DOCKETED	
Docket Number:	19-SPPE-03
Project Title:	Sequoia Data Center
TN #:	229419-2
Document Title:	Appendices A-N - part 1
Description:	N/A
Filer:	Patty Paul
Organization:	C1-Santa Clara, LLC
Submitter Role:	Applicant
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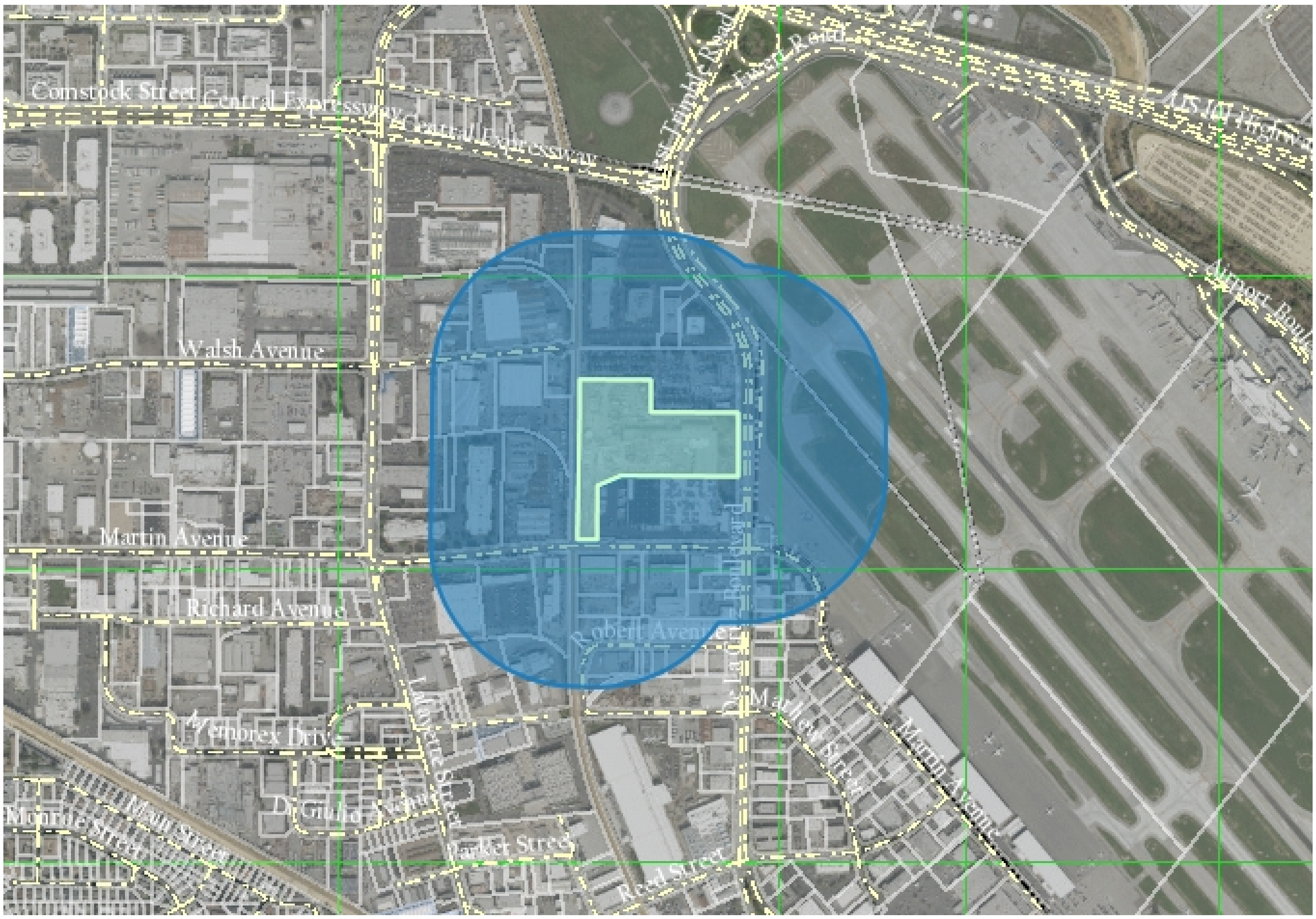
APPENDIX A: MAILING LIST

Report Generated: 7/23/19 2:00 PM

2600 De la Cruz Blvd - 1000 ft



APN	OWNER	MAIL1	MAIL2
224-04-005	L.A.W. LLC	330 COMMERCIAL ST	SAN JOSE, CA 95112-4403
224-04-005	CURRENT RESIDENT or TENANT	860 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-005	CURRENT RESIDENT or TENANT	880 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-005	CURRENT RESIDENT or TENANT	850 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-005	CURRENT RESIDENT or TENANT	870 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-005	CURRENT RESIDENT or TENANT	858 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-006	FRANK MENACHO ET AL	15635 CALISTOGA DR	RAMONA, CA 92065
224-04-006	CURRENT RESIDENT or TENANT	810 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-006	CURRENT RESIDENT or TENANT	812 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-011	BARNHART CONSTRUCTION COMPANY	7008 WILDROSE TR	CARLSBAD, CA 92011
224-04-011	CURRENT RESIDENT or TENANT	785 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	651 WALSH PARTNERS LLC	14573 BIG BASIN WY	SARATOGA, CA 95070-6013
224-04-059	CURRENT RESIDENT or TENANT	711 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	661 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	701 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	691 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	651 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	705 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	627 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	621 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	631 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	625 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	601 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-059	CURRENT RESIDENT or TENANT	611 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-062	WITKIN PROPERTIES LP	188 TWIN OAKS DR	LOS GATOS, CA 95032-5649
224-04-062	CURRENT RESIDENT or TENANT	2709 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-062	CURRENT RESIDENT or TENANT	2705 LAFAYETTE STREET	SANTA CLARA, CA 95054

224-04-062	CURRENT RESIDENT or TENANT	2711 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-062	CURRENT RESIDENT or TENANT	2775 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-062	CURRENT RESIDENT or TENANT	2707 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-062	CURRENT RESIDENT or TENANT	2715 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-062	CURRENT RESIDENT or TENANT	2725 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-062	CURRENT RESIDENT or TENANT	2765 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-062	CURRENT RESIDENT or TENANT	2755 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-071, 224-04-088, 224-04-089, 224-04-090	GAHRAHMAT FAM LP IILP	3476 EDWARD AVENUE	SANTA CLARA, CA 95054-2130
224-04-071	CURRENT RESIDENT or TENANT	651 MARTIN AVENUE	SANTA CLARA, CA 95054
224-04-071	CURRENT RESIDENT or TENANT	631 MARTIN AVENUE	SANTA CLARA, CA 95054
224-04-088	CURRENT RESIDENT or TENANT	2555 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-090	CURRENT RESIDENT or TENANT	801 MARTIN AVENUE	SANTA CLARA, CA 95054
224-04-090	CURRENT RESIDENT or TENANT	881 MARTIN AVENUE	SANTA CLARA, CA 95054
224-04-090	CURRENT RESIDENT or TENANT	851 MARTIN AVENUE	SANTA CLARA, CA 95054
224-04-090	CURRENT RESIDENT or TENANT	821 MARTIN AVENUE	SANTA CLARA, CA 95054
224-04-090	CURRENT RESIDENT or TENANT	831 MARTIN AVENUE	SANTA CLARA, CA 95054
224-04-075	ESTANISLAO AND MARTHA HARO TRUSTEE	12395 COLUMBET AVENUE	SAN MARTIN, CA 95046
224-04-075	CURRENT RESIDENT or TENANT	614 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-075	CURRENT RESIDENT or TENANT	630 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-076	DJ SMITH FAM PARTNERSHIP LP	4208 CHABOYA RD	SAN JOSE, CA 95148-3707
224-04-076	CURRENT RESIDENT or TENANT	750 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-076	CURRENT RESIDENT or TENANT	764 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-076	CURRENT RESIDENT or TENANT	760 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	PELIO 650 WALSH LLC	14573 BIG BASIN WY	SARATOGA, CA 95070-6013
224-04-077	CURRENT RESIDENT or TENANT	668 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	664 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	680 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	688 WALSH AVENUE	SANTA CLARA, CA 95054

224-04-077	CURRENT RESIDENT or TENANT	672 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	676 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	684 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	686 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	696 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	670 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-077	CURRENT RESIDENT or TENANT	660 WALSH AVENUE	SANTA CLARA, CA 95054
224-04-093	DIGITAL LAFAYETTE LLC	16600 WOODRUFF AVENUE, STE 200	BELLFLOWER, CA 90706
224-04-093	CURRENT RESIDENT or TENANT	2825 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-093	CURRENT RESIDENT or TENANT	2845 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-04-094	DIGITAL BH 800 LLC	16600 WOODRUFF AVENUE, STE 200	BELLFLOWER, CA 90706
224-04-094	CURRENT RESIDENT or TENANT	2805 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-35-014	D & R MILLER PROPS LLC	630 MARTIN AVENUE	SANTA CLARA, CA 95050-2914
224-35-017	PENINSULA BUILDING MATERIALS CO	2490 CHARLESTON RD	MOUNTAIN VIEW, CA 94043-1627
224-35-017	CURRENT RESIDENT or TENANT	650 MARTIN AVENUE	SANTA CLARA, CA 95054
224-35-017	CURRENT RESIDENT or TENANT	680 MARTIN AVENUE	SANTA CLARA, CA 95054
224-35-017	CURRENT RESIDENT or TENANT	640 MARTIN AVENUE	SANTA CLARA, CA 95054
224-35-020	WESCO PROPERTIES INC	936 E GREEN STREET, STE 108	PASADENA, CA 91106-2946
224-35-020	CURRENT RESIDENT or TENANT	2435 LAFAYETTE STREET	SANTA CLARA, CA 95054
224-40-001	VANTAGE DATA CENTERS 7 LLC	2820 NORTHWESTERN PY	SANTA CLARA, CA 95051
224-40-002	MATHEW REALTY INVESTMENT LLC	2820 NORTHWESTERN PY	SANTA CLARA, CA 95051
230-03-019	CURRENT RESIDENT or TENANT	483 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-019, 230-03-020	DANIEL AND ARTEMISA VARGAS TRUSTEE	1616 CROW CT	SUNNYVALE, CA 94087-4623
230-03-020	CURRENT RESIDENT or TENANT	495 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-020	CURRENT RESIDENT or TENANT	485 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-021	525 ROBERT LLC	1985 HILL LN	COLORADO SPRINGS, CO 80904
230-03-021	CURRENT RESIDENT or TENANT	525 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-021	CURRENT RESIDENT or TENANT	527 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-022	RICHARD LONG TRUSTEE	17810 FOSTER RD	LOS GATOS, CA 95030-0000

230-03-022	CURRENT RESIDENT or TENANT	575 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-026	3J RENTALS INC	2322 KLUNE CT	SANTA CLARA, CA 95054-1326
230-03-026	CURRENT RESIDENT or TENANT	518 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-027	WILLIAM ESERINI TRUSTEE & ET AL	508 ROBERT AVENUE	SANTA CLARA, CA 95050-2955
230-03-028	JANE HARVEY TRUSTEE & ET AL	1490 OAK AVENUE	LOS ALTOS, CA 94024-5710
230-03-028	CURRENT RESIDENT or TENANT	506 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-028	CURRENT RESIDENT or TENANT	504 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-031	JOHN SCHAFER TRUSTEE	15710 MONTEBELLO RD	CUPERTINO, CA 95014-5409
230-03-031	CURRENT RESIDENT or TENANT	440 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-031	CURRENT RESIDENT or TENANT	436 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-047, 230-03-094, 230-03-095	SOUTHERN PACIFIC TRANSPORTATION CO	65 CAHILL ST	SAN JOSE, CA 95110
230-03-055	JENIC	1500 UNIVERSITY AVENUE	SAN JOSE, CA 95126
230-03-055	CURRENT RESIDENT or TENANT	444 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-055	CURRENT RESIDENT or TENANT	446 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-055	CURRENT RESIDENT or TENANT	448 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-055	CURRENT RESIDENT or TENANT	442 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-059	540 MARTIN AVE LLC	127 AMANDA LN	LOS GATOS, CA 95032
230-03-059	CURRENT RESIDENT or TENANT	510 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-059	CURRENT RESIDENT or TENANT	540 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-062	JRDL ASSOCIATES LLC	5263 COLERIDGE CT	CARLSBAD, CA 92008
230-03-062	CURRENT RESIDENT or TENANT	462 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-062	CURRENT RESIDENT or TENANT	430 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-062	CURRENT RESIDENT or TENANT	450 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-062	CURRENT RESIDENT or TENANT	444 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-062	CURRENT RESIDENT or TENANT	440 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-062	CURRENT RESIDENT or TENANT	442 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-063	RICHARD N REESE FAMLIMITED LIABILITY CO E	9310 S 370 W	SANDY, UT 84070
230-03-063	CURRENT RESIDENT or TENANT	570 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-069	CALVIN AND JEAN MCGILLIS TRUSTEE	100 LYELL ST	LOS ALTOS, CA 94022
230-03-069	CURRENT RESIDENT or TENANT	590 MARTIN AVENUE	SANTA CLARA, CA 95054

230-03-070, 230-03-071	RICHARD LONG TRUSTEE	17810 FOSTER RD	LOS GATOS, CA 95030-0000
230-03-071	CURRENT RESIDENT or TENANT	585 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-082	DOREEN CALI TRUSTEE	1709 MULBERRY LN	SAN JOSE, CA 95125-4945
230-03-082	CURRENT RESIDENT or TENANT	2482 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-082	CURRENT RESIDENT or TENANT	2480 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-082	CURRENT RESIDENT or TENANT	2490 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-082	CURRENT RESIDENT or TENANT	2488 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-083	AXIS HOLDINGS LTD LLC	5477 HARVARD DR	SAN JOSE, CA 95118-3417
230-03-083	CURRENT RESIDENT or TENANT	2474 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-084	MORAN COMMERCIAL LLC	2464 DE LA CRUZ BLVD	SANTA CLARA, CA 95050-2923
230-03-084	CURRENT RESIDENT or TENANT	2470 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-084	CURRENT RESIDENT or TENANT	2468 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-084	CURRENT RESIDENT or TENANT	2466 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-090	NEWARK GROUP INDUSTRIES INC	525 MATHEW ST	SANTA CLARA, CA 95050-3001
230-03-090	CURRENT RESIDENT or TENANT	535 MATHEW STREET	SANTA CLARA, CA 95054
230-03-091	CURRENT RESIDENT or TENANT	445 ROBERT AVENUE	SANTA CLARA, CA 95054
230-03-091	CURRENT RESIDENT or TENANT	2460 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-091	CURRENT RESIDENT or TENANT	2440 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-091	CURRENT RESIDENT or TENANT	2402 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-096	CURRENT RESIDENT or TENANT	2858 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-096	CURRENT RESIDENT or TENANT	2860 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-096	CURRENT RESIDENT or TENANT	2830 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-096	CURRENT RESIDENT or TENANT	2880 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-096	CURRENT RESIDENT or TENANT	2890 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-096	CURRENT RESIDENT or TENANT	2850 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-06-097, 230-03-098	CENTRAL PROPERTY OWNER LLC	260 CALIFORNIA STREET, STE 1100	SAN FRANCISCO, CA 94111
230-03-097	CURRENT RESIDENT or TENANT	2800 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-098	CURRENT RESIDENT or TENANT	2770 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-099	NATIONAL CAR RENTALSYSTS INC	130 S JEFFERSON STREET, STE 300	CHICAGO, IL 60661
230-03-099	CURRENT RESIDENT or TENANT	2752 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054

230-03-099	CURRENT RESIDENT or TENANT	2750 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-101	SAN JOSE CITY OF	201 S ORANGE AVENUE, STE 1290	ORLANDO, FL 32801
230-03-101	CURRENT RESIDENT or TENANT	393 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-101	CURRENT RESIDENT or TENANT	373 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-102	CURRENT RESIDENT or TENANT	2777 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-03-106	EMF LLC	1875 BOOKSIN AVENUE	SAN JOSE, CA 95125-4502
230-03-106	CURRENT RESIDENT or TENANT	2500 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-013	MARILYN AND GERALD TABOR TRUSTEE	1053 LA CUESTA RD	HILLSBOROUGH, CA 94010
230-47-013	CURRENT RESIDENT or TENANT	2415 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-013	CURRENT RESIDENT or TENANT	2403 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-013	CURRENT RESIDENT or TENANT	2405 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-014	GILBERT AND ANN COCCHETTO ET AL	19302 VIA CRECENTE CT	SARATOGA, CA 95070
230-47-014	CURRENT RESIDENT or TENANT	2439 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-014	CURRENT RESIDENT or TENANT	2441 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-014	CURRENT RESIDENT or TENANT	2433 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-014	CURRENT RESIDENT or TENANT	2437 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-014	CURRENT RESIDENT or TENANT	2435 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-061	DE LA CRUZ PETROLEUM MKTG INC	401 SAN MATEO AVENUE	SAN BRUNO, CA 94066
230-47-061	CURRENT RESIDENT or TENANT	2495 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-061	CURRENT RESIDENT or TENANT	2491 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-108	GIULIO AND HAZEL CHIOINI TRUSTEE	19302 VIA CRECENTE CT	SARATOGA, CA 95070
230-47-108	CURRENT RESIDENT or TENANT	390 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-108	CURRENT RESIDENT or TENANT	392 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	DE LA CRUZ BSNS CTRLLC	4020 MOORPARK AVENUE, STE 218	SAN JOSE, CA 95117
230-47-109	CURRENT RESIDENT or TENANT	402 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	412 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	410 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	416 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	398 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	406 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	400 MARTIN AVENUE	SANTA CLARA, CA 95054

230-47-109	CURRENT RESIDENT or TENANT	408 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	396 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	404 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	394 MARTIN AVENUE	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	2465 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	2455 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	2475 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	2485 DE LA CRUZ BOULEVARD	SANTA CLARA, CA 95054
230-47-109	CURRENT RESIDENT or TENANT	414 MARTIN AVENUE	SANTA CLARA, CA 95054
230-03-105	C1-SANTA CLARA LLC	2101 CEDAR SPRINGS RD., STE 900	DALLAS, TX 75201
230-03-105	CURRENT RESIDENT or TENANT	2600 DE LA CRUZ BLVD.	SANTA CLARA, CA 95054
	CITY OF SANTA CLARA, PLANNING DIVISION, DEBBY FERNANDEZ, 2600 DE LA CRUZ BLVD)	1500 WARBURTON AVENUE	SANTA CLARA, CA 95050

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APPENDIX B: SVP WILL-SERVE LETTER

SILICON VALLEY POWER
CITY OF SANTA CLARA
Powering The Center of What's Possible

July 22, 2019

CyrusOne
Todd Masters, Energy Manager
2101 Cedar Springs Road
Suite 900
Dallas, TX 75201

SUBJECT: ***CyrusOne Sequoia Data Center***
2600 De La Cruz

Dear Mr. Masters,

The City of Santa Clara's Electric Department, Silicon Valley Power (SVP), is the electric utility for this project. Electric service to the above mentioned address will be provided in accordance with the Rules and Regulations for the utility as approved by Santa Clara City Council. The terms in this letter expire one year from the date of this letter or are superseded by the execution of an Electric Service and Substation Agreement between the City of Santa Clara and C1-Santa Clara LLC.

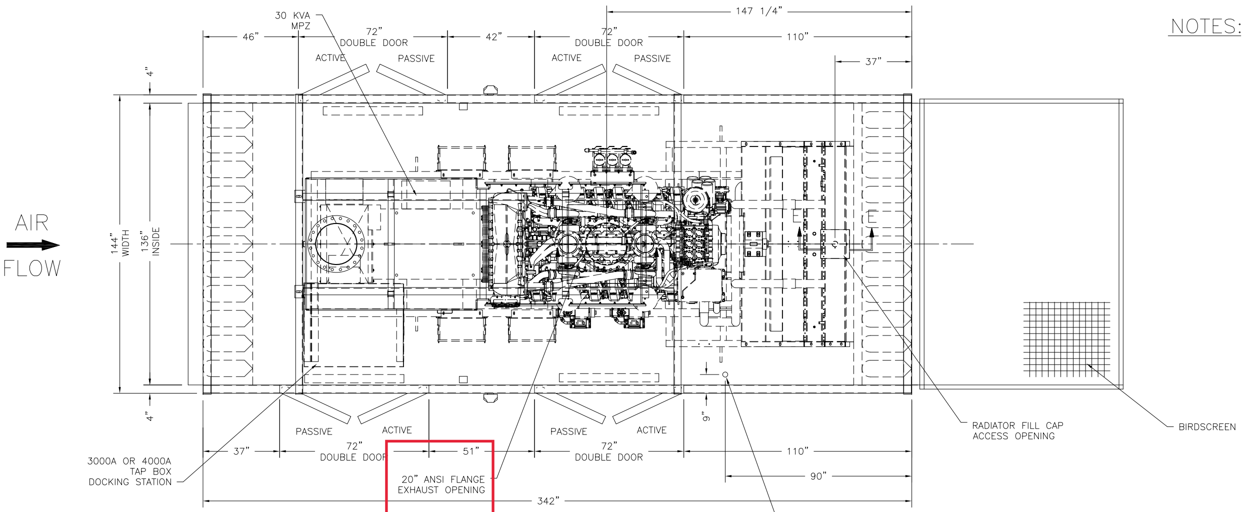
SVP can provide 27 MW of electricity to the project site immediately and another 72 MW upon the completion of an onsite substation by CyrusOne. The total capacity that will be provided to the project will not exceed 99 MW.

Thank you,

Kevin Keating
Electric Division Manager

APPENDIX C: MANUFACTURER SPECIFICATION SHEETS

E & C A "CUSTOM FIT"



PLAN VIEW

NOTES:

ENCLOSURE ASSEMBLY:
* FOR AN MTU 2250 KW GEN-SET.
* FULLY ASSEMBLED DROP OVER ENCLOSURE TO BE ANCHORED TO THE BASE TANK.
* PANEL JOINTS ARE SKIP WELDED AND CAULKED.

ENCLOSURE CONSTRUCTION:
* WALLS AND ROOF – 14 GAUGE GALVANNEALED STEEL.
* FRAME CONSTRUCTION – A36 STRUCTURAL CHANNEL & A-500 TUBING.
* INNER LINER – PERFORATED GALVANNEALED STEEL.
* INSULATION – MINERAL WOOL AND POLY LINER.
* DOORS – THREE (3) DOUBLE & ONE (1) SINGLE ACCESS SERVICE DOORS WITH STAINLESS STEEL HINGES AND LATCHES.
* BAFFLES – 24" DEEP INLET & 24" DEEP DISCHARGE PANELS. GALVANNEALED CONSTRUCTION.
* LOUVERS – FIXED INLET WEATHER LOUVERS W/BIRDSCREEN. GALVANNEALED CONSTRUCTION.
* ELBOW – DISCHARGE ELBOW WITH BIRDSCREEN. GALVANNEALED CONSTRUCTION.
* BOLTING HARDWARE – STAINLESS STEEL.

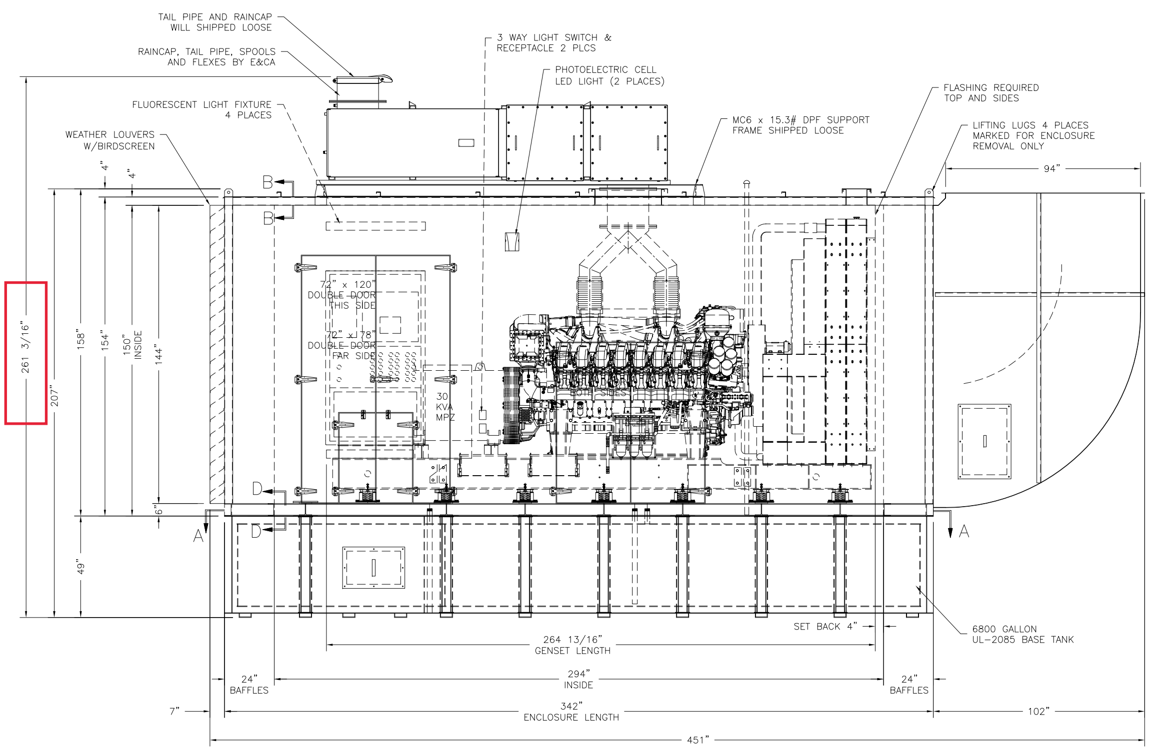
DESIGN SPECIFICATIONS:
* DESIGNED TO REDUCE THE AIRBORNE GEN-SET EQUIPMENT NOISE LEVELS BY 15 dB(A) WHEN MEASURED AT A DISTANCE OF 23 FEET FROM THE ENCLOSURE AND 5 1/2 FEET ABOVE GRADE IN A FREE FIELD ENVIRONMENT.
* THE GEN-SET EQUIPMENT NOISE DOESN'T EXCEED 128 dB.
* BASED ON A TOTAL AIR REQUIREMENT OF 128,780 CFM AT LESS THAN 1/2" W.G. BACK PRESSURE THROUGH THE ENCLOSURE.
* ENGINE EXHAUST IS NOT INCLUDED.

PAINTING:
* ALL EXTERIOR GALVANNEALED SURFACES TO BE SOLVENT CLEANED PER SSPC-SP1 AND PAINTED AS FOLLOWS:
  INTERMEDIATE – ONE COAT AMERICAN COATINGS POLYURETHANE (1-1.5 MILS DFT)
  FINISH – ONE COAT AMERICAN COATINGS POLYURETHANE (.5-1 MILS DFT)
* ALL CARBON STEEL SURFACES TO BE POWER TOOL CLEANED PER SSPC-SP3 AND PAINTED AS FOLLOWS:
  PRIMER – ONE COAT INDUSTRIAL PRIMER (2-4 MILS DFT)
  FINISH – ONE COAT AMERICAN COATINGS POLYURETHANE (2-4 MILS DFT)
* COLOR – SPECTRUM GREY.

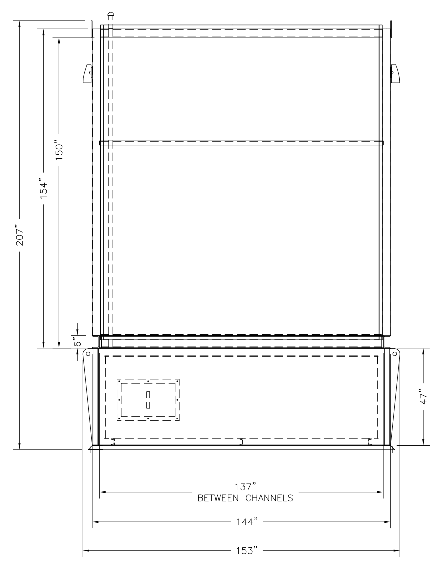
ELECTRICAL:
* SEE DRAWING H0806182C.

ENCLOSURE SHIPPING SIZE & WEIGHT:
* SIZE – 451" L x 150" W x 158" H
* WEIGHT – 19,500 LBS.

TANK WEIGHT (Dry): 31000 Lbs.
GENSET WEIGHT: 45000 Lbs.
MUFFLER WEIGHT: 3950 Lbs.
PACKAGE WEIGHT (Dry Tank with Muffler): 90,500 Lbs.



ELEVATION VIEW



END VIEW

ACOUSTICAL ENCLOSURE

MTU 2250 KW

DRAWING NUMBER	SCALE	APPROVED BY	DRAWN BY	PROJECT NAME
H0806182B	NONE		JS	CYRUS ONE SANTA CLARA
	DATE 11/09/18		REVISION 0	

DIESEL GENERATOR SET
MTU 16V4000 DS2250

2250 kWe / 60 Hz / Standby
380 - 13.8kV

Reference MTU 16V4000 DS2250 (2045 kWe) for Prime Rating Technical Data

SYSTEM RATINGS

Standby

Voltage (L-L)	380V	480V*	600V	4160V	12470V	13200V	13800V
Phase	3	3	3	3	3	3	3
PF	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Hz	60	60	60	60	60	60	60
kW	2250	2250	2250	2250	2250	2250	2250
kVA	2812	2812	2812	2812	2812	2812	2812
Amps	4273	3383	2706	390	130	123	117
skVA@30% Voltage Dip	3625	8400	3900	5000	4120	4120	4900
Generator Model	1020FDL1102	744RSL4058	1020FDS1120	744FSM4376	1020FDH1246	1020FDH1244	1020FDH1246
Temp Rise	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C	130 °C/40 °C
Connection	6 LEAD WYE	4 LEAD WYE	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE	6 LEAD WYE

* UL 2200 Offered

CERTIFICATIONS AND STANDARDS

// **Emissions –** EPA Tier 2 Certified

// **Generator set is designed and manufactured in facilities certified to standards ISO 9001:2008 and ISO 14001:2004**

// **Seismic Certification – Optional**
– IBC Certification
– OSHPD Pre-Approval

// **UL 2200 Listed – Optional**

// **Performance Assurance Certification (PAC)**
- Generator Set Tested to ISO 8528-5 for Transient Response
- Verified product design, quality and performance integrity
- All engine systems are prototype and factory tested

// **Power Rating**
- Accepts Rated Load in One Step Per NFPA 110
- Permissible average power output during 24 hours of operation is approved up to 85%.

STANDARD FEATURES*

- // MTU Onsite Energy is a single source supplier
- // Global Product Support
- // 2 Year Standard Warranty
- // 16V4000 Diesel Engine
  - 76.3 Liter Displacement
  - Common Rail Fuel Injection
  - 4-Cycle
- // Complete Range of Accessories
- // Generator
  - Brushless, Rotating Field Generator
  - 2/3 Pitch Windings
  - PMG (Permanent Magnet Generator) supply to regulator
  - 300% Short Circuit Capability
- // Digital Control Panel(s)
  - UL Recognized, CSA Certified, NFPA 110
  - Complete System Metering
  - LCD Display
- // Cooling System
  - Integral Set-Mounted
  - Engine-Driven Fan

STANDARD EQUIPMENT*

// Engine

Air Cleaners
Oil Pump
Oil Drain Extension and S/O Valve
Full Flow Oil Filter
Closed Crankcase Ventilation
Jacket Water Pump
Inter Cooler Water Pump
Thermostats
Blower Fan and Fan Drive
Radiator - Unit Mounted
Electric Starting Motor - 24V
Governor – Electronic Isochronous
Base - Structural Steel
SAE Flywheel and Bell Housing
Charging Alternator - 24V
Battery Box and Cables
Flexible Fuel Connectors
Flexible Exhaust Connection
EPA Certified Engine

// Generator

NEMA MG1, IEEE and ANSI standards compliance for temperature rise and motor starting
Sustained short circuit current of up to 300% of the rated current for up to 10 seconds
Self-Ventilated and Drip-Proof
Superior Voltage Waveform
Digital, Solid State, Volts-per-Hertz Regulator
No Load to Full Load Regulation
Brushless Alternator with Brushless Pilot Exciter
4 Pole, Rotating Field
130 °C Max. Standby Temperature Rise
1 Bearing, Sealed
Flexible Coupling
Full Amortisseur Windings
125% Rotor Balancing
3-Phase Voltage Sensing
±0.25% Voltage Regulation
100% of Rated Load - One Step
5% Max. Total Harmonic Distortion

// Digital Control Panel(s)

Digital Metering
Engine Parameters
Generator Protection Functions
Engine Protection
CANBus ECU Communications
Windows®-Based Software
Multilingual Capability
Remote Communications to RDP-110 Remote Annunciator
Programmable Input and Output Contacts
UL Recognized, CSA Certified, CE Approved
Event Recording
IP 54 Front Panel Rating with Integrated Gasket
NFPA110 Compatible

* Represents standard product only. Consult Factory/MTU Onsite Energy Distributor for additional configurations.

APPLICATION DATA

// Engine

Manufacturer	MTU
Model	16V4000G84S
Type	4-Cycle
Arrangement	16-V
Displacement: L (in^3)	76.3 (4,656)
Bore: cm (in)	17 (6.69)
Stroke: cm (in)	21 (8.27)
Compression Ratio	16.5:1
Rated RPM	1,800
Engine Governor	Electronic Isochronous (ADEC)
Max. Power: kWm (bhp)	2,500 (3,353)
Speed Regulation	±0.25%
Air Cleaner	Dry

// Liquid Capacity (Lubrication)

Total Oil System: L (gal)	300 (79.3)
Engine Jacket Water Capacity: L (gal)	175 (46.2)
After Cooler Water Capacity: L (gal)	50 (13.2)
System Coolant Capacity: L (gal)	547 (145)

// Electrical

Electric Volts DC	24
Cold Cranking Amps Under -17.8 °C (0 °F)	2,800

// Fuel System

Fuel Supply Connection Size	-16 JIC 37° Female 1" NPT Adapter Provided
Fuel Return Connection Size	-16 JIC 37° Female 1" NPT Adapter Provided
Max. Fuel Lift: m (ft)	1 (3)
Recommended Fuel	Diesel #2
Total Fuel Flow: L/hr (gal/hr)	1,200 (317)

// Fuel Consumption

At 100% of Power Rating: L/hr (gal/hr)	617 (163)
At 75% of Power Rating: L/hr (gal/hr)	467 (123)
At 50% of Power Rating: L/hr (gal/hr)	325 (86)

// Cooling - Radiator System

Ambient Capacity of Radiator: °C (°F)	40 (104)
Max. Restriction of Cooling Air: Intake and Discharge Side of Rad.: kPa (in. H_20)	0.12 (0.5)
Water Pump Capacity: L/min (gpm)	1,350 (357)
After Cooler Pump Capacity: L/min (gpm)	583 (154)
Heat Rejection to Coolant: kW (BTUM)	930 (52,888)
Heat Rejection to After Cooler: kW (BTUM)	680 (38,671)
Heat Radiated to Ambient: kW (BTUM)	206 (11,711)
Fan Power: kW (hp)	95.4 (128)

// Air Requirements

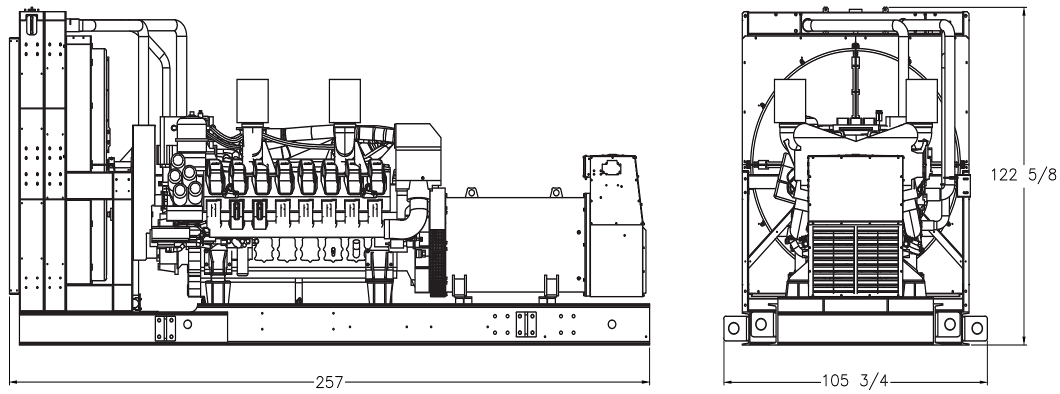
Aspirating: *m^3/min (SCFM)	192 (6,780)
Air Flow Required for Rad. Cooled Unit: *m^3/min (SCFM)	2,053 (72,500)
Remote Cooled Applications; Air Flow Required for Dissipation of Radiated Generator Set Heat for a Max. of 25 °F Rise: *m^3/min (SCFM)	752 (26,412)

* Air density = 1.184 kg/m^3 (0.0739 lbm/ft^3)

// Exhaust System

Gas Temp. (Stack): °C (°F)	505 (941)
Gas Volume at Stack Temp: m^3/min (CFM)	504 (17,799)
Max. Allowable Back Pressure: kPa (in. H_20)	8.5 (34.1)

WEIGHTS AND DIMENSIONS



Drawing above for illustration purposes only, based on standard open power 480 volt generator set. Lengths may vary with other voltages. Do not use for installation design. See website for unit specific template drawings.

System	Dimensions (L x W x H)	Weight (less tank)
Open Power Unit (OPU)	6,528 x 2,686 x 3,115 mm (257 x 105.7 x 122.6 in)	16,429 kg (36,220 lb)

Weights and dimensions are based on open power units and are estimates only. Consult the factory for accurate weights and dimensions for your specific generator set.

SOUND DATA

Unit Type	Standby Full Load
Level 0: Open Power Unit dB(A)	98.7

Sound data is provided at 7 m (23 ft). Generator set tested in accordance with ISO 8528-10 and with infinite exhaust.

EMISSIONS DATA

NO_x + NMHC	CO	PM
5.07	0.52	0.04

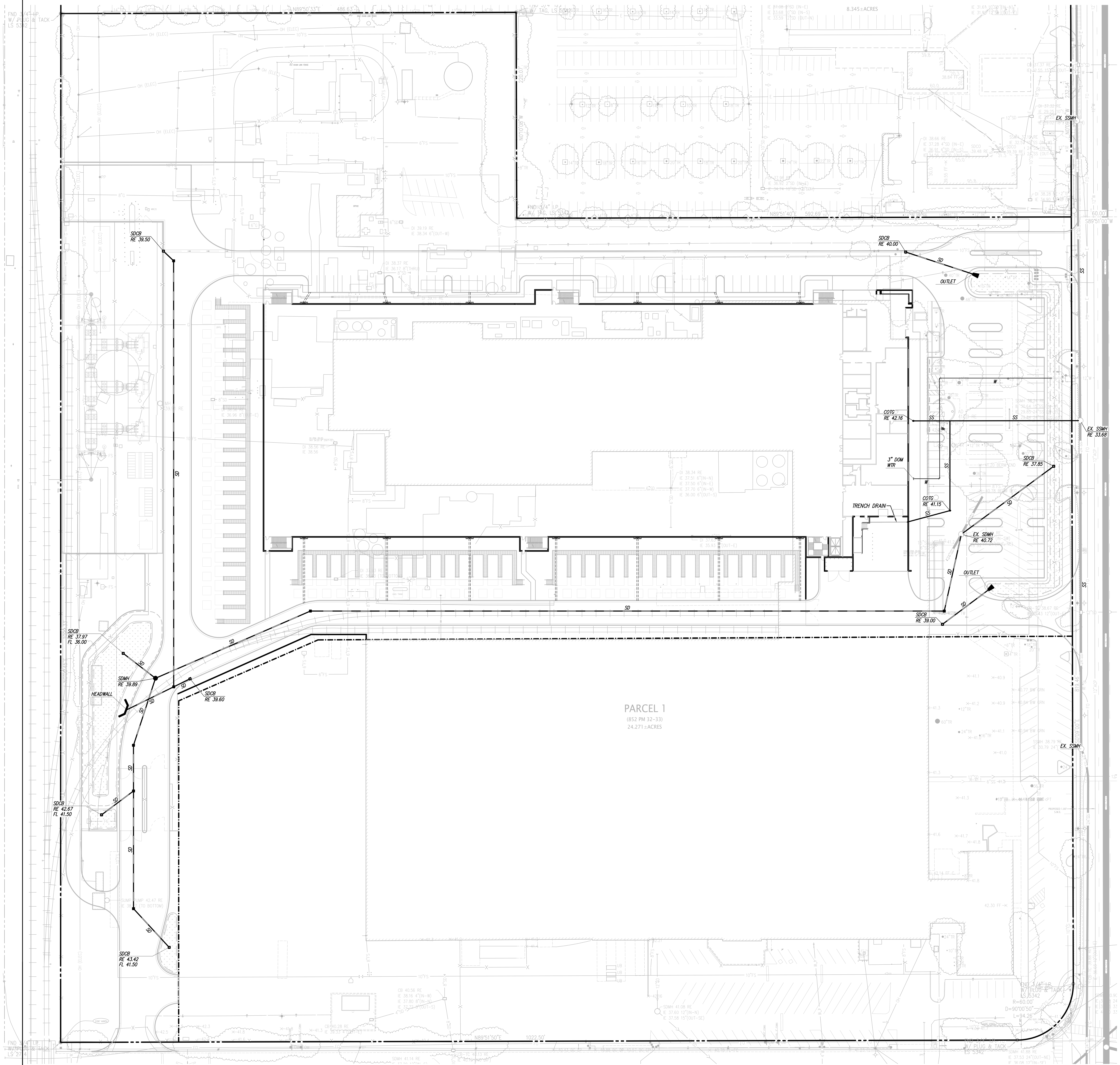
All units are in g/hp-hr and shown at 100% load (not comparable to EPA weighted cycle values).
Emission levels of the engine may vary with ambient temperature, barometric pressure, humidity, fuel type and quality, installation parameters, measuring instrumentation, etc. The data was obtained in compliance with US EPA regulations. The weighted cycle value (not shown) from each engine is guaranteed to be within the US EPA Standards.

RATING DEFINITIONS AND CONDITIONS

- // Standby ratings apply to installations served by a reliable utility source. The standby rating is applicable to varying loads for the duration of a power outage. No overload capability for this rating. Ratings are in accordance with ISO 8528-1, ISO 3046-1, BS 5514, and AS 2789. Average load factor: ≤ 85%.
- // Deration Factor:
  Altitude: Consult your local MTU Onsite Energy Power Generation Distributor for altitude derations.
  Temperature: Consult your local MTU Onsite Energy Power Generation Distributor for temperature derations.

C/F = Consult Factory/MTU Onsite Energy Distributor
N/A = Not Available

APPENDIX D: PRELIMINARY UTILITY PLAN



NORTH

0 20 40 80 120

Scale 1" = 40'

LEGEND

ASR	AUTOMATIC SPRINKLER RISER
RE	RIM ELEVATION
TC	TOP OF CURB
WS	WATER SERVICE
	EXISTING UTILITY TO BE ABANDONDED BY REMOVAL
FS	FIRE SERVICE
SS	SANITARY SEWER
COTG	CLEANOUT TO GRADE
	STORM DRAIN LINE
	AREA DRAIN
	STORM DRAIN CATCH BASIN
	STORM DRAIN JUNCTION BOX
	STORM DRAIN MANHOLE
	BACK FLOW PREVENTION DEVICE
	FIRE DEPARTMENT CONNECTION
	FIRE HYDRANT & VALVE
	POST INDICATOR VALVE
SSMH	SANITARY SEWER MANHOLE
	SINGLE CHECK VALVE
SDMH	STORM DRAIN MANHOLE
	WATER METER

CORGAN

Architect Firm Name
Architect Address
T: Architect Phone F: Architect Fax

kW Mission Critical Engineering, d.p.c.
433 River Street, Suite 7002, Troy, NY 12180

Bennt & Pless Inc.
47 Perimeter Central East,
Suite 500 Atlanta, GA 30346

Design Consulting LLC
103 E Haning St. Howe TX 75459

KIER+WRIGHT
4081 Mission Oaks Blvd. Suite. B Camarillo, Ca 93012

ISSUES

1	6-12-2019	DD Submittal

REVISIONS

This Document was produced by or under the authority of Registered Architect:

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Date of issue:
Project Issue Date

SANTA CLARA
2600 De La Cruz Blvd
Santa Clara, CA 95050

CyrusOne

PRELIMINARY UTILITY PLAN

PROJECT NUMBER 17125.0300

DATE JUNE 12,2019

SHEET NUMBER C3.1

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APPENDIX E: GEOTECHNICAL INVESTIGATION REPORT

GEOTECHNICAL INVESTIGATION
CYRUSONE DATA CENTER
2600 DE LA CRUZ BOULEVARD
SANTA CLARA, CALIFORNIA

PROJECT NO. 20190787.001A

October 31, 2018

October 31, 2018
Project No. 20190787.001A

CyrusOne LLC
2101 Cedar Springs Road, Suite 900
Dallas, Texas 75201

Attention: Sylvia Kang
Vice President, Site Selection and Energy Management
skang@cyrusone.com

cc: Jenelle Taflin, PE, LEED AP
Navix Engineering
jtaflin@navixeng.com

SUBJECT: Geotechnical Investigation
CyrusOne Data Center
2600 De La Cruz Boulevard
Santa Clara, California

Dear Ms. Kang:

This letter transmits the final geotechnical investigation report for the CyrusOne data center project located at 2600 De La Cruz Boulevard, in Santa Clara, California. The report presents the results of our field investigation and laboratory testing for the project, and our conclusions and recommendations pertaining to geotechnical design and construction. This report supersedes the preliminary geotechnical report dated August 23, 2018 and incorporates additional geotechnical design information related to a mat foundation design alternative, which was discussed with the design team following production of the preliminary report.

We appreciate the opportunity to be of service on this project. If you have any questions, comments or require additional information, please contact the undersigned.

Sincerely,

KLEINFELDER, INC.

Eric Johnson, PE
Senior Engineer

Mark D. Fuhriman, PE, GE
Principal Geotechnical Engineer

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FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 GENERAL

Kleinfelder has conducted geotechnical field exploration, performed related laboratory testing, and is providing this geotechnical investigation report in support of design and construction planning for the proposed CyrusOne data center project in Santa Clara, California. This report summarizes the geotechnical design data, presents conclusions on the geotechnical site characterization, and presents conclusions and recommendations to guide geotechnical aspects of project design and construction.

We understand the subject project will consist of redevelopment of the approximately 14.8-acre, single-parcel site, at 2600 De La Cruz Blvd. in Santa Clara, California. The site is in an industrial zone southwest of the San Jose International Airport and is bounded to the west by a freight rail corridor, to the east by De La Cruz Boulevard, an existing warehouse and loading dock to the south, and a rental car facility and parking lot to the north. The project site is currently occupied by a paper mill operation, which is in the process of being decommissioned and demolished. We understand the paper mill was originally constructed in the 1950s and includes a warehouse building with a 20-foot deep basement, office space, loading docks, asphalt-paved driveways, a cogeneration plant, an electrical substation, a 40,000-gallon water storage tank, various other process facilities, as well as structures and above-ground storage vessels that are in various stages of being decommissioned or demolished. The general site location is shown on Figure 1. A more detailed site plan is shown on Figure 2.

Based on information provided by Bennett & Pless, the project structural engineer, the approximate floor load (dead load plus permanent live load) on the data hall wings is about 1,300 pounds per square foot (psf). Between the data hall wings, the central office building and dock area will have floor loads of up to 1,000 psf. The design team has indicated a desire to limit long-term, post-construction settlement to no more than 4 inches.

The conclusions and recommendations presented in this report are based on the subsurface conditions encountered at the specific locations of our explorations and are subject to the provisions and requirements outlined in the Limitations section of this report. The conclusions and recommendations presented herein should not be extrapolated to other areas, applied to other improvements, or used for other projects without our prior review and comment.

1.2 PROJECT DESCRIPTION

Based on information provided by Navix Engineering and correspondence with the project team, we understand key elements of the project include a multi-story data center, a separate multi-story office building, and exterior gantry structures. It is also our understanding that many of the existing facilities on site will be demolished and removed, but the cogeneration plant, the electrical substation, and the water storage tank (and associated water supply well) may be incorporated into the proposed site redevelopment.

If our understanding of the project is inaccurate we should be notified so the conclusions and recommendations provided in our report may be reviewed and revised if necessary.

1.3 PURPOSE AND SCOPE OF INVESTIGATION

The purpose of this investigation was to explore and evaluate the subsurface conditions at the proposed project site and to develop conclusions and geotechnical design recommendations to guide the design and construction of the proposed improvements. The scope of services included the following:

- Health and Safety Plan (HASP) development.
- Background literature and existing geotechnical data review.
- Site reconnaissance and location of existing underground utilities near exploration locations.
- Geophysical survey to identify potential underground obstructions and buried utilities.
- Subsurface exploration consisting of three (3) soil borings and five (5) cone penetration tests (CPTs).
- In-situ electrical resistivity testing.
- In-situ thermal resistivity testing.
- Discussion of regional geology, seismicity, and seismic and geologic hazards based on published information, engineering analyses, and subsurface conditions.
- Geotechnical laboratory testing.
- Discussion of generalized subsurface conditions based on the explorations (CPTs and borings) performed for this study.
- Discussion of liquefaction, lateral spreading and seismic settlement analyses, as appropriate.

- Seismic design parameters in accordance with the 2016 California Building Code (CBC). A site-specific seismic ground motion hazard analysis currently is outside the scope of this project.
- Discussion of design groundwater level and its effect on earth pressures against buried structures and uplift (buoyancy) design.
- Evaluation of shallow foundation alternatives, including net allowable bearing pressure, lateral resistance, and differential settlement.
- Evaluation of deep foundation alternatives, including charts of geotechnical resistance versus depth, lateral response for single pile alternatives, discussion of drag load and its effect on geotechnical resistance, discussion on settlement, and consideration of pile group effects.
- Earth pressures against basement and retaining walls, both restrained and unrestrained. The discussion will include seismic increment, as appropriate, effects of surcharge loading, and hydrostatic pressure.
- A brief discussion of the corrosion potential of the subsurface soils encountered during our field exploration based on laboratory corrosivity tests.
- Pavement recommendations for both flexible and rigid pavement sections, including subgrade preparation and recommended section thicknesses based on an assumed range of Traffic Index (TI) values.
- Recommendations for exterior flatwork, such as sidewalks and reinforced concrete slabs on grade for lightly-loaded appurtenant equipment.
- Construction considerations including site preparation, engineered fill selection and compaction, landscape and drainage considerations, and foundation installation recommendations for both shallow and deep foundation systems.
- Recommendations for construction monitoring and testing by the geotechnical engineer of record.

Environmental testing and evaluations are outside the scope of this report.

1.4 PREVIOUS STUDIES

As part of this geotechnical investigation, Kleinfelder reviewed the following previous reports with site-specific geotechnical data.

- John T. O'Rourke & Associates (1985), "Soil/Groundwater Investigation, Diesel Tank Excavation Pit, Container Corporation of America, Santa Clara, California Project No.:181-A." Report to Container Corporation of America dated May 13, 1985.

- Acurex (1990a), “Container Corporation of America, Site Remediation Work Plan and Preliminary Site Assessment, Project No.:9505”. Report to Container Corporation of America dated July 3, 1990.
- Acurex (1990b), “Container Corporation of America, Remedial Investigation Report, Project No.:9505, 9506, and 9507.” Report to Container Corporation of America dated November 28, 1990.
- Acurex (1992), “Container Corporation of America Additional Subsurface Investigation, Project No.:FR-92-110.” Report to Container Corporation of America dated May 5, 1992.
- Environ (2011), “Additional Soil and Groundwater Characterization Report, Graphic Packaging International, Inc., 2500 De La Cruz Boulevard, Santa Clara, California, Project No.:03-25055B1.” Report to Graphic Packaging International, Inc. dated June 23, 2011.
- James C. Reynolds Soil and Foundation Engineers (1975), “Soil Investigation for Wet End Project-Santa Clara Plant, Santa Clara, California, Project No.:316-SC54-B42.” Report to Container Corporation of America dated September 22, 1975.

2.0 FIELD EXPLORATION

2.1 GENERAL

To explore subsurface conditions and to obtain samples for laboratory testing, Kleinfelder drilled three soil borings, labeled B-1 through B-3, using mud rotary drilling methods and conducted five cone penetration tests (CPTs), labeled CPT-1 through CPT-5, at the locations shown on Figure 2.

Prior to the drilling and CPT work, a geophysical investigation to locate and map buried utilities, buried debris, and other substructures such as underground storage tanks and undocumented foundation remnants was performed. The geophysical survey, geotechnical drilling, and CPT testing took place between July 12 and July 19, 2018. Additionally, in-situ thermal resistivity and electrical resistivity tests were performed on August 10, 2018, and August 3, 2018, respectively.

Data from our field investigations are summarized into the following report appendices:

- Appendix A Logs of Soil Borings
- Appendix B Laboratory Test Results
- Appendix C Results of Cone Penetration Tests
- Appendix D Thermal Resistivity Test Report
- Appendix E Electrical Resistivity Test Report
- Appendix F Geophysical Survey Report

The following sections describe Kleinfelder's field exploration program.

2.2 PRE-EXPLORATION PLANNING

Prior to subsurface exploration, a site-specific health and safety plan was prepared. This plan was discussed with all field crews prior to the start of field exploration work. Drilling permits were obtained from the Santa Clara Valley Water District (SCVWD) for the geotechnical exploration locations (soil borings and CPTs).

2.3 UNDERGROUND UTILITIES LOCATING

Exploration locations were marked in the field, and Underground Service Alert (USA) was contacted to mark the locations of underground utilities in the public right-of way. As part of the geophysical investigation scope, Advanced Geological Services (AGS), of Moraga, California, marked the locations of detected underground utilities near the planned exploration locations prior to any ground disturbance.

2.4 GEOTECHNICAL BORINGS

Three geotechnical borings, B-1 through B-3, were drilled between August 16 and 19, 2018 at the locations indicated on Figure 2. All borings were drilled by Pitcher Drilling Co. of East Palo Alto, California under the direction of Kleinfelder.

Table 2.1 lists the exploration coordinates and other information about the borings drilled for this investigation.

Table 2.1 –Geotechnical Borings

Exploration Identification	Latitude	Longitude	Surface Elevation (feet NAVD88)	Exploration Depth (feet)	Depth to Groundwater at Time of Drilling (feet)
B-1	37.36930°	-121.94420°	40	48	10.5
B-2	37.36820°	-121.94470°	41	120	10
B-3	37.36930°	-121.94200°	41	120	10

*Coordinates were acquired using consumer grade GPS equipment in datum: WGS 1984 / UTM Zone 10 North.

**Ground surface elevations estimated based on Santa Clara Valley Water District elevation contour shapefile (NADV88).

2.4.1 Drilling Methods

The geotechnical borings were drilled using drill rigs equipped with hollow-stem auger and mud rotary drilling capabilities. The deep borings were started with solid-stem or hollow-stem auger methods until free groundwater was noticed. After free groundwater was first noticed, the drilling was temporarily halted for periodic depth-to-water measurements. Borings B-2 and B-3 were then completed using mud-rotary drilling methods, Boring B-1 was advanced entirely using mud-rotary drilling methods. Groundwater observations are noted on the boring logs and in Table 2.1. Further groundwater discussion is provided in Section 5.2.2 of this report.

2.4.2 Soil Sampling

Relatively undisturbed samples were obtained from the borings at selected depths by driving 2.5-inch and 2-inch inside diameter (I.D.), split-barrel, California and Modified California samplers containing stainless steel liners into undisturbed soil with a 140-pound automatic hammer free-falling a distance of 30 inches. The California sampler was used in general conformance with ASTM D3550.

Disturbed samples were also obtained at selected depths by driving a 1.4-inch I.D. Standard Penetration Test (SPT) sampler into undisturbed soil with a 140-pound automatic hammer free-falling a distance of 30 inches. The SPT sampler was used in general conformance with ASTM D1586.

Blow counts were recorded at 6-inch intervals for each driven sample and are reported on the logs. Blow counts shown on the boring logs have not been corrected for the effects of overburden pressure, rod length, sampler size, or hammer efficiency. Sampler size correction factors were applied to estimate the sample apparent density noted on the boring logs. The consistency terminology used in soil descriptions for cohesive soil is based on field observations (see Figure A-2).

2.4.3 Soil Classification and Sample Handling

A Kleinfelder engineer logged the borings, visually classified the soils in general accordance with the Unified Soil Classification System (ASTM D2488 visual-manual procedure), and packaged samples of the subsurface materials. Soil classifications, blow counts recorded during sampling, and other related information were documented during drilling and are shown on the boring logs in Appendix A. The Unified Soil Classification System and a key to the symbols used on the boring logs are both described on Figure A-1. A Soil Description Key is presented on Figure A-2. Boring logs are presented on Figures A-3 through A-5

Soil classifications made in the field from samples and auger cuttings were in accordance with ASTM D2488. These classifications were re-evaluated in the laboratory after further examination and testing in accordance with ASTM D2487. The undrained shear strengths of cohesive samples were estimated in the field using a hand-held penetrometer device to aid in field classification of the soil. The shear strength estimates from the pocket penetrometer are shown on the boring logs in Appendix A.

Soil samples obtained from the borings were packaged and sealed in the field to reduce moisture loss and disturbance, then transported to our laboratory in general accordance with ASTM D4220.

2.4.4 Boring Completion

The completed borings were backfilled with grout in accordance with SCVWD permit requirements and under observation of a SCVWD inspector. Drilling spoils and excess fluids were contained in steel drums. Our drilling subcontractor arranged for testing and disposal of the drummed materials.

2.5 CONE PENETRATION TESTS

California Push Technologies Inc. of San Leandro, California mobilized a 30-ton truck-mounted CPT rig and completed the CPT program under the observation of a Kleinfelder field engineer between July 17, 2018 and July 18, 2018. Five CPTs were conducted to approximate depths of 120 feet each. The CPT results are presented in Appendix C. As discussed below, downhole shear wave velocity was measured at one CPT location, and pore water pressure dissipation tests were conducted at selected depth intervals in all CPTs.

Table 2.2 lists the exploration coordinates and other information about the CPTs conducted for this investigation. See Figure 2 for exploration locations.

Table 2.2 – Cone Penetrometer Tests

Exploration Identification	Northing* (Meters)	Easting* (Meters)	Approximate Ground Surface Elevation (feet)	Total Depth (Feet)	Shear Wave Velocity (Yes/No)
CPT-01	4136308	593423	41	120.73	No
CPT-02	4136311	593523	41	120.90	No
CPT-03	4136320	593612	41	120.73	No
SCPT-03B	4136319	593615	41	120.90	Yes
CPT-04	4136215	593429	41.5	120.90	No
CPT-05	4136231	593599	39	120.57	No

*Coordinates were acquired using consumer grade GPS equipment in datum: WGS 1984 / UTM Zone 10 North.

**Ground surface elevations estimated based on Santa Clara Valley Water District elevation contour shapefile (NADV88).

The CPTs were conducted by hydraulically pushing an instrumented steel cone into the ground in general accordance with ASTM D5778. The instrumented cone assembly includes a cone tip with a 60-degree apex and a cone base area of 15 square centimeters (cm^2), a friction sleeve segment with a surface area of 225 cm^2, and a pore pressure transducer mounted near the base (shoulder) of the cone tip, and geophone sensors located just above the friction sleeve. Prior to the start of the test, the rig was raised hydraulically onto rigid feet to unload the vehicle suspension and leveled to provide a stable reaction for cone thrust. The instrumented cone was advanced through the soil at a steady rate of about 2 centimeters per second (cm/s). As the cone advanced, transducers inside the cone monitored cone tip resistance, sleeve (side) friction, and pore water pressure. These data were recorded and digitally stored during the test.

Where measured, downhole shear wave velocity measurements were taken at approximately 3-foot intervals. Results of the downhole shear wave velocity measurements are included in the CPT results in Appendix C.

Pore-water pressure dissipation tests were performed to evaluate static piezometric pressure, which is an indicator of groundwater depth. During pore-water dissipation tests, the pore pressures were allowed to stabilize over a period of approximately 5 minutes. Results of the pore water dissipation tests are included in the CPT results in Appendix C.

2.6 GEOTHERMAL RESISTIVITY TESTING

In-situ soil thermal resistivity testing was performed at two locations selected by Kleinfelder on August 10, 2018 by GeothermUSA. A hand auger was used to advance a borehole to depths of 2½ feet and 4½ feet at each location. At each depth, a thermal probe was inserted into the soil, and thermal resistivity and temperature readings were taken. Additionally, a soil sample was collected for laboratory testing. Laboratory testing included moisture content, density, and thermal dryout characterization.

Results of the geothermal resistivity testing, including detailed descriptions of the investigation methods, are provided in Appendix D of this report.

2.7 ELECTRICAL RESISTIVITY TESTING

In-situ soil electrical resistivity testing was performed at four locations as selected by a Kleinfelder engineer on August 3, 2018. In-situ electrical resistivity as measured using the Wenner 4-pin technique. At each location, probes were placed in suitable soil at spacings of 2.5, 5, 7.5, 10, 15, and 20-feet. An electrical current was then applied to the soil and measured at the probes locations to determine the soil resistivity.

Results of the electrical resistivity testing, including detailed descriptions of the investigation methods, are provided in Appendix E of this report.

2.8 GEOPHYSICAL SURVEY

The site is known to include numerous underground utilities, old foundations, buried vaults, and other underground objects. While many of these utilities and other underground objects are documented on existing drawings, a geophysical survey was performed to supplement the available information and to identify subsurface anomalies that are not shown on available as-built drawings.

The geophysical survey was performed by Advanced Geological Services (AGS) of Moraga, California, and utilized a combination of electromagnetic metal detection, radio-magnetic utility locating, and ground penetrating radar (GPR) methods.

Mapped anomalies identified by AGS include buried utilities-electrical cables, water and "process-water" pipes, telephone/data, sewer and storm drains, and unidentified subsurface lines, and appear to be in general agreement with the available as-built information. Anomalies associated reinforced concrete align well with historically developed portions of the site as well as existing concrete slabs.

Results of the geophysical survey, including detailed descriptions of the investigation methods, are provided in Appendix F of this report.

3.0 LABORATORY TESTING

Geotechnical laboratory testing was performed on representative samples obtained from borings to aid in soil classification and to evaluate physical properties of the soils that affect the geotechnical aspects of project design and construction. Geotechnical laboratory testing was performed by Kleinfelder, Inc. in Hayward, California. Preliminary corrosion screening was performed by CERCO Analytical in Concord, California.

3.1 GEOTECHNICAL LABORATORY TESTING

Laboratory testing for geotechnical characterization included the following:

- Moisture Content and Unit Weight (ASTM D2216 and D7263): Determines the in-situ soil moisture content and the unit weight. Used in expressing the phase relationships of air, water, and solids in a given volume of material. Unit weight testing was performed on samples obtained from California samplers.
- Grain Size Distribution (ASTM D422): Provides a particle size distribution of gravel, sand, and fines (silt and clay) in a given soil sample and aids in soil classification.
- Grain Size – Percent Passing No. 200 Sieve (ASTM D1140): Provides the percentage of fine-grained silt and clay sized particles and aids in soil classification. The No. 200 sieve generally represents the boundary between sand and silt-size particles.
- Atterberg liquid and plastic limits (ASTM D4318): Index test that describes the plasticity characteristics of the soil. The test results aid in soil classification and can be correlated with published data to estimate other material properties.
- Unconsolidated-Undrained (UU) Triaxial Compression (ASTM D2850): Evaluates the shear strength of soils. The shear characteristics measured under undrained conditions at a constant rate of axial deformation.
- Resistance Value (R-Value) (Caltrans 301): Measures the potential strength of subgrade materials for use in pavement design.
- Corrosion Suite: Includes electrical resistivity test (ASTM G57), chloride concentration (ASTM D4327), sulfate concentration (ASTM D4327), and pH (ASTM D4972). Corrosion test results are used in determining the type of concrete to be used for the foundation elements and level of protection needed to protect the steel in those foundation elements.

The results of the laboratory testing are summarized on the boring logs and are presented in Appendix B.

3.2 SOIL CORROSION

The screening-level potential for corrosion of buried steel and deterioration of buried concrete was evaluated through in-situ testing as well as analytical laboratory testing of selected soil samples.

Analytical laboratory testing includes electrical resistivity, moisture content, pH, chloride concentration, and sulfate concentration. These test results are summarized below. If imported fill is used, similar analytical testing should be performed to evaluate the corrosivity potential of those soils.

Table 3.1 – Analytical Laboratory Test Results

Boring	Soil Type	Depth (feet)	Resistivity, ohm-cm	Moisture Content (%)	pH	Water-Soluble Ion Concentration (ppm)	
			Minimum	At-Test		Chloride	Sulfate
B-2	Lean Clay	5.5	710	710	7.9	30	140
B-2	Lean Clay	36	1,100	1,200	7.9	N.D.	50

Conclusions and recommendations regarding the corrosive potential and electrical resistivity of onsite soils were provided by JDH Corrosion Consultants and are included in Appendix E.

4.0 GEOLOGIC AND SEISMIC HAZARDS

This section of the report discusses regional geology, area and site geology, and geologic hazards that could impact the site. The hazards considered include: fault-related ground surface rupture, seismically-induced ground failures (liquefaction, lateral spreading and dynamic compaction), expansive soils.

4.0 REGIONAL GEOLOGY

The site is centrally located in the Santa Clara Valley, within the Coast Range Geomorphic Province of Northern California. This province is generally characterized by northwest-trending mountain ranges and intervening valleys, which are a reflection of the dominant northwest structural trend of the bedrock in the region. The basement rock in the north-central portion of this province consists of the Great Valley Complex, a Jurassic (approximately 145 to 175 million years old) volcanic ophiolite sequence with associated Lower Cretaceous to Upper Jurassic (approximately 100 to 160 million years old) sedimentary rocks, and the Franciscan Complex, a subduction complex of diverse groups of igneous, sedimentary, and metamorphic rocks of Cretaceous to Upper Jurassic age (65 to 160 million years old). The Great Valley Complex was tectonically juxtaposed with the Franciscan Complex (most likely during subduction accretion of the Franciscan Complex), and these ancient fault boundaries are truncated by a modern right-lateral fault system that includes the San Andreas, Hayward-Rodgers Creek, and Calaveras faults. Located approximately 11.4 miles southwest of the site, the San Andreas fault defines the westernmost boundary of the local bedrock. In the site vicinity, the Great Valley Sequence and Franciscan Complex are unconformably overlain by Tertiary age (approximately 2.6 to 65 million years old) continental and marine sedimentary and volcanic rocks. These Tertiary age rocks are locally overlain by younger Quaternary (approximately 2.6 million years old to present day) alluvial deposits.

4.1 AREA AND SITE GEOLOGY

The site has been mapped by Wentworth et al. (1999), the California Geological Survey (2002), Witter et al. (2006), and by Dibblee and Minch (2007), among others. Wentworth et al. (1999) have mapped the site as underlain by Holocene age (approximately 11,700 years old to present day) basin deposits consisting of clay and silty clay, rich in organic material. The California Geological Survey (2006) and Witter et al. (2006) are in general agreement, and indicate the site is transected by a north-south trending geologic contact. The area east of the contact is shown to be underlain by Holocene age fine facies alluvial fan deposits and flood plain overbank deposits, consisting of silt and clay. The area west of the contact is shown to be underlain by Holocene age alluvial fan deposits, comprised of sand, gravel, silt and clay. Dibblee and Minch (2007) indicate the site is underlain by Quaternary age fossiliferous silty clay and organic clay.

4.2 GEOLOGIC HAZARDS

4.2.1 Faulting and Seismicity

The site is not located within an Earthquake Fault Zone as defined by the California Geological Survey (CGS, 2010) in accordance with the Alquist-Priolo Earthquake Fault Zone Act of 1972. The nearest zoned active fault is the Hayward-Rodgers Creek fault, which, according to the CGS (2010), is located approximately 5.8 miles northeast of the site boundary. Peterson et al. (2008), indicate the Hayward-Rodgers fault (considered a source of seismic shaking) is located approximately 7.8 miles from the site. Moderate to major earthquakes generated on the Hayward-Rodgers Creek and other faults in the region can be expected to cause strong ground shaking at the site.

The U.S. Geological Survey (USGS, 2010) (Quaternary Fault and Fold Database http://gldims.cr.usgs.gov/qfault) and Peterson et al. (2008) indicate the Monte Vista-Shannon fault is located approximately 7.6 miles southwest of the site. This fault has not been zoned as active by the CGS, but is considered a source of seismic shaking by the USGS.

The U.S. Geological Survey (USGS, 2010, Quaternary Fault and Fold Database http://gldims.cr.usgs.gov/qfault) also identifies the Silver Creek fault zone approximately 1.9 miles to the northeast of the site, the San Jose fault approximately 2.2 miles to the southwest of the site, and the Stanford fault approximately 3.4 miles to the southwest of the site. According to the USGS, the faults have exhibited activity in the Quaternary. The faults have not been zoned as active by the CGS, and are not considered a source of seismic shaking by the USGS.

The proximities and seismic parameters of significant faults in the vicinity of the site are listed in Table 4.1. For faults with multiple segmentation scenarios we have only listed parameters for the scenario rupturing the most segments (i.e., the most severe scenario). The locations of the faults and associated parameters presented on Table 3.1 are based on Petersen et al. (2008). The maximum earthquake magnitudes presented in this table are based on the moment magnitude scale developed by Kanamori (1977). Felzer (2008) details calculations of California seismicity rates including correction for magnitude rounding and error, Gutenberg-Richter b value and seismicity rates.

The following table identifies the significant faults in the area and their corresponding parameters.

TABLE 4.1
SIGNIFICANT FAULTS

Fault Name	Closest Distance to Site* (mi)	Magnitude of Characteristic Earthquake**	Slip Rate (millimeters/year)
Monte Vista-Shannon	7.6	6.5	0.4
Hayward-Rodgers Creek-SH+NH+RC	7.8	7.3	9
Calaveras-CN+CC+CS	9.1	7.0	6
San Andreas-SAS+SAP+SAN+SAO	11.4	8.1	17-24
Zayante-Vergales	19.4	7.0	0.1
Greenville Connected	23.9	7.0	2
San Gregorio	24.9	7.5	5.5
Mount Diablo Thrust	25.8	6.7	2
Monterey Bay-Tularcitos	32.4	7.3	0.5

* Closest distance to the potential rupture.
** *Moment magnitude*: An estimate of an earthquake's magnitude based on the seismic moment (measure of an earthquake's size utilizing rock rigidity, amount of slip, and area of rupture).

According to Petersen et al. (2008), characterizations of the Hayward-Rodgers Creek, Calaveras, and the San Andreas faults are based on the following fault rupture segments and fault rupture scenarios:

- The Hayward-Rodgers Creek fault has been characterized by three segments and six rupture scenarios plus a floating earthquake. The three segments are the Rodgers Creek fault (RC), the Hayward North (HN), and the Hayward South (HS).
- The Calaveras fault includes three segments and six rupture scenarios, plus a floating earthquake. The three segments are southern (CS), central (CC), and northern (CN).
- The San Andreas fault has been characterized by four segments and nine rupture scenarios, plus a floating earthquake. The four segments are Santa Cruz Mountains (SAS), Peninsula (SAP), North Coast (SAN), and Offshore (SAO).

Future seismic events in this region can be expected to produce strong seismic ground shaking at this site. The intensity of future shaking will depend on the distance from the site to the earthquake focus, magnitude of the earthquake, and the response of the underlying soil and bedrock.

4.2.2 Seismically-Induced Ground Failure

4.2.2.1 Liquefaction

Earthquake-induced soil liquefaction can be described as a significant loss of soil strength and stiffness caused by an increase in pore water pressure resulting from cyclic loading during shaking. Liquefaction is most prevalent in loose to medium dense, sandy and gravely soils below the groundwater table, but can also occur in non-plastic to low-plasticity finer grained soils. The potential consequences of liquefaction to engineered structures include loss of bearing capacity, buoyancy forces on underground structures, ground oscillations or “cyclic mobility”, increased lateral earth pressures on retaining walls, liquefaction settlement, and lateral spreading or “flow failures” in slopes.

The site is located within a State of California Seismic Hazard Zones map for liquefaction where areas of historical occurrence of liquefaction, or local geological, geotechnical and ground-water conditions indicate a potential for permanent ground displacements such that mitigation as defined in Public Resources Code Section 2693(c) would be required (CGS, 2003b).

Evaluations of potential liquefaction susceptibility based on soil composition were made according to the criteria of Bray and Sancio (2006) for the Seed et al. SPT analyses. Boulanger and Idriss (2006) was used as the compositional screening basis for the Idriss and Boulanger (2006 and 2008) and Youd et al. (2001) analysis methods. For CPT analyses, we used the recommendations of Youd et al. (2001) to consider layers with soil behavior type index, $I_c<2.6$ as potentially liquefiable.

For layers that met the compositional criteria, liquefaction triggering (factor of safety) analyses were performed using methodologies proposed by Youd et al. (2001), Seed et al (2003), Idriss & Boulanger (2006, 2008), and Moss et al. (2006). The analyses utilized both SPT data from our rotary wash borings and tip resistance data from our CPT soundings. In order to perform liquefaction analysis, estimates of earthquake magnitude and peak ground acceleration (PGA_m) are needed. Based on a probabilistic seismic hazard deaggregation using the USGS Unified Hazard Tool (https://earthquake.usgs.gov/hazards/interactive/, and PGA from the USGS Seismic

Design Maps Application (https://earthquake.usgs.gov/designmaps/us/application.php) liquefaction analyses were performed using a moment magnitude of 6.9 and a MCE_R peak ground acceleration (PGA) of 0.5g.

For liquefaction analyses the groundwater level was taken as the depth to water measured at the time of drilling.

Liquefaction induced volumetric settlements were estimated using the methods of Tokimatsu and Seed (1987), Idriss and Boulanger (2008), and Cetin et al. (2009). In general, the Idriss and Boulanger (2008) and Cetin et al. (2009) methods provide reasonably consistent results, while the Tokimatsu and Seed (1987) method provides lower estimates of settlement.

The site is comprised predominately of lean clays that are of moderate plasticity and therefore non-liquefiable based on soil composition, and sand layers that are too dense to liquefy. However, our subsurface exploration and subsequent calculations indicate that potentially liquefiable soils occur sporadically in discontinuous layers between depths of roughly 15 and 25 feet. Calculated post-liquefaction settlements in the free field could approach about 1 to 2 inches locally.

4.2.2.2 Lateral Spreading

Lateral spreading is a potential hazard commonly associated with liquefaction where extensional ground cracking and settlement occur as a response to lateral migration of subsurface liquefiable material. These phenomena typically occur adjacent to free faces such as slopes and creek channels. The potentially liquefiable layers identified in the explorations conducted for this study are not considered continuous across the site, and there are no known free faces or channels in the immediate project vicinity, therefore we consider the lateral spreading hazard at the site to be low.

4.2.2.3 Dynamic Compaction

Another type of seismically induced ground failure that can occur as a result of seismic shaking is dynamic compaction, or seismic settlement. Such phenomena typically occur in unsaturated, loose granular material or uncompacted fill soils. The borings and CPTs performed for this project indicate that granular soils below the observed groundwater depth. For this reason, we conclude that the potential for shaking-related dynamic compaction is low.

4.2.3 Expansive Soils

Soil expansion potential was characterized via laboratory testing of the near-surface soils during our geotechnical investigation for the site. Moderately expansive clayey soils were encountered near the ground surface throughout the site.

5.0 SITE AND SUBSURFACE CONDITIONS

5.1 SITE DESCRIPTION

The subject project site is a 14.8-acre parcel located in an industrial zone southwest of the San Jose International Airport. The site is bounded to the west by a freight rail corridor, to the east by De La Cruz Boulevard, an existing warehouse and loading dock to the south, and a rental car facility and parking lot to the north. The project site is currently occupied by a paper mill operation, which is in the process of being decommissioned and demolished. We understand the paper mill was originally constructed in the 1950s and includes a warehouse building with a 20-foot deep basement, office space, loading docks, asphalt-paved driveways, a cogeneration plant, an electrical substation, a 40,000-gallon water storage tank, various other process facilities, as well as structures and above-ground storage vessels that are in various stages of being decommissioned or demolished. The site is generally flat, the ground surface elevation ranges from approximately El +39 feet to El +43 feet across the site. A more detailed depiction of the existing site including the locations of the borings and cone penetration tests performed as part of the investigation is shown on Figure 2.

5.2 SUBSURFACE CONDITIONS

The subsurface conditions described below are based on information obtained during our field exploration program and geotechnical laboratory testing. See the boring logs, CPT results, and laboratory test data in the appendices for detailed information.

5.2.1 Stratigraphy

The borings encountered up to about 4½ feet of fill consisting of lean clay with sand and clayey sand. Below the fill the site is underlain by interlayered alluvial soils that include interlayered lean clays with varying quantities of fine to coarse sand and clayey to silty sands with fine to coarse gravel. The clays are generally stiff to very stiff, with apparent strengths that tend to increase with depth. Granular soils (sands and gravels) are generally medium dense in the upper 30 to 40 feet. Sands below that depth range tend to be dense to very dense.

The sandy and gravelly layers tend to be discontinuous and of highly variable thickness across the site.

5.2.2 Groundwater

Groundwater was encountered in the borings at a depth of about 10 feet below existing grade. This depth is consistent with our experience in the general vicinity and with published geologic maps. This groundwater depth may be used for consideration of buoyancy resistance of underground structures. Our interpretations of soil and groundwater conditions are based on conditions encountered in the borings and the results of CPTs, published geologic maps, and our knowledge of geologic and hydrogeologic conditions in the site vicinity. It is possible that groundwater conditions at the site could change due to variations in rainfall, groundwater withdrawal or recharge, construction activities, well pumping, or other factors not apparent at the time of our investigation.

5.2.3 Variations in Subsurface Conditions

Our interpretations of soil and groundwater conditions are based on conditions encountered in the borings and the results of CPTs, published geologic maps, and our knowledge of geologic and hydrogeologic conditions in the site vicinity. It is possible that groundwater conditions at the site could change due to variations in rainfall, groundwater withdrawal or recharge, construction activities, well pumping, or other factors not apparent at the time of our investigation. If soil or groundwater conditions exposed during construction vary from those presented in this report, Kleinfelder should be notified to evaluate whether our conclusions or recommendations should be modified.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Conclusions and recommendations presented in this report are developed based on general project and geotechnical information presented above and on discussions with the project design team throughout the current design phase. The conclusions and recommendations that follow are intended to guide geotechnical aspects of the project design and construction.

6.1 SEISMIC DESIGN PARAMETERS

Seismic design parameters based on the 2016 California Building Code (CBC), which is in turn based on the 2015 International Building Code (IBC) and the American Society of Civil Engineers (ASCE) Standard 7-10, were developed for the subject project site. Based on information obtained during our field exploration it is our opinion that this site can be classified as Site Class D according to Chapter 20 of ASCE 7-10. This classification applies to a stiff soil condition in the upper 100 feet, with Standard Penetration Test (SPT) blow counts generally between 15 and 50 blows per foot.

To provide the ground motion parameters associated with the 2016 CBC, an online tool was used (http://earthquake.usgs.gov/designmaps/us/application.php), which was developed by the USGS based on the Seismic Design Maps in the 2015 IBC. Estimated values of PGA are based on mapped values of Maximum Considered Earthquake Geometric Mean (MCE_G) Peak Ground Accelerations (Figure 22-7, ASCE 7-10). The resulting 2016 CBC seismic design factors (for a risk factor of I, II, or III) are presented below in Table 6.1.

TABLE 6.1
GROUND MOTION PARAMETERS BASED ON 2016 CBC

PARAMETER	VALUE	2016 CBC/ASCE 7-10 REFERENCE
Latitude	37.368071°N	-
Longitude	121.943273°W	-
S_S	1.5g	2016 CBC Section 1613.3.1
S_1	0.6g	2016 CBC Section 1613.3.1
Site Class	D	ASCE 7-10 Chapter 20
Seismic Design Category	D	2016 CBC Tables 1613.3.5 (1) and (2)
F_a	1.0	2016 CBC Table 1613.3.3(1)
F_v	1.5	2016 CBC Table 1613.3.3(2)
S_{MS}	1.5g	2016 CBC Section 1613.3.3
S_{M1}	0.9g	2016 CBC Section 1613.3.3
S_{DS}	1.0g	2016 CBC Section 1613.4.4
S_{D1}	0.6g	2016 CBC Section 1613.4.4
T_L	12 seconds	ASCE 7-10, Figure 22-12
PGA	0.5g	ASCE 7-10, Figure 22-7
F_{PGA}	1.0	ASCE 7-10, Table 11.8-1
PGA_M (MCE_G)	0.5g	ASCE 7-10, Equation 11.8-1
C_{RS}	1.126	ASCE 7-10, Figure 22-17
C_{R1}	1.072	ASCE 7-10, Figure 22-18

6.2 GRADING

While substantial changes to the existing site grade are not planned, cuts and fills on the order of 2 to 3 feet may be required. It is anticipated that required site grading can be performed with conventional grading equipment and techniques.

6.3 SITE PREPARATION

Recommendations for site preparation and earthwork construction are presented below. All earthwork, including excavation, backfill and preparation of subgrade, should be performed in accordance with the geotechnical recommendations presented in this report and applicable portions of the grading code of local regulatory agencies. The grading contractor is responsible for notifying governmental agencies, as required, and the geotechnical engineer at the start of site cleanup, the initiation of grading and any time that grading operations are resumed after an interruption. All earthwork should be performed under the observation and testing of a qualified geotechnical engineer. References to compaction, maximum density and optimum moisture content are based on ASTM D1557, unless otherwise noted.

6.3.1 Stripping and Demolition

Areas to receive fill and support structures should be stripped of debris and any other deleterious materials prior to over-excavation or placement of engineered fill. Any stripped debris or organic matter should not be reused as engineered fill. Any stripped soil that contains roots or other organics, debris, or deleterious materials should not be reused as engineered fill.

The existing subgrade soils will be exposed and disturbed during demolition and stripping of the remnants of existing foundations and other underground structures. Existing foundations, debris, old concrete or pavement materials should be removed from proposed improvement areas. Excavations from removal of foundations, underground utilities or other below-ground obstructions should be cleaned of loose soil and any potentially deleterious material and backfilled with compacted engineered fill, lean concrete or cement slurry backfill. In addition, active or inactive utilities within the construction area should be protected, relocated, or abandoned.

During construction, soft or loose areas could be encountered and may require over-excavation. The assessment of these areas and determination of over-excavation extent should be performed by the geotechnical engineer at the time of construction when conditions are exposed. Unit prices for over-excavation and replacement with engineered fill should be obtained during bidding.

Where mats or other shallow foundation systems are used, buried obstructions such as old foundations should be removed to a depth within 2 feet of rough grade and backfilled to rough grade elevation with engineered fill, placed and compacted in accordance with the recommendations provided in Section 6.4.

Stripping and removals should extend laterally a minimum of 5 feet beyond the perimeters of roadways, concrete flatwork, and any other facilities supported on grade.

6.3.2 Disturbed Soil, Undocumented Fill, and Subsurface Obstructions

The site is known to contain soil disturbed by previous activity, documented and undocumented fill soils, abandoned underground structures and existing utilities within the project footprint. Any loose or disturbed soil, void spaces or otherwise unsuitable conditions at the bottoms of excavations should be removed to expose firm or dense soil, as approved by the geotechnical engineer. Additional subgrade preparation recommendations are provided below.

6.3.3 Scarification and Compaction

After stripping and performing any necessary removals, the bottom of excavations should be scarified to a depth of at least 8 inches, uniformly moisture conditioned to at least 2 percent above the optimum moisture content and compacted to at least 90 percent relative compaction. The subgrade should not be allowed to dry out prior to the placement of engineered fill or concrete improvements.

6.3.4 Foundation Subgrade Preparation

Concrete for foundations and exterior flatwork (e.g., sidewalks or walkways) should be placed neat against undisturbed soil or properly-prepared fill as described below. Foundation subgrades should not be allowed to dry out before placing concrete. If shrinkage cracks appear in the excavations, the excavations should be thoroughly moistened to close all cracks prior to concrete placement. The foundation excavations should be observed by the geotechnical engineer for compliance with appropriate moisture control and to confirm the adequacy of the supporting soils. If soft, loose, or otherwise deleterious materials are encountered at the bottoms of footing excavations, they should be removed and replaced with compacted engineered fill, lean concrete or additional foundation concrete.

6.3.5 Groundwater Handling and Subgrade Preparation Below Groundwater Level

The discussion of groundwater elevation in Section 5.2.2 is intended to provide general guidance for construction planning purposes. Dewatering needs may vary across the building footprint based on groundwater level at the time of construction and local variations in planned excavation depth (e.g., elevator pits and other mechanical spaces often extend below rough subgrade elevation for surrounding foundations). If excavations extend close to or below the static groundwater elevation, loose, wet and sandy soil conditions at rough subgrade elevations are expected to present difficult workability conditions.

6.4 ENGINEERED FILL

6.4.1 Materials

Material for use in engineered fill should be free of significant organic materials, debris, and other deleterious materials, be essentially non-expansive, and have a maximum particle size less than 3 inches in maximum dimension, as described in Table 6.2 below. From a geotechnical materials perspective, some of the on-site, near-surface soils may be suitable for use as engineered fill, provided they meet environmental regulations and can be processed to meet the following requirements.

Table 6.2 – Engineered Fill Requirements

Fill Requirement		Test Procedures	
		ASTM[1]	Caltrans[2]
Gradation			
Sieve Size	**Percent Passing**		
3 inch	100	D 422	202
¾ inch	70-100	D 422	202
No. 4	50-100	D 422	202
No. 200	20-70	D 422	202
Plasticity			
Liquid Limit	**Plasticity Index**		
<30	<12	D 4318	204
Organic Content			
Less than 3%		D 2974	---
Expansion Potential			
20 or less		D 4829	---
Soluble Sulfates			
Less than 2,000 ppm		---	417
Soluble Chloride			
Less than 300 ppm		---	422
Resistivity			
Greater than 2,000 ohm-cm		---	643

[1]*American Society for Testing and Materials Standard (latest edition)*
[2]*State of California, Department of Transportation, Standard Test Methods (latest edition)*

Imported materials to be used for engineered fill should be sampled and tested by the geotechnical engineer prior to being transported to the site. We recommend representative samples of imported materials proposed for use as engineered fill be submitted to the geotechnical engineer for testing and approval at least one week prior to the start of grading and import of this material.

6.4.2 Placement and Compaction Criteria

Soils used for engineered fill should be uniformly moisture conditioned to at least 2 percent above the optimum moisture content, placed in horizontal lifts less than 8 inches in loose thickness, and compacted to at least 90 percent relative compaction. Within the upper 12 inches of pavement subgrade areas, the soil should be uniformly moisture conditioned to slightly above the optimum moisture content and be compacted to at least 95 percent relative compaction.

Additional fill lifts should not be placed if the previous lift did not meet the required relative compaction or if soil conditions are not stable. Disking or blending may be required to uniformly moisture condition soils used for engineered fill. Ponding or jetting compaction methods should not be allowed.

All site preparation and fill placement should be observed by the geotechnical engineer. It is important that during the stripping and scarification processes, a representative of the geotechnical engineer be present to observe whether any undesirable material is encountered in the construction area and to confirm that exposed soils are similar to those encountered during the geotechnical site exploration.

6.5 TEMPORARY EXCAVATIONS

6.5.1 General

All excavations should comply with applicable local, state, and federal safety regulations including the current Occupational Safety & Health Administration (OSHA) Excavation and Trench Safety Standards. Construction site safety generally is the responsibility of the contractor, who is also solely responsible for the means, methods, and sequencing of construction operations.

6.5.2 Excavations and Slopes

Slope height, slope inclination, or excavation depths (including utility trench excavations) should not exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced, and, if they are not followed, the owner, contractor, or earthwork and utility subcontractors could be liable for substantial penalties. Based on our interpretation of the OSHA regulations and on the findings from this investigation, we expect that the existing near-surface soils will be predominantly Type B soils. For planning purposes, excavations less than about 20 feet deep should have maximum allowable slopes of 1H:1V. The actual OSHA soil type classification and sloping requirements should be determined by the contractor's responsible person based on the materials exposed during construction. OSHA requires that excavated slope heights in excess of 20 feet be designed by a professional engineer.

Underground utilities should be located above a 1H:1V plane projected downward from the bottoms of new foundations to avoid undermining the foundations during the excavation of the utility trench.

At the time of our field exploration static groundwater was encountered below an elevation of roughly El. +30. The contractor should be aware that groundwater may be encountered at or above this elevation.

6.5.3 Trench Backfill

General trench backfill should be placed and compacted in accordance with recommendations provided in this report for engineered fill (Section 6.4). Separate bedding and backfill recommendations for pipes are provided below.

6.5.4 Pipe Bedding and Pipe Zone Backfill Placement

In pipe bedding zones, special pipe bedding and backfill materials should be used to a minimum depth of 6 inches below the pipe and to a height of at least 12 inches above the top of pipe. The recommended pipe zone bedding and backfill gradation is provided below.

Table 6.3 – Select Pipe Bedding Backfill Gradation

Sieve Size	Percent Passing by Weight
¾ inch	100
No. 4	25 – 90
No. 200	0 – 12

In general, most of the soils that are likely to be encountered in trench excavations for this project contain fines (material passing the No. 200 sieve) that exceed the limits noted above. However, suitable granular materials for use in a select backfill blend may be found in limited quantities in on-site excavations.

Bedding materials (select backfill) should be compacted to a firm condition prior to placement of pipes. Initial backfill materials around the pipe zone should be placed in a manner to eliminate voids beneath the pipe. Special care should be taken in the control of utility trench backfilling and compaction under paved areas. Poor compaction may cause excessive settlements resulting in damage to the overlying pavement section. Select backfill materials should be placed in lifts approximately 8 inches in thickness and be compacted to at least 95 percent relative compaction based on ASTM D1557. Jetting of pipe bedding or trench backfill materials should not be allowed.

6.5.5 Temporary Shoring

If there is insufficient space for sloped excavations, shoring should be used to support the excavation sides. Cantilevered or braced shoring may be considered. Cantilevered shoring can be utilized where some deflection is acceptable. However, where shoring will support adjacent improvements or facilities and excessive deflection can lead to settlement, braced shoring should be utilized. Temporary shoring should be designed by a qualified California-registered civil engineer.

6.6 SURFACE DRAINAGE

It is important that drainage away from the improvements be provided and maintained to reduce ponding and/or saturation of the soils in the vicinity of structures. The design should incorporate the basis for good drainage, including:

- Defined drainage gradients away from structures to points of conveyance, such as drainage swales and/or area drains and discharge pipe.
- A plan for long term maintenance to address settlement issues and to correct ponding and erosion areas, if needed.
- If stormwater infiltration basins are employed in the design, these facilities should be sited away from buildings with basement levels, as concentrated stormwater infiltration could locally raise the groundwater elevation,

During wet weather, earthen berms or other methods should be used to prevent runoff water from entering excavations. Runoff should be collected and disposed of outside the construction limits. Maintenance personnel should maintain the established site drainage by not blocking or obstructing gradients away from foundations or structures.

6.7 RETAINING WALLS

6.7.1 Wall Earth Pressures

Retaining walls should be designed to resist lateral pressures caused by water, backfill, seismic pressures, and external surface loads. The magnitude of the lateral pressures will depend on wall flexibility, the backfill type and the method of its placement, the magnitude of external loads (e.g., seismic or surcharge loads), and back drainage provisions. The earth pressures recommended below apply for backslopes behind the walls of up to about ±10 percent. Kleinfelder should be contacted for additional recommendations if earth pressures for back slopes steeper than 10 percent become necessary.

6.7.1.1 Soil Backfill

Restrained Walls – Soil Backfill

For restrained retaining walls with drained, conventional granular (i.e., no more than 20 percent massing the No. 200 sieve) soil backfill selected, placed, and compacted in accordance with the recommendations provided in Section 6.7.2, we recommend an "at-rest," triangular earth pressure distribution based on an equivalent fluid weight of 60 pounds per cubic foot (pcf). The at-rest pressure distribution may be taken as triangular, with the resultant force applied at a distance of H/3 above the bottom of the wall, where H = wall height.

The additional pressure due to a surcharge at the ground surface acting against restrained walls with soil backfill may be taken as a uniform pressure estimated by multiplying the surface load by a factor of 0.5.

Unrestrained Walls – Soil Backfill

For unrestrained retaining walls with drained, conventional granular soil backfill selected and placed in accordance with the recommendations provided in Section 6.7.2, we recommend an "active," triangular earth pressure distribution based on an equivalent fluid weight of 40 pounds per cubic foot (pcf).

The additional pressure due to a surcharge at the ground surface acting against unrestrained walls with soil backfill may be taken as a uniform pressure estimated by multiplying the surface load by a factor of 0.3.

Seismic Increment – Soil Backfill

For seismic design, the active earth pressure for soil backfill may be used in conjunction with a seismic pressure increment. For seismic design an active earth pressure distribution based on an equivalent fluid weight of 40 pcf may be used in conjunction with a seismic increment based on an equivalent fluid weight of 25 pcf. The seismic pressure increment is an ultimate value, with no load factor. All pressure distributions may be taken as triangular, and all resultant forces may be assumed to apply at a distance of H/3 above the bottom of the wall, where H = wall height.

<u>Passive Resistance – Soil Backfill</u>

Ultimate passive pressures will develop under lateral deflections of about 2 percent of the wall height. For allowable passive resistance an equivalent fluid weight of 300 pcf acting against the side of the wall may be used. This value is based on a safety factor of at least 1.5 and generally corresponds to a lateral deflection of less than about ½ inch. Passive resistance in the upper 12 inches should be neglected. For design purposes, any passive pressure due to lateral resistance of deep foundations may be assumed to act concurrently with the passive wall pressure.

6.7.2 Retaining Wall Backfill and Drainage

Where soil backfill is used, backfill adjacent to retaining walls should consist of granular soil (maximum passing the No. 200 sieve of 20 percent), compacted according to the recommendations provided in Section 6.4.2. Kleinfelder should review and approve the proposed backfill materials before they are used in construction. Over-compaction of wall backfill should be avoided because increased compaction effort can result in lateral pressures significantly greater than those used in design. We recommend that all backfill placed within 3 feet of the walls be compacted with hand-operated equipment.

The walls may be designed without hydrostatic pressures if they are fully drained. Wall drainage should consist of either a prefabricated drainage material or a layer of drain rock placed behind the wall that is connected to a suitable drainage location. Prefabricated drainage material (such as Miradrain or an approved alternative) may be used behind retaining walls. Prefabricated drainage material should be installed in accordance with the manufacturer’s recommendations.

As an alternative to prefabricated drainage material and where soil backfill is used, a drain rock layer may be used. The drain rock should be at least 12 inches thick and extend to within 2 feet of the ground surface. Four-inch diameter perforated plastic pipe should be installed (with perforations facing down) along the base of the walls on a 2-inch thick bed of drain rock. The pipe should be sloped to drain by gravity to a sump or other drainage facility. If gravity drainage is not possible, the drainage system may need to incorporate sumps and pumps. Drain pipe should be rigid-walled PVC or similar material that is capable of withstanding all applied loads.

Drain rock should conform to Caltrans specifications for Class 2 Permeable Material. Alternatively, clean, ½ to ¾-inch maximum size crushed rock or gravel could be used, provided it is encapsulated in a nonwoven geotextile filter fabric, such as Mirafi 140N or an approved alternative. A 1-foot thick cap of clayey soil should be placed over the drain rock to inhibit surface water infiltration.

6.8 SPREAD AND STRIP FOOTINGS

Foundations should satisfy two independent criteria with respect to foundation soils. First, the foundation should have an adequate safety factor against bearing failure with respect to shear strength of the foundation soils. Second, the vertical movements of the foundation due to settlement of the foundation soils (immediate elastic settlement, consolidation settlement and seismically-induced settlements) should be within tolerable limits.

Relatively lightly-loaded ancillary structures and equipment that are not sensitive to differential settlement may be founded on spread or strip footings. Recommendations for mat foundation support of the main buildings are provided in Section 6.9. Deep foundation recommendations are provided in Section 6.10.

6.8.1 Allowable Bearing Pressure and Depth

Spread or strip footings should be founded at least 24 inches below lowest adjacent finished grade. Spread or strip footings bearing on properly-prepared subgrade soils, as described in Section 6.3.4 of this report, may be designed for a net allowable bearing pressure of 2,500 psf due to dead loads plus live loads. A one-third increase may be applied to this value when considering the effects of transient loads such as wind or seismic. The recommended net allowable bearing pressure includes a safety factor of at least 3 with respect to shear failure of the foundation soils.

Where footings are located near and parallel to underground utilities, the footings should extend below a plane projected at a slope of 1H:1V upward from the utility to avoid surcharging the underground utility. This should be evaluated for both existing and new utilities at the site. Where footings are located adjacent to below-grade structures or near major underground utilities, the footings should extend below a 2H:1V plane projected upward from the structure footing or bottom of the underground utility to avoid surcharging the below grade structure and underground utility. Utility plans should be reviewed by Kleinfelder prior to trenching for conformance with these recommendations.

6.8.2 Lateral Load Resistance

Lateral loads may be resisted by a combination of friction between the foundation bottoms bearing on firm native soils or engineered fill, and by passive resistance acting against the vertical faces of the foundations. An allowable coefficient of sliding friction of 0.35 between the foundation and the supporting subgrade may be used for design. This value includes a safety factor of at least 1.5. For allowable passive resistance for foundations placed neat against excavated soil or where engineered soil backfill is used against foundations, an equivalent fluid weight of 300 pounds per cubic foot (pcf) acting against the side of the foundation may be used. This value is based on a safety factor of at least 1.5 and generally corresponds to a lateral deflection of less than about ½ inch. Passive resistance in the upper 12 inches should be neglected unless the area in front of the foundation is protected from disturbance by concrete or pavement. The friction coefficient and passive resistance may be used concurrently without reduction. Under seismic and wind loading conditions, the passive pressure and frictional resistance may be increased by one-third.

6.8.3 Settlement

For spread and strip footings with design pressures equal to or less than the net allowable pressure provided above, and under static loading conditions, total post-construction foundation settlement is expected to be less than about 2 inches. Post-construction differential settlement may be taken as one-half of the total settlement (i.e., about 1 inch). These settlement estimates are based on the assumption that the foundation subgrade is properly prepared and the foundations are designed and constructed in accordance with the recommendations presented in this report.

6.8.4 Hydrostatic Uplift

Groundwater conditions are described above. As discussed in Section 5.3.2 above, we recommend that for purposes of hydrostatic uplift design the groundwater level be taken at El. +30 feet (about 10-foot depth below existing grade). For uplift resistance computation purposes, we recommend use of a total unit weight of concrete of 150 pcf and a total unit weight of soil of 125 pcf.

6.9 MAT FOUNDATION

Kleinfelder analyzed long-term settlement for a building complex consisting of two data halls and an adjoining office building according to a layout provided by the design team. The given dead load plus permanent live load used in our analyses are 1,300 psf for each data hall wing and 1,000 psf for the office building. The discussion of a mat foundation alternative and the conclusions and recommendations that follow apply to the building layout and load conditions noted above. Estimated settlement will vary with changes in the applied loads.

6.9.1 Mat Settlement

To evaluate the settlement performance of a mat foundation, Kleinfelder developed a settlement model of the site based on the results of soil borings and CPT explorations across the site and our experience with similar soils in the general site vicinity. The settlement model was developed using the commercial computer program Settle3D (by Rocscience). The Settle3D model allows the loads to be applied in stages, in accordance with planned construction sequencing and timing and computes elastic settlement, heave (rebound), and time-dependent consolidation settlement. In Settle3D, settlement may be analyzed with respect to any specified "reference stage," or starting point in the loading and post-loading history.

For our analyses we assumed the bottom of the mat will be founded 5 feet below existing grade. The results of the settlement analyses are illustrated on Figure 3. For a flexible mat foundation system with assumed uniform mat pressures of 1,300 psf for the data hall wings and 1,000 psf for the adjoining office building, Kleinfelder estimates total post-construction settlement of about 3 to 4 inches. Between adjacent columns, variability in subsurface conditions may produce differential settlements of 1 to 1½ inches between columns.

The computed settlement values shown on Figure 3 show a precision of 0.1 inch. This is not meant to imply accuracy to that level. The computed grid values are for indicative illustration purposes only. Settlement contours are estimated to be accurate to within about 30 percent.

6.9.2 Subgrade Modulus

We understand a mat foundation design will be based on a stiff, post-tensioned mat foundation about 2 to 3 feet thick. The mat stiffness will help to reduce the magnitude of differential settlement described above and will also affect the subgrade modulus. The mat stiffness and load distribution will also affect the subgrade reaction, which is a function of foundation dimensions, mat stiffness, deflection, load conditions, and soil properties.

The For an initial evaluation of the reaction of a mat foundation, we recommend a modulus of subgrade reaction, K_{V1}, of 100 psi per inch of deflection (for a 1 square-foot bearing plate) be used for mat design. The modulus should be adjusted for the actual foundation size using appropriate formulas or software.

The constant value of subgrade modulus provided above is a simplifying assumption that is intended for an initial structural analysis of a mat foundation. The actual modulus of subgrade reaction may vary across a mat. Following an analysis of the mat deflection under the design loading conditions, Kleinfelder should use the computed contact pressure distribution and evaluate a refined subgrade response (i.e., refined contours of soil settlement). Through an iterative process, Kleinfelder and the structural engineer can refine the distribution of subgrade reaction modulus across the mat until compatibility is reached between the computed settlement and the computed mat deflection.

6.9.3 Mat Foundation Construction Considerations

The recommendations provided in Section 6.3 provide general recommendations that are applicable to mat foundations, including a recommendation to remove existing underground obstructions, such as existing piles, to a depth of at least 2 feet below the rough grade elevation.

In order to provide a capillary moisture break, we recommend that interior floor slabs be constructed on a 6-inch layer of either angular gravel or crushed rock that meets the specifications for Caltrans Class 2 Permeable Material. If an impermeable membrane is specified by the architect, the membrane should be placed over the base materials in accordance with the architect's recommendations. The membrane may be covered with 2 inches of well-graded sand to provide a cushion for the membrane and to help promote proper curing of the concrete. However, with approval from the architect and the structural engineer, the sand cushion may be eliminated.

6.10 DEEP FOUNDATIONS

The deep foundation recommendations presented herein are intended for settlement sensitive structures, such as the data center structure. Based on our conversations with the design team it is our understanding that deep a foundation system consisting of either 18-inch diameter drilled displacement (DD) piles, or 14-inch square precast concrete (PCC) piles are being considered. Both options would be used under pile caps that are connected by grade beams. The selection of deep foundation type will be based on consideration of several factors, including those listed on the table below. Other factors, such as relative cost, scheduling, and environmental considerations, will also influence the selection of a deep foundation type.

Table 6.4 – Deep Foundation Alternatives

Factor	Drilled Displacement Pile	Driven Precast Concrete Pile
Installation Noise	Low	High
Installation Vibration	Low	High
Indicator Piles and Load Testing	Dynamic and static load testing typically performed by the foundation installation contractor as part of a design-build process, as means, methods and materials are proprietary	Dynamic testing during initial driving and restriking measured with Pile Driving Analyzer (PDA) during Indicator Pile Program
Quality Control Inspections and Testing	Grout requires field inspection / testing during mixing and installation	Requires production yard inspection / testing of concrete during casting
Installation Monitoring	Monitor torque, advancement rates, grout return	Develop and monitor driving criteria by blow count per foot
Advantages	Less noise and vibration than driven piles Minimal spoils generation when compared with traditional auger cast-in-place pile	Little to no spoils generation
Disadvantages	Proprietary means and methods among the various contractors, which makes direct comparisons among competing contractor proposals more difficult.	Noise and vibration

The recommendations that follow for geotechnical resistance and lateral pile response of 18-inch diameter drilled displacement piles and 14-inch square precast concrete piles are based on an assumed pile cap thickness of up to 3 feet.

6.10.1 Axial Geotechnical Resistance

Axial geotechnical resistance of drilled displacement piles and precast concrete piles were developed based on Federal Highway Administration methods using the commercial computer software APILE produced by Ensoft, Inc. Curves illustrating ultimate compressive and tensile axial geotechnical resistance of an 18-inch diameter drilled displacement pile installed from El. +40 feet (roughly existing grade) are shown on Figure 4. Ultimate compressive and tensile axial geotechnical resistance of a 14-inch square precast concrete pile installed from El. +40 feet (roughly existing grade) are shown on Figure 5. For allowable axial geotechnical resistance under static conditions a safety factor of 2 may be used. For allowable geotechnical resistance in tension under transient flood, wind or seismic conditions a safety factor of 1.5 may be used. For allowable sustained geotechnical resistance in tension a safety factor of 3 should be used.

For preliminary design purposes, the recommended maximum ultimate geotechnical resistance for both an 18-inch diameter drilled displacement pile, and a 14-inch square precast concrete pile is 600 kips, which corresponds to a tip elevation of about El. -43 to El. -50 feet.

6.10.2 Pile Settlement

Settlement of pile groups will result from relatively rapid compression of the foundation soils during construction, and from long-term consolidation of the clayey soils that underlie the piles. Based on column loads of up to about 2,550 kips (Dead Load + Live Load), as provided by the structural engineer, and common pile cap geometries, we estimate that total settlement of pile foundations could approach up to about 1 inch. Differential settlement between adjacent columns could approach up to about half the total settlement.

6.10.3 Group Effects

The recommended axial geotechnical resistance applies to single, isolated piles with center-to-center spacings of at least three effective pile diameters. For closer pile spacings the geotechnical resistance of individual piles will be reduced. At present pile group configurations have not been determined. Axial geotechnical resistance should be re-evaluated by Kleinfelder when specific pile group configurations are known.

6.10.4 Effect of Liquefaction and Site Settlement on Axial Resistance

Based on the findings from our geotechnical site exploration program, the project site is comprised predominately of lean clays that are of moderate plasticity and therefore non-liquefiable based on soil composition. Occasional sandy layers interbedded within the clays are liquefiable under design ground motion loading, but liquefiable layers tend to be sporadic and non-continuous. After strong ground shaking stops, dissipation of excess pore water pressures in liquefied layers could result in ground settlement that would also impart post-seismic drag loading on piles. However, based on our experience with similar conditions at other sites, we do not anticipate that post-seismic drag loads will affect the pile design for support of external loads.

Placement of future site grading fills over about 2 feet in height over large lateral areas could create additional site settlement that may result in additional drag loads on the pile foundation system. This settlement will result in additional loading on the pile foundations which should be considered, in addition to the long-term pile loads, for evaluating the structural capacity of the pile foundations. We should review the proposed site grading plan to evaluate this effect further during final design.

6.10.5 Lateral Response of Deep Foundations

The response of single piles subjected to lateral loads was analyzed using the commercial program LPILE produced by Ensoft, Inc. The software uses input soil properties to generate soil resistance curves (p-y curves) that are functions of pile deflection. Based on imposed pile-head deflections of ¼ inch and ½ inch, as specified by the structural engineer, the analyses produced diagrams of pile deflection, bending moment and shear force versus pile length. These lateral response curves were developed for 18-inch diameter drilled displacement piles and 14-inch square precast concrete piles. The piles were modeled using nonlinear moment-curvature relationships generated by a finite element analysis internally in the programs based on the structural section and pile-head fixity conditions.

Pile caps were assumed to be 3 feet thick, with the bottom of pile cap expected at El +37 feet. Other assumptions:

- Single pile (pile group configurations were not analyzed)
- Pinned-head and fixed-head conditions
- Concrete compressive strength = 5,000 psi
- Analysis pile length is 80 feet (well below the point of fixity)

Lateral response analysis results are presented on Figures 5 through 8.

The analysis results presented on Figures 6 through 9 should be reviewed to ensure that plastic hinges do not develop in the piles. At present, pile group configurations have not been determined. After pile group configurations are developed, Kleinfelder can conduct lateral response analyses for pile groups.

6.10.6 Construction Considerations – Drilled Displacement Piles

6.10.6.1 General

Drilled displacement piles are normally designed and installed by a specialty contractor under a design-build contract format. Under a design-build arrangement, the contractor will provide the guidelines for development of material specifications (e.g., grout mixture, reinforcing steel requirements) based on the contractor's proprietary means and methods, the subsurface conditions reported in this report, and on the structural load and performance demands. The contractor should use the results of the indicator pile and test pile programs, as described in Section 6.9.8, in developing the final pile design and planning for installation of the production piles.

Kleinfelder should be present in the field to monitor construction during installation of production piles.

6.10.6.2 Quality Control

Drilled displacement piles should be installed in general accordance with the Deep Foundations Institute *Augered Cast-in-Place Manual*, which includes recommended guidelines for drilled displacement piles. Each installation rig should monitor the installation parameters (such as drill rate, crowd pressure, grout volume) using a Pile Installation Recorder for Augercast Piles (PIR-A, made by Pile Dynamics, Inc.) or equivalent equipment. The recorder should maintain continuous data during both the augering phase and the grouting phase of the installation to ensure a minimum grout volume is pumped per depth increment and the installation criteria developed by the contractor are met.

6.10.7 Construction Considerations – Precast Concrete Piles

6.10.7.1 General

The contractor should use the results of the indicator pile and test pile programs, as described in Section 6.9.8, in developing the final pile design and planning for installation of the production piles. Kleinfelder should be present in the field to monitor construction during installation of production piles.

6.10.7.2 Quality Control

Precast concrete piles should be installed in general accordance with Federal Highway Administration (FHWA) Geotechnical Engineering Circular 12, *Design and Construction of Driven Pile Foundations* (FHWA-NHI-16-009 and FHWA-NHI-16-010).

6.10.8 Indicator Pile Program and Load Testing

We recommend that prior to production pile driving, an indicator pile program be undertaken to evaluate driving resistances and developed geotechnical resistance across the site and obtain data for the selection of production pile lengths. We recommend that precast concrete indicator pile driving be monitored with a pile driving analyzer (PDA) to evaluate soil resistance and driving criteria and the stresses in the pile during driving. Static and dynamic testing of the drilled displacement test piles and compression testing of the pile grout is recommended for drilled displacement piles.

The pile contractor should provide details on the proposed indicator pile program, including proposed equipment, installation methods, static and dynamic load testing, and quantity and location of the test piles. This information should be reviewed and approved by Kleinfelder prior to beginning the test pile program.

6.11 EXTERIOR CONCRETE SLABS ON GRADE

Exterior concrete slabs-on-grade should be constructed on soil subgrades prepared as recommended in this report. The slab-on-grade recommendations that follow apply to slabs and flatwork that are not exposed to vehicular traffic.

Once the slab subgrade soil has been moisture conditioned and compacted, the soil should not be allowed to dry prior to concrete placement. If the subgrade soil is too dry, the moisture content of the soil should be restored to the recommended value prior to placement of concrete. Kleinfelder should check the moisture content of the subgrade soil prior to construction of the slabs.

Exterior concrete slabs-on-grade should be cast free from adjacent footings or other non-heaving edge restraints. This may be accomplished by using a strip of 1/2-inch asphalt-impregnated felt divider material between the slab edges and the adjacent structure. Frequent construction or control joints should be provided in all concrete slabs where cracking is objectionable. Dowels at the construction and control joints will also aid in reducing uneven slab movements.

A modulus of subgrade reaction (k) of 100 pounds per square inch/per inch of settlement may be used for preliminary design of exterior flatwork supported on subgrades of engineered fill. The structural engineer should design the slab thickness, reinforcing, and control joint spacing. Special care should be taken to place the reinforcement at mid-height within the slab.

6.12 PAVEMENTS

Traffic Index (TI) design input parameters for use in pavement design have not been provided to us. We have assumed TI values between 5 and 8 for preliminary design. The appropriate TI should be selected by the designer based on anticipated axle loadings using Caltrans pavement design methods.

Based on Caltrans design methods and measured Resistance Value (R-value) test result of 7 for the clayey on-site soils, the recommended pavement sections for TIs ranging between 5 and 8 are provided below. Each TI represents a different level of use. The owner or designer should determine which level of use best reflects the project and select appropriate pavement sections. A TI of 5 is commonly used for automobile parking spaces. A TI of 6 is commonly used for automobile access lanes. A TI of 8 is commonly used for heavy-duty traffic areas.

Pavement design recommendations provided below are based on the assumption that subgrade material will be similar to the clayey soils encountered in our borings. If site grading exposes soil other than that what we've assumed, or if imported "non-expansive" fill is used to construct pavement subgrades, we should perform additional tests to confirm or revise the recommended pavement sections for actual field conditions.

6.12.1 Flexible Pavements

For flexible pavements, pavement section parameters include flexible asphalt concrete (AC) over Caltrans Class II aggregate base (AB).

Table 6.5 – Recommended AC Flexible Pavement Sections
Design R-Value = 7

Traffic Index (TI)	AC (inches)	AB (inches)
5	3	10
	4	8
6	4	12
	5	9
7	6	11
	7	9
8	6	15
	7	13

Note: AC = Type B Asphalt Concrete
AB = Class 2 Aggregate Base (Minimum R-Value = 78)

6.12.2 Rigid Pavements

Rigid pavements are constructed of Portland cement concrete (PCC) over aggregate base. Due to the presence of weak clayey subgrade soils, PCC pavement sections should include an AB layer at least 6 inches thick.

Table 6.6 – Recommended PCC Rigid Pavement Sections
Design R-Value = 7

Traffic Index (TI)	PCC (inches)	AB (inches)
5	7.5	6.0
6	8.0	6.0
7	8.0	6.0
8	8.5	6.0

6.12.3 General Pavement Design and Construction Considerations

The anticipated traffic indices and the recommended pavement sections presented above should be reviewed by the project civil engineer in consultation with the owner during the development of the final grading and paving plans. Plans for subgrade soil treatment and final grading plans that will be developed in later design phases may result in a different design R-value. Additional subgrade sampling and laboratory testing is recommended during initial site earthwork grading to better characterize the subgrade R-values and refine pavement section designs if necessary.

Pavement areas should be sloped and drainage gradients maintained at 2% minimum to carry surface water from the site. Surface water ponding should not be allowed anywhere on site during or after construction. We recommend that pavement sections be isolated from non-developed areas and areas of intrusion of irrigation water from landscaped areas. Concrete curbs should extend a minimum of 2 inches below the baserock and into the subgrade to provide a barrier against drying of the subgrade soils, or reduction of migration of landscape water, into the pavement section.

Pavement sections provided above are contingent on the following additional recommendations being implemented during construction.

- Prior to pavement construction, the subgrades should be prepared as recommended in this report. Subgrade preparation should extend at least 2 feet laterally beyond the face of the curb or edge of pavement.
- Subgrade soils should be in a stable, “non-pumping” condition at the time the aggregate base materials are placed and compacted.
- Aggregate base materials should be compacted to at least 95 percent relative compaction.
- Adequate drainage (both surface and subsurface) should be provided such that the subgrade soils and aggregate base materials are not allowed to become saturated.
- Aggregate base materials should meet current Caltrans specifications for Class 2 Aggregate Base.
- Asphalt paving materials and placement methods should meet current Caltrans specifications for asphalt concrete.

Removal and subsequent replacement of some material (i.e., areas of excessively wet materials, unstable subgrade, or pumping soils) may be required to obtain the minimum 95 percent compaction to the recommended depth.

7.0 LIMITATIONS

Information contained in this report is based on our field observations, subsurface explorations completed by Kleinfelder and others, laboratory tests, and our present knowledge of the existing site conditions. Variations in subsurface conditions should be expected between exploration locations. It is possible that soil and groundwater conditions could vary between or beyond the points explored. If subsurface conditions are encountered during construction that differ from those described herein, the client is responsible for ensuring that Kleinfelder is notified immediately so that we may reevaluate the recommendations of this report. If the scope of the proposed construction, including the estimated building loads, and the design depths or locations of the foundations changes from those described in this report, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions of this report are modified or approved in writing, by Kleinfelder.

This report is prepared in substantial accordance with generally accepted geotechnical engineering practice as it exists in the project vicinity at the time of our study. No warranty, expressed or implied, is provided. This report may be used only by CyrusOne and their consultants, and only for the purposes stated. Land use, site conditions (both on site and off site), or other factors may change over time, and additional work may be required with the passage of time. Any party other than the client who wishes to use this report shall notify Kleinfelder of such intended use. Based on the intended use of the report, Kleinfelder may require that additional work be performed and that an updated report be issued. Non-compliance with any of these requirements by the client or anyone else will release Kleinfelder from liability resulting from the use of this report by any unauthorized party.

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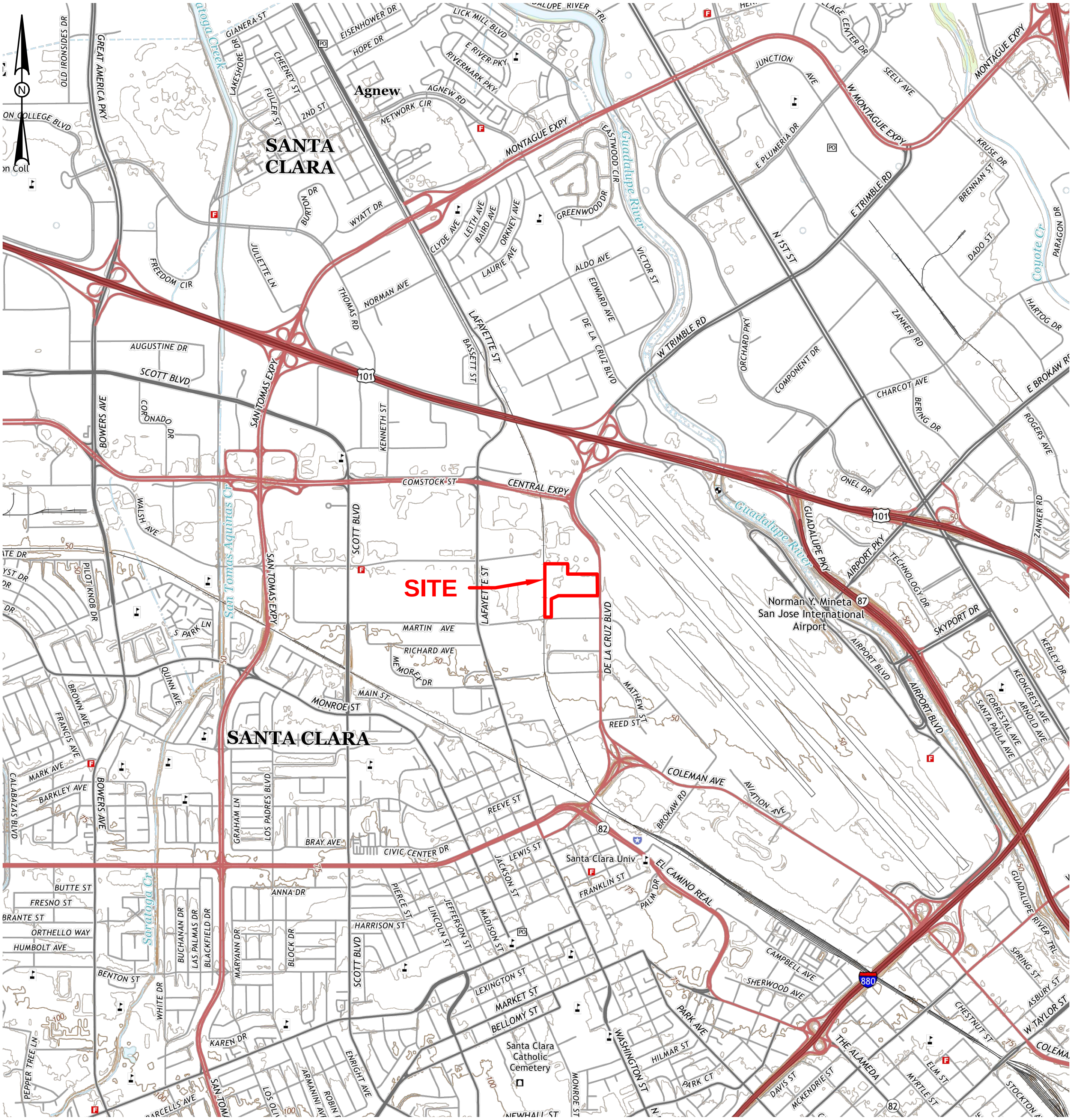
FIGURES



REFERENCE:
VICINITY MAP CREATED FROM DATA COMPILED
BY USGS US TOPO MILPITAS AND SAN JOSE WEST
QUADRANGLE CALIFORNIA, 7.5-MINUTE SERIES, DATED 2015.

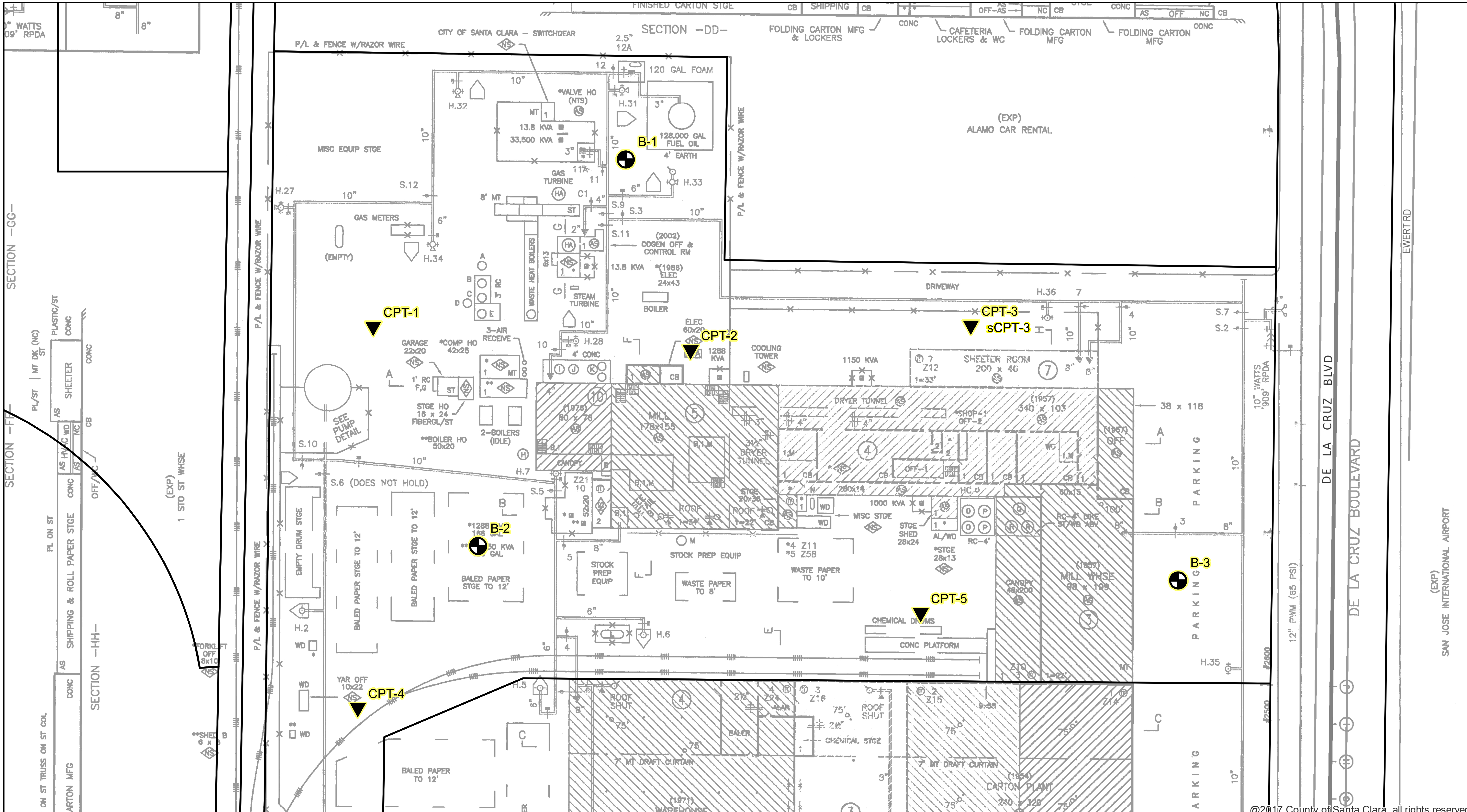
0 3000 6000

SCALE: 1" = 3000' SCALE IN FEET

KLEINFELDER Bright People. Right Solutions.	PROJECT NO. 20190787 DRAWN BY: JDS CHECKED BY: JA DATE: 08/23/2018 REVISED:	SITE VICINITY MAP CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	FIGURE 1

PLOTTED: 8/23/2018 11:37 AM BY: jeff sala

CAD FILE: W:\2019\20190787.001A - Cyrus One Data Center\20190787.dwg



EXPLORATION LOCATIONS

Boring

CPT

0 50 100 200 Feet

Approximate Scale

N

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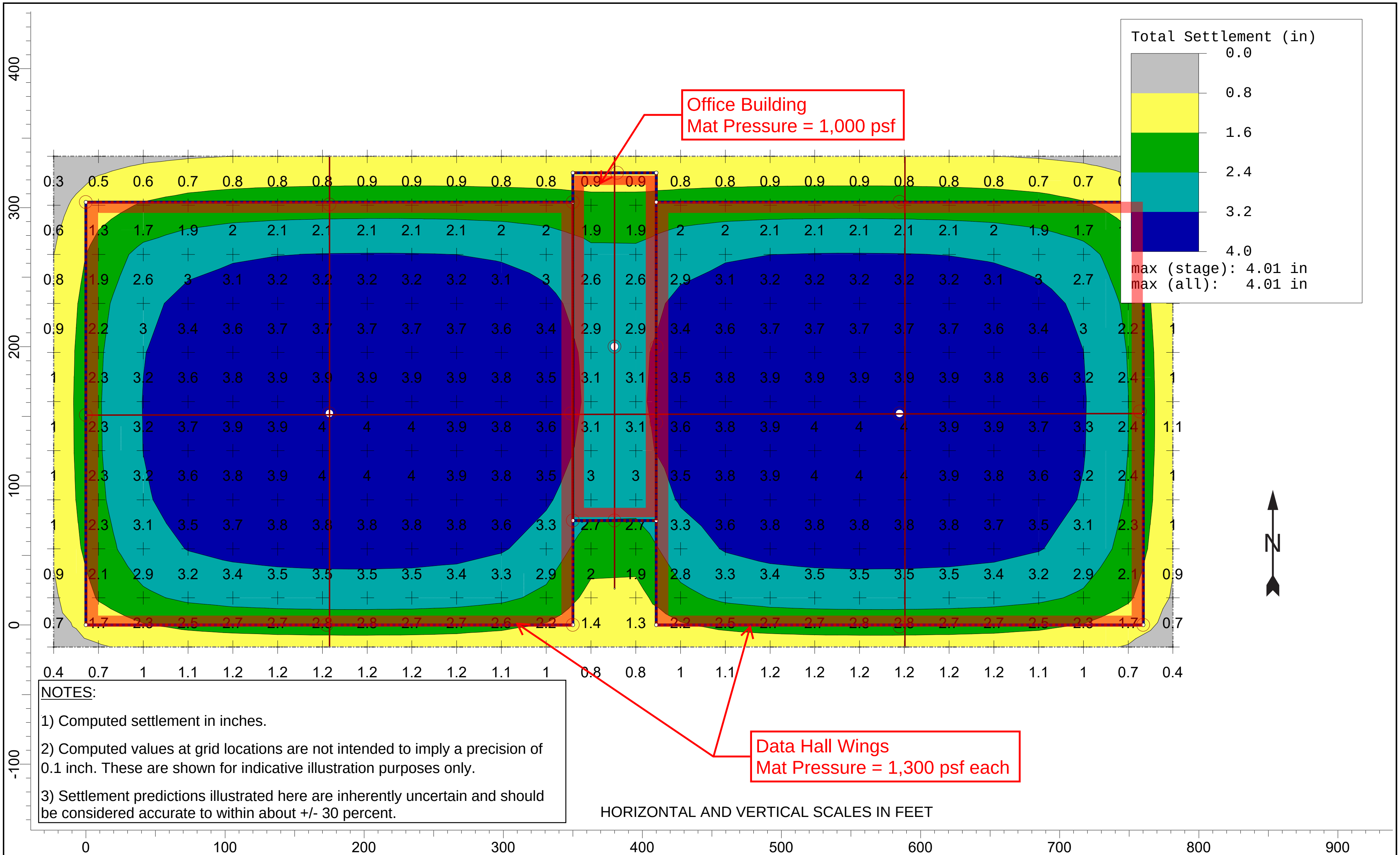
PROJECT NO.	20190787
DRAWN:	8/22/2018
DRAWN BY:	EGJ
CHECKED BY:	MDF
FILE NAME:	CyrusOneGeo.mdx

SITE PLAN

CYRUSONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE

2



NOTES:

1) Computed settlement in inches.

2) Computed values at grid locations are not intended to imply a precision of 0.1 inch. These are shown for indicative illustration purposes only.

3) Settlement predictions illustrated here are inherently uncertain and should be considered accurate to within about +/- 30 percent.

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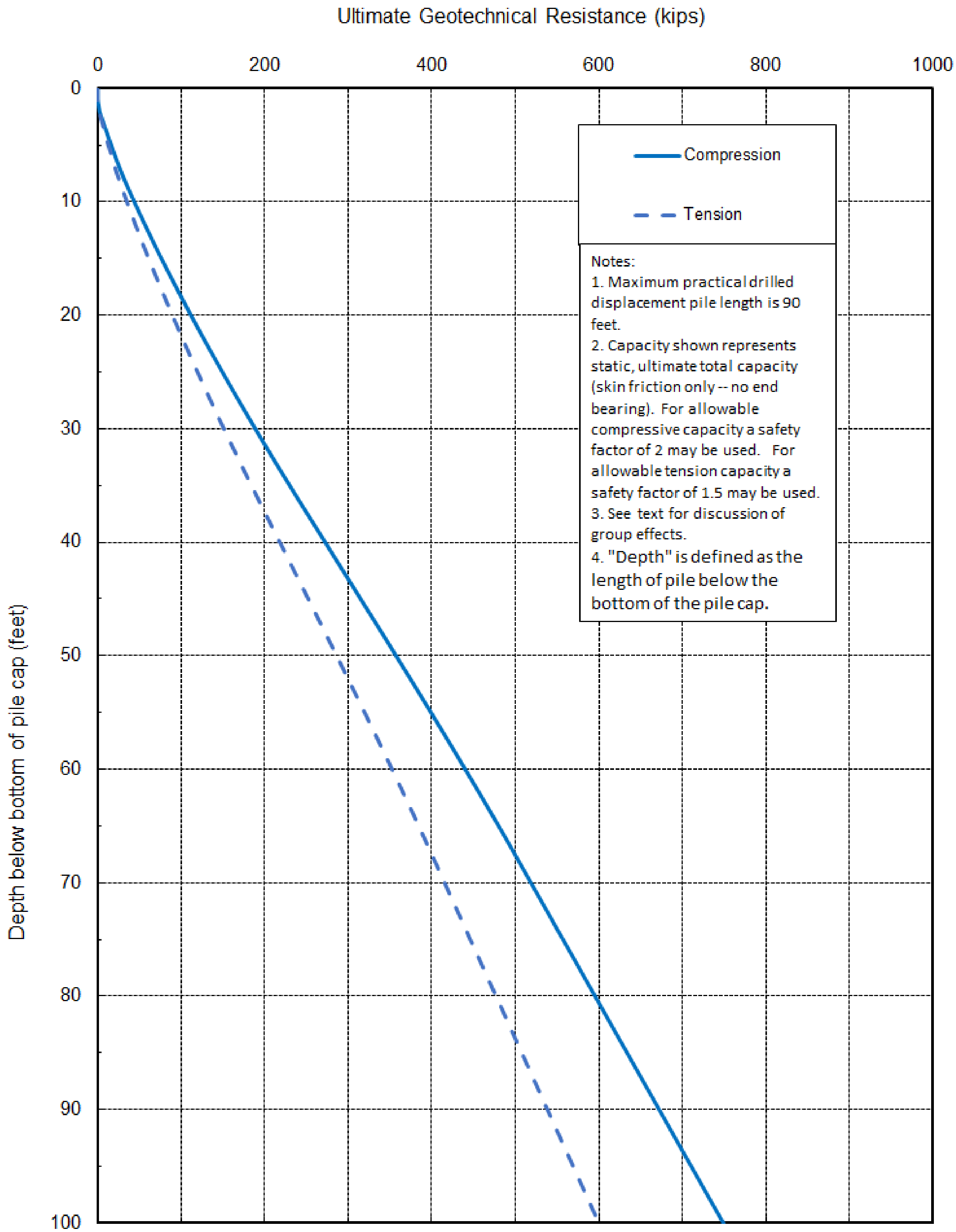
PROJECT NO. 20190787.001A	COMPUTED LONG-TERM SETTLEMENT MAT FOUNDATION
DRAWN: September 17, 2018	
DRAWN BY: F. Ma	CYRUSONE DATA CENTER 2600 DE LA CRUZ WAY SANTA CLARA, CALIFORNIA
CHECKED BY: A. Wright	
FILE NAME:	

FIGURE: 3



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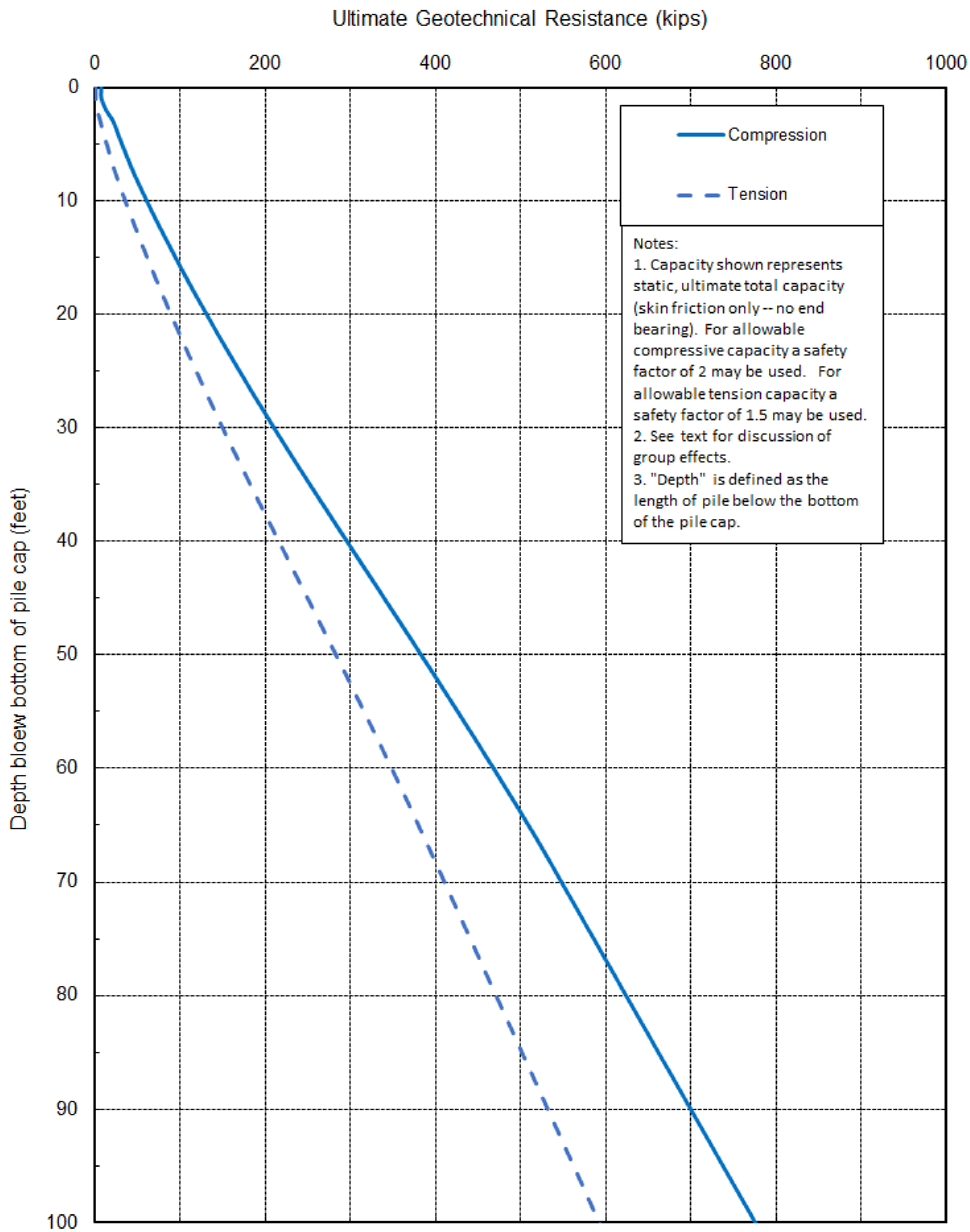
PROJECT NO.	20190787.001A
DRAWN:	08/21/2018
DRAWN BY:	JCA
CHECKED BY:	RF
FILE NAME:	AXIAL DDP.PDF

ULTIMATE GEOTECHNICAL RESISTANCE
18-INCH DIAMETER
DRILLED DISPLACEMENT PILE

CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE:
4



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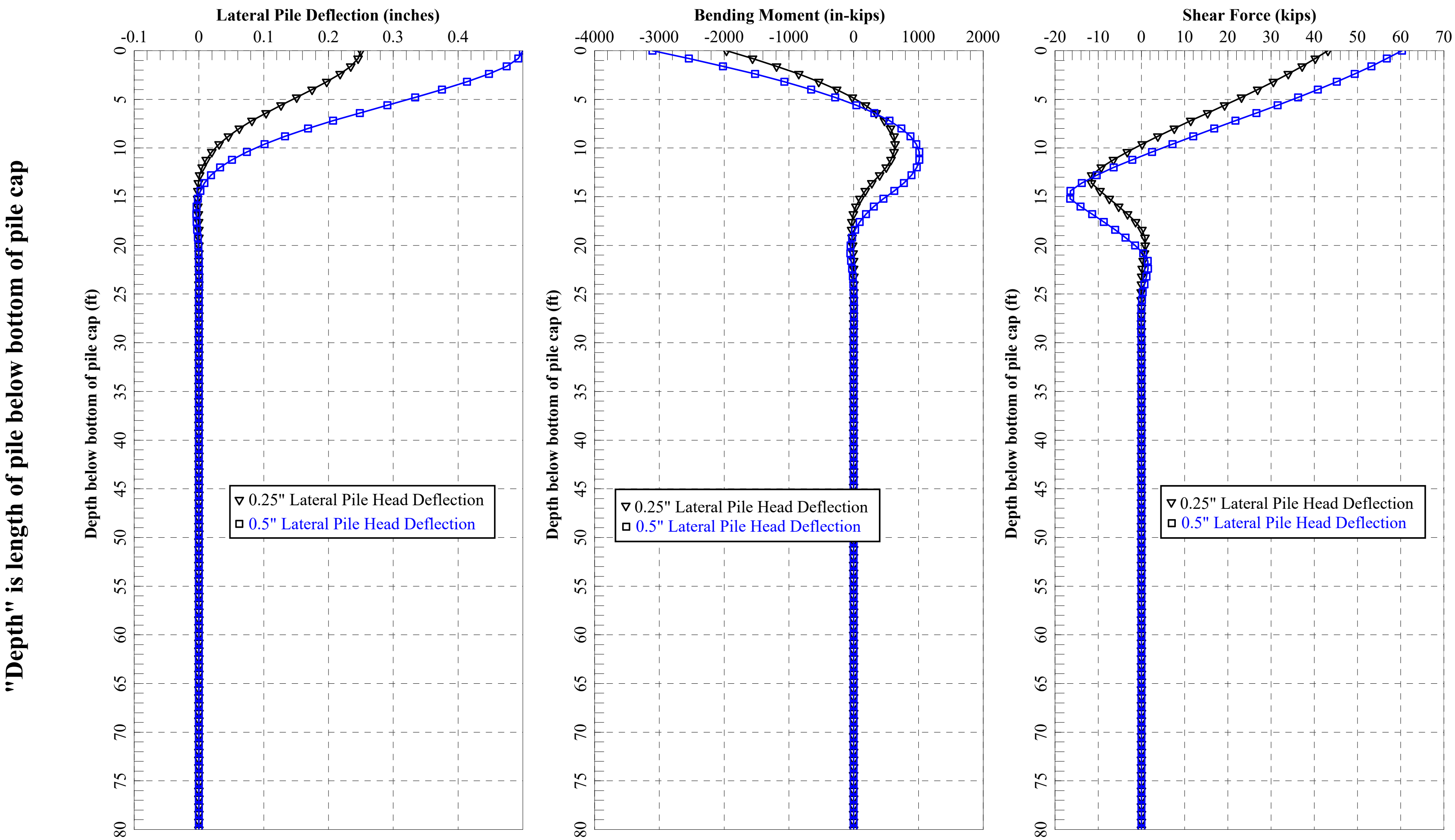
PROJECT NO.	20190787.001A
DRAWN:	08/21/2018
DRAWN BY:	JCA
CHECKED BY:	RF
FILE NAME:	AXIAL PCC.PDF

ULTIMATE GEOTECHNICAL RESISTANCE 14-INCH SQUARE PRECAST CONCRETE PILE

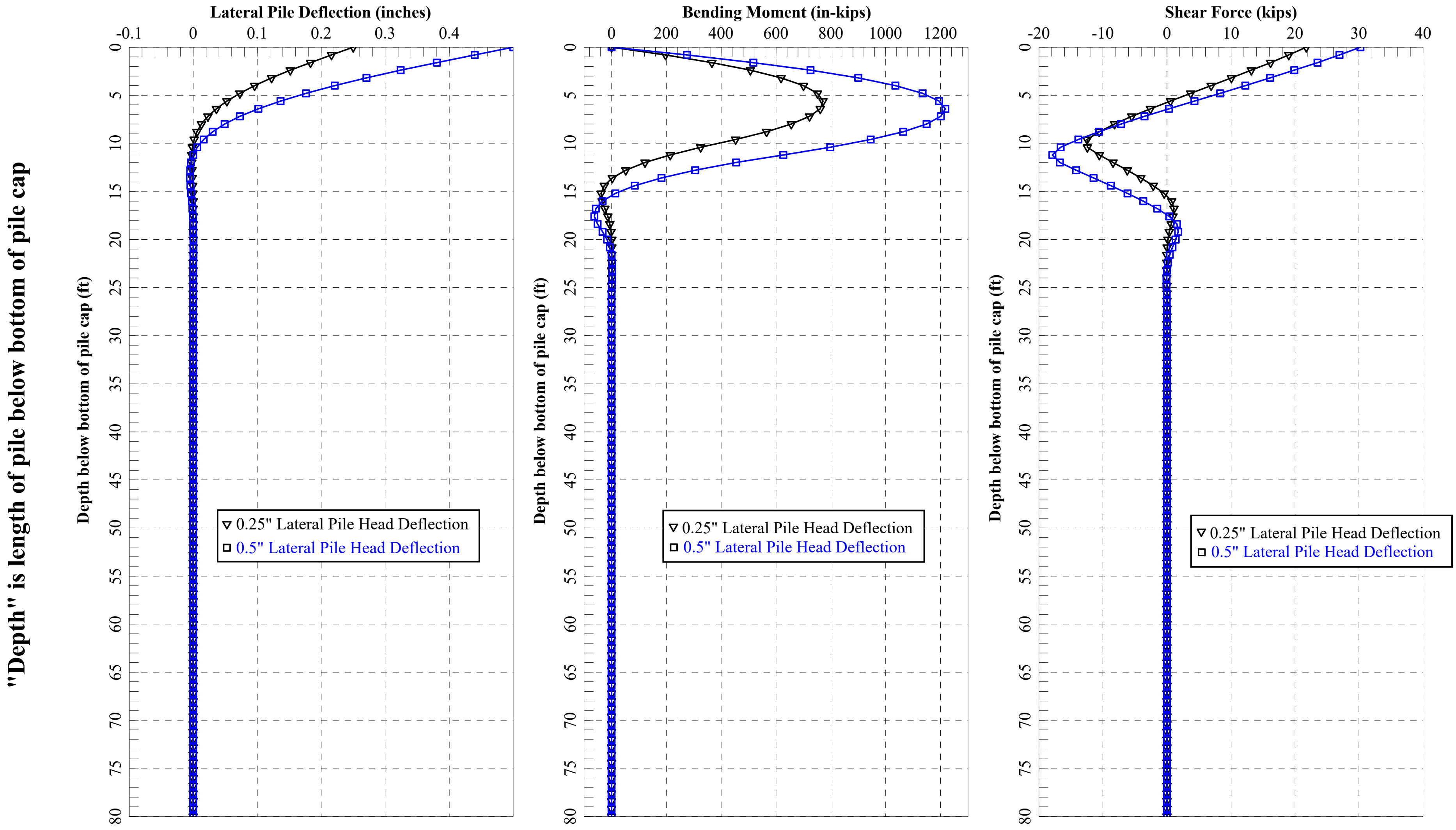
CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE:
5



Note: Lateral response for single pile. For pile groups, see text.

KLEINFELDER Bright People. Right Solutions. www.kleinfelder.com	PROJECT NO. 20190787.001A	LATERAL PILE RESPONSE DRILLED DISPLACEMENT PILE 18-INCH DIAMETER PINNED CONNECTION	FIGURE: 6
	DRAWN: 08/2018		
	DRAWN BY: JCA		
	CHECKED BY: EJ	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD SANTA CLARA, CALIFORNIA	
	FILE NAME: Lateral Pinned DDP.pdf		



Note: Lateral response for single pile. For pile groups, see text.

PROJECT NO.	20190787.001A	
DRAWN:	08/21/2018	
DRAWN BY:	JCA	
CHECKED BY:	EJ	
FILE NAME:	Lateral Fixed DDP.pdf	

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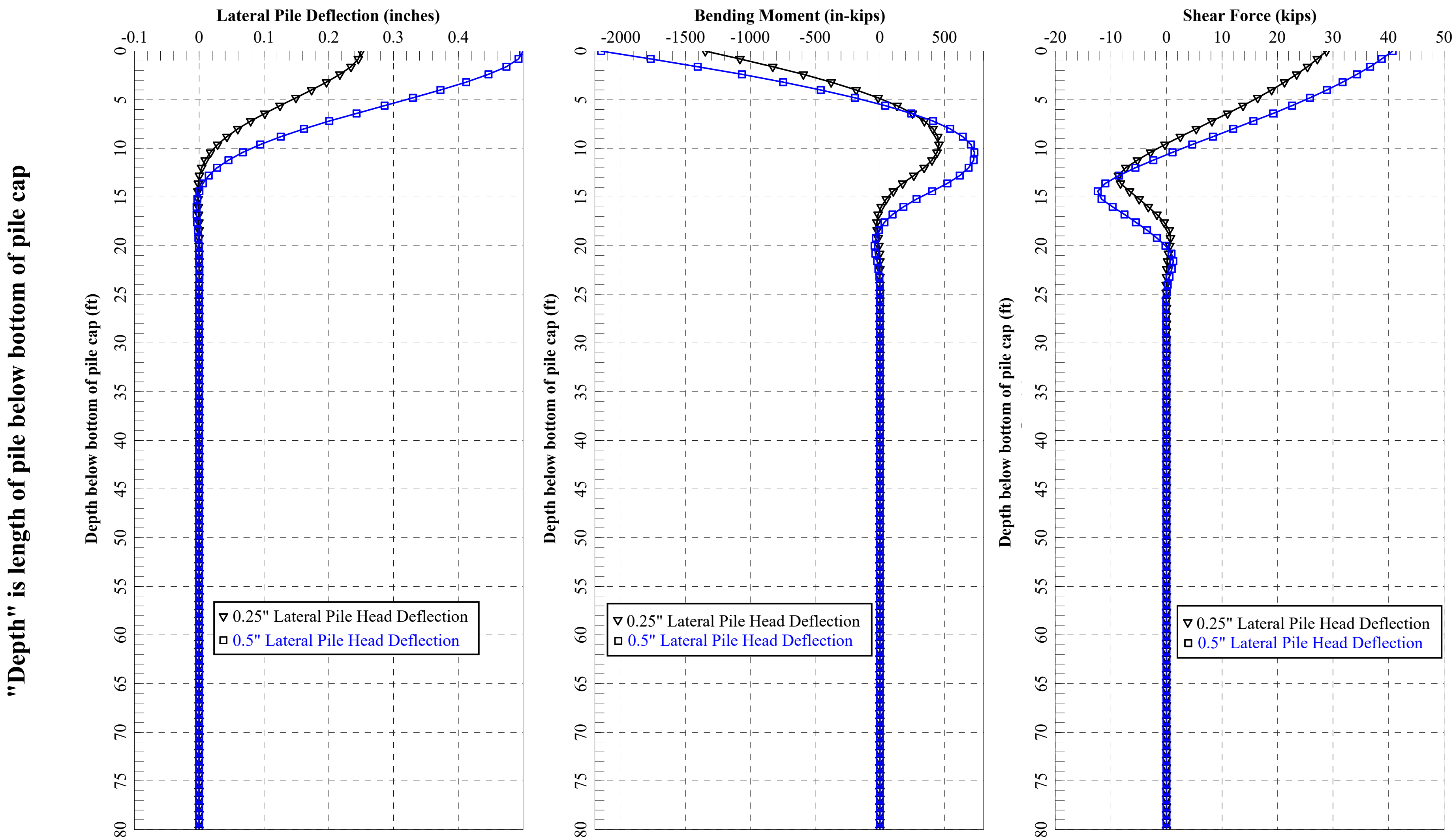
LATERAL PILE RESPONSE
DRILLED DISPLACEMENT PILE
18-INCH DIAMETER
FIXED-HEAD

CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD
SANTA CLARA, CALIFORNIA

FIGURE: 7



Note: Lateral response for single pile. For pile groups, see text.

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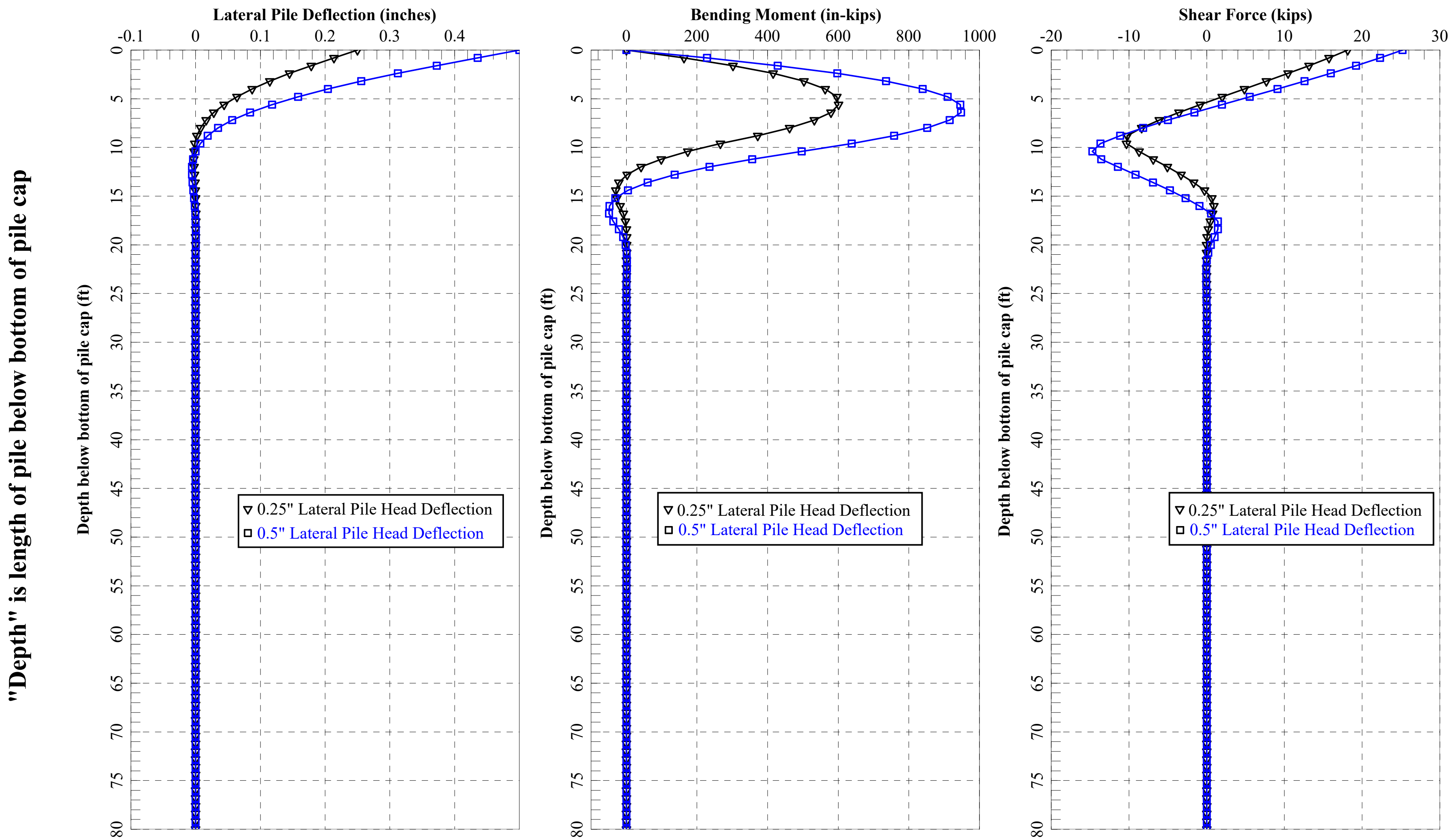
DRAWN BY:	JCA
CHECKED BY:	EJ
FILE NAME:	Lateral Pinned PCC.pdf

LATERAL PILE RESPONSE
PRECAST CONCRETE PILE
14-INCH SQUARE
PINNED CONNECTION

CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD
SANTA CLARA, CALIFORNIA

FIGURE:
8



Note: Lateral response for single pile. For pile groups, see text.

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DRAWN:	08/21/2018
DRAWN BY:	JCA
CHECKED BY:	EJ
FILE NAME:	Lateral Fixed PCC.pdf

LATERAL PILE RESPONSE
PRECAST CONCRETE PILE
14-INCH SQUARE
FIXED-HEAD

CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD
SANTA CLARA, CALIFORNIA

FIGURE:
9

APPENDIX A

Logs of Soil Borings

SAMPLER AND DRILLING METHOD GRAPHICS

- BULK / GRAB / BAG SAMPLE
- MODIFIED CALIFORNIA SAMPLER (2 or 2-1/2 in. (50.8 or 63.5 mm.) outer diameter)
- CALIFORNIA SAMPLER (3 in. (76.2 mm.) outer diameter)
- STANDARD PENETRATION SPLIT SPOON SAMPLER (2 in. (50.8 mm.) outer diameter and 1-3/8 in. (34.9 mm.) inner diameter)
- SHELBY TUBE SAMPLER
- HOLLOW STEM AUGER
- SOLID STEM AUGER
- WASH BORING

GROUND WATER GRAPHICS

- WATER LEVEL (level where first observed)
- WATER LEVEL (level after exploration completion)
- WATER LEVEL (additional levels after exploration)
- OBSERVED SEEPAGE

NOTES

- The report and graphics key are an integral part of these logs. All data and interpretations in this log are subject to the explanations and limitations stated in the report.
- Lines separating strata on the logs represent approximate boundaries only. Actual transitions may be gradual or differ from those shown.
- No warranty is provided as to the continuity of soil or rock conditions between individual sample locations.
- Logs represent general soil or rock conditions observed at the point of exploration on the date indicated.
- In general, Unified Soil Classification System designations presented on the logs were based on visual classification in the field and were modified where appropriate based on gradation and index property testing.
- Fine grained soils that plot within the hatched area on the Plasticity Chart, and coarse grained soils with between 5% and 12% passing the No. 200 sieve require dual USCS symbols, ie., GW-GM, GP-GM, GW-GC, GP-GC, GC-GM, SW-SM, SP-SM, SW-SC, SP-SC, SC-SM.
- If sampler is not able to be driven at least 6 inches then 50/X indicates number of blows required to drive the identified sampler X inches with a 140 pound hammer falling 30 inches.

ABBREVIATIONS

WOH - Weight of Hammer
WOR - Weight of Rod

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D 2487)

COARSE GRAINED SOILS (More than half of material is larger than the #200 sieve)	**GRAVELS** (More than half of coarse fraction is larger than the #4 sieve)	CLEAN GRAVEL WITH <5% FINES	Cu≥4 and 1≤Cc≤3	**GW**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
			Cu<4 and/ or 1>Cc>3	**GP**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES
		GRAVELS WITH 5% TO 12% FINES	Cu≥4 and 1≤Cc≤3	**GW-GM**	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				GW-GC	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
			Cu<4 and/ or 1>Cc>3	**GP-GM**	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE FINES
				GP-GC	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES WITH LITTLE CLAY FINES
		GRAVELS WITH > 12% FINES		**GM**	SILTY GRAVELS, GRAVEL-SILT-SAND MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
				GC-GM	CLAYEY GRAVELS, GRAVEL-SAND-CLAY-SILT MIXTURES
	SANDS (More than half of coarse fraction is smaller than the #4 sieve)	CLEAN SANDS WITH <5% FINES	Cu≥6 and 1≤Cc≤3	**SW**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
			Cu<6 and/ or 1>Cc>3	**SP**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE OR NO FINES
		SANDS WITH 5% TO 12% FINES	Cu≥6 and 1≤Cc≤3	**SW-SM**	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SW-SC	WELL-GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
			Cu<6 and/ or 1>Cc>3	**SP-SM**	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE FINES
				SP-SC	POORLY GRADED SANDS, SAND-GRAVEL MIXTURES WITH LITTLE CLAY FINES
		SANDS WITH > 12% FINES		**SM**	SILTY SANDS, SAND-GRAVEL-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-GRAVEL-CLAY MIXTURES
				SC-SM	CLAYEY SANDS, SAND-SILT-CLAY MIXTURES

FINE GRAINED SOILS (More than half of material is smaller than the #200 sieve)	SILTS AND CLAYS (Liquid Limit less than 50)	**ML**	INORGANIC SILTS AND VERY FINE SANDS, SILTY OR CLAYEY FINE SANDS, SILTS WITH SLIGHT PLASTICITY
		CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		CL-ML	INORGANIC CLAYS-SILTS OF LOW PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
		OL	ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS (Liquid Limit greater than 50)	**MH**	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILT
		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
		OH	ORGANIC CLAYS & ORGANIC SILTS OF MEDIUM-TO-HIGH PLASTICITY

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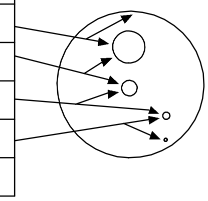
PROJECT NO.: 20190787		GRAPHICS KEY	FIGURE
DRAWN BY:	JDS		
CHECKED BY:	MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	A-1
DATE:	8/22/2018		
REVISED:	-		

GRAIN SIZE

DESCRIPTION		SIEVE SIZE	GRAIN SIZE	APPROXIMATE SIZE
Boulders		>12 in. (304.8 mm.)	>12 in. (304.8 mm.)	Larger than basketball-sized
Cobbles		3 - 12 in. (76.2 - 304.8 mm.)	3 - 12 in. (76.2 - 304.8 mm.)	Fist-sized to basketball-sized
Gravel	coarse	3/4 -3 in. (19 - 76.2 mm.)	3/4 -3 in. (19 - 76.2 mm.)	Thumb-sized to fist-sized
	fine	#4 - 3/4 in. (#4 - 19 mm.)	0.19 - 0.75 in. (4.8 - 19 mm.)	Pea-sized to thumb-sized
Sand	coarse	#10 - #4	0.079 - 0.19 in. (2 - 4.9 mm.)	Rock salt-sized to pea-sized
	medium	#40 - #10	0.017 - 0.079 in. (0.43 - 2 mm.)	Sugar-sized to rock salt-sized
	fine	#200 - #40	0.0029 - 0.017 in. (0.07 - 0.43 mm.)	Flour-sized to sugar-sized
Fines		Passing #200	<0.0029 in. (<0.07 mm.)	Flour-sized and smaller



SECONDARY CONSTITUENT

	AMOUNT	
Term of Use	Secondary Constituent is Fine Grained	Secondary Constituent is Coarse Grained
Trace	<5%	<15%
With	≥5 to <15%	≥15 to <30%
Modifier	≥15%	≥30%

MOISTURE CONTENT

DESCRIPTION	FIELD TEST
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but no visible water
Wet	Visible free water, usually soil is below water table

CEMENTATION

DESCRIPTION	FIELD TEST
Weakly	Crumbles or breaks with handling or slight finger pressure
Moderately	Crumbles or breaks with considerable finger pressure
Strongly	Will not crumble or break with finger pressure

CONSISTENCY - FINE-GRAINED SOIL

CONSISTENCY	SPT - N_{60} (# blows / ft)	Pocket Pen (tsf)	UNCONFINED COMPRESSIVE STRENGTH (Q_u)(psf)	VISUAL / MANUAL CRITERIA
Very Soft	<2	PP < 0.25	<500	Thumb will penetrate more than 1 inch (25 mm). Extrudes between fingers when squeezed.
Soft	2 - 4	0.25≤ PP <0.5	500 - 1000	Thumb will penetrate soil about 1 inch (25 mm). Remolded by light finger pressure.
Medium Stiff	4 - 8	0.5≤ PP <1	1000 - 2000	Thumb will penetrate soil about 1/4 inch (6 mm). Remolded by strong finger pressure.
Stiff	8 - 15	1≤ PP <2	2000 - 4000	Can be imprinted with considerable pressure from thumb.
Very Stiff	15 - 30	2≤ PP <4	4000 - 8000	Thumb will not indent soil but readily indented with thumbnail.
Hard	>30	4≤ PP	>8000	Thumbnail will not indent soil.

FROM TERZAGHI AND PECK, 1948; LAMBE AND WHITMAN, 1969; FHWA, 2002; AND ASTM D2488

REACTION WITH HYDROCHLORIC ACID

DESCRIPTION	FIELD TEST
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

APPARENT / RELATIVE DENSITY - COARSE-GRAINED SOIL

APPARENT DENSITY	SPT-N_{60} (# blows/ft)	MODIFIED CA SAMPLER (# blows/ft)	CALIFORNIA SAMPLER (# blows/ft)	RELATIVE DENSITY (%)
Very Loose	<4	<4	<5	0 - 15
Loose	4 - 10	5 - 12	5 - 15	15 - 35
Medium Dense	10 - 30	12 - 35	15 - 40	35 - 65
Dense	30 - 50	35 - 60	40 - 70	65 - 85
Very Dense	>50	>60	>70	85 - 100

FROM TERZAGHI AND PECK, 1948

PLASTICITY

DESCRIPTION	LL	FIELD TEST
Non-plastic	NP	A 1/8-in. (3 mm.) thread cannot be rolled at any water content.
Low (L)	< 30	The thread can barely be rolled and the lump or thread cannot be formed when drier than the plastic limit.
Medium (M)	30 - 50	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump or thread crumbles when drier than the plastic limit.
High (H)	> 50	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump or thread can be formed without crumbling when drier than the plastic limit.

STRUCTURE

DESCRIPTION	CRITERIA
Stratified	Alternating layers of varying material or color with layers at least 1/4-in. thick, note thickness.
Laminated	Alternating layers of varying material or color with the layer less than 1/4-in. thick, note thickness.
Fissured	Breaks along definite planes of fracture with little resistance to fracturing.
Slickensided	Fracture planes appear polished or glossy, sometimes striated.
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown.
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness.

ANGULARITY

DESCRIPTION	CRITERIA
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces.
Subangular	Particles are similar to angular description but have rounded edges.
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges.
Rounded	Particles have smoothly curved sides and no edges.

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20190787 DRAWN BY: JDS CHECKED BY: MF DATE: 8/22/2018 REVISED: -	SOIL DESCRIPTION KEY CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	FIGURE A-2

Date Begin - End:	7/18/2018	**Drilling Co.-Lic.#:**	Pitcher Drilling - #CA73863
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.

BORING LOG B-1

Hammer Type - Drop: 140 lb. Auto - 30 in.
Hammer Efficiency: 75%
Hammer Cal. Date: 5/16/2017

FIELD EXPLORATION / LABORATORY RESULTS

Latitude: 37.36930° N
Longitude: -121.94420° E
Approximate Ground Surface Elevation (ft.): 40.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		approximately 4-inches of asphalt												solid flight auger to 14'
		approximately 2-inches of aggregate baserock	BULK B-1					24.8			63			R-Value = 7
		Sandy Lean CLAY (CL): fine to coarse-grained sand, olive brown, dry, medium stiff, trace fine gravel to 1/4" (FILL)	1		BC=5 7 13 PP=4.0	12"								
35	5	**Fat CLAY (CH)**: light brown, moist, very stiff, (FILL)	2		BC=3 6 8 PP=2.5	6"	CH	33.2	88.0			64	43	
		Lean CLAY (CL): olive gray, moist, very stiff	3		BC=2 4 5 PP=2.3	12"								
30	10	**Clayey SAND (SC)**: fine-grained sand, olive brown, moist, very loose	4		BC=0 0 2	12"	CL	23.5	106.1		54			
		Lean CLAY with Sand (CL): olive gray to brown, moist, medium stiff, with fine sand	5		BC=0 0 4	18"	CL	28.4				41	22	mud rotary below 14'
25	15		6		BC=6 21 29	12"								
		Clayey SAND (SC): fine to coarse-grained sand, olive brown, moist, dense, fine to coarse subangular gravel to 1"												
20	20	**Well-Graded GRAVEL with Silt and Sand (GW-GM)**: olive brown, wet, medium dense, fine to coarse subangular gravel to 1-1/2"	7		BC=8 10 11	6"								
			8		BC=4 10 14	12"	GW-GM			49	5.0			
		Poorly Graded SAND (SP): fine to coarse-grained sand, olive brown, moist, medium dense, trace subangular fine gravel to 1/2"												
15	25		9		BC=6 14 12	6"								
10	30		10		BC=4 3 3	NR								
		light bluish gray below 32'	11		BC=6 8 10	4"								

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PROJECT NO.:	20190787
DRAWN BY:	JDS
CHECKED BY:	MF
DATE:	8/22/2018
REVISED:	-

BORING LOG B-1

CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE
A-3

Date Begin - End:	7/18/2018	**Drilling Co.-Lic.#:**	Pitcher Drilling - #CA73863			**BORING LOG B-1**	
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe				
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500	**Hammer Type - Drop:**	140 lb. Auto - 30 in.		
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary	**Hammer Efficiency:**	75%		
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.	**Hammer Cal. Date:**	5/16/2017		

Latitude: 37.36930° N
Longitude: -121.94420° E
Approximate Ground Surface Elevation (ft.): 40.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	FIELD EXPLORATION: Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	LABORATORY RESULTS: USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
				12		BC=10 4 5	12"								
			Lean CLAY (CL): light bluish gray, moist, very stiff												
0	40			13		BC=16 18 20	6"								
			Clayey SAND (SM): fine-grained sand, yellowish brown, moist, dense	14		BC=5 7 7	NR								
-5	45		**Poorly Graded SAND with Silt and Gravel (SP-SM)**: fine to coarse-grained sand, olive brown, wet, dense, with fine subangular gravel	15		BC=31 37 38	11"	SP-SM			83	7.2			
				16		BC=11 15 22	12"								
-10	50														
-15	55														
-20	60														
-25	65														

The boring was terminated at approximately 48 ft. below ground surface. The boring was backfilled with grout on July 18, 2018.

GROUNDWATER LEVEL INFORMATION:
▼ Groundwater was observed at approximately 10.5 ft. below ground surface after 10 minutes.
▽ Groundwater was observed at approximately 12.5 ft. below ground surface during drilling.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.: 20190787	BORING LOG B-1	FIGURE
DRAWN BY: JDS		A-3
CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	
DATE: 8/22/2018		
REVISED: -		PAGE: 2 of 2

Date Begin - End:	7/16/2018 - 7/17/2018	**Drilling Co.-Lic.#:**	Pitcher Drilling - #CA73863		**BORING LOG B-2**
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary	**Hammer Efficiency:**	75%
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.	**Hammer Cal. Date:**	5/16/2017

FIELD EXPLORATION / LABORATORY RESULTS

Latitude: 37.36820° N
Longitude: -121.94470° E
Approximate Ground Surface Elevation (ft.): 41.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
41	0	approximately 4-inches of asphalt												flight auger used for top 12.5'
40		approximately 3-inches of aggregate baserock	BULK B-2											
		Clayey SAND with Gravel (SC): fine to coarse-grained sand, yellowish brown, moist, with fine gravel (FILL)	1		BC=4 6 7 PP=3.0	6"								
		Lean CLAY with Silt (CL): trace fine-grained sand, light brownish gray and dark gray, moist, very stiff, (FILL)												
35	5	**Lean CLAY (CL)**: trace fine-grained sand, dark olive brown, moist, stiff	2		BC=2 6 8 PP=2.0	12"		35.2	84.6					
		with trace organic silt pockets below 8'	3		BC=3 4 4 PP=2.5	12"								
30	10	light olive brown, moist to wet, medium stiff, below 9'	4		BC=1 2 2 PP=0.75	6"		28.6	92.0					
		olive, wet, medium stiff to stiff, with silt below 12'	5		BC=1 3 4 PP=1.0	12"								switched to mud rotary below 12.5'
		with ferrous stains below 14'												
25	15	**Silty SAND (SM)**: fine-grained sand, olive brown, moist, medium dense	6		BC=7 8 10	12"								
			7		BC=4 4 4	11"	SM				17			
20	20	**Well-Graded SAND with Silt and Gravel (SW-SM)**: fine to coarse-grained sand, reddish brown to olive, moist, medium dense, fine to coarse subangular gravel to 1"	8		BC=15 18 11	10"	SW-SM			54	6.2			
15	25	increasing gravel size below 25'	9		BC=6 5 5	4"								
		Lean CLAY (CL): olive brown, moist, with trace fine sand												
		Poorly Graded GRAVEL (GP): wet, fine subrounded up to 1/2"												
		Sandy Lean CLAY (CL): gray, moist, with trace subangular fine gravel to 1/4"												
10	30		10		BC=10 11 9	11"								
		Lean CLAY (CL): trace fine-grained sand, olive gray, moist, very stiff												

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PROJECT NO.: 20190787	BORING LOG B-2	FIGURE
DRAWN BY: JDS		
CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	A-4
DATE: 8/22/2018		
REVISED: -		PAGE: 1 of 4

Date Begin - End:	7/16/2018 - 7/17/2018	**Drilling Co.-Lic.#:**	Pitcher Drilling - #CA73863		**BORING LOG B-2**
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary	**Hammer Efficiency:**	75%
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.	**Hammer Cal. Date:**	5/16/2017

FIELD EXPLORATION / LABORATORY RESULTS

Latitude: 37.36820° N
Longitude: -121.94470° E
Approximate Ground Surface Elevation (ft.): 41.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
5		**Lean CLAY (CL)**: trace fine-grained sand, olive gray, moist, very stiff	11		BC=10 11 15 PP=2.5	12"								
		Silty CLAY with Sand (CL-ML): fine-grained sand, olive yellowish brown, moist, stiff, trace fine gravel to 1/2"												
0	40		12		BC=8 8 10 PP=2.5	12"	CL-ML	25.6	100.6		79	27	5	TXUU: c = 1.25 ksf
		Poorly Graded SAND with Silt and Gravel (SP-SM): fine-grained sand, yellowish brown, moist, dense, fine to coarse subangular gravel to 1/2"												
-5	45		13		BC=16 16 14	10"								
-10	50	medium dense	14		BC=13 16 11	9"	SP-SM			76	5.2			
		Clayey SAND with Gravel (SC): fine-grained sand, olive brown, moist, medium dense, subangular gravel to 1/2"												
-15	55		15		BC=6 7 10 PP=1.75	12"								
		Poorly Graded SAND: fine to coarse-grained sand, olive brown, wet, very dense, with trace fine subangular gravel to 1/4"												
-20	60		16		BC=30 35 30	13"								
-25	65	dense, below 65'	17		BC=13 20 25	10"								

Date Begin - End:	7/16/2018 - 7/17/2018	**Drilling Co.-Lic.#:**	Pitcher Drilling - #CA73863		**BORING LOG B-2**
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary	**Hammer Efficiency:**	75%
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.	**Hammer Cal. Date:**	5/16/2017

FIELD EXPLORATION / LABORATORY RESULTS

Latitude: 37.36820° N
Longitude: -121.94470° E
Approximate Ground Surface Elevation (ft.): 41.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
-30			**Sandy Lean CLAY (CL)**: fine-grained sand, yellowish brown, moist, very stiff, trace fine gravel	18		BC=9 11 15 PP=2.5	12"	CL	17.3	114.9		59			
-35	75		**Silty SAND (SM)**: fine-grained sand, olive gray, moist, dense	19		BC=11 16 21	12"								
-40	80		**Sandy Lean CLAY (CL)**: with fine-grained sand, light bluish gray, moist, medium stiff	20		BC=0 1 6	18"								
			with fine subrounded gravel 84' to 85'												
-45	85		**Clayey SAND (SC)**: fine-grained sand, olive gray, moist, medium dense	21		BC=6 4 8	18"	SC	18.6			47			
-50	90		**Sandy Lean CLAY (CL)**: with fine-grained sand, light bluish gray, moist, medium stiff	22		BC=3 2 3	18"								
-55	95		6" layer of clayey sand	23		BC=5 11 19 PP=3.0	12"								
			Lean CLAY (CL): with trace fine-grained sand, light bluish gray, moist, very stiff												
-60	100			24		BC=19 23 25 PP=>4.5	12"								
			olive brown, below 104'												

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20190787	BORING LOG B-2	FIGURE
	DRAWN BY: JDS		A-4
	CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	
	DATE: 8/22/2018		
	REVISED: -		PAGE: 3 of 4

Date Begin - End:	7/16/2018 - 7/17/2018	**Drilling Co.-Lic.#:**	Pitcher Drilling - #CA73863		**BORING LOG B-2**
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary	**Hammer Efficiency:**	75%
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.	**Hammer Cal. Date:**	5/16/2017

FIELD EXPLORATION								LABORATORY RESULTS							
Approximate Elevation (feet)	Depth (feet)	Graphical Log	Latitude: 37.36820° N Longitude: -121.94470° E Approximate Ground Surface Elevation (ft.): 41.00 Surface Condition: Asphalt Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
-65			**Lean CLAY (CL)**: with trace fine-grained sand, light bluish gray, moist, very stiff	25		BC=7 10 13 PP=2.0	12"								
	110		with increasing sand below 110'	26		BC=6 8 18 PP=2.5	12"								
-70								CL	29.6	95.0					TXUU: c = 1.58 ksf
	115		**Sandy Lean CLAY (CL)**: with fine-grained sand, light bluish gray, moist, very stiff	27		BC=3 6 14 PP=2.25	12"								
-75			silty fine sand layer 118' to 119'												
				28		BC=11 10 10	18"								
	120														
-80			The boring was terminated at approximately 120 ft. below ground surface. The boring was backfilled with grout on July 16, 2018.												
	125														
-85															
	130														
-90															
	135														
-95															

GROUNDWATER LEVEL INFORMATION:

▽ Groundwater was observed at approximately 12 ft. below ground surface during drilling.

▼ Groundwater was observed at approximately 10 ft. below ground surface after 10 minutes.

GENERAL NOTES:

The exploration location and elevation are approximate and were estimated by Kleinfelder.

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PROJECT NO.: 20190787	BORING LOG B-2		FIGURE
DRAWN BY: JDS			A-4
CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA		
DATE: 8/22/2018			
REVISED: -			PAGE: 4 of 4

Date Begin - End: 7/18/2018 - 7/19/2018	**Drilling Co.-Lic.#:** Pitcher Drilling - #CA73863			**BORING LOG B-3**
Logged By: D. Dockendorf	**Drill Crew:** Marcos/Joe			
Hor.-Vert. Datum: Not Available	**Drilling Equipment:** Failing 1500	**Hammer Type - Drop:** 140 lb. Auto - 30 in.		
Plunge: -90 degrees	**Drilling Method:** Mud Rotary	**Hammer Efficiency:** 75%		
Weather: Clear	**Exploration Diameter:** 3.88 in. O.D.	**Hammer Cal. Date:** 5/16/2017		

FIELD EXPLORATION / LABORATORY RESULTS

Latitude: 37.36810° N
Longitude: -121.94200° E
Approximate Ground Surface Elevation (ft.): 41.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
		approximately 4-inches of asphalt												solid flight auger to 15'
40		approximately 3-inches of aggregate baserock	BULK B-3			NR								
		Clayey SAND with Gravel (SC): yellowish brown, moist, very dense to hard, (FILL)	1		BC=12 11 8 PP=>4.5	12"								
	5	**Sandy Lean CLAY (CL)**: fine to coarse-grained sand, medium plasticity, light brown, moist, very stiff, (NATIVE)	2		BC=5 7 8 PP=1.5	6"								
35		**Lean CLAY with Sand (CL)**: fine to coarse-grained sand, light brown and dark brown, moist, stiff, trace fine to coarse gravel												
		Lean CLAY (CL): dark brown, moist, stiff, trace fine sand	3		BC=2 4 8 PP=1.75	11"								
	10	**Silty SAND (SM)**: fine to coarse-grained sand, olive, moist to wet, medium dense, with trace fine gravel	4		BC=6 6 6	NR								
30			5		BC=7 9 12	18"	SM			89	13			
25	15	decrease in gravel below 15'	6		BC=8 12 9	9"								switched to mud rotary at 15'
	20	**Poorly Graded GRAVEL with Sand (GP)**: olive brown, wet, medium dense, fine to coarse subangular gravel, with fine to coarse sand	7		BC=12 12 13	NR								
20		**Poorly Graded SAND with Gravel (SP)**: fine to coarse-grained sand, olive brown, moist, medium dense, trace silts, fine to coarse subangular gravel to 2"	8		BC=12 13 16	11"	SP			65	4.6			
15	25	with clay below 26'	9		BC=3 2 5	NR								
		Lean CLAY (CL): trace fine-grained sand, olive bluish gray, moist, stiff	10		BC=6 5 4 PP=1.75	11"								
10	30	**Silty SAND (SM)**: fine-grained sand, bluish gray, moist, medium dense with gravel to 30.5'	11		BC=13 14 6	11"	SM	23.0	105.8		36			
			12		BC=5 7 11	18"								

KLEINFELDER Bright People. Right Solutions.	PROJECT NO.: 20190787	BORING LOG B-3	FIGURE
	DRAWN BY: JDS		A-5
	CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	
	DATE: 8/22/2018		
	REVISED: -		PAGE: 1 of 4

Date Begin - End:	7/18/2018 - 7/19/2018	Drilling Co.-Lic.#:	Pitcher Drilling - #CA73863		**BORING LOG B-3**
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary	**Hammer Efficiency:**	75%
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.	**Hammer Cal. Date:**	5/16/2017

FIELD EXPLORATION / LABORATORY RESULTS

Latitude: 37.36810° N
Longitude: -121.94200° E
Approximate Ground Surface Elevation (ft.): 41.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
5			**Lean CLAY (CL)**: trace fine-grained sand, bluish gray, moist, stiff, trace woody organic material	13		BC=0 2 6 PP=1.0	12"		26.2	100.4					
			Clayey SAND (SC): fine-grained sand, yellowish brown, moist, medium dense												
0	40			14		BC=2 5 8 PP=1.75	12"								
			Lean CLAY (CL): trace fine-grained sand, yellowish brown, moist, stiff												
-5	45			15		BC=5 7 9 PP=1.5	12"		25.2	101.6					
			Sandy Lean CLAY (CL): with trace fine-grained sand, bluish gray, moist, very stiff												
-10	50			16		BC=10 13 14 PP=2.25	12"	CL	23.1	105.0			32	16	TXUU: c = 1.35 ksf
-15	55			17		BC=7 10 12 PP=2.0	12"		24.9	104.0					
-20	60		stiff below 60'	18		BC=9 15 17 PP=1.5	12"		24.6	102.9					
-25	65			19		BC=4 8 11 PP=1.75	12"								
			Lean CLAY with Sand (CL): with fine-grained sand, olive gray, moist, stiff to very stiff												

Date Begin - End: 7/18/2018 - 7/19/2018	**Drilling Co.-Lic.#:** Pitcher Drilling - #CA73863		
Logged By: D. Dockendorf	**Drill Crew:** Marcos/Joe		
Hor.-Vert. Datum: Not Available	**Drilling Equipment:** Failing 1500	**Hammer Type - Drop:** 140 lb. Auto - 30 in.	
Plunge: -90 degrees	**Drilling Method:** Mud Rotary	**Hammer Efficiency:** 75%	
Weather: Clear	**Exploration Diameter:** 3.88 in. O.D.	**Hammer Cal. Date:** 5/16/2017	

FIELD EXPLORATION / LABORATORY RESULTS

Latitude: 37.36810° N
Longitude: -121.94200° E
Approximate Ground Surface Elevation (ft.): 41.00
Surface Condition: Asphalt

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
-30			with coarse subangular gravel to 69' **Lean CLAY with Sand (CL)**: with fine-grained sand, olive gray, moist, stiff to very stiff	20		BC=3 5 7	18"	CL				74			
-35	75		light olive brown and gray, very stiff below 75'	21		BC=11 17 22	NR								
-40	80		**Silty SAND with Gravel (SM)**: fine to coarse-grained sand, olive brown, moist, dense, with fine subangular fine gravel to 1/2"	22		BC=13 22 23	14"								
-45	85		**Clayey SAND (SC)**: fine-grained sand, olive brown, wet, dense	23		BC=17 21 18 PP=2.5	12"								
			Lean CLAY (CL): trace fine to coarse-grained sand, olive brown, moist, very stiff, trace subangular gravel												
-50	90		**Clayey SAND (SC)**: fine to coarse-grained sand, light brown, moist, dense, trace of 1/4" subangular gravel	24		BC=10 18 21	12"								
-55	95			25		BC=10 20 27 PP=4.5+	12"								
			Lean CLAY (CL): trace fine-grained sand, brown, moist, very stiff												
-60	100		**Sandy Lean CLAY (CL)**: brown, moist to wet, medium stiff	26		BC=0 1 2	18"		24.3						

KLEINFELDER
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PROJECT NO.: 20190787	BORING LOG B-3		FIGURE
DRAWN BY: JDS			
CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA		A-5
DATE: 8/22/2018			
REVISED: -			

PLOTTED: 08/22/2018 08:33 AM BY: JSala
OFFICE FILTER: OAKLAND
PROJECT NUMBER: 20190787.001A
gINT FILE: Klf_gint_master_2017
gINT TEMPLATE: E:KLF_STANDARD_GINT_LIBRARY_2017.GLB [_KLF_BORING/TEST PIT SOIL LOG]

Date Begin - End:	7/18/2018 - 7/19/2018	**Drilling Co.-Lic.#:**	Pitcher Drilling - #CA73863		**BORING LOG B-3**
Logged By:	D. Dockendorf	**Drill Crew:**	Marcos/Joe		
Hor.-Vert. Datum:	Not Available	**Drilling Equipment:**	Failing 1500	**Hammer Type - Drop:**	140 lb. Auto - 30 in.
Plunge:	-90 degrees	**Drilling Method:**	Mud Rotary	**Hammer Efficiency:**	75%
Weather:	Clear	**Exploration Diameter:**	3.88 in. O.D.	**Hammer Cal. Date:**	5/16/2017

FIELD EXPLORATION

Latitude: 37.36810° N
Longitude: -121.94200° E
Approximate Ground Surface Elevation (ft.): 41.00
Surface Condition: Asphalt

LABORATORY RESULTS

Approximate Elevation (feet)	Depth (feet)	Graphical Log	Lithologic Description	Sample Number	Sample Type	Blow Counts(BC)= Uncorr. Blows/6 in. Pocket Pen(PP)= tsf	Recovery (NR=No Recovery)	USCS Symbol	Water Content (%)	Dry Unit Wt. (pcf)	Passing #4 (%)	Passing #200 (%)	Liquid Limit	Plasticity Index (NP=NonPlastic)	Additional Tests/ Remarks
-65			**Clayey SAND (SC)**: fine to coarse-grained sand, olive brown, wet, dense, trace fine subangular gravel to 1/4"	27		BC=5 15 16	12"								
-70	110		**Lean CLAY with Sand (ML)**: fine-grained sand, olive brown, moist, stiff	28		BC=0 8 10	18"		31.4						
-75	115		**Clayey SAND (SM)**: fine-grained sand, olive brown, moist, very dense	29		BC=17 26 25	16"								
			dark bluish grey, below 118'	30		BC=16 37 30									
-80	120														
-85	125														
-90	130														
-95	135														

The boring was terminated at approximately 120 ft. below ground surface. The boring was backfilled with grout on July 18, 2018.

GROUNDWATER LEVEL INFORMATION:
▽ Groundwater was observed at approximately 12 ft. below ground surface during drilling.
▼ Groundwater was observed at approximately 10 ft. below ground surface after 10 minutes.

GENERAL NOTES:
The exploration location and elevation are approximate and were estimated by Kleinfelder.

KLEINFELDER
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PROJECT NO.: 20190787	BORING LOG B-3	FIGURE
DRAWN BY: JDS		
CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	A-5
DATE: 8/22/2018		
REVISED: -		PAGE: 4 of 4

APPENDIX B

Laboratory Test Results

Exploration ID	Depth (ft.)	Sample No.	Sample Description	Water Content (%)	Dry Unit Wt. (pcf)	Sieve Analysis (%)			Atterberg Limits			Additional Tests
						Passing 3/4"	Passing #4	Passing #200	Liquid Limit	Plastic Limit	Plasticity Index	
B-1	1.5		OLIVE BROWN SANDY LEAN CLAY (CL)	24.8				63				R-Value = 7
B-1	6.0		OLIVE GRAY FAT CLAY (CH)	33.2	88.0				64	21	43	
B-1	11.0		OLIVE GRAY SANDY LEAN CLAY (CL)	23.5	106.1			54				
B-1	13.5		OLIVE GRAY LEAN CLAY WITH SAND (CL)	28.4					41	19	22	
B-1	21.5 - 26.5	8	OLIVE WELL GRADED GRAVEL WITH SILT & SAND (GW-GM)			88	49	5.0				
B-1	46.0		OLIVE BROWN POORLY GRADED SAND WTIH SILT (SP-SM)			100	83	7.2				
B-2	6.0			35.2	84.6							
B-2	11.0			28.6	92.0							
B-2	17.5		DARK OLIVE SILTY SAND (SM)					17				
B-2	20.0 - 21.5	8	DARK OLIVE BROWN WELL GRADED SAND WITH SILT & GRAVEL (SW-SM)			95	54	6.2				
B-2	41.0		OLIVE BROWN SILTY CLAY WITH SAND (CL-ML)	25.6	100.6			79	27	22	5	TXUU: c = 1.25 ksf
B-2	51.0		OLIVE BROWN POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM)			100	76	5.2				
B-2	70.5		OLIVE BROWN SANDY LEAN CLAY (CL)	17.3	114.9			59				
B-2	86.0		OLIVE GRAY CLAYEY SAND (SC)	18.6				47				
B-2	111.0		DARK OLIVE GRAY LEAN CLAY (CL)	29.6	95.0							TXUU: c = 1.58 ksf
B-3	12.5		OLIVE BROWN SILTY SAND (SM)			98	89	13				
B-3	22.5		OLIVE GRAY POORLY GRADED SAND WITH GRAVEL (SP)			86	65	4.6				
B-3	31.0		DARK GRAY SILTY SAND (SM)	23.0	105.8			36				
B-3	35.5			26.2	100.4							
B-3	45.5			25.2	101.6							
B-3	51.0		OLIVE GRAY SANDY LEAN CLAY (CL)	23.1	105.0				32	16	16	TXUU: c = 1.35 ksf
B-3	55.5			24.9	104.0							
B-3	60.5			24.6	102.9							
B-3	71.0		OLIVE GRAY LEAN CLAY WITH SAND (CL)					74				
B-3	101.0			24.3								
B-3	111.0			31.4								

Refer to the Geotechnical Evaluation Report or the supplemental plates for the method used for the testing performed above.
NP = NonPlastic
NA = Not Available

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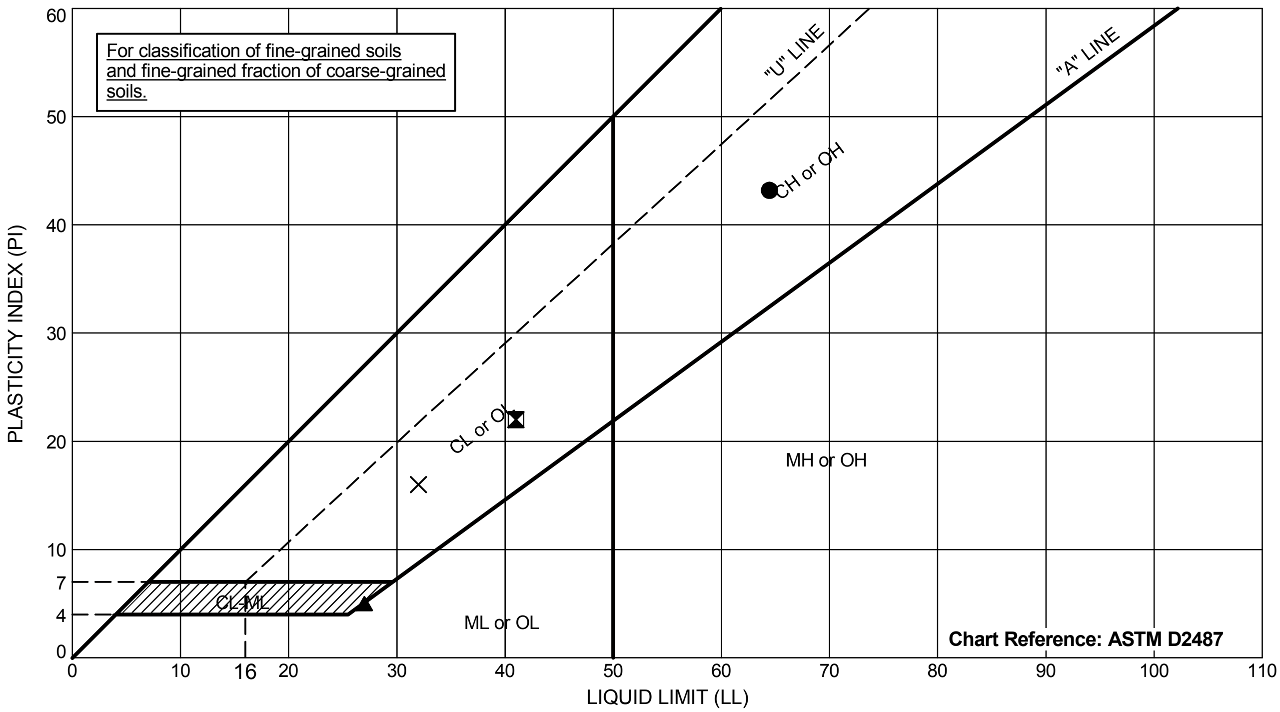
PROJECT NO.: 20190787
DRAWN BY: JDS
CHECKED BY: MF
DATE: 8/22/2018
REVISED: -

LABORATORY TEST RESULT SUMMARY

CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE
B-1



	Exploration ID	Depth (ft.)	Sample Number	Sample Description	Passing #200	LL	PL	PI
●	B-1	6	NA	OLIVE GRAY FAT CLAY (CH)	NM	64	21	43
⊠	B-1	13.5 - 14	NA	OLIVE GRAY LEAN CLAY WITH SAND (CL)	NM	41	19	22
▲	B-2	41	NA	OLIVE BROWN SILTY CLAY WITH SAND (CL-ML)	79	27	22	5
×	B-3	51	NA	OLIVE GRAY SANDY LEAN CLAY (CL)	NM	32	16	16

Testing performed in general accordance with ASTM D4318.
NP = Nonplastic
NA = Not Available
NM = Not Measured

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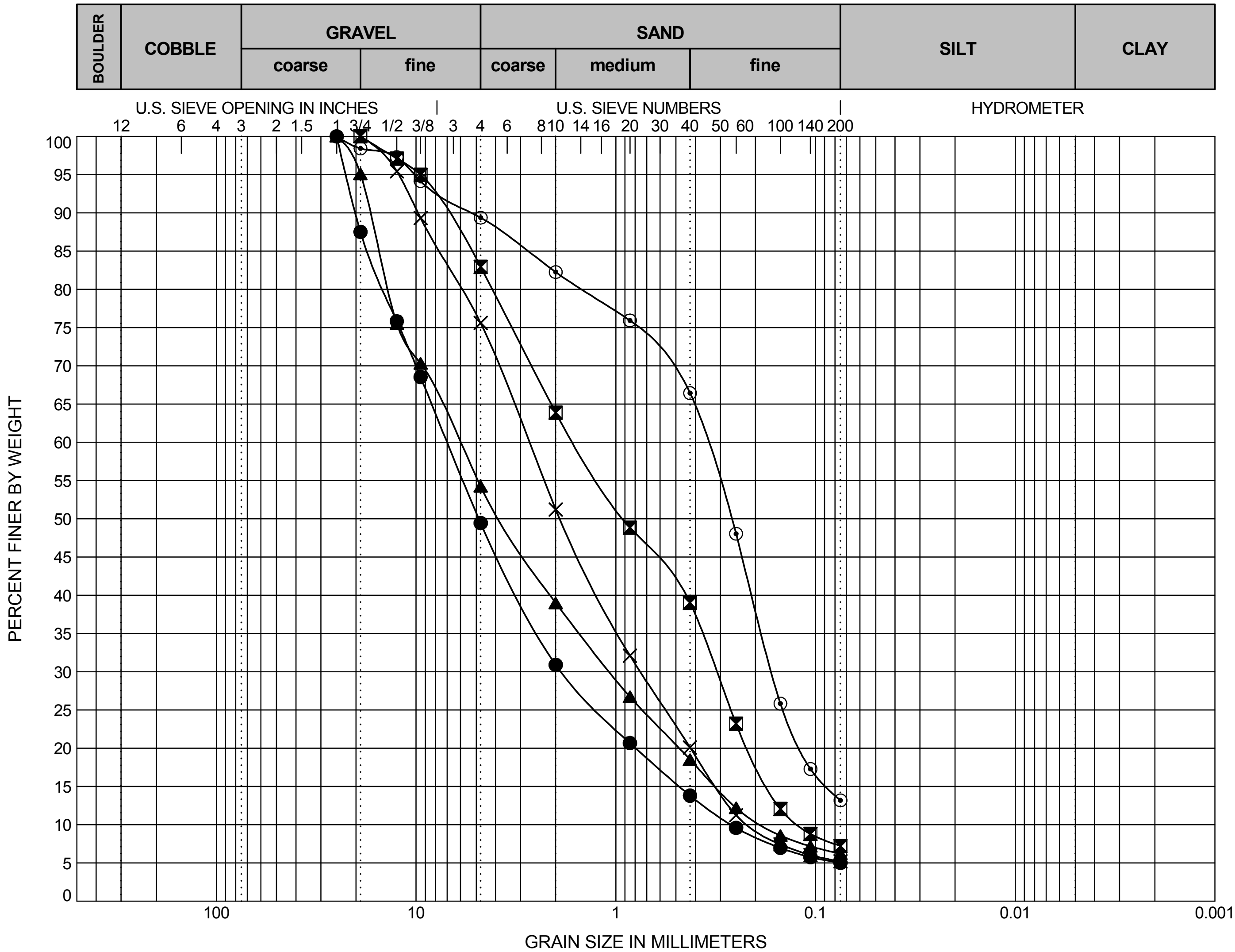
PROJECT NO.: 20190787	ATTERBERG LIMITS	FIGURE
DRAWN BY: JDS		
CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	B-2
DATE: 8/22/2018		
REVISED: -		



Exploration ID		Depth (ft.)	Sample Number	Sample Description	LL	PL	PI
●	B-1	21.5 - 26.5	8	OLIVE WELL GRADED GRAVEL WITH SILT & SAND (GW-GM)	NM	NM	NM
⧗	B-1	46	NA	OLIVE BROWN POORLY GRADED SAND WTIH SILT (SP-SM)	NM	NM	NM
▲	B-2	20 - 21.5	8	DARK OLIVE BROWN WELL GRADED SAND WITH SILT & GRAVEL (SW-SM)	NM	NM	NM
×	B-2	51 - 52	NA	OLIVE BROWN POORLY GRADED SAND WITH SILT & GRAVEL (SP-SM)	NM	NM	NM
⊙	B-3	12.5	NA	OLIVE BROWN SILTY SAND (SM)	NM	NM	NM

Exploration ID		Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt	%Clay
●	B-1	21.5 - 26.5	25	6.97	1.855	0.263	1.87	26.45	88	49	5.0	NM	NM
⧗	B-1	46	19	1.604	0.314	0.121	0.51	13.31	100	83	7.2	NM	NM
▲	B-2	20 - 21.5	25	6.088	1.068	0.183	1.02	33.20	95	54	6.2	NM	NM
×	B-2	51 - 52	19	2.73	0.753	0.211	0.98	12.92	100	76	5.2	NM	NM
⊙	B-3	12.5	25	0.353	0.165	NM	NM	NM	98	89	13	NM	NM

Sieve Analysis and Hydrometer Analysis testing performed in general accordance with ASTM D422.
NP = Nonplastic
NA = Not Available
NM = Not Measured

Coefficients of Uniformity - $C_u = D_{60} / D_{10}$
Coefficients of Curvature - $C_C = (D_{30})^2 / D_{60} D_{10}$
D_{60} = Grain diameter at 60% passing
D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

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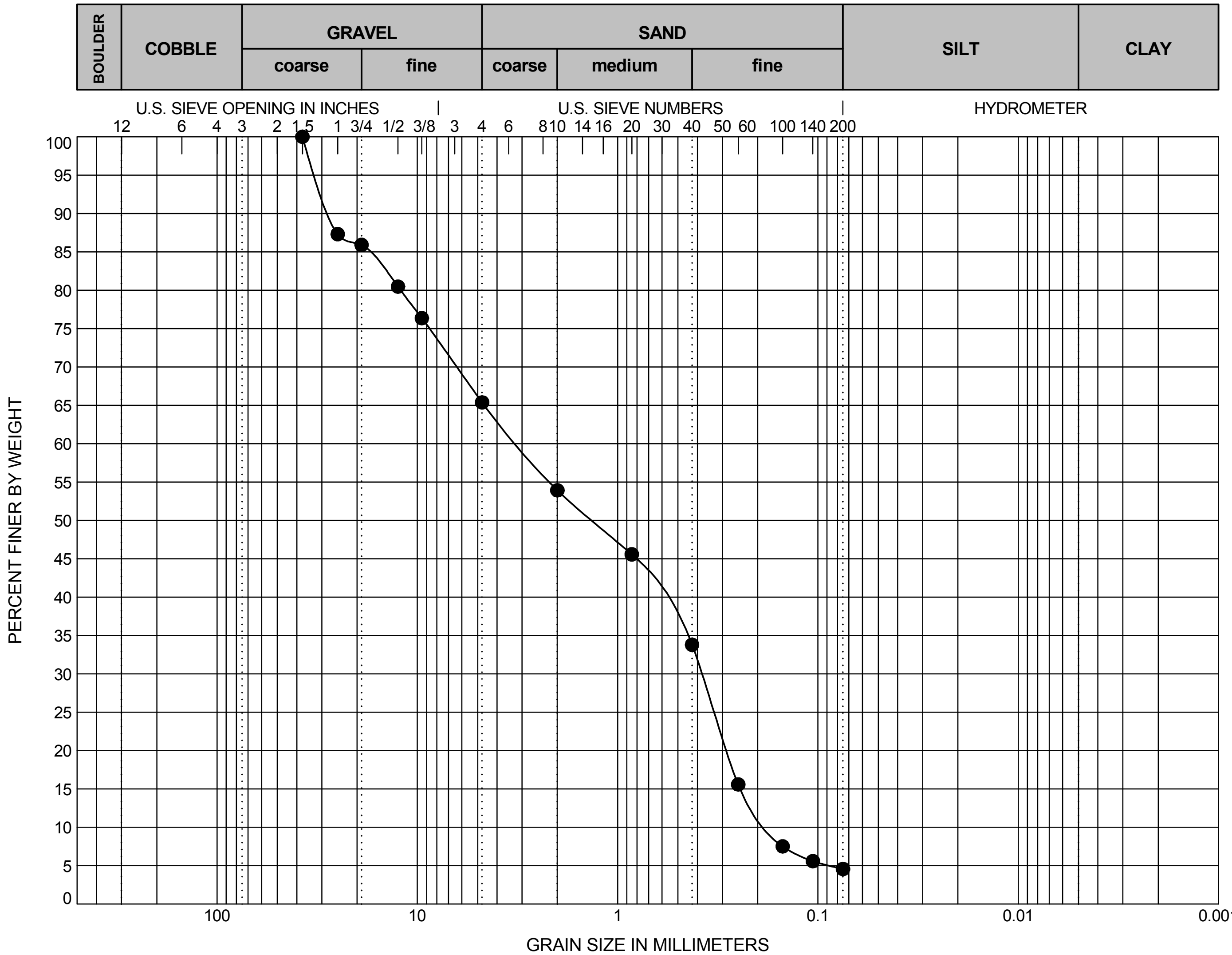
PROJECT NO.: 20190787	SIEVE ANALYSIS	FIGURE
DRAWN BY: JDS		
CHECKED BY: MF	CYRUS ONE DATA CENTER 2600 DE LA CRUZ BLVD. SANTA CLARA, CALIFORNIA	B-3
DATE: 8/22/2018		
REVISED: -		



Exploration ID	Depth (ft.)	Sample Number	Sample Description	LL	PL	PI
● B-3	22.5	NA	OLIVE GRAY POORLY GRADED SAND WITH GRAVEL (SP)	NM	NM	NM

Exploration ID	Depth (ft.)	D_{100}	D_{60}	D_{30}	D_{10}	Cc	Cu	Passing 3/4"	Passing #4	Passing #200	%Silt	%Clay
● B-3	22.5	37.5	3.164	0.381	0.176	0.26	18.02	86	65	4.6	NM	NM

Sieve Analysis and Hydrometer Analysis testing performed in general accordance with ASTM D422.
NP = Nonplastic
NA = Not Available
NM = Not Measured

Coefficients of Uniformity - $C_u = D_{60} / D_{10}$
Coefficients of Curvature - $C_C = (D_{30})^2 / D_{60}\,D_{10}$
D_{60} = Grain diameter at 60% passing
D_{30} = Grain diameter at 30% passing
D_{10} = Grain diameter at 10% passing

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PROJECT NO.: 20190787
DRAWN BY: JDS
CHECKED BY: MF
DATE: 8/22/2018
REVISED: -

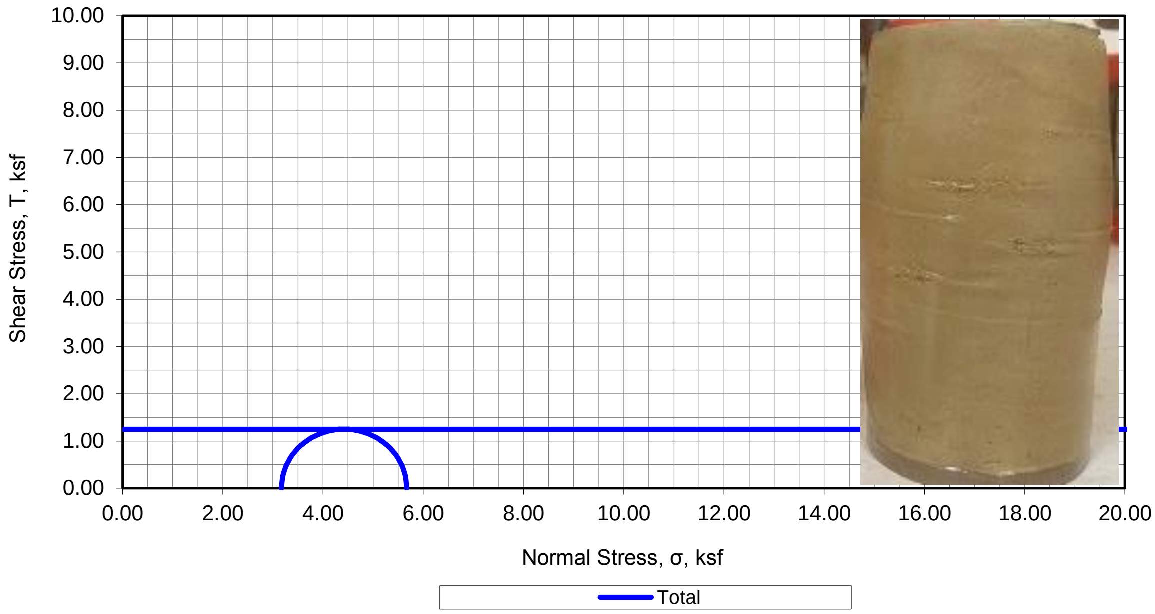
SIEVE ANALYSIS

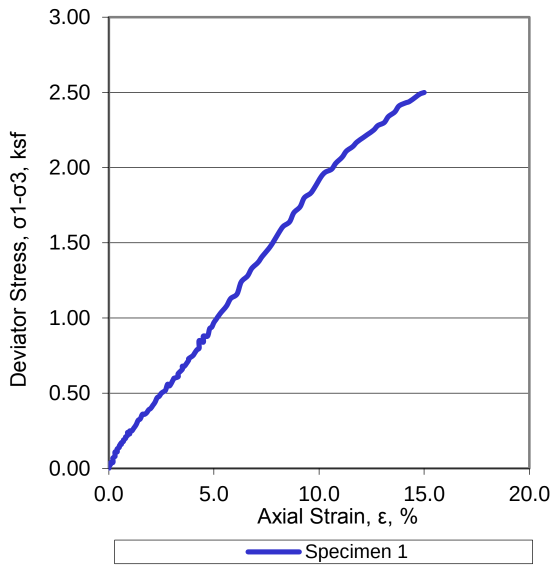
CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE
B-4

Total	
c = 1.25	ksf

Specimen Shear Picture





Specimen No.			1
Initial	Diameter, in	D_O	2.41
	Height, in	H_O	5.28
	Water Content, %	ω_O	25.6
	Dry Density, lbs/ft^3	γ_{d_o}	100.6
	Saturation, %	S_O	100
	Void Ratio	e_O	0.674
Minor Principal Stress, ksf		σ_3	3.17
Maximum Deviator Stress, ksf		$(\sigma1-\sigma3)_{max}$	2.50
Time to $(\sigma_1\text{-}\sigma_3)_{max}$, min		t_f	15.02
Deviator Stress @ 15% Axial Strain, ksf		$(\sigma_1-\sigma_3)_{15\%}$	2.50
Ultimate Deviator Stress, ksf		$(\sigma_1-\sigma_3)_{ult}$	na
Rate of strain, %/min		'ε	1.00
Axial Strain at Failure, %		ε_f	15.02

Description of Specimen: Olive Brown Silty Clay with Sand (CL-ML)

Amount of Material Finer than the No. 200, %: 79

LL: 27 | PL: 5 | PI: 22 | G_S: 2.70 Assumed | Specimen Type: Undisturbed | Test Method: ASTM D2850

Membrane correction applied

Boring:	B-2
Sample:	12C
Depth, ft:	41.0
Test Date:	7/23/18

Remarks: nm= not measured, na = not applicable

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2601 Barrington Ct, Hayward, CA 94545

Project No.:	20190787.001A
Date:	8/22/18
Entry By:	CP
Checked By:	CP
File Name:	HL11453

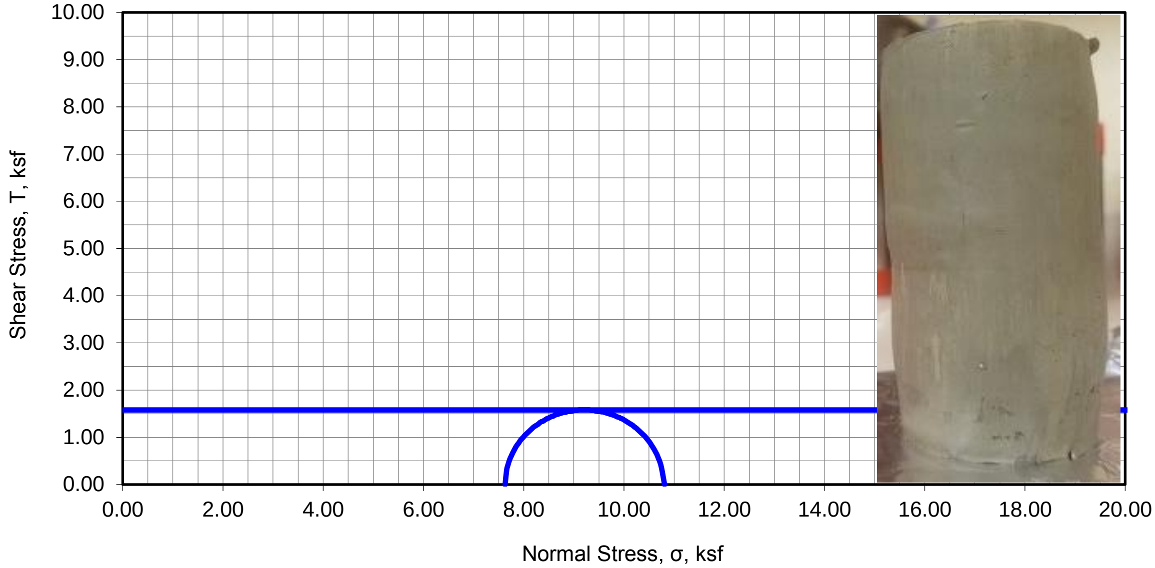
TRIAXIAL COMPRESSION TEST (UU)

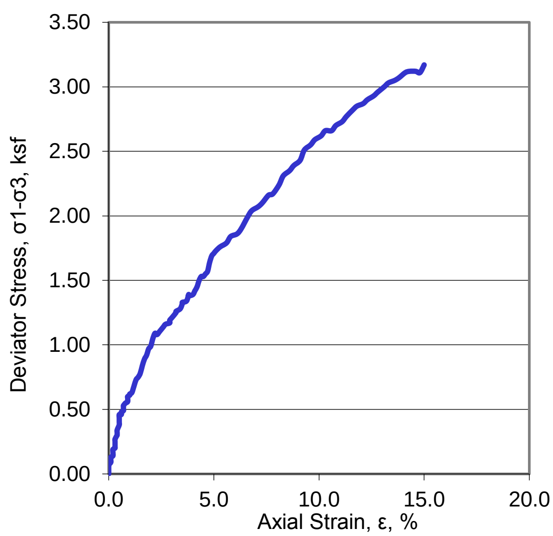
CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE
B-5

Total		
c =	1.58	ksf

Specimen Shear Picture





Specimen No.			1
Initial	Diameter, in	D_O	2.41
	Height, in	H_O	5.78
	Water Content, %	ω_O	29.6
	Dry Density, lbs/ft^3	γd_o	95.0
	Saturation, %	S_O	100
	Void Ratio	e_O	0.774
Minor Principal Stress, ksf		σ_3	7.63
Maximum Deviator Stress, ksf		$(\sigma1-\sigma3)_{max}$	3.17
Time to $(\sigma_1\text{-}\sigma_3)_{max}$, min		t_f	15.00
Deviator Stress @ 15% Axial Strain, ksf		$(\sigma_1-\sigma_3)_{15\%}$	3.17
Ultimate Deviator Stress, ksf		$(\sigma_1-\sigma_3)_{ult}$	na
Rate of strain, %/min		'ε	1.00
Axial Strain at Failure, %		ε_f	15.00

Description of Specimen: Dark Olive Brown Lean Clay (CL)

Amount of Material Finer than the No. 200, %: 79

LL: 27 | PL: 5 | PI: 22 | G_S: 2.70 Assumed | Specimen Type: Undisturbed | Test Method: ASTM D2850

Membrane correction applied

Boring:	B-2
Sample:	26C
Depth, ft:	111.0
Test Date:	7/23/18

Remarks: nm= not measured, na = not applicable

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2601 Barrington Ct, Hayward, CA 94545

Project No.:	20190787.001A
Date:	8/22/18
Entry By:	CP
Checked By:	CP
File Name:	HL11453

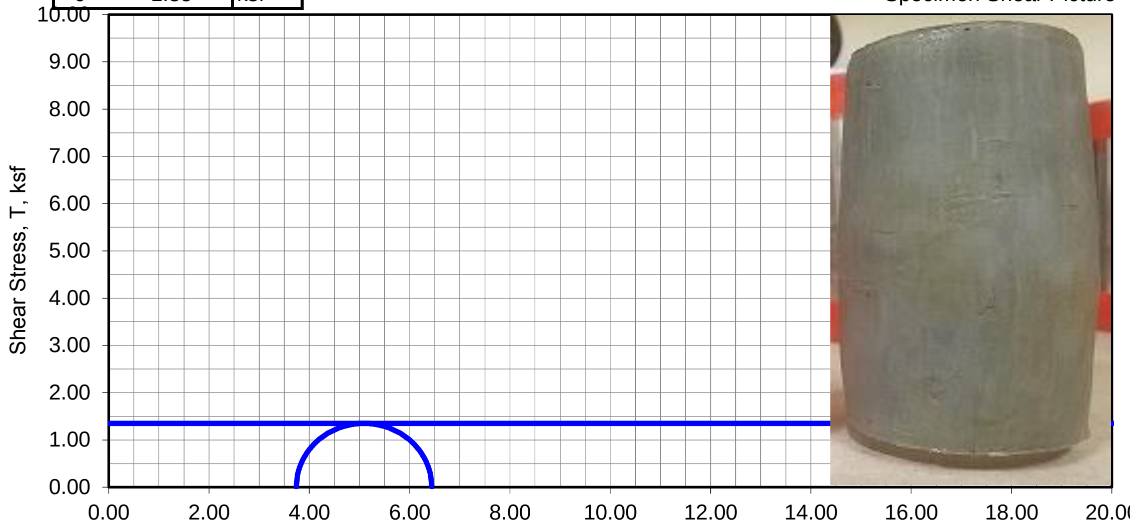
TRIAXIAL COMPRESSION TEST (UU)

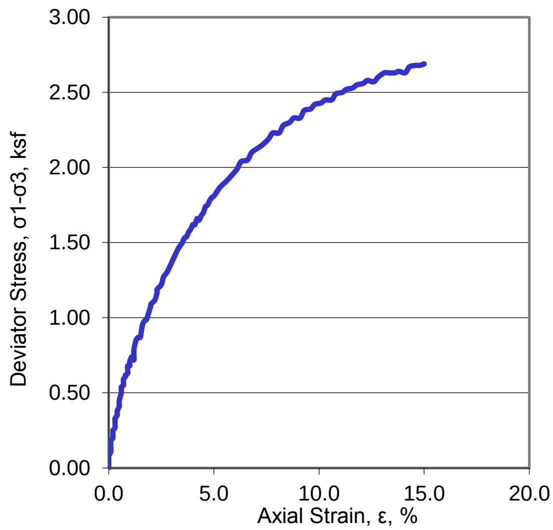
CYRUS ONE DATA CENTER
2600 DE LA CRUZ BLVD.
SANTA CLARA, CALIFORNIA

FIGURE
B-6

Total		
c =	1.35	ksf

Specimen Shear Picture





Specimen No.			1
Initial	Diameter, in	D_O	2.41
	Height, in	H_O	5.00
	Water Content, %	ω_O	23.1
	Dry Density, lbs/ft^3	γd_o	105.0
	Saturation, %	S_O	100
	Void Ratio	e_O	0.605
Minor Principal Stress, ksf		σ_3	3.74
Maximum Deviator Stress, ksf		$(\sigma1-\sigma3)_{max}$	2.69
Time to $(\sigma_1\text{-}\sigma_3)_{max}$, min		t_f	15.02
Deviator Stress @ 15% Axial Strain, ksf		$(\sigma_1-\sigma_3)_{15\%}$	2.69
Ultimate Deviator Stress, ksf		$(\sigma_1-\sigma_3)_{ult}$	na
Rate of strain, %/min		$'\varepsilon$	1.00
Axial Strain at Failure, %		ε_f	15.02

Description of Specimen: Olive Gray Sandy Lean Clay (CL)

Amount of Material Finer than the No. 200, %: nm

LL: 32 | PL: 16 | PI: 16 | G_S: 2.70 Assumed | Specimen Type: Undisturbed | Test Method: ASTM D2850

Membrane correction applied

Boring:	B-3
Sample:	16C
Depth, ft:	51.0
Test Date:	7/23/18

Remarks: nm= not measured, na = not applicable

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Bright People. Right Solutions.

2601 Barrington Ct, Hayward, CA 94545

Project No.:	20190787.001A
Date:	8/22/18
Entry By:	CP
Checked By:	CP
File Name:	HL11453

TRIAXIAL COMPRESSION TEST (UU)

CYRUS ONE DATA CENTER

2600 DE LA CRUZ BLVD.

SANTA CLARA, CALIFORNIA

FIGURE

B-7

Laboratory Test Report

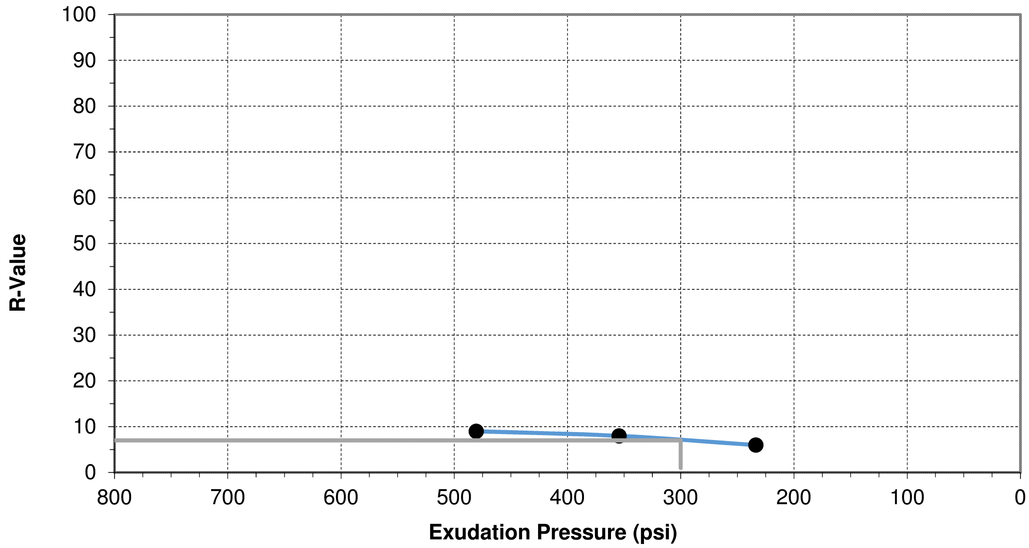
Client:	**CyrusOne LLC**	Report No.:	**18-HAY-01279 Rev. 0**	Issued:	**7/27/2018**
Project:	**20190787.001A**			Field ID:	**HL11453**
	CyrusOne Data Center Geotech	Sampled by:	**D. Dockendorf**	Date:	**7/18/2018**
	03-000L - Geotechnical Laboratory Testing	Submitted by:	**M. Fuhriman**	Date:	**7/19/2018**

Tested on **7/26/2018** by **J. Savage**

Test Method: **ASTM D2844**

Material Description: **Olive Brown Sandy Lean Clay**

Specific Location: **B-1 @ 0-2.5'**



Briquette No.	**A**	**B**	**C**
Dry Unit Weight at Test (pcf)	93.2	98.5	98.7
Expansion Pressure (psf)	48	35	165
Exudation Pressure (psi)	234	355	481
Moisture at Time of Test (%)	28.1	26.5	25.4
Resistance Value	6	8	9
R - VALUE AT 300 PSI EXUDATION PRESSURE:			**7**

Reviewed on 7/27/2018 by Cindy Pimentel,
Senior Technician

California State Certified Laboratory No. 2153

CERCO analytical
1100 Willow Pass Court, Suite A
Concord, CA 94520-1006
925 462 2771 Fax. 925 462 2775
www.cercoanalytical.com

Client: Kleinfelder
Client's Project No.: 2019787.001A
Client's Project Name: Cyrus One Data
Date Sampled: 18-Jul-2018
Date Received: 31-Jul-2018
Matrix: Soil
Authorization: Signed Chain of Custody

Date of Report: 15-Aug-2018

Job/Sample No.	Sample I.D.	Redox (mV)	pH	Resistivity (As Received) (ohms-cm)	Resistivity (100% Saturation) (ohms-cm)	Sulfide (mg/kg)*	Chloride (mg/kg)*	Sulfate (mg/kg)*
1807239-001	B-2, 2b @ 5.5'	+250	7.94	710	710	N.D.	30	140
1807239-002	B-2, 11C @ 36'	+250	7.92	1,100	1,200	N.D.	N.D.	50

Method:	ASTM D1498	ASTM D4972	ASTM G57	ASTM G57	ASTM D4658M	ASTM D4327	ASTM D4327
Reporting Limit:	-	-	-	-	50	15	15
Date Analyzed:	10-Aug-2018	10-Aug-2018	09-Aug-2018 & 13-Aug-2018	09-Aug-2018 & 13-Aug-2018	2-Aug-2018	10-Aug-2018	10-Aug-2018

Cheryl McMillen
Laboratory Director

* Results Reported on "As Received" Basis
N.D. - None Detected

Quality Control Summary - All laboratory quality control parameters were found to be within established limits

APPENDIX C

Results of Cone Penetration Tests

PRESENTATION OF SITE INVESTIGATION RESULTS

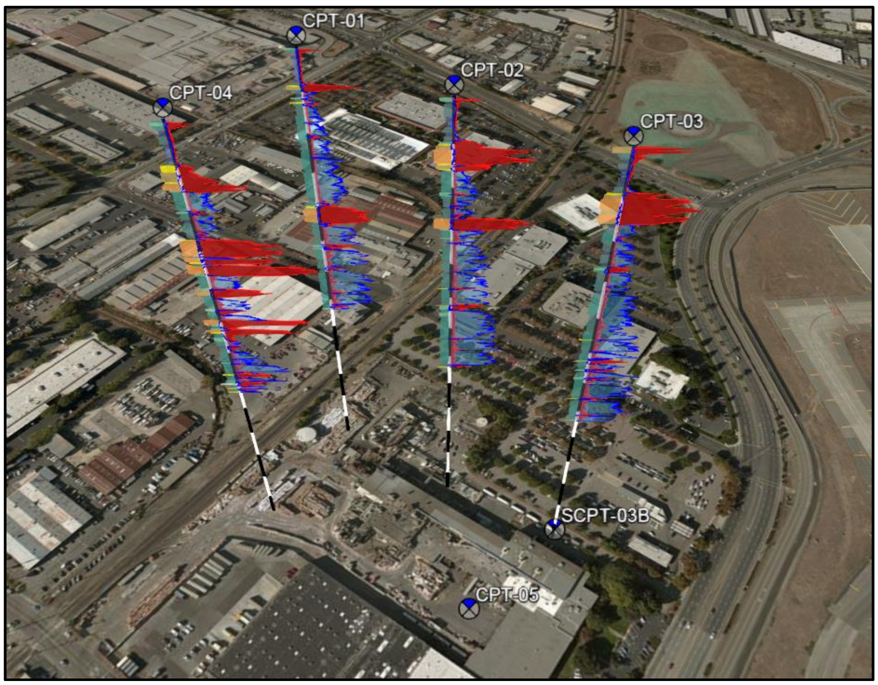
CyrusOne Geotechnical

Prepared for:

Kleinfelder Inc.

CPT Inc. Job No: 18-56117

Project Start Date: 17-Jul-2018
Project End Date: 18-Jul-2018
Report Date: 20-Jul-2018



Prepared by:

California Push Technologies Inc.
820 Aladdin Avenue
San Leandro, CA 94577

Tel: (510) 357-3677

Email: cpt@cptinc.com
www.cptinc.com

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

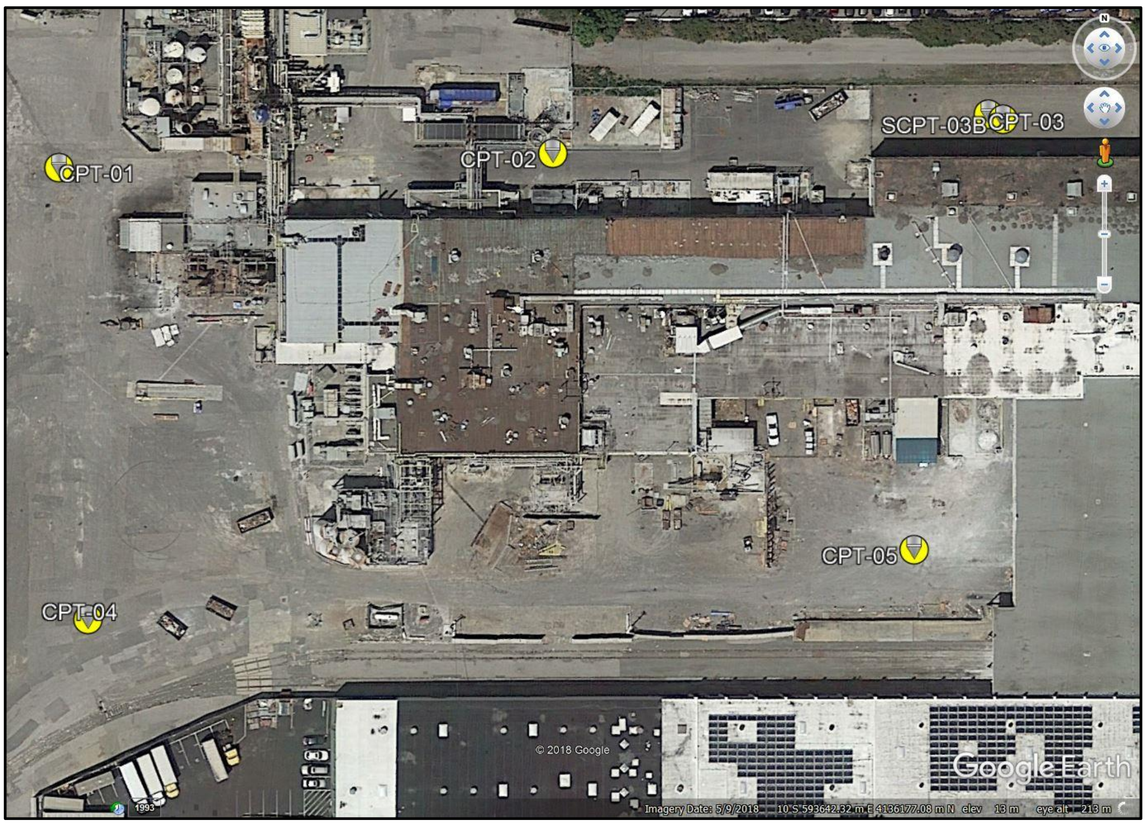
Introduction

The enclosed report presents the results of the site investigation program conducted by CPT Inc. for Kleinfelder Inc. near De La Cruz Blvd and Martin Ave, Santa Clara, CA. The program consisted of six cone penetration tests (CPTs), one of which was a seismic cone penetration test (SCPT).

Project Information

Project	
Client	Kleinfelder Inc.
Project	CyrusOne Geotechnical
CPT Inc. project number	18-56117

A plan view from Google Earth including the CPT and SCPT test locations is presented below.



Rig Description	Deployment System	Test Type
CPT truck rig (C17)	30 ton rig cylinder	CPT, SCPT

Coordinates		
Test Type	Collection Method	EPSG Reference
CPT, SCPT	Consumer grade GPS	32610

Cone Penetration Test (CPT)	
Depth reference	Depths are referenced to the existing ground surface at the time of each test.
Tip and sleeve data offset	0.1 meter This has been accounted for in the CPT data files.
Additional plots	Soil behavior type (SBT) scatter plots, seismic plots and advanced plots are provided in the data release package.

Cone Penetrometers Used for this Project						
Cone Description	Cone Number	Cross Sectional Area (cm^2)	Sleeve Area (cm^2)	Tip Capacity (bar)	Sleeve Capacity (bar)	Pore Pressure Capacity (psi)
448:T1500F15U500	448	15	225	1500	15	500
Cone 448 was used for all CPT soundings.						

CPT Calculated Parameters	
Additional information	The Normalized Soil Behavior Type Chart based on Q_{tn} (SBT Qtn) (Robertson, 2009) was used to classify the soil for this project. A detailed set of calculated CPT parameters have been generated and are provided in Excel format files in the release folder. The CPT parameter calculations are based on values of corrected tip resistance (q_t) sleeve friction (f_s), and pore pressure (u_2). Soils were classified as either drained or undrained based on the Qtn Normalized Soil Behavior Type Chart (Robertson, 2009). Calculations for both drained and undrained parameters were included for materials that classified as silt mixtures – clayey silt to silty clay (zone 4).

Limitations

This report has been prepared for the exclusive use of Kleinfelder Inc. (Client) for the project titled "CyrusOne Geotechnical" The report's contents may not be relied upon by any other party without the express written permission of CPT Inc. CPT Inc. has provided site investigation services, prepared the factual data reporting, and provided geotechnical parameter calculations consistent with current best practices. No other warranty, expressed or implied, is made.

The information presented in the report document and the accompanying data set pertain to the specific project, site conditions and objectives described to CPT Inc. by the Client. In order to properly understand the factual data, assumptions and calculations, reference must be made to the documents provided and their accompanying data sets, in their entirety.

The cone penetration tests (CPTu) are conducted using an integrated electronic piezocone penetrometer and data acquisition system manufactured by Adara Systems Ltd. of Richmond, British Columbia, Canada.

CPT Inc.'s piezocone penetrometers are compression type designs in which the tip and friction sleeve load cells are independent and have separate load capacities. The piezocones use strain gauged load cells for tip and sleeve friction and a strain gauged diaphragm type transducer for recording pore pressure. The piezocones also have a platinum resistive temperature device (RTD) for monitoring the temperature of the sensors, an accelerometer type dual axis inclinometer and a geophone sensor for recording seismic signals. All signals are amplified down hole within the cone body and the analog signals are sent to the surface through a shielded cable.

The penetrometers are manufactured with various tip, friction and pore pressure capacities in both 10 cm^2 and 15 cm^2 tip base area configurations in order to maximize signal resolution for various soil conditions. The specific piezocone used for each test is described in the CPT summary table presented in the first appendix. The 15 cm^2 penetrometers do not require friction reducers as they have a diameter larger than the deployment rods. The 10 cm^2 piezocones use a friction reducer consisting of a rod adapter extension behind the main cone body with an enlarged cross sectional area (typically 44 mm diameter over a length of 32 mm with tapered leading and trailing edges) located at a distance of 585 mm above the cone tip.

The penetrometers are designed with equal end area friction sleeves, a net end area ratio of 0.8 and cone tips with a 60 degree apex angle.

All piezocones can record pore pressure at various locations. Unless otherwise noted, the pore pressure filter is located directly behind the cone tip in the "u_2" position (ASTM Type 2). The filter is 6 mm thick, made of porous plastic (polyethylene) having an average pore size of 125 microns (90-160 microns). The function of the filter is to allow rapid movements of extremely small volumes of water needed to activate the pressure transducer while preventing soil ingress or blockage.

The piezocone penetrometers are manufactured with dimensions, tolerances and sensor characteristics that are in general accordance with the current ASTM D5778 standard. Our calibration criteria also meet or exceed those of the current ASTM D5778 standard. An illustration of the piezocone penetrometer is presented in Figure CPTu.

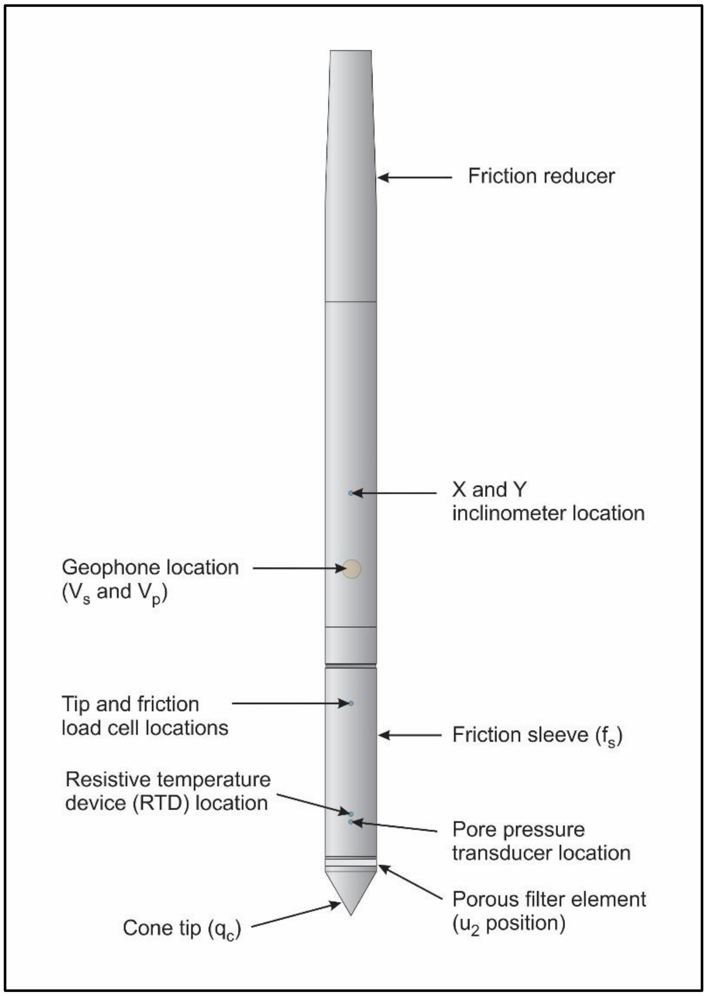


Figure CPTu. Piezocone Penetrometer (15 cm^2)

The data acquisition systems consist of a Windows based computer and a signal conditioner and power supply interface box with a 16 bit (or greater) analog to digital (A/D) converter. The data is recorded at fixed depth increments using a depth wheel attached to the push cylinders or by using a spring loaded rubber depth wheel that is held against the cone rods. The typical recording intervals are either 2.5 cm or 5.0 cm depending on project requirements; custom recording intervals are possible. The system displays the CPTu data in real time and records the following parameters to a storage media during penetration:

- Depth
- Uncorrected tip resistance (q_c)
- Sleeve friction (f_s)
- Dynamic pore pressure (u)
- Additional sensors such as resistivity, passive gamma, ultra violet induced fluorescence, if applicable

All testing is performed in accordance to CPT Inc.'s CPT operating procedures which are in general accordance with the current ASTM D5778 standard.

Prior to the start of a CPTu sounding a suitable cone is selected, the cone and data acquisition system are powered on, the pore pressure system is saturated with either glycerin or silicone oil and the baseline readings are recorded with the cone hanging freely in a vertical position.

The CPTu is conducted at a steady rate of 2 cm/s, within acceptable tolerances. Typically one meter length rods with an outer diameter of 1.5 inches are added to advance the cone to the sounding termination depth. After cone retraction final baselines are recorded.

Additional information pertaining to CPT Inc.'s cone penetration testing procedures:

- Each filter is saturated in silicone oil or glycerin under vacuum pressure prior to use
- Recorded baselines are checked with an independent multi-meter
- Baseline readings are compared to previous readings
- Soundings are terminated at the client's target depth or at a depth where an obstruction is encountered, excessive rod flex occurs, excessive inclination occurs, equipment damage is likely to take place, or a dangerous working environment arises
- Differences between initial and final baselines are calculated to ensure zero load offsets have not occurred and to ensure compliance with ASTM standards

The interpretation of the piezocone data and associated calculated parameters for this report are based on the corrected tip resistance (q_t), sleeve friction (f_s) and pore water pressure (u). The interpretation of soil type is based on the correlations developed by Robertson (1990) and Robertson (2009). It should be noted that it is not always possible to accurately identify a soil type based on these parameters. In these situations, experience, judgment and an assessment of other parameters may be used to infer soil behavior type.

The recorded tip resistance (q_c) is the total force acting on the piezocone tip divided by its base area. The tip resistance is corrected for pore pressure effects and termed corrected tip resistance (q_t) according to the following expression presented in Robertson et al, 1986:

$$q_t = q_c + (1\text{-}a) \bullet u_2$$

where: q_t is the corrected tip resistance
q_c is the recorded tip resistance
u_2 is the recorded dynamic pore pressure behind the tip (u_2 position)
a is the Net Area Ratio for the piezocone (0.8 for CPT Inc. probes)

The sleeve friction (f_s) is the frictional force on the sleeve divided by its surface area. As all CPT Inc. piezocones have equal end area friction sleeves, pore pressure corrections to the sleeve data are not required.

The dynamic pore pressure (u) is a measure of the pore pressures generated during cone penetration. To record equilibrium pore pressure, the penetration must be stopped to allow the dynamic pore pressures to stabilize. The rate at which this occurs is predominantly a function of the permeability of the soil and the diameter of the cone.

The friction ratio (Rf) is a calculated parameter. It is defined as the ratio of sleeve friction to the tip resistance expressed as a percentage. Generally, saturated cohesive soils have low tip resistance, high friction ratios and generate large excess pore water pressures. Cohesionless soils have higher tip resistances, lower friction ratios and do not generate significant excess pore water pressure.

A summary of the CPTu soundings along with test details and individual plots are provided in the appendices. A set of files with calculated geotechnical parameters were generated for each sounding based on published correlations and are provided in Excel format in the data release folder. Information regarding the methods used is also included in the data release folder.

For additional information on CPTu interpretations and calculated geotechnical parameters, refer to Robertson et al. (1986), Lunne et al. (1997), Robertson (2009), Mayne (2013, 2014) and Mayne and Peuchen (2012).

Shear wave velocity testing is performed in conjunction with the piezocone penetration test (SCPTu) in order to collect interval velocities. For some projects seismic compression wave (Vp) velocity is also determined.

CPT Inc.'s piezocone penetrometers are manufactured with a horizontally active geophone (28 Hertz) that is rigidly mounted in the body of the cone penetrometer, 0.2 meters behind the cone tip.

Shear waves are typically generated by using an impact hammer horizontally striking a beam that is held in place by a normal load. In some instances an auger source or an imbedded impulsive source maybe used for both shear waves and compression waves. The hammer and beam act as a contact trigger that initiates the recording of the seismic wave traces. For impulsive devices an accelerometer trigger may be used. The traces are recorded using an up-hole integrated digital oscilloscope which is part of the SCPTu data acquisition system. An illustration of the shear wave testing configuration is presented in Figure SCPTu-1.

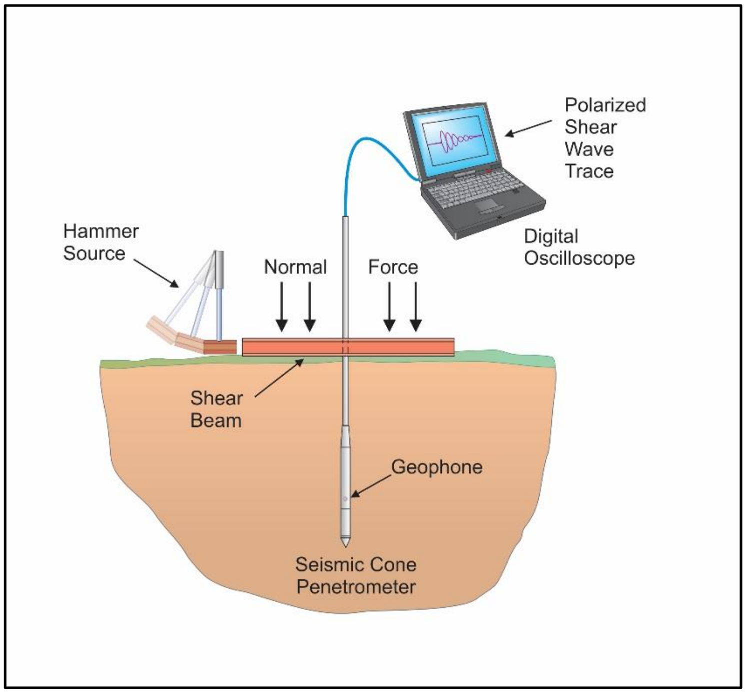


Figure SCPTu-1. Illustration of the SCPTu system

All testing is performed in accordance to CPT Inc.'s SCPTu operating procedures.

Prior to the start of a SCPTu sounding, the procedures described in the Cone Penetration Test section are followed. In addition, the active axis of the geophone is aligned parallel to the beam (or source) and the horizontal offset between the cone and the source is measured and recorded.

Prior to recording seismic waves at each test depth, cone penetration is stopped and the rods are decoupled from the rig to avoid transmission of rig energy down the rods. Multiple wave traces are recorded for quality control purposes. After reviewing wave traces for consistency the cone is pushed to the next test depth (typically one meter intervals or as requested by the client). Figure SCPTu-2 presents an illustration of a SCPTu test.

For additional information on seismic cone penetration testing refer to Robertson et.al. (1986).

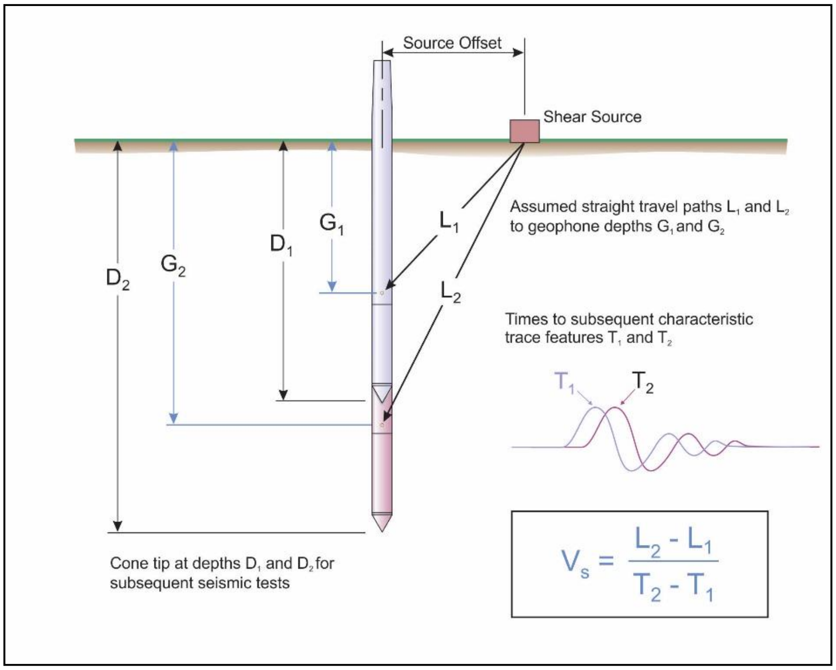


Figure SCPTu-2. Illustration of a seismic cone penetration test

Calculation of the interval velocities is performed by visually picking a common feature (e.g. the first characteristic peak, trough, or crossover) on all of the recorded wave sets and taking the difference in ray path divided by the time difference between subsequent features. Ray path is defined as the straight line distance from the seismic source to the geophone, accounting for beam offset, source depth and geophone offset from the cone tip.

The average shear wave velocity to a depth of 100 feet (30 meters) ($\bar{v}_s$) has been calculated and provided for all applicable soundings using the following equation presented in ASCE, 2010.

$$\bar{v}_s = \frac{\sum_{i=1}^{n} d_i}{\sum_{i=1}^{n} \frac{d_i}{v_{si}}}$$

where: $\bar{v}_s$ = average shear wave velocity ft/s (m/s)
d_i = the thickness of any layer between 0 and 100 ft (30 m)
v_{si} = the shear wave velocity in ft/s (m/s)
$\sum_{i=1}^{n} d_i$ = 100 ft (30 m)

Average shear wave velocity, $\bar{v}_s$ is also referenced to V_{s100} or V_{s30}.

The layer travel times refers to the travel times propagating in the vertical direction, not the measured travel times from an offset source.

Tabular results and SCPTu plots are presented in the relevant appendix.

The cone penetration test is halted at specific depths to carry out pore pressure dissipation (PPD) tests, shown in Figure PPD-1. For each dissipation test the cone and rods are decoupled from the rig and the data acquisition system measures and records the variation of the pore pressure (u) with time (t).

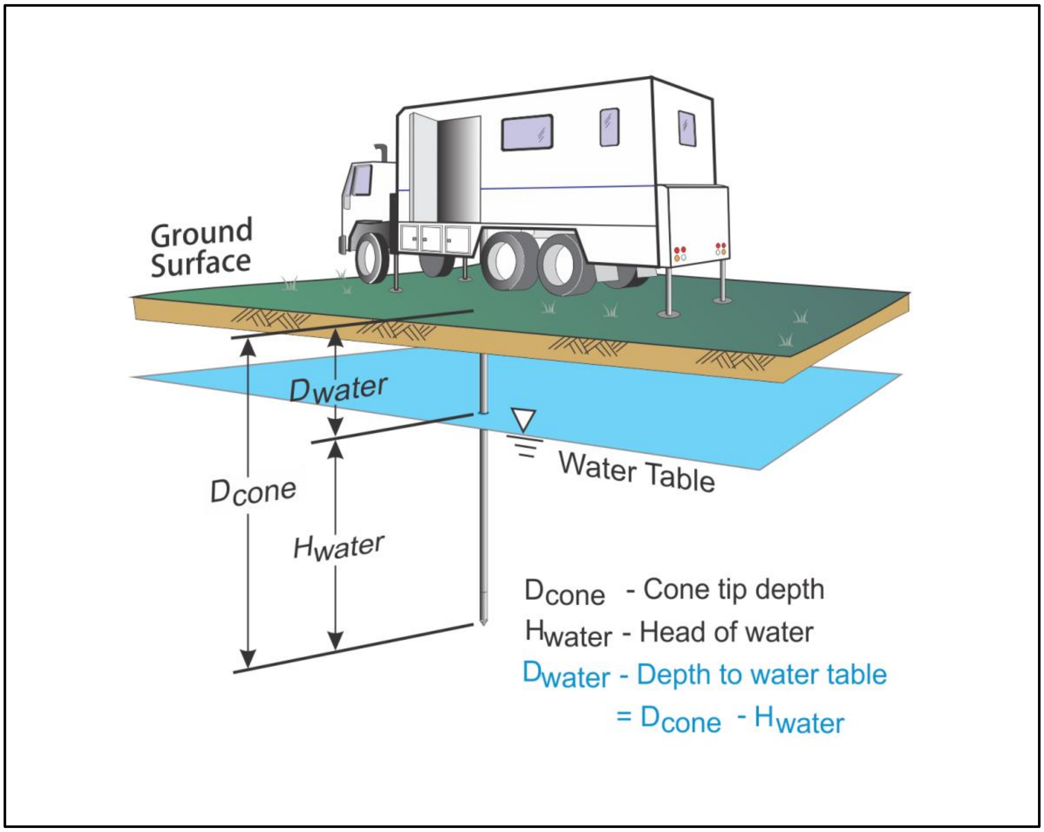


Figure PPD-1. Pore pressure dissipation test setup

Pore pressure dissipation data can be interpreted to provide estimates of ground water conditions, permeability, consolidation characteristics and soil behavior.

The typical shapes of dissipation curves shown in Figure PPD-2 are very useful in assessing soil type, drainage, in situ pore pressure and soil properties. A flat curve that stabilizes quickly is typical of a freely draining sand. Undrained soils such as clays will typically show positive excess pore pressure and have long dissipation times. Dilative soils will often exhibit dynamic pore pressures below equilibrium that then rise over time. Overconsolidated fine-grained soils will often exhibit an initial dilatory response where there is an initial rise in pore pressure before reaching a peak and dissipating.

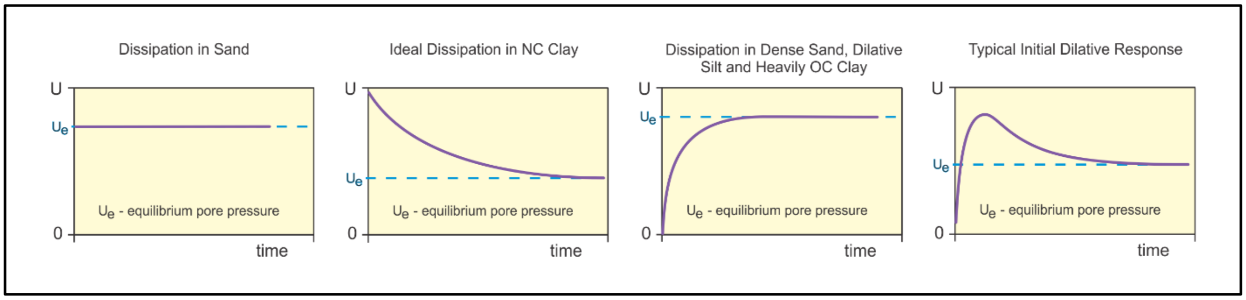


Figure PPD-2. Pore pressure dissipation curve examples

In order to interpret the equilibrium pore pressure (u_{eq}) and the apparent phreatic surface, the pore pressure should be monitored until such time as there is no variation in pore pressure with time as shown for each curve of Figure PPD-2.

In fine grained deposits the point at which 100% of the excess pore pressure has dissipated is known as t_{100}. In some cases this can take an excessive amount of time and it may be impractical to take the dissipation to t_{100}. A theoretical analysis of pore pressure dissipations by Teh and Houlsby (1991) showed that a single curve relating degree of dissipation versus theoretical time factor (T*) may be used to calculate the coefficient of consolidation (c_h) at various degrees of dissipation resulting in the expression for c_h shown below.

$$c_h = \frac{T^* \cdot a^2 \cdot \sqrt{I_r}}{t}$$

Where:

T* is the dimensionless time factor (Table Time Factor)
a is the radius of the cone
I_r is the rigidity index
t is the time at the degree of consolidation

Table Time Factor. T* versus degree of dissipation (Teh and Houlsby, 1991)

Degree of Dissipation (%)	20	30	40	50	60	70	80
T* (u_2)	0.038	0.078	0.142	0.245	0.439	0.804	1.60

The coefficient of consolidation is typically analyzed using the time (t_{50}) corresponding to a degree of dissipation of 50% (u_{50}). In order to determine t_{50}, dissipation tests must be taken to a pressure less than u_{50}. The u_{50} value is half way between the initial maximum pore pressure and the equilibrium pore pressure value, known as u_{100}. To estimate u_{50}, both the initial maximum pore pressure and u_{100} must be known or estimated. Other degrees of dissipations may be considered, particularly for extremely long dissipations.

At any specific degree of dissipation the equilibrium pore pressure (u at t_{100}) must be estimated at the depth of interest. The equilibrium value may be determined from one or more sources such as measuring the value directly (u_{100}), estimating it from other dissipations in the same profile, estimating the phreatic surface and assuming hydrostatic conditions, from nearby soundings, from client provided information, from site observations and/or past experience, or from other site instrumentation.

For calculations of c_h (Teh and Houlsby, 1991), t_{50} values are estimated from the corresponding pore pressure dissipation curve and a rigidity index (I_r) is assumed. For curves having an initial dilatory response in which an initial rise in pore pressure occurs before reaching a peak, the relative time from the peak value is used in determining t_{50}. In cases where the time to peak is excessive, t_{50} values are not calculated.

Due to possible inherent uncertainties in estimating I_r, the equilibrium pore pressure and the effect of an initial dilatory response on calculating t_{50}, other methods should be applied to confirm the results for c_h.

Additional published methods for estimating the coefficient of consolidation from a piezocone test are described in Burns and Mayne (1998, 2002), Jones and Van Zyl (1981), Robertson et al. (1992) and Sully et al. (1999).

A summary of the pore pressure dissipation tests and dissipation plots are presented in the relevant appendix.

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Sully, J.P., Robertson, P.K., Campanella, R.G. and Woeller, D.J., 1999, “An approach to evaluation of field CPTU dissipation data in overconsolidated fine-grained soils”, Canadian Geotechnical Journal, 36(2): 369-381.

Teh, C.I., and Houlsby, G.T., 1991, “An analytical study of the cone penetration test in clay”, Geotechnique, 41(1): 17-34.

The appendices listed below are included in the report:

- Cone Penetration Test Summary and Standard Cone Penetration Test Plots
- Advanced Cone Penetration Test Plots with Ic, Su(Nkt), Phi and N1(60)Ic
- Seismic Cone Penetration Test Tabular Results
- Seismic Cone Penetration Test Plots
- Seismic Cone Penetration Test Time Domain Traces
- Soil Behavior Type (SBT) Scatter Plots
- Pore Pressure Dissipation Summary and Pore Pressure Dissipation Plots

Cone Penetration Test Summary and
Standard Cone Penetration Test Plots

CALIFORNIA PUSH
TECHNOLOGIES
INCORPORATED

Job No: 18-56117
Client: Kleinfelder Inc.
Project: CyrusOne Geotechnical
Start Date: 17-Jul-2018
End Date: 18-Jul-2018

CONE PENETRATION TEST SUMMARY

Sounding ID	File Name	Date	Cone	Assumed Phreatic Surface[1] (ft)	Final Depth (ft)	Northing[2] (m)	Easting (m)	Refer to Notation Number
CPT-01	18-56117_CP01	17-Jul-2018	448:T1500F15U500	5.7	120.73	4136308	593423	
CPT-02	18-56117_CP02	17-Jul-2018	448:T1500F15U500	11.7	120.90	4136311	593523	
CPT-03	18-56117_CP03	18-Jul-2018	448:T1500F15U500	13.2	120.73	4136320	593612	
SCPT-03B	18-56117_SP03B	18-Jul-2018	448:T1500F15U500	13.2	120.90	4136319	593615	
CPT-04	18-56117_CP04	17-Jul-2018	448:T1500F15U500	8.9	120.90	4136215	593429	
CPT-05	18-56117_CP05	17-Jul-2018	448:T1500F15U500	9.6	120.57	4136231	593599	

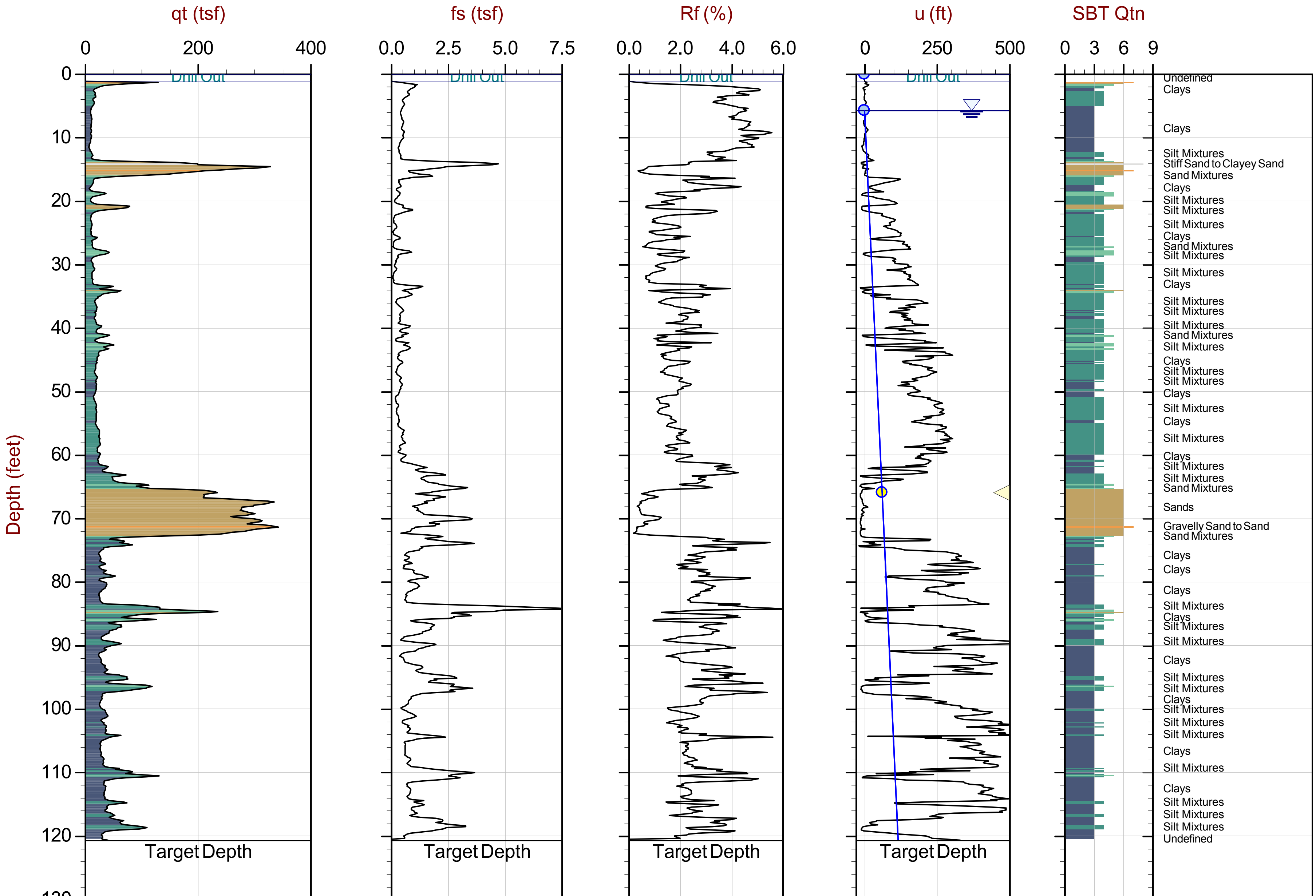
1. The assumed phreatic surface was based on pore pressure dissipation tests. Hydrostatic conditions were assumed for the calculated parameters.
2. Coordinates were acquired using consumer grade GPS equipment in datum: WGS 1984 / UTM Zone 10 North.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 11:38
Site: CyrusOne Geotechnical

Sounding: CPT-01
Cone: 448:T1500F15U500



Max Depth: 36.800 m / 120.73 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP01.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136308m E: 593423m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

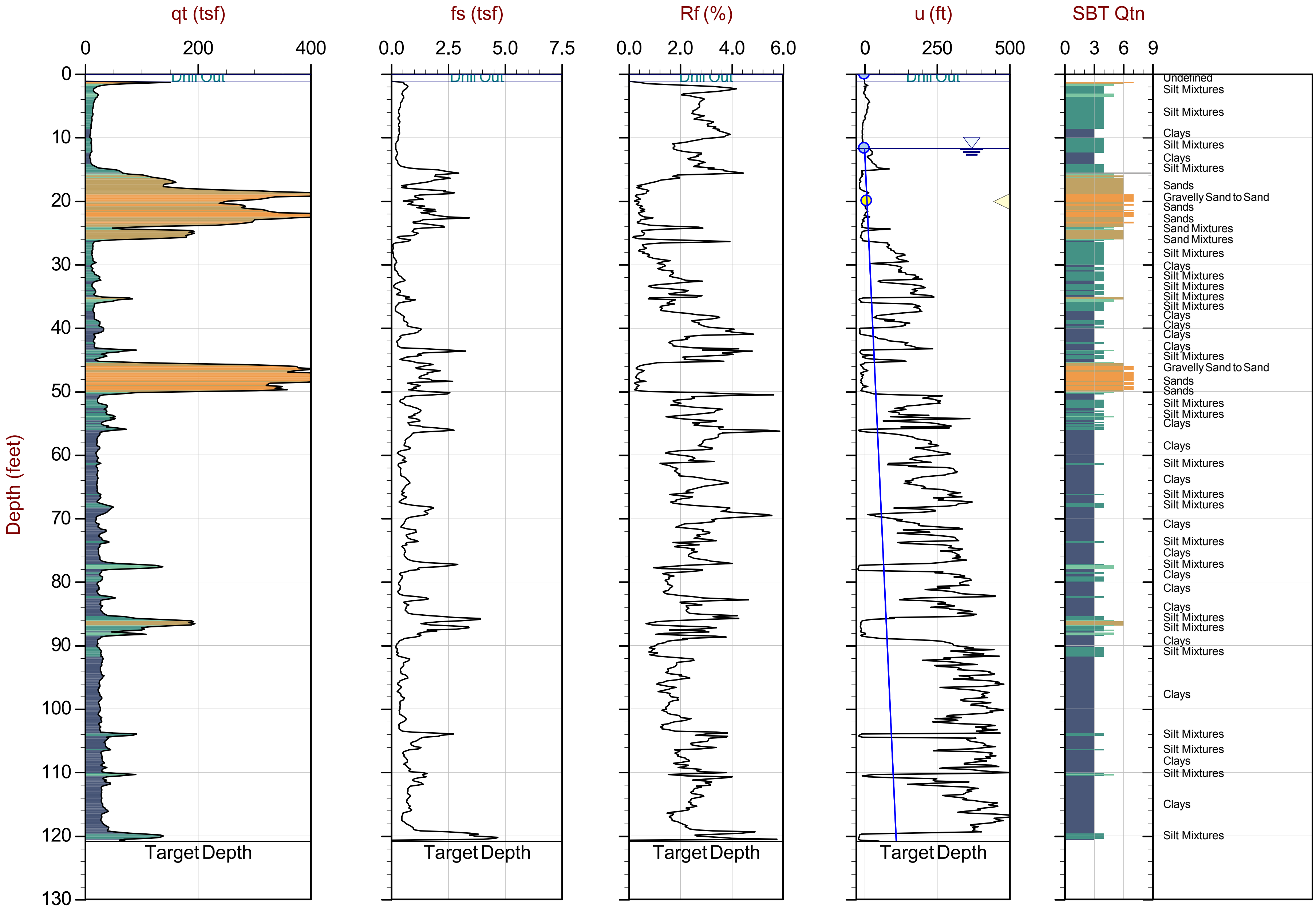
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 13:17
Site: CyrusOne Geotechnical

Sounding: CPT-02
Cone: 448:T1500F15U500



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Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP02.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136311m E: 593523m
Sheet No: 1 of 1

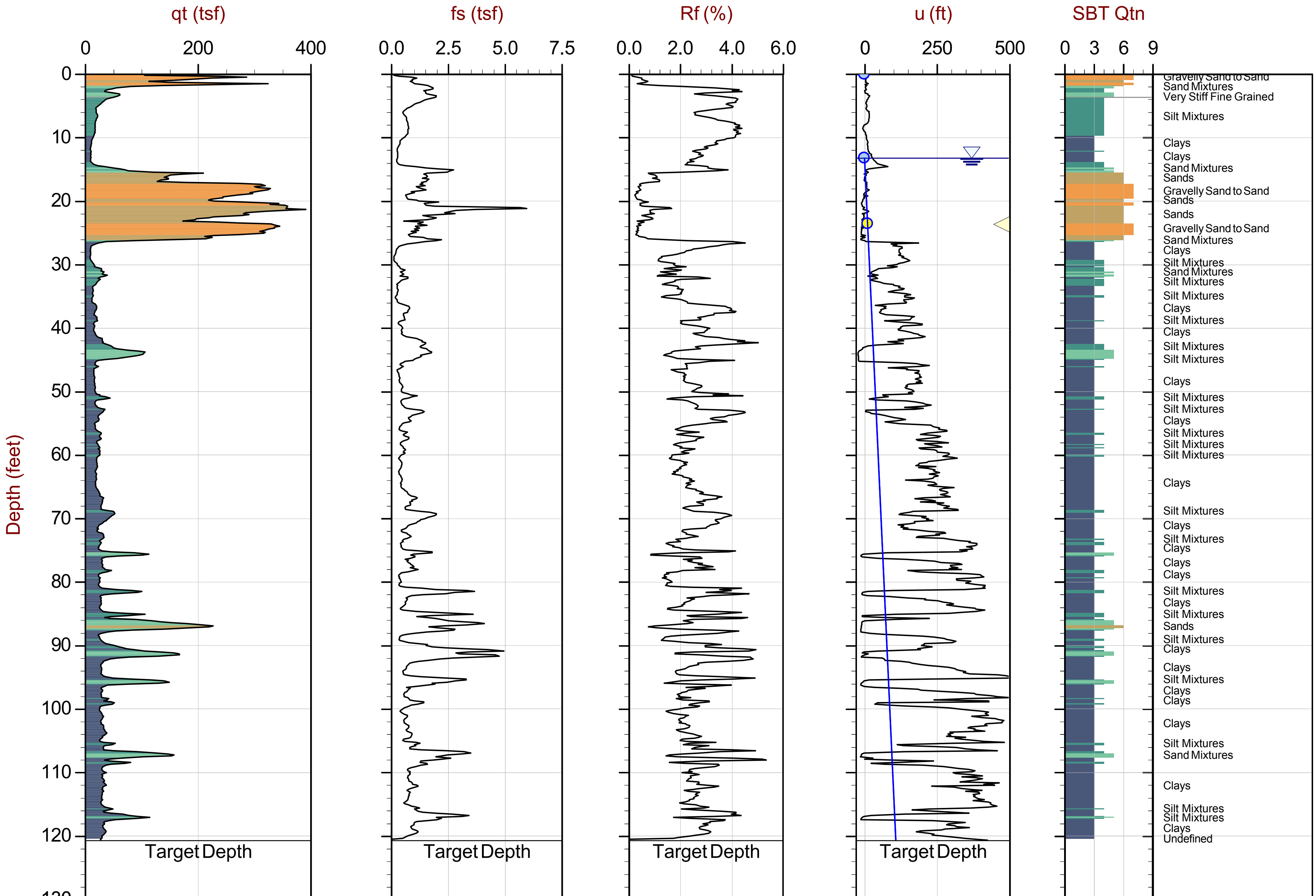
Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-18 07:41
Site: CyrusOne Geotechnical
Sounding: CPT-03
Cone: 448:T1500F15U500



Max Depth: 36.800 m / 120.73 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP03.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136320m E: 593612m
Sheet No: 1 of 1

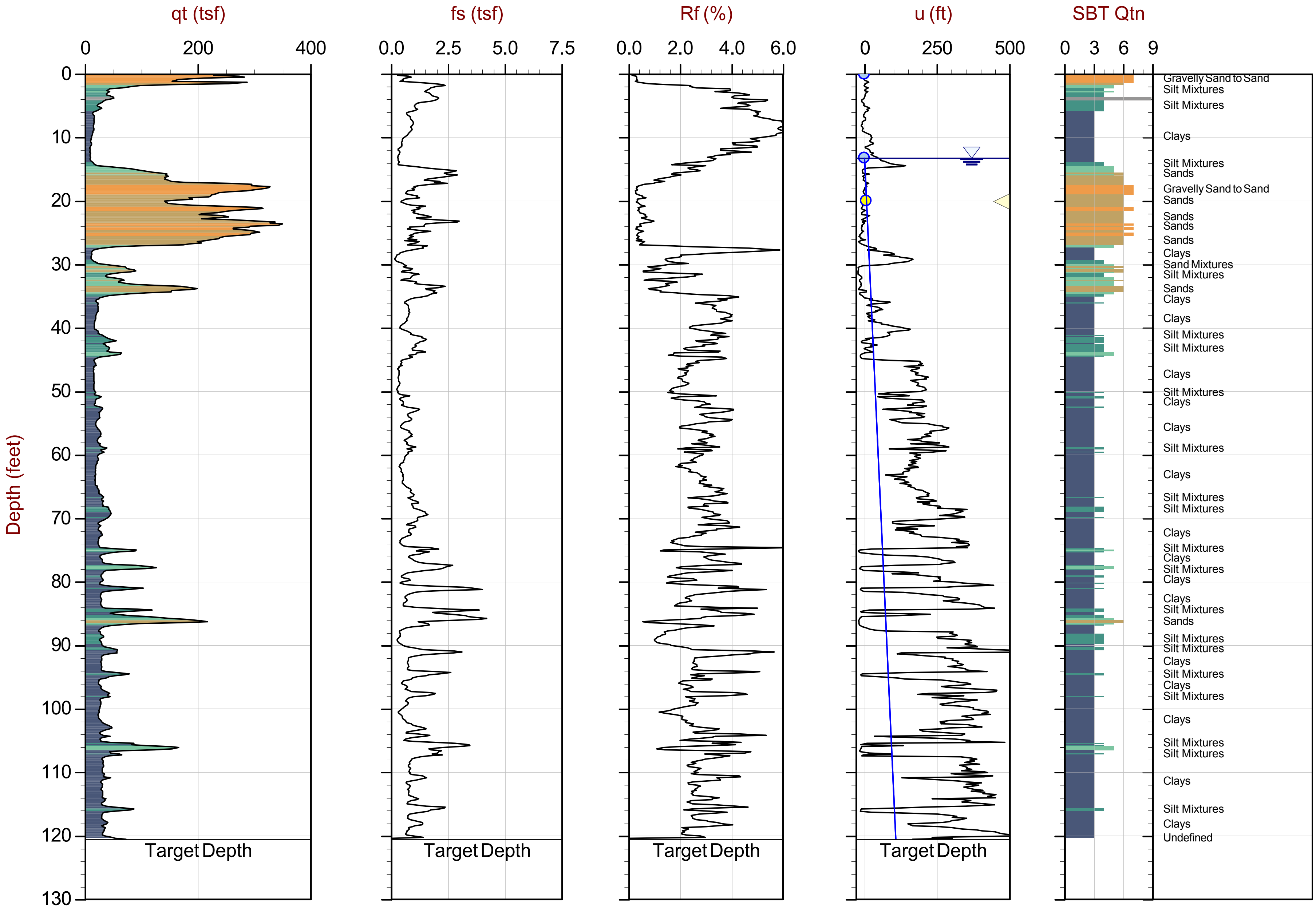
Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-18 08:58
Site: CyrusOne Geotechnical
Sounding: SCPT-03B
Cone: 448:T1500F15U500



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Avg Int: Every Point

File: 18-56117_SP03B.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136319m E: 593615m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

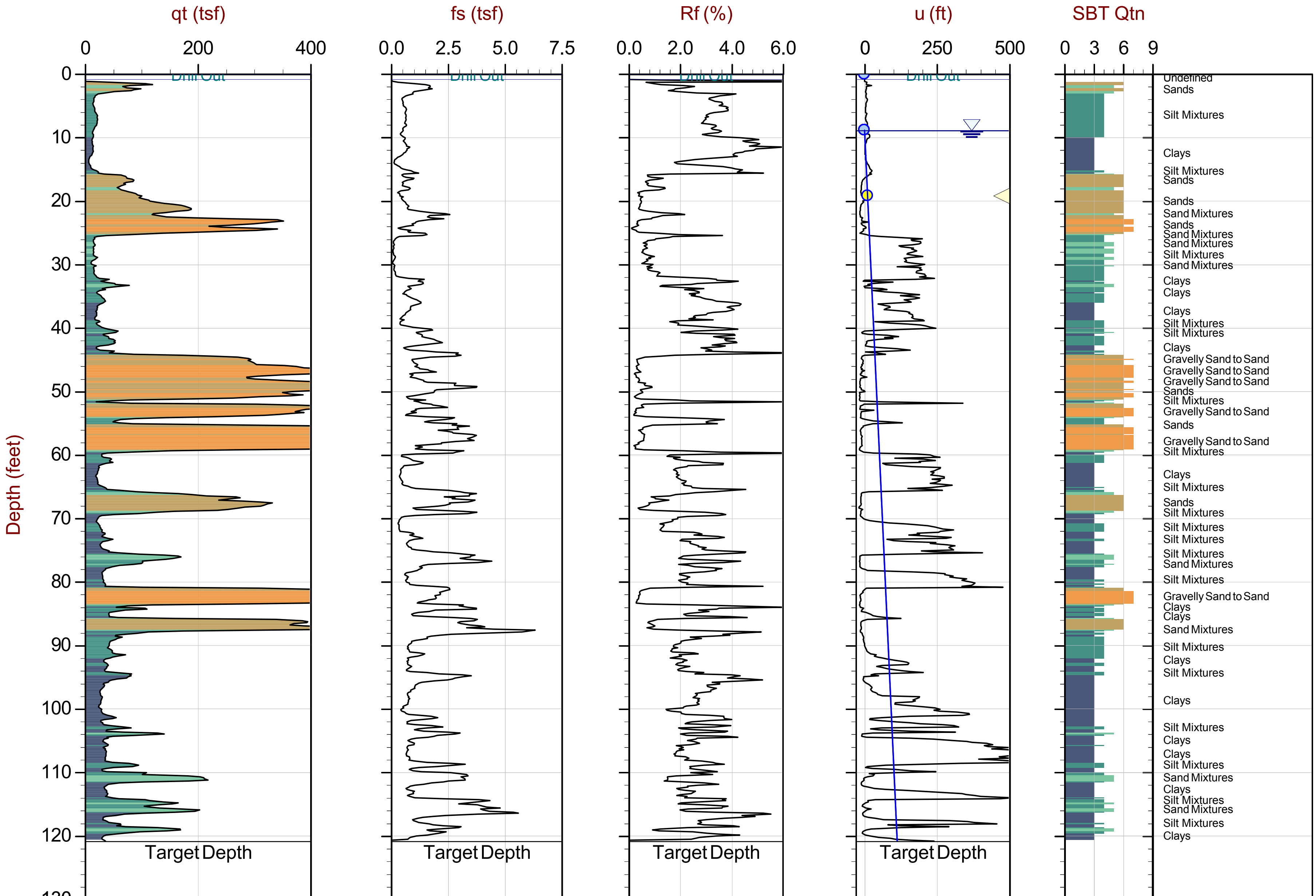
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 07:54
Site: CyrusOne Geotechnical

Sounding: CPT-04
Cone: 448:T1500F15U500



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Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP04.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136215m E: 593429m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

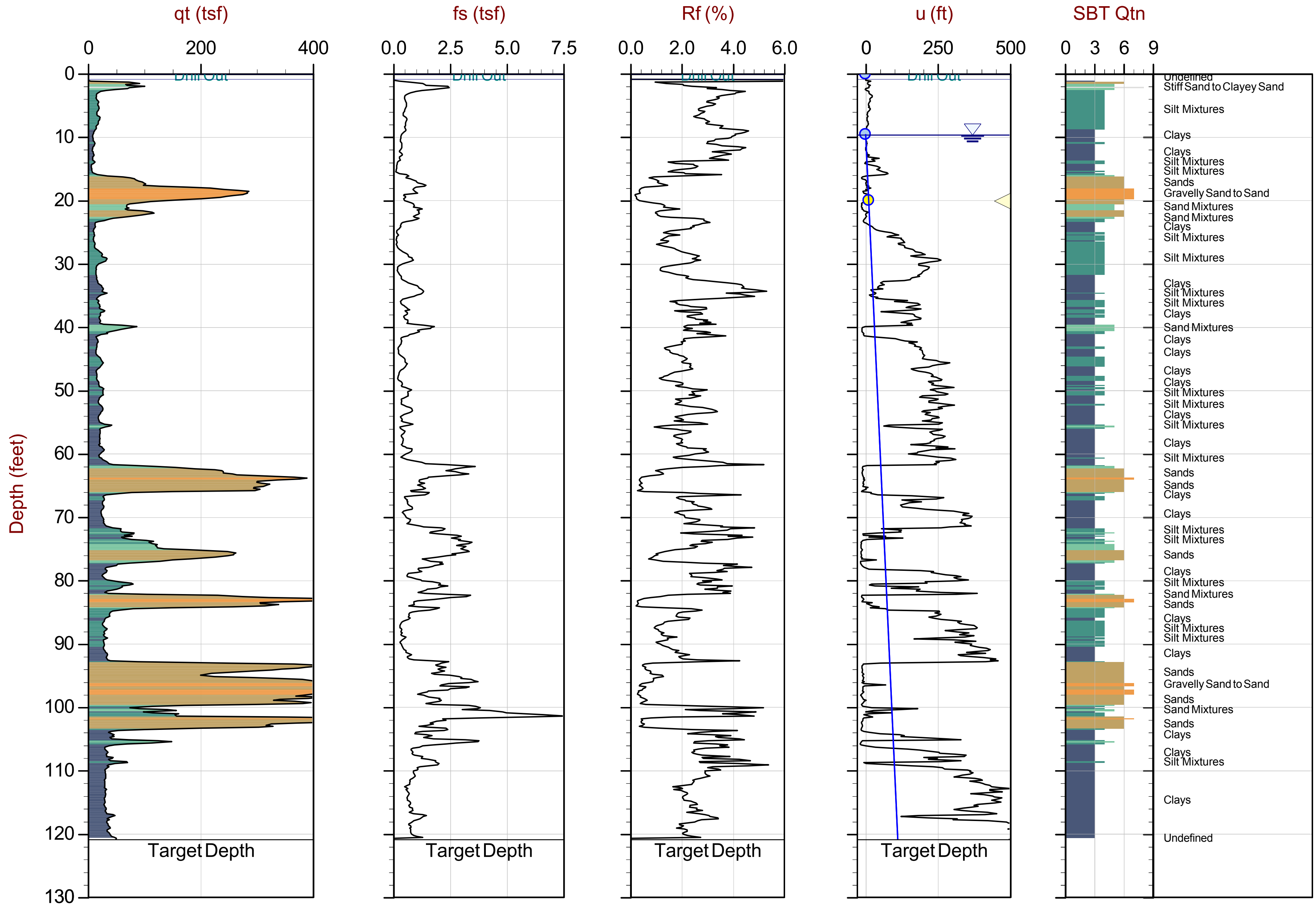
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 09:43
Site: CyrusOne Geotechnical

Sounding: CPT-05
Cone: 448:T1500F15U500



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Avg Int: Every Point

File: 18-56117_CP05.COR
Unit Wt: SBTQtn (PKR2009)

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136231m E: 593599m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) | Assumed Ueq | Dissipation, Ueq achieved | Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Advanced Cone Penetration Test Plots with Ic, Su (Nkt), Phi and N1(60)Ic

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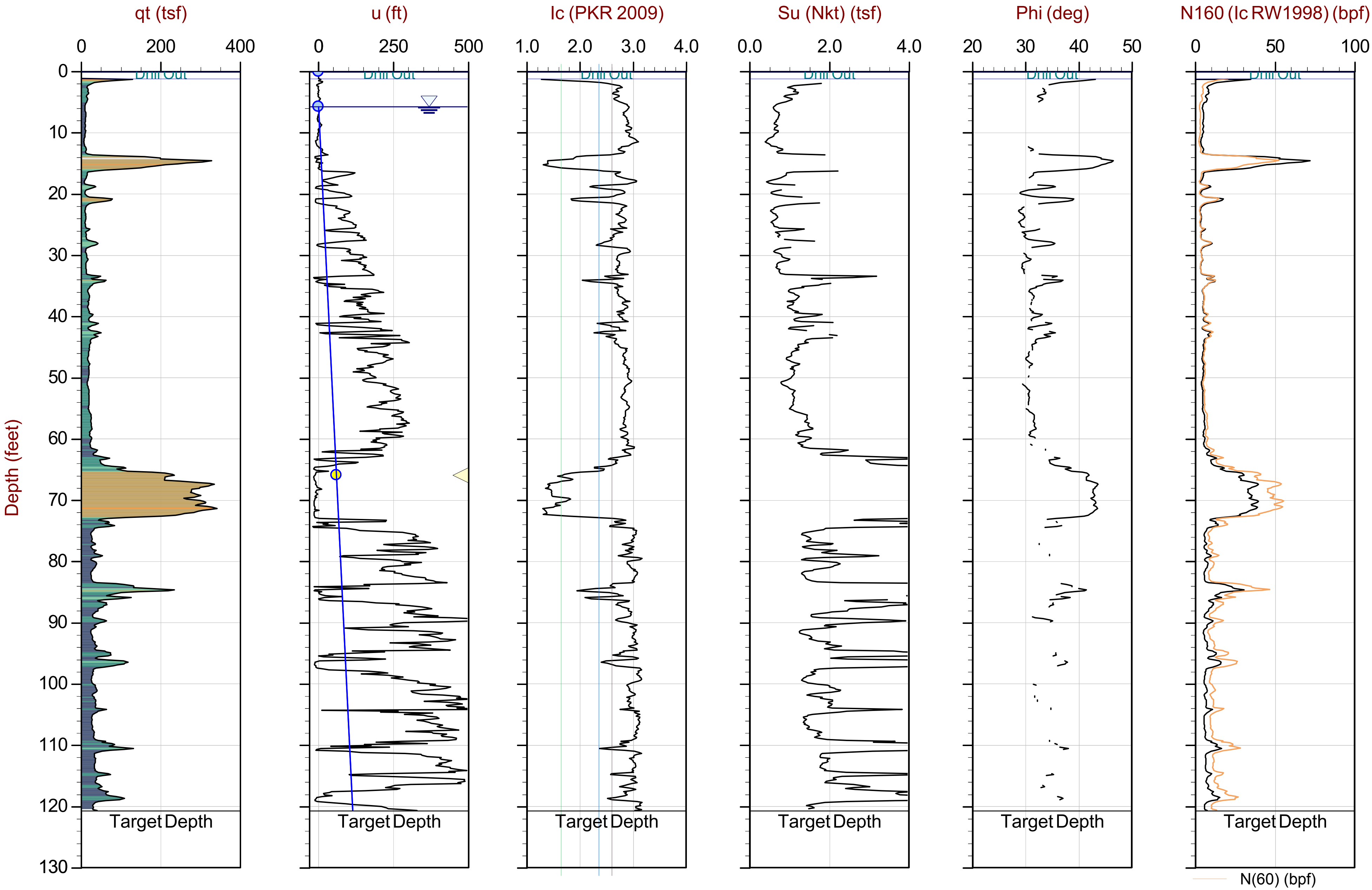
INCORPORATED

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 11:38
Site: CyrusOne Geotechnical

Sounding: CPT-01
Cone: 448:T1500F15U500



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Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP01.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136308m E: 593423m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq)   Assumed Ueq   Dissipation, Ueq achieved   Hydrostatic Line

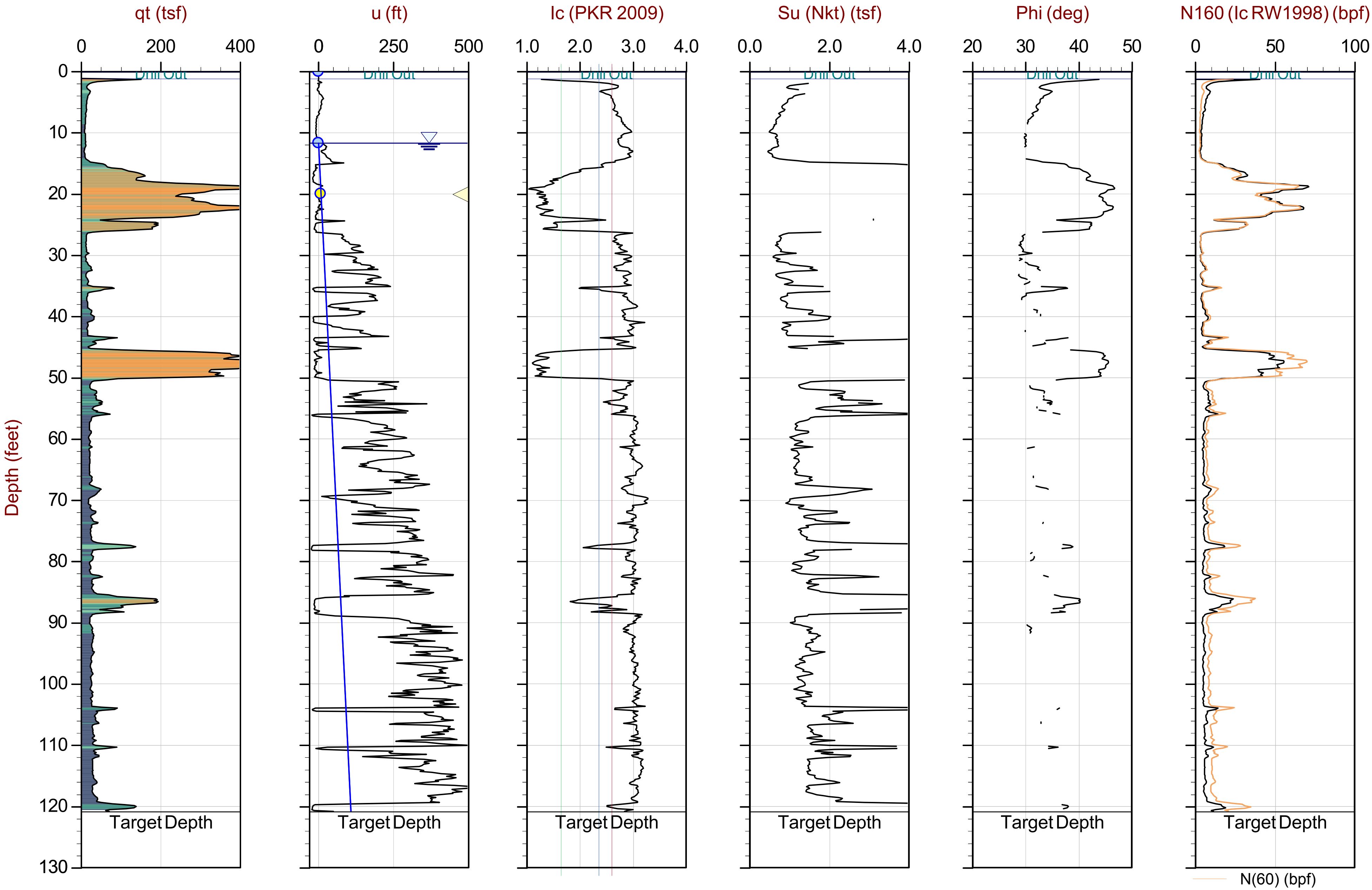
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 13:17
Site: CyrusOne Geotechnical

Sounding: CPT-02
Cone: 448:T1500F15U500



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Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP02.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136311m E: 593523m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

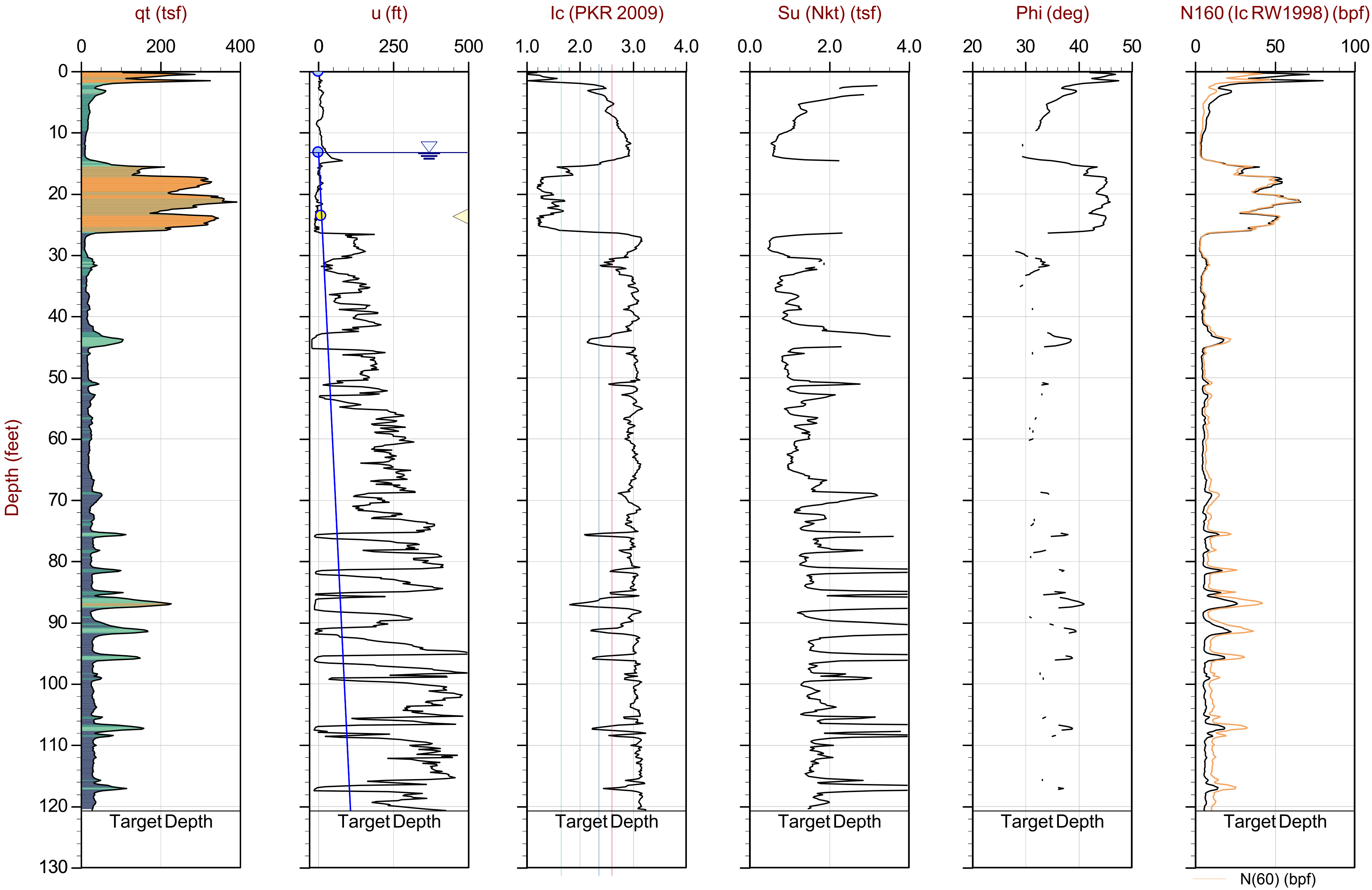
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-18 07:41
Site: CyrusOne Geotechnical

Sounding: CPT-03
Cone: 448:T1500F15U500



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Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP03.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136320m E: 593612m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

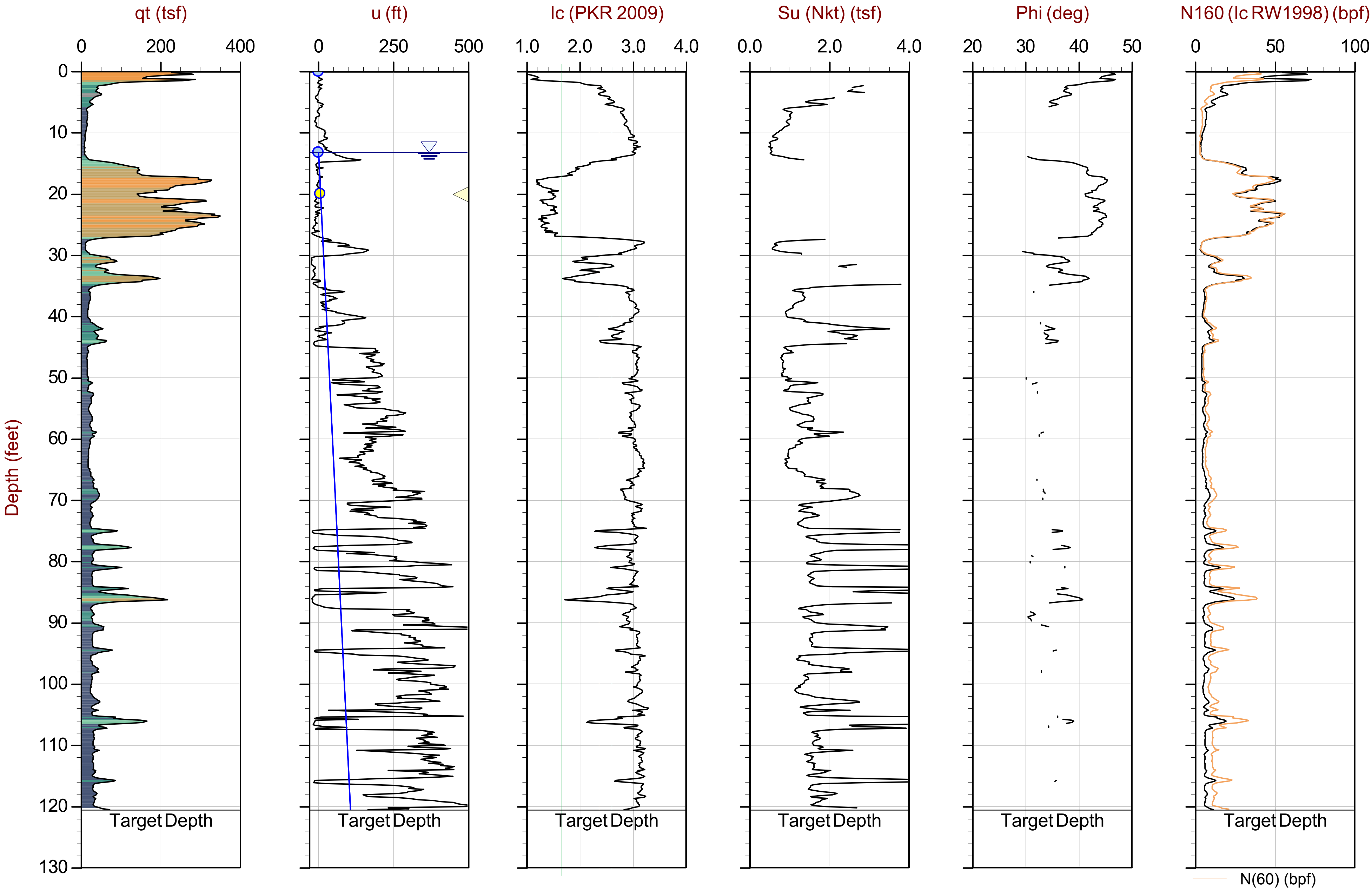
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-18 08:58
Site: CyrusOne Geotechnical

Sounding: SCPT-03B
Cone: 448:T1500F15U500



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Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_SP03B.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136319m E: 593615m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

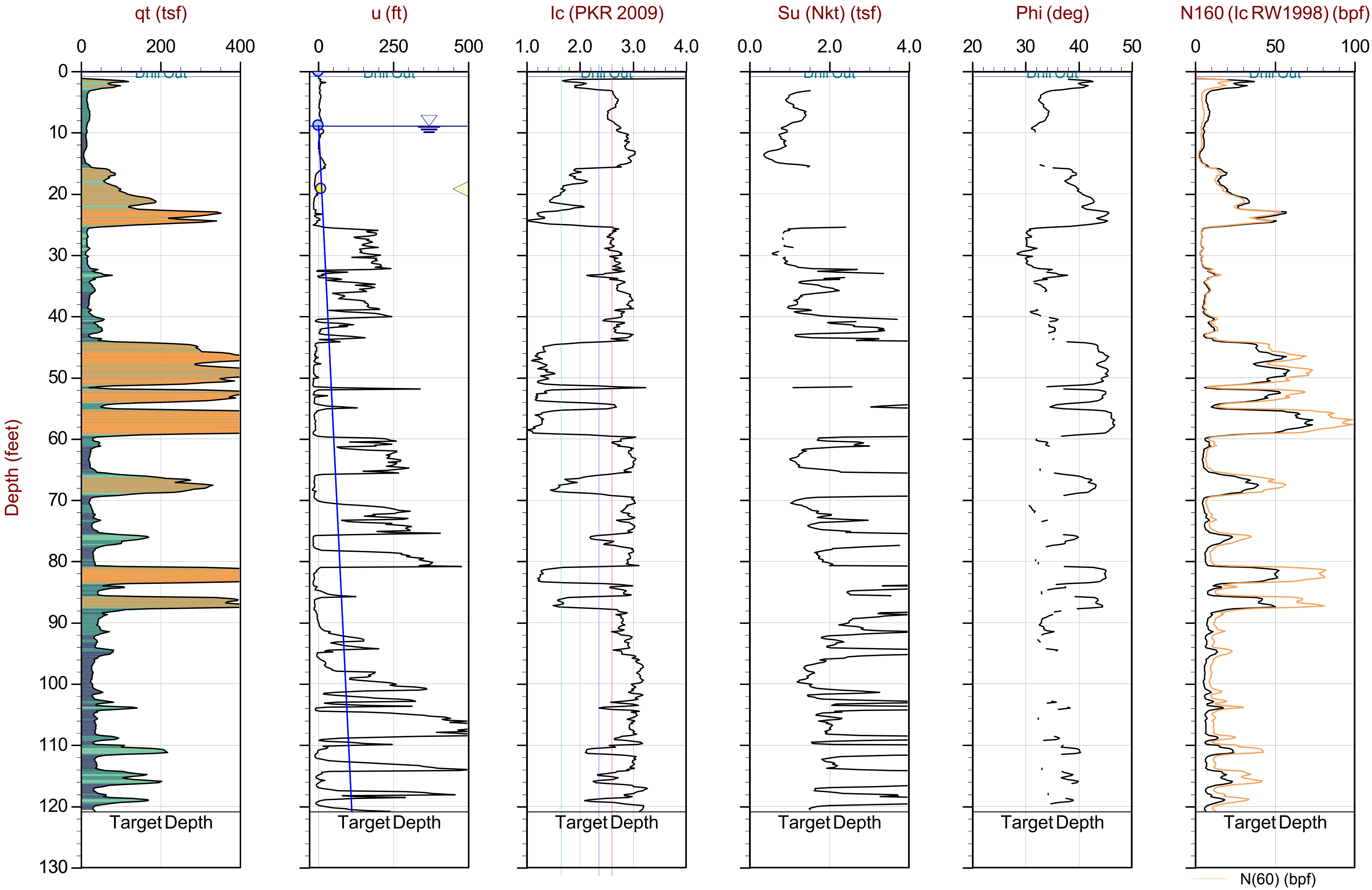
The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 07:54
Site: CyrusOne Geotechnical

Sounding: CPT-04
Cone: 448:T1500F15U500



Max Depth: 36.850 m / 120.90 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP04.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136215m E: 593429m
Sheet No: 1 of 1

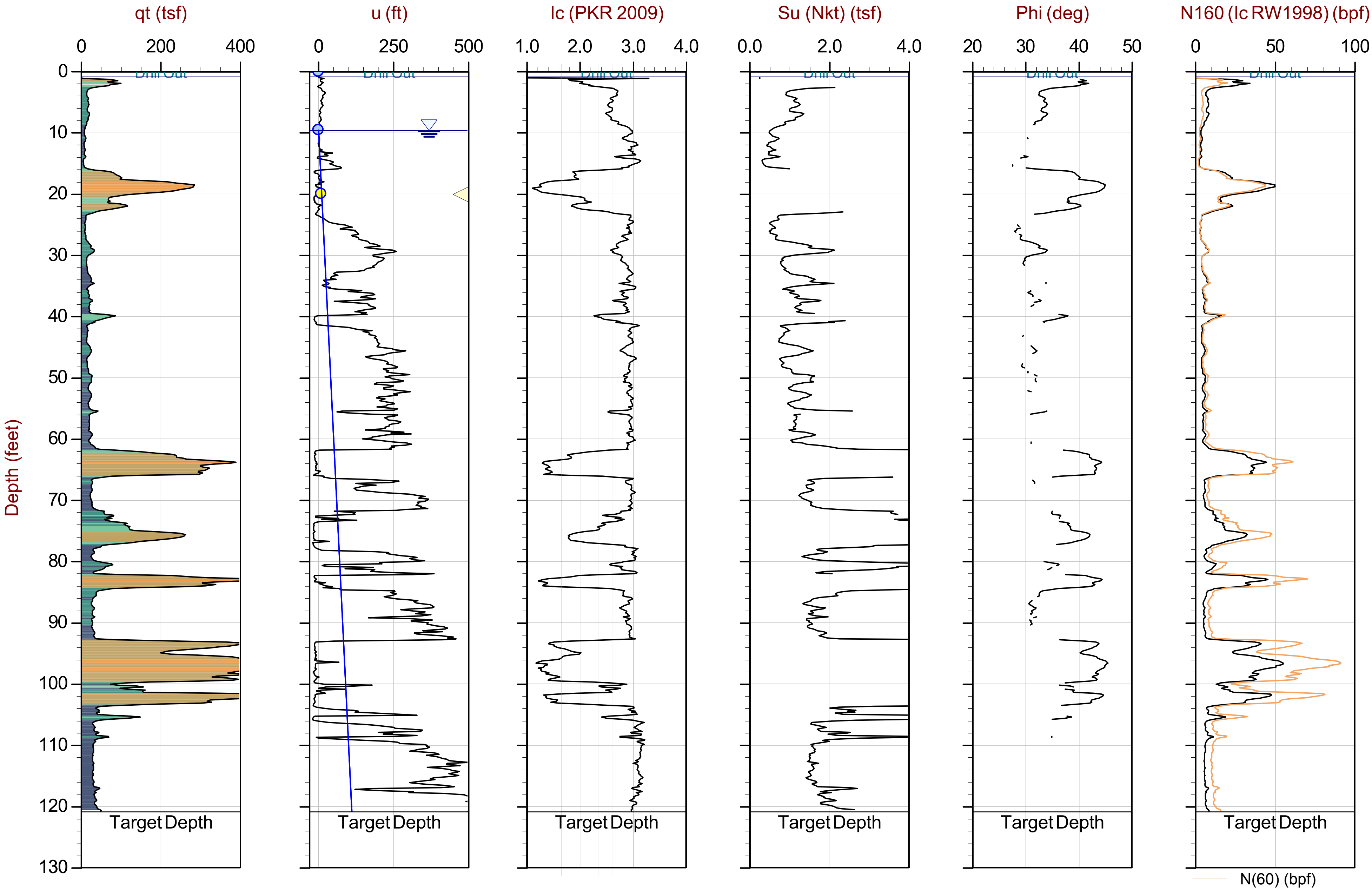
Equilibrium Pore Pressure (Ueq) — Assumed Ueq — Dissipation, Ueq achieved — Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 09:43
Site: CyrusOne Geotechnical
Sounding: CPT-05
Cone: 448:T1500F15U500



Max Depth: 36.850 m / 120.90 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_CP05.COR
Unit Wt: SBTQtn (PKR2009)
Su Nkt: 15.0

SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136231m E: 593599m
Sheet No: 1 of 1

Equilibrium Pore Pressure(Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Tabular Results

Job No: 18-56117
Client: Kleinfelder Inc.
Project: CyrusOne Geotechnical
Sounding ID: SCPT-03B
Date: 18-Jul-2018

Seismic Source: Beam
Source Offset (ft): 1.8
Source Depth (ft): 0.0
Geophone Offset (ft): 0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)	Interval Velocity (m/s)
2.1	1.5	2.3				
5.7	5.1	5.4	3.1	4.9	622	190
9.0	8.4	8.6	3.2	6.1	517	158
12.3	11.6	11.8	3.2	6.5	500	152
15.6	14.9	15.0	3.3	7.2	453	138
18.9	18.2	18.3	3.3	3.7	886	270
22.1	21.5	21.6	3.3	4.3	763	233
25.4	24.8	24.8	3.3	3.4	962	293
28.7	28.1	28.1	3.3	3.5	927	283
32.0	31.3	31.4	3.3	5.2	627	191
35.3	34.6	34.7	3.3	4.9	672	205
38.5	37.9	37.9	3.3	4.4	747	228
41.8	41.2	41.2	3.3	4.7	698	213
45.1	44.5	44.5	3.3	4.4	743	227
48.4	47.7	47.8	3.3	4.5	727	222
51.7	51.0	51.0	3.3	4.4	748	228
55.0	54.3	54.3	3.3	3.9	841	256
58.1	57.4	57.4	3.1	4.0	776	237
61.4	60.7	60.7	3.3	3.8	865	264
64.8	64.1	64.2	3.4	3.6	965	294
68.1	67.4	67.4	3.3	3.7	898	274
71.4	70.7	70.7	3.3	3.1	1070	326
74.6	74.0	74.0	3.3	3.3	1003	306
77.9	77.3	77.3	3.3	3.7	888	271
81.2	80.5	80.6	3.3	3.3	992	302
84.5	83.8	83.8	3.3	3.2	1040	317
87.8	87.1	87.1	3.3	3.1	1074	327
91.0	90.4	90.4	3.3	3.3	991	302
94.3	93.7	93.7	3.3	2.6	1262	385
97.6	96.9	97.0	3.3	3.3	1006	307
100.9	100.2	100.2	3.3	2.9	1115	340

Job No:	18-56117
Client:	Kleinfelder Inc.
Project:	CyrusOne Geotechnical
Sounding ID:	SCPT-03B
Date:	18-Jul-2018

Seismic Source:	Beam
Source Offset (ft):	1.8
Source Depth (ft):	0.0
Geophone Offset (ft):	0.66

SCPTu SHEAR WAVE VELOCITY TEST RESULTS - Vs

Tip Depth (ft)	Geophone Depth (ft)	Ray Path (ft)	Ray Path Difference (ft)	Travel Time Interval (ms)	Interval Velocity (ft/s)	Interval Velocity (m/s)
104.2	103.5	103.5	3.3	3.3	988	301
107.4	106.8	106.8	3.3	3.2	1033	315
110.7	110.1	110.1	3.3	3.5	948	289
114.0	113.4	113.4	3.3	3.6	917	279
117.3	116.6	116.6	3.3	3.3	1001	305
120.6	119.9	119.9	3.3	3.0	1106	337

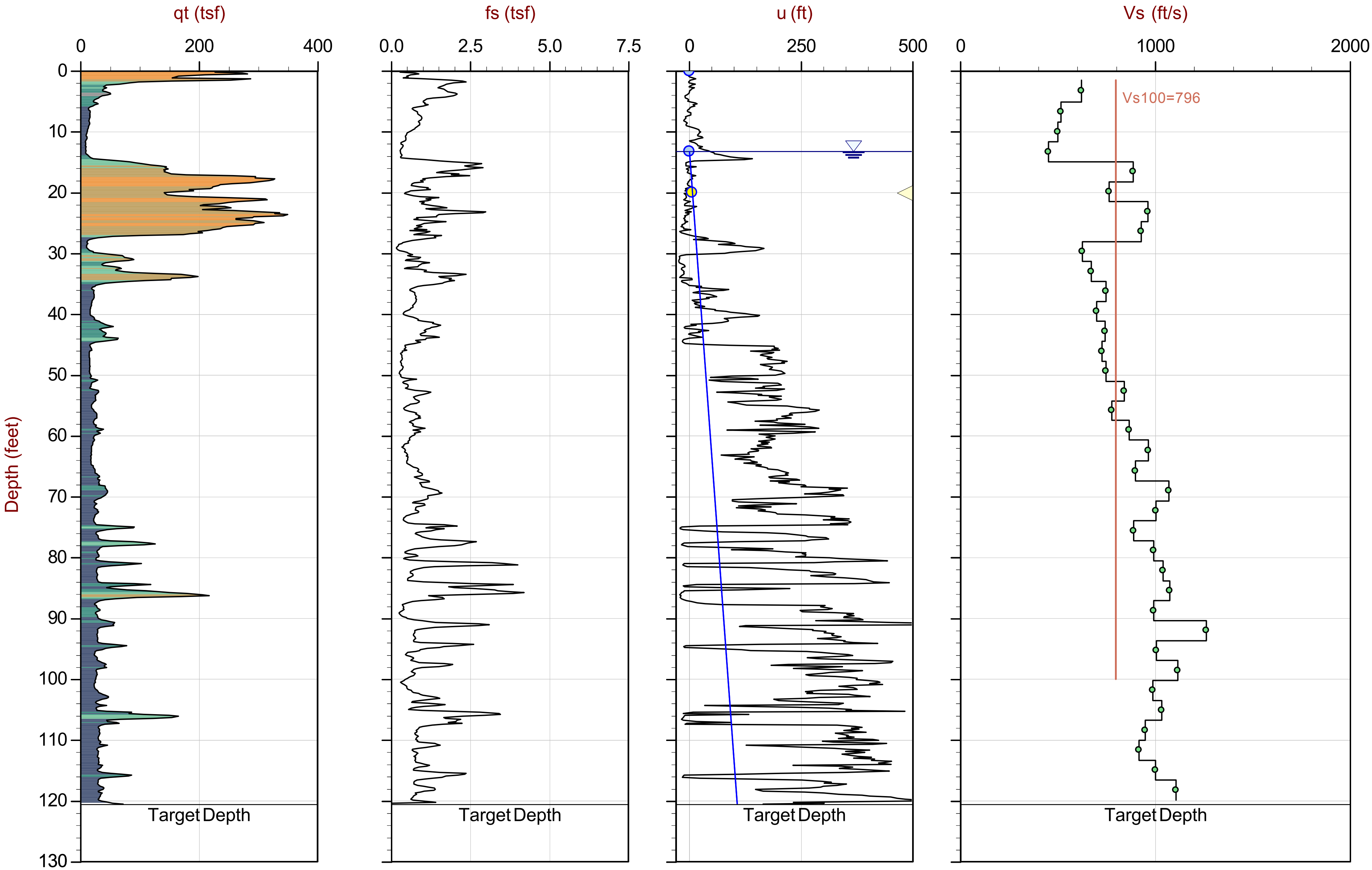
Seismic Cone Penetration Test Plots

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-18 08:58
Site: CyrusOne Geotechnical

Sounding: SCPT-03B
Cone: 448:T1500F15U500



Max Depth: 36.750 m / 120.57 ft
Depth Inc: 0.050 m / 0.164 ft
Avg Int: Every Point

File: 18-56117_SP03B.COR
Unit Wt: SBTQtn (PKR2009)

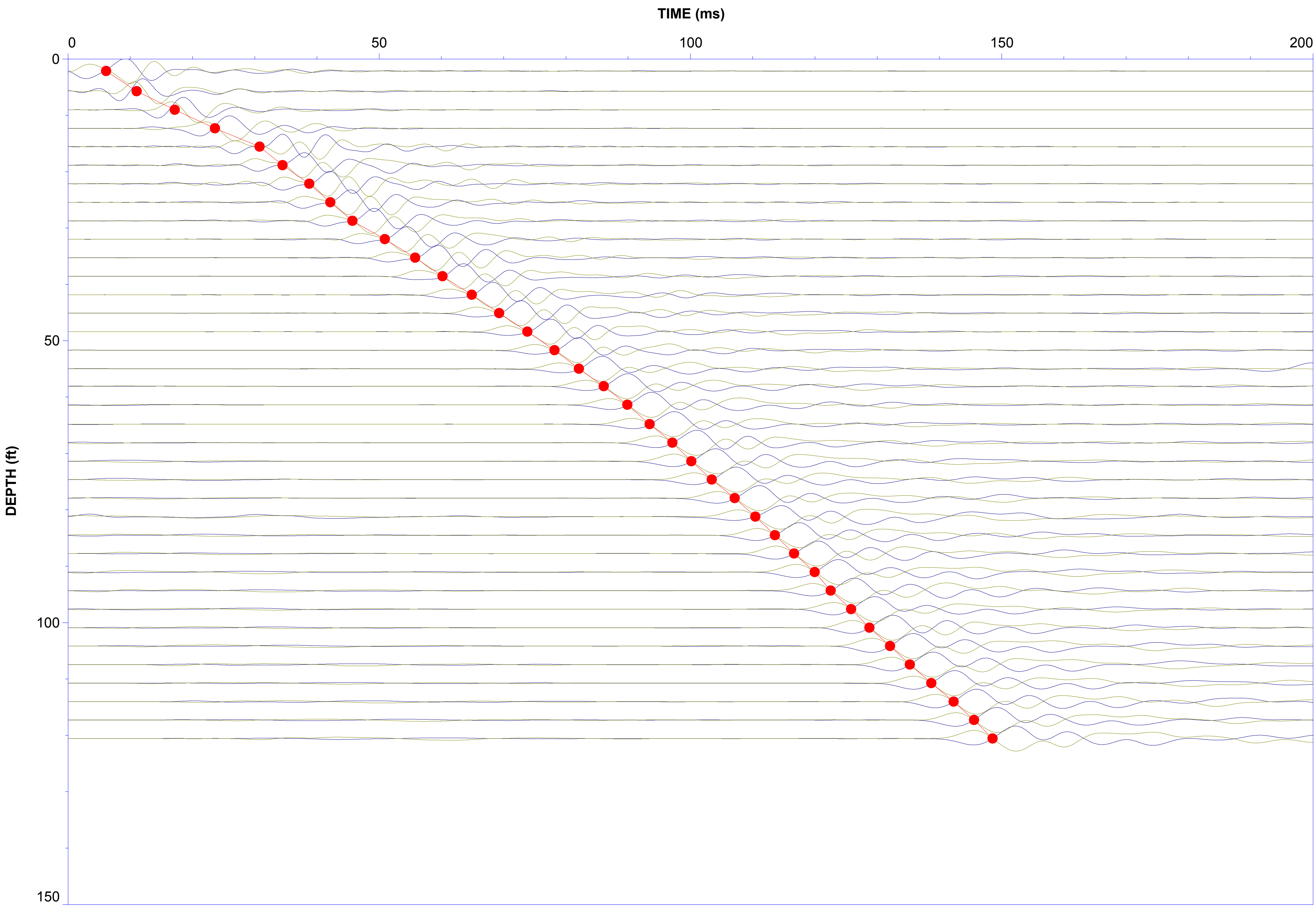
SBT: Robertson, 2009 and 2010
Coords: UTM 10 N N: 4136319m E: 593615m
Sheet No: 1 of 1

Equilibrium Pore Pressure (Ueq) Assumed Ueq Dissipation, Ueq achieved Hydrostatic Line

The reported coordinates were acquired from consumer grade GPS equipment and are only approximate locations. The coordinates should not be used for design purposes.

Seismic Cone Penetration Test Time Domain Traces

Job No: 18-56117 Client: Kleinfelder Inc. Project Title: CyrusOne Geotechnical Filter: 0-200 Hz Souding: SCPT-03B Date: 18-Jul-2018



Soil Behavior Type (SBT) Scatter Plots

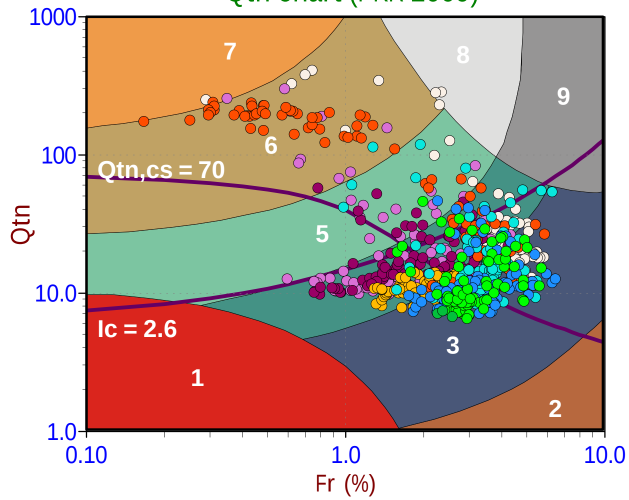
CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

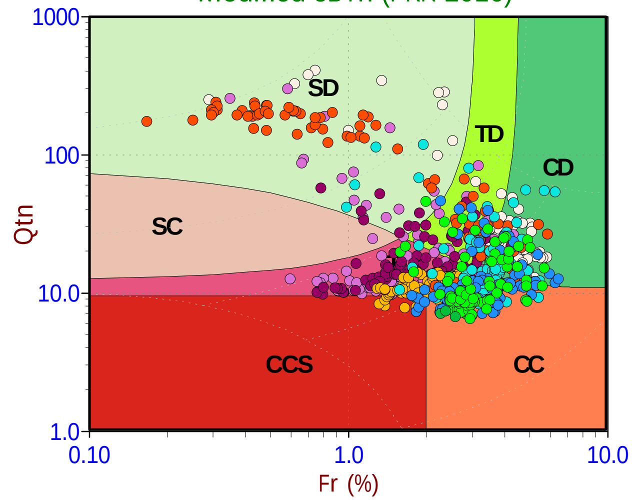
Job No: 18-56117
Date: 2018-07-17 11:38
Site: CyrusOne Geotechnical

Sounding: CPT-01
Cone: 448:T1500F15U500

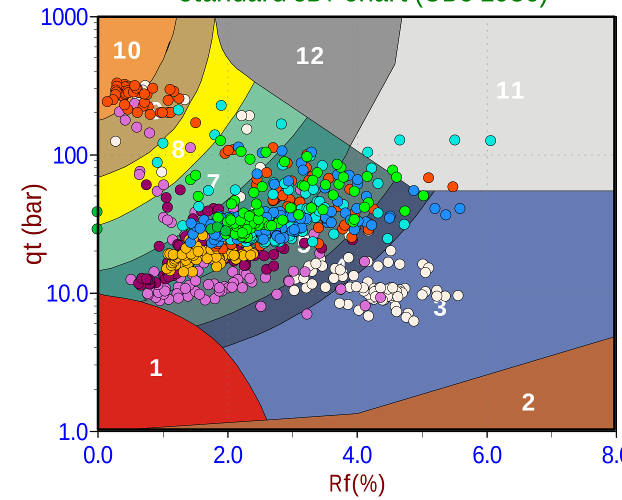
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



Depth Ranges
- >0.0 to 15.0 ft
- >15.0 to 30.0 ft
- >30.0 to 45.0 ft
- >45.0 to 60.0 ft
- >60.0 to 75.0 ft
- >75.0 to 90.0 ft
- >90.0 to 105.0 ft
- >105.0 to 120.0 ft
- >120.0 to 135.0 ft
- >135.0 to 150.0 ft
- >150.0 ft

Legend
- Sensitive, Fine Grained
- Organic Soils
- Clays
- Silt Mixtures
- Sand Mixtures
- Sands
- Gravelly Sand to Sand
- Stiff Sand to Clayey Sand
- Very Stiff Fine Grained

Legend
- CCS (Cont. sensitive clay like)
- CC (Cont. clay like)
- TC (Cont. transitional)
- SC (Cont. sand like)
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Legend
- Sensitive Fines
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- Cemented Sand

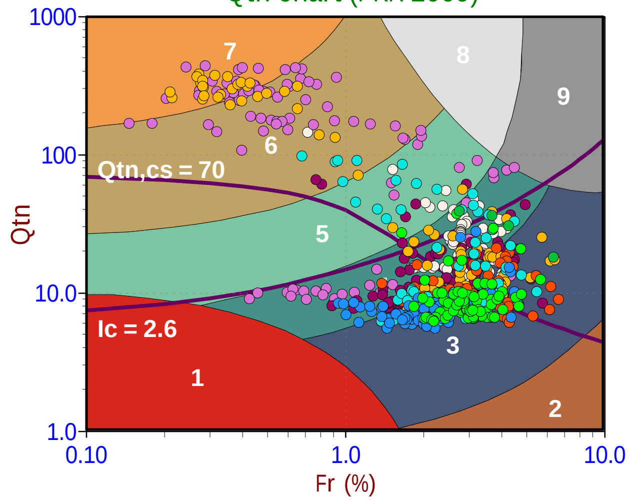
CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

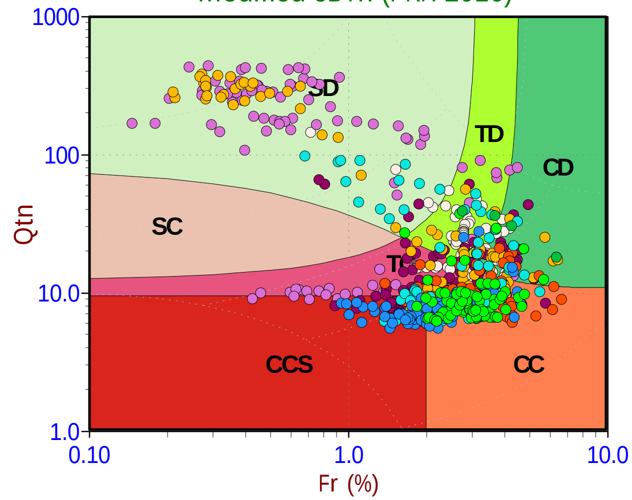
Job No: 18-56117
Date: 2018-07-17 13:17
Site: CyrusOne Geotechnical

Sounding: CPT-02
Cone: 448:T1500F15U500

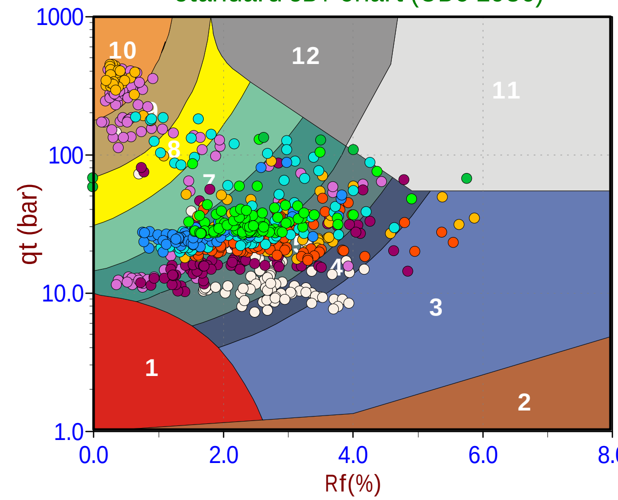
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



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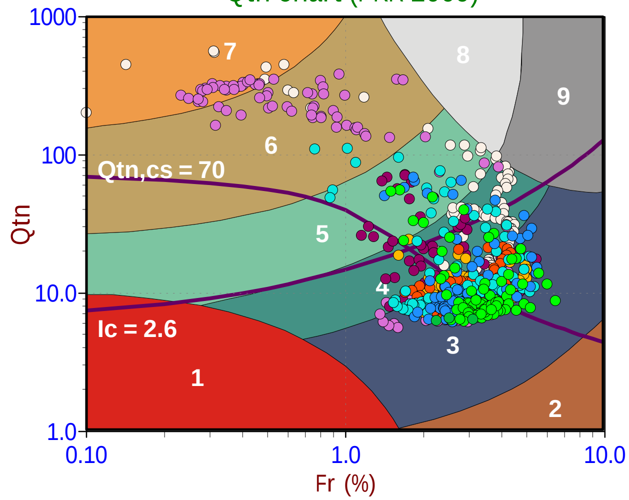
Kleinfelder

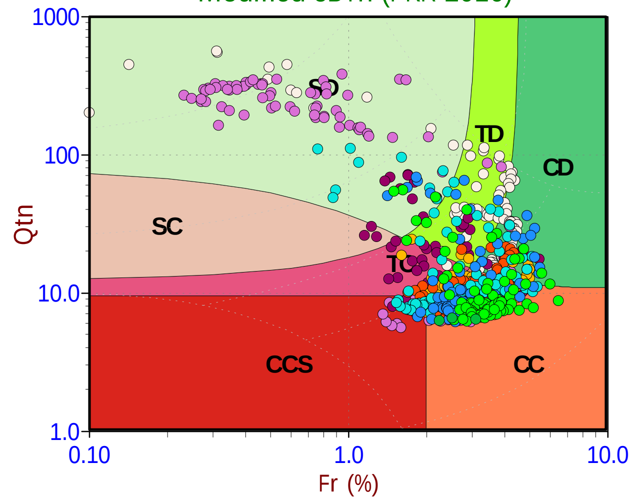
Job No: 18-56117
Date: 2018-07-18 07:41
Site: CyrusOne Geotechnical

Sounding: CPT-03
Cone: 448:T1500F15U500

Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



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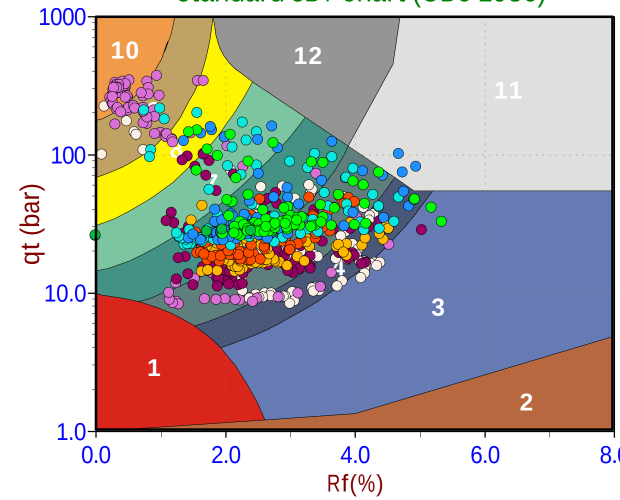

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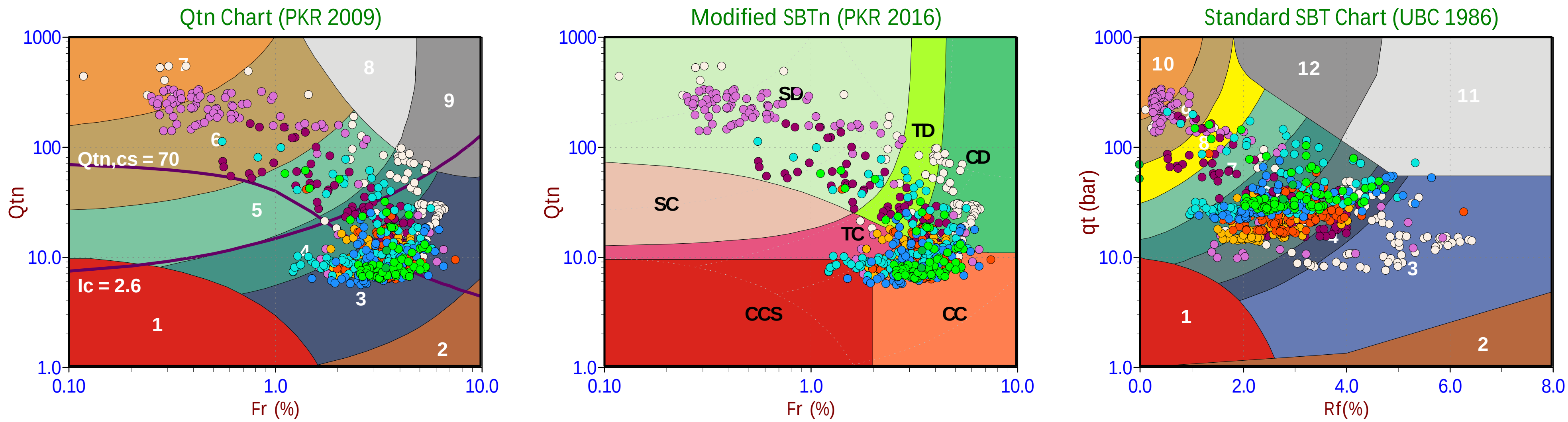
CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-18 08:58
Site: CyrusOne Geotechnical

Sounding: SCPT-03B
Cone: 448:T1500F15U500



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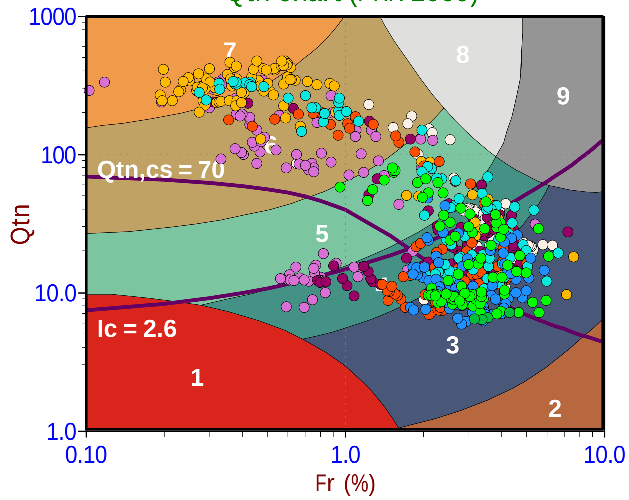
CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

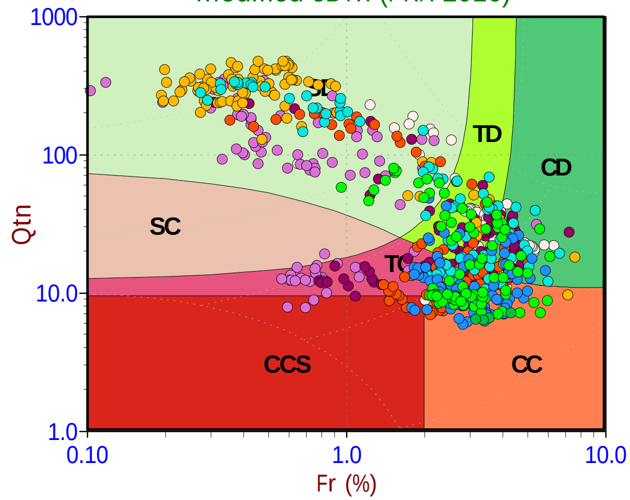
Job No: 18-56117
Date: 2018-07-17 07:54
Site: CyrusOne Geotechnical

Sounding: CPT-04
Cone: 448:T1500F15U500

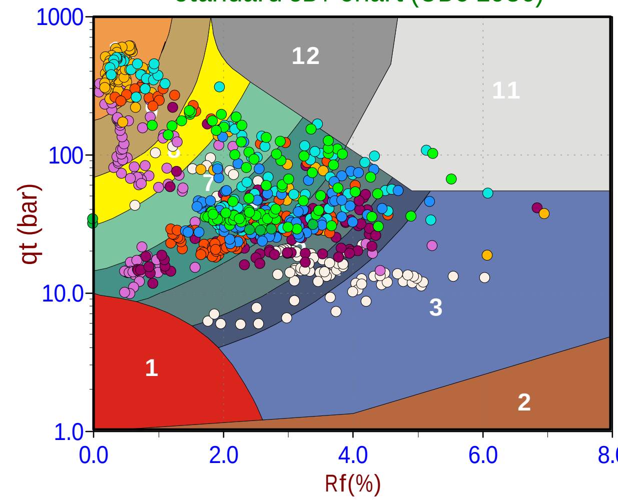
Qtn Chart (PKR 2009)



Modified SBTn (PKR 2016)



Standard SBT Chart (UBC 1986)



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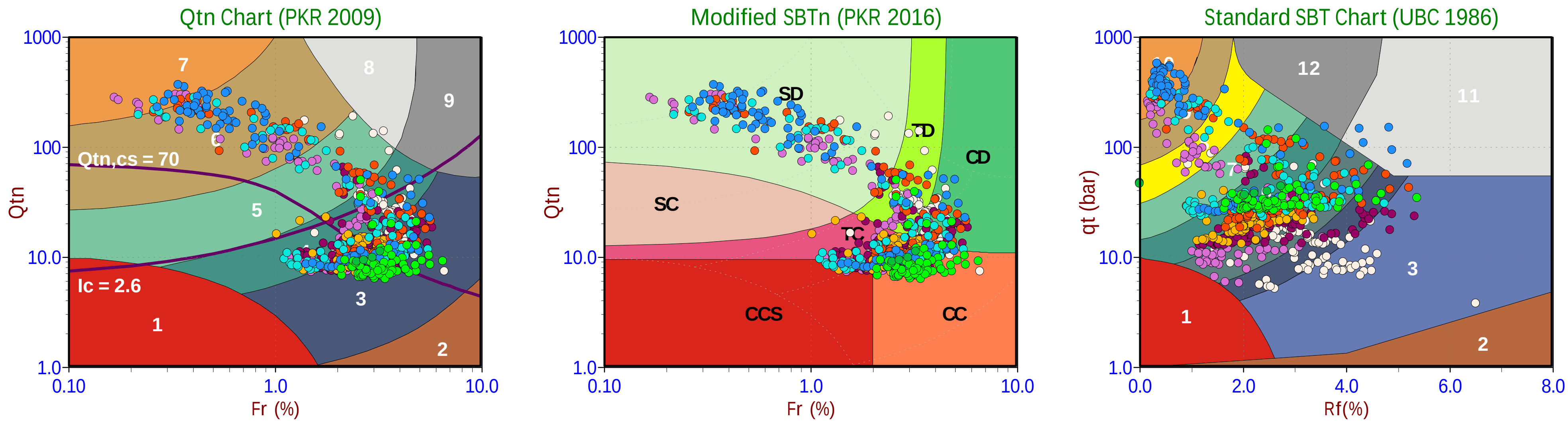
CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder

Job No: 18-56117
Date: 2018-07-17 09:43
Site: CyrusOne Geotechnical

Sounding: CPT-05
Cone: 448:T1500F15U500



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Pore Pressure Dissipation Summary and
Pore Pressure Dissipation Plots

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

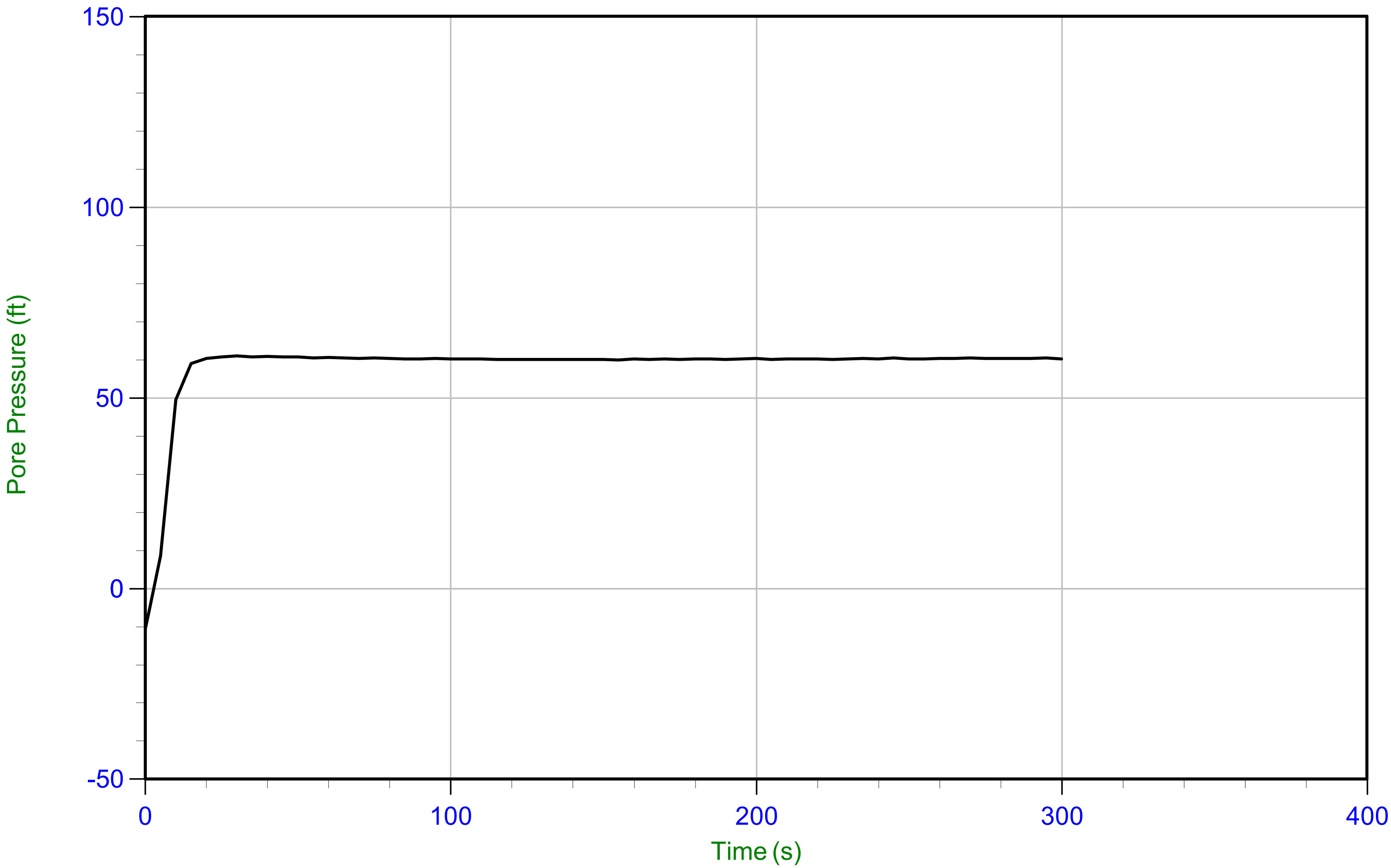
Job No: 18-56117
Client: Kleinfelder Inc.
Project: CyrusOne Geotechnical
Start Date: 17-Jul-2018
End Date: 18-Jul-2018

CPTu PORE PRESSURE DISSIPATION SUMMARY

Sounding ID	File Name	Cone Area (cm^2)	Duration (s)	Test Depth (ft)	Estimated Equilibrium Pore Pressure U_{eq} (ft)	Calculated Phreatic Surface (ft)
CPT-01	18-56117_CP01	15	300	65.94	60.2	5.7
CPT-02	18-56117_CP02	15	300	20.01	8.3	11.7
CPT-03	18-56117_CP03	15	300	23.62	10.4	13.2
SCPT-03B	18-56117_SP03B	15	305	20.01	6.8	13.2
CPT-04	18-56117_CP04	15	390	19.19	10.3	8.9
CPT-05	18-56117_CP05	15	310	20.01	10.4	9.6

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder	Job No: 18-56117 Date: 07/17/2018 11:38 Site: CyrusOne Geotechnical	Sounding: CPT-01 Cone: 448:T1500F15U500 Area=15 cm²

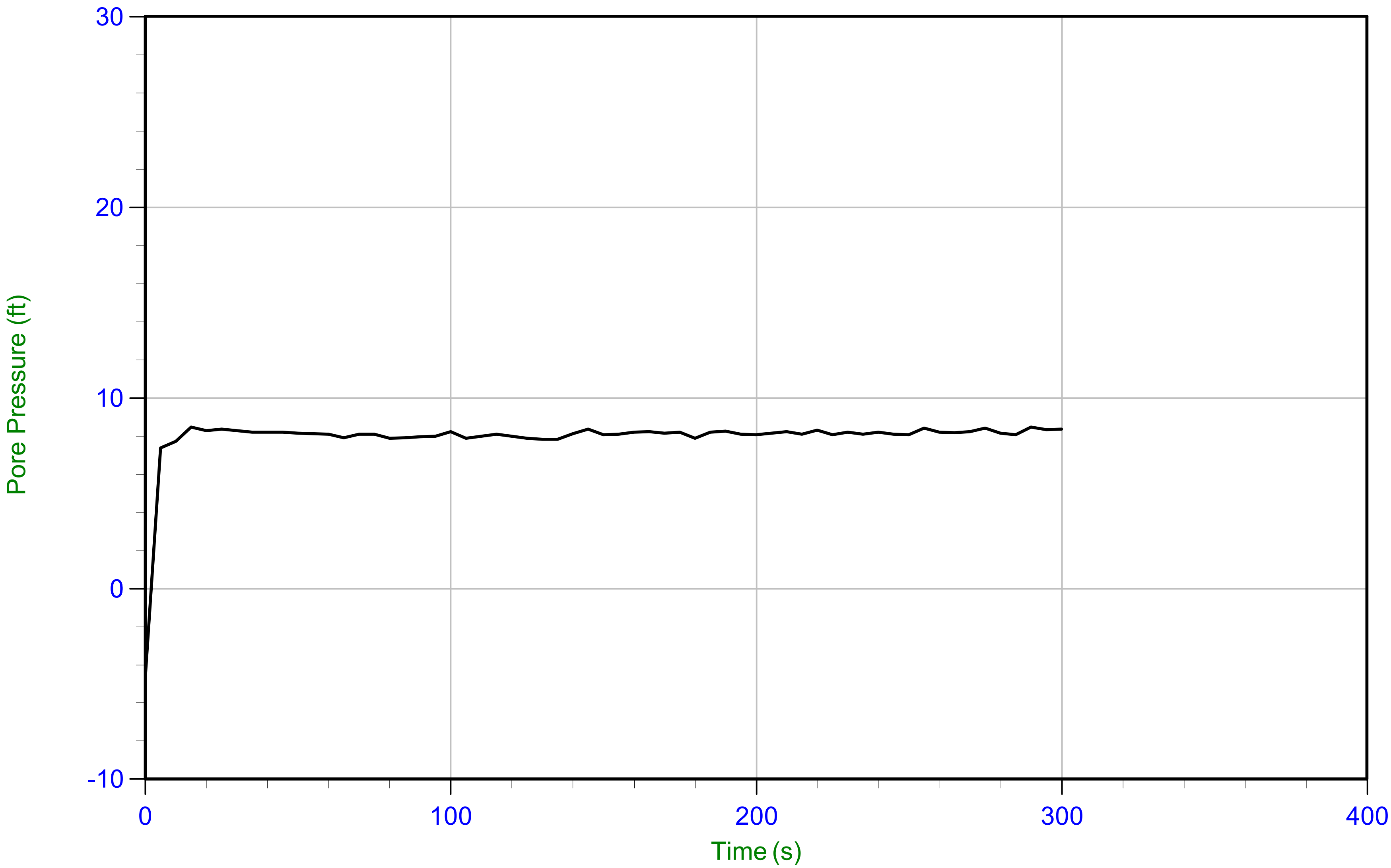


Trace Summary:

Filename: 18-56117_CP01.PPF	U Min: -10.6 ft	WT: 1.750 m / 5.741 ft
Depth: 20.100 m / 65.944 ft	U Max: 61.0 ft	Ueq: 60.2 ft
Duration: 300.0 s		

CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder	Job No: 18-56117	Sounding: CPT-02
	Date: 07/17/2018 13:17	Cone: 448:T1500F15U500 Area=15 cm²
	Site: CyrusOne Geotechnical	



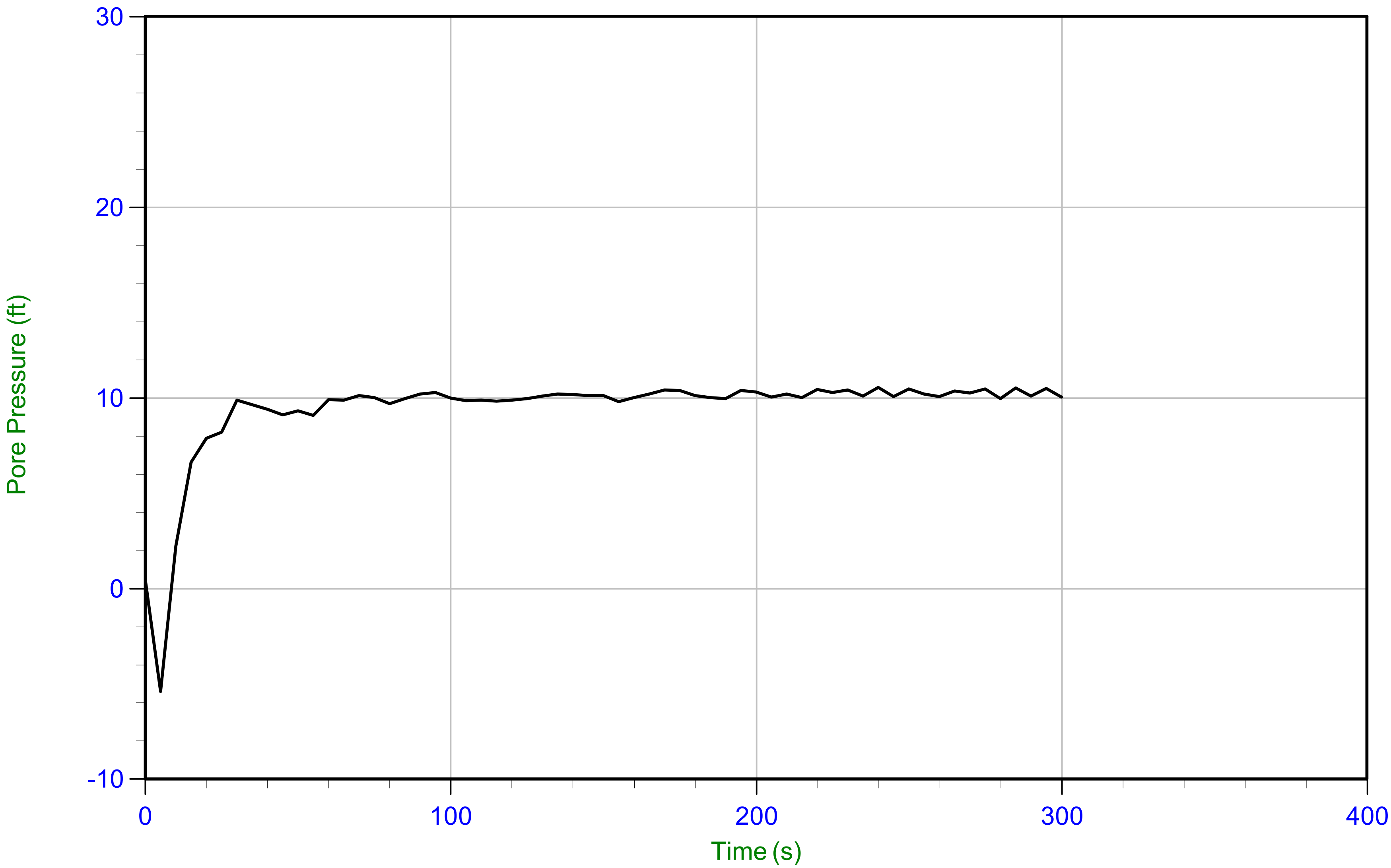
Trace Summary:

Filename: 18-56117_CP02.PPF	U Min: -4.6 ft	WT: 3.563 m / 11.689 ft
Depth: 6.100 m / 20.013 ft	U Max: 8.5 ft	Ueq: 8.3 ft
Duration: 300.0 s		

Kleinfelder

Job No: 18-56117
Date: 07/18/2018 07:41
Site: CyrusOne Geotechnical

Sounding: CPT-03
Cone: 448:T1500F15U500 Area=15 cm²

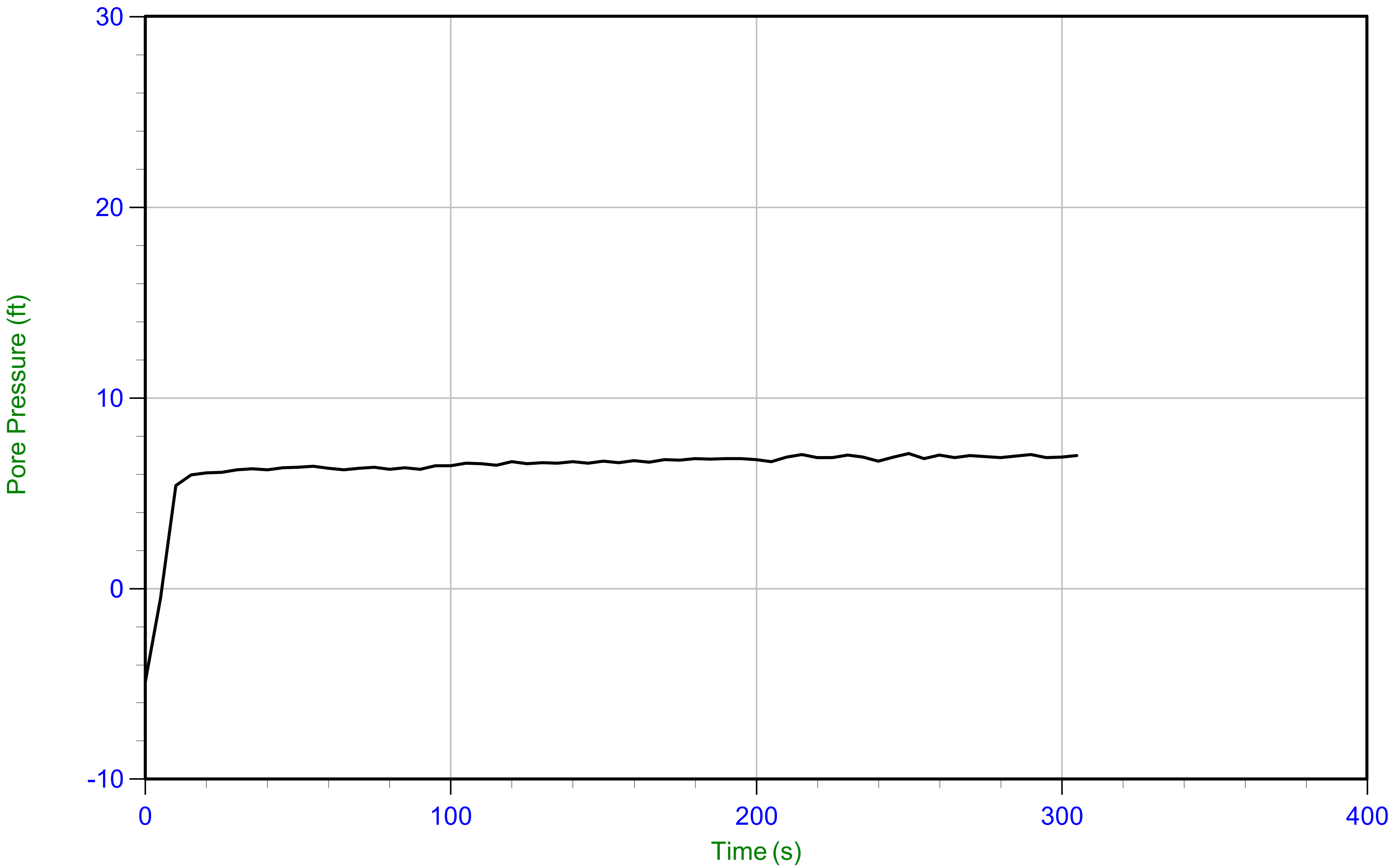


Trace Summary:	Filename: 18-56117_CP03.PPF	U Min: -5.4 ft	WT: 4.028 m / 13.215 ft
	Depth: 7.200 m / 23.622 ft	U Max: 10.6 ft	Ueq: 10.4 ft
	Duration: 300.0 s		

Kleinfelder

Job No: 18-56117
Date: 07/18/2018 08:58
Site: CyrusOne Geotechnical

Sounding: SCPT-03B
Cone: 448:T1500F15U500 Area=15 cm²



Trace Summary:

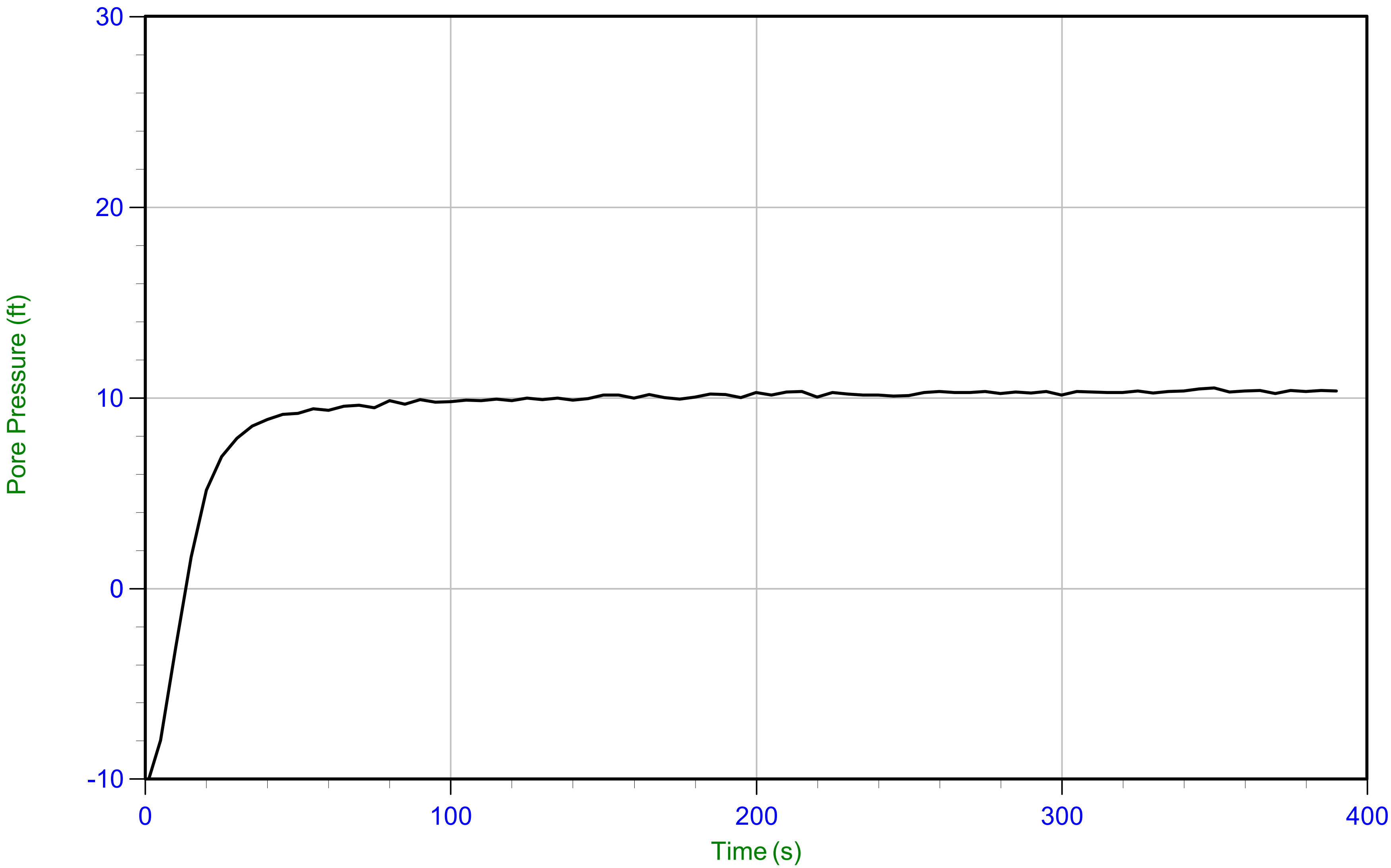
Filename: 18-56117_SP03B.PPF
Depth: 6.100 m / 20.013 ft
Duration: 305.0 s

U Min: -4.9 ft
U Max: 7.1 ft

WT: 4.033 m / 13.231 ft
Ueq: 6.8 ft

CPT CALIFORNIA PUSH TECHNOLOGIES INCORPORATED

Kleinfelder	Job No: 18-56117 Date: 07/17/2018 07:54 Site: CyrusOne Geotechnical	Sounding: CPT-04 Cone: 448:T1500F15U500 Area=15 cm²



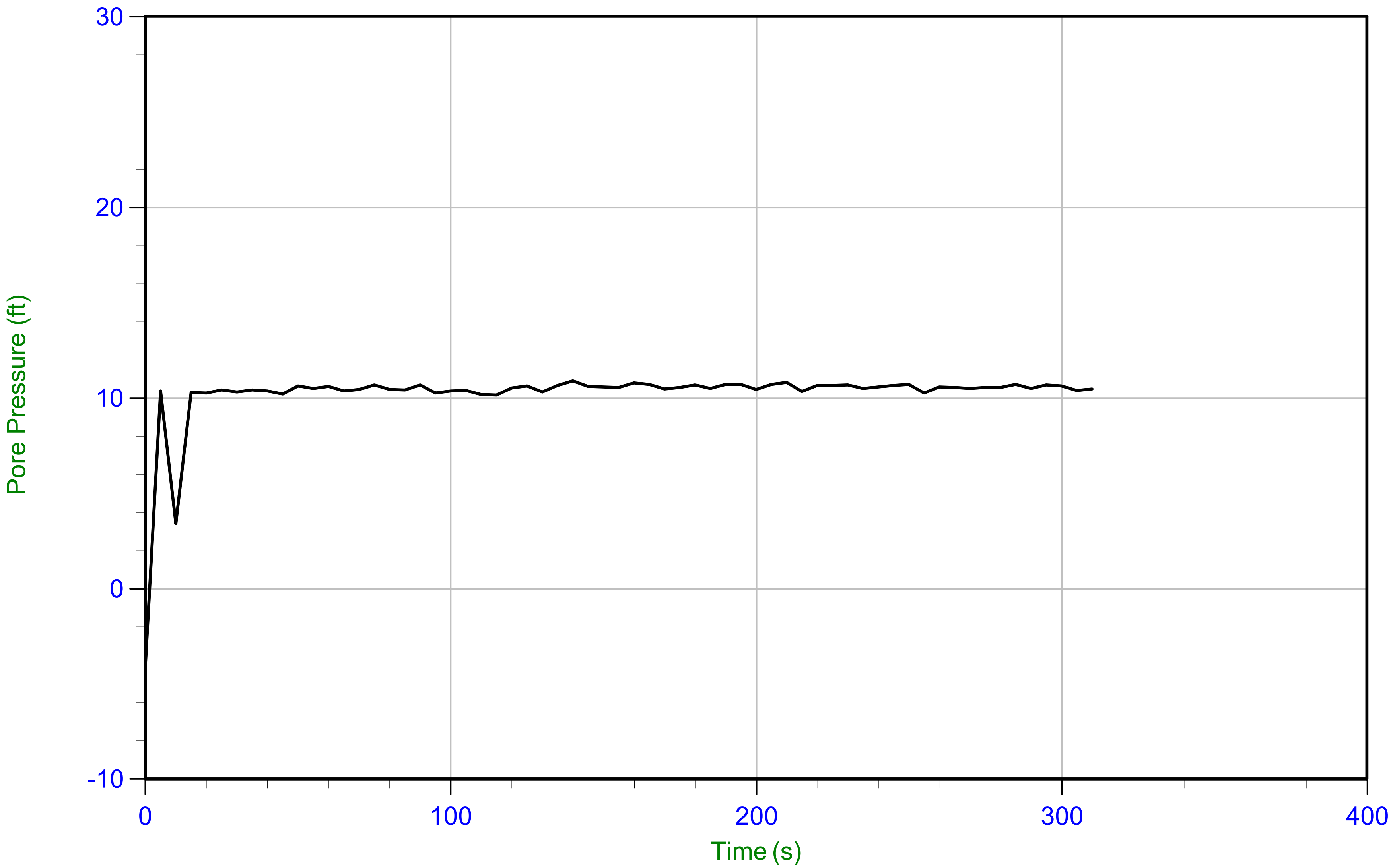
Trace Summary:

Filename: 18-56117_CP04.PPF	U Min: -10.6 ft	WT: 2.705 m / 8.875 ft
Depth: 5.850 m / 19.193 ft	U Max: 10.5 ft	Ueq: 10.3 ft
Duration: 390.0 s		

Kleinfelder

Job No: 18-56117
Date: 07/17/2018 09:43
Site: CyrusOne Geotechnical

Sounding: CPT-05
Cone: 448:T1500F15U500 Area=15 cm²



Trace Summary:

Filename: 18-56117_CP05.PPF
Depth: 6.100 m / 20.013 ft
Duration: 310.0 s

U Min: -4.1 ft
U Max: 10.9 ft

WT: 2.928 m / 9.606 ft
Ueq: 10.4 ft

APPENDIX D

Thermal Conductivity Test Results

4370 Contractors Common
Livermore, CA 94551
Tel: 925-999-9232
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info@geothermusa.com

Soil Thermal Survey
CyrusOne
2600 De La Cruz, Santa Clara, CA

August 2018

Prepared for:

KLEINFELDER
1330 Broadway #1200
Oakland, CA 94612

Submitted by:

GEOTHERM USA, LLC

COOL SOLUTIONS FOR UNDERGROUND POWER CABLES
THERMAL SURVEYS, CORRECTIVE BACKFILLS & INSTRUMENTATION

Serving the electric power industry since 1978

Geotherm USA

SOIL THERMAL SURVEY
CyrusOne
2600 De La Cruz, Santa Clara, CA

AUGUST 2018

INTRODUCTION

A field thermal resistivity survey of the native soils was performed for the underground power cables at the proposed **CyrusOne - 2600 De La Cruz Project Site in Santa Clara, CA.** ***Kleinfelder*** staked the test locations and provided personnel to hand-auger test holes.

Field Testing and Soil Sampling:

Thermal resistivity testing was carried out on August 10th, 2018 at two (2) select locations. At each location, a hand auger was used to advance the borehole to a maximum depth of 5-ft. In-situ thermal resistivity tests were performed at depths of 2.5 and 4.5 feet below grade. In addition, samples for visual description and the measurement of moisture content, density and thermal dry out characterization were taken.

In-situ thermal resistivity and ambient temperature measurements were made using field thermal probes and the *Geotherm* **TPA-2000** run off a portable power source. All thermal testing was performed in accordance with the **IEEE Standard 442-2017**. Laboratory geotechnical testing was conducted in accordance with **ASTM**.

The field thermal resistivity values were measured at the given soil moisture on that day. Depending on weather and environmental conditions; i.e. drying due to cable heat or other heat source, seasonal drying (drought), artificial draining, etc., the soil may be drier at certain times of the year. Therefore, the design thermal resistivity for the native soils should be based on the driest expected conditions.

The attached table presents factual information on the subsurface conditions at the specific test locations; no warrantee is expressed or implied that materials or conditions other than those described here may be encountered along the proposed cable route.

Laboratory Testing:

The tests included the measurement of moisture content, density and thermal dryout characterization (thermal resistivity as a function of moisture content). Samples from depth of 2'-3' and 4'-5' were re-compacted at the 'in-situ' moisture content and at a density that gave a thermal resistivity measurement similar to the in-situ values. A series of thermal resistivity measurements were made in stages with moisture content ranging from the 'in-situ' to totally dry condition. The tests were conducted in accordance with IEEE standard 442-2017. The test results are given in **Table 1** and the thermal dryout curves are presented in **Figure 1.**

Comments:

Ambient Temperature: In-situ testing was conducted at the time of the year when the earth ambient temperatures are close to the highest. At the proposed cable burial depth of about 3-4 ft., temperature of about **28 ºC** is suggested.

*Geotherm believes a maximum ambient soil temperature of approximately **28 ºC** shall be adequate; however, the Engineer of Record will ultimately be responsible for the determination of appropriate soil temperature assumptions.*

Please contact us if you or your client/consultants have any questions or if we can be of further assistance.

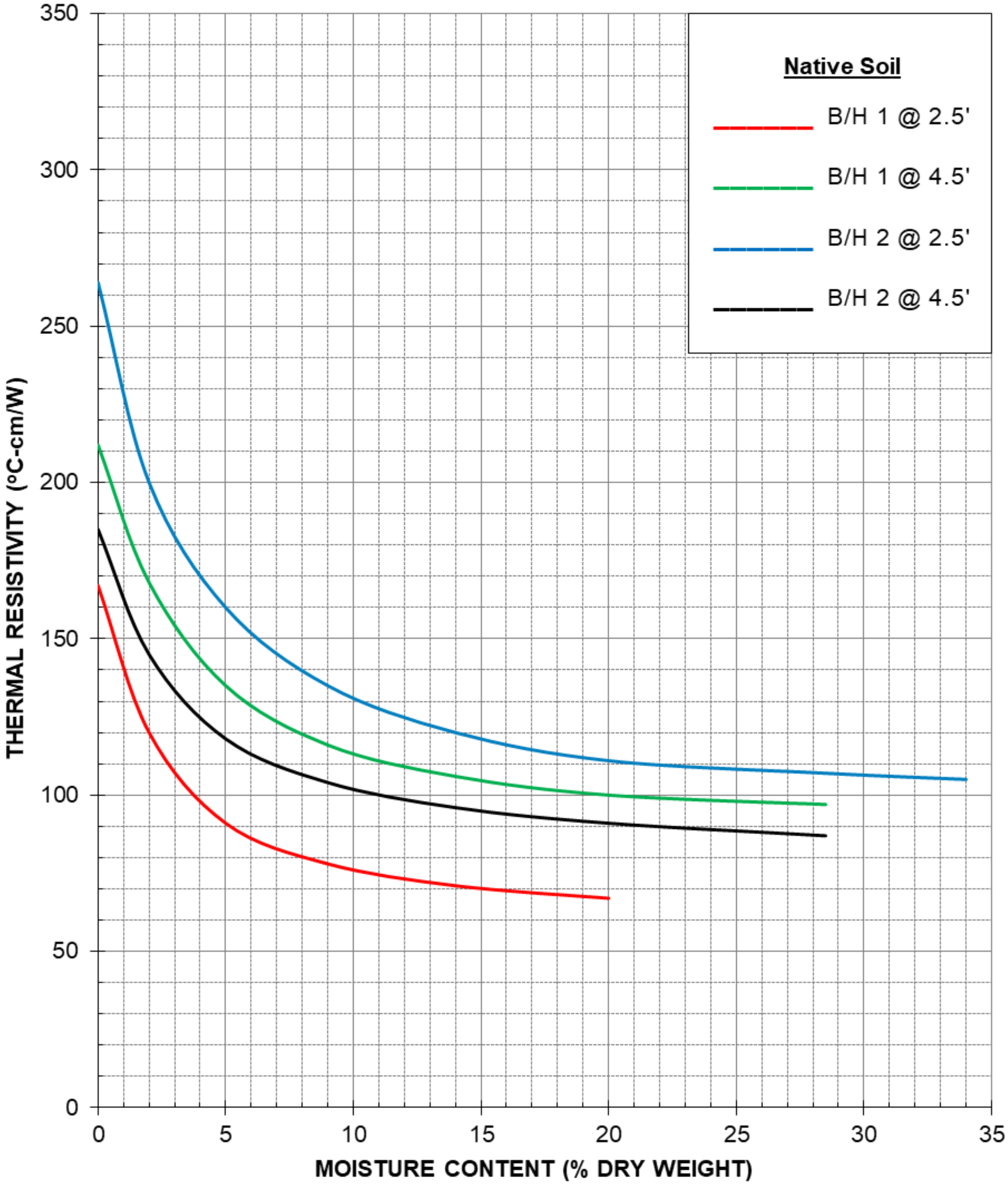
Geotherm USA

Deepak Parmar

TABLE 1 (In-situ and Laboratory Test Results)

B/H #	Test Depth (ft.)	Temp (°C)	Thermal Resistivity (°C-cm/W)			M/C %	Dry Density (lb/ft^3)	Non-classified Visual Description
			In-situ	Wet	Dry			
1	2.5	26.2	66	67	167	20	105	Silty Clay
	4.5	25.1	99	97	212	28	88	Sandy Silt
2	2.5	26.7	107	105	264	34	84	Silty Clay trace organics
	4.5	25.0	88	87	185	29	92	Silty Clay

THERMAL DRYOUT CURVES



KLEINFELDER - CyrusOne (PO #20190787.001A)

Thermal Survey

2600 De La Cruz, Santa Clara, CA

August 2018 **Figure 1**

APPENDIX E

Electrical Resistivity Test Report

August 17, 2018

Kleinfelder
1330 Broadway, Suite 1200
Oakland, CA 94612

Attention: **Mr. Robert Fosse, P.E., G.E.**
Principal Geotechnical Engineer

Subject: **Site Corrosivity Evaluation**
Underground Utilities and Concrete Foundations
Data for Grounding Calculations
De La Cruz Boulevard Property
2600 De La Cruz Boulevard, Santa Clara, CA

Dear Mr. Fosse,

Pursuant to your request, **JDH Corrosion Consultants, Inc**. has conducted a site corrosivity evaluation for the above referenced project site and we have provided herein recommendations for long-term corrosion control for the proposed materials of construction for the underground water piping systems and concrete foundations at this site.

Purpose

The purpose for this evaluation is to determine the corrosion potential, resulting from the soils at the subject site and to provide recommendations for long-term corrosion control for the underground piping systems and data for grounding calculations.

Background

Kleinfelder will use the project site to develop a 4-story data center, a separate multi-story office building, and exterior gantry structures. There will be new buried utilities associated with the development.

Soil Testing And Analysis

Soil Testing Results

Two (2) soil samples were collected from the site by **Kleinfelder** field personal and they were transported to a state certified testing laboratory, **CERCO Analytical, Inc.** (certificate no. 2153) located in Concord, CA for chemical analysis. The samples were analyzed for pH, chlorides, resistivity (@ 100% saturation), sulfides, sulfates and Redox potential using ASTM test methods as detailed in the table below. The preparation of the soil samples for chemical analysis was in accordance with the applicable specifications.

Soil Analysis Test Methods

Chemical Analysis	ASTM Method
Chlorides	D4327
pH	D4972
Resistivity	G57
Sulfide	D4658M
Sulfate	D4327
Redox Potential	D1498

The results of the chemical analysis are provided in the CERCO Analytical, Inc. report dated August 15, 2018. The results are summarized as follows:

CERCO Analytical, Inc.
Laboratory Analysis

Chemical Analysis	Range of Results	Corrosion Classification*
Chlorides	N.D. - 30	Non-corrosive*
pH	7.92 – 7.94	Non-corrosive*
Resistivity (100% saturation)	710 – 1,200 (ohms-cm)	Corrosive*
Sulfide	None Detected	Non-corrosive**
Sulfate	50 – 140 (mg/kg)	Non-corrosive**
Redox Potential	250 (mV)	Mildly Corrosive*

* With respect to bare steel or ductile iron.
** With respect to mortar coated steel

Chemical Testing Analysis

The chemical analysis provided by **CERCO Analytical** indicates that the soils are generally classified as “corrosive” based on the soil resistivity measurement. The chloride levels indicate “non-corrosive” conditions to steel and ductile iron and the sulfate and sulfide levels indicate “non-corrosive” conditions for concrete structures placed into these soils with regard to sulfate attack. The pH of the soils is alkaline which classifies them as “non-corrosive” to buried steel and concrete structures.

In-Situ Soil Resistance Measurements

The in-situ resistance of the soil was measured at four (4) locations at the project site by **JDH Corrosion Consultants, Inc.** field personnel at the locations shown on the attached map. Resistance measurements were conducted with probe spacing of 2.5, 5, 7.5, 10, 15 and 20-feet at each location. For analysis purposes we have calculated the resistivity of soil layers 0-2.5, 2.5-5, 5-7.5, 7.5-10, 10-15, and 15-20' using the Barnes Method as follows:

$$\rho_{b-a} = KR_{(b-a)}$$

Where;

ρ_{b-a} = soil resistivity of layer depth b-a (ohm-cm)

- a = soil depth to top layer (ft)
- b = soil depth to bottom layer (ft)
- R_a = soil resistance read at depth a (ohms)
- R_b = soil resistance read at depth b (ohms)
- R_{b-a} = resistance of soil layer from a to b (ft)
- K = layer constant = $60.96\pi(b-a)$ (cm)

and

$$\frac{1}{R_{b-a}} = \frac{1}{R_a} - \frac{1}{R_b}$$

The visual diagrams below describe the Wenner 4-pin testing configuration.

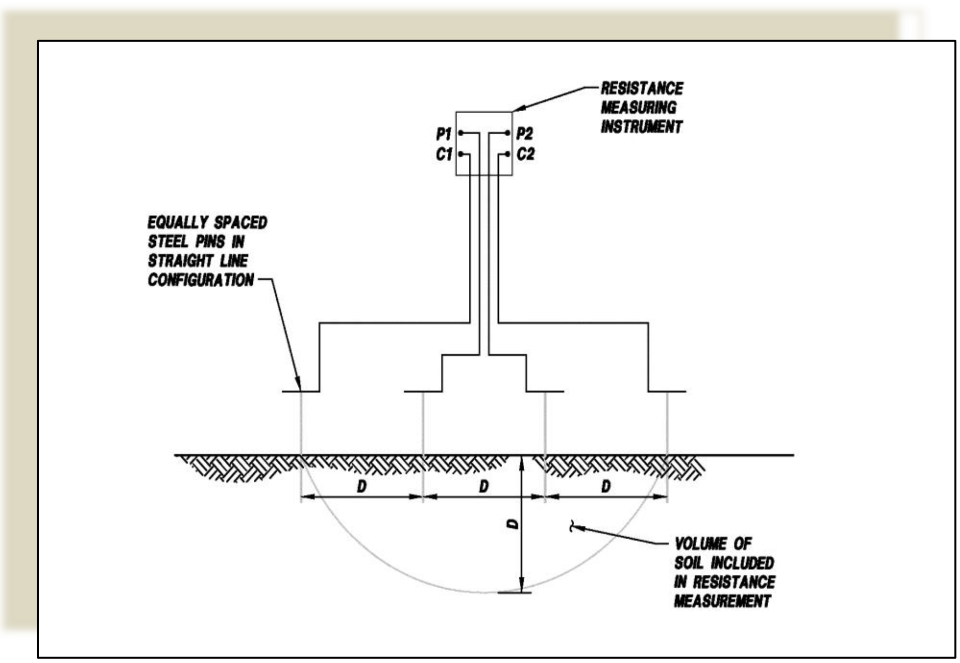


Fig 1: Wenner 4-Pin Resistivity Schematic No.1

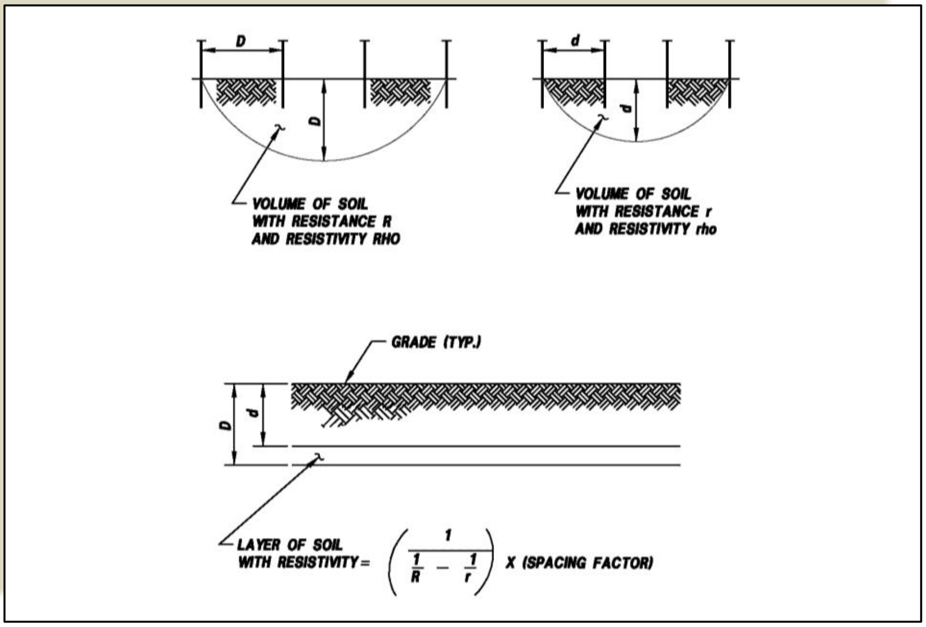


Fig 2: Illustration of Barnes Layer Calculations

In-Situ Soil Resistivity Analysis

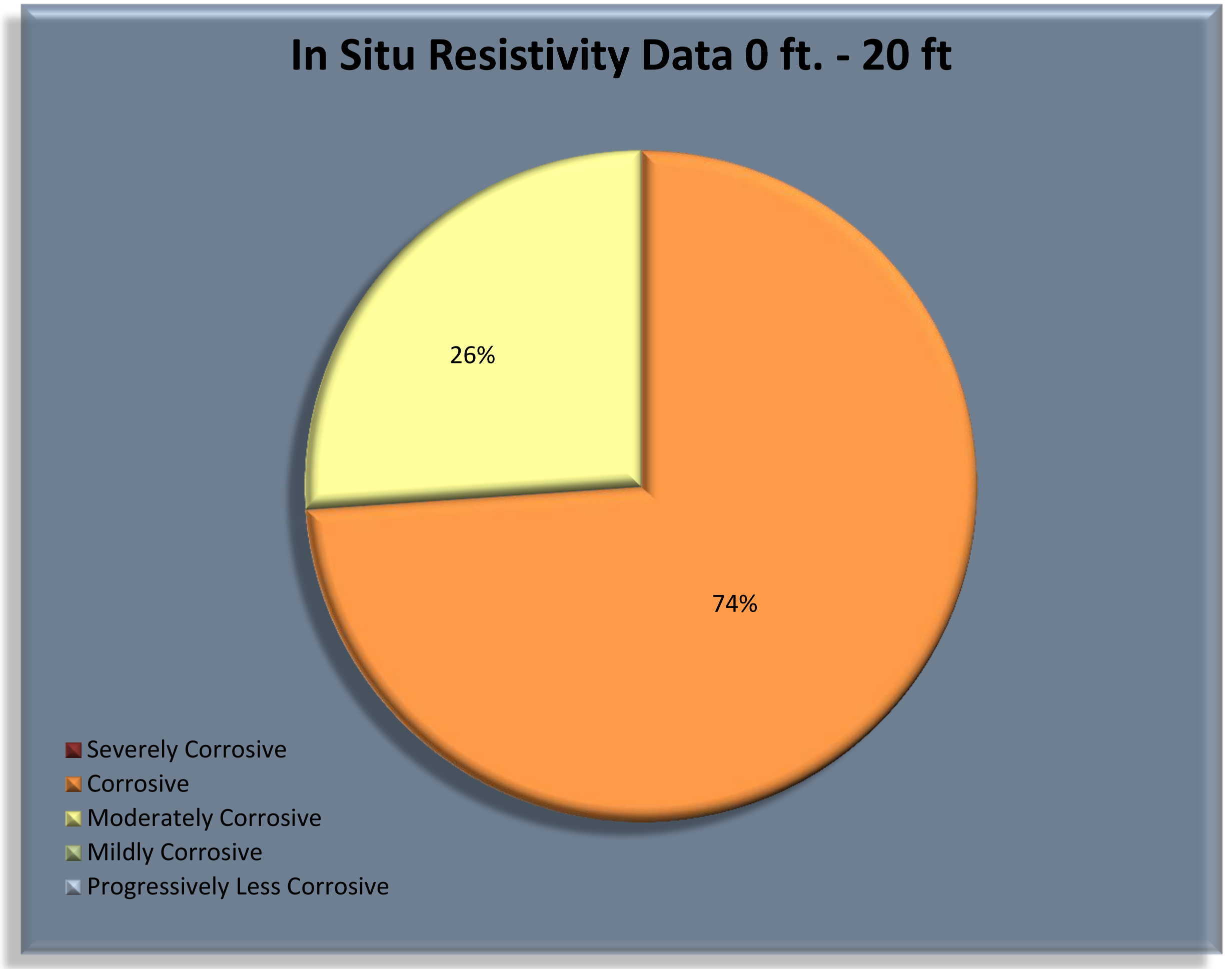
Corrosion of a metal is an electro-chemical process and is accompanied by the flow of electric current. Resistivity is a measure of the ability of a soil to conduct an electric current and is, therefore, an important parameter in consideration of corrosion data. Soil resistivity is primarily dependent upon the chemical content and moisture content of the soil mass.

The greater the amount of chemical constituents present in the soil, the lower the resistivity will be. As moisture content increases, resistivity decreases until maximum solubility of dissolved chemicals is attained. Beyond this point, an increase in moisture content results in dilution of the chemical concentration and resistivity increases. The corrosion rate of steel in soil normally increases as resistivity decreases. Therefore, in any particular group of soils, maximum corrosion will generally occur in the lowest resistivity areas. The following classification of soil corrosivity, developed by William J. Ellis[1], is used for the analysis of the soil data for the project site.

Resistivity (Ohm-cm)	Corrosivity Classification
0 – 500	Very Corrosive
501 – 2,000	Corrosive
2,001 – 8,000	Moderately Corrosive
8,001 – 32,000	Mildly Corrosive
> 32,000	Progressively Less Corrosive

The above classifications are appropriate for the project site and the results are presented in the graphs below. In general, the soils are classified as “moderately corrosive to corrosive” with respect to corrosion of buried cast/ductile iron and steel structures throughout the top 0 to 20 feet of the site.

The chart of the in-situ soil resistivity data for the soil layers 0 to 20 feet indicated that 74% of the soils are classified as "corrosive" and 26% of the soils are classified as "moderately corrosive."



Discussion

Reinforced Concrete Foundations

Due to the low levels of water-soluble sulfates found in these soils, there is no special requirement for sulfate resistant concrete to be used at this site. The type of cement used should be in accordance with California Building Code (CBC) for soils which have less than 0.10 percent by weight of water soluble sulfate (SO_4) in soil and the minimum depth of cover for the reinforcing steel should be as specified in CBC as well.

Underground Metallic Pipelines

The soils at the project site are considered to be “moderately corrosive to corrosive” to ductile/cast iron, steel and dielectric coated steel. Therefore, we recommend the use of coatings, and/or polyethylene encasement, supplemented with cathodic protection for direct buried metallic pressure piping such as domestic and fire water pipelines. All underground pipelines should also be electrically isolated from above grade structures, reinforced concrete structures and copper lines in order to minimize potential galvanic corrosion problems.

Recommendations

Reinforced Concrete Foundations

We recommend using a Type II concrete mix with a water-to-cement ratio as specified in the California Building Code (CBC) for soils containing less than 0.10% water soluble sulfate by weight. Adhering to the minimum depth of cover for the reinforcing steel in the foundations as specified in the CBC is recommended for the subject structures as well.

Ductile Iron Pipe (Pressure Piping such as Domestic Water and Fire)

1. Direct buried ductile iron pipe should be encased in 8-mil polyethylene as specified in AWWA specification C-105. Epoxy coatings are also an acceptable alternative type of coating system for the pipe and/or fittings such as valves.
2. All rubber gasket joints, fusion-bonded epoxy coated flanges and flexible couplings on ductile iron pipelines should be bonded with insulated copper cable to insure electrical continuity of the pipeline and fittings.
3. Insulating flanges and/or couplings should be installed to electrically isolate the buried portion of pipeline from other metallic pipelines, reinforced concrete structures and above grade buildings or structures.
4. Test stations shall be installed on all ductile iron pipelines at a spacing of 800 to 1,000 feet. Bonding and test stations shall comply with NACE Standards.
5. A sacrificial type of cathodic protection utilizing magnesium anodes should be installed to protect the entire length of buried metallic pipeline. Cathodic protection should be designed in accordance with NACE Standard SP0169-13 and applicable local standards and included with the contract documents to permit installation along with the pipeline.
6. As an alternate, non-metallic piping may be used in lieu of ductile iron piping as allowed by State and local codes. Non-metallic piping does not require the implementation of any special type of corrosion prevention measures. However, all metallic valves, fittings and appurtenances on non-metallic piping will require protection as specified below.

Ductile Iron Fittings & Metallic Valves (On Plastic Pressure Piping)

1. All direct buried ductile iron fittings installed on non-metallic piping shall be provided with a bituminous coating from the factory and encased in an 8-mil polyethylene bag in the field in accordance with AWWA Specification C-105. All bolts, restraining rods, etc. shall be coated with bitumastic prior to encasement in the polyethylene bag.

2. All metallic valves shall be coated from the factory (i.e. using powdered epoxy or equivalent type of coating system) and all bolts shall be coated with bitumastic in the field and the entire valve shall be encased in an 8-mil polyethylene bag in accordance with AWWA Specification C-105.

3. A sacrificial type of cathodic protection utilizing magnesium anodes should be installed to protect the valves and fittings. Cathodic protection should be designed in accordance with NACE Standard SP0169-13 and applicable local standards and included with the contract documents to permit installation along with the pipeline.

Cast Iron (Gravity Sewer and Storm Drain Lines)

1. No special corrosion considerations are required for gravity sewer and storm drain lines.

Steel Pipelines (Natural Gas Pipelines & Risers)

1. A fusion-bonded epoxy coating system or a suitable tape coating should be applied to all buried steel pipelines in accordance with ANSI/AWWA C214-95, “AWWA Standard for Tape Coating Systems for the Exterior of Steel Water Pipelines.” Also, a tape coating per AWWA Standard C209-95 is recommended for special sections, connections and fittings.

2. Insulating flanges and/or couplings should be installed to electrically isolate the buried portions of steel pipelines from other metallic pipelines, reinforced concrete structures and above grade structures.

3. All rubber gasket joints, fusion epoxy coated flanges and flexible couplings should be bonded with insulated copper cable to insure electrical continuity of the pipeline and fittings.

4. A sacrificial type of cathodic protection using magnesium anodes should be installed to protect the buried portions of steel pipelines used for the natural gas piping systems. Cathodic protection should be designed in accordance with NACE Standard SP0169-13 and applicable local standards and included with the contract documents to permit installation along with the subject pipeline.

5. As an alternate, non-metallic piping may be used in lieu of steel piping as allowed by State and local codes. Non-metallic piping does not require the implementation of any special type of corrosion prevention measures.

<u>Copper Water Pipelines (Service Lines)</u>

1. All copper water laterals shall be provided with a 6-mil polyethylene sleeve to effectively isolate the copper piping from the earth.

2. All copper water laterals shall be electrically isolated from metallic water mains via the use of insulating type corporation stops installed at the water main.

LIMITATIONS

The conclusions and recommendations contained in this report reflect the opinion of the author of this report and are based on the information and assumptions referenced herein. All services provided herein were performed by persons who are experienced and skilled in providing these types of services and in accordance with the standards of workmanship in this profession. No other warrantees or guarantees either expressed or implied are provided.

We thank you for the opportunity to be of assistance on this important project. If you have any questions concerning this report or the recommendations provided herein, please feel free to contact us at (925) 927-6630.

Respectfully submitted,

Sergio Maciel

Sergio Maciel, P.E.
JDH Corrosion Consultants, Inc.
Project Engineer

REGISTERED PROFESSIONAL ENGINEER
SERGIO BASSOCO MACIEL
No. CH 6848
Exp. March 31, 2020
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Mohammed Ali

Mohammed Ali, P.E.
JDH Corrosion Consultants, Inc.
Principal

REGISTERED PROFESSIONAL ENGINEER
MOHAMMED ALI
No. CR 1035
Exp. June 30, 2019
CORROSION
STATE OF CALIFORNIA

CC: File 18169

REFERENCES

1. *Ellis, William J., <u>Corrosion of Concrete Pipelines,</u> Western States Corrosion Seminar, 1978*

2. *AWWA Manual of Water Supply Practices - M27, First Edition, <u>External Corrosion - Introduction to Chemistry and Control</u> (Denver, CO: 1987)*

3. *National Association of Corrosion Engineers, Standard Recommended Practice, <u>SP 01-69-13, Control of External Corrosion on Underground or Submerged Pipeline</u>*

APPENDIX F

Geophysical Survey Report

ADVANCED GEOLOGICAL SERVICES

1605 School Street, #4
Moraga CA 94556
925 (808-8965)

August 6, 2018

Eric Johnson, PE
Senior Engineer
1330 Broadway #1200
Oakland, Ca 94612

Subject: **Geophysical Investigation Report**
CyrusOne Property
Santa Clara, California

Mr. Johnson-

1.0 INTRODUCTION

This report presents the results of Advanced Geological Services, Inc. (AGS) geophysical investigation at the CyrusOne site at 2600 De La Cruz Boulevard in Santa Clara, California (Figure 1). The investigation objective was to locate and map buried utilities, buried debris, and other substructures such as underground storage tanks (USTs) and undocumented foundation remnants. In addition, AGS scanned eight pre-marked locations for buried utilities and other subsurface obstructions so they could be avoided during subsequent drilling and sampling activities. The field work was performed on July 12 and 13, 2018 by AGS geophysicist Roark Smith, who used a RadioDetection RD-8000 pipe-and-cable locating system, a GSSI SIR-3000 ground penetrating radar (GPR) system, a Fisher TW-6 M-Scope, and a Geonics EM31 terrain conductivity meter.

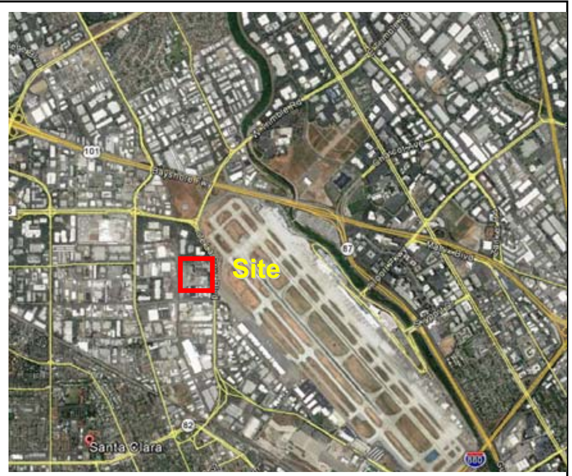


Figure 1 –Site Location Map, Santa Clara, California

Briefly, the RD-8000 and M-Scope were used to look for buried utilities, while the EM31 was used to look for larger metallic substructures and pockets of buried debris. GPR was used to look for non-metallic subsurface features, both buried utilities and other substructures as well as debris pockets. In general, EM surveying can be an important part of a subsurface investigation because it usually provides a deeper investigation depth than GPR, which can be as shallow as two feet at some sites. Depending on their size, the EM methods can detect objects as deep as 12 feet or greater; however, it is recognized that they can detect only larger objects at that depth.

2.0 RESULTS SUMMARY

- The investigation results and are presented on Figures 2 through 7. Figures 2, 3, and 4 show the locations of underground utilities and metallic objects that were detected in the western, central, and eastern portions of the investigation area, respectively. Figures 5, 6 and 7 are color-filled contour maps of the EM31 terrain conductivity data from those same areas.

- Overall, AGS detected numerous buried utilities, including electrical cables, storm drains, natural gas and water pipes. One of the more notable utility layouts is the network of metal pipes observed in several valve pits found in the western “back lot” portion of the site. Other notable utility alignments include the electrical feeder cables, a natural gas pipe, and a large-diameter water pipe that runs east toward the plant complex from the large above-ground storage tank.

- A dense network of underground utilities and other possible substructures was detected in the back lot, within a 100- by 190-foot area between the above-ground tank and the plant buildings. Potential substructure(s) were also detected at there other locations.

- In the front (eastern) parking lot AGS detected a number of water pipes, electrical cables, telcom cables, storm drain and sanitary sewer pipelines.

- GPR did not perform well at the CyrusOne site due to the electrically conductive soil/fill, which limited GPR signal penetration depth to less than 3 feet below ground surface (bgs).

3.0 SITE DESCRIPTION

The investigation was performed across an approximately 11-acre area surrounding the plant and warehouse buildings of an inactive, closed paper mill complex (Figure 2). The site includes a number of distinctive “sub-areas”, including the 1.5-acre landscaped front parking lot area alongside De La Cruz Boulevard; the 3.7-acre paved back lot area, which is crossed by railroad tracks and contains a large above-ground storage tank but is otherwise comprised mostly of open space; an electrical substation, and other small areas that are crowded with boilers, dryers, cooling towers, and other types of machinery.

4.0 GEOPHYSICAL METHODS AND EQUIPMENT

The geophysical investigation was performed using the following geophysical instruments and methods:

- Underground utility locating, using a RadioDetection RD-8000 pipe-and-cable locating system

- Ground Penetrating Radar (GPR) using a GSSI SIR-3000 connected to a 270-MHz antenna

- Frequency-domain electromagnetics, using a Geonics EM31 Terrain Conductivity Meter

- Utility locating and metal-detecting using a Fisher TW-6 M-Scope

4.1 RF Utility Locating using an RD-8000

Briefly, the RD-8000 system locates energized electrical power lines by detecting the magnetic field associated with flowing electrical current. High-voltage cables, especially, are readily detected with RF locating systems. Additionally, the RD-8000 can locate metal pipes and unenergized cables if a tracing signal (i.e., a weak electrical current) can be applied using the RD-8000 transmitter; they can also be located by detecting radio signals traveling within them; the radio signals are ambient signals from distant sources (e.g., a radio station transmitter) that are captured naturally by the utility (which acts as a buried radio antenna). The RD-8000 receiver has various modes of operation for detecting utilities as they radiate signals from electrical current, ambient radio waves, and/or the specific tracing frequencies applied with the RD-8000 transmitter.

Using the RD-8000 transmitter to apply tracing signals of a specific known frequency directly to a utility that daylights in or near the survey area is the best way to detect underground utilities because this approach produces the strongest tracing signal within the utility. The tracing signals can be applied in two ways: either directly or indirectly. The RD transmitter can be directly connected via a jumper wire to a daylighting portion of a metal pipe (a metal ground stake is used to complete the circuit). In areas without exposed utilities a signal can be applied indirectly-- the RD-8000 transmitter placed on the ground surface within the search area, which enables a tracing signal to be transferred to nearby utilities via natural electromagnetic induction. A third approach that is particularly important for utility tracing at electrical substations uses an inductive clamp to apply tracing signals to insulated cables or cables running inside conduit, which are accessed from within pull-boxes and junction boxes.

4.2 Ground Penetrating Radar (GPR)

GPR uses radar technology to produce a graphical profile of the subsurface in a "fish-finder" type display that shows soil layering and images of buried objects. Although its investigation depth is typically limited, GPR can locate buried objects with greater precision, both horizontally and vertically, than EM and magnetic methods. In addition, GPR can be used to search for non-metallic targets. Most GPR systems comprise a single transceiving antenna (one that both transmits and receives the radar signal) that is dragged along the ground surface. The antenna emits a radar pulse into the ground; some of the radar energy reflects off of interfaces between materials with different electrical properties (e.g., soil and a UST) and returns to the surface where it is detected by the antenna and sent via an umbilical cable to a separate control unit, which amplifies the signal and displays it on a computer screen as a vertical "wiggle trace," which is a plot of the strength (amplitude) of the received GPR signal (i.e., the reflection) over time. Although the vertical scale of a GPR profile is usually considered as depth, it actually measures the travel time of the radar pulse from the surface to a reflecting interface and back to the surface.

A subsurface profile is built as the antenna is pulled along the survey line and successive wiggle traces are recorded. GPR data are usually displayed as an array of closely-spaced traces; this procedure produces an image of the subsurface as the reflections (wiggles) on adjacent traces merge into coherent patterns. Soil layer boundaries appear as laterally continuous horizontal bands across a GPR profile. Buried objects appear as localized, high-amplitude (dark) reflection patterns. Buried pipes and USTs often exhibit a characteristic "upside down U" hyperbolic pattern, which allows them to be readily identified on a GPR record. Buried refuse often appears as zones of chaotic reflection patterns that disrupt the horizontal layering on a GPR profile. Although GPR can be subject to significant investigation depth limitations, it is used for shallow subsurface investigations because of its high-resolution capabilities and because it has the potential to detect non-metallic targets. Burial depths are determined by using calibrating GPR profiles with images objects buried at known depths. Culverts and storm drain pipelines observed in drop inlets are often used for this purpose.

4.3 Electromagnetic Terrain Conductivity using a Geonics EM31

The EM31 measures the electrical conductivity of subsurface materials; it is used for shallow geologic and groundwater investigations and to look for areas of buried refuse. It can also detect larger metal items and metallic underground utilities. The instrument measures conductivity by inducing small electrical currents to flow in the subsurface in such a manner that the strength of the induced current is proportional to electrical conductivity. The EM31 consists of a transmitter and receiver coils on a fixed PVC boom. Briefly, alternating electrical current flowing within the transmitter coil produces a magnetic field that penetrates into the subsurface, causing (inducing) small electrical currents to flow in the subsurface. These subsurface currents have their own magnetic fields, which are detected and measured by the receiver coil. The induced current strength is proportional to conductivity, which allows the EM31 to be calibrated to measure conductivity directly. For subsurface investigations, variations in EM conductivity ("terrain conductivity") can indicate changes in the material properties of soil, rock, and fill material, the presence of buried refuse, and buried utilities and other types of metallic substructures.

4.4 Electromagnetic Metal Detecting using the TW-6 M-Scope

AGS uses the M-Scope to look for discontinuous metal utilities (e.g., a jointed cast-iron drain pipe) and localized metal masses (e.g., a buried manhole cover), which are not readily detected by RF locating systems such as the RD-8000. The M-Scope comprises a pair of wire coils (transmitter and receiver coils); the receiver soil is first "tuned" to a null position with respect to the magnetic field emanating from the transmitter coil. When the M-Scope is held near a metal object, the magnetic field becomes distorted and the system is thrown "out-of-tune." The M-Scope is designed to emit an audible tone when it becomes out of tune, thus signaling the presence of a nearby metal object. For substation surveys, the M-Scope is particularly useful for discriminating between ground cables and conduit runs because ground cables produce a strong (loud) response from the instrument, whereas conduits respond weakly, if at all, to M-Scope scanning.

5.0 FIELD PROCEDURES

In general, AGS scanned each site "sub-area" separately, beginning in the front parking lot, taking special care to identify each of the eight proposed drilling locations and subject them to focused, detailed scanning with each of the geophysical instruments to identify any nearby buried utilities. At each area, AGS first scanned with the RD-8000 and M-Scope and marked the locations of detected utilities and other anomalous response areas on the ground surface with fluorescent pink spray paint. After verifying the type of utility detected (e.g., electrical, storm drain, water, natural gas), AGS re-marked the utility location with the appropriate colors— red for electrical, green for storm drain, yellow for natural gas; unidentified utilities and anomaly areas were marked with pink paint.

Next, AGS performed the terrain conductivity survey by hand-carrying the EM31 instrument back-and-forth across the site along north-south and east-west lines spaced approximately 25 feet apart. Horizontal positioning data were obtained using a backpack-mounted Trimble Pro-XR Global Positioning System (GPS). The EM31 was programmed to obtain two readings a second, which corresponds to a conductivity reading every four feet along the survey lines. Approximately 40,000 line-feet (7.6 miles) of EM31 data were collected for this investigation.

AGS then performed the Ground Penetrating Radar (GPR) survey. GPR data were obtained by wheeling the cart-mounted GPR system along a north-south/east-west reconnaissance grid of lines spaced approximately 25 feet apart, with additional more closely-spaced scans obtained around the proposed drilling locations, and at EM31 anomalies and other features of interest. Approximately 10,200 line-feet of GPR data were obtained.

After the geophysical surveys were completed, AGS prepared a map of the investigation findings thus far (e.g., detected underground utilities) using a Trimble Pro-XR Global Positioning System (GPS). AGS also mapped prominent site features such as fences, roads, valve pits, pavement cut patches, pavement slabs, railroad tracks. The GPS information was used to aid the interpretation of the EM31data and to prepare a basemap upon which the investigation findings are presented (Figures 2 – 7).

6.0 DATA PROCESSING AND ANALYSIS

The M-Scope, RD-8000, and GPR data were analyzed in the field as the investigation progressed. The M-Scope and RD-8000 instruments are designed to produce an audible tone when held near a metallic object; a detected object's location is then pinpointed by adjusting the instrument's sensitivity and monitoring the instrument readout to determine the "peak signal" location. Accordingly, the AGS geophysicist used the two instruments in such a manner to pinpoint the locations of detected utilities, which were marked on the ground surface with fluorescent pink spray paint. For the GPR survey, AGS monitored the GPR data in the field and to look for "upside-down V" reflection patterns indicative of buried utilities, and/or underground storage tanks, and pronounced "flat spot" images and/or other lateral discontinuities indicative of buried foundation remnants.

The EM31 data processing and analysis was done using the GEOSOFT Oasis montaj earth science software system. A GEOSOFT kriging algorithm was used to prepare color-filled contour maps showing EM31 response variations across the site (Figures 5, 6, and 7). To identify substructures and potential buried refuse areas, AGS looked for high-amplitude EM31 responses not readily attributable to observed surface metal objects. Such responses are considered "anomalies" and are attributed to subsurface source bodies, which may include refuse, USTs, buried utilities, and reinforced concrete foundations. On the color contour maps EM31 anomalies can appear as both "hot" (red-pink) and "cool" (blue) colors representing terrain conductivity measurements above and below background readings, respectively. As a further aid to the analysis, data profiles for each survey transect were prepared and inspected. The profiles are especially useful for assessing anomaly amplitudes and for identifying bad data caused by, say, a low-battery condition or a loose connection or other type of equipment malfunction.

EM31 anomalies indicating buried refuse often appear as areas of elevated terrain conductivity readings, which are caused by electrically conductive leachate from decaying domestic waste, and/or by the accumulation and infiltration of stormwater runoff in the topographic depression caused by settling of the fill material. In addition, buried refuse can exhibit more subtle conductivity increases where the refuse material covers and/or has displaced electrically resistive (i.e., less conductive) native soil and rock. It is worth noting, however, that elevated conductivity can also have a natural geologic cause, such as an increase in clay, salt, and/or moisture content in the native soil. Above-ground metallic objects, such as buildings and chain-link fences, can produce a similar elevated response. Conversely, buried metal objects can produce lower conductivity readings and in some instances even "negative" conductivity values, which are caused by an over-saturation and distortion of the EM31 system and are not a true conductivity measurement. In addition, EM31 responses in buried refuse areas containing large metal objects, such as appliances and vehicles, often exhibit abrupt, high-amplitude positive and negative "kicks."

GPR analysis entails plotting the locations of notable reflection patterns on a basemap and looking for patterns that would suggest an underground storage tank, buried pipe, foundation, refuse pocket, etc. On GPR profiles, buried objects typically appear as localized high-amplitude ("dark") images against a background of horizontal or gently undulating bands indicative of undisturbed soil or fill material. Typical buried object images are a broad "upside-down U" reflection pattern that would indicate a UST, and the narrow "upside-down Vs" associated with buried pipes. Flat, high-amplitude reflection patterns indicate building foundation remnants and other substructures, while buried refuse appears as zones of chaotic reflection patterns.

7.0 RESULTS

The investigation results and are presented on Figures 2 through 7. Figures 2, 3, and 4 show the locations of underground utilities and metallic objects that were detected in the western, central, and eastern portions of the investigation area, respectively. Figures 5, 6 and 7 are color-filled contour maps of the EM31 terrain conductivity data from those same areas.

Overall, AGS detected numerous buried utilities throughout the site, including electrical cables, storm drains, natural gas and water pipes. One of the more notable utility layouts is the network of metal pipes observed in several valve pits found in the western "back lot" portion of the site. AGS has labeled this piping network as "process water" piping on the Report figures. Other notable utility alignments include electrical feeder cables running across the back lot into the plant complex from utility poles along the western property line. In addition, a large-diameter water pipe was detected running east toward the plant complex from the large above-ground storage tank along the western edge of the back lot. A large-diameter natural gas pipe was also detected in this area.

A dense network of underground utilities and other possible substructures was detected in the same back lot area, within an approximately 100- by 190-foot area between the above-ground tank and plant buildings. Potential substructure(s) were also detected in three other areas of the western back lot (see Figures 2 and 5). No significant substructures were detected in the southern half of the back lot.

AGS detected a number of water pipes, electrical cables, telcom cables, storm drain and sanitary sewer pipelines in the front parking lot area in the eastern portion of the site.

Geophysical locating methods were not very effective in central portion of the site due to high noise levels produced by nearby large surface metal objects such as buildings and machinery. The narrow corridor north of the Mill and Dryer building (Figures 3 and 6) was particularly noisy. GPR can be useful for subsurface investigations in such high-noise areas; however, GPR did not perform well at the CyrusOne site due to the electrically conductive soil/fill, which limited GPR signal penetration depth to less than 3 feet below ground surface (bgs).

8.0 CLOSING

All geophysical data and field notes collected for this investigation will be archived at the AGS office. The data collection and interpretation methods used in this investigation are consistent with standard practices applied to similar geophysical investigations. The correlation of geophysical responses with probable subsurface features is based on the past results of similar surveys although it is possible that some variation could exist at this site. Due to the nature of geophysical data, no guarantees can be made or implied regarding the targets identified or the presence or absence of additional objects or targets.

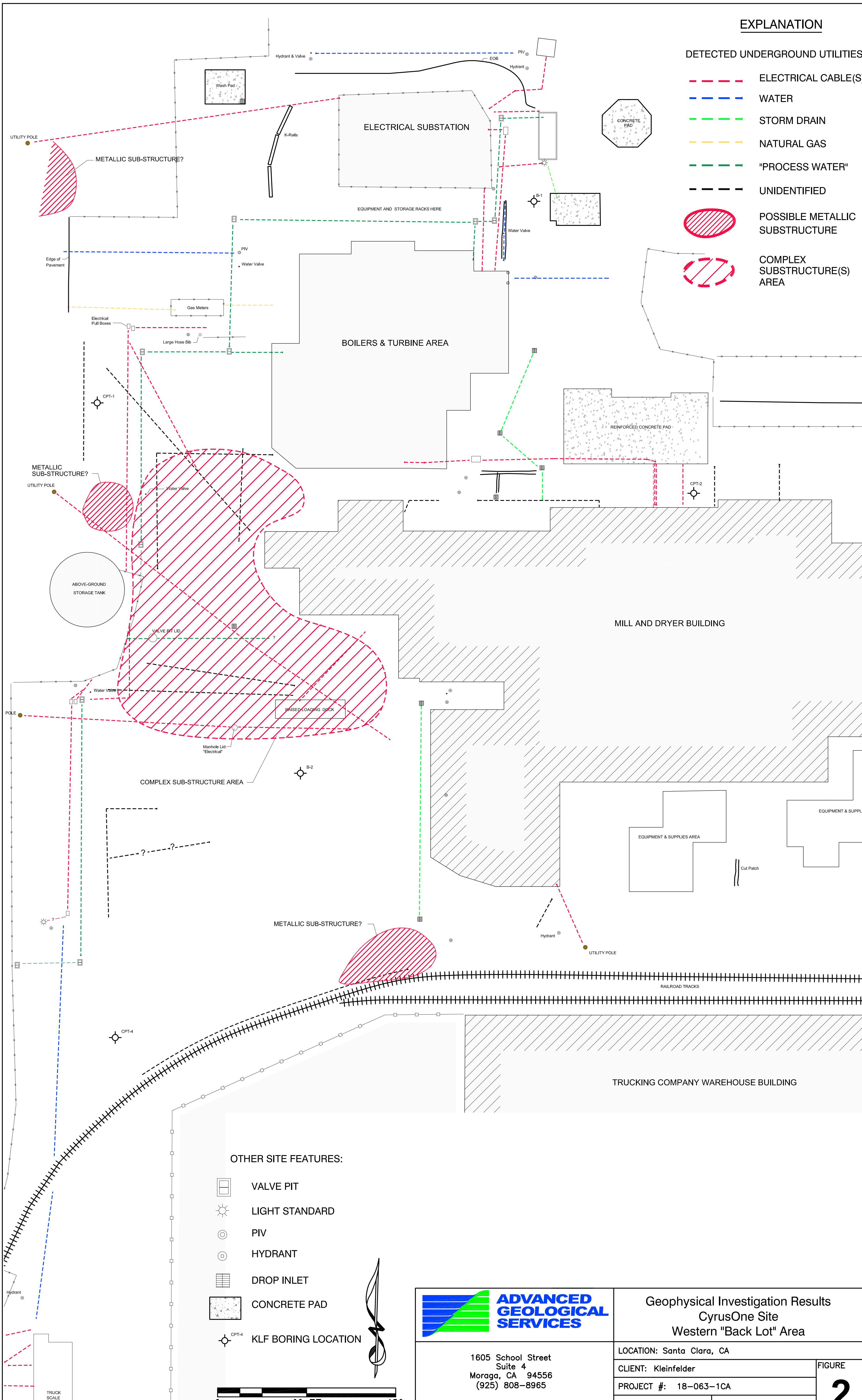
We appreciated working for you on this project and hope to work with you again. If you have any questions, I can be reached at (925) 808-8965 or Rsmith@Advancedgeo.com.

Respectfully,

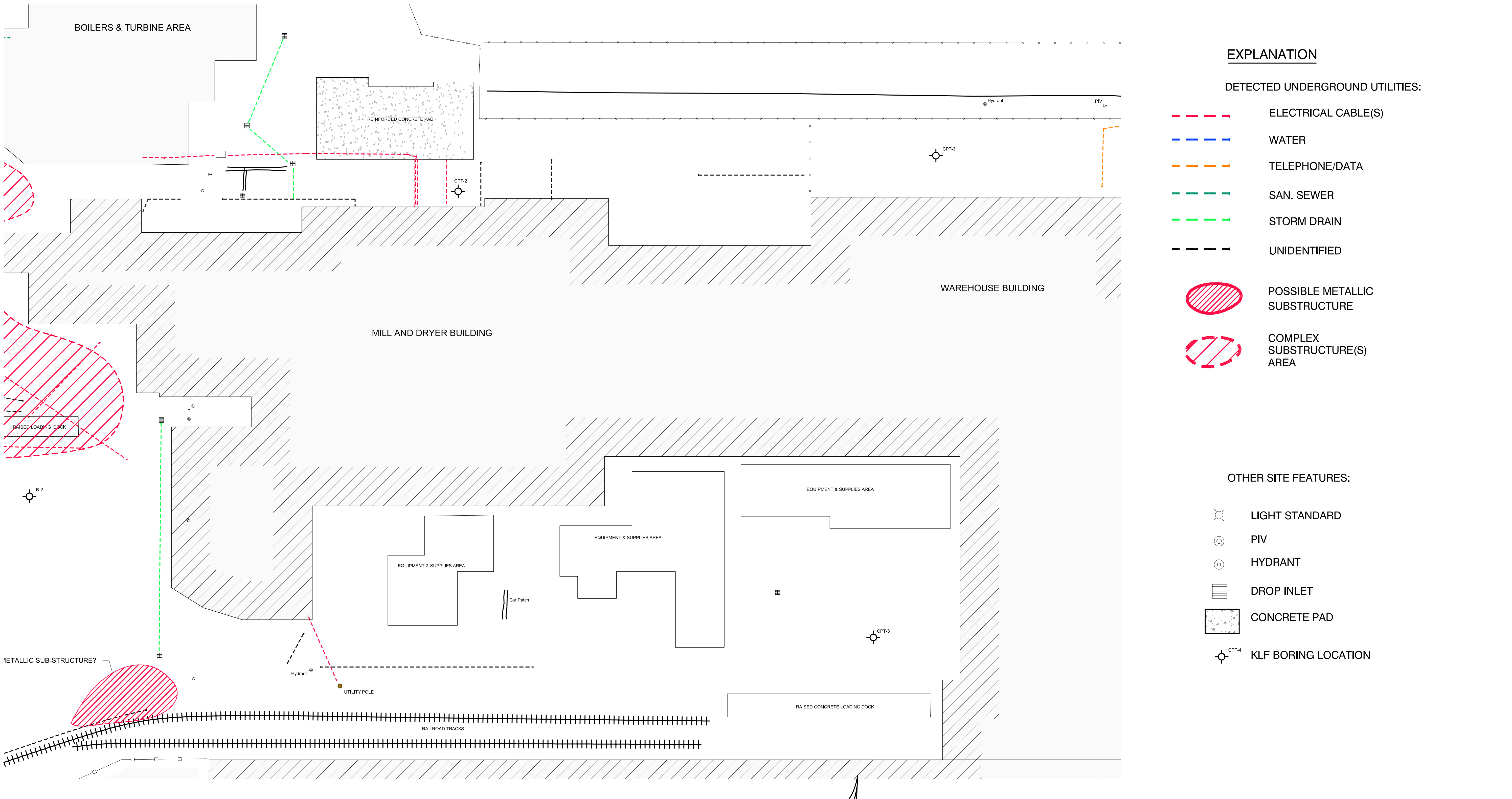
Roark W. Smith, GP 987
Senior Geophysicist
Advanced Geological Services

Figures:

Figure 1	Site Location Map (imbedded in Report text, above)
Figure 2	Geophysical Investigation Results, Western "Back Lot" Area
Figure 3	Geophysical Investigation Results, Central Area
Figure 4	Geophysical Investigation Results, Eastern "Front Parking Lot" Area
Figure 5	EM31 Survey Results, Western "Back Lot" Area
Figure 6	EM31 Survey Results, Central Area
Figure 7	EM31 Survey Results, Eastern "Front Parking Lot" Area



EXPLANATION
DETECTED UNDERGROUND UTILITIES:
ELECTRICAL CABLE(S)
WATER
STORM DRAIN
NATURAL GAS
"PROCESS WATER"
UNIDENTIFIED
POSSIBLE METALLIC SUBSTRUCTURE
COMPLEX SUBSTRUCTURE(S) AREA
OTHER SITE FEATURES:
VALVE PIT
LIGHT STANDARD
PIV
HYDRANT
DROP INLET
CONCRETE PAD
KLF BORING LOCATION
CPT-4
0
60 FT
120
ELECTRICAL SUBSTATION
BOILERS & TURBINE AREA
MILL AND DRYER BUILDING
TRUCKING COMPANY WAREHOUSE BUILDING
REINFORCED CONCRETE PAD
EQUIPMENT AND STORAGE RACKS HERE
EQUIPMENT & SUPPLIES AREA
EQUIPMENT & SUPPLIE
ABOVE-GROUND STORAGE TANK
METALLIC SUB-STRUCTURE?
COMPLEX SUB-STRUCTURE AREA
RAISED LOADING DOCK
VALVE PIT LID
Manhole Lid: "Electrical"
UTILITY POLE
POLE
Hydrant & Valve
Hydrant
PIV
EOB
Wash Pad
K-Rails
CONCRETE PAD
Water Valve
Edge of Pavement
Gas Meters
Electrical Pull Boxes
Large Hose Bib
Cut Patch
RAILROAD TRACKS
TRUCK SCALE
CPT-1
CPT-2
B-1
B-2
ADVANCED GEOLOGICAL SERVICES
1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965
Geophysical Investigation Results
CyrusOne Site
Western "Back Lot" Area
LOCATION: Santa Clara, CA
CLIENT: Kleinfelder
PROJECT #: 18-063-1CA
DATE: Aug 6, 2018
DRAWN BY: R. SMITH
FIGURE
2



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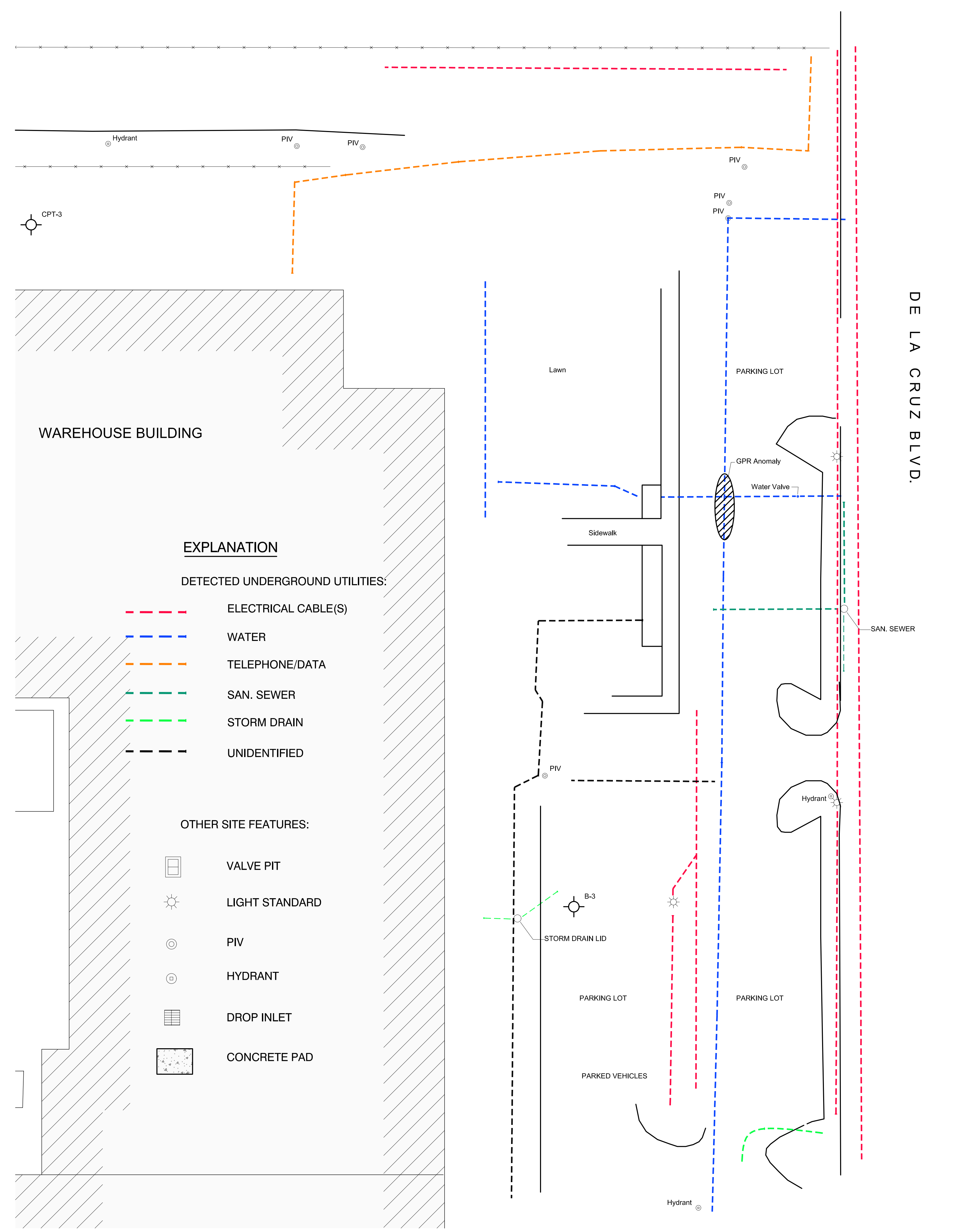
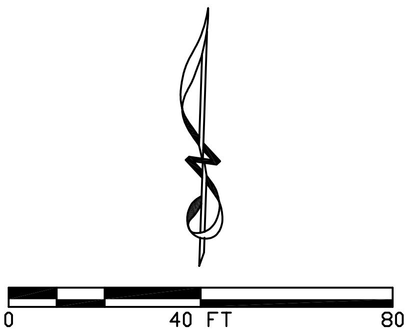
Geophysical Investigation Results
CyrusOne Site
Central Area

LOCATION: Santa Clara, CA	
CLIENT: Kleinfelder	FIGURE
PROJECT #: 18-063-1CA	3
DATE: Aug 6, 2018 / DRAWN BY: R. SMITH	





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1605 School Street
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(925) 808–8965

Geophysical Investigation Results
CyrusOne Site
Front Parking Lot Area

LOCATION: Santa Clara, CA

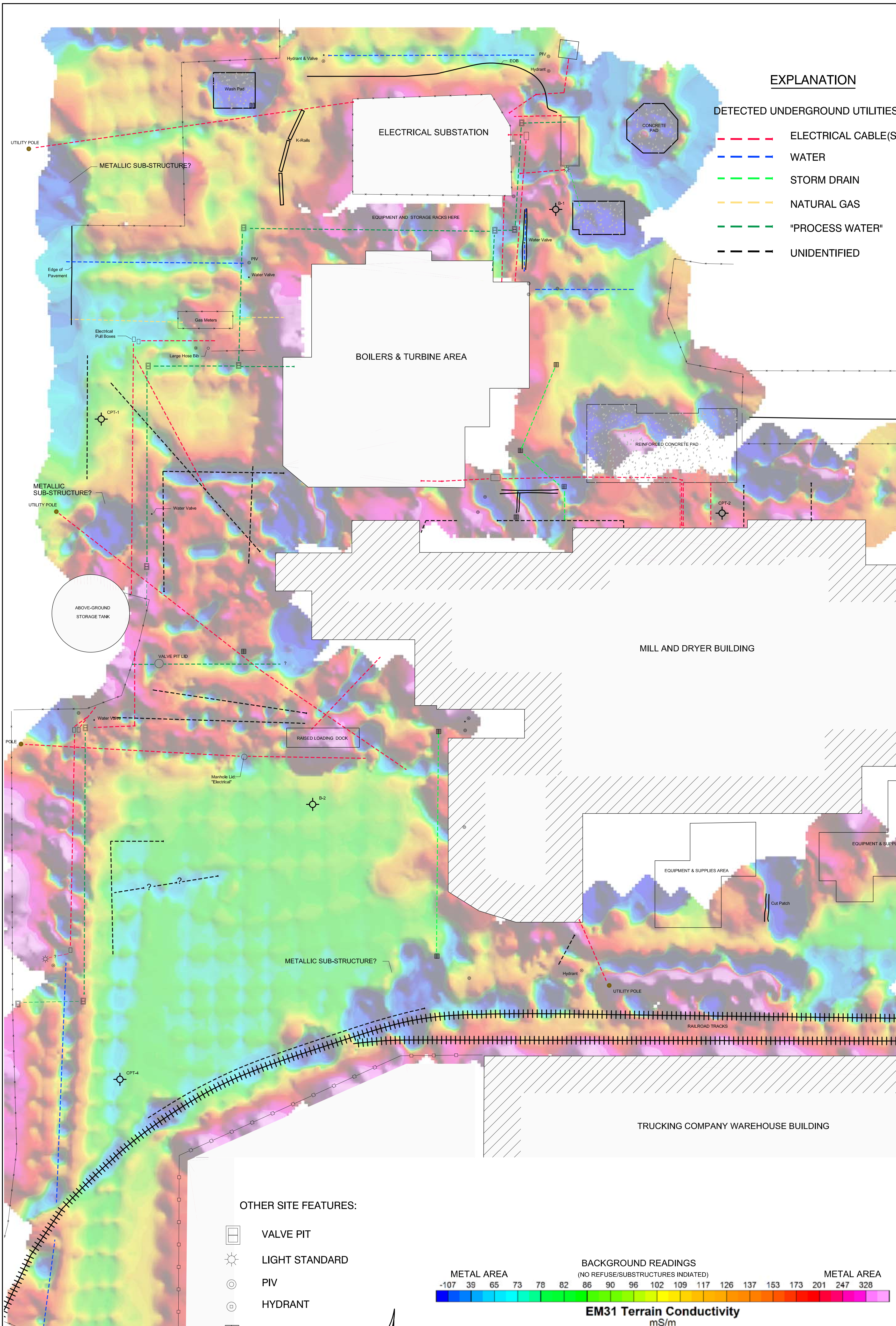
CLIENT: Kleinfelder

PROJECT #: 18–063–1CA

DATE: Aug 6, 2018

DRAWN BY: R. SMITH

FIGURE
4



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1605 School Street
Suite 4
Moraga, CA 94556
(925) 808–8965

EM31 Survey Results
CyrusOne Site
Western "Back Lot" Area

LOCATION: Santa Clara, CA

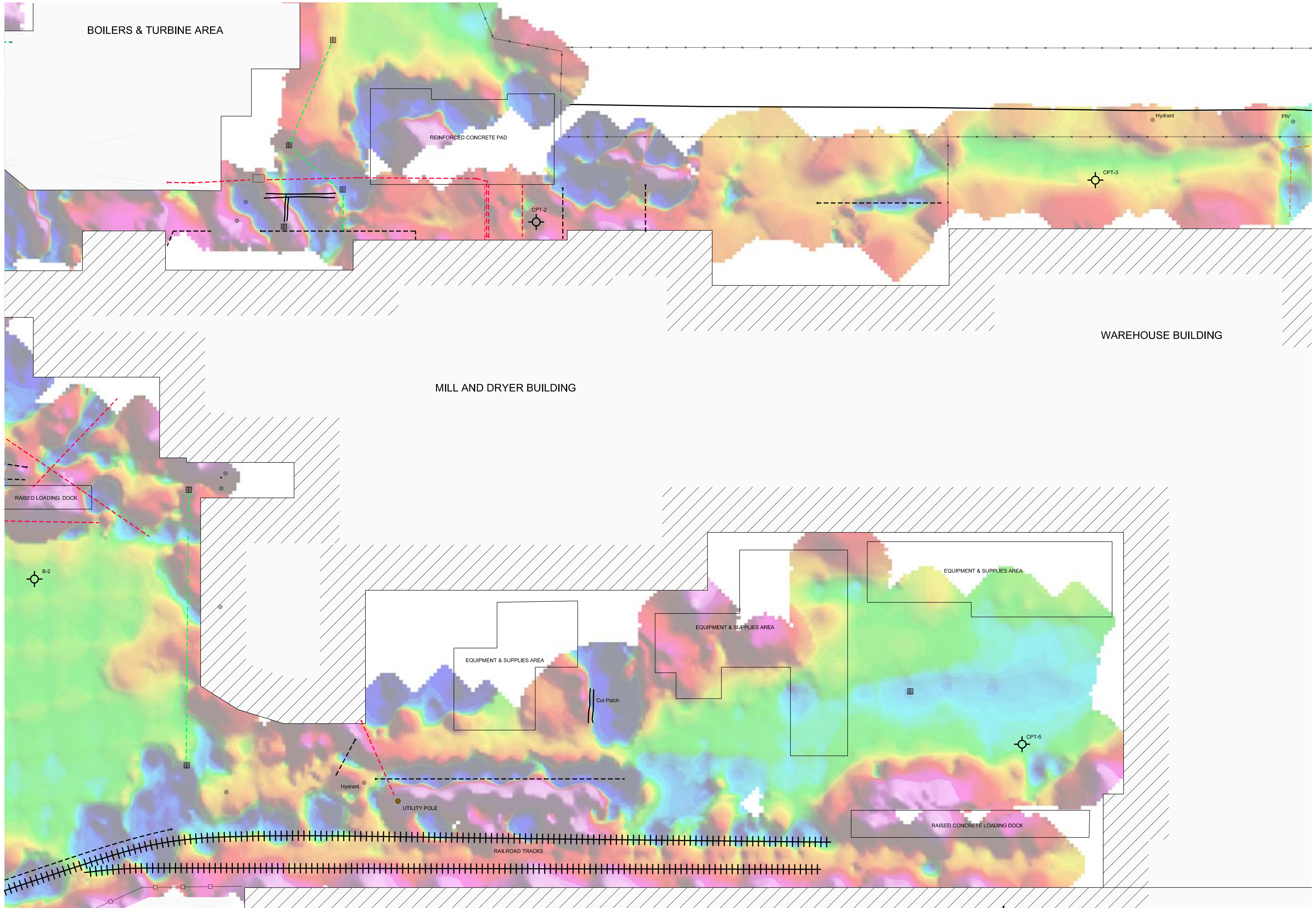
CLIENT: Kleinfelder

PROJECT #: 18–063–1CA

DATE: Aug 6, 2018

DRAWN BY: R. SMITH

FIGURE 5



EXPLANATION

DETECTED UNDERGROUND UTILITIES:

- ELECTRICAL CABLE(S)
- WATER
- TELEPHONE/DATA
- SAN. SEWER
- STORM DRAIN
- UNIDENTIFIED

OTHER SITE FEATURES:

- LIGHT STANDARD
- PIV
- HYDRANT
- DROP INLET
- CONCRETE PAD
- CPT-4 KLF BORING LOCATION

METAL AREA — BACKGROUND READINGS (NO REFUSE/SUBSTRUCTURES INDIATED) — METAL AREA

-107 39 65 73 78 82 86 90 96 102 109 117 126 137 153 173 201 247 328

EM31 Terrain Conductivity
mS/m

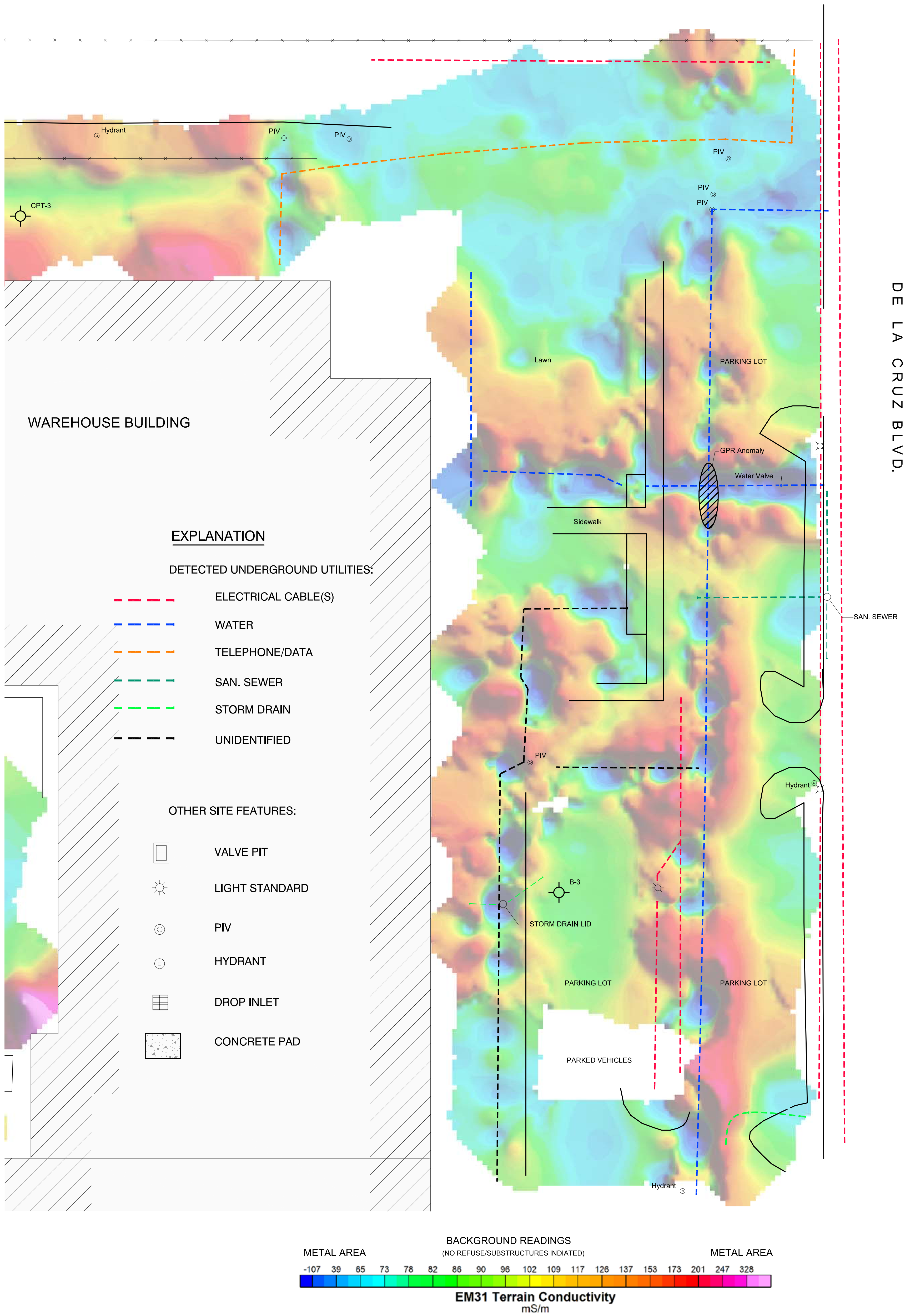
0 60 FT 120

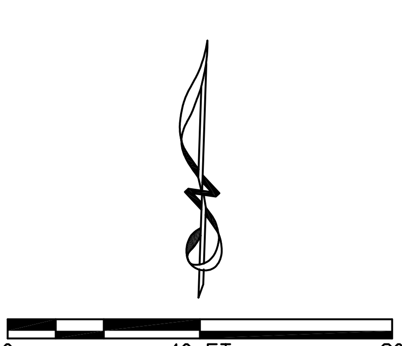
ADVANCED GEOLOGICAL SERVICES

1605 School Street
Suite 4
Moraga, CA 94556
(925) 808–8965

EM31 Survey Results
CyrusOne Site
Central Area

LOCATION: Santa Clara, CA
CLIENT: Kleinfelder
PROJECT #: 18–063–1CA
DATE: Aug 6, 2018
DRAWN BY: R. SMITH
FIGURE 6





ADVANCED GEOLOGICAL SERVICES

1605 School Street
Suite 4
Moraga, CA 94556
(925) 808-8965

EM31 Survey Results
CyrusOne Site
Front Parking Lot Area

LOCATION: Santa Clara, CA

CLIENT: Kleinfelder

PROJECT #: 18-063-1CA

DATE: Aug 6, 2018

DRAWN BY: R. SMITH

FIGURE 7

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APPENDIX F: AIR QUALITY AND GREENHOUSE GAS TECHNICAL REPORT

Prepared for
CyrusOne
Santa Clara, California

Prepared by
Ramboll US Corporation
San Francisco, California

Project Number
1690013366
August 2019

AIR QUALITY AND GREENHOUSE GAS TECHNICAL REPORT – SEQUOIA DATA CENTER AND SEQUOIA BACKUP GENERATING FACILTIY

CYRUSONE PROJECT SEQUOIA
SANTA CLARA, CALIFORNIA

CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATIONS

AERMOD	American Meteorological Society/Environmental Protection Agency regulatory air dispersion model
AQ	Air Quality
ARB	California Air Resources Board
aREL	Acute Reference Exposure Level
ASF	Age Sensitivity Factor
BAAQMD	Bay Area Air Quality Management District
Cal/EPA	California Environmental Protection Agency
CAP	Criteria Air Pollutant
CEQA	California Environmental Quality Act
CH_4	Methane
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide equivalent
CPF	Cancer Potency Factor
cREL	Chronic Reference Exposure Level
DPF	Diesel Particulate Filter
DPM	Diesel Particulate Matter
GHG	Greenhouse Gas
HI	Hazard Index
HQ	Hazard Quotient
HRA	Health Risk Assessment
MAF	Modelling Adjustment Factor
MEIR	Maximally Exposed Individual Resident
MEISR	Maximally Exposed Individual Sensitive Receptor
MEIW	Maximally Exposed Individual Worker
MESCR	Maximally Exposed Soccer Child Receptor
N_2O	Nitrogen Dioxide
NOx	Nitrous Oxide
OEHHA	Office of Environmental Health Hazard Assessment
$PM_{2.5}$	Fine Particulate Matter Less than 2.5 Micrometers in Aerodynamic Diameter

PM_{10}	Respirable Particulate Matter Less than 10 Micrometers in Aerodynamic Diameter
PMI	Point of Maximum Impact
ppm	part per million
REL	Reference Exposure Level
ROG	Reactive Organic Gas
RPS	Renewables Portfolio Standard
TAC	Toxic Air Contaminant
TOG	Total Organic Gas
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

<u>Units</u>

g	Gram
kg	Kilogram
m	Meter
MT	Metric Ton
MW	Megawatts
MWh	Megawatts Hour
µg	Microgram
$\mu g/m^3$	Micrograms per cubic meter
m^3/kg-day	Milligrams per kilogram per day
m^3	Cubic meters
mg	Milligram
s	Second
tpy	Ton per Year
yr	Year

EXECUTIVE SUMMARY

CyrusOne LLC (CyrusOne)'s Project Sequoia at 2600 De La Cruz Boulevard is a proposed new data center and backup generating facility in Santa Clara, California. The Sequoia Data Center (SDC) and Sequoia Backup Generating Facility (SBGF) would be located on a 15-acre plot bounded by rail tracks and existing warehouse buildings to the West, De La Cruz Boulevard and the San Jose International Airport to the East, an Enterprise Rent a Car facility to the North, and One Work Place, a furniture warehouse to the South. The proposed plan for the SBGF includes fifty-four (54) 2.25-megawatts (MW) emergency diesel generators to provide back-up power for the data center which may draw up to 67.5 MW to support the maximum critical IT load and up to 96.5 MW total of power from the grid to support the total maximum SDC demand. The construction of the SDC and SBGF would take place in one phase from 2020 to 2021. The site has been demolished in accordance with a demolition permit issued by the City of Santa Clara.[1] Therefore, for environmental baseline purposes, the site is vacant and unpaved. Development of the site would include the construction of an approximately 702,000 square feet SDC data center building and 141 parking spaces. Approximately 70,00 square feet of the SDC building would be dedicated for administrative and office uses.

This report evaluates the air quality (AQ) and greenhouse gas (GHG) impacts, together with risks and hazards associated with the SBGF operational activities. In addition, at the request of CyrusOne, Ramboll US Corporation (Ramboll) has conducted a California Environmental Quality Act (CEQA) analysis of criteria air pollutants (CAPs) and precursor emissions associated with the proposed construction and operation of the SDC and SBGF. Ramboll also estimated GHG emissions from construction and operation of the SDC and SBGF and performed a health risk assessment (HRA) of SBGF operations. The local air agency, the Bay Area Air Quality Management District (BAAQMD) has published CEQA Guidelines for use in determining significance, which will apply here for AQ and GHG (BAAQMD 2011).[2] As shown in **Table ES-1**, the relevant thresholds for Project Sequoia are:

- Construction CAP and precursor emissions
- Operational CAP and precursor emissions
- Local carbon monoxide (CO) concentrations[3]
- Operational GHG emissions
- Excess lifetime cancer risk, chronic hazard index (HI), acute HI, and fine particulate matter ($PM_{2.5}$) concentrations from SBGF operation on off-site receptors; and

1 All that is remaining on the site at the time of this report is miscellaneous piping and foundations associated with a demolished cogeneration facility.

2 A March 2012 Alameda County Superior Court judgment determined that the BAAQMD had failed to evaluate the environmental impacts of the land use development patterns that would result from adoption of the thresholds and ordered the thresholds set aside. The Court of Appeal reversed that judgment and the California Supreme Court decided the limited issue that CEQA does not require an analysis of the environment's impact on a project, with the exception of schools.

3 CO concentrations are addressed separately in our report "CyrusOne Sequoia Backup Generating Facility: Air Dispersion Modeling Report".

- Cumulative excess lifetime cancer risk, chronic HI, and $PM_{2.5}$ concentration from SBGF operation and surrounding sources on off-site receptors.

Construction and operational CAP and GHG emissions were calculated using the California Emissions Estimator Model (CalEEMod®) version 2016.3.2, using project-specific information where available. Emissions from backup generator operations were estimated using manufacturer's data for stationary sources (emergency generators).

Health impacts from diesel particulate matter and speciated on-road total organic gas (TOG) emissions were calculated consistent with guidance in BAAQMD's 2011 CEQA guidelines (BAAQMD 2011) and the 2015 California Environmental Protection Agency (Cal/EPA) Office of Environmental Health Hazard Assessment (OEHHA) Hot Spots Guidance (2015). Consistent with BAAQMD and OEHHA Hot Spots guidance, health impacts were based on emissions of toxic air contaminants (TACs). Concentrations of TACs were estimated using AERMOD, a Gaussian air dispersion model recommended by United States Environmental Protection Agency (USEPA), California Air Resources Board (ARB), and BAAQMD for use in preparing environmental documentation for stationary sources. Health impacts were calculated using the TAC concentrations and TAC toxicities and exposure assumptions consistent with the 2015 OEHHA Hot Spots guidance.

Table ES-1 shows the SDC and SBGF emissions and the BAAQMD CEQA thresholds.

Table ES-1: Summary of SDC and SBGF Construction and Operational Emissions

	ROG	**NOx**	**PM_{10}**	**$PM_{2.5}$**
Construction Daily Emissions (lb/day)				
SDC and SBGF Emissions	15.5	23	0.8	0.8
BAAQMD CEQA Thresholds	***54***	***54***	***82***	***54***
Operational Daily Emissions (lb/day)				
SDC and SBGF Emissions	21	8.4	4.4	2.1
BAAQMD CEQA Thresholds	***54***	***54***	***82***	***54***
Operational Annual Emissions (tpy)[4]				
SDC and SBGF Emissions	3.9	1.5	0.81	0.39
BAAQMD CEQA Thresholds	***10***	***10***	***15***	***10***

4 Total annual operational emissions for the SBGF is estimated based on 50 hours of operation for maintenance and testing per engine each year.

Table ES-2 shows the SBGF operational health impacts and the BAAQMD CEQA thresholds.

Table ES-2: Summary of SBGF Operational Health Impacts at the Maximally Exposed Individual Resident (MEIR)

	Excess Lifetime Cancer Risk in one million	Noncancer Chronic HI (unitless)	Noncancer Acute HI (unitless)	$PM_{2.5}$ Concentration ($\mu g/m^3$)
SBGF Operational Health Impacts				
SBGF Impacts	0.19	0.00005	0.10	0.00026
BAAQMD CEQA Thresholds	***10***	***1***	***1***	***0.3***

1. INTRODUCTION

At the request of CyrusOne, Ramboll US Corporation (Ramboll) has prepared this technical report documenting air quality (AQ) and greenhouse gas (GHG) analyses for the construction and operational activities of Project Sequoia, which includes the proposed Sequoia Data Center (SDC) and the proposed Sequoia Backup Generating Facility (SBGF), located at 2600 De La Cruz Boulevard in Santa Clara, California . The analyses follow the Bay Area Air Quality Management District (BAAQMD) California Environmental Quality Act (CEQA) Guidelines released in 2011 (BAAQMD 2011).[5]

1.1 Project Description

The proposed SDC and SBGF would be located at 2600 De La Cruz Boulevard and bounded by rail tracks and existing warehouse buildings to the West, De La Cruz Boulevard and the San Jose International Airport to the East, an Enterprise Rent a Car facility to the North, and One Work Place, a furniture warehouse to the South. The property is an approximately 15-acre lot. The proposed location and boundary are shown in **Figure 1**. The SDC and SBGF would be developed over one construction phases from 2020 to 2021. At full build-out, Project Sequoia would include fifty-four (54) 2.25-megawatts (MW) capacity Tier-2 emergency generators with diesel particulate filters (DPF) (a total backup capacity of 96.5 MW), housed in a generation yard adjacent to the west and south sides of the four-story data center building. A driveway, surface parking spaces, and outdoor storage areas on the east side of the building are planned to be concrete-paved.

1.2 Objective and Methodology

The BAAQMD 2011 CEQA Guidelines contain recommended thresholds for operational criteria air pollutant (CAP) and precursor emissions, GHG emissions, and risks and hazards associated with toxic air contaminant (TAC) emissions from an individual project (BAAQMD 2011). This report evaluates the AQ and GHG impacts associated with the construction and operation of the SDC and SBGF. This report also evaluates the health risks and hazards associated with SBGF operations on off-site receptors, and the cumulative impact to off-site sensitive receptors from backup generator operations and surrounding sources. Since construction emissions are below the BAAQMD thresholds (as shown in Section 2.1 below) and the closest receptors are 1,500 feet away (as discussed in Section 3.3 below), construction health impacts are expected to be minimal and therefore a refined construction HRA was not performed.

1.3 Thresholds Evaluated

The AQ analysis of this report evaluates the daily and annual regional emissions of criteria pollutants and precursors from operation of the backup generators and evaluates these emissions against BAAQMD's May 2011 significance thresholds for emissions (BAAQMD 2011). These thresholds are as follows:

Construction CAP Emissions:

[5] A March 2012 Alameda County Superior Court judgment determined that the BAAQMD had failed to evaluate the environmental impacts of the land use development patterns that would result from adoption of the thresholds and ordered the thresholds set aside. The Court of Appeal reversed that judgment and the California Supreme Court decided the limited issue that CEQA does not require an analysis of the environment's impact on a project, with the exception of schools.

- Average daily emissions of Reactive Organic Gases (ROG) greater than 54 pounds per day (lb/day);
- Average daily emissions of Nitrogen Oxides (NOx) greater than 54 lb/day;
- Average daily exhaust emissions of particulate matter less than 10 micrometers in diameter (PM10) greater than 82 lb/day; and
- Average daily exhaust emissions of fine particulate matter less than 2.5 micrometers in diameter (PM2.5) greater than 54 lb/day.
- Operational CAP Emissions:
- Average daily emissions of ROG greater than 54 lb/day, or maximum annual emissions of 10 tons per year (tpy);
- Average daily emissions of NOx greater than 54 lb/day, or maximum annual emissions of 10 tpy;
- Average daily emissions of PM10 greater than 82 lb/day, or maximum annual emissions of 10 tpy; and
- Average daily emissions of PM2.5 greater than 54 lb/day, or maximum annual emissions of 10 tpy.
- Local carbon monoxide (CO) concentrations:
- 8-hour average concentration of 9.0 parts per million (ppm)
- 1-hour average concentration of 20.0 ppm

The GHG analysis of this report evaluates the GHG emissions from operation of the SDC and SBGF and evaluates these emissions against BAAQMD's May 2011 significance thresholds for emissions. These thresholds are as follows:

- Stationary source direct GHG emissions of 10,000 metric tonnes per year (MT/yr) and
- Direct and indirect GHG emissions of 1,100 MT/yr or
- Direct and indirect GHG emissions per service population of 4.6 metric tonnes per service population (MT/SP) or
- For direct and indirect GHG emissions, compliance with a Qualified GHG Reduction Strategy.

The health risk assessment (HRA) in this report evaluates the estimated cancer risk, noncancer chronic hazard index (HI), acute HI, and $PM_{2.5}$ concentration associated with the SBGF's operational emissions of Toxic Air Contaminants (TACs). The Toxic Air Contaminants considered are those included in BAAQMD Rule 2-5, New Source Review of Toxic Air Contaminants. No chronic or acute health impacts are shown for CAPs, including NO_2, consistent with BAAQMD CEQA guidance. The HRA evaluates potential sensitive receptor locations including:

- "Residential dwellings, including apartments, houses, condominiums;
- Schools, colleges, and universities;
- Daycares;

- Hospitals; and
- Senior-care facilities." (BAAQMD 2012a)

Ramboll conducted a sensitive receptor search within the 1,000-foot zone of influence, and determined that the only sensitive receptors are residential dwellings to the southwest of the Project Sequoia site. However, for completeness, Ramboll also included a nearby soccer facility (2,130 feet from project site) directly south of the Project Sequoia site as a potential sensitive receptor and a childcare receptor (about 4,000 feet from project site) located Southeast of the site.

To meet the above stated objectives, this HRA was conducted consistent with the following guidance:

- Air Toxics Hot Spots Program Risk Assessment Guidelines (Office of Environmental Health Hazard Assessment [OEHHA] 2015);
- May 2011 BAAQMD CEQA Guidelines (BAAQMD 2011); and
- BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards (BAAQMD 2012a).

Ramboll compared the results of emissions and health risk analyses to the BAAQMD 2011 CEQA significance thresholds. Operational health impacts of the SBGF were compared against the BAAQMD 2011 CEQA single source thresholds. The thresholds are:

Single Source Impacts:

- An excess lifetime cancer risk level of more than 10 in one million;
- A noncancer chronic HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ concentration of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$).

If a project does not exceed the identified significance thresholds, its emissions would not be cumulatively considerable. For reference, the BAAQMD 2011 cumulative CEQA significance thresholds are:

- An excess lifetime cancer risk level of more than 100 in one million;
- A noncancer chronic HI greater than 10.0; and
- An annual average $PM_{2.5}$ concentration of greater than 0.8 micrograms per cubic meter ($\mu g/m^3$).

1.4 Report Organization

This technical report is divided into eight sections as follows:

Section 1.0 – Introduction: describes the purpose and scope of this technical report, the objectives and methodology used in this technical report, and the report organization.

Section 2.0 – Emission Estimates: describes the methods used to estimate the emissions of CAPs, GHGs, and TACs from the SDC and SBGF;

Section 3.0 – Estimated Air Concentrations: discusses the air dispersion modeling, the selection of the dispersion models, the data used in the dispersion models (e.g., terrain, meteorology, source characterization), and the identification of residential and sensitive locations evaluated in this technical report.

Section 4.0 – Risk Characterization Methods: provides an overview of the methodology for conducting the HRA.

Section 5.0 – Project Health Risk Assessment: presents the estimated emissions of CAPs and GHGs, estimated excess lifetime cancer risks, chronic noncancer HIs, acute noncancer HIs, and $PM_{2.5}$ concentrations for the SBGF.

Section 6.0 – References: includes a listing of all references cited in this report.

2. EMISSION ESTIMATES

Ramboll estimated CAP, GHG, and TAC emissions from construction of the SDC and SBGF from 2020 to 2021, as well as emissions from the operation of the SDC and SBGF. The CAPs of interest include ROG, NOx, $PM_{2.5}$ and PM_{10} (the BAAQMD thresholds for construction specify exhaust PM only). The GHGs of interest include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O), which are commonly combined by global warming potential-weighted average into carbon dioxide equivalents (CO_2e). One of the TACs of interest is diesel particulate matter (DPM), emissions of which are assumed to be equal to exhaust PM_{10} from on- and off-road construction equipment, and exhaust PM_{10} from backup diesel engines during operation. Other TACs are speciated from TOG from on-road emissions from gasoline vehicles. These emissions estimates were used to compare to BAAQMD thresholds and as inputs to the operational HRA. The methodologies used by Ramboll are summarized below.

Tables 1 and **2** present the SDC and SBGF characteristics and land use assumptions used in the emissions estimation.

2.1 Calculation Methodologies for Construction Emissions

Emissions from construction activities were estimated using the California Emissions Estimator Model (CalEEMod®). CalEEMod® was developed by Ramboll (then known as Ramboll Environ) in collaboration with the California Air Pollution Control Officers Association for use in developing emission inventories suitable for CEQA analysis. Sources of construction CAP and TAC emissions are exhaust from off-road equipment, on-road vehicles and ROG emissions from architectural coating and paving activities.

2.1.1 Emissions from Off-road Equipment

CAP and TAC emissions from off-road equipment were based on the equipment inventory, equipment specifications, their daily usage and construction phasing schedule based on CalEEMod® defaults. CalEEMod® defaults are based on the Project land use area for each type.

2.1.2 Emissions from On-road Vehicles

CalEEMod® estimates CAP and TAC emissions from on-road haul trucks and worker and vendor trips based on vehicle type, emission factor, distance travelled, and number of trips. The number of truck and construction worker and vendor trips are from the CalEEMod® default trip rates. The Project Sequoia construction trip generation is shown in **Appendix A**. Emission factors used are the CalEEMod® defaults. All hauling trucks were assumed by CalEEMod® to be Heavy Heavy Duty Trucks (HHDT), vendor trucks were assumed to be 50% HHDT and 50% Medium Heavy Duty Truck, and worker vehicles were assumed to be a 50%/25%/25% mix of Light Duty Automobiles, Light Duty Truck class 1 and Light Duty Truck class 2, consistent with CalEEMod® defaults. CalEEMod® contains fuel-type information by fleet mix for each year. The default trip lengths in CalEEMod® were used. That is, for haul trucks, a 20-mile one-way trip length was used. For worker trips a 10.8-mile trip length was used. For vendor trips a 7.3-mile trip length was used.

2.1.3 Emissions from Architectural Coating and Asphalt Paving

ROG off-gassing emissions from paving are calculated based on the paved parking area of the Project Sequoia site using CalEEMod®'s Volatile Organic Compounds (VOC) per square foot emission factor.

ROG off-gassing emissions from architectural coating are calculated based on the square footage of the new buildings, an assumed VOC content of the paint, and an application rate of 100%, consistent with CalEEMod®. The VOC content of the indoor and outdoor paints are assumed to be consistent with the limits set in BAAQMD Regulation 8, Rule 3 (BAAQMD 2009).

2.1.4 Summarized Construction Emissions:

CAP emissions from SDC and SBGF construction phases were added and then normalized over the number of days in the construction period. CAP emissions from on- and off-road construction sources are presented in **Table 3**. Additionally, GHG emissions for construction are presented for informational purposes in **Table 3**.

CalEEMod® outputs for SDC and SBGF construction emissions per construction phase are included in **Appendix A** of this technical report.

2.2 Calculation Methodologies for Operational Emissions

Emissions from SDC and SBGF operation were estimated using CalEEMod® for land-use and building emissions and manufacturer's data for stationary sources (emergency generators).

2.2.1 Stationary Sources

The proposed SBGF includes 54 diesel back-up emergency generators, the locations of which are shown in **Figure 1**. **Table 9a** presents controlled emission factors used to calculate average daily emissions and annual criteria pollutant emission based on for 50 hours of operation per year per generator for testing and maintenance . This table also includes uncontrolled emission factors and DPF abatement efficiencies used to calculate the controlled emission. **Table 9b** presents daily and annual emissions based on 50 hours of operational for testing and maintenance purposes, plus an additional 100 hours of operation during emergence periods for each generator. The additional 100 hours of emergency operation for each engine is based on a recent policy adopted by BAAQMD for emergency generators (BAAQMD 2019). Ramboll used United States Environmental Protection Agency (USEPA) Engine Family Certification emissions factors with reductions. Engine emissions are based on non-emergency operations (primarily the schedule of testing that is required for the generators) and the planned number of hours of non-emergency operations (in accordance with BAAQMD Regulation 2, Rule 5). Consistent with BAAQMD permitting methods, no load factor is applied. Annual non-emergency operation is limited to 50 hours, as stated in the Airborne Toxic Control Measure for Stationary Toxic Compression Ignition Engines (Section 93115, Title 17, CCR). As discussed above, operational emissions are calculated assuming all 54 back-up generators operate for 50 hours each per year. However, CyrusOne estimates normal maintenance and testing would be on the order of less than 11 hours per year. Emission rates were averaged over the period of a year since the emergency generators could potentially be tested at any time of day or day of year. **Tables 8** also presents the daily and annual CAP emissions from non-emergency operation of the backup engines, with annual GHG emissions also presented in **Table 11**. GHG emissions were calculated following the same methodology as described above for CAPs. GHG emission factors were obtained from AP-42 documentation for Large Stationary Diesel Engines. Ramboll used the USEPA Mandatory Reporting Rule emission factors for CH_4 and N_2O emissions (USEPA 2013), which were added to develop a carbon dioxide equivalent (CO_2e) emission factor using the same global warming potentials as in CalEEMod®.

2.2.2 Land Use Sources

Ramboll used CalEEMod® to estimate CAP and GHG emissions due to electricity usage, natural gas usage, mobile sources, area sources such as landscaping maintenance equipment, water treatment and distribution, and wastewater usage.

Annual GHG emissions associated with electricity usage are the product of estimated annual electricity usage and the utility-specific carbon intensity factor, which depends on the utility's portfolio of power generation sources. The proposed SDC is served by Silicon Valley Power. For the SDC's first year of operation, 2021, Ramboll used a carbon intensity value of 271 pounds CO_2 per MWh, based on data provided by Silicon Valley Power and the City of Santa Clara (City of Santa Clara, 2019). To be conservative, since the Silicon Valley Power carbon intensity may already include CH_4 and N_2O, the CalEEMod® default CH_4 and N_2O intensity factors of 0.029 and 0.006 pounds of CO_2e per MWh, respectively, were used for all years considered.

The annual electricity usage from general building operation was estimated based on building energy usage from CalEEMod® with the addition of supplemental energy usage for data center operations. The land-use specific CalEEMod® default energy use rates were adjusted to incorporate the 2019 Title 24 energy efficiency standards, as presented in **Table 4**.

Energy use from the data center activities was estimated by the applicant to be 655,633 MWh/year. Total energy usage estimates for SDC operations are presented in **Table 5**.

CAP and GHG emissions associated with energy usage (on-site natural gas and building electricity use plus data center electricity demand) are shown in **Table 6 and Table 7,** respectively.

Ramboll relied on a project operational trip generation consistent with the transportation discussion in the SPPE Application. We understand this is a conservative assessment of trips because data centers tend to produce fewer trips than the characteristic land use from Institute of Transportation Engineers.

In addition, annual GHG emissions associated with water usage were based on estimated annual water usage of 686,672 gallons per year for landscaping and 1,565,351 gallons per year of potable water use. Summary of Project Operational Criteria Pollutant Emissions

Total SDC and SBGF operational CAP emissions are the sum of land-use and emergency generator emissions, as shown in **Table 6**. As required by BAAQMD Rule 2-2, the BAAQMD will provide offsets for stationary source NOx emissions (i.e., the emergency generators). The emissions in **Table 6** are average daily emissions, for comparison to the BAAQMD threshold for average daily emissions.

CalEEMod® outputs for SDC and SBGF operational emissions are included in **Appendix A** of this technical report.

2.2.3 Summary of Project Operational GHG Emissions

GHG emissions for SDC and SBGF operation are presented in **Table 7**. CalEEMod® outputs for SDC and SBGF operational emissions are included in **Appendix A** of this technical report. GHG emissions from the emergency generators are subject to the BAAQMD CEQA threshold for stationary sources. The land-use and building energy GHG emissions are summarized in Table 7.

Electricity usage makes up nearly 99% of the operational SDC GHG emissions, with mobile sources making up slightly under half a percent. GHG emissions associated with electricity usage from the data center will continue to decline after 2021 due to increasing requirements for renewable power in California. As described above, electricity to the SDC would be provided by SVP, a utility that is on track to meet the 2030 GHG emissions reductions target established by AB 32. Mobile source emissions will also decline after 2020 due to increasing fuel efficiency and electric car market penetration.

3. ESTIMATED AIR CONCENTRATIONS

SDC and SBGF operational activities will generate emissions that will be transported outside of the physical boundaries of the Project Sequoia site, potentially impacting nearby sensitive receptors such as residential areas. Methodologies to estimate concentrations resulting from SDC and SBGF operational activities are provided below. Ramboll performed a refined HRA for non-emergency operation of the emergency generators.

3.1 Chemical Selection

The cancer risk, chronic, and acute hazards in the refined HRA for the SBGF stationary source operations were based on TAC emissions from the SBGF. Modeled sources of TACs include the diesel-powered emergency generators. Accordingly, the chemicals to be evaluated in the HRA were DPM and speciated total organic gases (TOG) in diesel exhaust. DPM emissions are assumed to be equal to exhaust PM_{10} from backup diesel engines during operation.

Diesel exhaust, a complex mixture that includes hundreds of individual constituents, is identified by the State of California as a known carcinogen (California Environmental Protection Agency [Cal/EPA] 1998). Under California regulatory guidelines, DPM is used as a surrogate measure of exposure for the mixture of chemicals that make up diesel exhaust as a whole. Cal/EPA and other proponents of using the surrogate approach to quantifying cancer risks associated with the diesel mixture indicate that this method is preferable to use of a component-based approach. A component-based approach involves estimating risks for each of the individual components of a mixture. Critics of the component-based approach believe it will underestimate the risks associated with diesel as a whole mixture because the identity of all chemicals in the mixture may not be known and/or exposure and health effects information for all chemicals identified within the mixture may not be available. Furthermore, Cal/EPA has concluded that "potential cancer risk from inhalation exposure to whole diesel exhaust will outweigh the multi-pathway cancer risk from the speciated components" (OEHHA 2003). The DPM analyses for cancer and chronic hazards will be based on the surrogate approach, as recommended by Cal/EPA. In the absence of an acute toxicity value for diesel exhaust, speciated TOG will be used as a conservative estimate.

3.2 Sources of Emissions

The relevant emissions sources of TACs for the refined HRA are the emergency generators during operation. Emissions estimates for operational mobile sources are not included in the refined HRA since BAAQMD screening tools are used to assess operational mobile source health impacts.

3.3 Air Dispersion Modeling

AERMOD Version 18081 was used to evaluate ambient air concentrations of DPM, $PM_{2.5}$ and TOG at off-site receptors from SBGF non-emergency use of the backup generators. For each receptor location, the model generates air concentrations that result from emissions from multiple sources. If unit emissions (i.e., 1 g/s) are modeled, the resultant value for each receptor location is called the air dispersion factor.

Air dispersion models such as AERMOD require a variety of inputs such as source parameters, meteorological conditions, topographical information, and receptor parameters. Modeling parameters are shown in **Table 12**. The Project Sequoia boundary is shown in **Figure 1**.

Meteorological data: Air dispersion modeling requires the use of meteorological data that ideally are spatially and temporally representative of conditions in the immediate vicinity of the site under consideration. Ramboll used surface meteorological data from the San Jose Airport for years 2013 through 2017, with upper air data collected at the Oakland Airport for the same time period. Data were processed using AERMINUTE (15272) and AERMET (18081). The meteorological data was processed using the ADJ_U* option that reduces overprediction of modeled concentrations that occur in stable conditions with low wind speeds due to underprediction of the surface friction velocity (u*). Underprediction of u* results in an underestimation of the mechanical mixing height and thus overprediction of ambient concentrations. The ADJ_U* option is now considered a regulatory default option with the recent update to Appendix W.

Terrain considerations: Elevation and land use data were imported from the National Elevation Dataset maintained by the United States Geological Survey (USGS 2013). An important consideration in an air dispersion modeling analysis is the selection of whether or not to model an urban area. Here the model assumes an urban land use as has been done for similar projects in the area. Ramboll used 1,664,496, the 2010 population of San Jose, as the urban population in AERMOD (US Census Bureau 2014).

Emission rates: Emissions were modeled using the unit rate emissions method for all pollutants such that each source has a unit emission rate (i.e., 1 gram per second [g/s]) and the model estimates dispersion factors with units of (μg/m^3)/(g/s). Actual emissions were multiplied by the dispersion factors to obtain concentrations.

For SBGF operation, generators were modeled as if they could operate at any hour of the day.

For annual average ambient air concentrations, the estimated annual average dispersion factors were multiplied by the annual average emission rates. For maximum hourly ambient air concentrations, the estimated maximum hourly dispersion factors were multiplied by the maximum hourly emission rates.

Source parameters: Source locations and parameters are necessary to model the dispersion of air emissions. Operational source locations are shown in **Figure 1**. At full buildout, there are 54 generators at ground-level. **Figure 1** shows locations for all 54 generators. Source parameters are detailed in **Table 12**.

The operational sources (i.e., emergency generators) were represented by point sources with identical exit temperatures, exit velocities and exit diameters, based on manufacturer provided information. The modelled stack height for all generators on the western side of the facility is 11.81 meters above ground, whereas the stack height for the generators along the southern edge is 7.54 m.

Receptors: Nearby sensitive receptor populations were identified within a 1,000-m buffer of the Project Sequoia site, which is larger than Project Sequoia's 1,000-foot zone of influence. As discussed above, sensitive receptors include residents to the southwest of the Project Sequoia site and a soccer facility south of the Project Sequoia site. A receptor grid was created to cover all potential sensitive receptors within 1,000-m of the Project Sequoia site. A grid of receptors with 20-m spacing was used. Modeled off-site receptors are shown in **Figure 2.** Receptors were modeled at 1.8 meters of height, consistent with BAAQMD guidance for breathing height. As discussed previously, average annual and maximum hourly dispersion factors were estimated for each receptor location.

Concentrations: As discussed above, emissions were modeled using the unit rate emission factor method, such that the model estimates dispersion factors based on an emission rate of 1 g/s and the dispersion factors have units of [$\mu g/m^3$]/[g/s]. Estimated emissions were multiplied by the dispersion factors to obtain concentrations.

Modeling Adjustment Factor: OEHHA (2015) recommends applying an adjustment factor to the annual average concentration modeled assuming continuous emissions (i.e., 24 hours per day, seven days per week), when the actual emissions are less than 24 hours per day and exposures are concurrent with the emitting activities. Operational emissions were modeled with the assumption that they can occur at any hour of the day. MAFs are shown in **Table 13**.

4. RISK CHARACTERIZATION METHODS

The following sections discuss in detail the various components required to conduct the HRA of SBGF operations.

4.1 Project Sources Evaluated

As discussed in Section 1.3, excess lifetime cancer risk, chronic and acute HIs, and $PM_{2.5}$ concentrations were evaluated for off-site sensitive receptor exposures to emissions from SBGF operation. The TACs of concern are those in BAAQMD Rule 2-5, so no health impacts from CAPs are considered in this analysis, consistent with BAAQMD CEQA Guidance.

4.2 Exposure Assessment

Potentially Exposed Populations: This assessment evaluated off-site receptors potentially exposed to SBGF emissions from operational activities. These exposed populations include residential receptors, recreational receptors at a nearby soccer field and childcare receptors. Both long-term health impacts (cancer risk, chronic HI, and $PM_{2.5}$ concentration) and acute hazards were evaluated for the residential, recreational and childcare facility locations.

Exposure Assumptions: The exposure parameters used to estimate excess lifetime cancer risks due to operational activities were obtained using risk assessment guidelines from OEHHA (2015) and draft guidelines from the BAAQMD that indicate how the BAAQMD would integrate the 2015 OEHHA Guidelines (BAAQMD 2016), unless otherwise noted, and are presented in **Table 13**. Based on the TACs considered, the only relevant exposure pathway is inhalation, so this HRA considers inhalation exposure only.

For offsite residential receptors, Ramboll selected conservative exposure parameters assuming that exposure would begin during the third trimester of a residential child's life. Ramboll used 95^{th} percentile breathing rates up to age 2, and 80^{th} percentile breathing rates above age 2, consistent with BAAQMD guidance (2016). For operation, off-site residents were assumed to be present at one location for a 30-year period, beginning with exposure in the third trimester.

For offsite recreational soccer receptors, Ramboll selected exposure parameters using the conservative assumption that a child would be located at the soccer facility starting at age 2, then that same child would continue to be exposed by participating in activities at the facility as they got older. For operation, the child was assumed to be present one day a week for one hour per day for a full 30 years. Operational exposures used the 95^{th} percentile 8-hour moderate intensity breathing rate from the OEHHA guidelines.

For offsite childcare receptors, exposure parameters were selected with the conservative assumption that a child would be present starting at age of six weeks, and would be present at the day care facility 8 hour a day for 5 days a week until the age of 6. Operational exposures used the 95^{th} percentile moderate intensity breathing rates from the OEHHA guidelines.

For offsite receptors, including fenceline and adjacent sidewalk receptors, Ramboll adopted the Commission Staff-requested methodology of assigning a worker exposure parameters to those locations for assessment of the point of maximum impact. Ramboll is not in agreement with this methodology and believes every receptor should be assigned exposure parameters based on existing conditions and land uses or what could feasibly occur at each receptor over the duration of the project. It is not reasonable that a worker will be present for 25-30 years on the fenceline of the Site or the adjacent sidewalk. However, consistent with the Staff's request, Ramboll has provided results of an analysis that assumes every receptor that is not classified as a resident or soccer child is assumed to have worker exposure parameters. This includes all receptors on the fenceline and all other public spaces adjacent to the project site. Operational exposure for a worker used the 95th percentile 8–hour breathing rate from the OEHHA guidelines (2015). A 25-year exposure duration for workers is assumed based on the OEHHA recommended exposure duration period and an exposure frequency of 250 days in a year is used in the analysis.

Ramboll evaluated the Point of Maximum Impact (PMI) as the highest impact value for each health metric, but maximum impacts do not all occur in the same location. Locations of both long-term and acute PMIs are presented.

Calculation of Intake: The dose estimated for each exposure pathway is a function of the concentration of a chemical and the intake of that chemical. The intake factor for inhalation, IF_{inh}, can be calculated as follows:

$$IF_{inh} = \frac{DBR * FAH * EF * ED * CF}{AT}$$

Where:

IF_{inh}	=	Intake Factor for Inhalation (m^3/kg-day)
DBR	=	Daily Breathing Rate (L/kg-day)
FAH	=	Fraction of Time at Home (unitless)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
AT	=	Averaging Time (days)
CF	=	Conversion Factor, 0.001 (m^3/L)

The chemical intake or dose is estimated by multiplying the inhalation intake factor, IF_{inh}, by the chemical concentration in air, C_i. When coupled with the chemical concentration, this calculation is mathematically equivalent to the dose algorithm given in the OEHHA Hot Spots guidance (2015).

4.3 Modeling Adjustment Factors

Cal/EPA recommends applying an adjustment factor to the annual average concentration determined through dispersion modeling by assuming continuous emissions (*i.e.*, 24 hours per day, 7 days per week), when the actual emissions occur less than 24 hours per day and exposures are concurrent with emissions-generating activities occurring at the Project. The modeling adjustment factors are discussed below.

Residents are assumed to be exposed to site emissions 24 hours per day, seven days per week. This assumption is consistent with the modeled annual average air concentration (24 hours per day, 7 days per week). Thus, the annual average concentration need not be adjusted for residential receptors.

The emissions associated with reliability-related activities are conservatively assumed to occur during the working hours and on the work days only while the offsite workers are present and children are expected to be at school or daycare. Thus, an modeling adjustment factor (MAF) of 4.2 was applied to the annual average concentration used in the evaluation of the offsite worker, soccer child and childcare receptor to account for an emissions schedule equivalent to a worker's schedule of 8 hours per day, 245 days per year ([24 hours/8 hours]*[365 days/245 days]). These concentrations represent the theoretical maximum average concentrations over the operating period to which the offsite worker, child playing soccer and child care child might be exposed.

The exposure point concentrations for the offsite worker, school child, daycare child, and infant care child receptors will be calculated using the following equation:

$$C_i = C_{i,annual} \text{ x } MAF$$

4.4 Toxicity Assessment

The toxicity assessment characterizes the relationship between the magnitude of exposure and the nature and magnitude of adverse health effects that may result from such exposure. For purposes of calculating exposure criteria to be used in risk assessments, adverse health effects are classified into two broad categories – cancer and non-cancer endpoints. Toxicity values used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the toxicity assessment component of a risk assessment.

Excess lifetime cancer risk and chronic HI calculations for SBGF operation utilized the toxicity values for DPM from diesel generators. Acute HI calculations utilized the toxicity values for TACs from speciated diesel TOG for diesel generators. The speciation profiles used are presented in **Table 14**. The toxicities of each chemical are shown in **Table 15**. The TACs of concern have inhalation health effects only.

4.5 Age Sensitivity Factors

The estimated excess lifetime cancer risks for a resident child was adjusted using the age sensitivity factors (ASFs) recommended by OEHHA (2015). This approach accounts for an "anticipated special sensitivity to carcinogens" of infants and children. Cancer risk estimates are weighted by a factor of 10 for exposures that occur from the third trimester of pregnancy to two years of age and by a factor of three for exposures that occur from two years through 15 years of age. No weighting factor (i.e., an ASF of one, which is equivalent to no adjustment) is applied to ages 16 to 30 years. **Table 16** shows the ASFs used.

4.6 Risk Characterization

4.6.1 Estimation of Cancer Risks

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk is expressed as a unitless probability. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF).

The equation used to calculate the potential excess lifetime cancer risk for the inhalation pathway is as follows:

$$Risk_{inh} = C_i \times CF \times IF_{inh} \times CPF \times ASF$$

Where:

$Risk_{inh}$	=	Cancer risk; the incremental probability of an individual developing cancer as a result of inhalation exposure to a particular potential carcinogen (unitless)
C_i	=	Annual average air concentration for chemical during activities$_i$ (µg/m^3)
CF	=	Conversion factor (mg/µg)
IF_{inh}	=	Intake factor for inhalation (m^3/kg-day)
CPF_i	=	Cancer potency factor for chemical$_i$ (mg chemical/kg body weight-day)$^{-1}$
ASF	=	Age sensitivity factor (unitless)

4.6.2 Estimation of Chronic and Acute Noncancer Hazard Quotients/Indices

Chronic HQ

The potential for exposure to result in adverse chronic noncancer effects is evaluated by comparing the estimated annual average air concentration (which is equivalent to the average daily air concentration) to the noncancer chronic reference exposure level (cREL) for each chemical. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient (HQ). To evaluate the potential for adverse chronic noncancer health effects from simultaneous exposure to multiple chemicals, the chronic HQs for all chemicals are summed, yielding a chronic HI.

$$HQi = Ci / cREL$$

Where:

HQi	=	Chronic hazard quotient for chemical i
HI	=	Hazard index
Ci	=	Annual average concentration of chemical i (µg/m3)
cRELi	=	Chronic noncancer reference exposure level for chemical i (µg/m^3)

Acute HI

The potential for exposure to result in adverse acute effects is evaluated by comparing the estimated one-hour maximum air concentration of chemical to the acute reference exposure level (aREL) for each chemical evaluated in this analysis. When calculated for a single chemical, the comparison yields an HQ. To evaluate the potential for adverse acute health effects from simultaneous exposure to multiple chemicals, the acute HQs for all chemicals are summed, yielding an acute HI.

$$HQi = Ci / aREL$$

Where:

HQi = Acute hazard quotient for chemical i

HI = Hazard index

Ci = One-hour maximum concentration of chemical i ($\mu g/m^3$)

aRELi = Acute reference exposure level for chemical i ($\mu g/m^3$)

5. PROJECT HEALTH RISK ASSESSMENT

In this section, the SBGF HRA results are presented for each of the BAAQMD CEQA thresholds.

As discussed in Section 1.3, the single source significance thresholds for health risks and hazards from SBGF operation are:

- An excess lifetime cancer risk level of more than 10 in one million;
- A chronic noncancer HI greater than 1.0;
- A noncancer acute HI greater than 1.0; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.3 µg/m^3.

5.1 Operational HRA

Table 17 shows the excess lifetime cancer risk, chronic noncancer HI, acute noncancer HI and annual $PM_{2.5}$ concentration at the maximally exposed individual resident (MEIR), maximally exposed individual worker (MEIW), maximally exposed soccer child receptor (MESCR), maximally exposed childcare receptor (MECR) and the point of maximum impact (PMI) during backup generator operation. The incremental increase in cancer risk due to SBGF operation is 0.19 in one million at the MEIR. The chronic HI is 0.00005, acute noncancer HI is 0.10 and the annual $PM_{2.5}$ concentration is 0.00026 µg/m^3. The incremental increase in cancer risk due to SBGF operation is 2.18 in one million at the MEIW and PMI, which occur at the same location. The MEIW/PMI chronic and acute noncancer HIs are 0.000704 and 0.54, respectively. The MEIW/PMI annual $PM_{2.5}$ concentration due to SBGF operation is 0.035215 µg/m^3. The incremental increase in cancer risk due to SBGF operation is 0.002 in one million at the MESCR. The MESCR chronic and acute noncancer HIs are 0.00006 and 0.11, respectively. The MESCR annual $PM_{2.5}$ concentration due to SBGF operation is 0.00031 µg/m^3. The incremental increase in cancer risk due to SBGF operation is 0.05 in one million at the MECR. The MECR chronic and acute noncancer HIs are 0.00003 and 0.06, respectively. The MESCR annual $PM_{2.5}$ concentration due to SBGF operation is 0.00016 µg/m^3.

5.2 Cumulative HRA

The BAAQMD CEQA Guidelines establish numerical criteria for determining when an emissions increase is considered cumulatively considerable and thus triggers the need for a quantitative cumulative impacts assessment.

In developing thresholds of significance for air pollutants, BAAQMD considered the emission levels for which a project's individual emissions would be cumulatively considerable. If a project does not exceed the identified significance thresholds, its emissions would not be cumulatively considerable, resulting in less-than-significant air quality impacts to the region's existing air quality conditions. Therefore, additional analysis to assess cumulative impacts is unnecessary, but an analysis of cumulative sources is performed here for completeness. Ramboll used the BAAQMD Stationary Source Screening Tool for Santa Clara County (BAAQMD 2012b) to identify existing permitted stationary sources within 1,000 feet of the MEIR. Ramboll submitted a stationary source inquiry form to the BAAQMD to request updates and received the response in **Appendix B**. **Table 18** summarizes the risks and hazards at the MEISR from existing stationary sources Any source identified as being within approximately 2,000 feet of the Project boundary in the GIS tool provided by BAAQMD is included in this analysis. Based on the GIS tool, Ramboll identified eight stationary sources within roughly 2,000 feet from the project boundary and the total cancer risk impact from these sources at the MEISR is 1.04 in a million. The total chronic HI is 0.0015. For most of these sources, data on acute noncancer HI and annual $PM_{2.5}$ concentration was not available.

The health impacts of major surface streets, railways, and highways were evaluated using BAAQMD's screening tools provided by BAAQMD as raster files in GIS.[6] The raster files consist of 20 by 20 m grid cells with cancer risk and $PM_{2.5}$ concentration associated with roads, railways, and nearby major streets. Risk and $PM_{2.5}$ concentration values at the location of the MEISR were determined based on the maximum impact of a raster cell located within the Project buildings. The raster files provided by the BAAQMD account for the most recent OEHHA risk assessment guidelines. As shown in **Table 18**, cancer risk from major streets, highways and railways total 49.5 in a million with most of the impacts coming from railway sources.

For TACs, the project would have a cumulatively considerable impact if project emissions would result in:

- Non-compliance with a qualified risk reduction plan; or
- An excess lifetime cancer risk level of more than 100 in one million;
- A chronic noncancer HI greater than 10; and
- An incremental increase in the annual average $PM_{2.5}$ of greater than 0.8 μg/m^3.

Based on the project-level analysis included above, the SBGF would not have a cumulatively considerable impact based on these BAAQMD criteria:

- There is no qualified risk reduction plan in effect for the City of Santa Clara.
- The SBGF would not exceed the BAAQMD cumulatively considerable thresholds relative to the region's existing air quality conditions per the BAAQMD criteria.

Because the project would not meet the BAAQMD CEQA Guidelines criteria for a contribution to any potential adverse cumulative air health risk impacts from either construction or operation, it would not contribute to any potential adverse cumulative air impact on sensitive receptors.

6 Received by Varsha Gopalakrishnan at Ramboll through Personal Communication with Areana Flores from BAAQMD on April 20, 2018. Available online at: https://www.dropbox.com/sh/r0d12b66m4scwlc/AADpA16Bsv1-9A5zIH3L9EAza?dl=0

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TABLES

Table 1
CalEEMod Project Characteristics
Cyrus One Data Center
Santa Clara, California

Characteristic	Project Value
Location Scope	County
County	Santa Clara
Climate Zone	4
Operational Year	2021
Utility	Silicon Valley Power
CO_2 Intensity Factor[1]	271
CH_4 Intensity Factor[2]	0.029
N_2O Intensity Factor[2]	0.006

Notes:

1. CO_2 Intensity Factor for 2021 operational year from City of Santa Clara and Silicon Valley Power annual projections for the utility mix after coal use was eliminated in 2017.
2. CH_4 and N_2O Intensity Factors are the CalEEMod® default values for Pacific Gas & Electric Co, used here to be conservative.

Abbreviations:

CalEEMod - California Emissions Estimator Model
CO_2 - carbon dioxide
CH_4 - methane
N_2O - nitrogen dioxide
PG&E - Pacific Gas and Electric

References:

City of Santa Clara. 2019. Mitigated Negative Declaration: 1150 Walsh Avenue SV 1 Data Center. Appendix A: Air Quality and GHG Emissions Assessment. February. Available at: http://santaclaraca.gov/home/showdocument?id=63306

Table 2
CalEEMod Land-Use Inputs
Cyrus One Data Center
Santa Clara, California

Land Use Type	Land Use Subtype[1]	Unit Amount[1]	Size Metric	Lot Acreage
Industrial	General Light Industry	702.11	1000sqft	13.73
Parking	Parking Lot	141	spaces	1.27

Notes:
1. CalEEMod land use type assumed based on client-provided description of proposed facility
2. Size and acreage of land uses based on client-provided information on facility size

Abbreviations:
CalEEMod - California Emissions Estimator Model
sqft - square feet

Table 3
Construction Emissions
CyrusOne Data Center
Santa Clara, California

Project Construction	CAP Emissions [lb][1,2]			
	ROG	**NOx**	**Exhaust PM_{10}**	**Exhaust $PM_{2.5}$**
Site Preparation	41	425	22	20
Grading	136	1507	65	60
Building Construction	1055	9,831	337	317
Paving	29	259	14	13
Architectural Coating	7,354	33	1.9	1.9
Total	**8,615**	**12,056**	**440**	**411**
Length of Construction (days)	559			
Average Daily Emissions (lb/day)	**15.4**	**22**	**0.8**	**0.7**
BAAQMD Significance Threshold (lb/day)	54	54	82	54
Construction GHG Emissions (MT CO_2e/project)	1,321 MT CO_2e/project			

Notes:

1. Emissions estimated using CalEEMod version 2016.3.2.
2. Construction activities associated with the SBGF are negligible and are included in the estimates for SDC.

Abbreviations:

CalEEMod - California Emissions Estimator Model
lb - pounds
NOx - nitrogen oxides
ROG - reactive organic gases
$PM_{2.5}$ - particulate matter < 2.5 µm
PM_{10} - particulate matter < 10 µm
BAAQMD - Bay Area Air Quality District
CAP - Criteria Air Pollutants
SBGF - Sequoia Backup Generating Facility
SDC - Sequoia Data Center

References:

CalEEMod Version 2013.2.2 Available Online at: http://www.caleemod.com

Table 4
Title 24 Adjustments to Energy Use Rates
Cyrus One Data Center
Santa Clara, California

Venue	CalEEMod® Venue Subtype	Size Metric	Title-24 Electricity (kWhr/size/yr)[1]	Non Title-24 Electricity (kWhr/size/yr)	Lighting Energy Intensity (kWhr/size/yr)[1]	Title-24 Natural Gas (kBTU/size/yr)[1]	Non-Title-24 Natural Gas (kBTU/size/yr)
Industrial	General Light Industry	SF	1.3216	3.7000	2.7504	19.5129	6.6700
Parking	Parking Lot	SF	0.0000	0.0000	0.3126	0.0000	0.0000

Notes:

1. CalEEMod default energy use was reduced to account for 2019 Title 24 Standards. Electricity consumption was reduced by 10.7%, lighting electricity consumption by 10.7%, and natural gas consumption by 1% from the CalEEMod default 2016 Title 24 Standards.

Abbreviations:

CalEEMod - California Emissions Estimator Model
CEC - California Energy Commission
kBTU - one thousand British Thermal Units
kWhr - kilowatt hour
yr - year

References:

CEC. 2019. California's Energy Efficiency Standards for Residential and Nonresidential Buildings. Available online at: https://www.energy.ca.gov/title24/2019standards/ . Accessed February 22, 2019.
CEC. 2019. 2019 Title 24 Impact Analysis. Available online at: https://ww2.energy.ca.gov/title24/2019standards/post_adoption/documents/2019_Impact_Analysis_Final_Report_2018-06-29.pdf
CalEEMod. Available online at http://www.caleemod.com/

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Table 5
Operational Energy Use Emissions
Cyrus One Data Center
Santa Clara, California

	Value	**Unit**
Maximum Annual Energy Use[1]	655,633,440	kWh/yr
CO_2 Intensity Factor[2]	271	lbs/MWh
CH_4 Intensity Factor[3]	0.029	lbs/MWh
N_2O Intensity Factor[3]	0.006	lbs/MWh
CO_{2e} Intensity Factor[4]	273.5	lbs/MWh
Annual CO_{2e} Emitted[5]	81,340	MT/yr

Notes:

1. Expected maximum annual energy consumption from CyrusOne.
2. CO_2 Intensity Factor of 271 lb/kWh projected by Sillicon Valley Power for operational year 2021.
3. CH_4 and N_2O Intensity Factor from CalEEMod default.
4. Global warming potential values of 1 for CO2, 25 for CH4, and 298 for N2O from US EPA's Federal Register (FR) final rule published on November 29, 2013 [78 FR 71904] and effective on January 1, 2014, were used to convert emissions to metric tones of carbon dioxide equivalents.
5. Annual emissions are the product of the energy usage and the intensity factor.

Abbreviations:

kWh - kilowatt-hours
lbs - pounds
MWh - megawatt-hours
MT - Metric Tons

References:

City of Santa Clara. 2019. Mitigated Negative Declaration: 1150 Walsh Avenue SV 1 Data Center. Appendix A: Air Quality and GHG Emissions Assessment. February. Available at: http://santaclaraca.gov/home/showdocument?id=63306

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Table 6
Operational Mass Emissions of Criteria Air Pollutants
Cyrus One Data Center
Santa Clara, California

Emissions Source	CAP Emissions[1] [ton/year]				CAP Emissions[1] [lb/day]			
	ROG	NO_x	PM_{10} Total	$PM_{2.5}$ Total	ROG	NO_x	PM_{10} Total	$PM_{2.5}$ Total
Architectural Coating	0.37	-	-	-	2.0	-	-	-
Consumer Products	2.7	-	-	-	15	-	-	-
Landscaping	7.3E-04	7.0E-05	3.0E-05	3.0E-05	0.0040	3.8E-04	1.6E-04	1.6E-04
Building Energy Use	0.099	0.90	0.069	0.069	0.54	4.9	0.38	0.38
On-Road Fugitive Dust	-	-	0.57	0.15	-	-	3.1	0.84
On-Road Exhaust	0.14	0.63	0.0054	0.0050	0.78	3.5	0.029	0.028
Emergency Generators[2]	0.54	35.96	0.16	0.16	2.9	197	0.88	0.88
BAAQMD Stationary Source Offsets	-	-35.96	-	-	-	-197	-	-
Total Project Emissions	**3.9**	**1.5**	**0.81**	**0.39**	**21**	**8.4**	**4.4**	**2.1**
BAAQMD Significance Threshold[3]	10	10	15	10	54	54	82	54

Notes:

1. Emissions estimated using CalEEMod version 2016.3.2.
2. Emergency generator emission factors from USEPA Engine Family Certification data for Large Non-road Compression-Ignition (NRCI) Engines - engine family group number KMDDL95.4GTR. Available at https://www.epa.gov/compliance-and-fuel-economy-data/annual-certification-data-vehicles-engines-and-equipment . Each engine is equipped with a Johnson Matthey CRT Particulate Filter system. Emission reduction efficiencies available at: https://www.jmsec.com/air-pollution-solutions/diesel-particulate-filters/crt-technology-for-diesel-emissions/?L=0
3. Thresholds from BAAQMD California Environmental Quality Act (CEQA) 2017 Guidelines. Available at http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator Model
CAP - Criteria Air Pollutant
lb - pounds

NOx - nitrogen oxides
ROG - reactive organic gases
PM_{10} - particulate matter less than 10 microns
$PM_{2.5}$ - particulate matter less than 2.5 microns

References:

CalEEMod® 2016.3.2 Available Online at: http://www.caleemod.com

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Table 7
Operational Mass Emissions of Greenhouse Gases
Cyrus One Data Center
Santa Clara, California

Emissions Source	GHG Emissions[1]	Units
Landscaping	0.016	$MT\ CO_2e/yr$
Building Energy Use	1,666	
Water Use	3.48	
Waste Disposed	438	
On-Road Exhaust	576	
Data Center Energy Use[2]	81,340	
Total (Excluding Emergency Generators)	**84,023**	$MT\ CO_2e/yr$

Emissions Source	GHG Emissions[4]	Units
Emergency Generators	4,301	$MT\ CO_2e/yr$
Total (Including Emergency Generator Testing & Maintenance)	**88,324**	
BAAQMD Stationary Source Threshold	**10,000**	

Notes:
1. Emissions estimated using CalEEMod® version 2016.3.2 for all emission sources except Data Center Energy Use.
2. Data Center energy use is calculated based on client-provided energy use projections for the maximum usage year, and Silicon Valley Power Carbon Intensity estimates for operational year 2021 (conservatively applied to the max operational year for data center energy use).
3. Thresholds from BAAQMD California Environmental Quality Act (CEQA) 2017 Guidelines. Available at http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf
4. Calculated based on emission factors from AP-42 Vol 1. Chapter 3.4 (Large Stationary Diesel And All Stationary Dual-fuel Engines) and scaled by engine horsepower, proposed annual operating hours, and number of proposed generators.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CalEEMod - California Emissions Estimator Model
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
MT - metric ton
SP - service population
yr - year

References:

CalEEMod® 2016.3.2 Available Online at: http://www.caleemod.com

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Table 8

Operational Trip Rate CalEEMod Input

Cyrus One Data Center

Santa Clara, California

Land Use	Average Daily Trip Rate[1]		
	Weekday	Saturday[2]	Sunday[2]
General Light Industry	695	132	70
Parking Lot	0	0	0
Total	**695**	**132**	**70**

Notes:

1. Average daily trip rate provided by client

2. Weekend trip rates scaled from client-provided weekday rate to CalEEMod default rates for Saturday, and Sunday rates

Table 9a
Emergency Generator Emissions - Testing & Maintenance
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Pollutant	AP-42 Emission Factors and 40 CFR 98 Subpart C	EPA Engine Certification Data - Uncontrolled Emission Factors	Control Efficiency at 100% Load[1]	Controlled Emission Factors[2]	GHG Emission Factors[3,4]	Average Daily Routine Emissions	Annual Routine Emissions[5]
	(g/hp-hr)	(g/kW-hr)		(g/kW-hr)	(g/hp-hr)	(lb/day)	(tons/year)
NOx[1]	--	5.37	0%	5.37	--	197.0	36.0
ROG[1,6]	--	0.27	70%	0.08	--	2.94	0.5
CO[1]	--	2.00	80%	0.40	--	14.7	2.7
PM_{10}[2]	--	0.16	85%	0.02	--	0.9	0.16
$PM_{2.5}$	--	0.16	85%	0.02	--	0.9	0.16
CO_2[3]	526.17	--	0%	--	526.17	25,891	4,287
CH_4[4]	0.021	--	0%	--	0.021	1.0	0.2
N_2O[4]	0.0042	--	0%	--	0.004	0.21	0.0
CO_2e[7]			0%		527.94	25,978	4,301

Notes:

1. Control Efficiency reductions assume a Johnson Matthey CRT® Particulate Filter System on each engine. Efficiency rates found at https://www.jmsec.com/air-pollution-solutions/diesel-particulate-filters/crt-technology-for-diesel-emissions/?L=0
2. Emission Factors from USEPA Engine Family Certification data for Large Non-road Compression-Ignition (NRCI) Engines - engine family group number KMDDL95.4GTR. Available at https://www.epa.gov/compliance-and-fuel-economy-data/annual-certification-data-vehicles-engines-and-equipment
3. Emissions factor from AP-42, Vol. I, Section 3.4, Table 3.4-1 for Large Stationary Diesel And All Stationary Dual-fuel Engines.
4. Emissions factors from 40 CFR 98, Subpart C, Table C-2. Petroleum emissions listed as 3 g CH_4/mmBtu and 0.6 g N_2O/mmBtu. Assumed conversion factor of 7000 Btu/hp-hr per AP-42 Vol I, Table 3.4-1.
5. Assumes 50 hours of operation per year per generator for routine testing and maintenance
6. Reactive Organic Gas emissions are assumed to be equivalent to VOC's. Conversion from Non-Methane Hydrocarbon (NMHC) emissions calculated based on USEPA Conversion Factors for Hydrocarbon Emission Components. Available at https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10081RP.TXT
7. Global warming potential values of 1 for CO_2, 25 for CH_4, and 298 for N_2O from US EPA's Federal Register (FR) final rule published on November 29, 2013 [78 FR 71904] and effective on January 1, 2014, were used to convert emissions to metric tones of carbon dioxide equivalents.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
DPF - Diesel Particulate Filter
g - gram
hp - horsepower
hr - hour
N_2O - nitrous oxide
PM - Particulate Matter
ROG - reactive organic gases
USEPA - United States Environmental Protection Agency

References:

Johnson Matthey, California Air Resources Board

USEPA. 2019. Large Engine Certification Data for Model Year 2015. Available at: https://www.epa.gov/compliance-and-fuel-economy-data/annual-certification-data-vehicles-engines-and-equipment

USEPA AP 42 Vol I. Chapter 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines. Available at: https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

40 CFR 98 Subpart C, Table C-2 available at: https://www.law.cornell.edu/cfr/text/40/appendix-Table_C-2_to_subpart_C_of_part_98

USEPA. 2010. Conversion Factors for Hydrocarbon Emission Components. Available at https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10081RP.TXT

Table 9b
Emergency Generator Emissions - Testing, Maintenance, & Emergency Usage
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Pollutant	AP-42 Emission Factors and 40 CFR 98 Subpart C	EPA Engine Certification Data - Uncontrolled Emission Factors	Control Efficiency at 100% Load[1]	Controlled Emission Factors[2]	GHG Emission Factors[3,4]	Annual Emissions[5]
	(g/hp-hr)	(g/kW-hr)		(g/kW-hr)	(g/hp-hr)	(tons/year)
NOx[1]	--	5.37	0%	5.37	--	108
ROG[1,6]	--	0.27	70%	0.08	--	1.6
CO[1]	--	2.00	80%	0.40	--	8.0
PM_{10}[2]	--	0.16	85%	0.02	--	0.48
$PM_{2.5}$	--	0.16	85%	0.02	--	0.48
CO_2[3]	526.17	--	0%	--	526.17	12,860
CH_4[4]	0.021	--	0%	--	0.021	0.51
N_2O[4]	0.0042	--	0%	--	0.004	0.10
CO_2e[7]			0%		527.94	12,903

Notes:

1. Control Efficiency reductions assume a Johnson Matthey CRT® Particulate Filter System on each engine. Efficiency rates found at https://www.jmsec.com/air-pollution-solutions/diesel-particulate-filters/crt-technology-for-diesel-emissions/?L=0
2. Emission Factors from USEPA Engine Family Certification data for Large Non-road Compression-Ignition (NRCI) Engines - engine family group number KMDDL95.4GTR. Available at https://www.epa.gov/compliance-and-fuel-economy-data/annual-certification-data-vehicles-engines-and-equipment
3. Emissions factor from AP-42, Vol. I, Section 3.4, Table 3.4-1 for Large Stationary Diesel And All Stationary Dual-fuel Engines.
4. Emissions factors from 40 CFR 98, Subpart C, Table C-2. Petroleum emissions listed as 3 g CH_4/mmBtu and 0.6 g N_2O/mmBtu. Assumed conversion factor of 7000 Btu/hp-hr per AP-42 Vol I, Table 3.4-1.
5. Assumes a total of 150 hours per year per generator, including 50 hours per year of routine testing and maintenance, and 100 hours per year of emergency usage.
6. Reactive Organic Gas emissions are assumed to be equivalent to VOC's. Conversion from Non-Methane Hydrocarbon (NMHC) emissions calculated based on USEPA Conversion Factors for Hydrocarbon Emission Components. Available at https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10081RP.TXT
7. Global warming potential values of 1 for CO_2, 25 for CH_4, and 298 for N_2O from US EPA's Federal Register (FR) final rule published on November 29, 2013 [78 FR 71904] and effective on January 1, 2014, were used to convert emissions to metric tones of carbon dioxide equivalents.

Abbreviations:

CH_4 - methane
CO - carbon monoxide
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalents
DPF - Diesel Particulate Filter
g - gram
hp - horsepower
hr - hour
N_2O - nitrous oxide
PM - Particulate Matter
ROG - reactive organic gases
USEPA - United States Environmental Protection Agency

References:

Johnson Matthey, California Air Resources Board

USEPA. 2019. Large Engine Certification Data for Model Year 2015. Available at: https://www.epa.gov/compliance-and-fuel-economy-data/annual-certification-data-vehicles-engines-and-equipment

USEPA AP 42 Vol I. Chapter 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines. Available at: https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

40 CFR 98 Subpart C, Table C-2 available at: https://www.law.cornell.edu/cfr/text/40/appendix-Table_C-2_to_subpart_C_of_part_98

USEPA. 2010. Conversion Factors for Hydrocarbon Emission Components. Available at https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P10081RP.TXT

Table 10
Operational Mass Emissions of Criteria Air Pollutants
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Emissions Source	CAP Emissions [ton/year]				CAP Emissions [lb/day]			
	ROG	NO_x	PM_{10} Total	$PM_{2.5}$ Total	ROG	NO_x	PM_{10} Total	$PM_{2.5}$ Total
Emergency Generators	0.54	36	0.16	0.16	2.9	197	0.88	0.88
BAAQMD Stationary Source Offsets	-	-36	-	-	-		-	-
Total Project Emissions	**0.54**	**0**	**0.161**	**0.161**	**2.9**	**197**	**0.88**	**0.88**
BAAQMD Significance Threshold	10	10	15	10	54	54	82	54

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CAP - Criteria Air Pollutant
lb - pounds
NOx - nitrogen oxides
ROG - reactive organic gases
PM_{10} - particulate matter less than 10 microns
$PM_{2.5}$ - particulate matter less than 2.5 microns

References:

CalEEMod® 2016.3.1 Available Online at: http://www.caleemod.com

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Table 11
Operational Mass Emissions of Greenhouse Gases
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Emissions Source	GHG Emissions	Units
Emergency Generators	4,301	MT CO_2e/yr
BAAQMD Stationary Source Threshold	**10,000**	

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
CO_2e - carbon dioxide equivalents
GHG - greenhouse gas
MT - metric ton
yr - year

References:

CalEEMod® 2016.3.1 Available Online at: http://www.caleemod.com

Table 12
Modeling Parameters
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Source	Source Type	Number of Sources[1]	Release Height (m)	Exit Temperature (K)	Exit Velocity (m/s)	Exit Diameter (m)
Back-Up Generators - Western Side	Point	32	7.54	778.15	41.2	0.51
Back-Up Generators - Southern Side	Point	22	11.81	778.15	41.2	0.51

Notes:
1. Fifty-four identical generators will be installed at the Project site.

Abbreviations:

K - Kelvin
m - meter
s - second

Table 13
Exposure Parameters, 2015 OEHHA Methodology
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Period	Starting Age	Receptor Age Group	Exposure Parameters							
			Daily Breathing Rate (DBR)[1] (L/kg-day, Soccer Child: L/kg-hr)	Exposure Duration (ED)[2] (years)	Fraction of Time at Home (FAH)[3] (unitless)	Exposure Frequency (EF)[4] (days/year)	Conversion Factor (CF) (m^3/L)	Averaging Time (AT) (days)	Modeling Adjustment Factor (MAF) (unitless)	Intake Factor, Inhalation (IF_{inh}) (m^3/kg-day)
Resident	3rd trimester	3rd Trimester	361	0.25	1	350	0.001	25,550	1	0.0012
		Age 0-<2 Years	1,090	2	1	350	0.001	25,550	1	0.030
		Age 2-<16 Years	572	14	1	350	0.001	25,550	1	0.11
		Age 16-30 Years	261	14	0.73	350	0.001	25,550	1	0.037
Childcare	6 weeks	Age 0-<2 Years	1,200	1.88	N/A	250	0.001	25,550	4.2	0.02
		Age 2-<9 Years	640	4	N/A	250	0.001	25,550	4.2	0.025
Soccer Child	2 years	Age 2-<16 Years	65	14	N/A	52	0.001	25,550	4.2	0.002
		Age 16-30 Years	30	16	N/A	52	0.001	25,550	4.2	0.00
Worker	16 years	Age 16-70 Years	230	25	N/A	250	0.001	25,550	4.2	0.056

Notes:

1. Daily breathing rates reflect default breathing rates from OEHHA 2015 as follows: Resident: 95th percentile for 3rd trimester and age 0-<2 years; 80th percentile for ages 2-<9 years, 2-<16 years, and 16-30 years. Soccer Child and Childcare: 95th percentile moderate intensity for all ages.
2. The total exposure duration for operation reflects the default residential exposure duration from Cal/EPA 2015.
3. Fraction of time at home (FAH) was conservatively assumed to be 1 for all age groups for residential exposure. FAH is not applicable to school, childcare, worker, or recreational soccer receptors.
4. Exposure frequency reflects default exposure frequency for residents from Cal/EPA 2015. For Soccer Child receptors, it was assumed that children would attend the soccer facility once a week for 52 weeks.
5. Exposure for children using the soccer facility was assumed to start at age 2 since children younger than 2 cannot participate in the activities at this facility. For operational exposures, 30-year exposure was evaluated starting at age 2 and the 16-30 year breathing rate was assumed for ages 16-32.
6. Daily breathing rates reflect default breathing rates from OEHHA 2015 for a worker: 95th percentile 8-hour breathing rate for ages 16-<70 years. A 25-year exposure duration for workers was assumed based on the OEHHA's recommended exposure duration period. Exposure frequency for workers is assumed to be 250 days in a year.

Calculation:

Resident:

IF_{inh} = DBR * ED * FAH * EF * CF / AT

CF = 0.001 (m^3/L)

Abbreviations:

Cal/EPA - California Environmental Protection Agency

L - liter

kg - kilogram

m^3 - cubic meter

Reference:

Cal/EPA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. Office of Environmental Health Hazard Assessment (OEHHA). February.
Available online at: http://oehha.ca.gov/air/hot_spots/hotspots2015.html.

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Table 14
Speciation Values
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Source	Emission Type	Fraction	Chemical[1]
Diesel Offroad Equipment (Generators)	Exhaust PM	1.0	Diesel PM
	Exhaust TOG	0.0019	1,3-Butadiene
		0.074	Acetaldehyde
		0.020	Benzene
		0.0031	Ethylbenzene
		0.15	Formaldehyde
		0.0016	n-Hexane
		3.0E-04	Methanol
		0.015	Methyl Ethyl Ketone
		9.0E-04	Naphthalene
		0.026	Propylene
		6.0E-04	Styrene
		0.015	Toluene
		0.0061	m-Xylene
		0.0034	o-Xylene
		0.0010	p-Xylene

Notes:

1. Compounds presented in this table are only those air toxic contaminants with toxicity values from Cal/EPA (2015) evaluated in the health risk assessment.

Speciation profiles presented in this table are from the following sources:

Diesel offroad exhaust, TOG: ARB 818 / EPA 3161

Abbreviations:

ARB - Air Resources Board
BAAQMD - Bay Area Air Quality Management District
Cal/EPA - California Environmental Protection Agency
PM - particulate matter
TOG - total organic gas
USEPA - United States Environmental Protection Agency

References:

ARB. Speciation Profiles Used in ARB Modeling. Available online at: http://www.arb.ca.gov/ei/speciate/speciate.htm#specprof

BAAQMD. 2011. Recommended Methods for Screening and Modeling Local Risks and Hazards. May.

Cal/EPA. 2015. OEHHA/ARB Consolidated Table of Approved Risk Assessment Health Values. May 13.

USEPA. SPECIATE 4.3. Available online at: http://cfpub.epa.gov/si/speciate/

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Table 15
Toxicity Values
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Chemical[1]	Cancer Potency Factor $(mg/kg\text{-}day)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)
Diesel PM	1.1	5.0	-
Acetaldehyde	0.010	140	470
Benzene	0.10	3.0	27
1,3-Butadiene	0.60	2.0	660
Chlorine	-	0.20	210
Copper	-	-	100
Ethylbenzene	0.0087	2,000	-
Formaldehyde	0.021	9.0	55
n-Hexane	-	7,000	-
Manganese	-	0.090	-
Methanol	-	4,000	28,000
Methyl Ethyl Ketone	-	-	13,000
Naphthalene	0.12	9.0	-
Nickel	0.91	0.014	0.20
Propylene	-	3,000	-
Styrene	-	900	21,000
Toluene	-	300	37,000
Xylenes	-	700	22,000

Notes:

1. Chemicals presented in this table reflect air toxic contaminants in the proposed fuel types that are expected from emergency generators.

Abbreviations:

- - not available or not applicable
$\mu g/m^3$ - micrograms per cubic meter
ARB - Air Resources Board
Cal/EPA - California Environmental Protection Agency
$(mg/kg\text{-}day)^{-1}$ - per milligram per kilogram-day
OEHHA - Office of Environmental Health Hazard Assessment
PM - particulate matter
REL - reference exposure level

Reference:

Cal/EPA. 2015. OEHHA/ARB Consolidated Table of Approved Risk Assessment Health Values. May 13.

Table 16
Age Sensitivity Factors
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Receptor Age Group	Age Sensitivity Factor[1] (ASF)
3rd Trimester	10
Age 0-<2 Years	10
Age 2-<16 Years	3
Age 16-30 Years	1

Notes:

1. Based on Cal/EPA 2015.

Abbreviation:

Cal/EPA: California Environmental Protection Agency

References:

Cal/EPA. 2015. Air Toxics Hot Spots Program. Risk Assessment Guidelines. Guidance Manual for Preparation of Health Risk Assessments. Office of Environmental Health Hazard Assessment (OEHHA). February.

Available online at: http://oehha.ca.gov/air/hot_spots/hotspots2015.html.

Table 17
Project-Related Operational Health Risk Impacts Summary
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Receptor Type	MEIR	MEIW[1]	MESCR	MECR	PMI
Cancer Risk Impact (in one million)	0.19	2.2	0.002	0.05	2.2
Chronic Non-Cancer Hazard Index	0.00005	0.007	0.00006	0.00003	0.007
Annual $PM_{2.5}$ Concentration ($\mu g/m^3$)	0.0003	0.04	0.00031	0.00016	0.04
UTMx	593,040	593,660	593,260	592,740	593,660
UTMy	4,135,660	4,136,140	4,135,660	4,135,340	4,136,140
Acute Non-Cancer Hazard Index[2]	0.10	0.54	0.11	0.06	0.54
UTMx for Acute HI	593,040	593,709	593,240	592,740	593,709
UTMy for Acute HI	4,135,660	4,136,333	4,135,660	4,135,340	4,136,333

Notes:

1. Worker exposure is assumed at any non-resident and non-soccer child receptor, including fenceline and sidewalk receptors adjacent to the Project Site. However, Cancer risk, Chronic HI and annual PM2.5 concentration at the worker receptor does not include fenceline and sidewalk receptors. All receptors including fenceline and sidewalk receptors are included in the acute non-HI analysis.
2. The acute non-HI analysis assumes that all generators are operating in any one hour time period, which is a conservative assumption.

Abbreviations:

MEISR - Maximally Exposed Individual Resident
MEIW - Maximally Exposed Individual Worker
MESCR -Maximally Exposed Soccer Child Receptor
MECR - Maximally Exposed Childcare Receptor
PMI - Point of Maximum Impact
HI - Hazard Index
$PM_{2.5}$ - fine particulate matter less than 2.5 microns
UTM - Universal Transverse Mercator coordinate system
$\mu g/m^3$ - micrograms per cubic meter

Table 18
Summary of Cumulative Health Risk Impacts to the MEISR
Sequoia Back-up Power Facility
CyrusOne - Santa Clara, California

Emission Source	Cancer Risk Impact (in one million)	Chronic Non-Cancer Hazard Index	Acute Non-Cancer Hazard Index	Annual $PM_{2.5}$ Concentration (ug/m^3)
Project Operational Generators	0.19	5.1E-05	0.10	2.6E-04
Subtotal, Project Impacts	**0.19**	**5.1E-05**	**0.10**	**2.6E-04**
Existing Stationary Sources[1]				
German Autobody Shop	0.42	0.001	--	--
Premier Body Shop LLC	0.044	--	--	--
Service King Paint & Body	0.05	--	--	--
The Way Auto Care	0.077	--	--	--
Barefoot Coffee Roasters	0.034	--	--	--
Unocal #255290[2]	0.416	0.0005	--	--
Vargas Gardening Service[3]	--	--	--	--
Alamo Rental (US) Inc.[3]	--	--	--	--
Subtotal, Background stationary sources	**1.04**	**0.0015**	**0.00**	**0.00**
Existing Rail and Roadway Sources[4]				
Railroad	30.9	NA	NA	0.055
Major Streets	7.1	NA	NA	0.2
Highways	8.1	NA	NA	0.2
Subtotal, Background mobile sources	46.2	0.0	0.0	0.4
Total Cumulative Impact	**47**	**0.002**	**0.103**	**0.397**
BAAQMD Significance Threshold	100	10	10	0.8

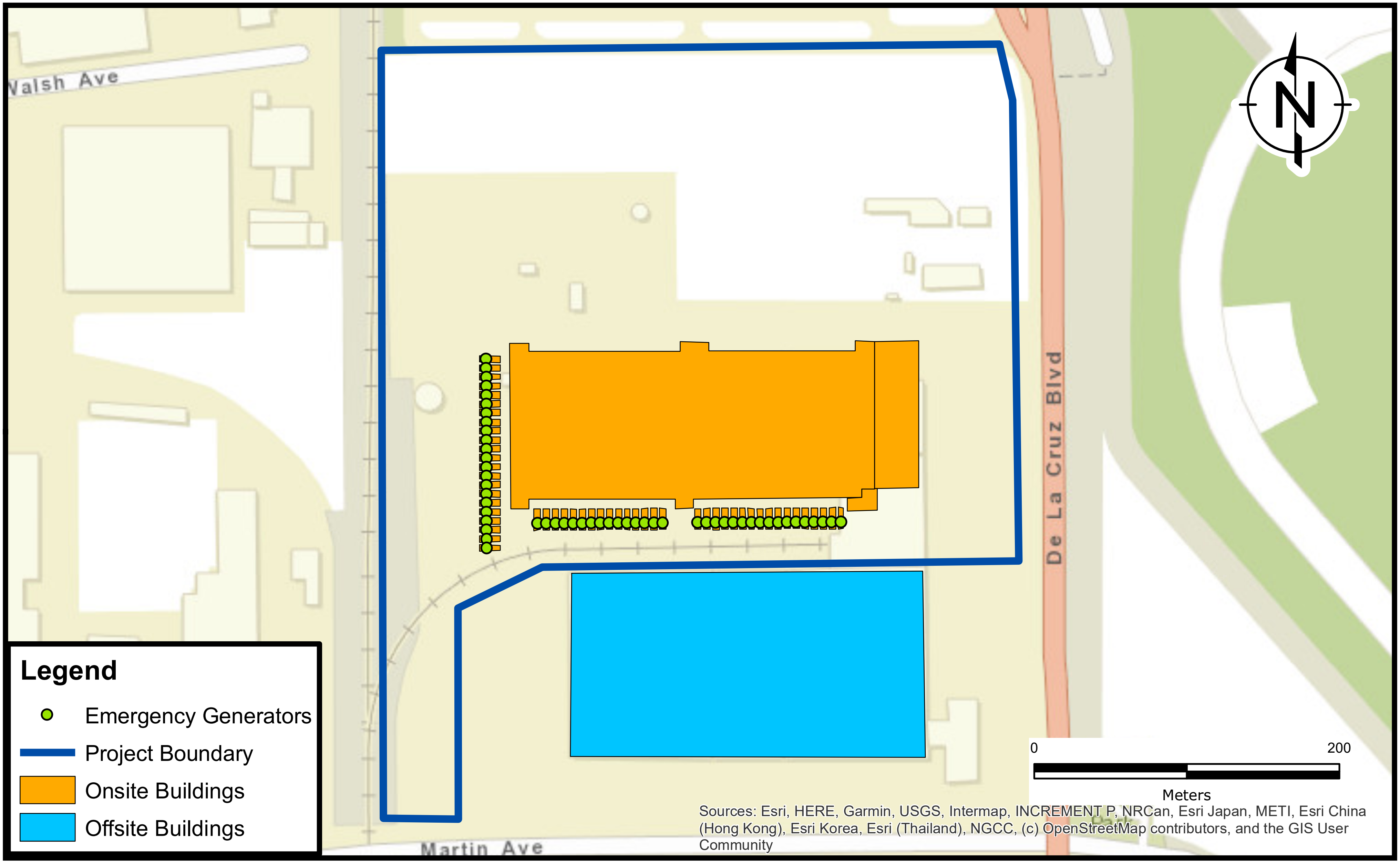
Notes:

1. The nearest permitted stationary source to the MEISR (of the sources located within 2000 ft of project facility) is greater than 1,000 ft from receptor; distances are thus treated as 1,000 ft in BAAQMD's Health Risk Calculator from MEIR to be conservative. Stationary source emissions within 2000 ft of the project facility boundary were obtained via a Stationary Source Inquiry Form submitted to BAAQMD in June 2019.
2. Facility emissions data was unavailable for speciated Toxic Air Contaminant (TAC) emissions. BAAQMD Stationary Source Screening Analysis KML Tool for Santa Clara county was used in place of emissions data, and scaled by BAAQMD GDF Distance Calculator. KML tool last updated May 2012; available at: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools
3. Data was unavailable for speciated Toxic Air Contaminant (TAC) emissions, as well as risks from BAAQMD KML tool. Throughput from both Vargas Gardening and Alamo Rental facilities were less than 50% of Unocal #255290 throughput and are >300m distance from MEISR; thus, risks are considered negligible for these facilities.
4. Cancer risks and Annual PM2.5 concentrations for mobile emission sources were obtained from BAAQMD's raster tool.

Abbreviations:

BAAQMD - Bay Area Air Quality Management District
HI - health index
MEISR - Maximally Exposed Individual Sensitive Receptor
$PM_{2.5}$ - fine particulate matter
ug/m^3 - micrograms per cubic meter
UTM - Universal Transverse Mercator coordinate system

FIGURES



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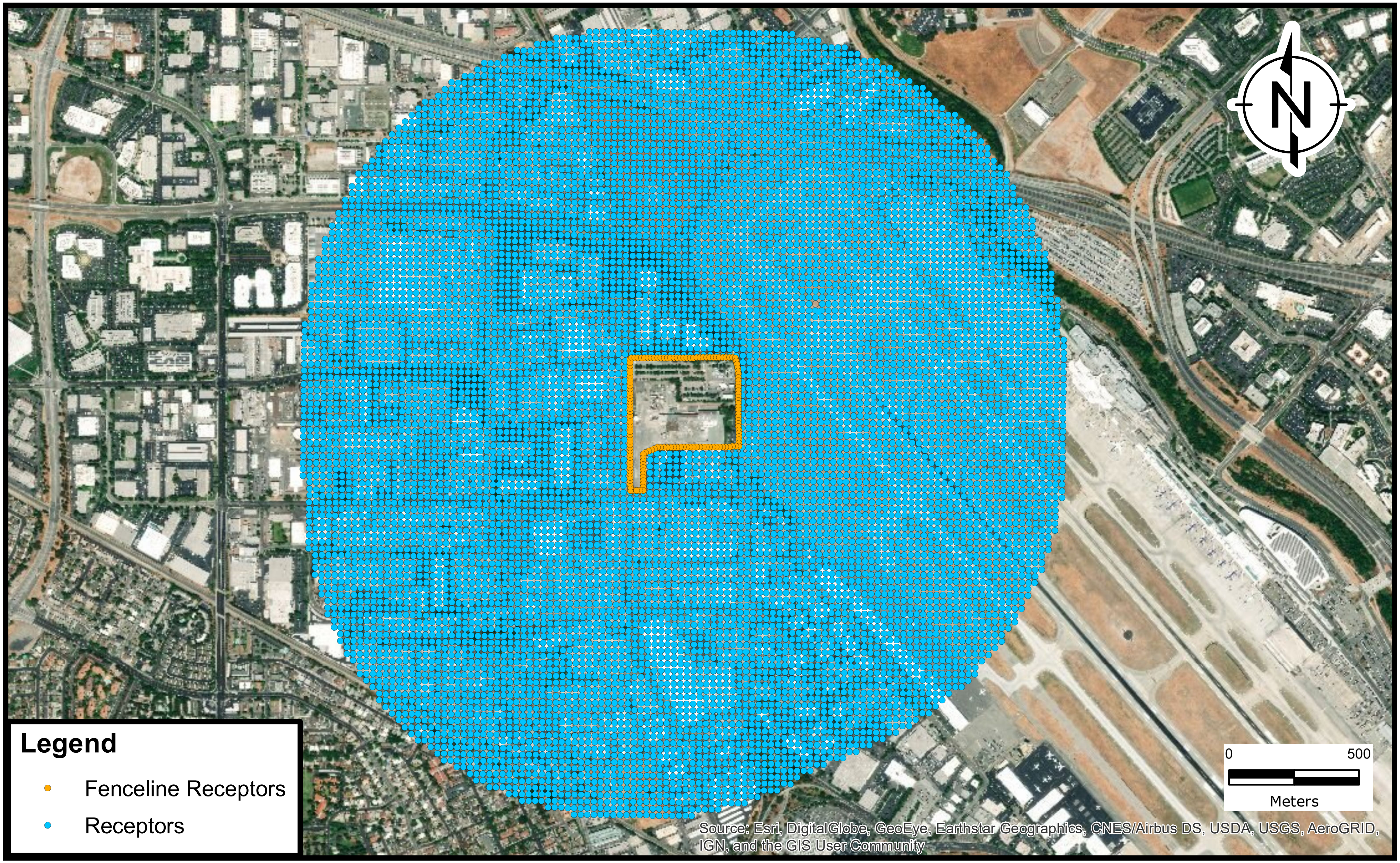
DRAFTED BY: SB | DATE: 7/29/2019

Project Location and Facility Layout
CyrusOne Project
CyrusOne Data Center
Santa Clara, California

FIGURE
1

PROJECT: 1690013366



RAMBOLL

DRAFTED BY: SB | DATE: 7/29/2019

Modelled Receptor Locations
CyrusOne Project
CyrusOne Data Center
Santa Clara, California

FIGURE
2

PROJECT: 1690013366

APPENDIX A
CALEEMOD® CONSTRUCTION AND OPERATIONAL EMISSIONS OUTPUTS

Cyrus One Santa Clara Data Center - Operational Only

County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Light Industry	702.11	1000sqft	13.73	702,110.00	25
Parking Lot	141.00	Space	1.27	56,400.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2021
Utility Company	User Defined				
CO2 Intensity (lb/MWhr)	271	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Utility company is Silicon Valley Power, using 271 lb/MWh based on Santa Clara County projections for 2020. PG&E defaults are used for CH4 and N2O intensity factors.

Land Use - Assuming lot area = 15 acres total (1.27 for parking, general light industry assumes the remainder: 13.73) and population = 25 employees

Construction Phase - Construction emissions evaluated separately

Vehicle Trips - Weekday rates calculated from 695 client-estimated trips/day divided by 702 land units. Saturday and Sunday trips scaled from CalEEMod defaults (weekday rate * 1.32/6.97 for Sat; weekday rate * 0.68/6.97).

Energy Use - 2019 Title 24 Energy and Lighting adjustment factors are applied, assuming defaults are 2016 T24 rates

Water And Wastewater - Using client-provided values: Landscaping = 686,672 gallons per year
Potable water use = 1,565,351 gallons per year

Table Name	Column Name	Default Value	New Value
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	10.00	0.00
tblConstructionPhase	NumDays	30.00	0.00
tblConstructionPhase	NumDays	300.00	0.00
tblConstructionPhase	NumDays	20.00	0.00
tblConstructionPhase	NumDays	20.00	0.00
tblLandUse	LotAcreage	16.12	13.73
tblLandUse	Population	0.00	25.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Maximum	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
		Highest		

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	3.1138	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Energy	0.0991	0.9010	0.7569	5.4100e-003		0.0685	0.0685		0.0685	0.0685	0.0000	1,653.6385	1,653.6385	0.0908	0.0329	1,665.7059
Mobile	0.1430	0.6297	1.8297	6.2900e-003	0.5706	5.3800e-003	0.5760	0.1527	5.0300e-003	0.1578	0.0000	575.3061	575.3061	0.0192	0.0000	575.7865
Waste						0.0000	0.0000		0.0000	0.0000	176.7280	0.0000	176.7280	10.4443	0.0000	437.8361
Water						0.0000	0.0000		0.0000	0.0000	0.4966	1.3366	1.8332	0.0512	1.2300e-003	3.4797
Total	**3.3559**	**1.5308**	**2.5943**	**0.0117**	**0.5706**	**0.0739**	**0.6445**	**0.1527**	**0.0735**	**0.2263**	**177.2246**	**2,230.2963**	**2,407.5209**	**10.6055**	**0.0341**	**2,682.8243**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	3.1138	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Energy	0.0991	0.9010	0.7569	5.4100e-003		0.0685	0.0685		0.0685	0.0685	0.0000	1,653.6385	1,653.6385	0.0908	0.0329	1,665.7059
Mobile	0.1430	0.6297	1.8297	6.2900e-003	0.5706	5.3800e-003	0.5760	0.1527	5.0300e-003	0.1578	0.0000	575.3061	575.3061	0.0192	0.0000	575.7865
Waste						0.0000	0.0000		0.0000	0.0000	176.7280	0.0000	176.7280	10.4443	0.0000	437.8361
Water						0.0000	0.0000		0.0000	0.0000	0.4966	1.3366	1.8332	0.0512	1.2300e-003	3.4797
Total	**3.3559**	**1.5308**	**2.5943**	**0.0117**	**0.5706**	**0.0739**	**0.6445**	**0.1527**	**0.0735**	**0.2263**	**177.2246**	**2,230.2963**	**2,407.5209**	**10.6055**	**0.0341**	**2,682.8243**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	2/3/2020	2/2/2020	5	0	
2	Site Preparation	Site Preparation	2/29/2020	2/28/2020	5	0	
3	Grading	Grading	3/14/2020	3/13/2020	5	0	
4	Building Construction	Building Construction	4/25/2020	4/24/2020	5	0	
5	Paving	Paving	6/19/2021	6/18/2021	5	0	
6	Architectural Coating	Architectural Coating	7/17/2021	7/16/2021	5	0	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 1.27

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 1,053,165; Non-Residential Outdoor: 351,055; Striped Parking Area: 3,384 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition		15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation		18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading		20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction		319.00	124.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving		15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating		64.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.2 Demolition - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.2 Demolition - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.3 Site Preparation - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.4 Grading - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.5 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Paving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Paving	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.6 Paving - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

3.7 Architectural Coating - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.1430	0.6297	1.8297	6.2900e-003	0.5706	5.3800e-003	0.5760	0.1527	5.0300e-003	0.1578	0.0000	575.3061	575.3061	0.0192	0.0000	575.7865
Unmitigated	0.1430	0.6297	1.8297	6.2900e-003	0.5706	5.3800e-003	0.5760	0.1527	5.0300e-003	0.1578	0.0000	575.3061	575.3061	0.0192	0.0000	575.7865

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
General Light Industry	695.09	133.40	70.21	1,534,435	1,534,435
Parking Lot	0.00	0.00	0.00		
Total	695.09	133.40	70.21	1,534,435	1,534,435

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
General Light Industry	9.50	7.30	7.30	59.00	28.00	13.00	92	5	3
Parking Lot	9.50	7.30	7.30	0.00	0.00	0.00	0	0	0

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
General Light Industry	0.607897	0.037434	0.184004	0.107261	0.014919	0.004991	0.012447	0.020659	0.002115	0.001554	0.005334	0.000623	0.000761
Parking Lot	0.607897	0.037434	0.184004	0.107261	0.014919	0.004991	0.012447	0.020659	0.002115	0.001554	0.005334	0.000623	0.000761

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	672.7456	672.7456	0.0720	0.0149	678.9840
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	672.7456	672.7456	0.0720	0.0149	678.9840
NaturalGas Mitigated	0.0991	0.9010	0.7569	5.4100e-003		0.0685	0.0685		0.0685	0.0685	0.0000	980.8930	980.8930	0.0188	0.0180	986.7219
NaturalGas Unmitigated	0.0991	0.9010	0.7569	5.4100e-003		0.0685	0.0685		0.0685	0.0685	0.0000	980.8930	980.8930	0.0188	0.0180	986.7219

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Light Industry	1.83812e+007	0.0991	0.9010	0.7569	5.4100e-003		0.0685	0.0685		0.0685	0.0685	0.0000	980.8930	980.8930	0.0188	0.0180	986.7219
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0991**	**0.9010**	**0.7569**	**5.4100e-003**		**0.0685**	**0.0685**		**0.0685**	**0.0685**	**0.0000**	**980.8930**	**980.8930**	**0.0188**	**0.0180**	**986.7219**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Light Industry	1.83812e+007	0.0991	0.9010	0.7569	5.4100e-003		0.0685	0.0685		0.0685	0.0685	0.0000	980.8930	980.8930	0.0188	0.0180	986.7219
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0991**	**0.9010**	**0.7569**	**5.4100e-003**		**0.0685**	**0.0685**		**0.0685**	**0.0685**	**0.0000**	**980.8930**	**980.8930**	**0.0188**	**0.0180**	**986.7219**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Light Industry	5.45539e +006	670.5964	0.0718	0.0149	676.8149
Parking Lot	17484	2.1492	2.3000e-004	5.0000e-005	2.1691
Total		**672.7456**	**0.0720**	**0.0149**	**678.9840**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Light Industry	5.45539e +006	670.5964	0.0718	0.0149	676.8149
Parking Lot	17484	2.1492	2.3000e-004	5.0000e-005	2.1691
Total		**672.7456**	**0.0720**	**0.0149**	**678.9840**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	3.1138	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Unmitigated	3.1138	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.3673					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	2.7457					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.3000e-004	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Total	**3.1138**	**7.0000e-005**	**7.7800e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**	**0.0000**	**0.0151**	**0.0151**	**4.0000e-005**	**0.0000**	**0.0161**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.3673					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	2.7457					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.3000e-004	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Total	**3.1138**	**7.0000e-005**	**7.7800e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**	**0.0000**	**0.0151**	**0.0151**	**4.0000e-005**	**0.0000**	**0.0161**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	1.8332	0.0512	1.2300e-003	3.4797
Unmitigated	1.8332	0.0512	1.2300e-003	3.4797

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Light Industry	1.56535 / 0.686672	1.8332	0.0512	1.2300e-003	3.4797
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1.8332**	**0.0512**	**1.2300e-003**	**3.4797**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Light Industry	1.56535 / 0.686672	1.8332	0.0512	1.2300e-003	3.4797
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**1.8332**	**0.0512**	**1.2300e-003**	**3.4797**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	176.7280	10.4443	0.0000	437.8361
Unmitigated	176.7280	10.4443	0.0000	437.8361

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Light Industry	870.62	176.7280	10.4443	0.0000	437.8361
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**176.7280**	**10.4443**	**0.0000**	**437.8361**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Light Industry	870.62	176.7280	10.4443	0.0000	437.8361
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**176.7280**	**10.4443**	**0.0000**	**437.8361**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

CyrusOne Construction

Santa Clara County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
General Light Industry	702.11	1000sqft	13.73	702,110.00	0
Parking Lot	141.00	Space	1.27	56,400.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	4			**Operational Year**	2021
Utility Company	User Defined				
CO2 Intensity (lb/MWhr)	271	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - Project Characteristics - Utility company is Silicon Valley Power, using 271 lb/MWh based on Santa Clara County projections for 2020. PG&E defaults are used for CH4 and N2O intensity factors.

Land Use - Updated acerage based on Project Description.

Vehicle Trips - Estimating emissions only from Construction. Operational emissions are estimated separately.

Road Dust - Estimating emissions only from Construction. Operational emissions are estimated separately.

Consumer Products - Estimating emissions only from Construction. Operational emissions are estimated separately.

Area Coating - Estimating emissions only from Construction. Operational emissions are estimated separately.

Landscape Equipment - Estimating emissions only from Construction. Operational emissions are estimated separately.

Energy Use - Estimating emissions only from Construction. Operational emissions are estimated separately.

Water And Wastewater - Estimating emissions only from Construction. Operational emissions are estimated separately.

Solid Waste - Estimating emissions only from Construction. Operational emissions are estimated separately.

Mobile Commute Mitigation -

Fleet Mix - Estimating emissions only from Construction. Operational emissions are estimated separately.

Construction Phase - Default construction schedule from CalEEMod.

Demolition - Site is currently vacant and unpaved.

Woodstoves - Estimating emissions only from Construction. Operational emissions are estimated separately.

Operational Off-Road Equipment - Estimating emissions only from Construction. Operational emissions are estimated separately.

Table Name	Column Name	Default Value	New Value
tblAreaCoating	Area_EF_Parking	150	0
tblAreaCoating	Area_Parking	3384	0
tblEnergyUse	LightingElect	0.35	0.00
tblLandUse	LotAcreage	16.12	13.73
tblProjectCharacteristics	CH4IntensityFactor	0	0.029
tblProjectCharacteristics	CO2IntensityFactor	0	271
tblProjectCharacteristics	N2OIntensityFactor	0	0.006
tblRoadDust	MaterialMoistureContent	0.5	0
tblRoadDust	MaterialSiltContent	4.3	0
tblRoadDust	MeanVehicleSpeed	40	0
tblRoadDust	MobileAverageVehicleWeight	2.4	0
tblRoadDust	RoadSiltLoading	0.1	0
tblSolidWaste	LandfillCaptureGasFlare	94.00	0.00
tblSolidWaste	LandfillNoGasCapture	6.00	0.00
tblVehicleTrips	CC_TL	7.30	0.00
tblVehicleTrips	CNW_TL	7.30	0.00
tblVehicleTrips	CW_TL	9.50	0.00
tblWater	AerobicPercent	87.46	0.00
tblWater	AnaDigestCombDigestGasPercent	100.00	0.00
tblWater	AnaerobicandFacultativeLagoonsPercent	2.21	0.00
tblWater	ElectricityIntensityFactorForWastewaterTreatment	1,911.00	0.00
tblWater	ElectricityIntensityFactorToDistribute	1,272.00	0.00
tblWater	ElectricityIntensityFactorToSupply	2,117.00	0.00
tblWater	ElectricityIntensityFactorToTreat	111.00	0.00
tblWater	SepticTankPercent	10.33	100.00

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.4506	4.3473	3.3770	9.1300e-003	0.5242	0.1679	0.6921	0.1861	0.1569	0.3430	0.0000	827.7394	827.7394	0.1102	0.0000	830.4936
2021	3.8906	2.0129	1.8323	5.3700e-003	0.2087	0.0684	0.2771	0.0566	0.0643	0.1209	0.0000	488.9371	488.9371	0.0519	0.0000	490.2353
Maximum	**3.8906**	**4.3473**	**3.3770**	**9.1300e-003**	**0.5242**	**0.1679**	**0.6921**	**0.1861**	**0.1569**	**0.3430**	**0.0000**	**827.7394**	**827.7394**	**0.1102**	**0.0000**	**830.4936**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2020	0.4506	4.3473	3.3770	9.1300e-003	0.5242	0.1679	0.6921	0.1861	0.1569	0.3430	0.0000	827.7390	827.7390	0.1102	0.0000	830.4932
2021	3.8906	2.0129	1.8323	5.3700e-003	0.2087	0.0684	0.2771	0.0566	0.0643	0.1209	0.0000	488.9369	488.9369	0.0519	0.0000	490.2351
Maximum	**3.8906**	**4.3473**	**3.3770**	**9.1300e-003**	**0.5242**	**0.1679**	**0.6921**	**0.1861**	**0.1569**	**0.3430**	**0.0000**	**827.7390**	**827.7390**	**0.1102**	**0.0000**	**830.4932**

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	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	2-1-2020	4-30-2020	1.5010	1.5010
2	5-1-2020	7-31-2020	1.2329	1.2329
3	8-1-2020	10-31-2020	1.2374	1.2374
4	11-1-2020	1-31-2021	1.2062	1.2062
5	2-1-2021	4-30-2021	1.0869	1.0869
6	5-1-2021	7-31-2021	2.7174	2.7174
7	8-1-2021	9-30-2021	1.7149	1.7149
		Highest	2.7174	2.7174

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	3.1126	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Energy	0.0999	0.9079	0.7627	5.4500e-003		0.0690	0.0690		0.0690	0.0690	0.0000	1,701.2727	1,701.2727	0.0952	0.0339	1,713.7568
Mobile	1.0058	4.4280	12.8669	0.0442	0.5876	0.0378	0.6255	0.2335	0.0354	0.2688	0.0000	4,045.8073	4,045.8073	0.1351	0.0000	4,049.1857
Waste						0.0000	0.0000		0.0000	0.0000	176.7280	0.0000	176.7280	10.4443	0.0000	437.8361
Water						0.0000	0.0000		0.0000	0.0000	51.5103	107.9940	159.5042	5.3022	0.1273	329.9975
Total	**4.2182**	**5.3359**	**13.6374**	**0.0497**	**0.5876**	**0.1069**	**0.6945**	**0.2335**	**0.1044**	**0.3379**	**228.2383**	**5,855.0890**	**6,083.3272**	**15.9769**	**0.1612**	**6,530.7922**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	3.1126	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Energy	0.0999	0.9079	0.7627	5.4500e-003		0.0690	0.0690		0.0690	0.0690	0.0000	1,701.2727	1,701.2727	0.0952	0.0339	1,713.7568
Mobile	1.0058	4.4280	12.8669	0.0442	0.5876	0.0378	0.6255	0.2335	0.0354	0.2688	0.0000	4,045.8073	4,045.8073	0.1351	0.0000	4,049.1857
Waste						0.0000	0.0000		0.0000	0.0000	176.7280	0.0000	176.7280	10.4443	0.0000	437.8361
Water						0.0000	0.0000		0.0000	0.0000	51.5103	107.9940	159.5042	5.3022	0.1273	329.9975
Total	**4.2182**	**5.3359**	**13.6374**	**0.0497**	**0.5876**	**0.1069**	**0.6945**	**0.2335**	**0.1044**	**0.3379**	**228.2383**	**5,855.0890**	**6,083.3272**	**15.9769**	**0.1612**	**6,530.7922**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	2/1/2020	2/28/2020	5	20	
2	Site Preparation	Site Preparation	2/29/2020	3/13/2020	5	10	
3	Grading	Grading	3/14/2020	4/24/2020	5	30	
4	Building Construction	Building Construction	4/25/2020	6/18/2021	5	300	
5	Paving	Paving	6/19/2021	7/16/2021	5	20	
6	Architectural Coating	Architectural Coating	7/17/2021	8/13/2021	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 75

Acres of Paving: 1.27

Residential Indoor: 0; Residential Outdoor: 0; Non-Residential Indoor: 1,053,165; Non-Residential Outdoor: 351,055; Striped Parking Area: 3,384 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	158	0.38
Demolition	Rubber Tired Dozers	2	8.00	247	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	2	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Scrapers	2	8.00	367	0.48
Grading	Tractors/Loaders/Backhoes	2	8.00	97	0.37
Building Construction	Cranes	1	7.00	231	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	130	0.42
Paving	Paving Equipment	2	8.00	132	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Grading	8	20.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	319.00	124.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	64.00	0.00	0.00	10.80	7.30	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

3.2 Demolition - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0331	0.3320	0.2175	3.9000e-004		0.0166	0.0166		0.0154	0.0154	0.0000	33.9986	33.9986	9.6000e-003	0.0000	34.2386
Total	**0.0331**	**0.3320**	**0.2175**	**3.9000e-004**		**0.0166**	**0.0166**		**0.0154**	**0.0154**	**0.0000**	**33.9986**	**33.9986**	**9.6000e-003**	**0.0000**	**34.2386**

3.2 Demolition - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-004	3.6000e-004	3.7500e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.2000e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	1.0202	1.0202	3.0000e-005	0.0000	1.0209
Total	**5.0000e-004**	**3.6000e-004**	**3.7500e-003**	**1.0000e-005**	**1.1900e-003**	**1.0000e-005**	**1.2000e-003**	**3.2000e-004**	**1.0000e-005**	**3.2000e-004**	**0.0000**	**1.0202**	**1.0202**	**3.0000e-005**	**0.0000**	**1.0209**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0331	0.3320	0.2175	3.9000e-004		0.0166	0.0166		0.0154	0.0154	0.0000	33.9986	33.9986	9.6000e-003	0.0000	34.2385
Total	**0.0331**	**0.3320**	**0.2175**	**3.9000e-004**		**0.0166**	**0.0166**		**0.0154**	**0.0154**	**0.0000**	**33.9986**	**33.9986**	**9.6000e-003**	**0.0000**	**34.2385**

3.2 Demolition - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.0000e-004	3.6000e-004	3.7500e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.2000e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	1.0202	1.0202	3.0000e-005	0.0000	1.0209
Total	**5.0000e-004**	**3.6000e-004**	**3.7500e-003**	**1.0000e-005**	**1.1900e-003**	**1.0000e-005**	**1.2000e-003**	**3.2000e-004**	**1.0000e-005**	**3.2000e-004**	**0.0000**	**1.0202**	**1.0202**	**3.0000e-005**	**0.0000**	**1.0209**

3.3 Site Preparation - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0204	0.2121	0.1076	1.9000e-004		0.0110	0.0110		0.0101	0.0101	0.0000	16.7153	16.7153	5.4100e-003	0.0000	16.8505
Total	**0.0204**	**0.2121**	**0.1076**	**1.9000e-004**	**0.0903**	**0.0110**	**0.1013**	**0.0497**	**0.0101**	**0.0598**	**0.0000**	**16.7153**	**16.7153**	**5.4100e-003**	**0.0000**	**16.8505**

3.3 Site Preparation - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-004	2.1000e-004	2.2500e-003	1.0000e-005	7.1000e-004	0.0000	7.2000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6121	0.6121	2.0000e-005	0.0000	0.6125
Total	**3.0000e-004**	**2.1000e-004**	**2.2500e-003**	**1.0000e-005**	**7.1000e-004**	**0.0000**	**7.2000e-004**	**1.9000e-004**	**0.0000**	**1.9000e-004**	**0.0000**	**0.6121**	**0.6121**	**2.0000e-005**	**0.0000**	**0.6125**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0204	0.2121	0.1076	1.9000e-004		0.0110	0.0110		0.0101	0.0101	0.0000	16.7153	16.7153	5.4100e-003	0.0000	16.8505
Total	**0.0204**	**0.2121**	**0.1076**	**1.9000e-004**	**0.0903**	**0.0110**	**0.1013**	**0.0497**	**0.0101**	**0.0598**	**0.0000**	**16.7153**	**16.7153**	**5.4100e-003**	**0.0000**	**16.8505**

3.3 Site Preparation - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.0000e-004	2.1000e-004	2.2500e-003	1.0000e-005	7.1000e-004	0.0000	7.2000e-004	1.9000e-004	0.0000	1.9000e-004	0.0000	0.6121	0.6121	2.0000e-005	0.0000	0.6125
Total	**3.0000e-004**	**2.1000e-004**	**2.2500e-003**	**1.0000e-005**	**7.1000e-004**	**0.0000**	**7.2000e-004**	**1.9000e-004**	**0.0000**	**1.9000e-004**	**0.0000**	**0.6121**	**0.6121**	**2.0000e-005**	**0.0000**	**0.6125**

3.4 Grading - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1301	0.0000	0.1301	0.0540	0.0000	0.0540	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0668	0.7530	0.4794	9.3000e-004		0.0326	0.0326		0.0300	0.0300	0.0000	81.7264	81.7264	0.0264	0.0000	82.3872
Total	**0.0668**	**0.7530**	**0.4794**	**9.3000e-004**	**0.1301**	**0.0326**	**0.1627**	**0.0540**	**0.0300**	**0.0840**	**0.0000**	**81.7264**	**81.7264**	**0.0264**	**0.0000**	**82.3872**

3.4 Grading - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-003	7.2000e-004	7.5100e-003	2.0000e-005	2.3800e-003	2.0000e-005	2.3900e-003	6.3000e-004	1.0000e-005	6.5000e-004	0.0000	2.0405	2.0405	5.0000e-005	0.0000	2.0417
Total	**1.0000e-003**	**7.2000e-004**	**7.5100e-003**	**2.0000e-005**	**2.3800e-003**	**2.0000e-005**	**2.3900e-003**	**6.3000e-004**	**1.0000e-005**	**6.5000e-004**	**0.0000**	**2.0405**	**2.0405**	**5.0000e-005**	**0.0000**	**2.0417**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.1301	0.0000	0.1301	0.0540	0.0000	0.0540	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0668	0.7530	0.4794	9.3000e-004		0.0326	0.0326		0.0300	0.0300	0.0000	81.7263	81.7263	0.0264	0.0000	82.3871
Total	**0.0668**	**0.7530**	**0.4794**	**9.3000e-004**	**0.1301**	**0.0326**	**0.1627**	**0.0540**	**0.0300**	**0.0840**	**0.0000**	**81.7263**	**81.7263**	**0.0264**	**0.0000**	**82.3871**

3.4 Grading - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.0000e-003	7.2000e-004	7.5100e-003	2.0000e-005	2.3800e-003	2.0000e-005	2.3900e-003	6.3000e-004	1.0000e-005	6.5000e-004	0.0000	2.0405	2.0405	5.0000e-005	0.0000	2.0417
Total	**1.0000e-003**	**7.2000e-004**	**7.5100e-003**	**2.0000e-005**	**2.3800e-003**	**2.0000e-005**	**2.3900e-003**	**6.3000e-004**	**1.0000e-005**	**6.5000e-004**	**0.0000**	**2.0405**	**2.0405**	**5.0000e-005**	**0.0000**	**2.0417**

3.5 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1897	1.7172	1.5079	2.4100e-003		0.1000	0.1000		0.0940	0.0940	0.0000	207.2909	207.2909	0.0506	0.0000	208.5552
Total	**0.1897**	**1.7172**	**1.5079**	**2.4100e-003**		**0.1000**	**0.1000**		**0.0940**	**0.0940**	**0.0000**	**207.2909**	**207.2909**	**0.0506**	**0.0000**	**208.5552**

3.5 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0440	1.2637	0.3366	3.0300e-003	0.0730	6.2600e-003	0.0793	0.0211	5.9900e-003	0.0271	0.0000	290.1492	290.1492	0.0133	0.0000	290.4819
Worker	0.0948	0.0681	0.7145	2.1500e-003	0.2264	1.4600e-003	0.2279	0.0602	1.3500e-003	0.0616	0.0000	194.1861	194.1861	4.7600e-003	0.0000	194.3052
Total	**0.1388**	**1.3318**	**1.0511**	**5.1800e-003**	**0.2995**	**7.7200e-003**	**0.3072**	**0.0813**	**7.3400e-003**	**0.0887**	**0.0000**	**484.3353**	**484.3353**	**0.0181**	**0.0000**	**484.7870**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1897	1.7172	1.5079	2.4100e-003		0.1000	0.1000		0.0940	0.0940	0.0000	207.2907	207.2907	0.0506	0.0000	208.5550
Total	**0.1897**	**1.7172**	**1.5079**	**2.4100e-003**		**0.1000**	**0.1000**		**0.0940**	**0.0940**	**0.0000**	**207.2907**	**207.2907**	**0.0506**	**0.0000**	**208.5550**

3.5 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0440	1.2637	0.3366	3.0300e-003	0.0730	6.2600e-003	0.0793	0.0211	5.9900e-003	0.0271	0.0000	290.1492	290.1492	0.0133	0.0000	290.4819
Worker	0.0948	0.0681	0.7145	2.1500e-003	0.2264	1.4600e-003	0.2279	0.0602	1.3500e-003	0.0616	0.0000	194.1861	194.1861	4.7600e-003	0.0000	194.3052
Total	**0.1388**	**1.3318**	**1.0511**	**5.1800e-003**	**0.2995**	**7.7200e-003**	**0.3072**	**0.0813**	**7.3400e-003**	**0.0887**	**0.0000**	**484.3353**	**484.3353**	**0.0181**	**0.0000**	**484.7870**

3.5 Building Construction - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1150	1.0546	1.0028	1.6300e-003		0.0580	0.0580		0.0545	0.0545	0.0000	140.1406	140.1406	0.0338	0.0000	140.9858
Total	**0.1150**	**1.0546**	**1.0028**	**1.6300e-003**		**0.0580**	**0.0580**		**0.0545**	**0.0545**	**0.0000**	**140.1406**	**140.1406**	**0.0338**	**0.0000**	**140.9858**

3.5 Building Construction - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0245	0.7709	0.2052	2.0300e-003	0.0494	1.7100e-003	0.0511	0.0143	1.6300e-003	0.0159	0.0000	194.3239	194.3239	8.4700e-003	0.0000	194.5356
Worker	0.0595	0.0412	0.4415	1.4000e-003	0.1531	9.6000e-004	0.1540	0.0407	8.9000e-004	0.0416	0.0000	126.7093	126.7093	2.8800e-003	0.0000	126.7813
Total	**0.0839**	**0.8121**	**0.6467**	**3.4300e-003**	**0.2024**	**2.6700e-003**	**0.2051**	**0.0550**	**2.5200e-003**	**0.0575**	**0.0000**	**321.0331**	**321.0331**	**0.0114**	**0.0000**	**321.3169**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1150	1.0546	1.0028	1.6300e-003		0.0580	0.0580		0.0545	0.0545	0.0000	140.1404	140.1404	0.0338	0.0000	140.9856
Total	**0.1150**	**1.0546**	**1.0028**	**1.6300e-003**		**0.0580**	**0.0580**		**0.0545**	**0.0545**	**0.0000**	**140.1404**	**140.1404**	**0.0338**	**0.0000**	**140.9856**

3.5 Building Construction - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0245	0.7709	0.2052	2.0300e-003	0.0494	1.7100e-003	0.0511	0.0143	1.6300e-003	0.0159	0.0000	194.3239	194.3239	8.4700e-003	0.0000	194.5356
Worker	0.0595	0.0412	0.4415	1.4000e-003	0.1531	9.6000e-004	0.1540	0.0407	8.9000e-004	0.0416	0.0000	126.7093	126.7093	2.8800e-003	0.0000	126.7813
Total	**0.0839**	**0.8121**	**0.6467**	**3.4300e-003**	**0.2024**	**2.6700e-003**	**0.2051**	**0.0550**	**2.5200e-003**	**0.0575**	**0.0000**	**321.0331**	**321.0331**	**0.0114**	**0.0000**	**321.3169**

3.6 Paving - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0126	0.1292	0.1465	2.3000e-004		6.7800e-003	6.7800e-003		6.2400e-003	6.2400e-003	0.0000	20.0235	20.0235	6.4800e-003	0.0000	20.1854
Paving	1.6600e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0142**	**0.1292**	**0.1465**	**2.3000e-004**		**6.7800e-003**	**6.7800e-003**		**6.2400e-003**	**6.2400e-003**	**0.0000**	**20.0235**	**20.0235**	**6.4800e-003**	**0.0000**	**20.1854**

3.6 Paving - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.6000e-004	3.2000e-004	3.4300e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.2000e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	0.9848	0.9848	2.0000e-005	0.0000	0.9854
Total	**4.6000e-004**	**3.2000e-004**	**3.4300e-003**	**1.0000e-005**	**1.1900e-003**	**1.0000e-005**	**1.2000e-003**	**3.2000e-004**	**1.0000e-005**	**3.2000e-004**	**0.0000**	**0.9848**	**0.9848**	**2.0000e-005**	**0.0000**	**0.9854**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0126	0.1292	0.1465	2.3000e-004		6.7800e-003	6.7800e-003		6.2400e-003	6.2400e-003	0.0000	20.0235	20.0235	6.4800e-003	0.0000	20.1854
Paving	1.6600e-003					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0142**	**0.1292**	**0.1465**	**2.3000e-004**		**6.7800e-003**	**6.7800e-003**		**6.2400e-003**	**6.2400e-003**	**0.0000**	**20.0235**	**20.0235**	**6.4800e-003**	**0.0000**	**20.1854**

3.6 Paving - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.6000e-004	3.2000e-004	3.4300e-003	1.0000e-005	1.1900e-003	1.0000e-005	1.2000e-003	3.2000e-004	1.0000e-005	3.2000e-004	0.0000	0.9848	0.9848	2.0000e-005	0.0000	0.9854
Total	**4.6000e-004**	**3.2000e-004**	**3.4300e-003**	**1.0000e-005**	**1.1900e-003**	**1.0000e-005**	**1.2000e-003**	**3.2000e-004**	**1.0000e-005**	**3.2000e-004**	**0.0000**	**0.9848**	**0.9848**	**2.0000e-005**	**0.0000**	**0.9854**

3.7 Architectural Coating - 2021

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	3.6728					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.1900e-003	0.0153	0.0182	3.0000e-005		9.4000e-004	9.4000e-004		9.4000e-004	9.4000e-004	0.0000	2.5533	2.5533	1.8000e-004	0.0000	2.5576
Total	**3.6750**	**0.0153**	**0.0182**	**3.0000e-005**		**9.4000e-004**	**9.4000e-004**		**9.4000e-004**	**9.4000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.8000e-004**	**0.0000**	**2.5576**

3.7 Architectural Coating - 2021

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.9700e-003	1.3700e-003	0.0146	5.0000e-005	5.0800e-003	3.0000e-005	5.1100e-003	1.3500e-003	3.0000e-005	1.3800e-003	0.0000	4.2019	4.2019	1.0000e-004	0.0000	4.2043
Total	**1.9700e-003**	**1.3700e-003**	**0.0146**	**5.0000e-005**	**5.0800e-003**	**3.0000e-005**	**5.1100e-003**	**1.3500e-003**	**3.0000e-005**	**1.3800e-003**	**0.0000**	**4.2019**	**4.2019**	**1.0000e-004**	**0.0000**	**4.2043**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	3.6728					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.1900e-003	0.0153	0.0182	3.0000e-005		9.4000e-004	9.4000e-004		9.4000e-004	9.4000e-004	0.0000	2.5533	2.5533	1.8000e-004	0.0000	2.5576
Total	**3.6750**	**0.0153**	**0.0182**	**3.0000e-005**		**9.4000e-004**	**9.4000e-004**		**9.4000e-004**	**9.4000e-004**	**0.0000**	**2.5533**	**2.5533**	**1.8000e-004**	**0.0000**	**2.5576**

3.7 Architectural Coating - 2021

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	1.9700e-003	1.3700e-003	0.0146	5.0000e-005	5.0800e-003	3.0000e-005	5.1100e-003	1.3500e-003	3.0000e-005	1.3800e-003	0.0000	4.2019	4.2019	1.0000e-004	0.0000	4.2043
Total	**1.9700e-003**	**1.3700e-003**	**0.0146**	**5.0000e-005**	**5.0800e-003**	**3.0000e-005**	**5.1100e-003**	**1.3500e-003**	**3.0000e-005**	**1.3800e-003**	**0.0000**	**4.2019**	**4.2019**	**1.0000e-004**	**0.0000**	**4.2043**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	1.0058	4.4280	12.8669	0.0442	0.5876	0.0378	0.6255	0.2335	0.0354	0.2688	0.0000	4,045.8073	4,045.8073	0.1351	0.0000	4,049.1857
Unmitigated	1.0058	4.4280	12.8669	0.0442	0.5876	0.0378	0.6255	0.2335	0.0354	0.2688	0.0000	4,045.8073	4,045.8073	0.1351	0.0000	4,049.1857

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Parking Lot	0.00	0.00	0.00		
General Light Industry	4,893.71	926.79	477.43	10,790,827	10,790,827
Total	4,893.71	926.79	477.43	10,790,827	10,790,827

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Parking Lot	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0
General Light Industry	9.50	7.30	7.30	59.00	28.00	13.00	92	5	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Parking Lot	0.607897	0.037434	0.184004	0.107261	0.014919	0.004991	0.012447	0.020659	0.002115	0.001554	0.005334	0.000623	0.000761
General Light Industry	0.607897	0.037434	0.184004	0.107261	0.014919	0.004991	0.012447	0.020659	0.002115	0.001554	0.005334	0.000623	0.000761

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	712.8863	712.8863	0.0763	0.0158	719.4969
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	712.8863	712.8863	0.0763	0.0158	719.4969
NaturalGas Mitigated	0.0999	0.9079	0.7627	5.4500e-003		0.0690	0.0690		0.0690	0.0690	0.0000	988.3864	988.3864	0.0189	0.0181	994.2599
NaturalGas Unmitigated	0.0999	0.9079	0.7627	5.4500e-003		0.0690	0.0690		0.0690	0.0690	0.0000	988.3864	988.3864	0.0189	0.0181	994.2599

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Light Industry	1.85217e+007	0.0999	0.9079	0.7627	5.4500e-003		0.0690	0.0690		0.0690	0.0690	0.0000	988.3864	988.3864	0.0189	0.0181	994.2599
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0999**	**0.9079**	**0.7627**	**5.4500e-003**		**0.0690**	**0.0690**		**0.0690**	**0.0690**	**0.0000**	**988.3864**	**988.3864**	**0.0189**	**0.0181**	**994.2599**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
General Light Industry	1.85217e+007	0.0999	0.9079	0.7627	5.4500e-003		0.0690	0.0690		0.0690	0.0690	0.0000	988.3864	988.3864	0.0189	0.0181	994.2599
Parking Lot	0	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total		**0.0999**	**0.9079**	**0.7627**	**5.4500e-003**		**0.0690**	**0.0690**		**0.0690**	**0.0690**	**0.0000**	**988.3864**	**988.3864**	**0.0189**	**0.0181**	**994.2599**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Light Industry	5.79943e +006	712.8863	0.0763	0.0158	719.4969
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**712.8863**	**0.0763**	**0.0158**	**719.4969**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
General Light Industry	5.79943e +006	712.8863	0.0763	0.0158	719.4969
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**712.8863**	**0.0763**	**0.0158**	**719.4969**

6.0 Area Detail

6.1 Mitigation Measures Area

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	3.1126	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Unmitigated	3.1126	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.3661					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	2.7457					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.3000e-004	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Total	**3.1126**	**7.0000e-005**	**7.7800e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**	**0.0000**	**0.0151**	**0.0151**	**4.0000e-005**	**0.0000**	**0.0161**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.3661					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	2.7457					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Landscaping	7.3000e-004	7.0000e-005	7.7800e-003	0.0000		3.0000e-005	3.0000e-005		3.0000e-005	3.0000e-005	0.0000	0.0151	0.0151	4.0000e-005	0.0000	0.0161
Total	**3.1126**	**7.0000e-005**	**7.7800e-003**	**0.0000**		**3.0000e-005**	**3.0000e-005**		**3.0000e-005**	**3.0000e-005**	**0.0000**	**0.0151**	**0.0151**	**4.0000e-005**	**0.0000**	**0.0161**

7.0 Water Detail

7.1 Mitigation Measures Water

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	159.5042	5.3022	0.1273	329.9975
Unmitigated	159.5042	5.3022	0.1273	329.9975

7.2 Water by Land Use

Unmitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Light Industry	162.363 / 0	159.5042	5.3022	0.1273	329.9975
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**159.5042**	**5.3022**	**0.1273**	**329.9975**

7.2 Water by Land Use

Mitigated

	Indoor/Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
General Light Industry	162.363 / 0	159.5042	5.3022	0.1273	329.9975
Parking Lot	0 / 0	0.0000	0.0000	0.0000	0.0000
Total		**159.5042**	**5.3022**	**0.1273**	**329.9975**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	176.7280	10.4443	0.0000	437.8361
Unmitigated	176.7280	10.4443	0.0000	437.8361

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Light Industry	870.62	176.7280	10.4443	0.0000	437.8361
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**176.7280**	**10.4443**	**0.0000**	**437.8361**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
General Light Industry	870.62	176.7280	10.4443	0.0000	437.8361
Parking Lot	0	0.0000	0.0000	0.0000	0.0000
Total		**176.7280**	**10.4443**	**0.0000**	**437.8361**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation