs	600S162-54(50), Boxed	6220.6	61	163.3	68.0	6.7	67.7
Vertical Header	600S200-97(50), Boxed	N/A	N/A	9330.9	6220.6	N/A	6220.6
Lat. Top Head	600S125-54(50), Single	N/A	N/A	118.6	79.1	N/A	79.1
Lat. Bottom Head	600T125-54(50), Single	N/A	N/A	23.0	12.0	N/A	12.0
Sill	600T125-54(50), Single	N/A	N/A	45.5	27.0	N/A	27.0

Design Results

		Deflection		Interaction				
Component(s)	Members(s)	Span	Parapet	Defl.	A + M	V + M	Web Stiffners	Design OK
Wall Studs	600S162-54(50), Single@24 in o/c	L/6521	L/1254	0.19	0.87	0.13	No	Yes
Jamb Studs	600S162-54(50), Boxed	L/9345	L/3026	0.08	0.48	0.04	No	Yes
Vertical Header	600S200-97(50), Boxed	L/394	NA	0.91	0.87	0.87	R1, R2	Yes
Lat. Top Head	600S125-54(50), Single	L/6134	NA	0.04	0.09	0.07	No	Yes

Lat. Bottom Head	600T125-54(50), Single	L/32771	NA	0.01	0.02	0.00	No	Yes
Sill	600T125-54(50), Single	L/16362	NA	0.01	0.03	0.03	No	Yes

Simpson Strong-Tie® Connectors @ Studs

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Connector Interaction	Anchor Interaction
R2	194.15	0.00	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	27.54 %	17.41 %
R1	10.85	4279.00	600T125-54 (50) & (1) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	1.17 %	2.65 %

* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

Simpson Strong-Tie® Connectors @ Jambs

Support	Rx(lb)	Ry(lb)	Simpson Strong-Tie® Connector	Connector Interaction	Anchor Interaction
R2	67.70	0.00	SCB45.5(2) & (2) #12-24 SST X or XL to A36 Steel	9.60 %	6.07 %
R1	6.71	6426.06	600T125-54 (50) & (2) .157" SST PDPA/PDPAT-62KP to steel (3/16" to 1/2" thickness)	0.45 %	0.82 %

* Reference catalog for connector and anchor requirement notes as well as screw placements requirement

Simpson Strong-Tie® Wall Stud Bridging Connectors @ Studs

Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min)[1]	LSUBH (Max)[1]	SUBH (Min)[1]	SUBH (Max)[1]	MSUBH (Min)[1]	MSUBH (Max)[1]
Top Parapet	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Span	48	3	10282.0	OK (0.66)	OK (0.33)	OK (0.54)	OK (0.43)	OK (0.45)	OK (0.43)

Simpson Strong-Tie® Wall Stud Bridging Connectors @ Jambs

Span/Parapet	Bracing Length(in.)	Design Number of Braces	Pn(lb.)	LSUBH (Min)[1]	LSUBH (Max)[1]	SUBH (Min)[1]	SUBH (Max)[1]	MSUBH (Min)[1]	MSUBH (Max)[1]
Top Parapet	Span	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Span	48	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Notes:

1) Values in parentheses are stress ratios.

2) “Min.” designates a solution with the minimum number of fasteners (1) #10 screw.

3) “Max.” designates a solution requiring the maximum number of fasteners (2) #10 screws.

4) Bridging connector solutions display only if the flexural and axial bracing settings are the same.

5) If the bracing length is larger than the span length, bridging connectors are not designed.

6) “N/A” will also appear if the brace length is greater than the span length, i.e., if a cantilever is 24” long and the brace length is 60”.

7) “No Good” will display when the required brace strength exceeds the corresponding connector capacity.

8) “No Soln” will display if the stud thickness is outside the range of the bridging connector applicability.
For example, an 18 ga stud is outside the acceptable thickness range for MSUBH, which is 16 ga to 12 ga.

9) Reference www.strongtie.com for latest load data, important information, and general notes.

PacRim Engineering	PREPARED BY	DATE	REVIEWED BY	DATE
	B. Mu	7/29/2026	S. Gu	7/31/2026
	Morongo Phase II			SHEET
Job No. 511				E

Geotechnical Report

MORONGO COMBINED HEATING AND POWER
CABAZON, CALIFORNIA

GEOTECHNICAL EXPLORATION

SUBMITTED TO
Jerry Dunaway
PacRim Engineering, Inc.
9320 Chesapeake Drive, Suite 218
San Diego, CA 92123

PREPARED BY
ENGEO Incorporated

September 10, 2025

PROJECT NO.
28791.000.001

ENGEO
Expect Excellence

GEOTECHNICAL
ENVIRONMENTAL
WATER RESOURCES
CONSTRUCTION SERVICES
COASTAL/MARINE GEOTECHNICS

Project No.
28791.000.001

September 10, 2025

Mr. Jerry Dunaway
PacRim Engineering, Inc.
9320 Chesapeake Drive, Suite 218
San Diego, CA 92123

Subject: Morongo Combined Heating and Power
Cabazon, California

GEOTECHNICAL EXPLORATION

Dear Mr. Dunaway:

In accordance with your request and our proposal dated May 1, 2025, we are pleased to present this geotechnical exploration report for the Morongo Combined Heating and Power (CHP) project located at the Morongo Casino Resort and Spa in Cabazon, California. The purpose of our exploration was to characterize the subsurface conditions at the site to provide the enclosed geotechnical recommendations for design.

From a geotechnical standpoint, the site is suitable for the planned development, provided the conclusions and recommendations presented in this report are incorporated into the design. The primary geotechnical constraints that could affect development on the site include seismic ground shaking and seismic dry-sand densification. We present potential mitigation methods for the sensitive soil in this report.

If you have any questions or comments regarding this report, please call and we will be glad to discuss them with you.

Sincerely,

ENGEO Incorporated

Jake Shelton, PG

Joseph Tootle, PE, GE

REGISTERED PROFESSIONAL ENGINEER
JOSEF TOOTLE
No. 2677
GEOTECHNICAL
STATE OF CALIFORNIA

jps/pe/jjt/ca

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of this geotechnical exploration report is to provide design recommendations for the construction of the Morongo Combined Heating and Power (CHP) project and associated improvements located at the Morongo Casino Resort and Spa in Cabazon, California. We have been authorized by PacRim Engineering to conduct the following scope of services.

- Review previous geotechnical studies and reports
- Subsurface field exploration
- Soil laboratory testing
- Data analysis and conclusions
- Report preparation

In preparation of this report, we have reviewed the referenced civil and structural plans prepared by PacRim Engineering showing the location of the proposed improvements. We have also reviewed previous geotechnical reports prepared by Van Beveren and Butelo, Inc.

This report was prepared for the exclusive use of PacRim Engineering and their consultants for design of this project. If any changes are made in the character, design, or layout of the development, we should be contacted to review the conclusions and recommendations contained in this report to determine whether modifications are necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without our express written consent.

1.2 SITE AND PROJECT DESCRIPTION

The project is located at the Morongo Casino Resort and Spa in Cabazon, California as shown in the Vicinity Map, Figure 1. Proposed improvement areas consisted of an asphalt paved parking lot and driveway located north of the existing CHP facility and a landscaped area located southeast of the existing swimming pool area. A fill slope divides the parking lot and existing CHP facility, sloping downward from north to south, with elevations between about 2005 and 1955 feet above mean sea level (msl). A gabion wall was observed at the base of the fill slope, measuring approximately 10 feet high and 300 feet long. The proposed improvement area at the Pool Pump House consisted of a gravel surfaced landscaped area with various low-lying vegetation and trees and an elevation of about 1960 feet above msl.

We understand the project will consist of the design and construction of a new generator room located within the parking lot north of the main casino building, a utility bridge connecting the generator room to the existing CHP facility, and additions to the existing Pool Pump House located southeast of the existing swimming pool area. Based on review of civil and structural plans prepared by PacRim Engineering, the utility bridge is to be supported by a deep foundation system while the generator pad and pool pump house expansion areas are to be supported by a shallow foundation system.

2.0 FINDINGS

2.1 PREVIOUS INVESTIGATION AND GRADING

We reviewed previous reports prepared by Van Beveren and Butelo, Inc pertaining to the conditions of the site. An initial investigation was performed at the site consisting of advancing 19 hollow-stem-auger borings and two test pits within the area of the existing casino resort and spa building, surrounding parking lots, and parking structure (Van Beveren and Butelo, 2003). Locations of previous explorations located within and near the subject site are provided in our Site Plans, Figures 2A and 2B.

Grading of the site was observed and documented by Van Beveren and Butelo, Inc. between the dates of April 17, 2003, and September 16, 2004 (Van Beveren and Butelo, 2004). Based on the referenced report, engineered fill exists beneath portions of the casino building, pool area, the northern and southern parking lots. Cut into native alluvium was made beneath potions of the casino building and garage. In addition, the reports contain the compaction tests and locations that confirm that the fill was placed as engineered fill.

2.2 FIELD EXPLORATION

Our field exploration consisted of drilling four exploratory borings using a truck-mounted drill rig equipped with 8-inch hollow stem augers. Figures 2A and 2B present the locations of our borings. An ENGEO geologist observed the drilling and logged the subsurface conditions encountered at each location. The borings were advanced to depths between about 25½ to 51 feet below existing surface grades.

We obtained bulk soil samples from drill cuttings and retrieved both disturbed and relatively undisturbed samples at various intervals in the borings using standard penetration tests and Modified California Sampler.

The standard penetration resistance blow counts were obtained by dropping a 140-pound automatic hammer through a 30-inch free fall. The 2-inch outside diameter (O.D. split-spoon sampler) was driven 18 inches and the number of blows was recorded for each 6 inches of penetration. In addition, 2.5-inch inside diameter (I.D.) samples were obtained using a Modified California Sampler driven into the soil with the 140-pound hammer previously described. Unless otherwise indicated, the blows per foot recorded on the boring log represent the accumulated number of blows to drive the last 1 foot of penetration; the blow counts have not been converted using any correction factors. When sampler driving was difficult, penetration was recorded only as inches penetrated for 50 hammer blows.

The logs depict subsurface conditions at the exploration locations during the exploration; however, subsurface conditions may vary with time. The exploration logs are included in Appendix A.

2.3 GEOLOGY AND SEISMICITY

2.3.1 Regional Geology

The site is located within the northeastern portion of the Peninsular Ranges geomorphic province of California. The Peninsular Ranges geomorphic province stretches from the Los Angeles Basin to the tip of Baja California. It is characterized by a series of northwest-trending, fault-bound mountain ranges separated by long, broad valleys. These ranges are primarily composed of Mesozoic metamorphic rocks, which have been intruded by plutonic rocks from the southern California batholith.

2.3.2 Seismicity

The site is located in a seismically active area that contains numerous faults. Small earthquakes occur every year in the Southern California region and larger earthquakes have been recorded and can be expected to occur in the future. Faults have been cataloged and mapped by the United States Geological Survey (USGS) in the Quaternary Fault and Fold Database of the United States. An active fault is defined by the California Geologic Survey as one that experienced surface displacement within Holocene time (about the last 11,700 years) (CGS, 2018). Figure 5 shows the approximate locations of known active faults along with other Quaternary faults based on the USGS Quaternary Fault and Fold Database as well as significant historical earthquakes recorded within the Southern California region.

To identify nearby faults that are capable of generating strong seismic ground shaking at the site, we utilized the USGS Earthquake Hazard Toolbox and the 2023 National Seismic Hazard Model (NSHM) to perform a disaggregation of the seismic hazard at the peak ground acceleration (PGA) and at spectral periods up to 5 seconds for a return period of 2,475 years. The resulting faults are listed in Table 2.3.2-1.

TABLE 2.3.2-1: Faults Considered Capable of Producing Strong Ground Shaking at the Site*

SOURCE NAME	RUPTURE DISTANCE, R_{RUP}		MOMENT MAGNITUDE, M_W
	(km)	(mi)	
San Andreas (San Bernardino south) (0)	4.76	2.98	7.31
San Andreas (San Gorgonio Pass – Garnet Hill) (9)	3.13	1.96	7.01
San Gorgonio Pass (0)	3.05	1.91	7.18
San Andreas (San Gorgonio Pass – Garnett Hill) (7)	9.27	5.79	6.98

*Based on USGS Earthquake Hazard Toolbox: NSHM Conterminous U.S. 2023

These results represent known fault sources contributing at least 1 percent to the seismic hazard. The rupture distances (R_{RUP}) and mean moment magnitudes (M_W) listed are based on values assigned according to the 2023 NSHM, and the numbers in parentheses after the fault names correspond to fault subsections assigned by the NSHM. Note that the above fault table is not an exhaustive list and other faults in the region may generate seismic shaking at the project site.

2.4 SUBSURFACE CONDITIONS

The site is underlain by artificial engineered fill overlying Quaternary-age alluvium (Dibblee and Minch, 2004). The description and distribution of soil encountered during our investigation are presented below and in Appendix A.

2.4.1 Previously Placed Fill (Qpf)

We encountered artificial fill beneath existing surface improvements at Borings 1-B1, 1-B2, and 1-B2A; and at the surface at Boring 1-B3. Based on our review of the existing data we understand that engineered fill was placed during the original construction of the site. Fill thicknesses range between 10 and 20 feet across the site. The fill consisted of medium dense to very dense silty sand and silty poorly graded sand with varying amounts of gravel and cobbles.

2.4.2 Alluvium (Qal)

Quaternary-age alluvium was encountered beneath the previously placed fill in each of our borings and extended through the maximum depth explored of about 51 feet below existing surface grades. The alluvium consisted of loose to very dense, dry to slightly moist, silty sand to silty poorly graded sand with varying amounts of gravel and cobble, and silty poorly graded gravel with varying amounts of cobble.

2.5 GROUNDWATER CONDITIONS

We did not encounter groundwater or seepage during our investigation; however, it is not uncommon to encounter groundwater where none was previously observed. Fluctuations in the level of groundwater may occur due to variations in rainfall, irrigation practice, and other factors not evident at the time measurements were made.

2.6 LABORATORY TESTING

We performed laboratory tests on selected samples to evaluate their engineering properties. Selected tests included moisture-density, grain size distribution, and corrosion potential testing. Moisture contents and dry densities were recorded on the boring logs in Appendices A and C; laboratory data is included in Appendices B and D.

3.0 CONCLUSIONS

From a geotechnical engineering viewpoint, in our opinion, the site is suitable for the proposed development, provided the geotechnical recommendations in this report are properly incorporated into the design plans and specifications. The primary geotechnical constraints are seismic ground shaking, seismic dry-sand densification, and the presence of artificial fill. We summarize our conclusions below.

3.1 EXISTING ARTIFICIAL FILL

Based on our review of the existing data we understand that engineered fill was placed during the original construction of the site. Our borings indicate that the site is underlain by fill overlying Quaternary-age alluvium. Since documentation of fill placement as engineered backfill exists and we have been able to review the specifications and compaction tests, we believe that in general the existing artificial fill has and will perform well under proposed structural loads.

3.2 EXPANSIVE SOIL

Expansive soil shrinks and swells as a result of moisture changes. This can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations.

However, based on the relatively sandy and gravelly nature of site soil encountered, we anticipate that on site soil can generally be considered non-expansive and having a low expansion potential.

3.3 COLLAPSIBLE SOIL

Collapsible soil forms where alluvial soil is rapidly deposited in semi-arid to arid climates, creating a sensitive material with little to no natural cementation or strength. Collapse occurs when the subject soil is wetted or experiences increased loading, which causes rapid changes in void ratio and results in soil settlement. Indicators of potentially collapsible soil are low density and low moisture contents of in situ soil. These properties suggest the soil contains an open structure with high-void ratio and high porosity and is characteristic of a geologically young deposit and low inter-particle bonding strength (Howayek et al., 2011).

Since most of the site is underlain by previously placed engineered fill with moisture conditioning, we believe that the potential for collapse due to wetting is low.

3.4 GEOLOGIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake can generally be classified as primary and secondary. The primary effect is ground rupture, also called surface faulting. The common secondary seismic hazards include ground shaking, dry-sand seismic settlement, liquefaction, and lateral spreading. The following sections present a discussion of these hazards as they apply to the site. Based on topographic and lithologic data, the risk of regional subsidence or uplift, lurching, landslides, tsunamis, or seiches is considered low to negligible at the site.

3.4.1 Ground Rupture

There are no known active faults crossing or trending towards the property and the site is not located within an Alquist-Priolo Earthquake Fault Zone. The USGS (2016) and Dibblee and Minch (2004) show that there are no mapped Quaternary faults trending towards or crossing through the site. The nearest known active fault is the San Gorgonio Pass fault zone located about 0.7 miles northwest of the site. It is our opinion that primary fault ground rupture is unlikely at the property.

3.4.2 Ground Shaking

An earthquake of moderate to high magnitude generated near the site could cause considerable ground shaking. To mitigate the shaking effects, structures should be designed using sound engineering judgment and the 2022 California Building Code (CBC) requirements, as a minimum. Seismic design provisions of current building codes generally prescribe minimum lateral forces, applied statically to the structure, combined with the gravity forces of dead and live loads. The code-prescribed lateral forces are generally considered to be substantially smaller than the comparable forces that would be associated with a major earthquake. Therefore, structures should be able to: (1) resist minor earthquakes without damage, (2) resist moderate earthquakes without structural damage, but with some non-structural damage, and (3) resist major earthquakes without collapse, but with some structural, as well as non-structural damage. Conformance to the current building code recommendations does not constitute any kind of guarantee that significant structural damage would not occur in the event of a maximum magnitude earthquake; however, it is reasonable to expect that a well-designed and well-constructed structure will not collapse or cause loss of life in a major earthquake (SEAOC, 1996).

3.4.3 Liquefaction

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. The soil considered the most susceptible to liquefaction is clean, loose, saturated, uniformly graded fine sand below the groundwater table. Empirical evidence indicates that loose fine-grained soil, including low plasticity silt and clay, is also potentially liquefiable. When seismic ground shaking occurs, the soil is subjected to cyclic shear stresses that can cause excess hydrostatic pressures to develop and liquefaction of susceptible soil to occur. If liquefaction occurs, and if the soil consolidates or vents to the surface during and following liquefaction, ground settlement and surface deformation may occur.

The site has not been evaluated by the California Geologic Survey for liquefaction hazards (CGS, 2021). Due to the lack of shallow groundwater and the relatively dense nature of the soil beneath the site, the risks associated with liquefaction are considered negligible.

3.4.4 Lateral Spreading

Youd (1993) defined lateral spreading as “horizontal displacement of surficial soil layers as a consequence of liquefaction of a subsurface granular deposit.” This condition can occur on gently sloping ground or movement towards an incised channel or “free face.” Youd (1993, 2002, and 2009) concluded that liquefiable soil layers with corrected/normalized blow counts, $(N_1)_{60}$, greater than 15 are too dense and too dilative for shallow lateral spreads to develop at shallow depths, at least for earthquakes with magnitude less than 8. As mentioned earlier in this report, groundwater is deeper than our deepest exploration depths and liquefaction potential at the site is low. Considering that lateral spread occurs as a consequence of liquefaction, and liquefaction potential is negligible, we conclude that the potential for lateral spreading at the site is also negligible.

3.4.5 Dry-Sand Densification

Dry-sand densification is a result of dry or partially saturated sand that compresses from seismic loading, which can lead to settlement. Sand encountered at our site generally consisted of silty sand with high fines content. Limited amounts of loose to medium dense clean sand were encountered within isolated areas of the engineered fill explorations. Given the previous documentation, and overall consistency, of the fill, the potential for significant dry-sand densification during the maximum credible earthquake is considered low at the site.

3.5 2022 CBC SEISMIC DESIGN PARAMETERS

The 2022 CBC utilizes seismic design criteria established in the ASCE/SEI Standard “Minimum Design Loads and Associated Criteria for Buildings and Other Structures,” (ASCE 7-16). Based on the subsurface data, including shear-wave velocity measurements, we characterized the site as Site Class D in accordance with Chapter 20 of ASCE 7-16.

ASCE 7-16 requires a site-specific ground-motion hazard analysis for Site Class D sites with a mapped S_1 value greater than or equal to 0.2; however, Section 11.4.8 of ASCE 7-16 and Supplement No. 3 provide an exception to this requirement. A site-specific ground-motion hazard analysis is not required where the value of the parameter S_{M1} determined by Equation 11.4-2 and shown in Table 3.5-1 is increased by 50 percent for developing the mapped Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral response, calculating S_{D1}, and evaluating C_s in accordance with Chapter 12 of ASCE 7-16.

In Table 3.6-1 below, we provide the 2022 CBC seismic parameters based on the United States Geological Survey's (USGS') Seismic Design Maps for your use. When using this table, considerations should be given to exceptions in Section 11.4.8 of ASCE 7-16, as described in this report.

TABLE 3.5-1: 2022 CBC Seismic Design Parameters

PARAMETER	VALUE	
	GENERATOR PAD	POOL PUMP HOUSE
Latitude	33.92363839	33.92163469
Longitude	-116.79912142	-116.79847496
Site Class	D	D
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	2.161	2.144
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.914	0.906
Site Coefficient, F_A	1	1
Site Coefficient, F_V	1.7*	1.7*
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	2.161	2.144
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	1.554*	1.54*
Design Spectral Response Acceleration at Short Periods, S_{DS} (g)	1.441	1.429
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	1.036*	1.026*
Mapped MCE Geometric Mean (MCE_G) Peak Ground Acceleration, PGA (g)	0.931	0.924
Site Coefficient, F_{PGA}	1.1	1.1
MCE_G Peak Ground Acceleration adjusted for Site Class effects, PGA_M (g)	1.024	1.016
Long period transition-period, T_L	8	8

*The parameters above should only be used for calculation of T_s, determination of Seismic Design Category, and, when taking the exceptions under Items 1 and 2 of ASCE 7-16 Section 11.4.8. (Supplement Number 3 https://ascelibrary.org/doi/epdf/10.1061/9780784414248.sup3).

We recommend that we collaborate with the Structural Engineer-of-Record to further evaluate the effects of taking the exceptions on the structural design and the potential benefit of a site-specific seismic-hazard analysis. We can provide a site-specific seismic-hazard analysis and ground-motion study separately, if needed.

3.6 SOIL CORROSION POTENTIAL

Two representative soil samples were collected for soil corrosion analyses during our field exploration. The results are included in Appendix B and listed in the table below.

TABLE 3.6-1: Corrosivity Test Results

SAMPLE LOCATION*	DEPTH (feet)	SULFATE (CTM 417) (MG/KG)	RESISTIVITY (OHMS-CM)	pH	CHLORIDE (MG/KG)
1-B2	5-6.5	19.1	9,180	8.31	19.7
1-B2	20-21.5	23.6	7,192	8.56	22.7

*Location provided on Figures 2A and 2B

The 2022 CBC references the 2019 American Concrete Institute Manual, ACI 318-19, Section 19.3.1 for concrete durability requirements. ACI Table 19.3.1.1 provides the following exposure categories and classes, and Table 19.3.2.1 provides requirements for concrete in contact with soil based upon the exposure class.

TABLE 3.6-2: ACI Table 19.3.1.1: Exposure Categories and Classes

<table>
<tr><th>CATEGORY</th><th>CLASS</th><th colspan="2">CONDITION</th></tr>
<tr><td rowspan="4">Freezing and thawing (F)</td><td>F0</td><td colspan="2">Concrete not exposed to freezing-and-thawing cycles</td></tr>
<tr><td>F1</td><td colspan="2">Concrete exposed to freezing-and-thawing cycles with limited exposure to water</td></tr>
<tr><td>F2</td><td colspan="2">Concrete exposed to freezing-and-thawing cycles with frequent exposure to water</td></tr>
<tr><td>F3</td><td colspan="2">Concrete exposed to freezing-and-thawing cycles with frequent exposure to water and exposure to deicing chemicals</td></tr>
<tr><th></th><th></th><th>WATER-SOLUBLE SULFATE (SO_4^{2-}) IN SOIL, % BY MASS[1]</th><th>DISSOLVED SULFATE (SO_4^{2-}) IN WATER MG/KG (PPM)[2]</th></tr>
<tr><td rowspan="4">Sulfate (S)</td><td>S0</td><td>$SO_4^{2-} < 0.10$</td><td>$SO_4^{2-} < 150$</td></tr>
<tr><td>S1</td><td>$0.10 \leq SO_4^{2-} < 0.20$</td><td>$150 \leq SO_4^{2-} \leq 1{,}500$
or seawater</td></tr>
<tr><td>S2</td><td>$0.20 \leq SO_4^{2-} \leq 2.00$</td><td>$1{,}500 \leq SO_4^{2-} \leq 10{,}000$</td></tr>
<tr><td>S3</td><td>$SO_4^{2-} > 2.00$</td><td>$SO_4^{2-} > 10{,}000$</td></tr>
<tr><th></th><th></th><th colspan="2">CONDITION</th></tr>
<tr><td rowspan="3">In contact with water (W)</td><td>W0</td><td colspan="2">Concrete dry in service</td></tr>
<tr><td>W1</td><td colspan="2">Concrete in contact with water where low permeability is not required</td></tr>
<tr><td>W2</td><td colspan="2">Concrete in contact with water where low permeability is required</td></tr>
<tr><td rowspan="3">Corrosion protection of reinforcement (C)</td><td>C0</td><td colspan="2">Concrete dry or protected from moisture</td></tr>
<tr><td>C1</td><td colspan="2">Concrete exposed to moisture but not to an external source of chlorides</td></tr>
<tr><td>C2</td><td colspan="2">Concrete exposed to moisture and an external source of chlorides from deicing chemicals, salt, brackish water, seawater, or spray from these sources</td></tr>
</table>

[1] Percent sulfate by mass in soil determined by ASTM C1580
[2] Concentration of dissolved sulfates in water in ppm determined by ASTM D516 or ASTM D4130

In accordance with the criteria presented in the above table, this soil is categorized as within the F0 freeze-thaw class, S0 sulfate exposure class, W0 moisture/water exposure class and C0 corrosion class.

Considering the S0 'Not Applicable' sulfate exposure, there is no requirement for cement type or water-cement ratio; however, a minimum concrete compressive strength of 2,500 psi is specified by the building code. For this sulfate range, we recommend Type II cement and a concrete mix design for foundations and building slabs-on-grade that incorporates a maximum water-cement ratio of 0.50. It should be noted, however, that the structural engineering design requirements for concrete may result in more stringent concrete specifications.

Based on the resistivity measurements, the soil is considered moderately corrosive to buried ferrous metal (Roberge, 2006). Values tested for chloride do not pose a significant impact to metals or concrete.

If desired to investigate this further, we recommend a corrosion consultant be retained to evaluate if specific corrosion recommendations are advised for the project.

4.0 CONSTRUCTION MONITORING

Our experience and that of our profession clearly indicate that the risk of costly design, construction, and maintenance problems can be significantly lowered by retaining the design geotechnical engineering firm to:

1. Review the final grading and foundation plans and specifications prior to construction to evaluate whether our recommendations have been implemented, and to provide additional or modified recommendations, as needed. This also allows us to check if any changes have occurred in the nature, design, or location of the proposed improvements and provides the opportunity to prepare a written response with updated recommendations.
2. Perform construction monitoring to check the validity of the assumptions we made to prepare this report. Earthwork operations should be performed under the observation of our representative to check that the site is properly prepared, the selected fill materials are satisfactory, and that placement and compaction of the fill has been performed in accordance with our recommendations and the project specifications. Sufficient notification to us prior to earthwork is important.

If we are not retained to perform the services described above, then we are not responsible for any party’s interpretation of our report (and subsequent addenda, letters, and verbal discussions).

5.0 EARTHWORK RECOMMENDATIONS

The relative compaction and optimum moisture content of soil, rock, and aggregate base referred to in this report are based on the most recent ASTM D1557 test method. Compacted soil is not acceptable if it is unstable. It should exhibit only minimal flexing or pumping, as determined by an ENGEO representative. As used in this report, the term “moisture condition” refers to adjusting the moisture content of the soil by either drying if too wet or adding water if too dry.

We define “structural areas” in a subsequent section of this report as any area sensitive to settlement of compacted soil. These areas include, but are not limited to building pads, sidewalks, pavement areas, and retaining walls.

5.1 GENERAL SITE CLEARING

Areas to be developed should be cleared of surface and subsurface deleterious materials, including existing building foundations, slabs, buried utility and irrigation lines, pavements, debris, and designated trees, surface organic material, shrubs, and associated roots. Excavations extending below the planned finished site grades should be cleaned and backfilled with suitable material and compacted to the recommendations presented in Section 5.4.

5.2 OVER-OPTIMUM SOIL MOISTURE CONDITIONS

The contractor should anticipate over-optimum (wet) soil moisture conditions during winter months or immediately following heavy rains. Under-optimum (dry) soil moisture conditions may be encountered during summer and fall months.

Wet soil conditions can generally be mitigated by:

1. Frequent spreading and mixing during warm dry weather,
2. Mixing with drier materials,
3. Mixing with a lime or cement product, or
4. Stabilizing with aggregate, geotextile stabilization fabric, or both.

Dry soil conditions can generally be mitigated by:

1. Ripping, adding water, mixing, and recompacting.
2. Mixing with wetter materials.
3. Sprinkling or wetting the exposed surface for several days.

5.3 ACCEPTABLE FILL

On-site soil material is suitable as fill material provided it is processed to remove concentrations of organic material, debris, and particles greater than 6 inches in maximum dimension. Imported fill materials should have a plasticity index equal to or less than 15. Allow ENGEO to sample and test proposed imported fill materials at least 5 days prior to delivery to the site.

5.4 FILL COMPACTION

5.4.1 General

Once a suitable firm base is achieved, the exposed non-yielding surface should be scarified to an approximate depth of 12 inches, moisture conditioned and compacted to provide adequate bonding with the initial lift of fill. Engineered fill should be spread in loose lifts that do not exceed 8 inches in thickness, or the depth of penetration of the compaction equipment used, whichever is less. Engineered fill should be placed according to the following fill specifications, depending upon location and material.

5.4.2 Grading in Structural Areas

Subgrade compaction should be performed prior to fill placement and following cutting operations as follows.

- Scarify to a depth of 12 inches
- Moisture condition to at least optimum moisture content
- Compact the soil to a minimum of 90 percent of relative compaction (ASTM D1557)

After the subgrade has been compacted, fill up to 10 feet thick, and underground utility backfill, should be placed and compacted as follows.

- Spread fill in loose lifts that do not exceed 8 inches
- Moisture condition to at least optimum moisture content
- Compact the soil to a minimum of 90 percent of relative compaction (ASTM D1557)
- Compact the upper 12 inches of finish pavement subgrade to at least 95 percent relative compaction prior to aggregate base placement

We may allow thicker loose lift thicknesses based on acceptable density test results, where increased effort is applied to rocky fill, or for the first lift of fill over pipe bedding.

5.4.3 Aggregate Base

Compact the pavement aggregate base section to at least 95 percent relative compaction (ASTM D1557). Moisture condition aggregate base to at least optimum moisture content prior to compaction.

5.5 REUSE OF ON-SITE RECYCLED MATERIALS

If desired to reuse asphaltic or Portland Cement concrete as engineered fill, we recommend that it be ground up and thoroughly mixed with on-site or import soil. In general, recycled asphalt or concrete should be ground down to less than 4 inches in greatest dimension, with no more than 25 percent larger than 2½ inches. Recycled material should be thoroughly mixed with a sufficient amount of soil, such that there is no more than 40 percent by weight of recycled material in the final mix.

5.6 SITE DRAINAGE

The project civil engineer is responsible for designing surface drainage improvements. From a geotechnical engineering perspective, we provide the following minimum recommendations for surface drainage.

- If landscape areas requiring limited irrigation are required, the planter areas should be underlain by impermeable liners.
- Pavement areas should be sloped a minimum of 1 percent toward drop inlets or other surface drainage facilities.
- Finished grade should be sloped away from structure exteriors at a minimum of 2 percent.
- Surface water should be collected and discharged into outlets approved by the civil engineer, unless collected into areas planned for infiltration or reuse.
- Building downspouts should be connected directly into the storm drain system.

6.0 FOUNDATION RECOMMENDATIONS

We developed structural improvement recommendations using data obtained from our field exploration, laboratory test results, and engineering analysis. Provided our recommendations in Section 5 are followed, the proposed generator room expansion and pool pump house can be supported on conventional shallow foundation system or a structural reinforced mat foundation bearing entirely in engineered fill. The proposed utility bridge can be supported by a deep foundation system bearing entirely in competent alluvium.

We will continue discussing alternative foundation systems with you and the design team and can provide additional recommendations as the design progresses.

6.1 CONVENTIONAL FOOTINGS WITH CONCRETE SLAB

6.1.1 Footing Dimensions and Allowable Bearing Capacity

If conventional footings with a concrete slab are selected for the support of structural loads, we recommend the footings should have the minimum dimensions shown in Table 6.1.1-1 below.

TABLE 6.1.1-1: Minimum Footing Dimensions

FOOTING TYPE	*MINIMUM DEPTH (inches)	MINIMUM WIDTH (inches)
Continuous	18	24
Isolated	18	24

* below lowest adjacent soil subgrade

We recommend a maximum allowable bearing pressure of 3,000 pounds per square foot (psf) for dead-plus-live loads. The bearing pressure may be increased to 4,000 psf for the short-term effects of wind or seismic loading. With these allowable pressures the expected settlement of the foundations will be less than ½ inches.

The maximum allowable bearing pressure is a net value; the weight of the footing may be neglected for design purposes. Footings located adjacent to utility trenches should have their bearing surfaces below an imaginary 1:1 (horizontal:vertical) plane projected upward from the bottom edge of the trench to the footing.

6.1.2 Foundation Lateral Resistance

Lateral loads may be resisted by friction along the base and by passive resistance along the sides of foundations. The passive resistance is based on an equivalent fluid pressure in pounds per cubic foot (pcf). We recommend the following allowable values for design.

- Passive Lateral Resistance: 350 pcf
- Coefficient of Friction: 0.30

The values may be increased by one-third for the short-term effects of wind or seismic loading.

6.2 SLABS-ON-GRADE

6.2.1 Interior Concrete Floor Slabs

We recommend the following minimum design.

1. Provide a minimum concrete thickness of 5 inches.
2. In lieu of welded wire mesh, consideration should be given to reinforcing slab-on-grade floors with steel bars within the middle third of the slab to help control the width of shrinkage cracking that inherently occurs as concrete cures.

The structural engineer should provide final design thickness and additional reinforcement, as necessary, for the intended structural loads.

6.2.2 Slab Moisture Vapor Reduction

When buildings are constructed with concrete slab-on-grade, water vapor from beneath the slab will migrate through the slab and into the building. This water vapor can be reduced but not stopped. Vapor transmission can negatively affect floor coverings and lead to increased moisture within a building. When water vapor migrating through the slab would be undesirable, we recommend the following to reduce, but not stop, water vapor transmission upward through the slab-on-grade.

1. A moisture retarder system should be installed directly beneath the slab on-grade that consists of the following.
    a. Vapor retarder membrane sealed at all seams and pipe penetrations and connected to all footings. Vapor retarders shall conform to Class A vapor retarder in accordance with ASTM E 1745, latest edition, “Standard Specification for Plastic Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs.” The vapor retarder should be **underlain by:**
    b. Four inches of clean crushed rock. Crushed rock should have 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 Sieve.
2. A concrete water-cement ratio for slabs-on-grade of no more than 0.50 should be used.
3. Inspection and testing should be provided during concrete placement to check that the proper concrete and water cement ratio are used.
4. Slabs should cure for a minimum of 3 days or use other equivalent curing specified by the structural engineer.

The structural engineer should be consulted as to the use of a layer of clean sand or pea gravel (less than 5 percent passing the U.S. Standard No. 200 Sieve) placed on top of the vapor retarder membrane to assist in concrete curing.

6.2.3 Subgrade Modulus for Structural Slab Design

Provided the site earthwork is conducted in accordance with the recommendations of this report, a subgrade modulus of 150 psi/in can be used for structural slab design.

6.3 DRILLED PIERS – UTILITY BRIDGE

The proposed utility bridge can be supported on drilled, cast-in-place, straight-shaft friction piers. The piers should have a minimum diameter of 18 inches and extend to a depth of at least 15 feet below the existing ground surface, or 5 feet into the native dense alluvium, whichever is greater. Pier should be designed for an allowable downward skin friction of 500 pounds per square foot for combined dead-plus-live loads with a one-third increase allowed for either transient wind or seismic loading. The skin friction should be disregarded in the upper 2 feet of embedment and above.

Resistance to uplift loads is developed in friction along the pier shafts. We recommend that an allowable uplift frictional resistance of 350 pounds per square foot be used. This value can be increased by one-third to account for transient wind or seismic loading.

Lateral loads exerted on drilled piers and may be resisted by a passive resistance based on an equivalent fluid pressure of 350 pounds per cubic foot acting over two pier diameters may be used for the portions below a depth of 2 feet, and as long as there is at least 10 feet of horizontal distance from the pier to the edge of any slope.

The bottoms of pier excavations should be dry, reasonably clean, and free of loose soil before reinforcing steel is installed and concrete is placed. We recommend that the excavation of piers be performed under our direct observation to establish that the piers are founded in suitable materials and constructed in accordance with the recommendations presented in this letter.

Due to the presence of gravel and cobbles, there is a potential for caving. If caving occurs, shafts may need to be cased. If groundwater is encountered, remove it from excavations prior to concrete placement. If groundwater cannot be removed from excavations prior to concrete placement, then we recommend that concrete be placed by tremie pipe. The concrete should be tremied to the bottom of the hole keeping the tremie pipe below the surface of the concrete to avoid entrapment of water in the concrete. As concrete is poured, water is displaced out of the hole.

7.0 RETAINING WALLS

7.1 LATERAL SOIL PRESSURES

Retaining walls should be designed to resist lateral earth pressures from adjoining natural materials and/or backfill and from surcharge loads. Provided that adequate drainage is included as recommended below, walls restrained from movement at the top should be designed to resist an equivalent fluid pressure of 60 pounds per cubic foot (pcf). In addition, design restrained walls to resist an additional uniform pressure equivalent to one-half of any surcharge loads applied at the surface.

Design drained, unrestrained retaining walls up to 10 feet high for active lateral equivalent fluid pressures as follows. If site walls over 6 feet are planned, a seismic increment should be considered.

TABLE 7.1-1: Retaining Wall Earth Pressures

BACKFILL SLOPE CONDITION (horizontal:vertical)	ACTIVE PRESSURE (pounds per cubic foot)
Level	40
3:1	50
2:1	60

The above lateral earth pressures assume sufficient drainage, as described in Section 7.2, behind the walls to prevent any build-up of hydrostatic pressures from surface water infiltration and/or a rise in the groundwater level. If adequate drainage is not provided, we recommend that an additional equivalent fluid pressure of 40 pcf be added to the values recommended above for both restrained and unrestrained walls. Damp-proofing of the walls should be included in areas where wall moisture would be problematic.

Walls retaining greater than 6 feet of backfill may need to be designed to resist seismic pressure in addition to static pressures. Under seismic conditions, the active incremental seismic force along the face of the wall should be added to the static active pressure and can be calculated as follows.

$$\Delta P = 24 \text{ x } H^2$$

Where H is the design height of the wall (in feet) and ΔP is the active incremental seismic force in pounds per foot of wall. Since seismic loading requires soil movement, evaluation of the seismic case should comprise adding the seismic increment to the active soil pressure for all wall types. The resultant seismic force should be applied at 1/3*H from the base of the wall, indicative of a triangular pressure distribution. The seismic active earth pressure increment presented above is applicable for level backfill only. ENGEO should be consulted if sloping backfill is anticipated for retaining walls.

7.2 RETAINING WALL DRAINAGE

Construct either graded rock drains or geosynthetic drainage composites behind the retaining walls to reduce hydrostatic lateral forces. For rock drain construction, we recommend two types of rock drain alternatives.

1. A minimum 12-inch-thick layer of Class 2 Permeable Filter Material (Caltrans Specification 68-2.02F) placed directly behind the wall, or
2. A minimum 12-inch-thick layer of washed, crushed rock with 100 percent passing the ¾-inch sieve and less than 5 percent passing the No. 4 sieve. Envelop rock in a minimum 6-ounce, non-woven geotextile filter fabric.

For both types of rock drains:

1. Place the rock drain directly behind the walls of the structure.
2. Extend rock drains from the wall base to within 12 inches of the top of the wall.
3. Place a minimum of 4-inch-diameter perforated pipe (glued joints and end caps) at the base of the wall, inside the rock drain and fabric, with perforations placed down.

4. Place pipe at a gradient at least 1 percent to direct water away from the wall by gravity to a drainage facility.

ENGEO should review and approve geosynthetic composite drainage systems prior to use.

7.3 BACKFILL

Backfill behind retaining walls should be placed and compacted in accordance with Section 5.0. Use light compaction equipment within 5 feet of the wall face. If heavy compaction equipment is used, the walls should be temporarily braced to avoid excessive wall movement.

7.4 FOUNDATIONS

Retaining walls may be supported on continuous footings bearing in engineered fill designed in accordance with recommendations presented in Section 6.1. For sloping foreground conditions, passive resistance should start at the depth necessary to achieve a horizontal distance of 10 feet between the wall elements and the nearest free face.

7.5 EXTERIOR FLATWORK RECOMMENDATIONS

Exterior flatwork includes items such as concrete sidewalks, steps, and outdoor courtyards exposed to foot traffic only. Provide a minimum section of 4 inches of concrete over compacted subgrade. In addition:

1. Compact the subgrade to at least 95 percent relative compaction (ASTM D1557).
2. Construct control and construction joints in accordance with current Portland Cement Association Guidelines.

8.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report presents geotechnical recommendations for design of the improvements discussed in Section 1.2 for the CHP project. If changes occur in the nature or design of the project, we should be allowed to review this report and provide additional recommendations, if any. It is the responsibility of the owner to transmit the information and recommendations of this report to the appropriate organizations or people involved in design of the project, including but not limited to developers, owners, buyers, architects, engineers, and designers. The conclusions and recommendations contained in this report are solely professional opinions and are valid for a period of no more than 2 years from the date of report issuance.

We strive to perform our professional services in accordance with generally accepted principles and practices currently employed in the area; there is no warranty, express or implied. There are risks of earth movement and property damages inherent in building on or with earth materials. We are unable to eliminate all risks; therefore, we are unable to guarantee or warrant the results of our services.

This report is based upon field and other conditions discovered at the time of report preparation. We developed this report with limited subsurface exploration data. We assumed that our subsurface exploration data are representative of the actual subsurface conditions across the site. Considering possible underground variability of soil and groundwater, additional costs may be required to complete the project. We recommend that the owner establish a contingency fund to cover such costs. If unexpected conditions are encountered, ENGEO must be notified immediately to review these conditions and provide additional and/or modified recommendations, as necessary.

Our services did not include excavation sloping or shoring, soil volume change factors, flood potential, or a geohazard exploration. In addition, our geotechnical exploration did not include work to determine the existence of possible hazardous materials. If any hazardous materials are encountered during construction, the proper regulatory officials must be notified immediately.

This document must not be subject to unauthorized reuse, that is, reusing without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time.

Actual field or other conditions will necessitate clarifications, adjustments, modifications, or other changes to ENGEO's documents. Therefore, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications, or other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-site construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies, or other changes necessary to reflect changed field or other conditions.

We determined the lines designating the interface between layers on the exploration logs using visual observations. The transition between the materials may be abrupt or gradual. The exploration logs contain information concerning samples recovered, indications of the presence of various materials such as clay, sand, silt, rock, existing fill, etc., and observations of groundwater encountered. The field logs also contain our interpretation of the subsurface conditions between sample locations. Therefore, the logs contain both factual and interpretative information. Our recommendations are based on the contents of the final logs, which represent our interpretation of the field logs.

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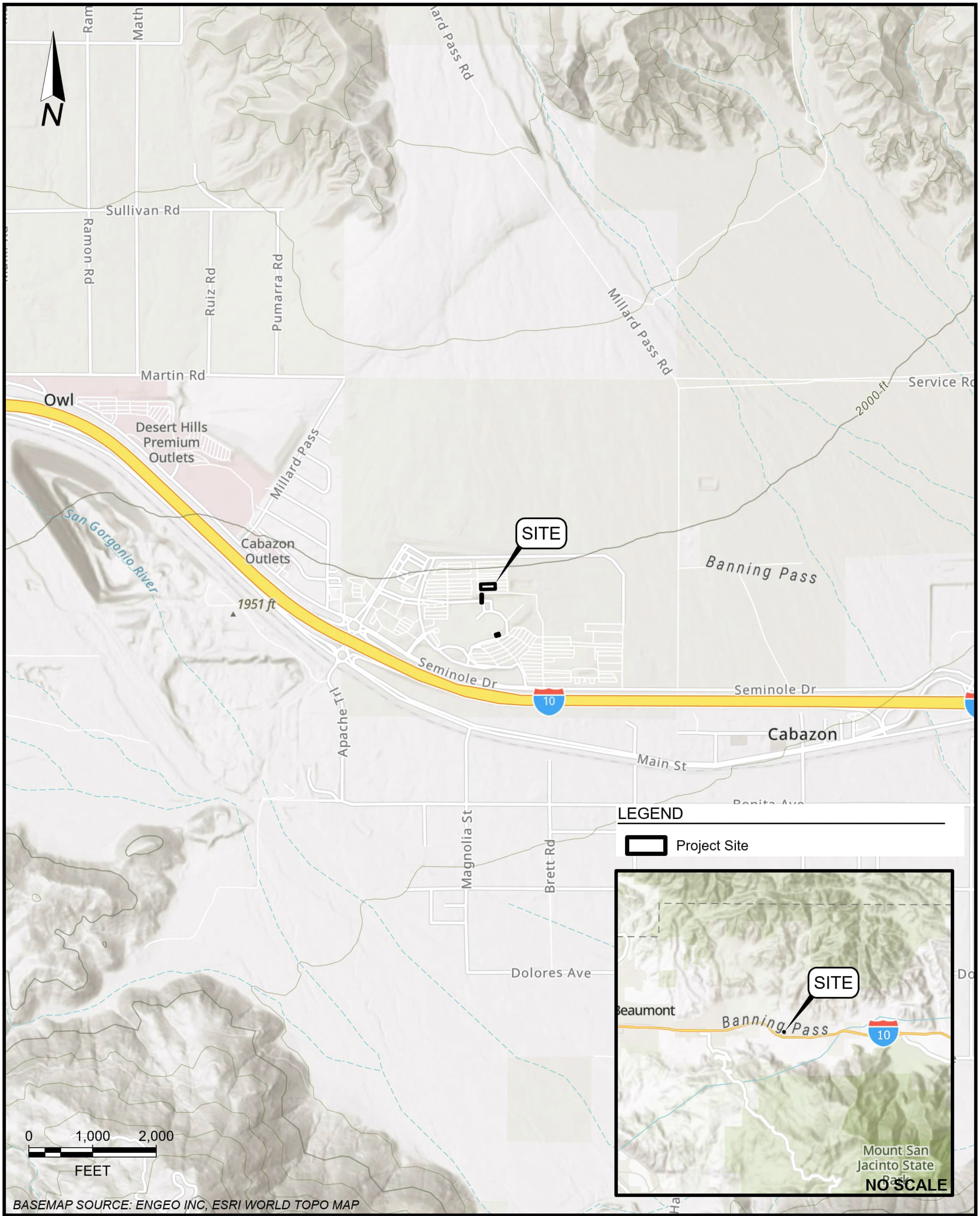
FIGURES



BASEMAP SOURCE: ENGEO INC, ESRI WORLD TOPO MAP

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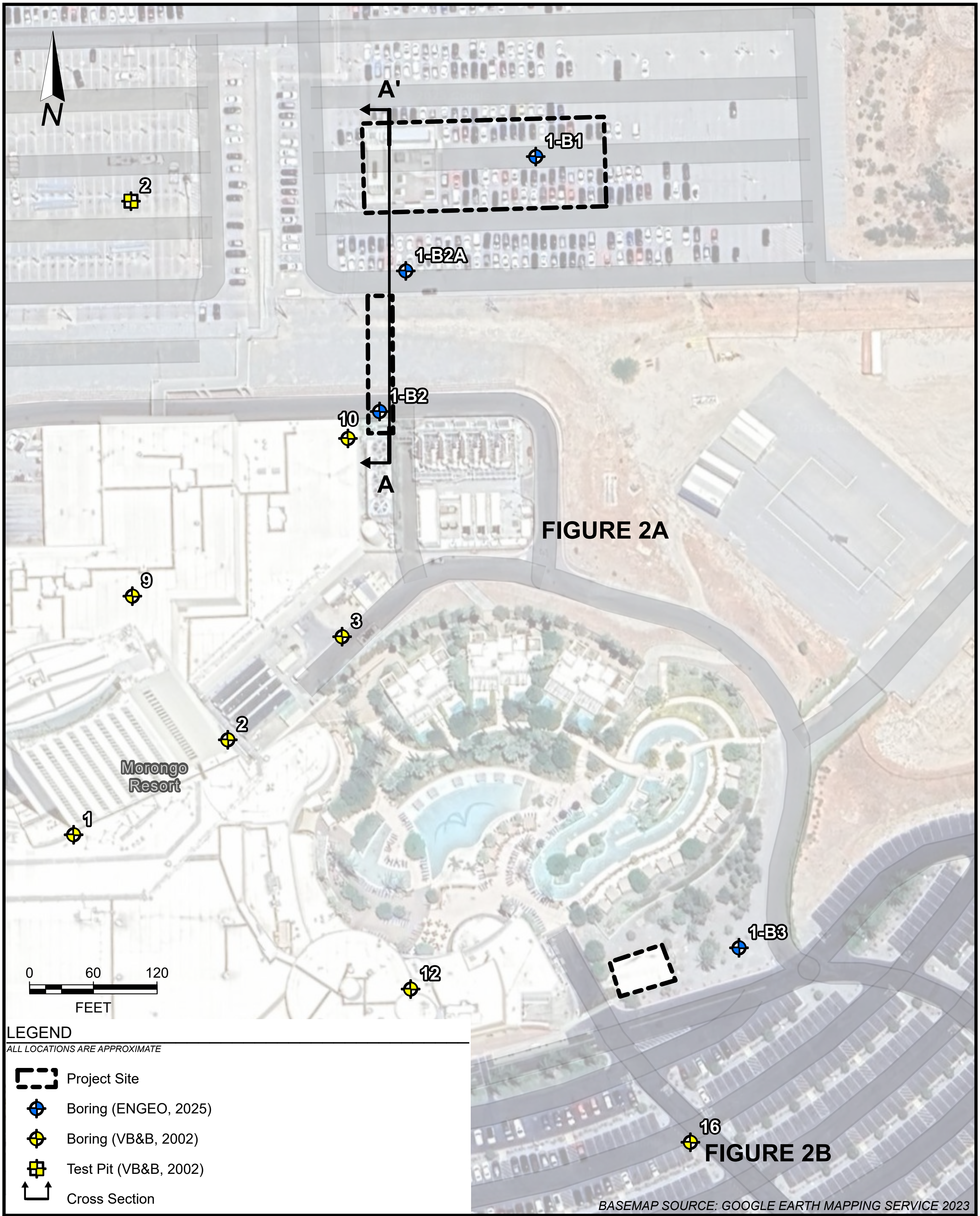
VICINITY MAP
MORONGO COMBINED HEATING AND POWER (CHP)
CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001
SCALE: AS SHOWN
DRAWN BY: LVL
CHECKED BY: KJM
FIGURE NO. 1

PATH: G:\DRAFTING\PROJECTS_28000 TO 29999\28791\028791000001\GEOTECHNICAL\GEX\028791000001-GEX-0825.APRX
LAYOUT: 01. VICINITY 8.5 X 11 PORTRAIT USER: LLOWY

ORIGINAL FIGURE PRINTED IN COLOR



BASEMAP SOURCE: GOOGLE EARTH MAPPING SERVICE 2023

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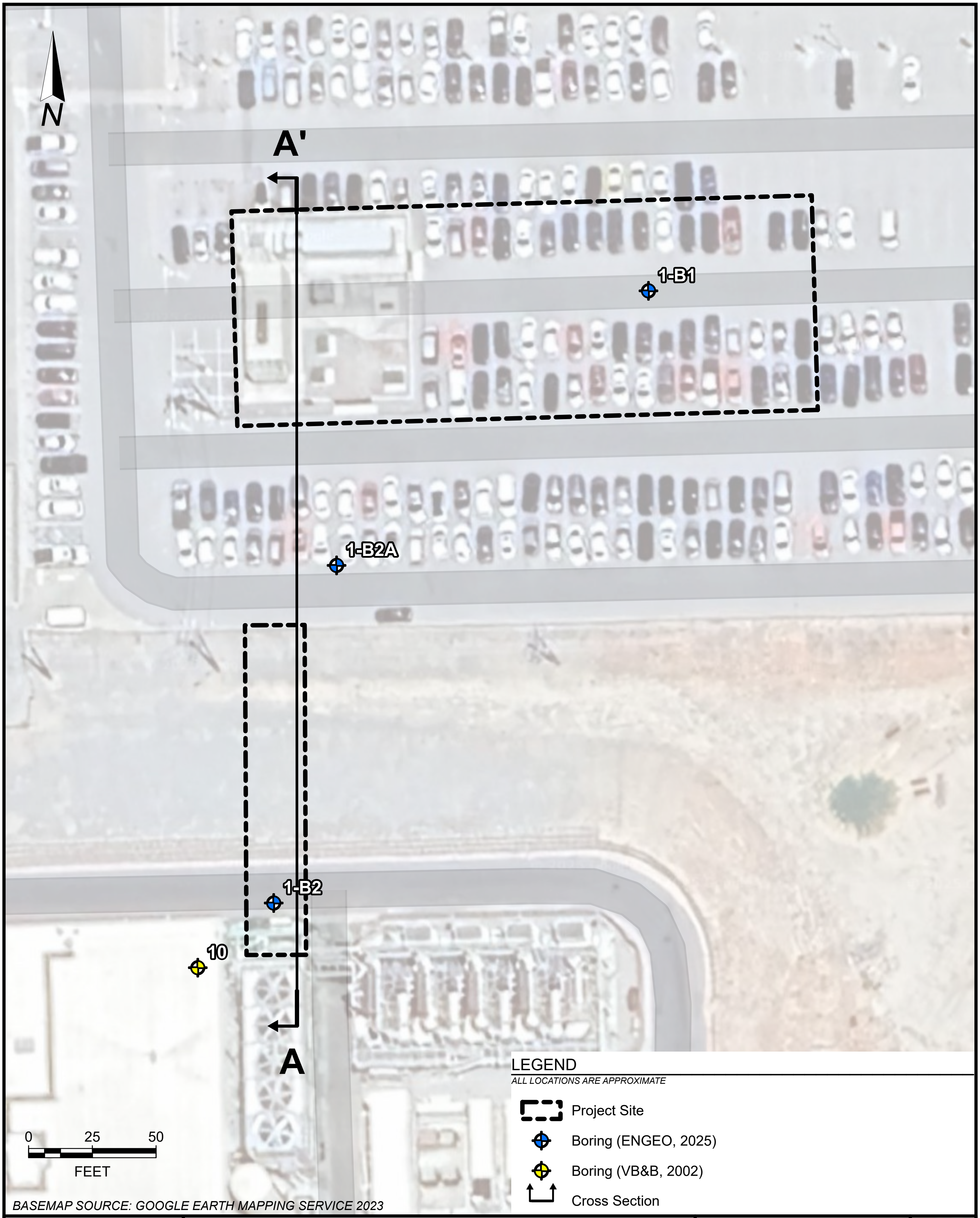
SITE PLAN
MORONGO COMBINED HEATING AND POWER (CHP)
CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001
SCALE: AS SHOWN
DRAWN BY: LVL
CHECKED BY: KJM
FIGURE NO. 2

PATH: G:\DRAFTING\PROJECTS_28000 TO 29999\28791\028791000001\GEOTECHNICAL\GEX\028791000001-GEX-0825.APRX
LAYOUT: 02. SITE PLAN 8.5 X 11 PORTRAIT USER: LLOWY

ORIGINAL FIGURE PRINTED IN COLOR



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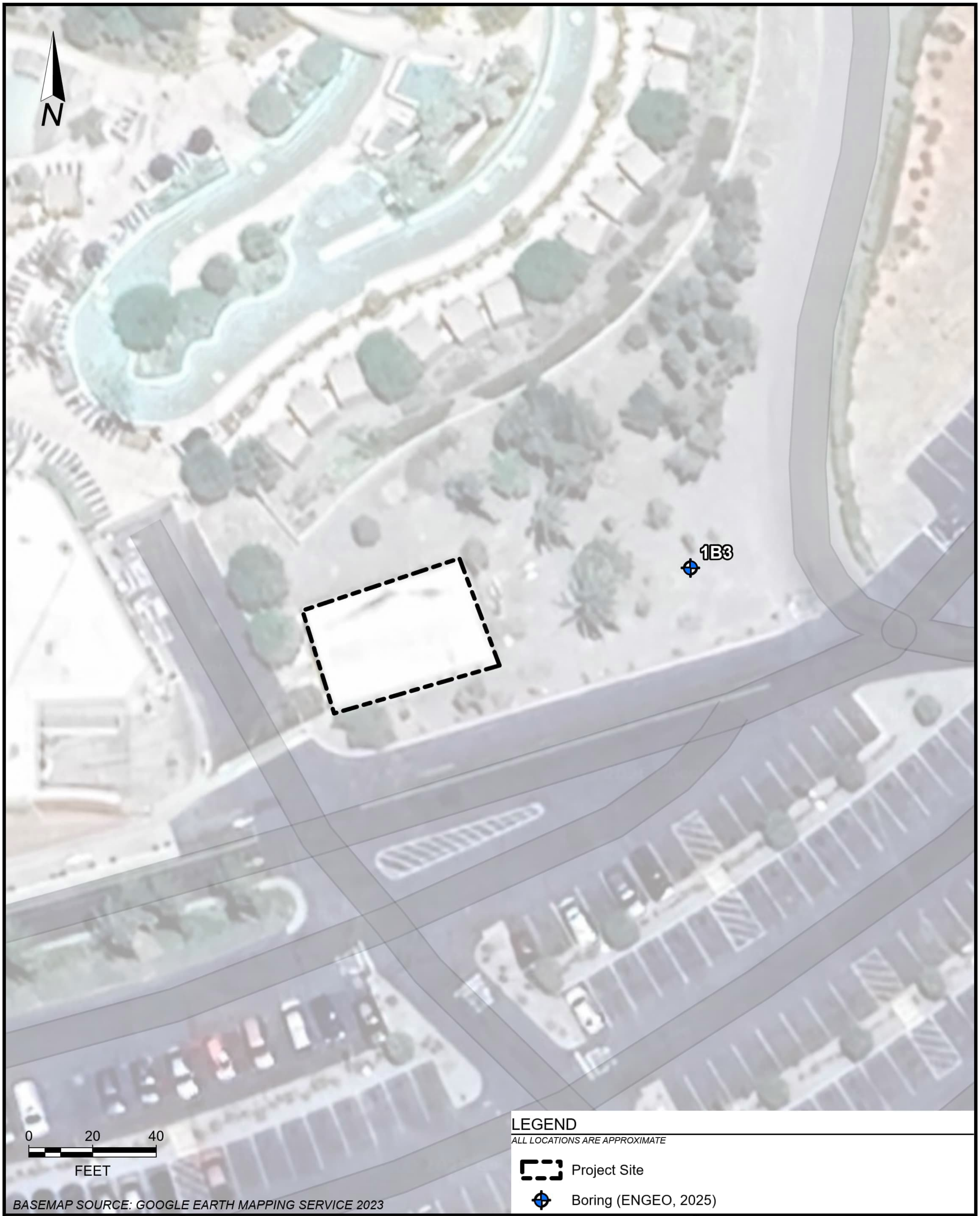
SITE PLAN
MORONGO COMBINED HEATING AND POWER (CHP)
CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001
SCALE: AS SHOWN
DRAWN BY: LVL
CHECKED BY: KJM
FIGURE NO.
2A

PATH: G:\DRAFTING\PROJECTS_28000 TO 29999\28791\028791000001\GEOTECHNICAL\GEX\028791000001-GEX-0825.APRX
LAYOUT: 02A. SITE PLAN 8.5 X 11 PORTRAIT USER: LLOWY

ORIGINAL FIGURE PRINTED IN COLOR



BASEMAP SOURCE: GOOGLE EARTH MAPPING SERVICE 2023

LEGEND

ALL LOCATIONS ARE APPROXIMATE

- ▭ Project Site
- ⊕ Boring (ENGEO, 2025)

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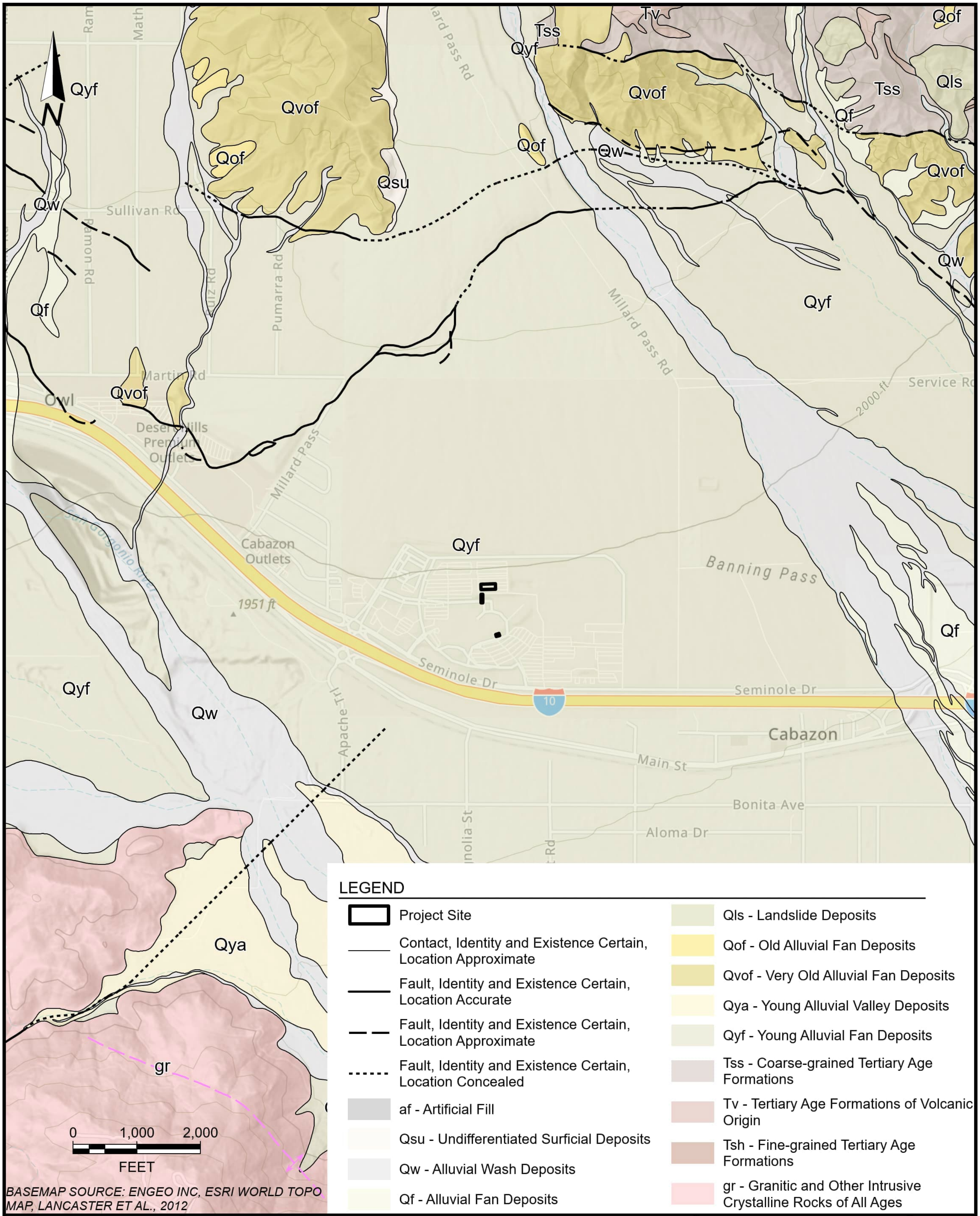
SITE PLAN

MORONGO COMBINED HEATING AND POWER (CHP)
CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001
SCALE: AS SHOWN
DRAWN BY: LVL
CHECKED BY: KJM
FIGURE NO. 2B

PATH: G:\DRAFTING\PROJECTS_28000 TO 29999\28791\028791000001\GEOTECHNICAL\GEX\028791000001-GEX-0825.APRX
LAYOUT: 02B. SITE PLAN 8.5 X 11 PORTRAIT USER: LLOWY

ORIGINAL FIGURE PRINTED IN COLOR



BASEMAP SOURCE: ENGEO INC, ESRI WORLD TOPO MAP, LANCASTER ET AL., 2012

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REGIONAL GEOLOGIC MAP

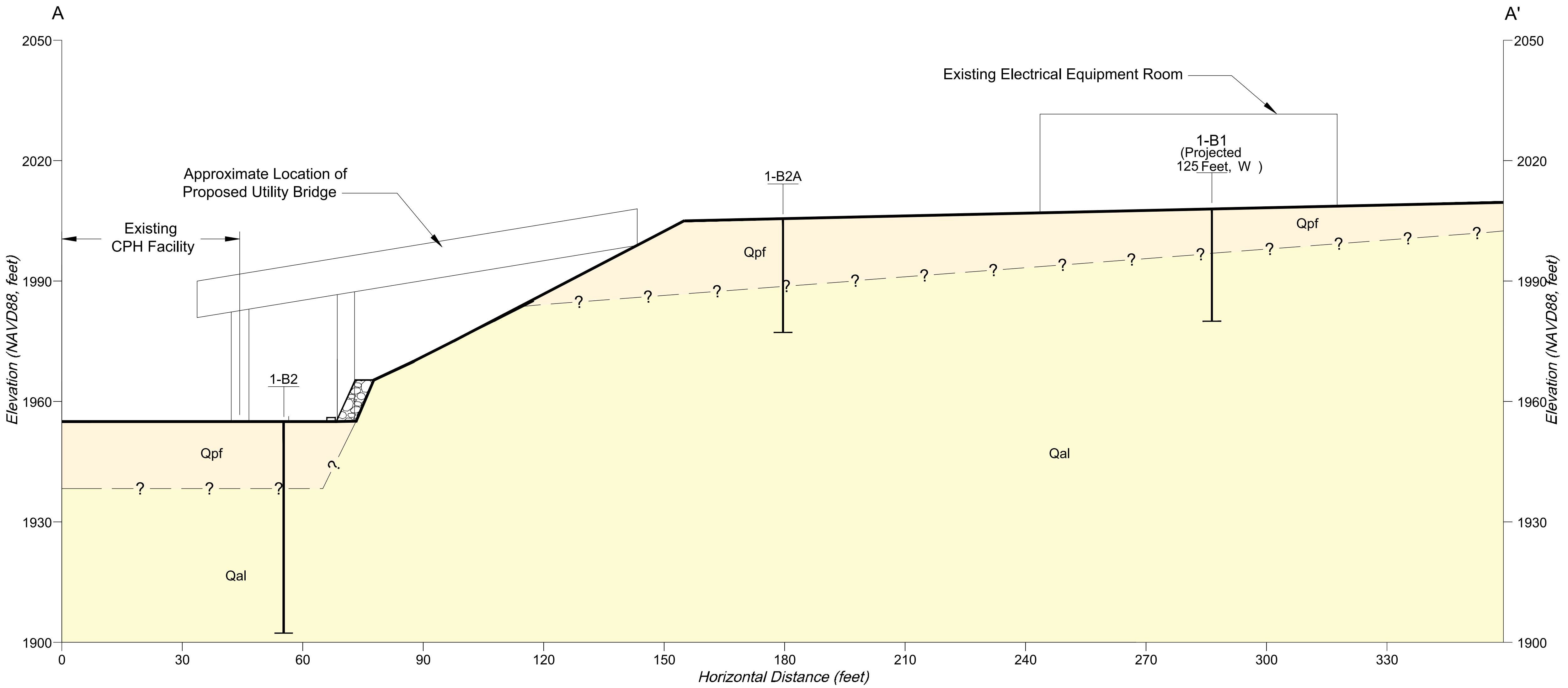
MORONGO COMBINED HEATING AND POWER (CHP)
CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001
SCALE: AS SHOWN
DRAWN BY: LVL
CHECKED BY: KJM
FIGURE NO. 3

PATH: G:\DRAFTING\PROJECTS_28000 TO 29999\28791\028791000001\GEOTECHNICAL\GEX\028791000001-GEX-0825.APRX
LAYOUT: 03. GEOLOGIC 8.5 X 11 PORTRAIT USER: LLOWY

ORIGINAL FIGURE PRINTED IN COLOR

Cross Section A-A'



Legend

Qpf	Previously Placed Fill (Van Beveren and Butelo, 2004)
Qal	Alluvial Fan Deposits
1-BX	Boring (ENGEO, 2025)
━━━━━	Existing Ground Surface
- - - - -	Proposed Ground Surface
—·—·—·—	Recommended Corrective Grading
— — — — —?—	Geologic Contact, dashed where approximate queried where inferred
/ / /	Apparent Dip of Bedding

Disclaimer: Cross Section Is For Illustration Purposes Only. The Transition Between Materials May Be Abrupt Or Gradual. Variations Should Be Expected.

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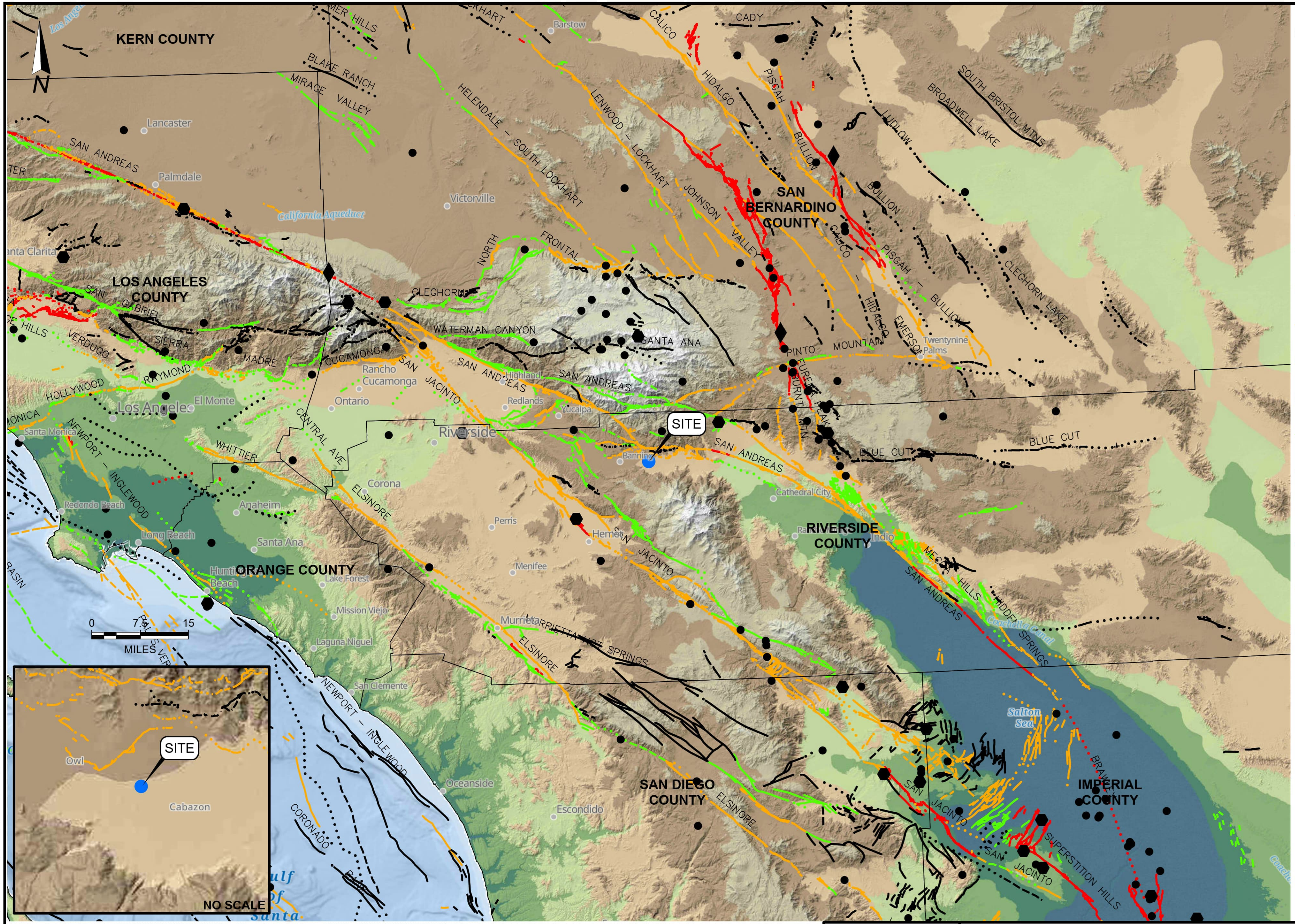
CROSS SECTION A-A'
MORONGO COMBINED HEATING AND POWER (CHP)
CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001
SCALE: AS SHOWN
DRAWN BY: LL
CHECKED BY: JTT
FIGURE NO. 4

ORIGINAL FIGURE PRINTED IN COLOR



LEGEND

HISTORICAL EARTHQUAKE EPICENTERS

- ● Magnitude 5-6
- ⬢ Magnitude 6-7
- ◆ Magnitude 7+
- ▨ Historical Blind Thrust Fault Zone

QUATERNARY FAULTS 2018-2020

Based on time of most recent surface deformation

- 🟥 Historical (<150 Years), Well Constrained Location
- 🟥 Historical (<150 Years), Moderately Constrained Location
- 🟥 Historical (<150 Years), Inferred Location
- 🟧 Latest Quaternary (<15,000 Years), Well Constrained Location
- 🟧 Latest Quaternary (<15,000 Years), Moderately Constrained Location
- 🟧 Latest Quaternary (<15,000 Years), Inferred Location
- 🟩 Late Quaternary (<130,000 Years), Well Constrained Location
- 🟩 Late Quaternary (<130,000 Years), Moderately Constrained Location
- 🟩 Late Quaternary (<130,000 Years), Inferred Location
- 🟦 Middle And Late Quaternary (<750,000 Years), Well Constrained Location
- 🟦 Middle And Late Quaternary (<750,000 Years), Moderately Constrained Location
- 🟦 Middle And Late Quaternary (<750,000 Years), Inferred Location
- ⬛ Undifferentiated Quaternary(<1.6 Million Years), Well Constrained Location
- ⬛ Undifferentiated Quaternary(<1.6 Million Years), Moderately Constrained Location
- ⬛ Undifferentiated Quaternary(<1.6 Million Years), Inferred Location
- ⬜ Class B (Various Age), Well Constrained Location
- ⬜ Class B (Various Age), Moderately Constrained Location
- ⬜ Class B (Various Age), Inferred Location

BASE MAP SOURCE: ESRI, GARMIN, NATURALVUE, UC RIVERSIDE, COUNTY OF RIVERSIDE, CALIFORNIA STATE PARKS, ESRI, TOMTOM, GARMIN, SAFEGRAPH, GEOTECHNOLOGIES, INC, METI/NASA, USGS, BUREAU OF LAND MANAGEMENT, EPA, NPS, USDA, USFWS, UC RIVERSIDE, COUNTY OF RIVERSIDE, CALIFORNIA STATE PARKS, ESRI, TOMTOM, GARMIN, SAFEGRAPH, FAO, METI/NASA, USGS, BUREAU OF LAND MANAGEMENT, EPA, NPS, USFWS, ESRI, GEBCO, GARMIN, NATURALVUE
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATA SET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, 2020

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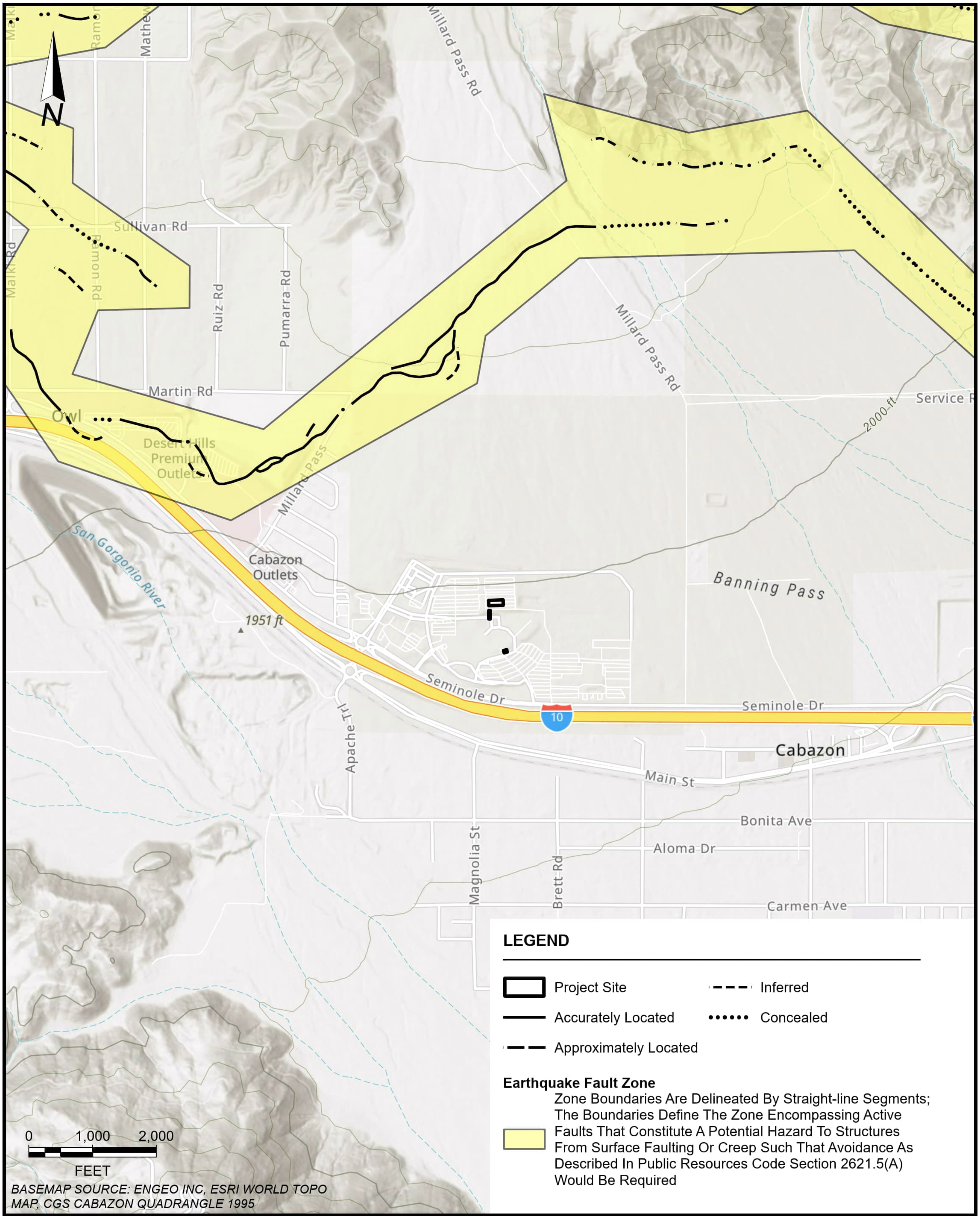
REGIONAL FAULTING & SEISMICITY MAP
MORONGO COMBINED HEATING AND POWER (CHP)
CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001
SCALE: AS SHOWN
DRAWN BY: LVL
CHECKED BY: KJM
FIGURE NO.
5

ORIGINAL FIGURE PRINTED IN COLOR



BASEMAP SOURCE: ENGEO INC, ESRI WORLD TOPO MAP, CGS CABAZON QUADRANGLE 1995

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SEISMIC HAZARD ZONES MAP

MORONGO COMBINED HEATING AND POWER (CHP)

CABAZON, CALIFORNIA

PROJECT NO.: 28791.000.001

SCALE: AS SHOWN

DRAWN BY: LVL

CHECKED BY: KJM

FIGURE NO.
6

ORIGINAL FIGURE PRINTED IN COLOR

PATH: G:\DRAFTING\PROJECTS_28000 TO 29999\28791\028791000001\GEOTECHNICAL\GEX\028791000001-GEX-0825.APRX
LAYOUT: 04. SEISMIC HAZARD ZONE MAP 8.5 X 11 PORTRAIT USER: LLOWY

APPENDIX A

KEY TO BORING LOGS
EXPLORATION LOGS

KEY TO BORING LOGS

MAJOR TYPES			DESCRIPTION
COARSE-GRAINED SOILS MORE THAN HALF OF MAT'L LARGER THAN #200 SIEVE	GRAVELS MORE THAN HALF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE	CLEAN GRAVELS WITH LESS THAN 5% FINES	GW - Well graded gravels or gravel-sand mixtures GP - Poorly graded gravels or gravel-sand mixtures
		GRAVELS WITH OVER 12 % FINES	GM - Silty gravels, gravel-sand and silt mixtures GC - Clayey gravels, gravel-sand and clay mixtures
	SANDS MORE THAN HALF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE	CLEAN SANDS WITH LESS THAN 5% FINES	SW - Well graded sands, or gravelly sand mixtures SP - Poorly graded sands or gravelly sand mixtures
		SANDS WITH OVER 12 % FINES	SM - Silty sand, sand-silt mixtures SC - Clayey sand, sand-clay mixtures
FINE-GRAINED SOILS MORE THAN HALF OF MAT'L SMALLER THAN #200 SIEVE	SILTS AND CLAYS LIQUID LIMIT 50 % OR LESS		ML - Inorganic silt with low to medium plasticity CL - Inorganic clay with low to medium plasticity OL - Low plasticity organic silts and clays
	SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 %		MH - Elastic silt with high plasticity CH - Fat clay with high plasticity OH - Highly plastic organic silts and clays
	HIGHLY ORGANIC SOILS		PT - Peat and other highly organic soils

For fine-grained soils with 15 to 29% retained on the #200 sieve, the words "with sand" or "with gravel" (whichever is predominant) are added to the group name.

For fine-grained soil with >30% retained on the #200 sieve, the words "sandy" or "gravelly" (whichever is predominant) are added to the group name.

GRAIN SIZES

	U.S. STANDARD SERIES SIEVE SIZE			CLEAR SQUARE SIEVE OPENINGS			
	200	40	10	4	3/4 "	3"	12"
SILTS AND CLAYS	SAND			GRAVEL		COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	COARSE		

RELATIVE DENSITY

SANDS AND GRAVELS	BLOWS/FOOT (S.P.T.)
VERY LOOSE	0-4
LOOSE	4-10
MEDIUM DENSE	10-30
DENSE	30-50
VERY DENSE	OVER 50

CONSISTENCY

SILTS AND CLAYS	STRENGTH*
VERY SOFT	0-1/4
SOFT	1/4-1/2
MEDIUM STIFF	1/2-1
STIFF	1-2
VERY STIFF	2-4
HARD	OVER 4

MOISTURE CONDITION

DRY	Dusty, dry to touch
MOIST	Damp but no visible water
WET	Visible freewater

SAMPLER SYMBOLS

■	Modified California (3" O.D.) sampler
☰	California (2.5" O.D.) sampler
◪	S.P.T. - Split spoon sampler
▯	Shelby Tube
▤	Dames and Moore Piston
▮	Continuous Core
☒	Bag Samples
✋	Grab Samples
NR	No Recovery

LINE TYPES

________	Solid - Layer Break
– – – – – –	Dashed - Gradational or approximate layer break

GROUNDWATER SYMBOLS

∇	Groundwater level during drilling
▼	Stabilized groundwater level

(S.P.T.) Number of blows of 140 lb. hammer falling 30" to drive a 2-inch O.D. (1-3/8 inch I.D.) sampler

* Unconfined compressive strength in tons/sq. ft., asterisk on log means determined by pocket penetrometer

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SOIL BORING 1-B1

LATITUDE: 33.92367
LONGITUDE: -116.79908

Morongo Combined Heating and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 26 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~2007 ft (NAVD88)

LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
			ASPHALT CONCRETE (**AC**), approximately 3 inches											
			AGGREGATE BASE, approximately 4 inches											
			POORLY GRADED SAND WITH SILT AND GRAVEL (**SP-SM**), yellowish brown, slightly moist, fine- to coarse-grained sand, approximately 20-25% fines, cobbles present [Qpf]											
	2005													
		✋							10		125.80			RS
5		■	No recovery			50/6"								
		◣	Gravel in shoe of sampler			50/6"								
			Hard drilling											
	2000													
10		■	**SILTY SAND** (**SM**), brown, medium dense, moist, fine- to coarse-grained sand, approximately 20-30% fines, slightly micaceous, trace subangular and subrounded gravel, no recovery at 10 feet [Alluvium (Qal)]			18								
	1995	◣				20								
		✋							23					
15		■				47								
			Becomes yellowish brown, dry, approximately 20% fines							1.3	127.3			
	1990													

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SOIL BORING 1-B1

LATITUDE: 33.92367
LONGITUDE: -116.79908

Morongo Combined Heating and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 26 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~2007 ft (NAVD88)

LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
		◣	Very dense, trace gravel and cobble	🟩		62/11"								
	1985			🟩										
25		■	Dense	🟩		78								

Bottom of boring at 26 feet below the ground surface.
Groundwater not encountered at time of drilling.

SOIL BORING 1-B2

LATITUDE: 33.92301 LONGITUDE: -116.79956

Morongo Combined Heating
and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 51 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~1955 ft (NAVD88)

LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
			ASPHALT CONCRETE (**AC**), approximately 3 inches	■										
			AGGREGATE BASE, approximately 4 inches	▨										
		✋	**POORLY GRADED SAND WITH SILT AND GRAVEL** (**SP-SM**), brown, dry, fine- to coarse-grained sand, approximately 20% fines, cobbles present [Qpf]	🟨					10	6.20	125.80			RS
5	1950	■	**SILTY SAND** (**SM**), brown, medium dense, dry, fine- to coarse-grained sand, approximately 20% fines [Artificial Fill (Qpf)]	🟩		31								
10	1945	◣	Becomes loose, approximately 10-15% fines	🟩		7								
			Hard drilling	🟩										
15	1940	■	**POORLY GRADED SAND WITH SILT** (**SP-SM**), olive brown, dense, fine- to coarse-grained sand, approximately 5-15% fines, trace plastic debris [Alluvium (Qal)]	🟨		80/10"			5	2.3	120.3			

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SOIL BORING 1-B2

LATITUDE: 33.92301
LONGITUDE: -116.79956

Morongo Combined Heating and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 51 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~1955 ft (NAVD88)
LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
		◣	**POORLY GRADED SAND WITH SILT** (**SP-SM**), yellowish brown, medium dense, dry, fine- to coarse-grained sand, approximately 5-15% fines [Alluvium (Qal)] Hard drilling	🟨		39								
25	1930			🟨										
30	1925	■	**SILTY SAND** (**SM**), light brown, very dense, dry, fine- to coarse-grained sand, approximately 15-25% fines	🟩		50/6"				2.3	126.9			
35	1920			🟩										

ENGEO
Expect Excellence

SOIL BORING 1-B2

LATITUDE: 33.92301
LONGITUDE: -116.79956

Morongo Combined Heating and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 51 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~1955 ft (NAVD88)

LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
				🟩		50/6"								
45	1910		**POORLY GRADED GRAVEL WITH SILT** (**GP-GM**), light brown, very dense, dry, approximately 5-15% fines	🟨										
50	1905		No recovery	🟨		50/6" 50/3"								

Bottom of boring at 51 feet below the ground surface.
Groundwater not encountered at time of drilling.

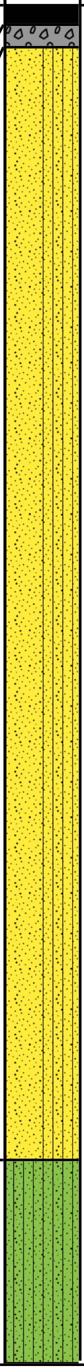
SOIL BORING 1-B2A

LATITUDE: 33.92338
LONGITUDE: -116.79948

Morongo Combined Heating and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 31 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~2005 ft (NAVD88)

LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip



Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
			ASPHALT CONCRETE (**AC**), approximately 3 inches											
			AGGREGATE BASE, approximately 4 inches											
		✋	**POORLY GRADED SAND WITH SILT AND GRAVEL** (**SP-SM**), yellowish brown, dry to slightly moist, fine- to coarse-grained sand, approximately 20% fines, cobbles present [Qpf]											
5	2000													
			Some asphalt debris in spoils											
10	1995	■	No recovery, becomes loose			19								
		■	No recovery, medium dense			34								
15	1990													
		✋	**SILTY SAND** (**SM**), light yellowish brown, very dense, dry, fine- to coarse-grained sand, approximately 20-25% fines, trace subangular and subrounded gravel [Alluvium (Qal)]						21					

SOIL BORING 1-B2A

LATITUDE: 33.92338 LONGITUDE: -116.79948

Morongo Combined Heating and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 31 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~2005 ft (NAVD88)

LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
		◣		▨		61								
25	1980			▨										
30	1975	■	No recovery, gravel in shoe of sampler	▨		65								

Bottom of boring at 31½ feet below the ground surface. Groundwater not encountered at time of drilling.

SOIL BORING 1-B3

LATITUDE: 33.92163 LONGITUDE: -116.79844

Morongo Combined Heating
and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 25.5 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~1959 ft (NAVD88)

LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
			POORLY GRADED SAND WITH SILT AND GRAVEL (**SP-SM**), light brown, dry, fine- to coarse-grained sand, approximately 15-20% fines, cobbles present [Qpf]	🟨										
		✋							10	6.20	125.80			RS
	1955													
5		■	No recovery			73								
		◣	Very dense			71								
	1950													
10		■	**SILTY SAND** (**SM**), brown, medium dense to dense, slightly moist, fine- to coarse-grained sand, approximately 20% fines, trace gravel and cobble [Alluvium (Qal)]	🟩		53				1.5	115.4			
		◣				32								
	1945													
15		■				67								
	1940													

ENGEO
Expect Excellence

SOIL BORING 1-B3

LATITUDE: 33.92163
LONGITUDE: -116.79844

Morongo Combined Heating and Power (CHP)
Cabazon, CA
28791.000.001

DATE DRILLED: 07/30/2025
HOLE DEPTH: 25.5 ft
HOLE DIAMETER: 8 in
SURFACE ELEV.: ~1959 ft (NAVD88)
LOGGED BY / REVIEWED BY: J. Shelton / K. Khatri
DRILLING CONTRACTOR: 24/7 Drilling
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth (ft)	Elevation (ft)	Sampler Type	MATERIAL DESCRIPTION	Graphic Log	Water Levels	Blow Count (blows/ft) or Penetration Resistance	Liquid Limit	Plasticity Index	Fines (%)	Moisture Content (%)	Dry Density (pcf)	Compressive Strength (tsf) *Field Approximation	Shear Strength (psf) *Field Approximation	Strength Test Type
			POORLY GRADED SAND WITH SILT (**SP-SM**), light yellowish brown, medium dense, dry, fine- to coarse-grained sand, approximately 5-15% fines, slightly micaceous			25								
	1935													
25			Very dense			50/6"								

Bottom of boring at 25½ feet below the ground surface. Groundwater not encountered at time of drilling.

BORING 1

Date Drilled: December 3, 2002

Depth to Water: Not Encountered

Equipment Used: Hollow Stem Auger (8-inch-dia. auger)

Driving Weight & Drop: 140 lbs / 18 inches

SURFACE ELEVATION: 1960 feet MSL (See Figure 1)

ELEVATION (feet)	DEPTH (feet)	MOISTURE (% of dry wt.)	DRY DENSITY (pcf)	N VALUE (SPT)	BLOW COUNT (blows/foot)	SAMPLE LOCATION	
							ALLUVIUM SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), light gray
					44	☒	(No Sample Recovery)
1955	5						
		0.7	123		70	⧓	
		0.8	118		70 for 10"	⧓	
1950	10						
					70 for 10"	⧓	
1945	15						
		2.5	98		18	⧓	
1940	20						
					50 for 7"	⧓	
1935	25						
					50 for 6"	⧓	
1930	30						
					60 for 5"	☒	(No Sample Recovery)
1925	35						
					70 for 11"	⧓	
1920	40						

(Continued on next page)

LOG OF BORING

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated.
It is not warranted to be representative of subsurface conditions at other locations and times.

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-2-03 [LOG FOR FIELD; 02-055.GPJ]

VAN BEVEREN & BUTELO, INC.

FIGURE A-1.1a

BORING 1

(Continued)

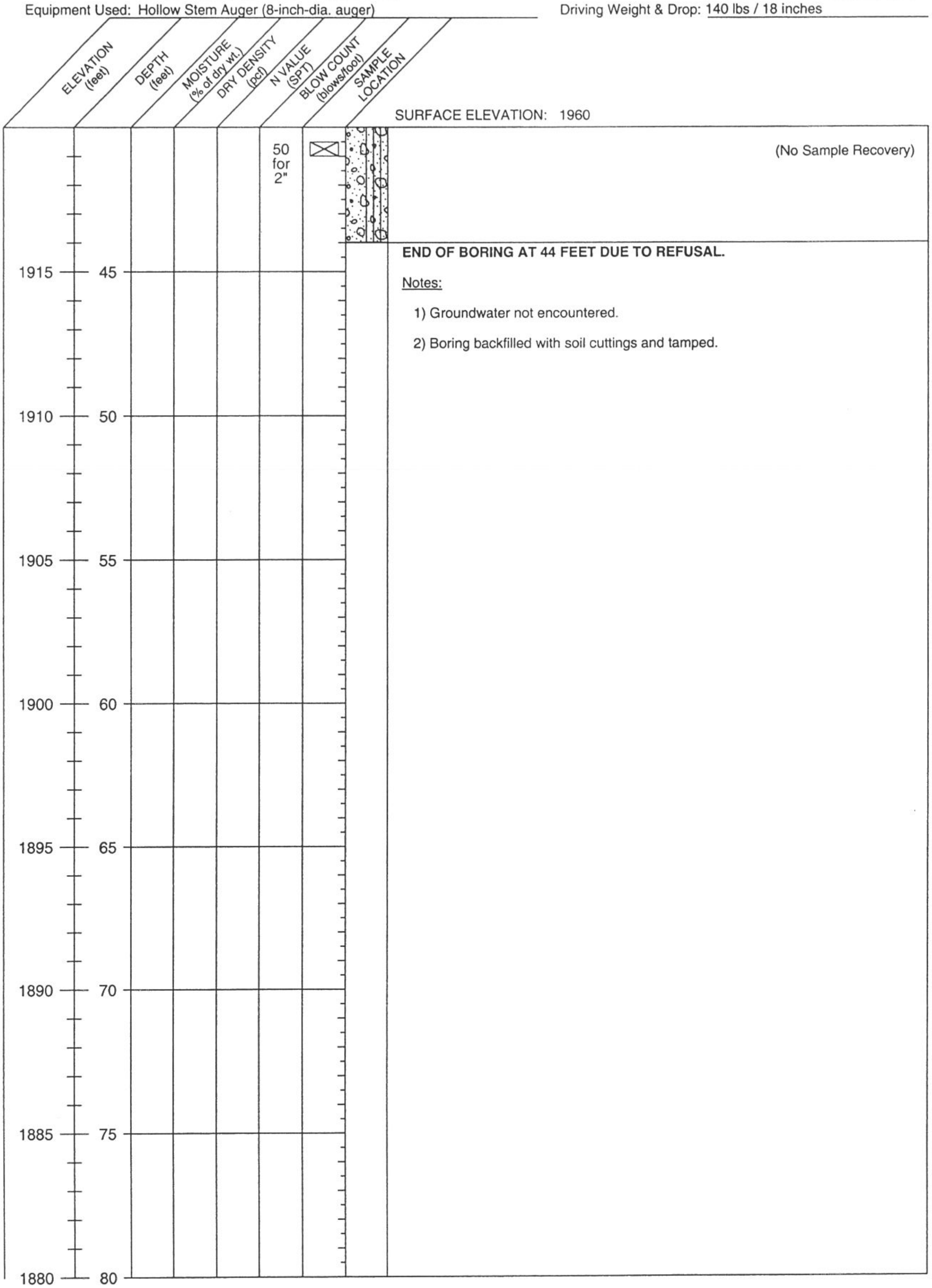
Date Drilled: December 3, 2002

Equipment Used: Hollow Stem Auger (8-inch-dia. auger)

Depth to Water: Not Encountered

Driving Weight & Drop: 140 lbs / 18 inches

SURFACE ELEVATION: 1960



(No Sample Recovery)

END OF BORING AT 44 FEET DUE TO REFUSAL.

Notes:

1) Groundwater not encountered.

2) Boring backfilled with soil cuttings and tamped.

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-2-03 [LOG FOR FIELD; 02-055.GPJ]

LOG OF BORING

VAN BEVEREN & BUTELO, INC.

FIGURE A-1.1b

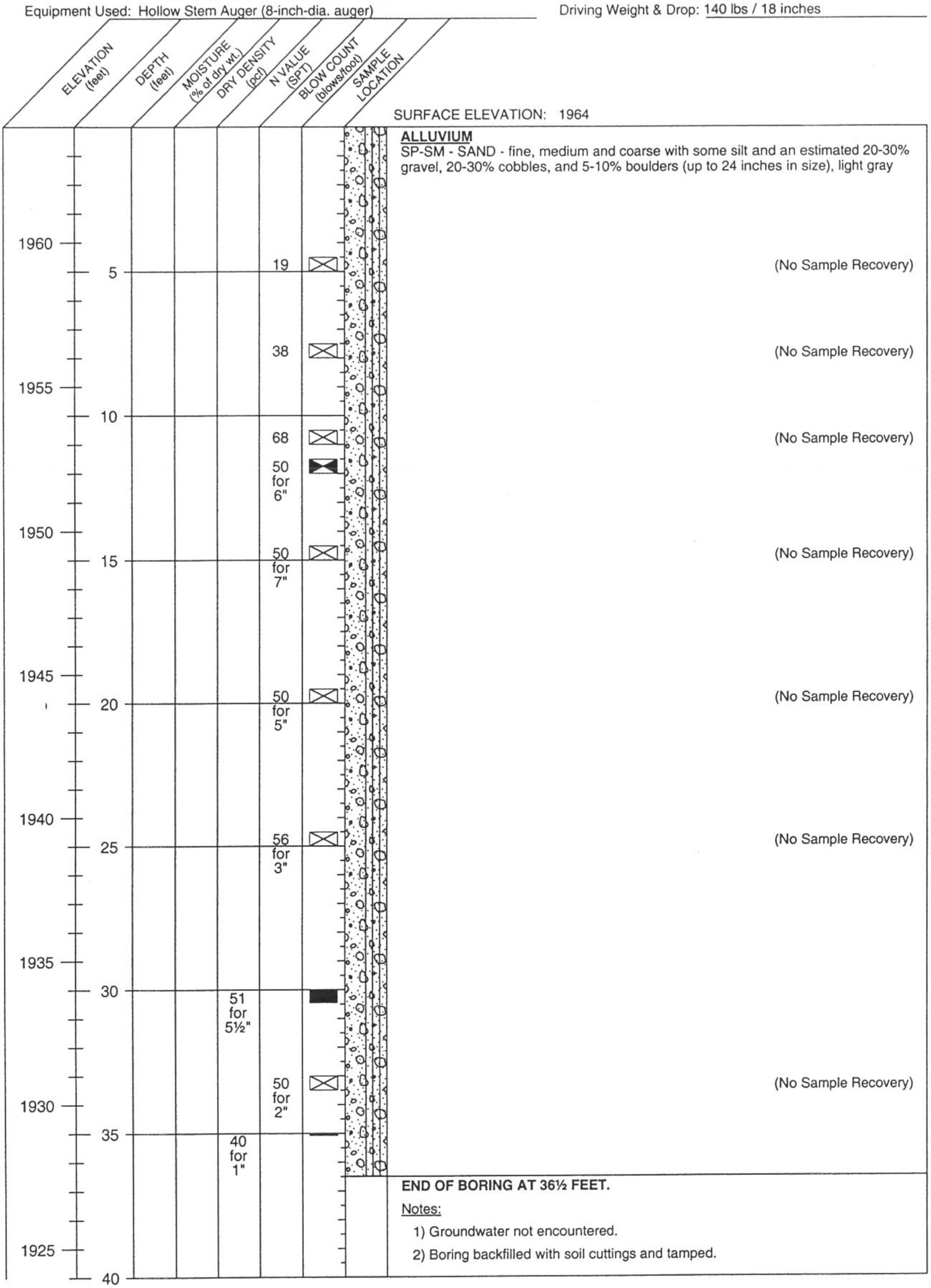
BORING 2

Date Drilled: December 4, 2002

Equipment Used: Hollow Stem Auger (8-inch-dia. auger)

Depth to Water: Not Encountered

Driving Weight & Drop: 140 lbs / 18 inches



SURFACE ELEVATION: 1964

ALLUVIUM

SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), light gray

N VALUE (SPT)	BLOW COUNT (blows/foot)	SAMPLE LOCATION	
	19	☒	(No Sample Recovery)
	38	☒	(No Sample Recovery)
	68	☒	(No Sample Recovery)
	50 for 6"	⧓	
	50 for 7"	☒	(No Sample Recovery)
	50 for 5"	☒	(No Sample Recovery)
	56 for 3"	☒	(No Sample Recovery)
51 for 5½"		■	
	50 for 2"	☒	(No Sample Recovery)
40 for 1"		—	

END OF BORING AT 36½ FEET.

Notes:

1) Groundwater not encountered.

2) Boring backfilled with soil cuttings and tamped.

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-2-03 [LOG FOR FIELD; 02-055.GPJ]

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

VAN BEVEREN & BUTELO, INC.

FIGURE A-1.2

BORING 3

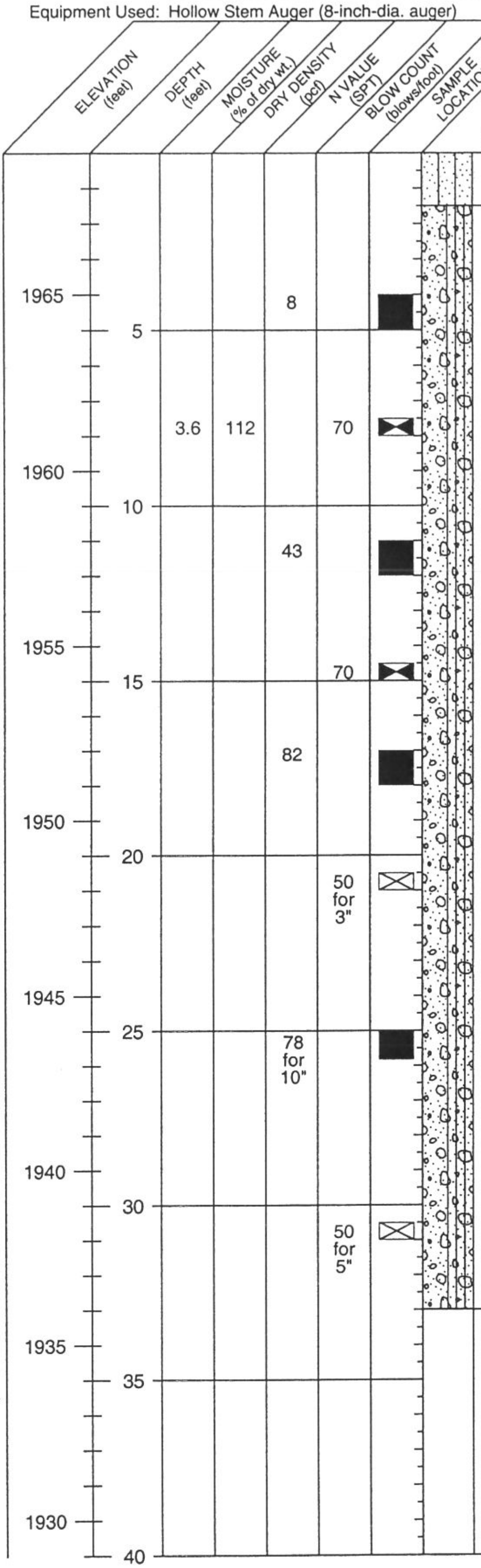
Date Drilled: December 5, 2002

Equipment Used: Hollow Stem Auger (8-inch-dia. auger)

Depth to Water: Not Encountered

Driving Weight & Drop: 140 lbs / 18 inches

SURFACE ELEVATION: 1969



ALLUVIUM
SM - SILTY SAND - fine, some gravel, brown

SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), light gray

Large root encountered (approximately 5 feet long)

(No Sample Recovery)

(No Sample Recovery)

END OF BORING AT 33 FEET DUE TO REFUSAL.

Notes:

1) Groundwater not encountered.

2) Boring backfilled with soil cuttings and tamped.

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-3-03 [LOG FOR FIELD: 02-055.GPJ]

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

VAN BEVEREN & BUTELO, INC.

FIGURE A-1.3

BORING 9

Date Drilled: December 4, 2002
Equipment Used: Hollow Stem Auger (8-inch-dia. auger)
Depth to Water: Not Encountered
Driving Weight & Drop: 140 lbs / 18 inches

SURFACE ELEVATION: 1972

ELEVATION (feet)	DEPTH (feet)	MOISTURE (% of dry wt.)	DRY DENSITY (pcf)	N VALUE (SPT)	BLOW COUNT (blows/foot)	SAMPLE LOCATION	
					54	☒	(No Sample Recovery)
				50 for 6"		■	
		0.5	--		50 for 7"	⧗	(Disturbed Sample)
				50 for 4"		■	
					50 for 8"	⧗	(Disturbed Sample)
				90		■	
					50 for 2"	☒	(No Sample Recovery)

Elevation scale: 1970, 1965, 1960, 1955, 1950, 1945, 1940, 1935
Depth scale: 5, 10, 15, 20, 25, 30, 35, 40

ALLUVIUM
SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), light gray

END OF BORING AT 25 FEET.

Notes:

1) Groundwater not encountered.
2) Boring backfilled with soil cuttings and tamped.

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-3-03 [LOG FOR FIELD; 02-055.GPJ]

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

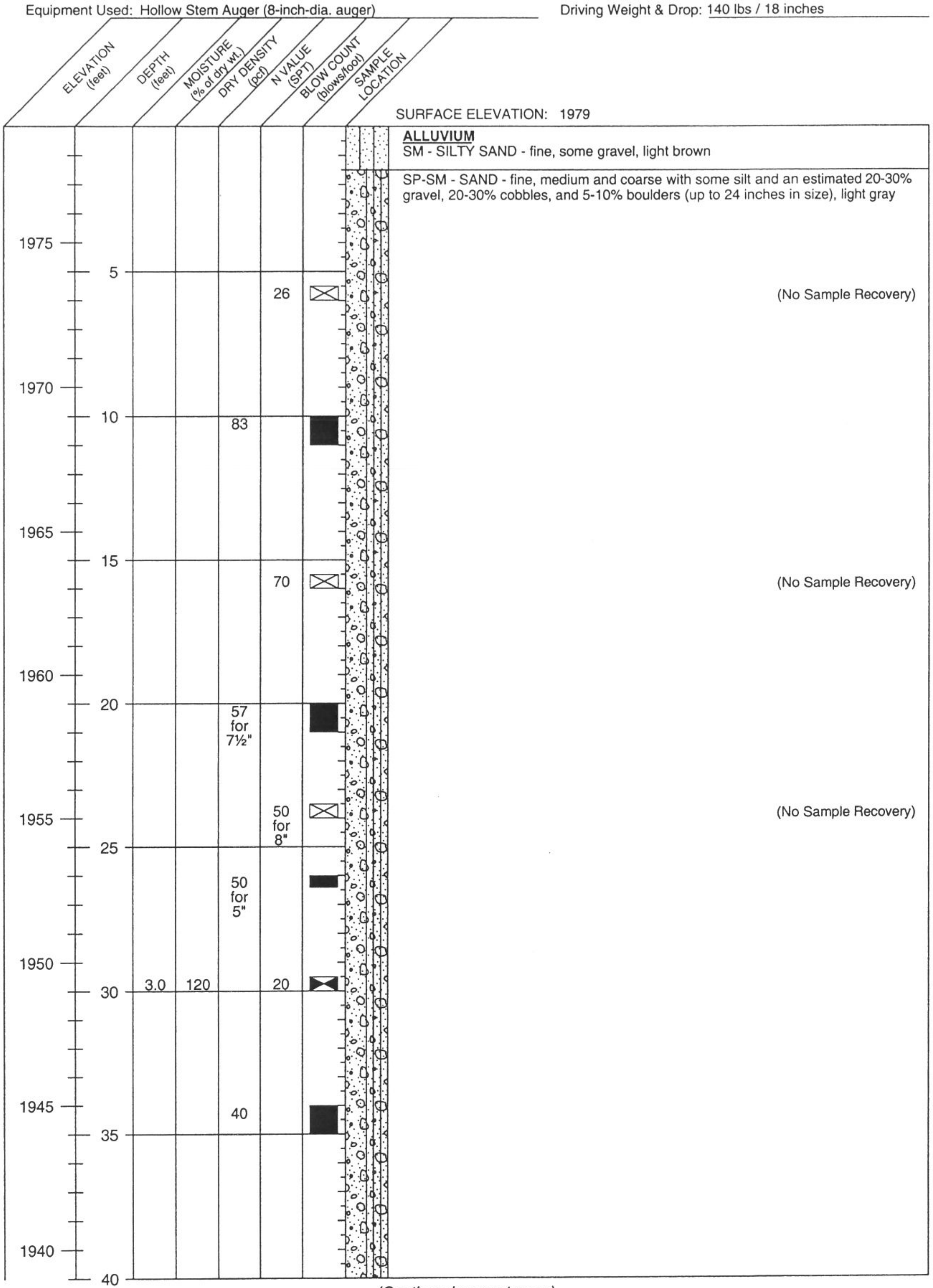
VAN BEVEREN & BUTELO, INC.

FIGURE A-1.9

BORING 10

Date Drilled: December 5, 2002
Equipment Used: Hollow Stem Auger (8-inch-dia. auger)
Depth to Water: Not Encountered
Driving Weight & Drop: 140 lbs / 18 inches

SURFACE ELEVATION: 1979



ELEVATION (feet)	DEPTH (feet)	MOISTURE (% of dry wt.)	DRY DENSITY (pcf)	N VALUE (SPT)	BLOW COUNT (blows/foot)	SAMPLE LOCATION	
					26	☒	(No Sample Recovery)
				83		■	
					70	☒	(No Sample Recovery)
				57 for 7½"		■	
					50 for 8"	☒	(No Sample Recovery)
				50 for 5"		■	
		3.0	120		20	⧓	
				40		■	

ALLUVIUM
SM - SILTY SAND - fine, some gravel, light brown

SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), light gray

(Continued on next page)

LOG OF BORING

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-2-03 [LOG FOR FIELD: 02-055.GPJ]

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

VAN BEVEREN & BUTELO, INC.

FIGURE A-1.10a

BORING 10

(Continued)

Date Drilled: December 5, 2002

Equipment Used: Hollow Stem Auger (8-inch-dia. auger)

Depth to Water: Not Encountered

Driving Weight & Drop: 140 lbs / 18 inches

ELEVATION (feet)
DEPTH (feet)
MOISTURE (% of dry wt.)
DRY DENSITY (pcf)
N VALUE (SPT)
BLOW COUNT (blows/foot)
SAMPLE LOCATION

SURFACE ELEVATION: 1979

END OF BORING AT 40½ FEET.

Notes:

1) Groundwater not encountered.

2) Boring backfilled with soil cuttings and tamped.

1935
45
1930
50
1925
55
1920
60
1915
65
1910
70
1905
75
1900
80

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-2-03 [LOG FOR FIELD; 02-055.GPJ]

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

VAN BEVEREN & BUTELO, INC.

FIGURE A-1.10b

BORING 12

Date Drilled: December 5, 2002

Equipment Used: Hollow Stem Auger (8-inch-dia. auger)

Depth to Water: Not Encountered

Driving Weight & Drop: 140 lbs / 18 inches

SURFACE ELEVATION: 1950

ELEVATION (feet)	DEPTH (feet)	MOISTURE (% of dry wt.)	DRY DENSITY (pcf)	N VALUE (SPT)	BLOW COUNT (blows/foot)	SAMPLE LOCATION
		7.3	117		15	⧓
1945	5					
					50	⧓
		2.6	--		68	⧓
1940	10					
					50 for 7"	☒
						■
				50 for 7"		
1935	15					
1930	20					
1925	25					
1920	30					
1915	35					
1910	40					

ALLUVIUM

SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), reddish brown

brown

(No Sample Recovery)

END OF BORING AT 15 FEET DUE TO REFUSAL.

Notes:

1) Groundwater not encountered.

2) Boring backfilled with soil cuttings and tamped.

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-3-03 [LOG FOR FIELD; 02-055.GPJ]

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF BORING

VAN BEVEREN & BUTELO, INC.

FIGURE A-1.12

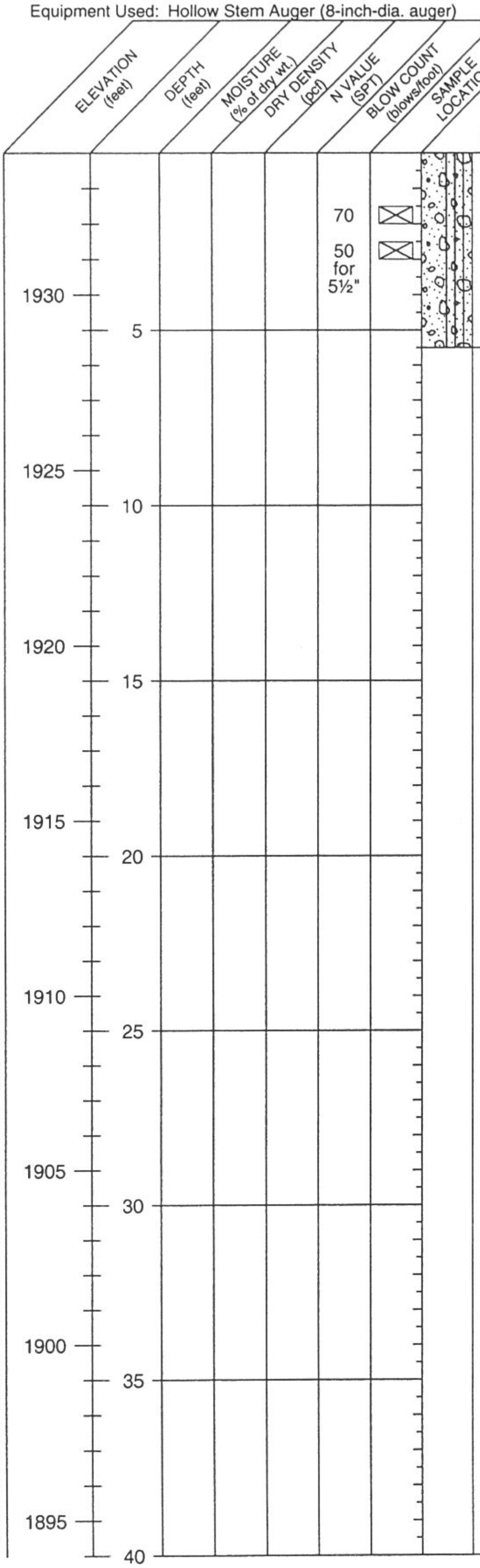
BORING 16

Date Drilled: December 5, 2002

Equipment Used: Hollow Stem Auger (8-inch-dia. auger)

Depth to Water: Not Encountered

Driving Weight & Drop: 140 lbs / 18 inches



SURFACE ELEVATION: 1934

ALLUVIUM

SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), yellowish brown

(No Sample Recovery)

(No Sample Recovery)

END OF BORING AT 5½ feet.

Notes:

1) Encountered refusal at 3½ feet. Boring moved 3 feet East and re-drilled.

2) Groundwater not encountered.

3) Boring backfilled with soil cuttings and tamped.

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-2-03 [LOG FOR FIELD; 02-055.GPJ]

LOG OF BORING

Van Beveren & Butelo, Inc.

FIGURE A-1.16

PIT 2

Drilled Date: December 4, 2002

Depth to Water: Not Encountered

Equipment Used: Backhoe

ELEVATION (feet)	DEPTH (feet)	MOISTURE (% of dry wt.)	DRY DENSITY (pcf)	BLOW COUNT (blows/foot)	SAMPLE LOCATION	SURFACE ELEVATION: 1992
						FILL SM - SILTY SAND - fine, few gravel (up to 2-inches in size), abundant rootlets, brown
						ALLUVIUM SP-SM - SAND - fine, medium and coarse with some silt and an estimated 20-30% gravel, 20-30% cobbles, and 5-10% boulders (up to 24 inches in size), light gray
	5					
	10					**BOTTOM OF PIT AT 10½ FEET.** Notes: 1) Groundwater not encountered. 2) Pit backfilled.
	15					
	20					
	25					
	30					
	35					
	40					

Job No: 02-055 By: FA Date: December 17, 2002 Checked: Printed: 1-3-03 [LOG OF TEST PIT; 02-055.GPJ]

The log of subsurface conditions shown hereon applies only at the specific boring location and at the date indicated. It is not warranted to be representative of subsurface conditions at other locations and times.

LOG OF TEST PIT

VAN BEVEREN & BUTELO, INC.

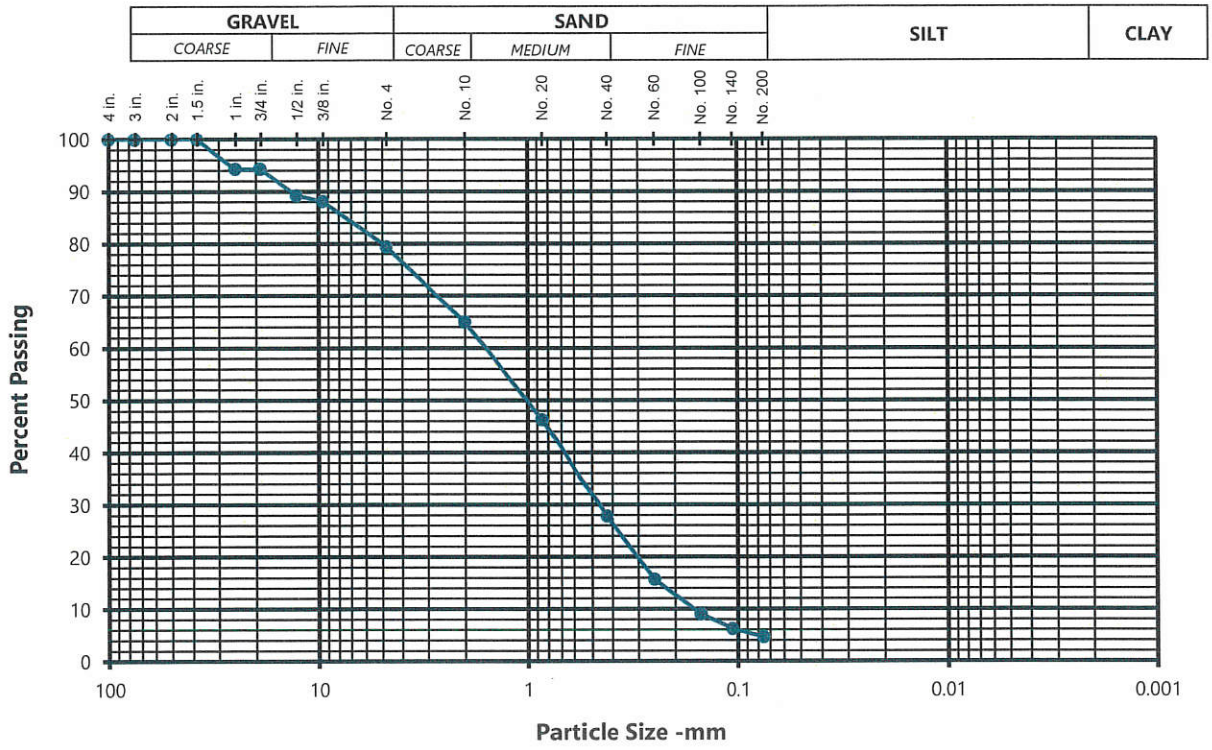
FIGURE A-2.2

APPENDIX B

LABORATORY TEST DATA

Sample Summary Report

ASTM D6913



%+3"	% GRAVEL		% SAND			% FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt and Clay
0.0	10.8	9.8	14.5	37.1	23.2	4.7

Sieve No.	Opening (mm)	Percent Finer	Sieve No.	Opening (mm)	Percent Finer		
4 in.	100	100	No. 4	4.75	79		
3 in.	75	100	No. 10	2.00	65		
2 in.	50	100	No. 20	0.85	46		
1.5 in.	38.1	100	No. 40	0.425	28		
1 in.	25	94	No. 60	0.250	16		
3/4 in.	19	94	No. 100	0.150	9		
1/2 in.	12.7	89	No. 140	0.106	6		
3/8 in.	9.5	88	No. 200	0.075	5		

Material Description

Lab No.: 38112

SP

Sample/Boring Number: 1B2
Depth: 15'-16.5'

Testing Remarks:

Atterberg Limits

Liquid Limit = ---
Plastic Limit = ---
Plasticity Index = ---

Moisture & Density Results

As-Received Moisture %:	---
Wet Density (pcf):	---
Dry Density (pcf):	---

Date Sampled: 7/31/2025
Date Tested: 8/21/2025
Tested By: RP
Checked By: M. Gibson

Coefficients

D-_{90} = 13.6525	D-_{85} = 7.7848
D-_{60} = 1.6948	D-_{50} = 1.0803
D-_{30} = 0.4749	D-_{15} = 0.2393
D-_{10} = 0.1647	
C_U = 10.29	C_c = 0.8081

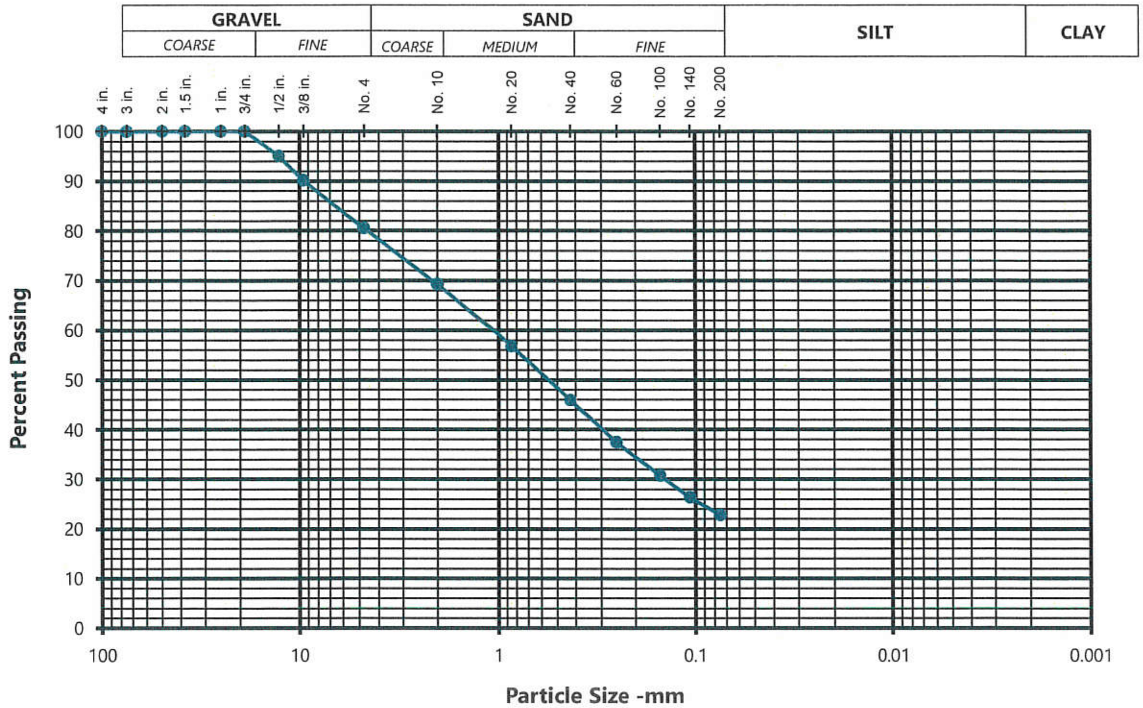
9177 Sky Park Court, San Diego, CA 92123
(858)278-3600

Client: ENGEO
Project: Morongo CHP
Project No.: US0045894.2305.01

Reviewed By:
David C. Wilson, PE C54734
Senior Associate Engineer - Materials

Sample Summary Report

ASTM D6913



%+3"	% GRAVEL		% SAND			% FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt and Clay
0.0	4.9	14.5	11.3	23.3	23.2	22.8

Sieve No.	Opening (mm)	Percent Finer	Sieve No.	Opening (mm)	Percent Finer
4 in.	100	100	No. 4	4.75	81
3 in.	75	100	No. 10	2.00	69
2 in.	50	100	No. 20	0.85	57
1.5 in.	38.1	100	No. 40	0.425	46
1 in.	25	100	No. 60	0.250	37
3/4 in.	19	100	No. 100	0.150	31
1/2 in.	12.7	95	No. 140	0.106	26
3/8 in.	9.5	90	No. 200	0.075	23

Material Description

Lab No.: 38108

SM/SC

Sample/Boring Number: 1B1

Depth: 13'-13.5'

Testing Remarks:

Atterberg Limits

Liquid Limit = ---

Plastic Limit = ---

Plasticity Index = ---

Moisture & Density Results

As-Received Moisture %:	---
Wet Density (pcf):	---
Dry Density (pcf):	---

Date Sampled: 7/31/2025

Date Tested: 8/21/2025

Tested By: RP

Checked By: M. Gibson

Coefficients

D_{90} = 9.4236	D_{85} = 6.9571
D_{60} = 1.1455	D_{50} = 0.5836
D_{30} = 0.1428	D_{15} = N/A
D_{10} = N/A	
C_U = N/A	C_c = N/A

9177 Sky Park Court, San Diego, CA 92123
(858)278-3600

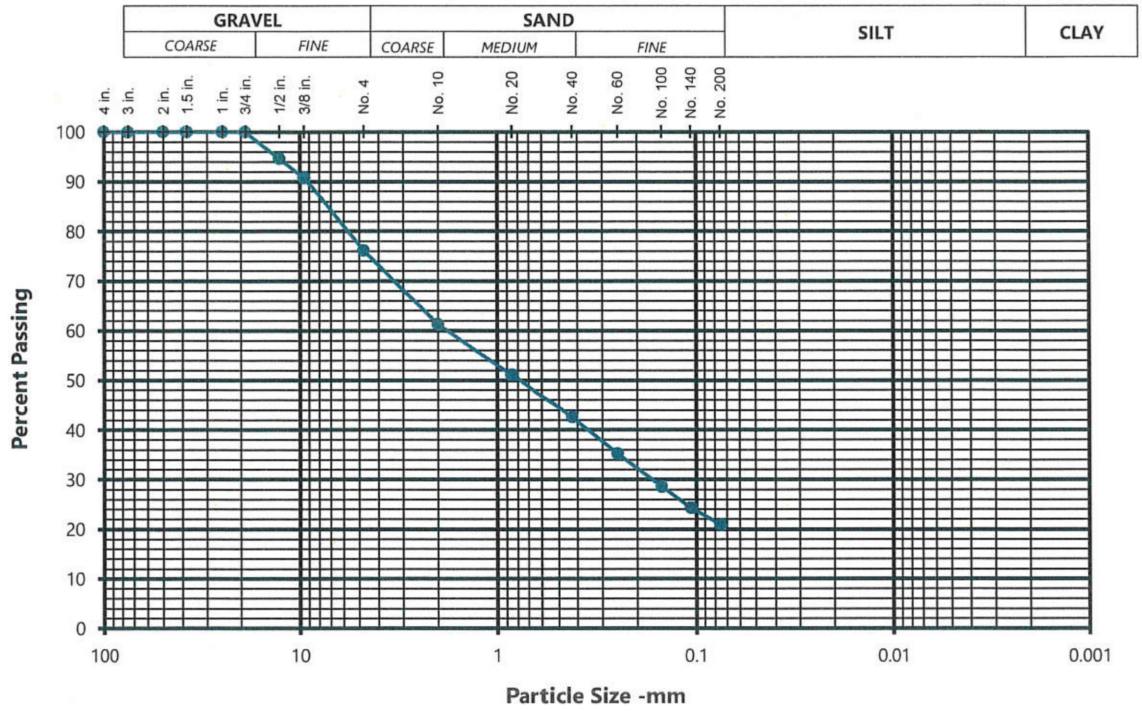
Client: ENGEO
Project: Morongo CHP
Project No.: US0045894.2305.01

Reviewed By:

David C. Wilson, PE C54734
Senior Associate Engineer - Materials

Sample Summary Report

ASTM D6913



%+3"	% GRAVEL		% SAND			% FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt and Clay
0.0	5.4	18.5	14.9	18.7	21.7	20.9

Sieve No.	Opening (mm)	Percent Finer	Sieve No.	Opening (mm)	Percent Finer		
4 in.	100	100	No. 4	4.75	76		
3 in.	75	100	No. 10	2.00	61		
2 in.	50	100	No. 20	0.85	51		
1.5 in.	38.1	100	No. 40	0.425	43		
1 in.	25	100	No. 60	0.250	35		
3/4 in.	19	100	No. 100	0.150	29		
1/2 in.	12.7	95	No. 140	0.106	24		
3/8 in.	9.5	91	No. 200	0.075	21		

Material Description

Lab No.: 38115

SM/SC

Sample/Boring Number: 1B2-A

Depth: 17'-18'

Testing Remarks:

Atterberg Limits

Liquid Limit = ---

Plastic Limit = ---

Plasticity Index = ---

Moisture & Density Results

As-Received Moisture %:	---
Wet Density (pcf):	---
Dry Density (pcf):	---

Date Sampled: 7/31/2025

Date Tested: 8/21/2025

Tested By: RP

Checked By: M. Gibson

Coefficients

D_{90} = 9.2607 D_{85} = 7.6342

D_{60} = 1.8568 D_{50} = 0.7961

D_{30} = 0.1720 D_{15} = N/A

D_{10} = N/A

C_U = N/A C_c = N/A

wsp

9177 Sky Park Court, San Diego, CA 92123
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Client: ENGEO

Project: Morongo CHP

Project No.: US0045894.2305.01

Reviewed By:

David C. Wilson, PE C54734

Senior Associate Engineer - Materials

LABORATORY TEST RESULTS OF SOIL SAMPLES

Project No.: US0045894.2305.01 Tested By: AC Date: 8/21/2025
Project Name: ENGEO- Morongo CHP Reviewed By: DW Date: 8/27/2025

		Soil Resistivity/pH		**Chemical Analysis in mg/kg (ppm)**	
		CTM 643		**CTM 422**	**CTM 417**
Lab No.	Boring ID/ Sample Depth (ft)	Min. Resistivity (ohm-cm)	pH	Cl	SO_4
38111	1B2/ 5'-6.5'	9,180	8.31	19.7	19.1
38113	1B2/ 20'-21.5'	7,192	8.56	22.7	23.6

Notes:
NT = Not tested
CTM = CALTRANS Test Method
mg/kg = milligrams per kilogram of (parts per million) of dry soil
Chemical analysis for CTM 417 and 422 were made on 1:3 soil-to-water extract

Respectfully Submitted:
WSP USA Inc.

David C. Wilson, PE C54734
Senior Principal Engineer

WSP USA Inc.
9177 Sky Park Court, San Diego, CA

Moisture & Density of ASTM Rings

Lab #	38109	38112	38114	38117
Boring #	1B1	1B2	1B2	1B3
Depth	16'-16.5'	16'-16.5'	31'-31.5'	11'-11.5'
Wt. Soil + Ring	1004.60	1095.00	1065.50	972.14
Wt. Ring	243.39	240.37	240.32	241.18
Wt. of Soil	761.21	854.63	825.18	730.96
Wet + Pan	837.04	935.84	909.19	811.09
Dry + Pan	827.39	916.83	890.78	800.26
Pan Wt.	75.83	81.72	81.29	80.28
Dia 1	2.37	2.39	2.39	2.39
Dia 2	2.40	2.39	2.39	2.40
Dia 3				
Dia 4				
Dia 5				
Ht 1	5.10	5.90	5.40	5.30
Ht 2				
Ht 3				
Ht 4				
Ht 5				
Volume of Rings	0.01302	0.01532	0.01402	0.01376
Moisture Content	1.3	2.3	2.3	1.5
Wet Density, pcf	128.9	123.0	129.8	117.1
Dry Density, pcf	127.3	120.3	126.9	115.4

Project: Morongo CHP
Project #: US0045894.2305.01

Sampled: On 7/31/25 by JPS
Tested By: CC
Date Tested: 8/18-19/25

Respectfully Submitted:
WSP USA Inc.

David C. Wilson, PE C54734
Senior Principal Engineer

Moisture Density Test Results - ASTM D698/D1557

8/21/2025

Sample Information

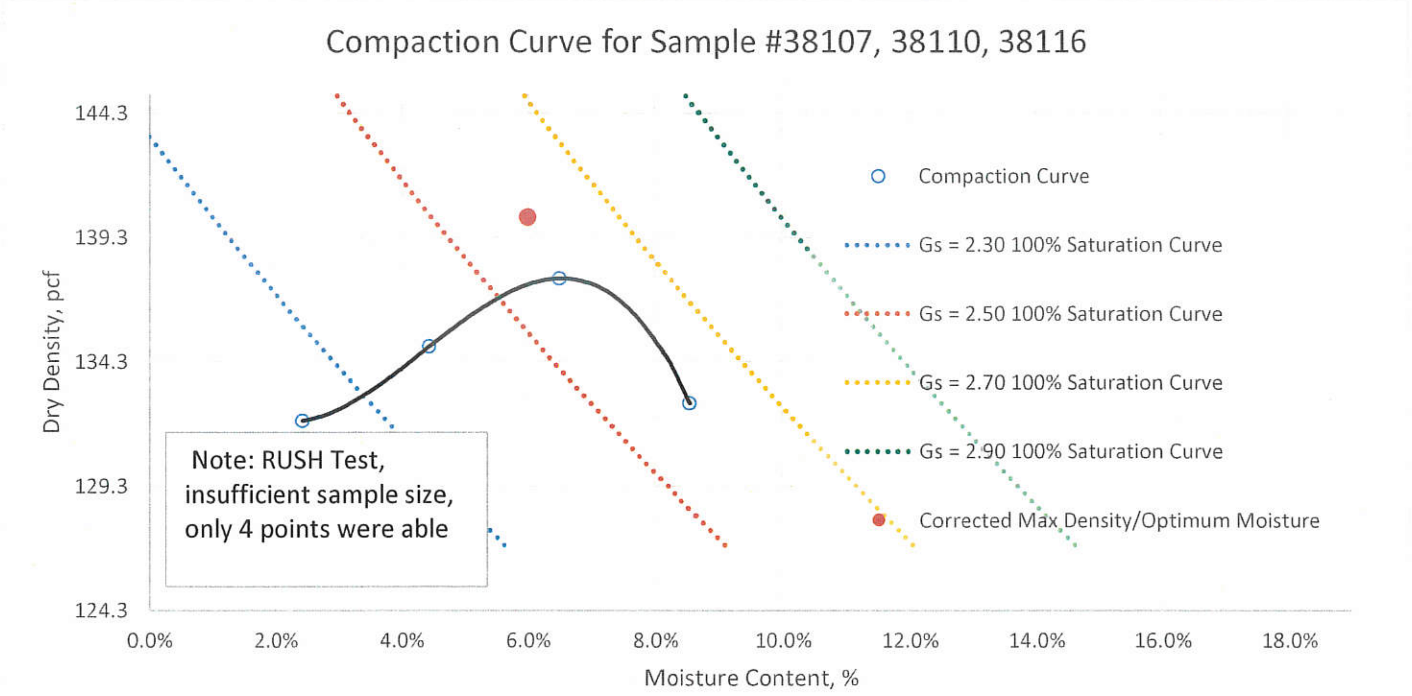
Client: ENGEO
Project: Morongo #28791.000.001
Project Number: US0045894.2305.01
Location: 1B1, 1B2, 1B3 (0-5')
Sample Number: 38107, 38110, 38116
Description: Dark Silty Clayey Sand w/ Gravel

Test Specification: ASTM D1557 Method C
Mold Diameter: 6.00
Hammer Wt.: 10.0 lbs.
Drop Height: 18 inches
Layers: 5
Blows per Layer: 56
Type of Hammer: Mechanical

Test Date: 8/21/2025
Tested By: SW
Checked By: LC

Test Results

Point #	1	2	3	4
Moisture (%)	2.4%	4.4%	6.5%	8.6%
Dry Density (pcf)	131.9	134.9	137.6	132.6



Note: RUSH Test, insufficient sample size, only 4 points were able

Uncorrected Results: Max. Dry Density: 137.6 pcf Optimum Moisture = 6.5%
Rock Corrected Results: Max. Dry Density: 140.1 pcf Optimum Moisture = 6%

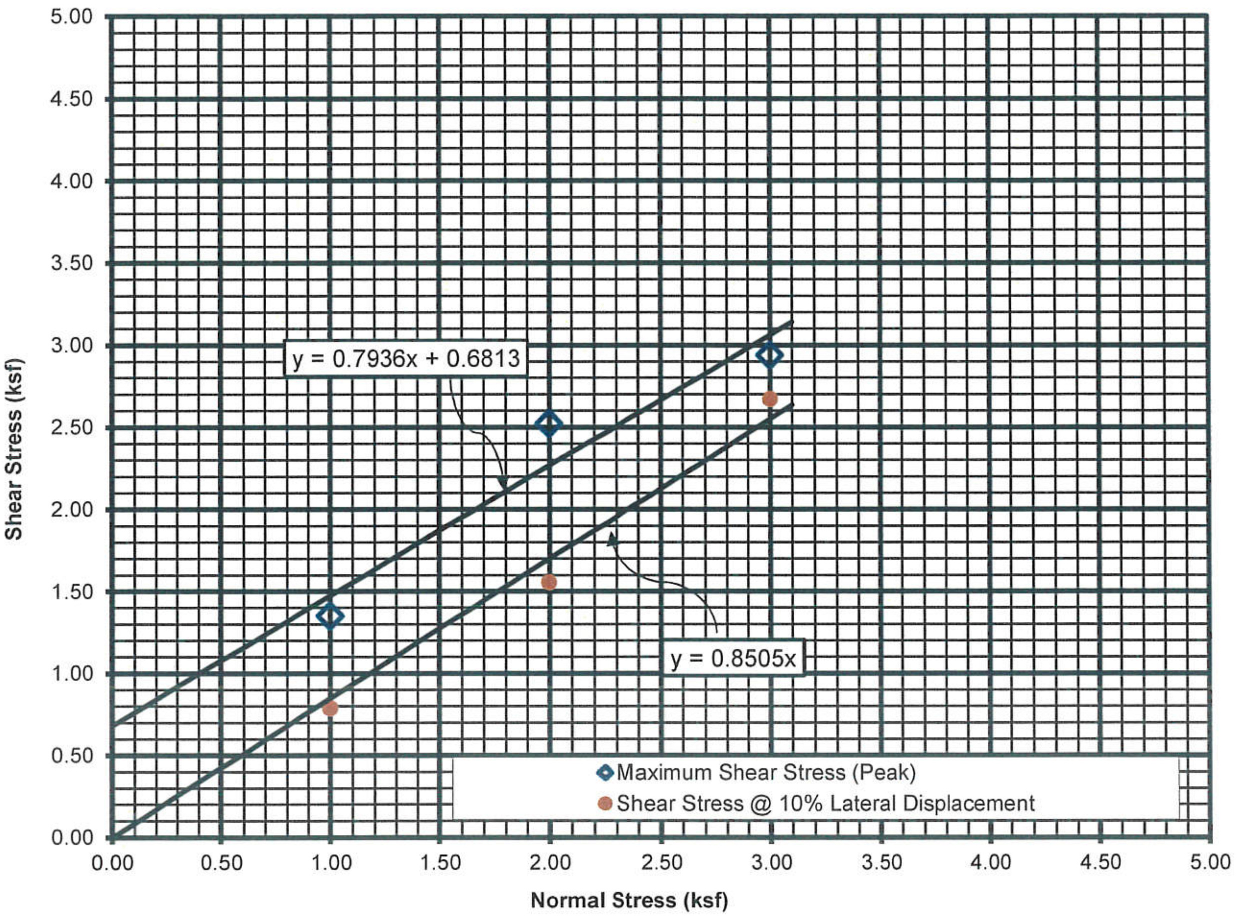
Rock Correction Data (Per ASTM D4718)

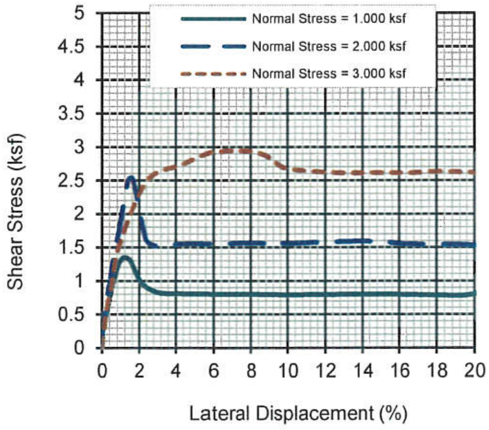
Percentage of Oversize Material = 10
Bulk Specific Gravity of Oversize Material = 2.678
Oversize Material Moisture Content = 1.5

Note: Rock correction was applied to the calculated maximum density and optimum moisture values.

Reviewed By:
David C. Wilson, PE C54734
Senior Associate Engineer - Materials

WSP USA Inc.
9177 Sky Park Court, San Diego, CA 92123





Boring No.:	1B1, 1B2, 1B3 (0-5')
Sample No.:	38107-38110-38116
Sample Depth :	0-5'
Soil Type:	Dark silty clayey sand with gravel
Sample Conditions:	Unsaturated; Remolded
Shear Rate:	0.03
As-Tested Dry Density (PCF):	125.8
As- Tested Moisture Content (%):	6.2%

	◇	●
Cohesion (PSF):	681	0
Friction Angle (Degrees):	47	40

DIRECT SHEAR TEST	Project No.
ENGEO- Morongo CHP	US0045894.2305.01

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DIRECT SHEAR TEST

(AASHTO-T236)

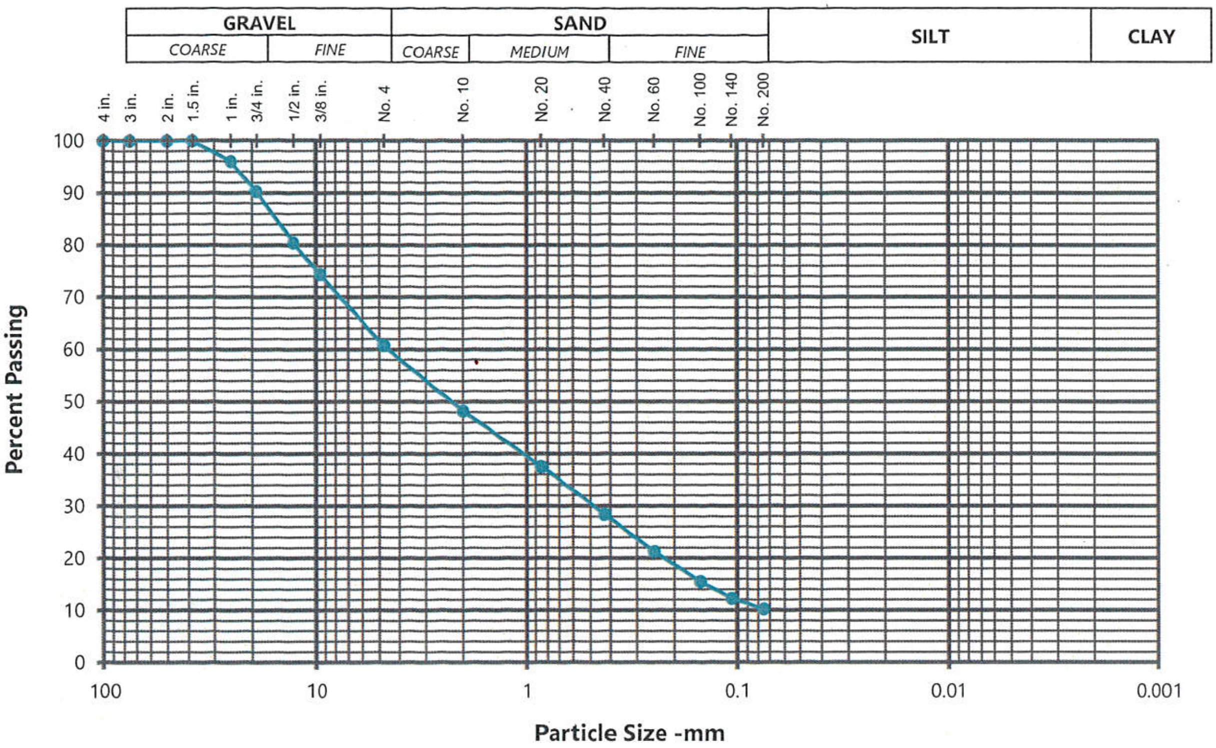
Project Name: ENGEO- Morongo CHP *Project No.:* US0045894.2305.01
Boring No.: 1B1, 1B2, *Sample No.:* 38107-38 *Depth:* 0-5' *Date:* 8/25/2025
Soil Description: Dark silty clayey sand with gravel *Tested By:* B. Lewis

			Before Consolidation			After Consolidation		
			Load 1	Load 2	Load 3	Load 1	Load 2	Load 3
Normal Stress, ksf:		Wt of Soil & Ring, gr:	203.98	202.09	202.89	209.15	208.07	208.61
1.000, 2.000, 3.000		Weight of Ring, gr:	43.23	42.92	41.99	43.23	42.92	41.99
Shear Rate, in/min:		Ring Diameter, in:	2.405	2.405	2.408	2.405	2.405	2.408
0.03		Height of Sample, in:	1.000	1.003	1.013	1.014	1.016	1.016
As-Tested Moisture:	6.2%	Tare No.:				221	69	51
Saturated:	NO	Wet Weight and Tare, gr:				242.30	241.49	243.89
Intact/Undisturbed:	NO	Dry Weight and Tare, gr:				225.29	224.12	226.00
Notes: Smaples were remolded to approx. 90% of ASTM D1557 Max density and optimum moisture. Combined sample from three separate boreholes at apprxoimately 0 to 5 foot depth intervals.		Tare Weight, gr:				78.26	76.41	76.71
		Moisture Content, %:	6.2%	6.2%	6.2%	11.6%	11.8%	12.0%
		Wet Density, pcf:	134.8	133.1	132.9	137.2	136.3	137.2
		Dry Density, pcf:	126.9	125.3	125.1	123.0	122.0	122.5

Load 1 (KSF): 1.000				Load 2 (KSF): 2.000				Load 3 (KSF): 3.000			
Shear Deflec -tion (in)	Lateral Displace -ment (%)	Load Ring Reading	Shear Stress (KSF)	Shear Deflec -tion (in)	Lateral Displace -ment (%)	Load Ring Reading	Shear Stress (KSF)	Shear Deflec -tion (in)	Lateral Displace -ment (%)	Load Ring Reading	Shear Stress (KSF)
0.001	0.0	42	0.271	0.001	0.0	43	0.278	0.005	0.2	73	0.470
0.005	0.2	72	0.465	0.007	0.3	115	0.742	0.012	0.5	140	0.901
0.012	0.5	132	0.852	0.017	0.7	223	1.439	0.023	1.0	240	1.545
0.019	0.8	183	1.181	0.024	1.0	290	1.872	0.059	2.4	335	2.483
0.024	1.0	202	1.304	0.034	1.4	336	2.505	0.106	4.4	351	2.733
0.029	1.2	209	1.349	0.040	1.7	337	2.520	0.140	5.8	362	2.905
0.036	1.5	202	1.304	0.057	2.4	253	1.633	0.154	6.4	363	2.920
0.047	2.0	161	1.039	0.065	2.7	238	1.536	0.161	6.7	364	2.936
0.056	2.3	142	0.916	0.073	3.0	235	1.517	0.196	8.1	363	2.920
0.072	3.0	128	0.826	0.080	3.3	235	1.517	0.218	9.0	357	2.827
0.087	3.6	125	0.807	0.108	4.5	240	1.549	0.241	10.0	347	2.670
0.156	6.5	124	0.800	0.152	6.3	240	1.549	0.307	12.7	343	2.608
0.190	7.9	124	0.800	0.187	7.8	242	1.562	0.357	14.8	343	2.608
0.241	10.0	122	0.787	0.239	9.9	241	1.555	0.400	16.6	343	2.608
0.324	13.5	124	0.800	0.339	14.1	246	1.588	0.430	17.8	344	2.623
0.402	16.7	123	0.794	0.405	16.8	239	1.542	0.451	18.7	344	2.623
0.465	19.3	121	0.781	0.463	19.2	238	1.536	0.487	20.2	343	2.608
0.492	20.5	129	0.833	0.492	20.4	235	1.519	0.494	20.5	343	2.608
Max. Shear Stress, ksf:			1.349				2.520				2.936
Lat.Displmt@Max Stress,%.:			1.2				1.7				6.7

Sample Summary Report

ASTM D6913



%+3"	% GRAVEL		% SAND			% FINES
	Coarse	Fine	Coarse	Medium	Fine	Silt and Clay
0.0	19.5	19.7	12.5	19.8	18.2	10.2

Sieve No.	Opening (mm)	Percent Finer	Sieve No.	Opening (mm)	Percent Finer		
4 in.	100	100	No. 4	4.75	61		
3 in.	75	100	No. 10	2.00	48		
2 in.	50	100	No. 20	0.85	38		
1.5 in.	38.1	100	No. 40	0.425	28		
1 in.	25	96	No. 60	0.250	21		
3/4 in.	19	90	No. 100	0.150	16		
1/2 in.	12.7	80	No. 140	0.106	12		
3/8 in.	9.5	74	No. 200	0.075	10		

Material Description

Lab No.: 38107,38110,38116

Poorly Graded Sand with Silt and Gravel, SP-SM

Sample/Boring Number: 1B1, 1B2, 1B3

Depth: 0-5'

Testing Remarks:

Atterberg Limits

Liquid Limit = ---

Plastic Limit = ---

Plasticity Index = ---

Moisture & Density Results

As-Received Moisture %:	---
Wet Density (pcf):	---
Dry Density (pcf):	---

Date Sampled: 7/31/2025

Date Tested: 8/21/2025

Tested By: RP

Checked By: M. Gibson

Coefficients

D_{90} = 18.7987 D_{85} = 15.5962

D_{60} = 4.5808 D_{50} = 2.3844

D_{30} = 0.4991 D_{15} = 0.1430

D_{10} = N/A

C_U = N/A C_c = N/A

wsp

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