ATTACHMENT 6
Geotechnical and Groundwater Investigation Report

This is the cover sheet for Attachment 6.

CHRISTIAN WHEELER
ENGINEERING

February 18, 2022

West Coast Tomato Growers, Inc.
5780 Mission Avenue
Oceanside, California 92054

CWE 2210728.01R

Subject: **Preliminary Storm Water Infiltration Feasibility Study**
Farm Workers Housing, 5780 Mission Avenue, Oceanside, California

References:
1) Christian Wheeler Engineering, 2015, Report of Preliminary Geotechnical Investigation, Singh Property, 5780 Mission Avenue, Oceanside, California, CWE Report No. 2150046.01, dated March 19, 2015
2) Geocon, 2014, Pesticide-Impacted Soil Reuse Summary, Singh Property Restoration Project, Oceanside, California, dated April 8, 2014
3) Snipes-Dye & Associates, Conceptual Grading Plan, Farm Workers Housing, West Coast Tomato Growers, N. River Road, Oceanside, CA 92057, dated January 27, 2022

Ladies and Gentlemen:

We have prepared this infiltration feasibility study to address the potential for storm water infiltration at the subject site in accordance with the City of Oceanside BMP Design Manual. In general, the purpose of our infiltration feasibility study is to provide design phase infiltration rates based on our borehole percolation tests and our subsurface explorations.

SITE AND PROJECT DESCRIPTION

The subject site is located at the western terminus of Singh Way, in the City of Oceanside California. The site comprises the eastern portion of a property that is presently utilized for agricultural packing purposes. The area subject of this proposal is presently vacant and is bounded on the north, south, and east by vacant land. Topographically, the site slopes very gently to the north. According to the grading plans average site elevation is about 133 feet.

We understand that the subject project will consist of the construction of 8 dormitory buildings and 4 multi-purpose buildings. Associated improvements will include outdoor seating areas, a play field, asphaltic concrete

access driveways, and Portland concrete cement sidewalks. It is our understanding that the buildings will consist of two-story prefabricated metal or modular structures. It is assumed that the structures will be supported by conventional shallow foundations. As part of the storm water management for the project a biofiltration basin is proposed. Grading to accommodate the proposed improvements will consist of cuts and fills up to about 7 and 5 feet from existing site grades, respectively.

To aid us in the preparation of this report, we were provided with a conceptual grading plan prepared by Snipes-Dye & Associates, dated January 27, 2022. A copy of the conceptual grading plan has been used as the base for our Site Plan and Geotechnical Map, and is included herein as Plate No. 1.

FIELD INVESTIGATION

The subsurface explorations associated with this study consisted of two, 8-inch-diameter auger borings which extended to a depth of approximately 19 feet below existing grade. The borings were drilled to supplement our previous (2015) subsurface explorations. The borings were logged in detail with emphasis on describing the soil profile. Low permeability and relatively impermeable materials were identified in the borings. No evidence of soil contamination was detected within the samples obtained.

The approximate locations of our recent and previous subsurface explorations are shown on Plate No. 1 of this report. Logs of the explorations are presented in Appendix A of this report. Four percolation test borings were also drilled within the area of the site initially proposed to support the biofiltration basin. Subsequent to our percolation study the location of the biofiltration basin was revised. From our extensive work at the subject site and in reviewing our subsurface explorations it is our opinion that the soil conditions in the percolation test area are representative of the soil conditions underlying the proposed biofiltration basin.

GEOLOGIC SETTING AND SOIL DESCRIPTION: The site is primarily underlain by Quaternary-age older alluvium deposits which are overlain by younger alluvium deposits. On the most southerly and westerly portions of the site there are areas where the alluvium is overlain by areas of either undocumented or documented fill. As encountered in our subsurface explorations, the fill extends to a maximum depth of about 4 feet from existing grade and consisted of well graded silty sand (SW-SM). The underlying alluvial deposits consisted of silty sand (SM) and clayey sand (SC).

MAPPED HYDROLOGIC SOIL GROUP: According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the site is located in the map unit designated Placentia sandy loam, (PeD2) and has a Hydrologic Soil Group rating of D. Group D soils have very slow infiltration rates and very slow rate of

water transmission. Our subsurface explorations and percolation testing correlate with a Group D soil rating. The NRCS Web Soil Survey map for the subject site and corresponding map unit description are presented in Appendix D.

GROUNDWATER

Seepage was encountered in boring B-1 during our subsurface explorations at a depth of 19 feet corresponding to an elevation of 107 feet. Previous CPT data has indicated groundwater at 14 feet corresponding to an elevation of 105 feet (CWE, 2150046.01). In addition, we reviewed available groundwater data in the vicinity of the site to determine the historic high groundwater elevation. The main resources utilized were Geotracker and California Department of Water Resources websites. Reports for the Cleanup Program site titled San Luis Rey Restoration/Mitigation Bank located approximately 250 feet north of the site were reviewed. The highest recorded water level was at elevation of 104.5 feet (Geocon, 2014) corresponding to approximately 20 feet below existing site grades. The depth to seasonal high groundwater beneath the site is expected to fluctuate seasonally and is estimated to be as high as 20 feet below the existing site grades based on nearby monitoring well information (Geocon, 2014). Based on this information we anticipate that seasonal high groundwater will not encroach within 10 feet of the base of the proposed biofiltration basin.

INFILTRATION RATE DETERMINATION

FIELD MEASUREMENTS

Percolation testing was performed within four borings, the approximate locations of the percolation borings are shown on Plate No. 1. Eight-inch-diameter borings, which are labelled as PT-1 through PT-4, were drilled to 3 feet below existing site grades. Once cleaned of slough, a 3-inch diameter perforated pipe was set in the excavation and surrounded by ¾-inch gravel to prevent caving. After pipe installation, the percolation borings were presoaked. The field percolation rates were determined the following day by using the falling head test method. It should be noted that water remained within all of the borings with after the presoaking on the previous day. The initial water level was established by refilling the test holes and percolation rates were monitored and recorded every 30 minutes over a period of at least 6 hours until the infiltration rates stabilized. Measurements were taken using a water level meter (Solinst, Model 101) with an accuracy of measurement of 0.005 foot (0.06 inch). To account for the use of gravel placed around the perforated pipe, an adjustment factor of 0.44 was used in the calculations.

FACTOR OF SAFETY

The City of Oceanside BMP Design Manual states that "a maximum factor of safety of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified. If the site passes the feasibility analysis at a factor of safety of 2.0, then infiltration must be investigated, but a higher factor of safety may be selected at the discretion of the design engineer." The field infiltration rates were averaged and a factor of safety factor of 2 was applied. The calculated infiltration rates are presented in Table I.

TABLE I: INFILTRATION RATES

Test No.	Location	Soil Tested	Depth of Testing (Inches)	Field Infiltration Rate (Inches per hour)	Average Field Infiltration Rate	Average Infiltration Rate with Factor of Safety (2) Applied
PT-1	See Pate 1	Younger Alluvium	36	0.04	0.07 inches per hour	0.03 inches per hour
PT-2			36	0.08		
PT-3			36	0.11		
PT-4			37	0.05		

Infiltration and percolation are two related but different processes describing the movement of moisture through soil. Lateral and downward movement of water into soil and porous or fractured rock is called percolation, and the downward entry of water into the soil is called infiltration. The direct measurement yielded by a percolation test tends to overestimate the infiltration rate, except perhaps in cases where an infiltration basin is similarly dimensioned to the borehole. As such, adjustments of the measured percolation rates were converted into infiltration rates using the Porchet Method. The spreadsheet used for the conversion is included in Appendix C.

POTENTIAL STORM WATER INFILTRATION HAZARDS

SETTLEMENT AND VOLUME CHANGE: Settlement and volume change can occur when water is introduced below grade. Settlement refers to a condition when soils decrease in volume (i.e. hydro collapse, calcareous soils, consolidation or liquefaction). Heave refers to expansion of soils or an increase in volume (i.e. expansive soils or frost heave). In our opinion the alluvium will not be subject to hydro collapse or heave; however, we do anticipate that the newly compacted fill will experience hydro collapse therefore; we have provided impermeable liner recommendations as discussed in this report.

SLOPE STABILITY: Infiltration of water has the potential to increase the risk of failure to nearby slopes. The BMP Design Manual recommends that infiltration BMPs be set back at least 50 feet from natural slopes (<25%) and at least a distance of 1.5H from the fill slopes where H is the height of the fill slope. The setbacks should be measured from the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP. Due to the proposed fill slopes which will surround the biofiltration basin we recommend that the sides of the biofiltration basin be lined with an impermeable liner to prevent the lateral migration of water. The liner should extend to the base of the aggregate storage layer.

UTILITY CONSIDERATIONS: Utilities are either public or private infrastructure components that include underground pipelines, vaults, and wires/conduit, and above ground wiring and associated structures. Infiltration of water can pose a risk to subsurface utilities, or geotechnical hazards can occur within the utility trenches when water is introduced. We anticipate that the proposed BMP devices will be located at least 10 feet away from the existing and proposed utilities to prevent water migration into the utility trenches. If the utility trenches are not located at a sufficient distance away from the proposed BMP devices, vertical cut-off liners should be used to prevent groundwater infiltration into the utility trenches. Therefore, the risk of introducing water into a utility trench may be considered low.

GROUNDWATER MOUNDING: Groundwater mounding occurs when infiltrated water creates a rise in the groundwater table beneath the facility. Groundwater mounding can affect nearby subterranean structures and utilities. Based on the anticipated soil conditions below the proposed BMP devices, the risk of groundwater mounding below the BMP devices is anticipated to be low.

RETAINING WALLS AND FOUNDATIONS: Infiltration of water can result in potential increases in lateral pressures and potential reduction in soil strength. Retaining walls and foundations can be negatively impacted by these changes in soil conditions. This should be taken into account when designing the storm water BMP devices, retaining walls and foundations for the site. The BMP manual recommends BMPs be setback at least 10 feet from foundations or settlement-sensitive improvements. This should be taken into account when designing the storm water BMP devices, retaining walls and foundations for the site. The setback must be measured from the closest horizontal radial distance from the surface edge (at the overflow elevation) of the BMP. If appropriate storm water control measures are implemented, the risk of increased lateral pressure and reduction in soil strength for retaining walls and foundations may be considered low.

SOIL AND GROUNDWATER CONTAMINATION: Infiltration should be avoided in areas where infiltration could contribute to the movement or dispersion of soil or groundwater contamination or adversely affect ongoing clean-up efforts, either on site or down-gradient of the project. We have no knowledge of the site

being used for industrial activities. Based on the information found on http://geotracker.waterboards.ca.gov/, a portion of the San Luis Rey Restoration/Mitigation Bank project located approximately 250 feet north of the site has an open site assessment designation. The referenced report titled Pesticide-Impacted Soil Reuse Summary (Geocon, 2014) proposes placing pesticide impacted soils from the site to the north beneath the subject site. It is our understanding that this was a mitigation possibility and no plans have been made to proceed with the recommendations presented in this report.

SEPARATION TO SEASONAL HIGH GROUNDWATER: The depth to seasonal high groundwater beneath the site is expected to fluctuate seasonally and is estimated to be 20 feet below the existing site grades. Based on this information we anticipate that seasonal high groundwater will not encroach within 10 feet of the base of the proposed BMPs.

WELLHEAD PROTECTION: Wellheads, natural and man-made, are water resources that may potentially be adversely impacted by storm water infiltration through the introduction of contaminants or alterations in water supply and levels. Infiltration BMP devices must be located at a minimum of 100 feet horizontally from any water supply well.

CONCLUSIONS AND RECOMMENDATIONS

Based on our experience with similar projects, we anticipate that, as long as our recommendations herein are implemented, infiltration of storm water utilizing the proposed onsite storm water infiltration BMP devices will not result in soil piping, daylight water seepage, or slope instability for the property or project sites down-gradient of the site.

The soils underlying the site were found to have a very low infiltration rate. Using a safety factor of 2.0, an infiltration rate of 0.03 inches per hour, can be used for the design phase at the subject site. These rates fall within the "Partial Infiltration" category based on the limits presented in City of Oceanside BMP Design Manual. We have completed the Worksheet C.4-1: Categorization of Infiltration Feasibility Condition which is presented in Appendix B.

Due to the proposed fill slopes which will surround the biofiltration basin we recommend that the sides of the biofiltration basin be lined with an impermeable liner to prevent the lateral migration of water into the proposed fill soils. The liner should extend to the base of the aggregate storage layer and we should review the final biofiltration design.

LIMITATIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on our limited percolation testing, an evaluation of the subsurface soil conditions encountered at our subsurface exploration locations and the assumption that the infiltration rates and soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the BMPs may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the soils engineer so that he may make modifications if necessary. In addition, this office should be advised of any changes in the project scope, proposed site grading or storm water BMP design so that it may be determined if the recommendations contained herein are appropriate. This should be verified in writing or modified by a written addendum.

It should be recognized that routine inspection and maintenance of infiltration basins are necessary to prevent clogging and failure. A maintenance plan should be specified for each basin by the designer and followed by the owner during the entire lifetime of the BMP device. It is not our intent to review the civil engineering plans, notes, details, or calculations, when prepared, to verify that the engineer has complied with any particular storm water design standards. It is the responsibility of the designer to properly prepare the storm water plan based on the municipal requirements considering the planned site development and infiltration rates.

Respectfully submitted,
CHRISTIAN WHEELER ENGINEERING

Daniel B. Adler, RCE #36037

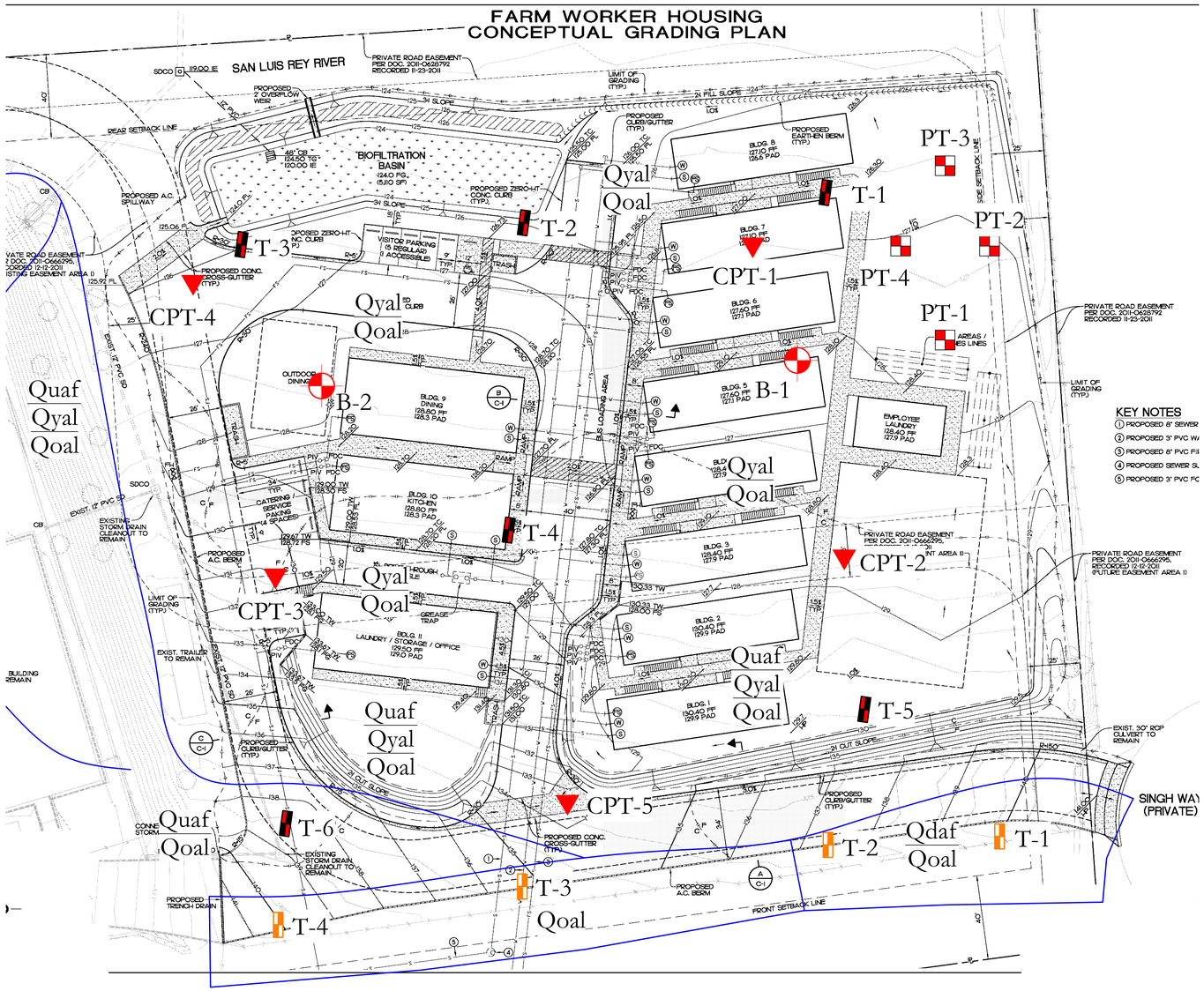
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FARM WORKER HOUSING
CONCEPTUAL GRADING PLAN



W+E

0 30' 60'

SCALE: 1" = 30'

CWE LEGEND

B-2	Approximate Boring Location (CWE, 2022)
PT-4	Approximate Percolation Test Location (CWE, 2022)
CPT-5	Approximate Cone Penetrometer Test Location (CWE, 2015)
T-6	Approximate Test Trench Location (CWE, 2015)
T-6	Approximate Test Trench Location (CWE, 2011)
~	Approximate Geologic Contact
Qdaf / Qoal	Documented Artificial Fill over Older Alluvium
Quaf / Qyal / Qoal	Undocumented Artificial Fill over Younger Alluvium over Older Alluvium
Quaf / Qoal	Undocumented Artificial Fill over Older Alluvium
Qyal / Qoal	Younger Alluvium over Older Alluvium

ENGINEER OF WORK
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STATE OF CALIFORNIA

SITE PLAN AND GEOLOGIC MAP

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE: FEBRUARY 2022 | JOB NO.: 2210728.01R
BY: SD | PLATE NO.: 1

CHRISTIAN WHEELER ENGINEERING

Appendix A

Subsurface Explorations

LOG OF TEST BORING B-1

Date Logged:	1/24/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	126'	Drive Type:	140lbs/30 inches
Proposed Elevation:	129'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0			SM	**Younger Alluvium (Qyal):** Dark brown, moist, very loose, fine- to medium-grained, SILTY SAND.							
				Reddish-brown, moist, loose, SILTY SAND with clay.							
5			SM/SW	Light brown, moist, medium dense, fine- to coarse-grained, SILTY SAND/well-graded SAND, micaceous.	47	Cal					
			SM	Reddish-brown, moist, medium dense, fine- to coarse-grained, SILTY SAND.	49	Cal					
10			SM	Olive green, moist, very dense, very fine- to fine-grained, VERY SILTY SAND, well-cemented, micaceous.	50/5"	Cal					
15			SM	Light gray, moist, very dense, fine- to medium-grained, SILTY SAND, micaceous.	50/5½"	Cal					
			SM	Light brown to light gray, very moist, very dense, fine- to coarse-grained, SILTY SAND, micaceous.							
20				Seepage at 19'.	50/6"**	Cal					
				Terminated at 19.5 feet. Seepage encountered at 19 feet.							
25											
30											

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	FEBRUARY 2022	JOB NO.:	2210728.01
BY:	SD	APPENDIX:	A-1

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-2

Date Logged:	1/24/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	127'	Drive Type:	140lbs/30 inches
Proposed Elevation:	131'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE
0	SM	**Younger Alluvium (Qyal):** Dark brown, moist, very loose, fine- to coarse-grained, SILTY SAND.		
	SM/ SC	Dark brown, moist, dense, SILTY SAND to CLAYEY SAND.	40	Cal
5	SM	Reddish-brown, moist, very dense, fine- to medium-grained, SILTY SAND, micaceous.	59	Cal
10	SM	Olive brown to reddish brown, moist, very dense, very fine- to fine-grained, VERY SILTY SAND.	50/5"	Cal
	SM	Light gray to olive brown, moist, very dense, very fine- to fine-grained, VERY SILTY SAND, micaceous.	50/6"	Cal
15	SM	Light gray to light brown, moist, very dense, fine- to coarse-grained, SILTY SAND, micaceous.	50/6"	Cal
20		Terminated at 19.5 feet. No seepage or groundwater encountered.		
25				
30				

BULK | MOISTURE CONTENT (%) | DRY DENSITY (pcf) | RELATIVE COMPACTION (%) | LABORATORY TESTS

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	FEBRUARY 2022	JOB NO.:	2210728.01
BY:	SD	APPENDIX:	A-2

CHRISTIAN WHEELER ENGINEERING

LOG OF TRENCH T-1

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	125 feet	Drive Type:	N/A
Finish Elevation:	137 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	125	SM	**Younger Alluvium (Qyal):** Brown, moist, very loose, fine- to coarse-grained, SILTY SAND; upper 2' disturbed.							MD
2			SILTY SAND with CLAY.		CK		13.4	120.8		
4		SW	Light brown, moist, loose, fine- to coarse-grained, WELL-GRADED SAND; micaceous, friable.							
5	120									
10	115	SM	Olive-brown, very moist, loose, very fine- to fine-grained, VERY SILTY SAND; micaceous.							
11					CK		18.6	94.0		
14					CK		18.8	99.0		
15	110		Test trench terminated at 15 feet. No groundwater or seepage encountered.							

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	3

CHRISTIAN WHEELER ENGINEERING

LOG OF TRENCH T-2

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	125 feet	Drive Type:	N/A
Finish Elevation:	138 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	125		SM	**Younger Alluvium (Qyal):** Brown, moist, very loose, very fine- to medium-grained, SILTY SAND; upper 2' disturbed.							
1											
2				Very moist.							
3			SC	Light brown, moist, loose, very fine- to medium-grained, CLAYEY SAND.		CK					
4						CK					
5	120		SW	Light brown, moist, SANDY CLAY.							
6											
7											
8			SM	Light brown to olive-brown, very moist, loose, very fine- to medium-grained, VERY SILTY SAND.							SA
9						CK		21.2	97.0		
10	115										
11											
12						CK					
13											
14				Test trench terminated at 15 feet. No groundwater or seepage encountered.							
15	110										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	4

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-3

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	125 feet	Drive Type:	N/A
Finish Elevation:	140 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

CP Collapse Potential

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	125		SM	**Younger Alluvium (Qyal):** Brown, moist, loose, fine- to coarse-grained, SILTY SAND; upper 2' disturbed.							
1											
2				Very moist.							
3			CL	Grayish-brown to brown, very moist, loose, very fine- to medium-grained, SANDY CLAY; mottled.							
4						CK		20.5	103.9		
5	120		SM	Grayish-brown, moist to very moist, loose, very fine- to medium-grained, VERY SILTY SAND.							
6						CK		15.6	113.1		
7											
8			SM	**Older Alluvium (Qoal):** Reddish-brown to orangish-brown, moist to very moist, dense, very fine- to medium-grained, SILTY SAND; micaceous.							
9						CK		18.8	100.2		CP
10	115			Light brown.							
11						CK		15.4	99.9		
12						CK		24.5	94.3		
13				Test trench terminated at 13 feet. No groundwater or seepage encountered.							
14											
15	110										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	5

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-4

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	128 feet	Drive Type:	N/A
Finish Elevation:	140 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	128		SM	**Younger Alluvium (Qyal):** Brown, moist, loose, fine- to coarse-grained, SILTY SAND; upper 2' disturbed.							
3	123		SC/CL	Grayish-brown to reddish-brown, moist, loose to medium dense/ medium stiff, CLAYEY SAND/SANDY CLAY.							
6			SM	Light brown to grayish-brown, very moist, loose to medium dense, very fine- to medium-grained, VERY SILTY SAND.							
13				Test trench terminated at 13 feet. No groundwater or seepage encountered.							
15	113										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	6

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-5

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	133 feet	Drive Type:	N/A
Finish Elevation:	139 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	133		SM	**Undocumented Artificial Fill (Quaf):** Light gray, damp, loose to medium dense, fine- to coarse-grained, SILTY SAND.							
1			SC	Brown, moist, loose to medium dense, fine- to coarse-grained, CLAYEY SAND.							
2											
3											
4			SM	**Younger Alluvium (Qyal):** Brown, moist, loose, fine- to coarse-grained, SILTY SAND.							
5	128										
6			SM	**Older Alluvium (Qoal):** Brown to reddish-brown, moist, medium dense to dense, very fine- to medium-grained, SILTY SAND.							
7						CK		16.4	110.9		CP
8											
9											
10	123			Test trench terminated at 10 feet. No groundwater or seepage encountered.							
11											
12											
13											
14											
15	118										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	7

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-6

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	137 feet	Drive Type:	N/A
Finish Elevation:	143 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	137		SM	**Undocumented Artificial Fill (Quaf):** Light gray, damp, loose to medium dense, fine- to coarse-grained, SILTY SAND.							
1			SC/CL	**Older Alluvium (Qoal):** Reddish-brown to dark brown, moist, medium dense/ stiff, very fine- to coarse-grained, CLAYEY SAND/ SANDY CLAY; mottled, moderately weathered to 3'.							
2						CK		16.9	112.5		
3				Dense/ very stiff.							
4						CK		14.6	113.0		
5	132		SM	Light brown, moist, very dense, fine- to coarse-grained, SILTY SAND; micaceous.							
6											
7						CK		15.6	108.3		CP
8											
9											
10	127			Test trench terminated at 10 feet. No groundwater or seepage encountered.							
11											
12											
13											
14											
15	122										

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

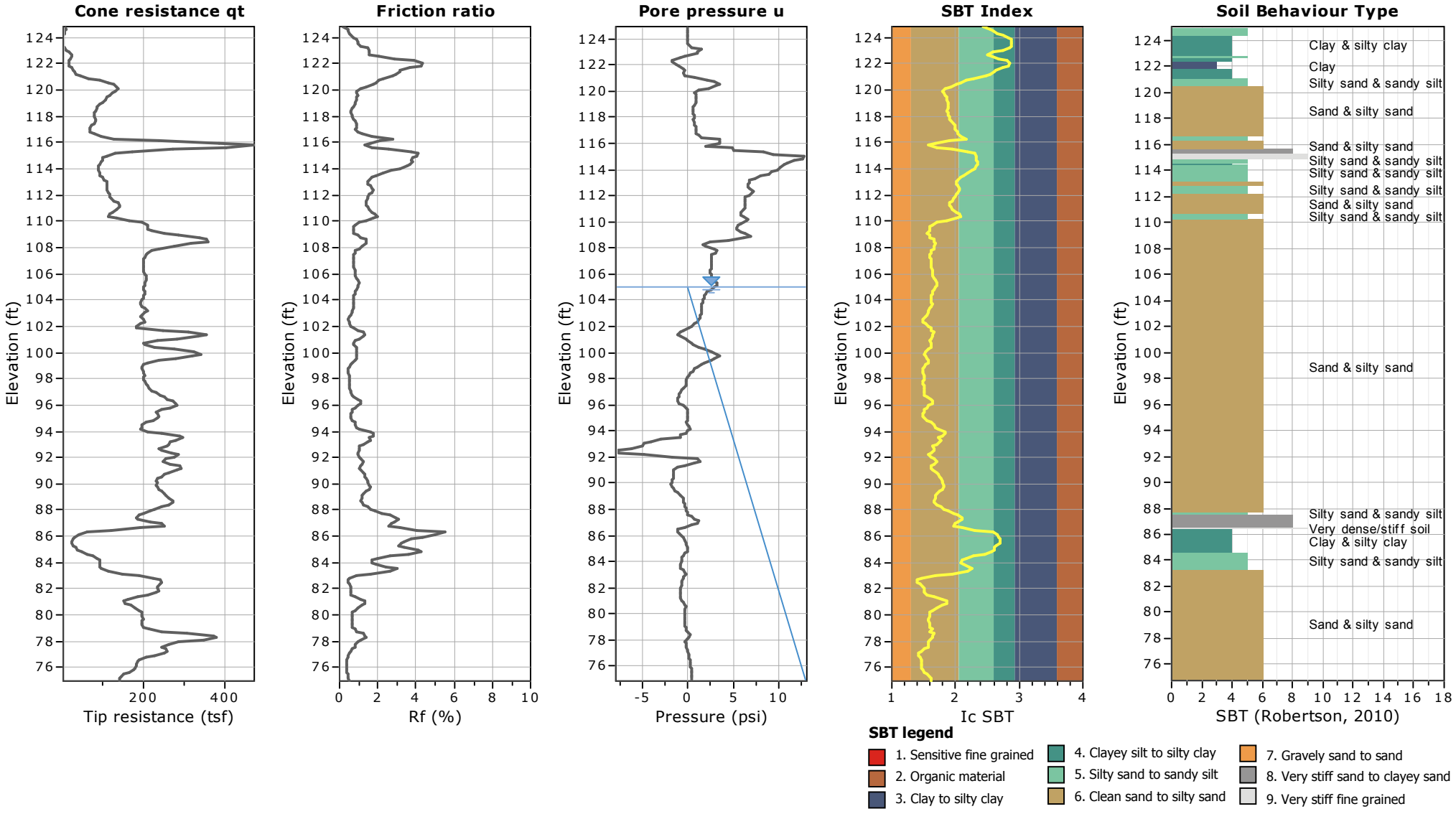
DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	8

CHRISTIAN WHEELER
ENGINEERING

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

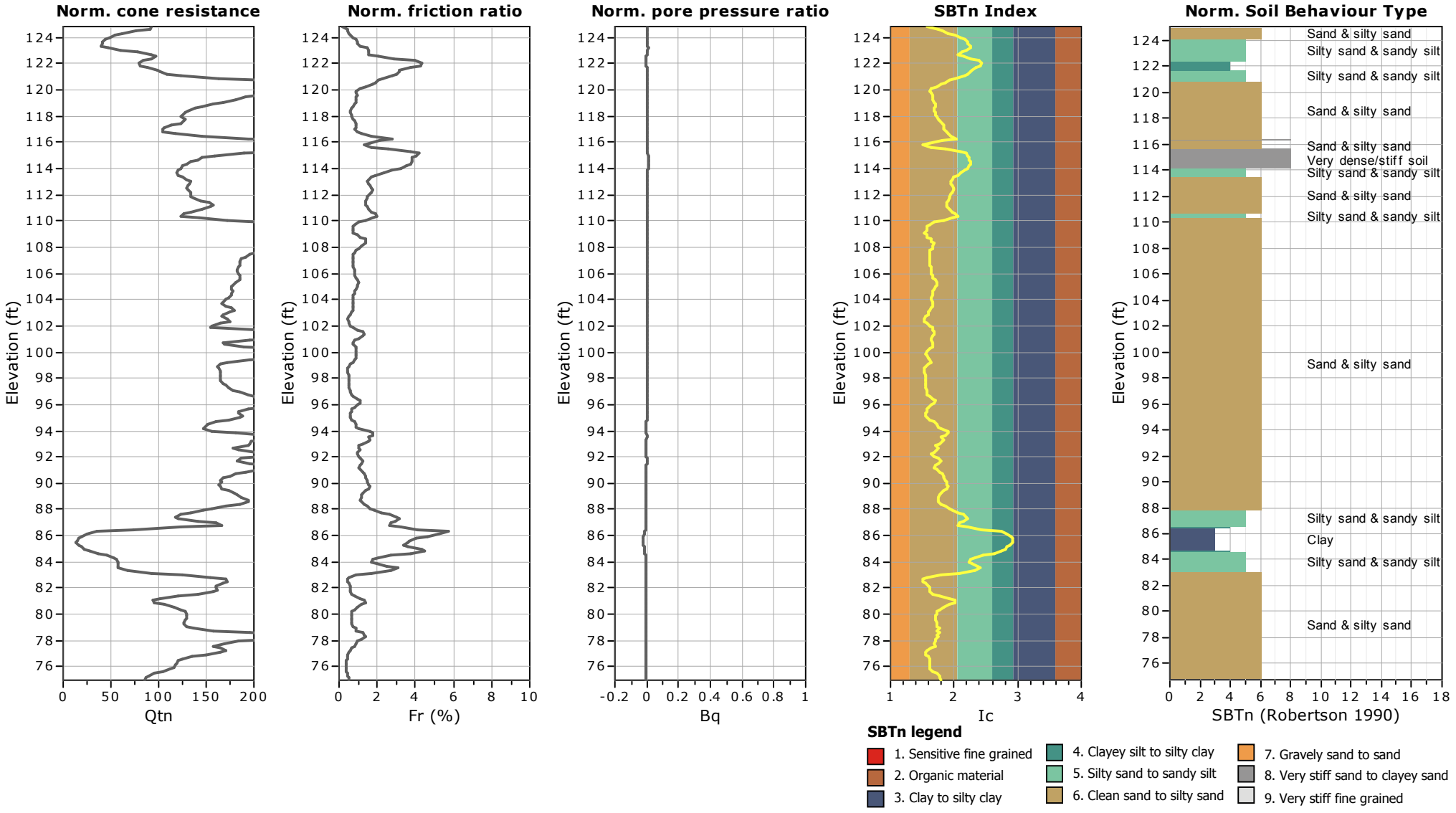
CPT: CPT-01
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 125.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

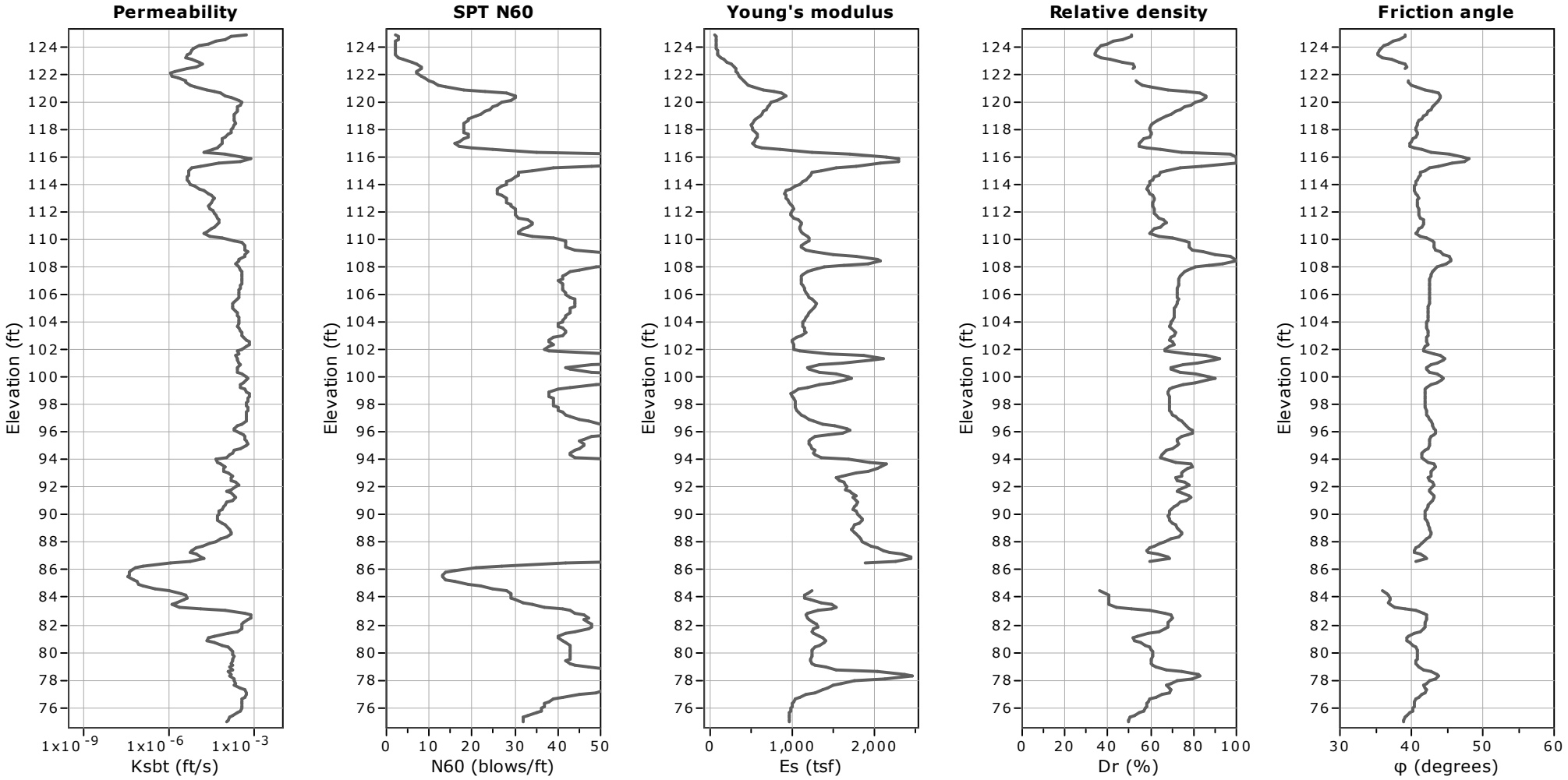
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Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 125.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-01
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 125.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



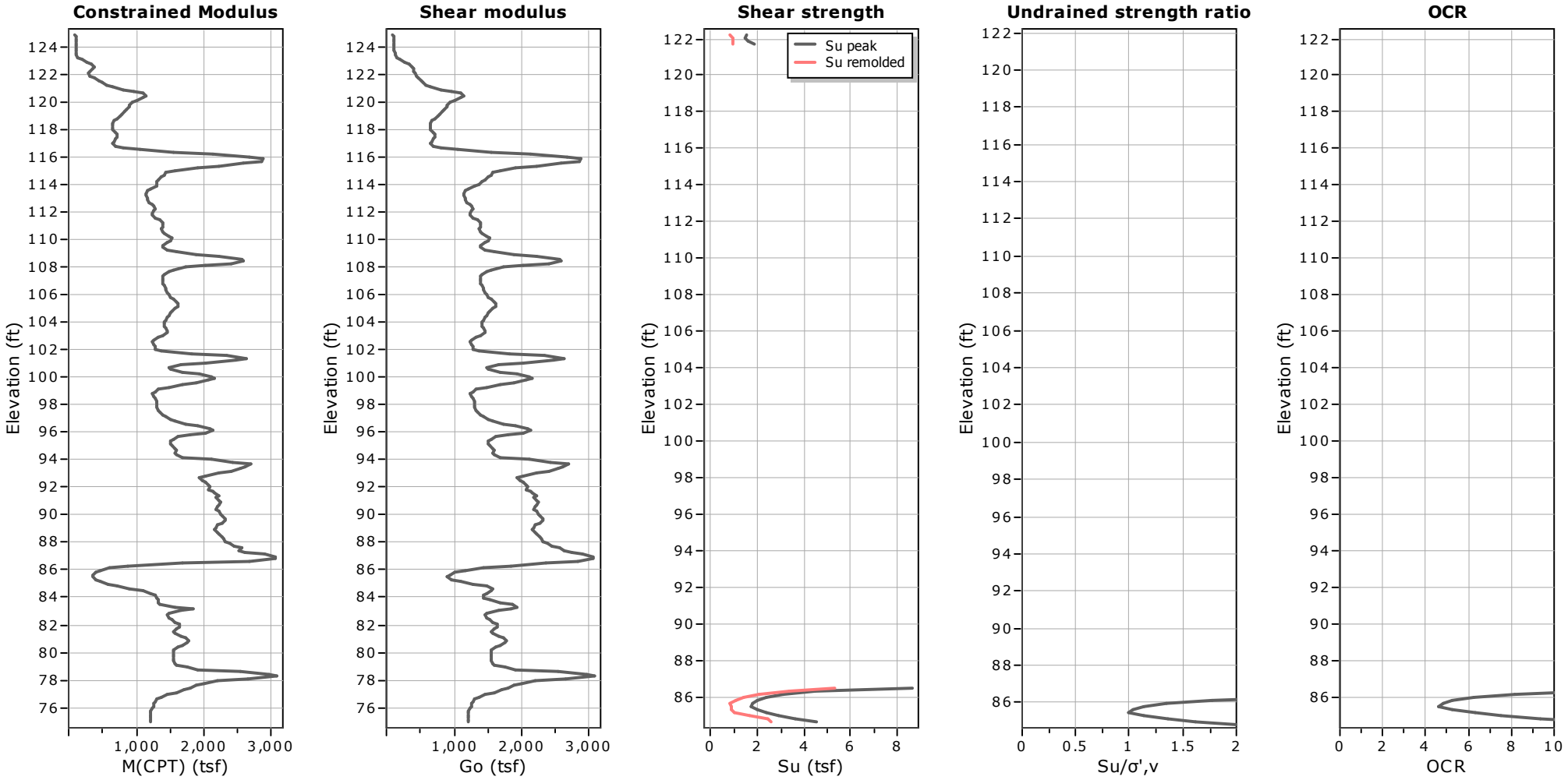
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative desnisty constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-01
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 125.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



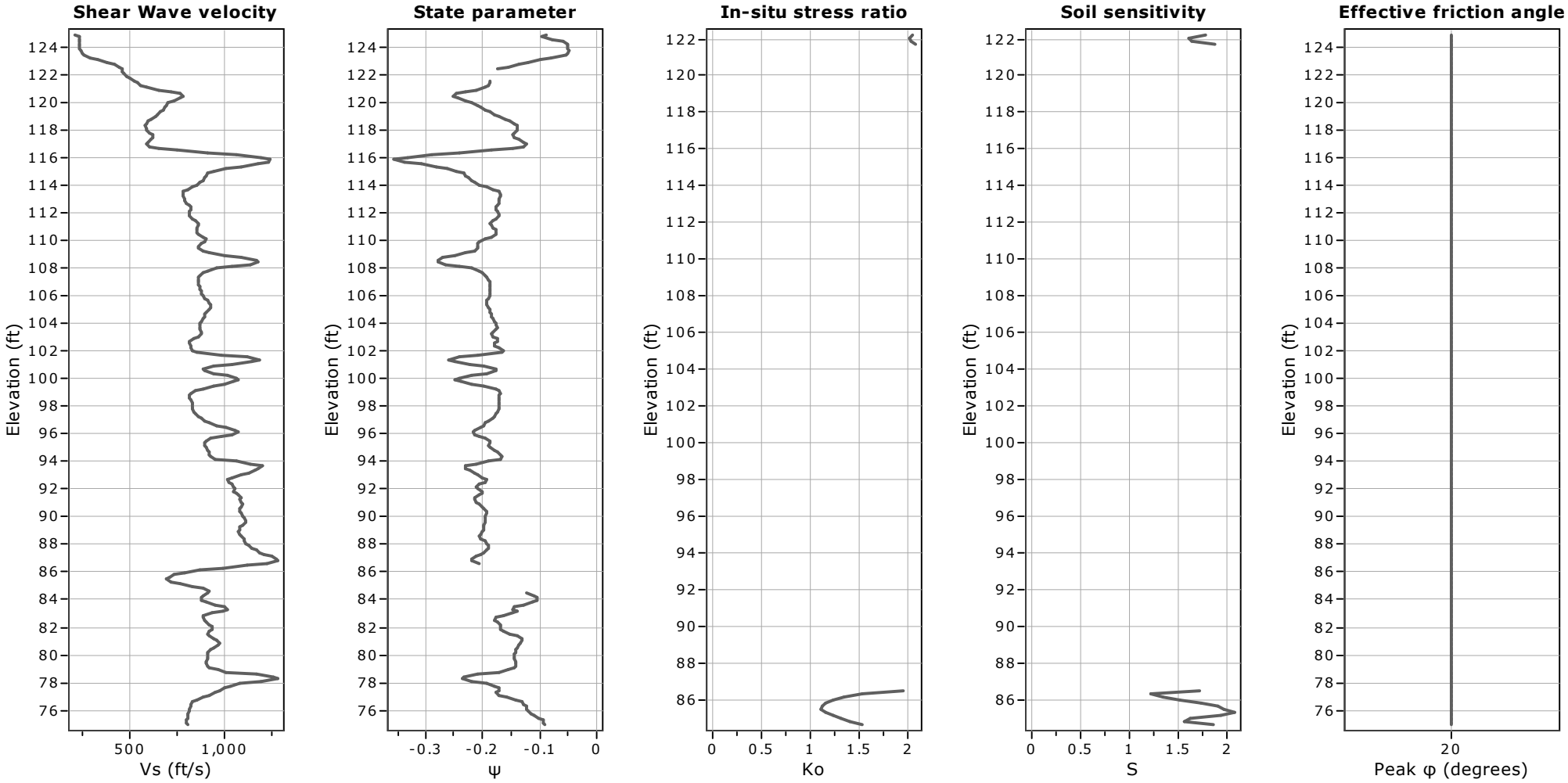
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-01
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 125.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



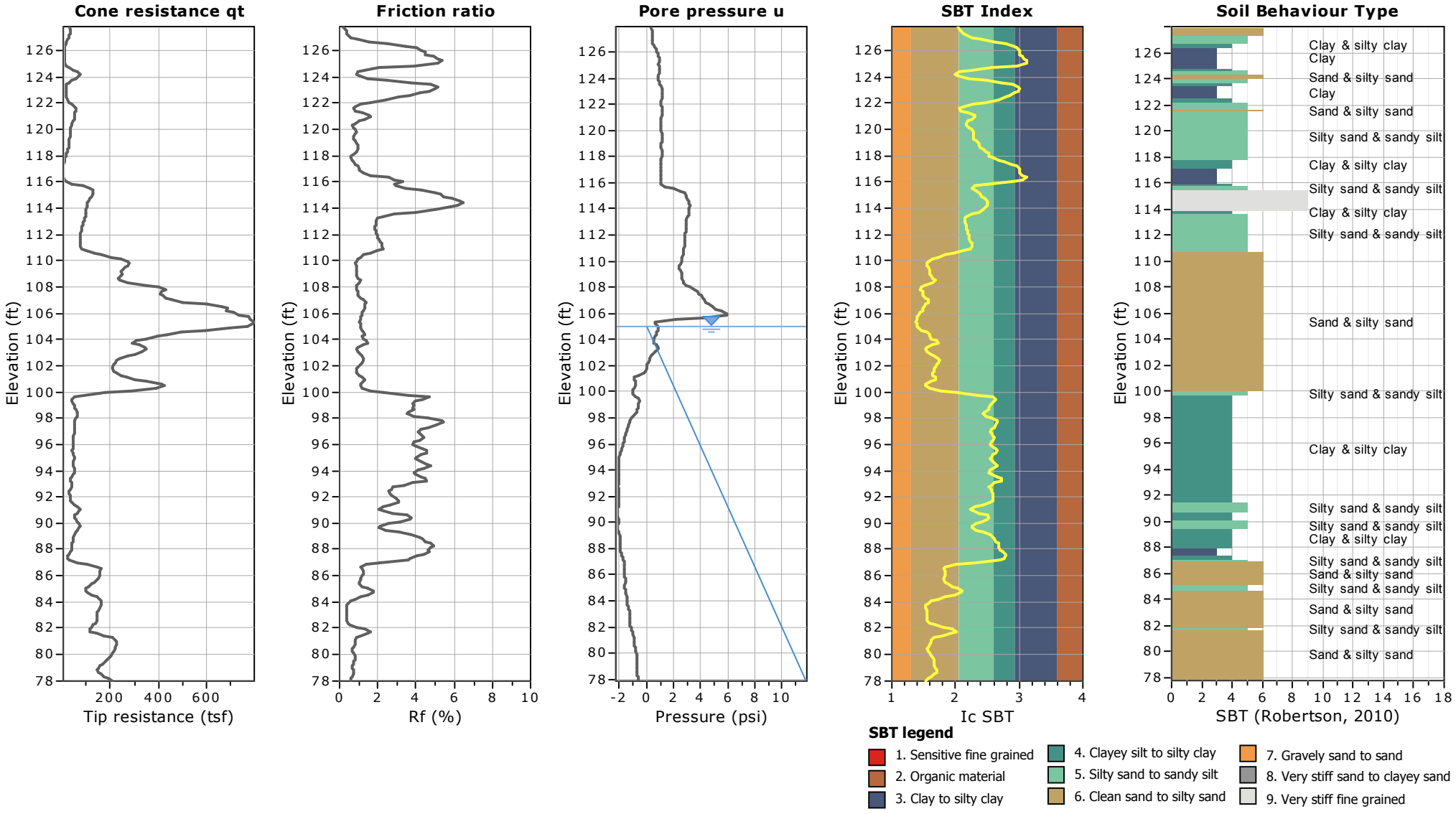
Calculation parameters

Soil Sensitivity factor, N_S: 7.00
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

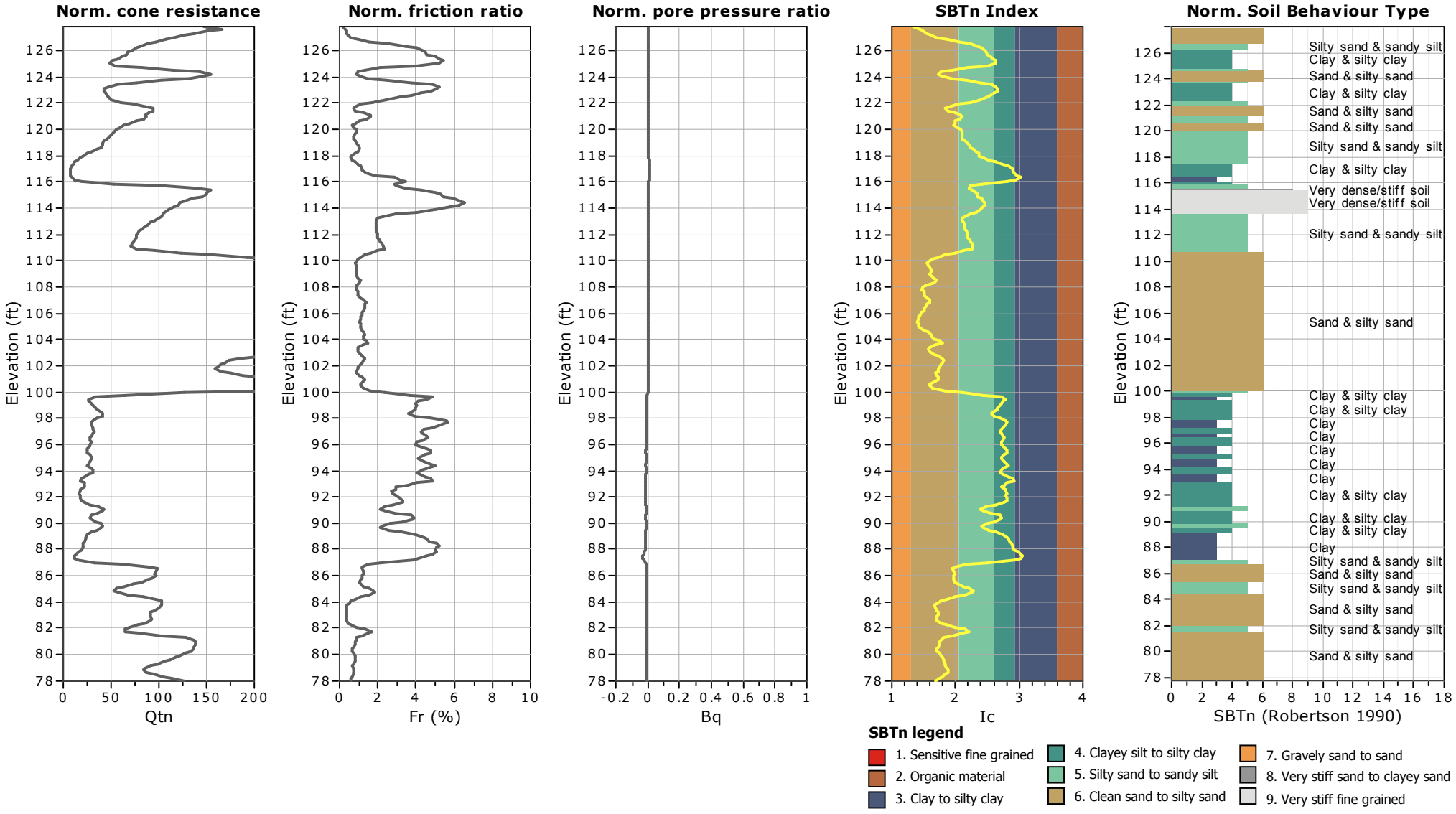
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Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 128.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

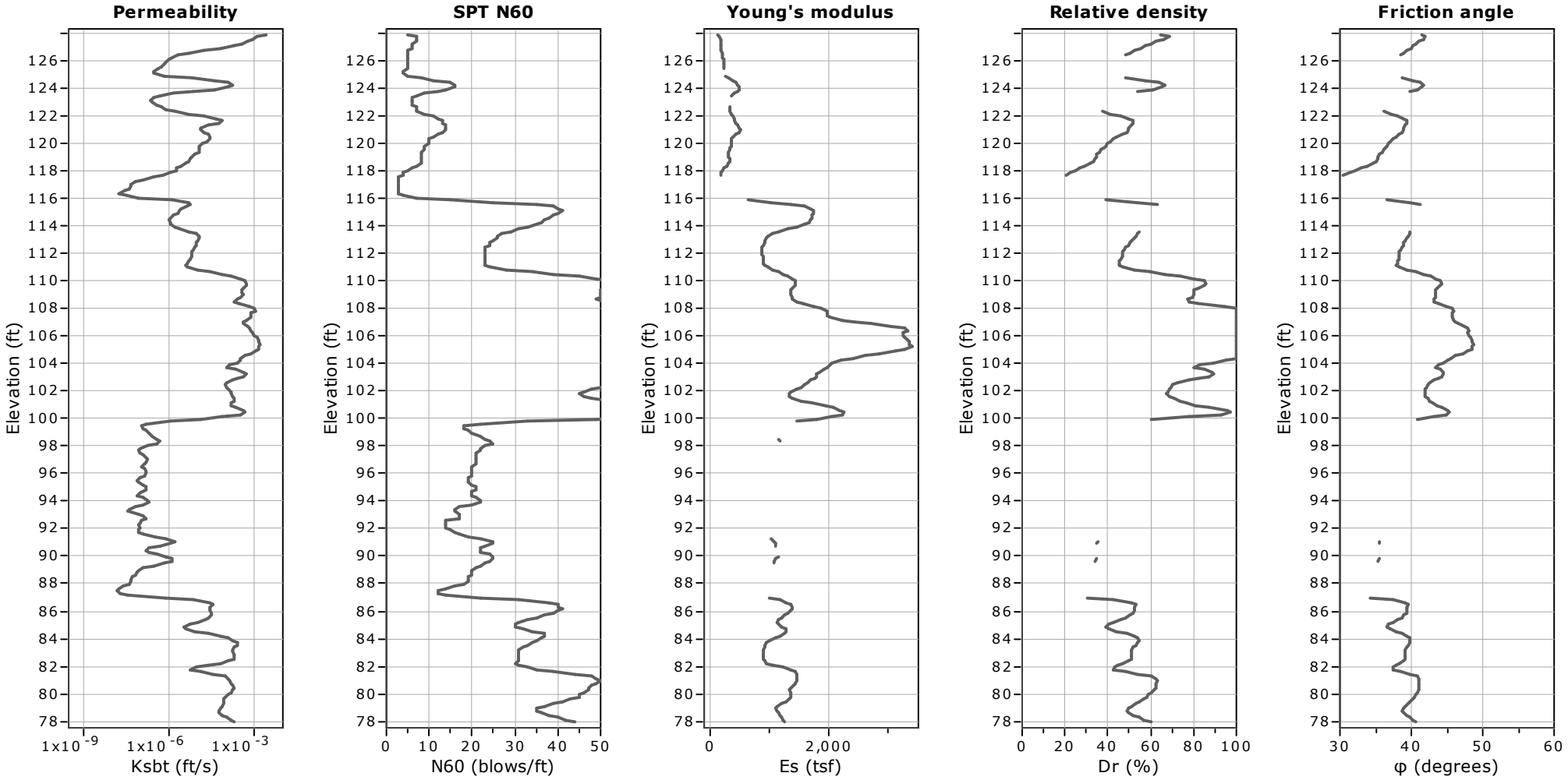
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Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 128.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-02
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 128.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



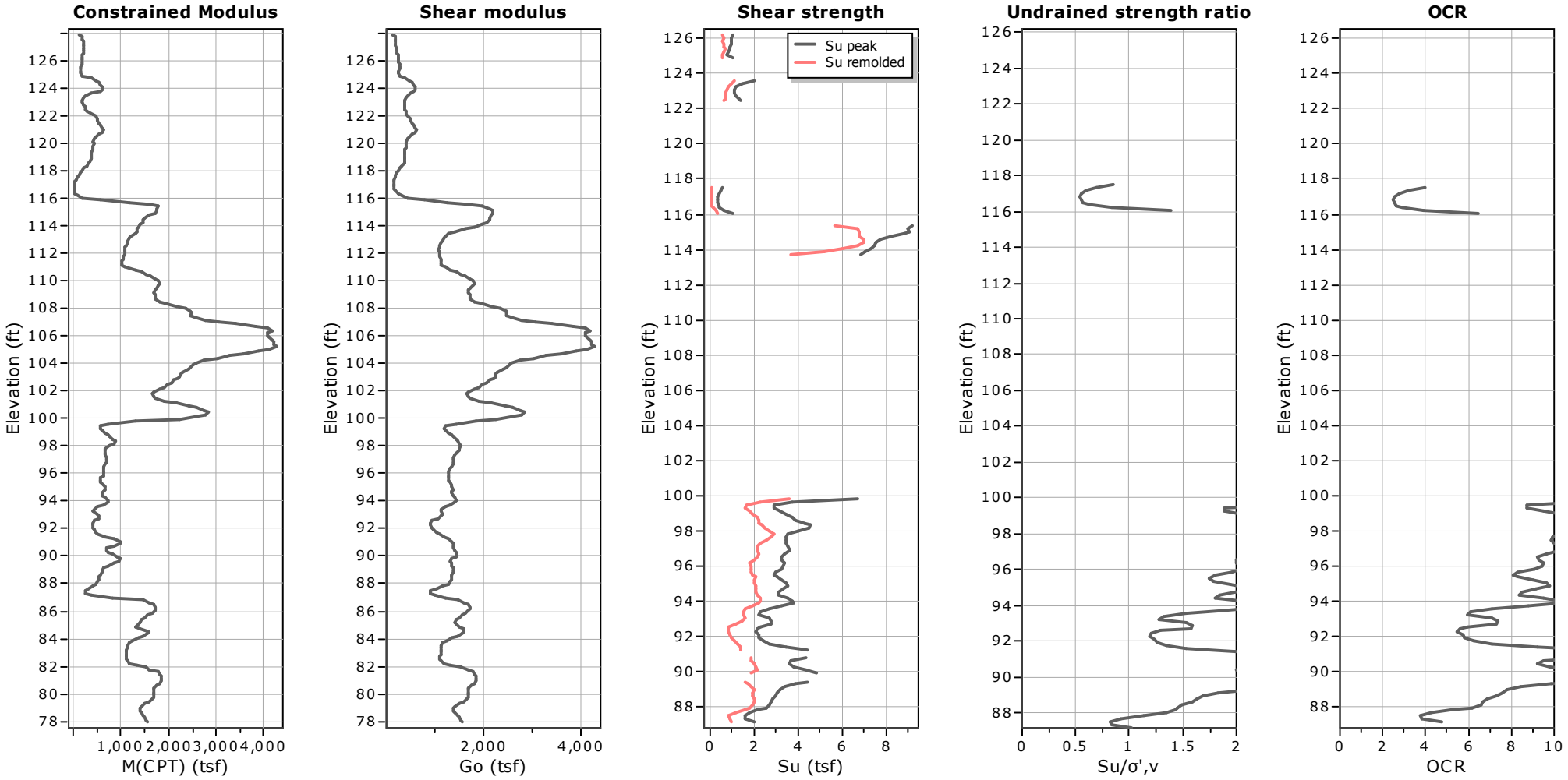
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative desnisty constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-02
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 128.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



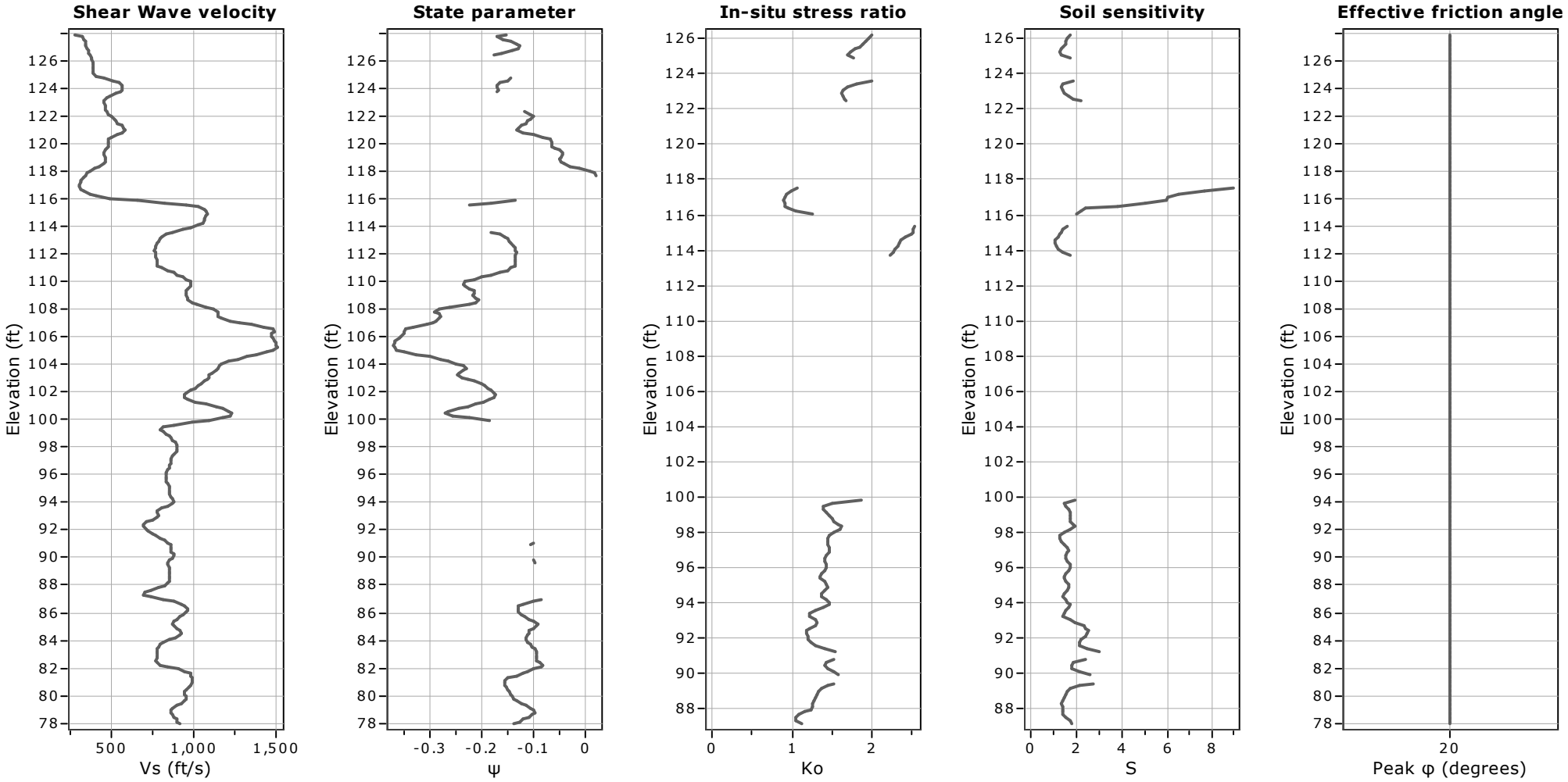
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-02
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 128.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Calculation parameters

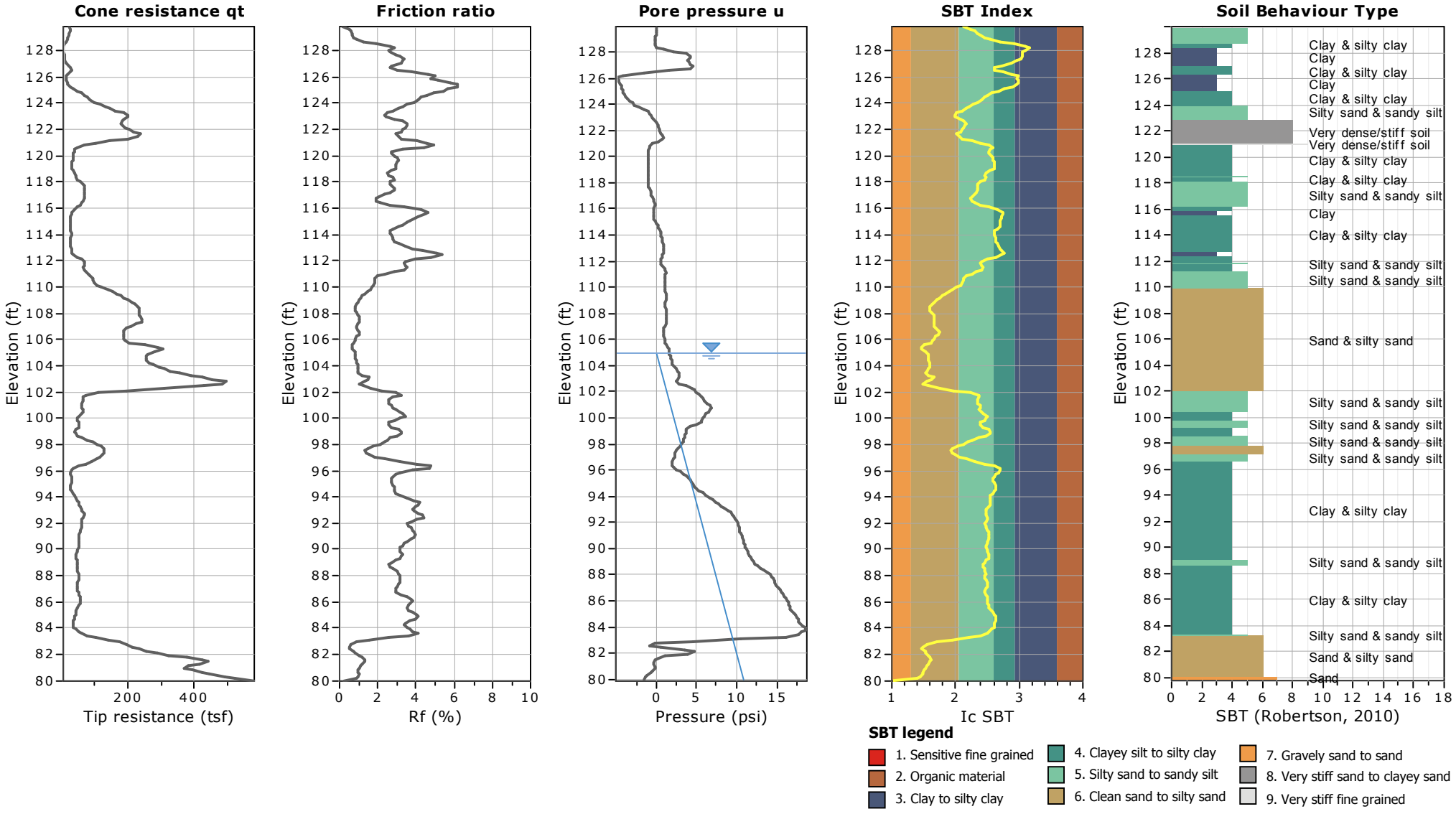
Soil Sensitivity factor, N_S: 7.00

User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

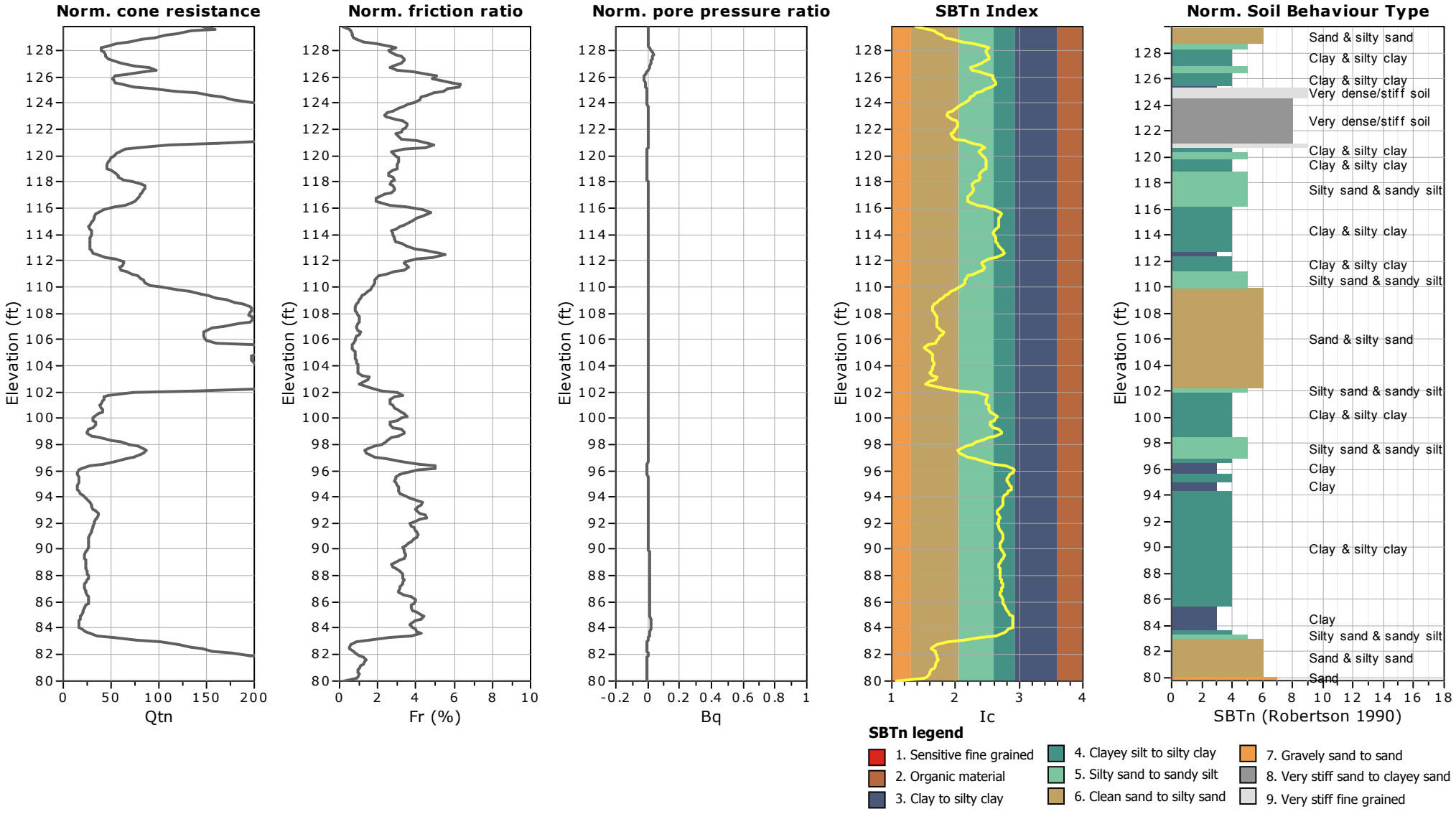
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Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 130.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

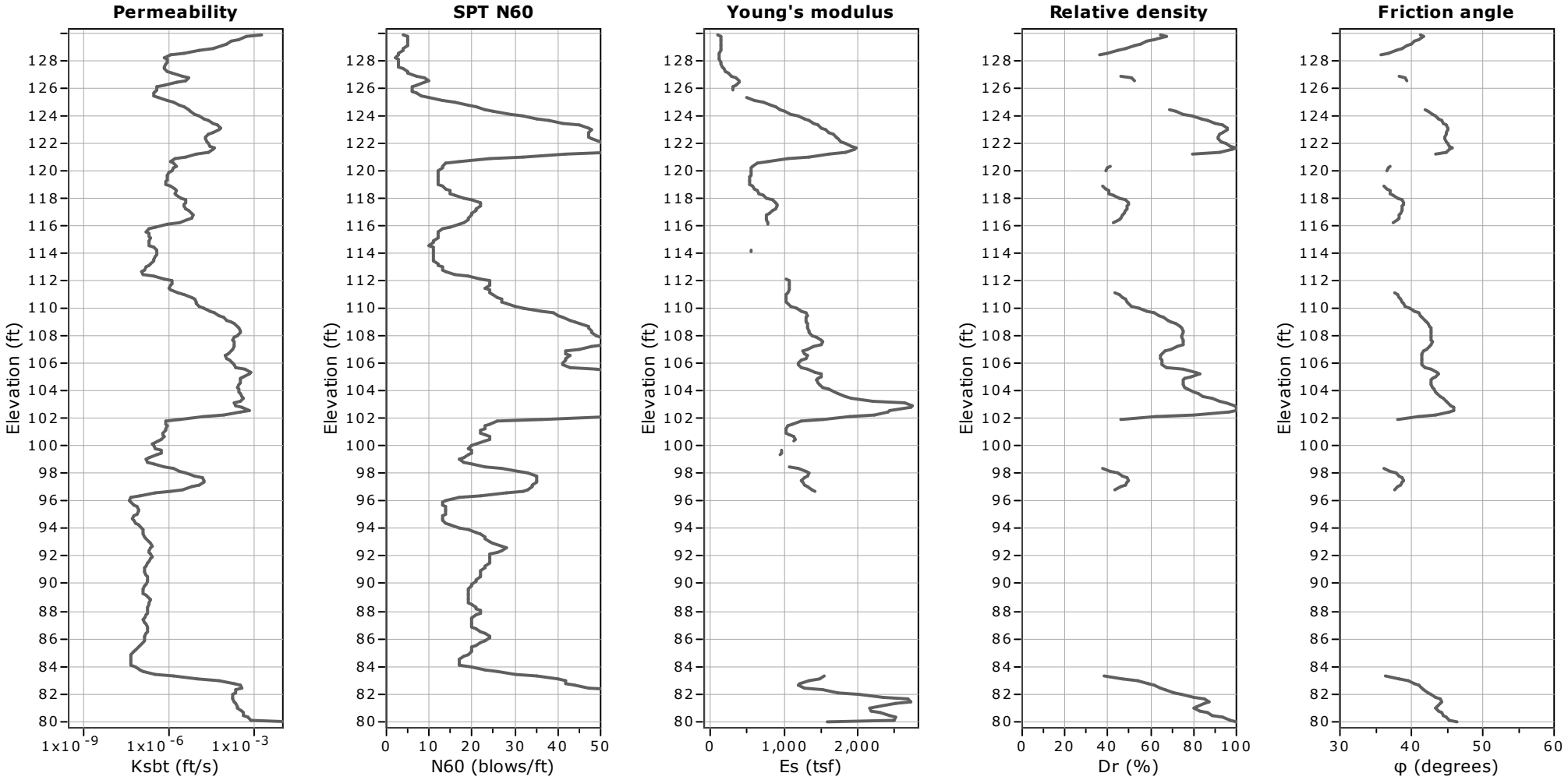
CPT: CPT-03
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 130.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-03
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 130.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



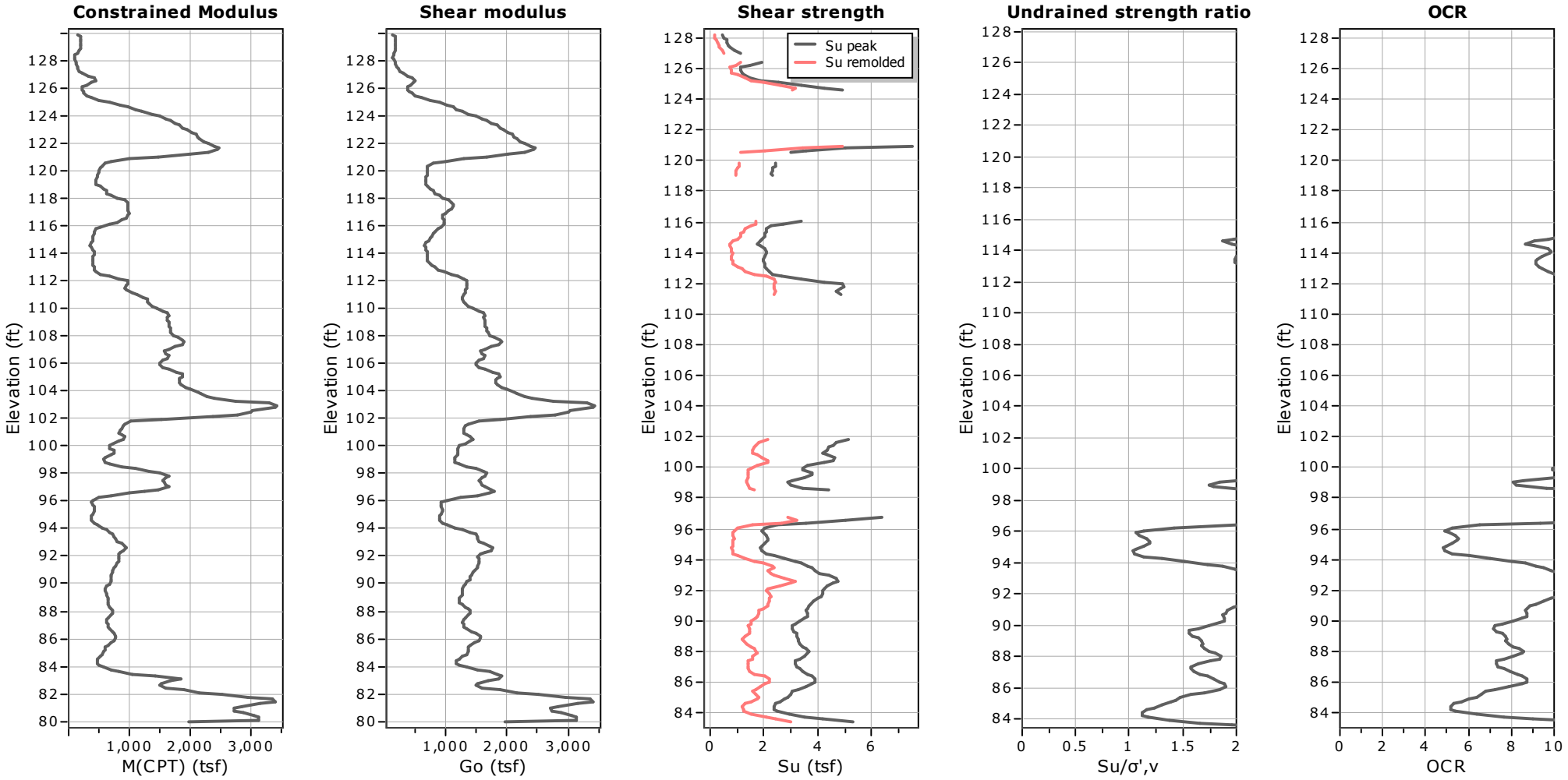
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative desnisty constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-03
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 130.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



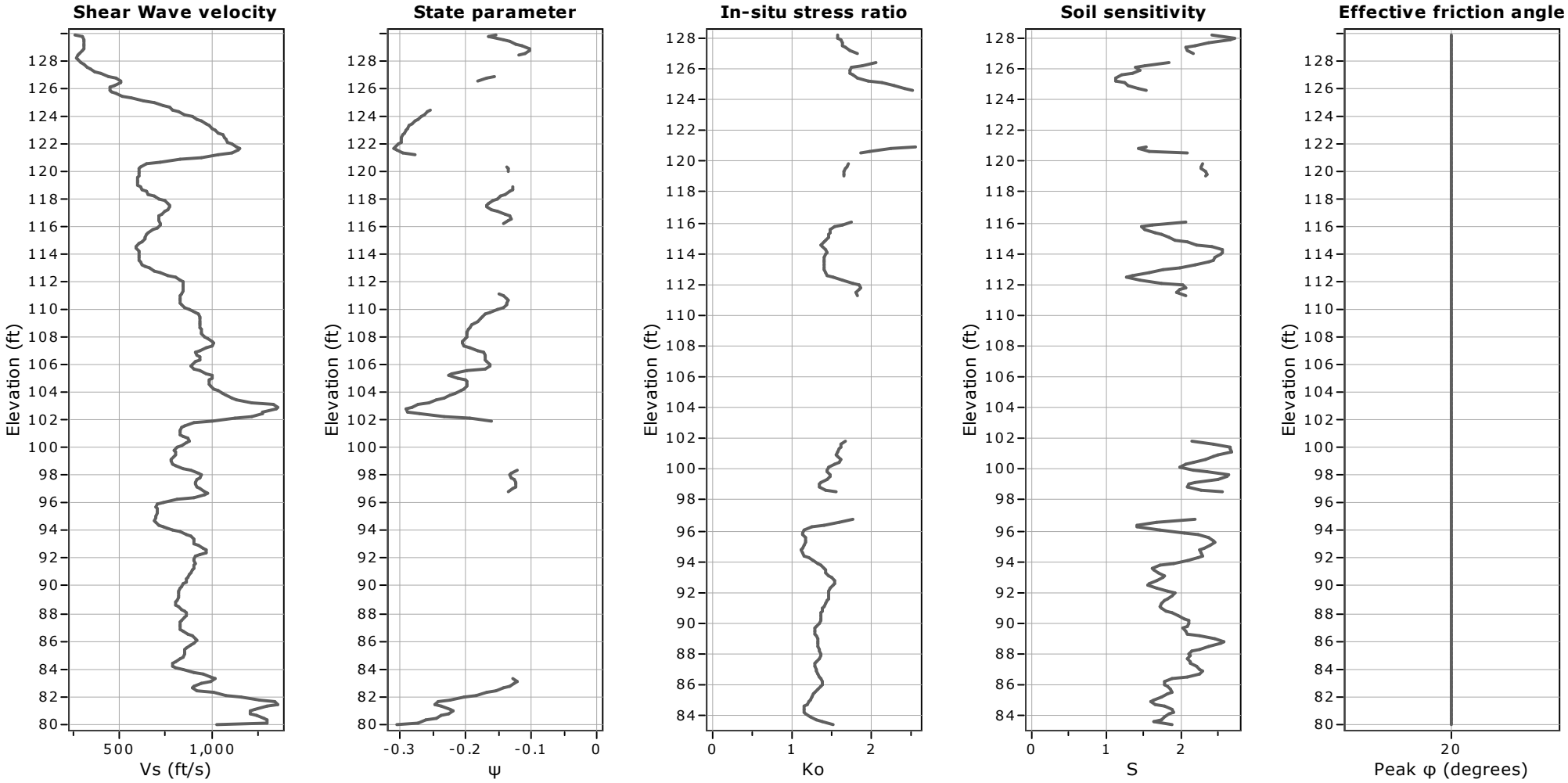
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-03
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 130.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Calculation parameters

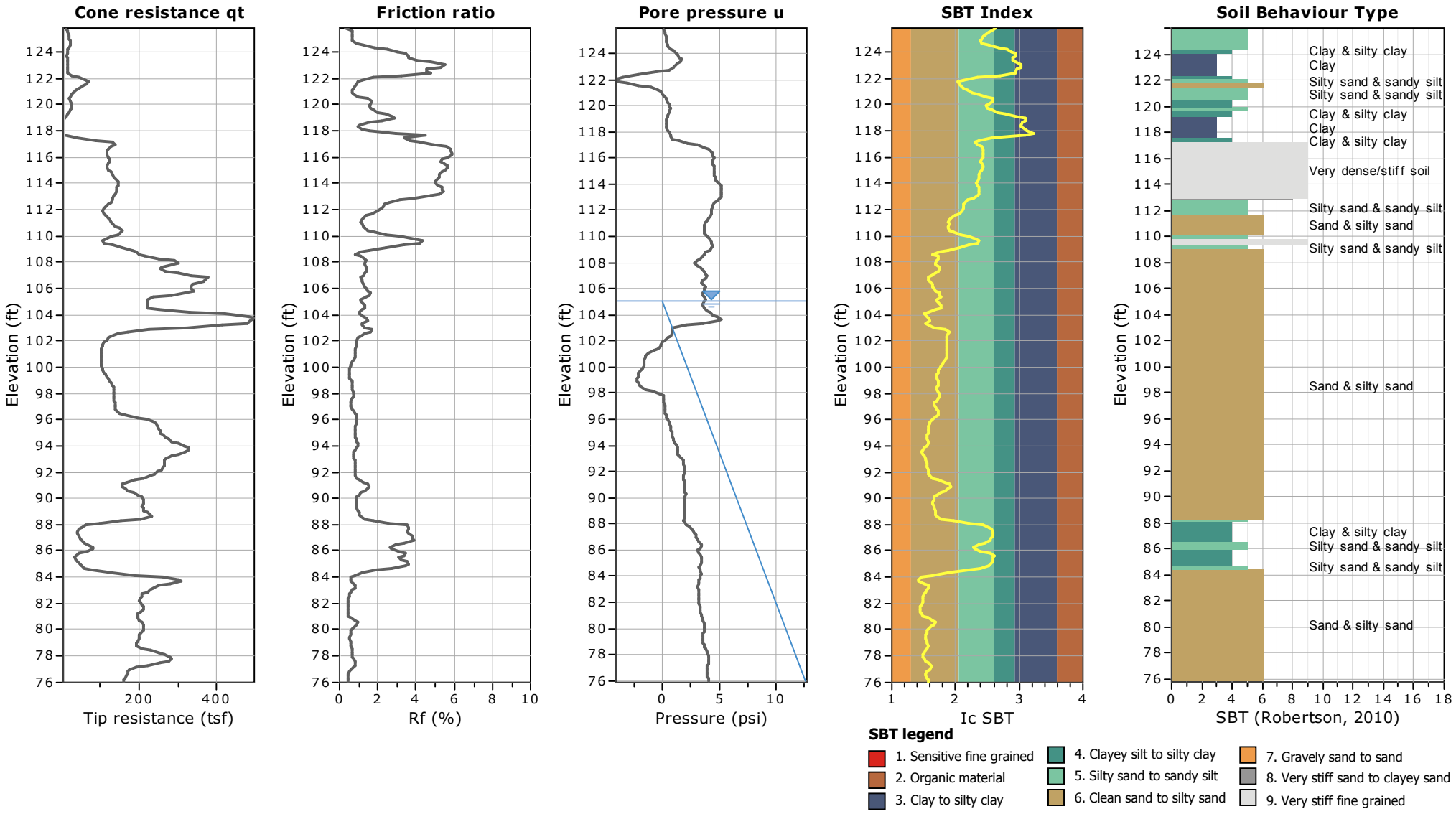
Soil Sensitivity factor, N_S: 7.00

User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

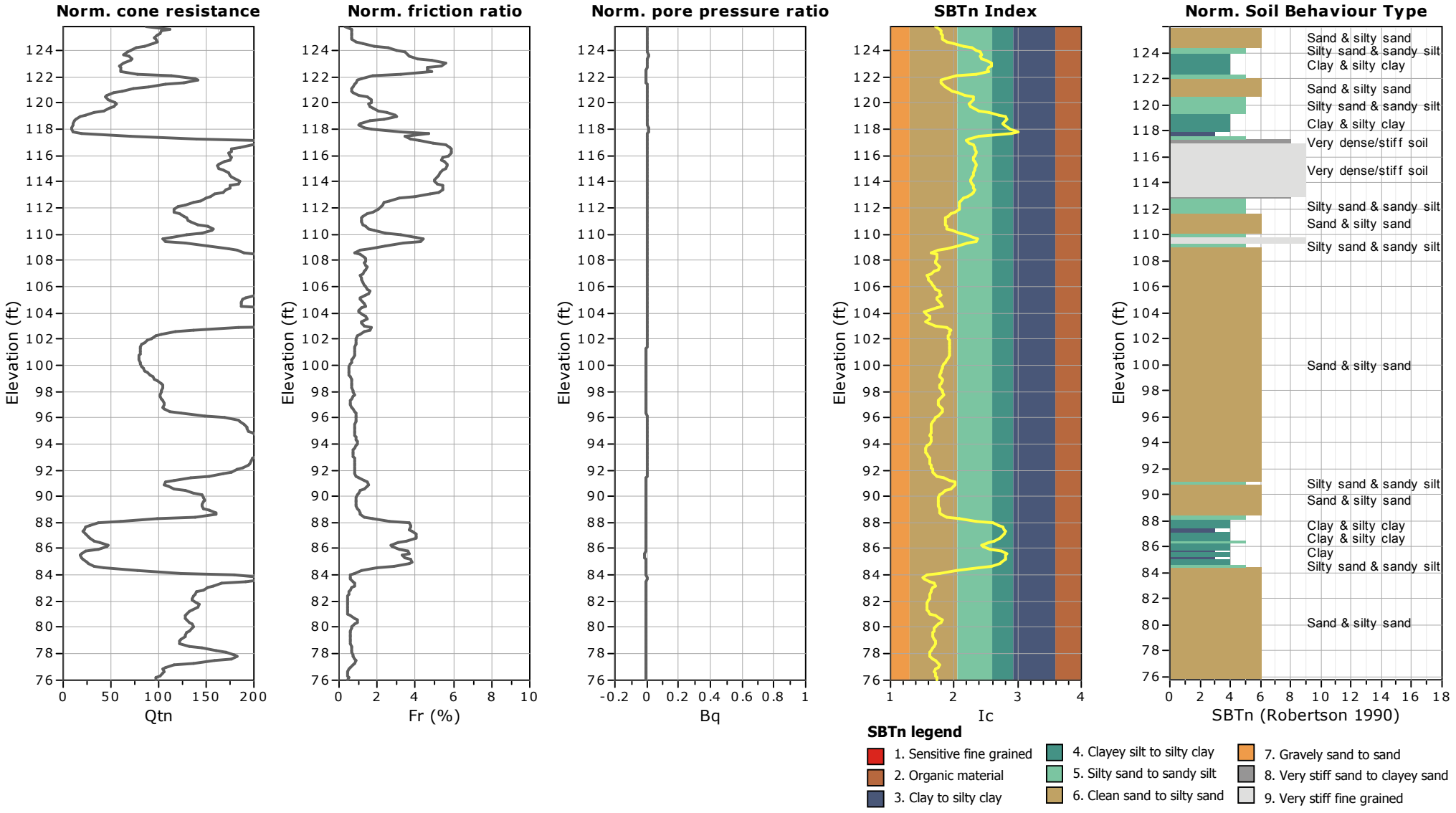
CPT: CPT-04
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 126.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

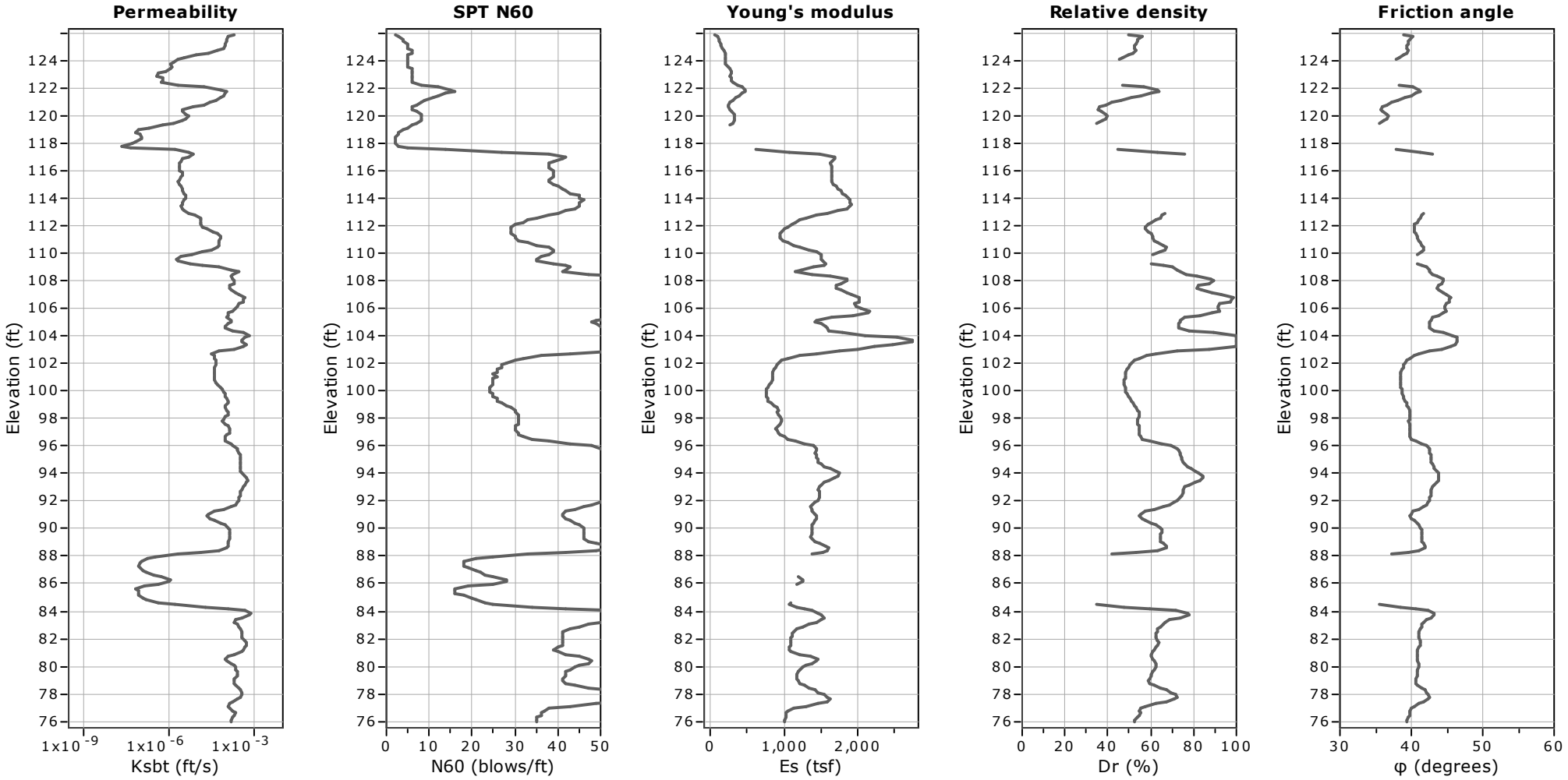
CPT: CPT-04
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 126.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-04
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 126.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



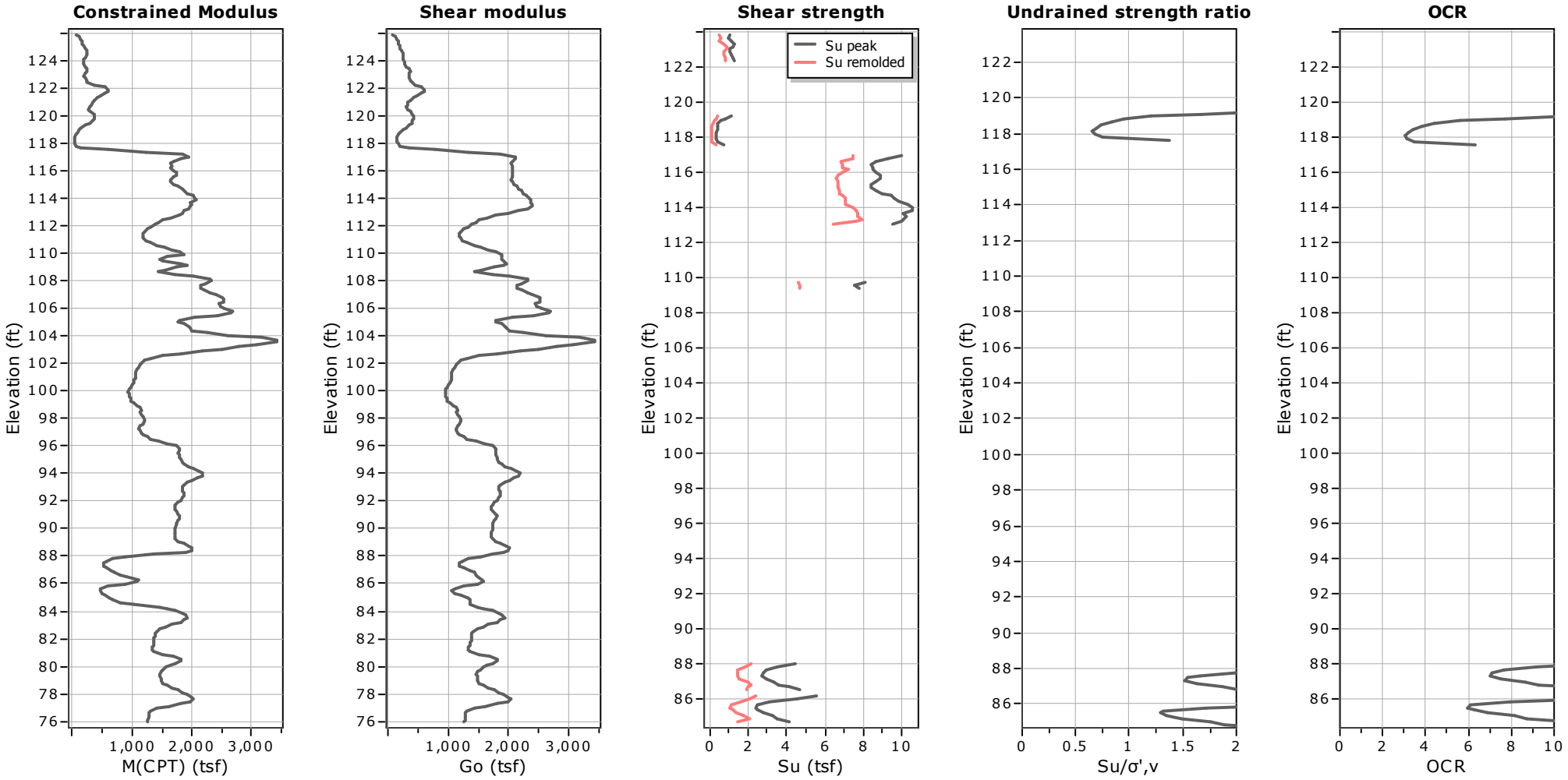
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative desnisty constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-04
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 126.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



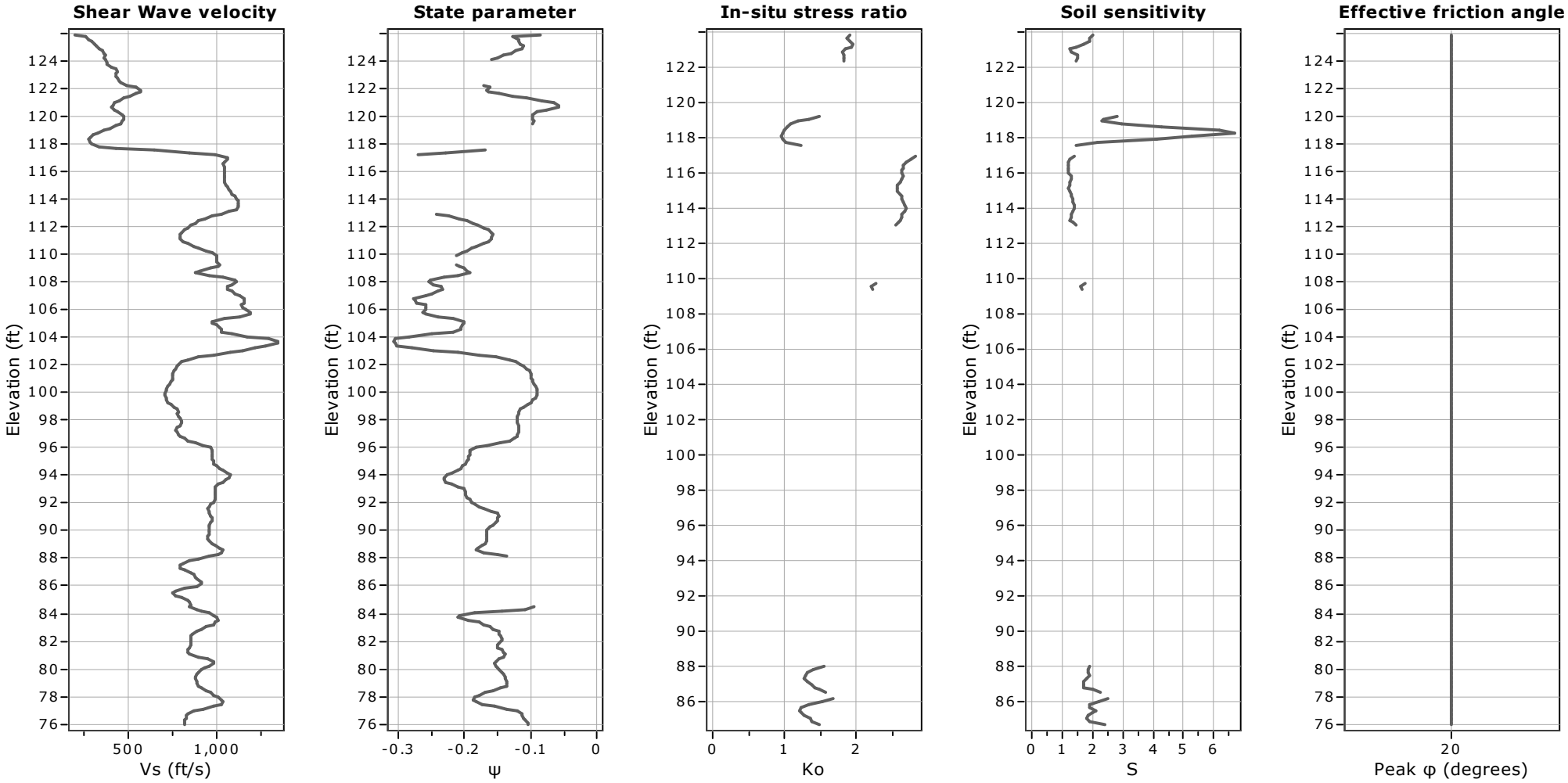
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-04
Total depth: 50.03 ft, Date: 1/28/2015
Surface Elevation: 126.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Calculation parameters

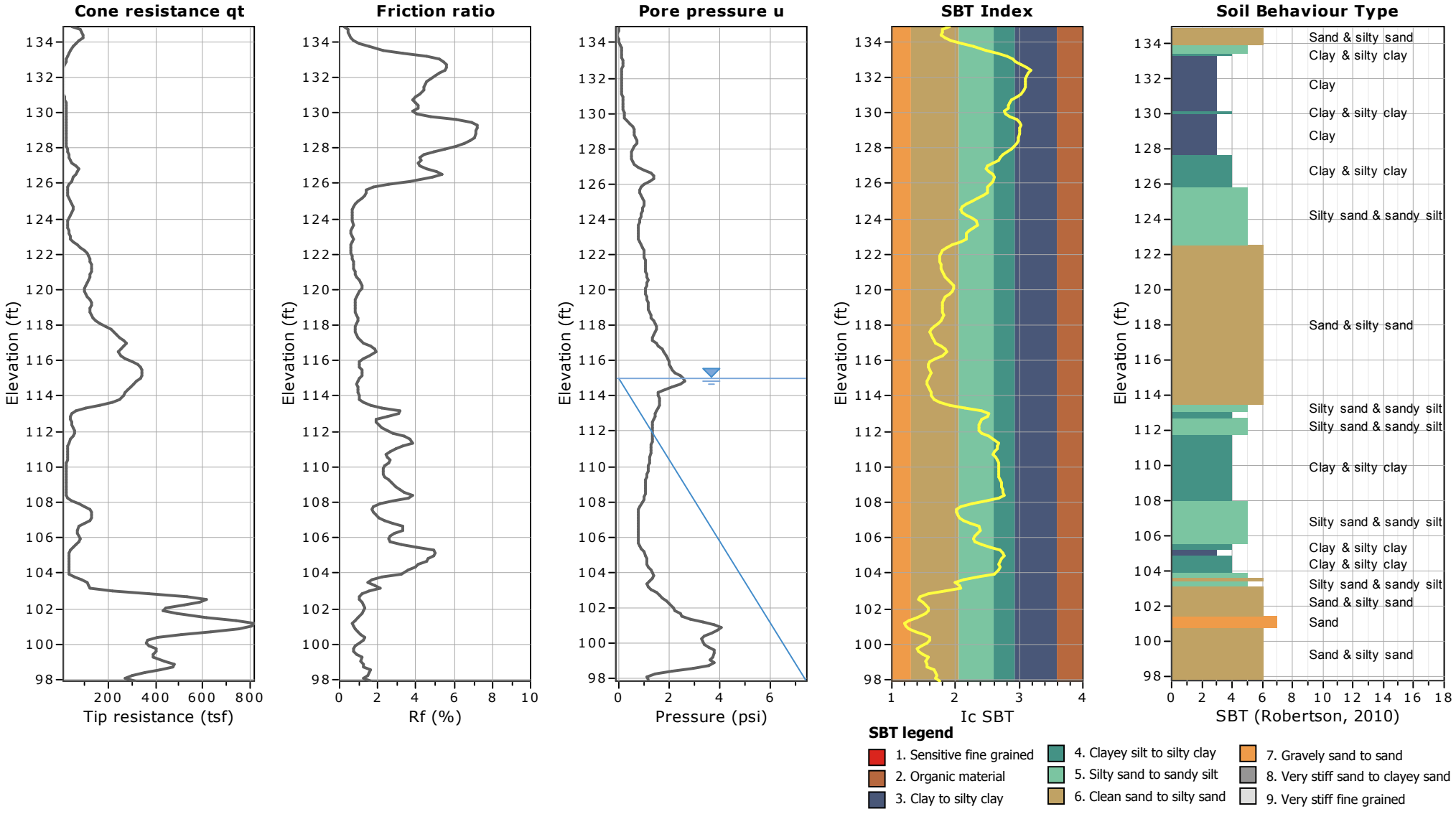
Soil Sensitivity factor, N_S: 7.00

User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

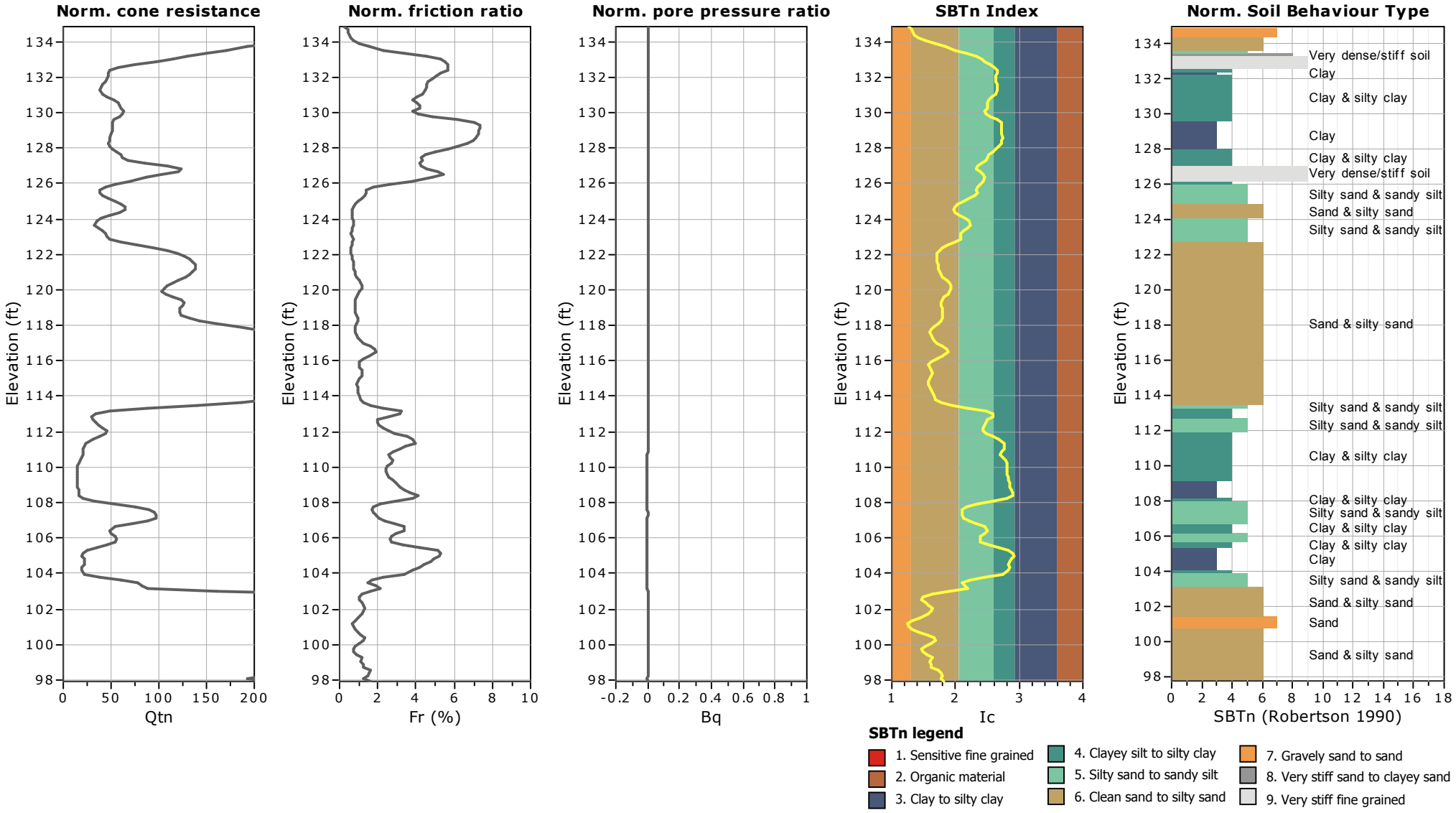
CPT: CPT-05
Total depth: 37.07 ft, Date: 1/28/2015
Surface Elevation: 135.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

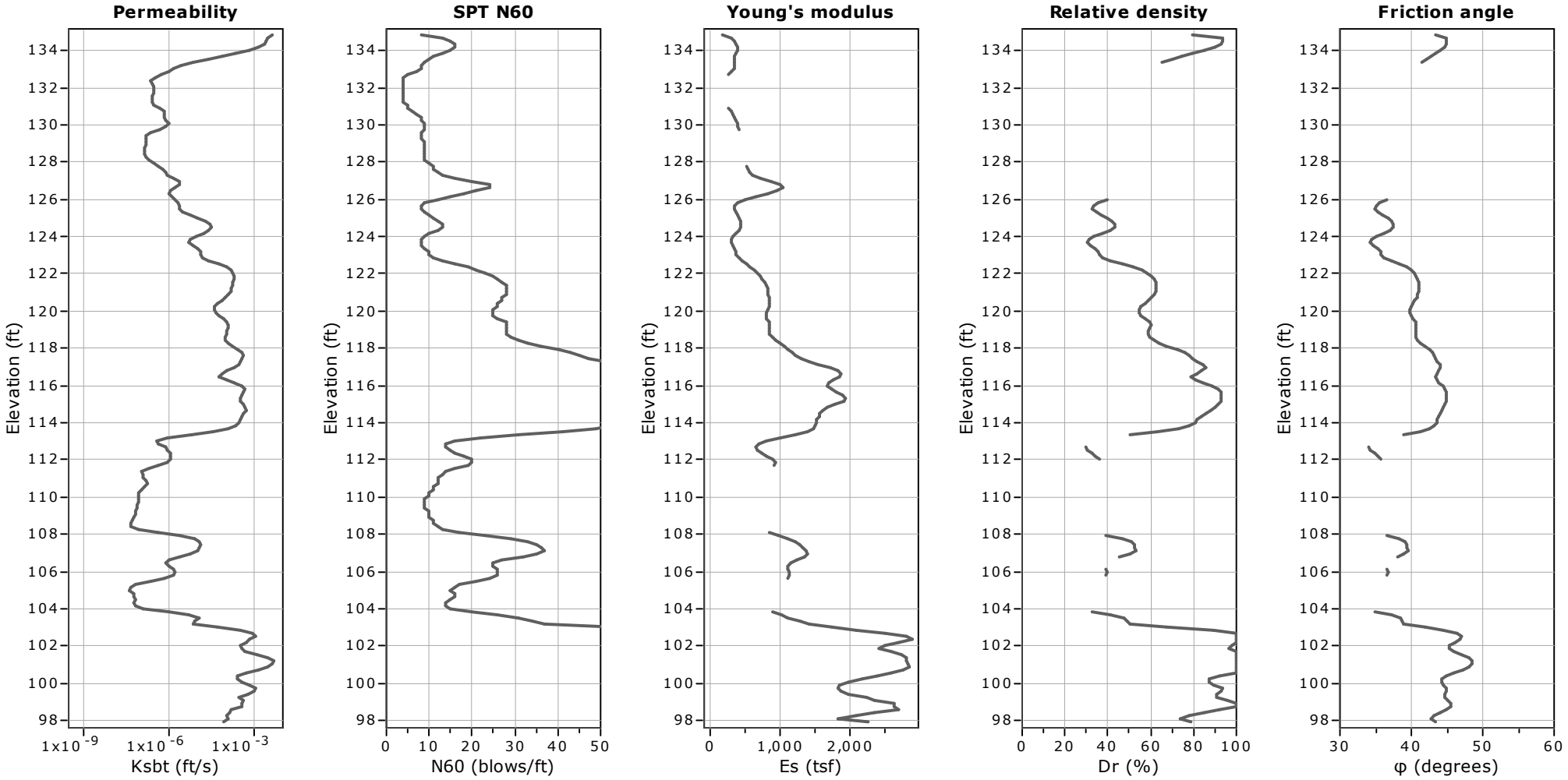
CPT: CPT-05
Total depth: 37.07 ft, Date: 1/28/2015
Surface Elevation: 135.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-05
Total depth: 37.07 ft, Date: 1/28/2015
Surface Elevation: 135.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



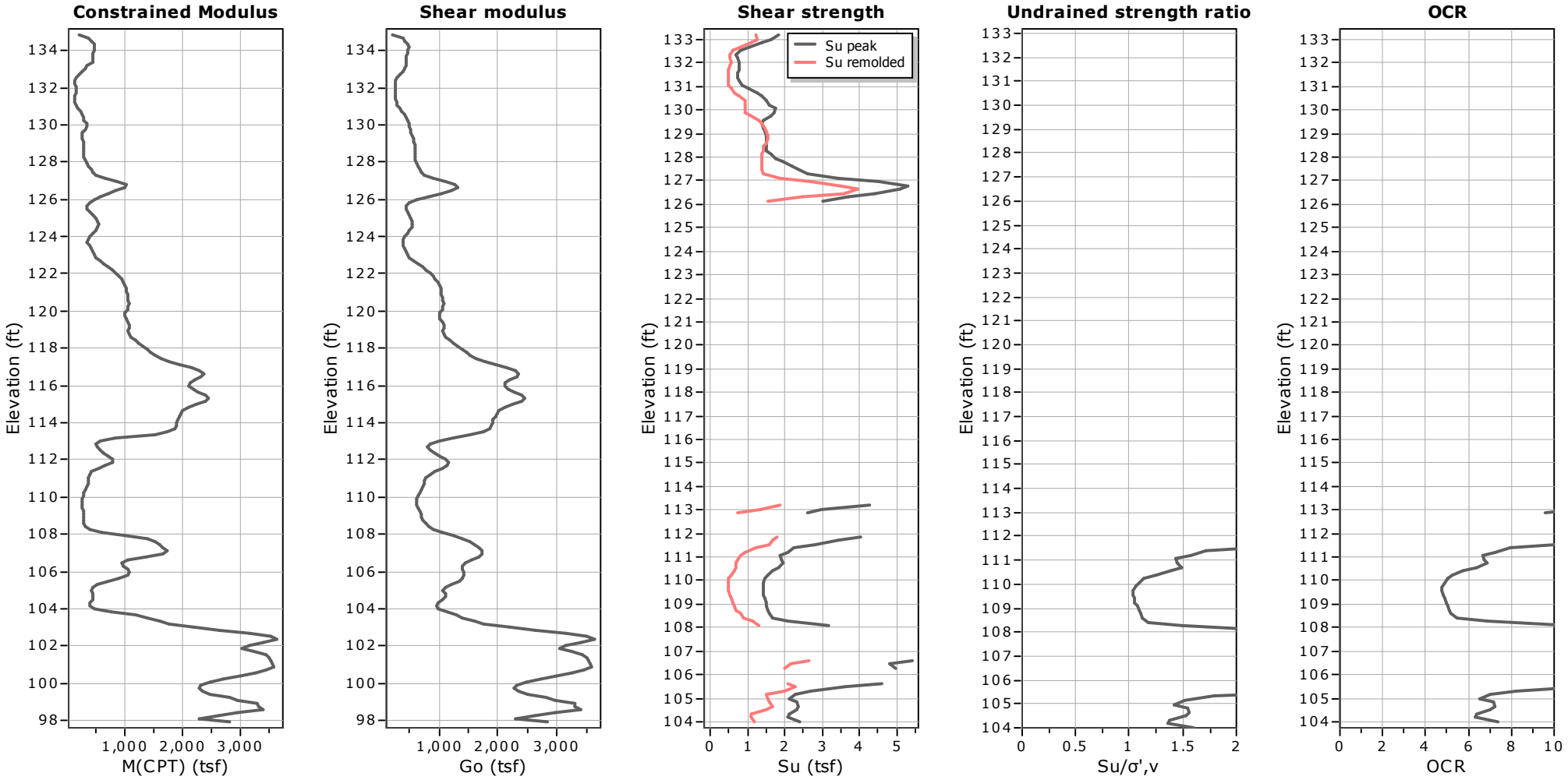
Calculation parameters

Permeability: Based on SBT_n
SPT N_{60}: Based on I_c and q_t
Young's modulus: Based on variable alpha using I_c (Robertson, 2009)
Relative desnisty constant, C_{Dr}: 350.0
Phi: Based on Kulhawy & Mayne (1990)
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-05
Total depth: 37.07 ft, Date: 1/28/2015
Surface Elevation: 135.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



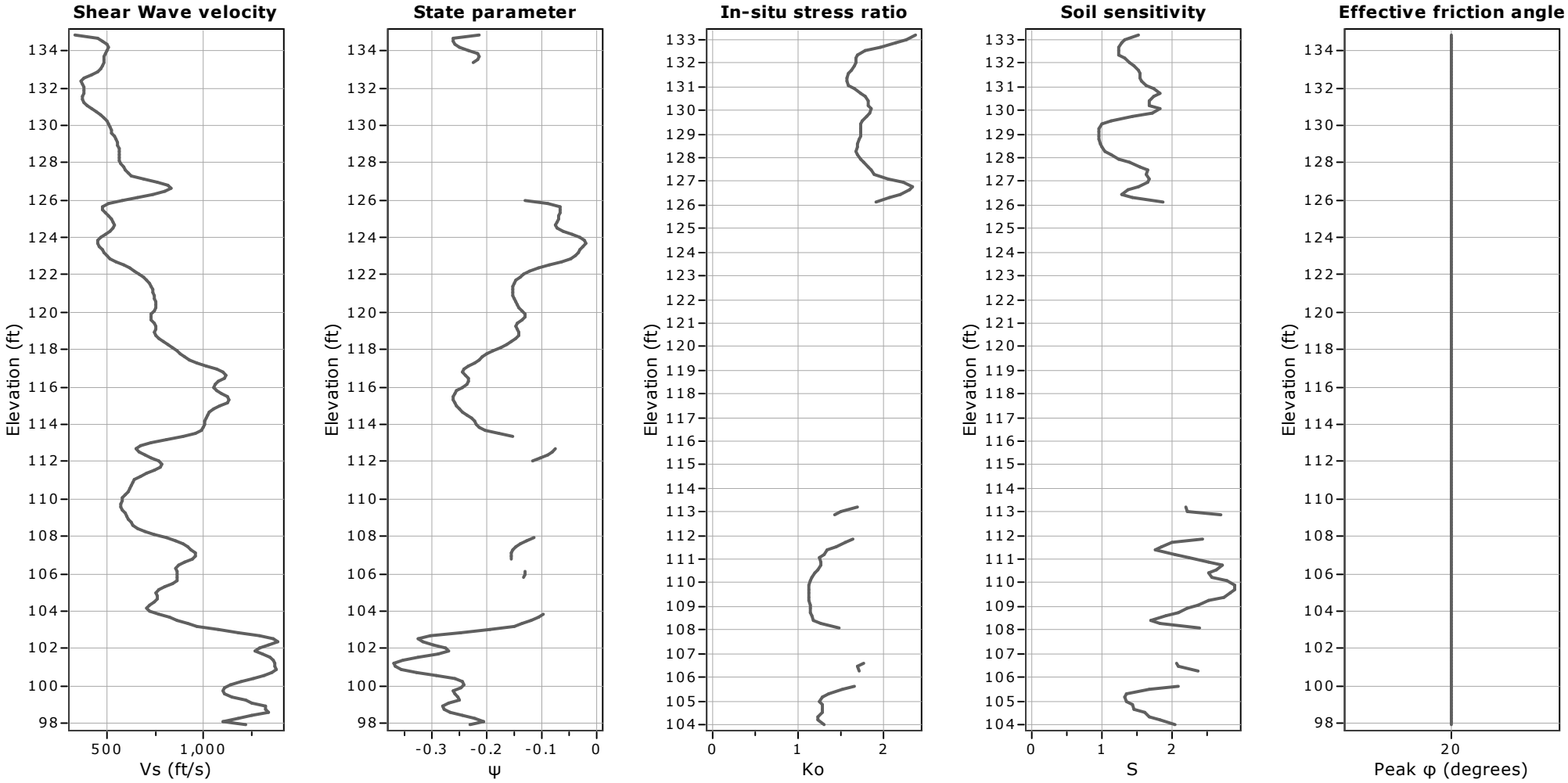
Calculation parameters

Constrained modulus: Based on variable *alpha* using I_c and Q_{tn} (Robertson, 2009)
Go: Based on variable *alpha* using I_c (Robertson, 2009)
Undrained shear strength cone factor for clays, N_{kt}: 14
OCR factor for clays, N_{kt}: 0.33
User defined estimation data

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

Project:
Location:

CPT: CPT-05
Total depth: 37.07 ft, Date: 1/28/2015
Surface Elevation: 135.00 ft
Coords: X:0.00, Y:0.00
Cone Type: Uknown
Cone Operator: Kehoe Testing & Engineering



Calculation parameters

Soil Sensitivity factor, N_S: 7.00

User defined estimation data

LOG OF TEST TRENCH T-1

Date Excavated:	11/16/11	Equipment:	Case 580L Backhoe
Logged by:	DJF	Bucket Size:	18 inches
Existing Elevation:	132.0 feet	Drive Weight:	N/A
Proposed Elevation:	138.0 Feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal Modified California Sampler
CK Chunk Sample
SPT Standard Penetration Test
DR Density Ring
ST Shelby Tube

MD Maximum Density
SO4 Soluble Sulfates
SA Sieve Analysis
HA Hydrometer
SE Sand Equivalent
PI Plasticity Index
DS Direct Shear
Con Consolidation
EI Expansion Index
R-Val Resistance Value
Chl Soluble Chlorides
Res pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	132		SW-SM	**Artificial Fill (Qaf):** Light gray, moist, medium dense, fine- to coarse-grained, WELL GRADED SAND-SILTY SAND.							
2	130		CL	**Subsoil:** Dark reddish-brown, moist, stiff, SANDY CLAY, Mottled.		CK		15.0	112.2		
4	128		SC	**Older Alluvium(Qoal):** Light reddish-brown to brown, moist, medium dense, very fine- to medium-grained, SILTY CLAYEY SAND, mottled and micaceous.		CK		13.5	110.3		
6	126					CK		10.9	112.1		
8	124					CK					
10	122		SP-SM	Light brown, very moist, medium dense, fine- to coarse-grained, POORLY GRADED SAND-SILTY SAND, micaceous with gravels.							
12	120			Test Pit terminated at 12 feet. No water or seepage encountered.							
14	118										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY: MAH	DATE: December 2011
JOB NO.: 2110464.01	PLATE NO.: 2

LOG OF TEST TRENCH T-2

Sample Type and Laboratory Test Legend

Cal Modified California Sampler — CK Chunk Sample
SPT Standard Penetration Test — DR Density Ring
ST Shelby Tube

MD Maximum Density — DS Direct Shear
SO4 Soluble Sulfates — Con Consolidation
SA Sieve Analysis — EI Expansion Index
HA Hydrometer — R-Val Resistance Value
SE Sand Equivalent — Chl Soluble Chlorides
PI Plasticity Index — Res pH & Resistivity

Date Excavated: 11/16/11
Logged by: DJF
Existing Elevation: 133.0 feet
Proposed Elevation: 134.0 Feet
Equipment: Case 580L Backhoe
Bucket Size: 18 inches
Drive Weight: N/A
Depth to Water: N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	133		SW-SM	**Artificial Fill (Qaf):** Light gray, damp, medium dense, fine- to coarse-grained, WELL GRADED SAND-SILTY SAND.							
			SC	Dark reddish-brown, very moist, loose to medium dense, very fine- to medium-grained, SILTY, CLAYEY SAND.		CK		21.9	107.0		SA R-Val
2	131		CL	**Subsoil:** Light brown to dark reddish-brown, moist, stiff, SANDY CLAY.		CK		16.7	102.5		
4	129		SC	**Older Alluvium(Qoal):** Dark reddish-brown, moist, loose to medium dense, very fine- to medium-grained, CLAYEY SAND, mottled and micaceous. Upper 1-foot highly porous. Becomes medium dense at 5 feet.		CK		14.1	105.8		
6	127										
8	125					CK					
10	123			Test Pit terminated at 10 feet. No water or seepage encountered.							
12	121										
14	119										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY: MAH
DATE: December 2011
JOB NO.: 2110464.01
PLATE NO.: 3

LOG OF TEST TRENCH T-3

Date Excavated:	11/16/11	Equipment:	Case 580L Backhoe
Logged by:	DJF	Bucket Size:	18 inches
Existing Elevation:	135.0 feet	Drive Weight:	N/A
Proposed Elevation:	135.5 Feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	135		SW-SM	**Artificial Fill (Qaf):** Light gray, moist, medium dense, fine- to coarse-grained, WELL GRADED SAND-SILTY SAND.							
			CL	Dark reddish-brown, moist, stiff, SANDY CLAY.							
2	133		CL	**Subsoil:** Dark reddish-brown, very moist, stiff, SILTY, SANDY CLAY.							
4	131										
			SC	**Older Alluvium(Qoal):** Light reddish-brown, moist, medium dense to dense, very fine- to medium-grained, SILTY, CLAYEY SAND, mottled and micaceous.		CK		14.1	108.9		
6	129										
8	127										
10	125			Test Pit terminated at 10 feet. No water or seepage encountered.							
12	123										
14	121										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY:	MAH	DATE:	December 2011
JOB NO.:	2110464.01	PLATE NO.:	4

LOG OF TEST TRENCH T-4

Date Excavated:	11/16/11	Equipment:	Case 580L Backhoe
Logged by:	DJF	Bucket Size:	18 inches
Existing Elevation:	138.0 feet	Drive Weight:	N/A
Proposed Elevation:	138.0 Feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	138		SM	**Artificial Fill (Qaf):** Light brown, moist, medium dense, fine- to medium-grained, SILTY SAND.		CK		7.7	119.3		
2	136		CL	**Subsoil:** Dark brown, moist, hard, SANDY CLAY, mottled.		CK		15.7	113.9		
4	134		SC	**Older Alluvium(Qoal):** Dark reddish-brown, moist, dense to very dense, very fine- to medium-grained, SILTY, CLAYEY SAND, mottled.		CK		6.6	121.6		
6	132			Test Pit terminated at 7 feet. No water or seepage encountered.							
8	130										
10	128										
12	126										
14	124										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY:	MAH	DATE:	December 2011
JOB NO.:	2110464.01	PLATE NO.:	5

Appendix B

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Worksheet C.4-1: Categorization of Infiltration Feasibility Condition

Categorization of Infiltration Feasibility Condition		Worksheet C.4-1	
Part 1 - Full Infiltration Feasibility Screening Criteria Would infiltration of the full design volume be feasible from a physical perspective without any undesirable consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
1	Is the estimated reliable infiltration rate below proposed facility locations greater than 0.5 inches per hour? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.		X
Provide basis: An infiltration rate assessment has been performed for the soils beneath the subject site as presented in the Preliminary Storm Water Infiltration Feasibility Study (CWE 2210728.01R). The measured percolation rates were converted to infiltration rates using the Porchet Method. The City of Oceanside BMP Design Manual states that "a maximum factor of safety (FOS) of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified." Field infiltration rates were low with an average of rate 0.07 inches per hour. Using a FOS of 2.0, the average infiltration rate will decrease to 0.03 inches per hour.			
2	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.		

Worksheet C.4-1 Page 2 of 4			
Criteria	Screening Question	Yes	No
3	Can infiltration greater than 0.5 inches per hour be allowed without increasing risk of groundwater contamination (shallow water table, storm water pollutants or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis: Based on our review of items presented in Appendix C.3, we anticipate that infiltration greater than 0.5 inches per hour can be allowed without increasing risk of groundwater contamination that cannot be mitigated to an acceptable level. .			
4	Can infiltration greater than 0.5 inches per hour be allowed without causing potential water balance issues such as change of seasonality of ephemeral streams or increased discharge of contaminated groundwater to surface waters? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.		
Provide basis:			
Part 1 Result*	If all answers to rows 1 - 4 are "Yes" a full infiltration design is potentially feasible. The feasibility screening category is Full Infiltration If any answer from row 1-4 is "No", infiltration may be possible to some extent but would not generally be feasible or desirable to achieve a "full infiltration" design. Proceed to Part 2		

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings.

Worksheet C.4-1 Page 3 of 4			
Part 2 – Partial Infiltration vs. No Infiltration Feasibility Screening Criteria Would infiltration of water in any appreciable amount be physically feasible without any negative consequences that cannot be reasonably mitigated?			
Criteria	Screening Question	Yes	No
5	Do soil and geologic conditions allow for infiltration in any appreciable rate or volume? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2 and Appendix D.	X	
Provide basis: An infiltration rate assessment has been performed for the soils beneath the subject site as presented in the Preliminary Storm Water Infiltration Feasibility Study (CWE 2210728.01R). The measured percolation rates were converted to infiltration rates using the Porchet Method. The City of Oceanside BMP Design Manual states that "a maximum factor of safety (FOS) of 2.0 is recommended for infiltration feasibility screening such that an artificially high factor of safety cannot be used to inappropriately rule out infiltration, unless justified." Field infiltration rates were low with an average of rate 0.07 inches per hour. Using a FOS of 2.0, the average infiltration rate will decrease to 0.03 inches per hour.			
6	Can Infiltration in any appreciable quantity be allowed without increasing risk of geotechnical hazards (slope stability, groundwater mounding, utilities, or other factors) that cannot be mitigated to an acceptable level? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.2.	X	
An infiltration rate assessment has been performed for the subject site. Based on the underlying soil conditions and our recommendations presented in our report, we anticipate that infiltration in any appreciable quantity can be allowed without increasing risk of geologic hazards that cannot be mitigated to an acceptable level. C.2.1 A site specific geotechnical investigation was performed. C.2.2 In our opinion the alluvium will not be subject to hydro collapse or heave; however we do anticipate that the newly compacted fill will experience hydro collapse therefore; we have provided impermeable liner recommendations for the sidewalls of the biofiltration basin. C.2.3 The site is relatively flat and in our opinion the risk of slope instability is very low. C.2.4 A vertical liner will be used to prevent lateral migration into nearby utility trenches. C.2.5 Based on the anticipated depth to groundwater, the potential for groundwater mounding is low. C.2.6 We recommend that the biofiltration have an impermeable liner on the sides of the BMP to prevent the lateral flow of water. The liner should extend to the base of the aggregate storage layer.			

Worksheet C.4-1 Page 4 of 4			
Criteria	Screening Question	Yes	No
7	Can Infiltration in any appreciable quantity be allowed without posing significant risk for groundwater related concerns (shallow water table, storm water pollutants or other factors)? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Based on our review of items presented in Appendix C.3, we anticipate that infiltration in any appreciable quantity can be allowed without increasing risk of groundwater contamination that cannot be mitigated to an acceptable level; however, the subject site has an open site assessment. Implications of the open site assessment should be further evaluated by the projects BMP designer. C.3.1 The subgrade soil appears to be suitable for onsite infiltration. C.3.2 The seasonal high groundwater table is estimated to be greater than 20 feet below existing grades. C.3.3 Infiltration BMP devices must be located at a minimum of 100 feet horizontally from any water supply well. This should be taken into account when designing the BMPs C.3.4 We have no knowledge of the site being used for industrial activities. Based on the information found on http://geotracker.waterboards.ca.gov/, a portion of the San Luis Rey Restoration/Mitigation Bank project located approximately 250 feet north of the site has an open site assessment designation. The report titled Pesticide-Impacted Soil Reuse Summary (Geocon, 2014) proposes placing pesticide impacted soils from the site to the north beneath the subject site. It is our understanding that this was a mitigation possibility and no plans have been made to proceed with the recommendations presented in this report. C.3.5 We recommend that infiltration activities be coordinated with the applicable groundwater management agency. C.3.6 There does not appear to be a high risk of causing potential water balance issues. C.3.7 We do not know of any water rights downstream of the project and have not evaluated this impact as part of our study.			
8	Can infiltration be allowed without violating downstream water rights? The response to this Screening Question shall be based on a comprehensive evaluation of the factors presented in Appendix C.3.	X	
Provide basis: Downstream water rights have not been evaluated at this time; however, we are not aware of any water rights in the area of the project or downstream of the project.			
Part 2 Result*	If all answers from row 1-4 are yes then partial infiltration design is potentially feasible. The feasibility screening category is Partial Infiltration. If any answer from row 5-8 is no, then infiltration of any volume is considered to be infeasible within the drainage area. The feasibility screening category is No Infiltration.		Partial Infiltration

*To be completed using gathered site information and best professional judgment considering the definition of MEP in the MS4 Permit. Additional testing and/or studies may be required by City Engineer to substantiate findings

Daniel J. Flowers, CEG #2686

Appendix C

Porchet Method- Percolation to Infiltration Conversion Spreadsheet

Percolation to Infiltration Rate Conversion (Porchet Method)

Farm Workers Housing
CWE 2210728.01R

Perc Test #	Gravel Adjustment Factor	Effective Radius (inches) r	Depth of Hole Below Existing Grade (inches)	Time Interval (min.) Δt	Height of pipe above surface (feet)	Initial Water Depth without correction (feet)	Final Water Depth without correction (feet)	Initial Water Height with correction (inches) H_o	Final Water Height with correction (inches) H_f	Change in head (inches) ΔH	Average Head Height (inches) H_{avg}	Tested Infiltration Rate (inch/hour) I_t
PT-1	0.44	8	36	30	2.25	2.80	2.83	29.40	29.04	0.36	29.22	0.04
PT-2	0.44	8	36	30	2.33	3.51	3.56	21.84	21.24	0.60	21.54	0.08
PT-3	0.44	8	36	30	2.42	3.82	3.88	19.20	18.48	0.72	18.84	0.11
PT-4	0.44	8	37	30	2.08	3.18	3.21	23.80	23.44	0.36	23.62	0.05
									Average Field Infiltration Rate=			0.07

"Initial and final water depth without correction" are measurements taken from top of pipe if pipe is sticking out of ground (most cases)

"Initial and final water height with correction" factors in the height of pipe above surface, and provides measurement of water above bottom of pipe

If measurements are taken from grade "Height of pipe above surface" = 0

Gravel Adjustment Factor:

4-inch Diameter Pipe: 1.00 - No Gravel Used (No Caving)
0.51 - 3/4 inch gravel with 8 inch diameter hole
0.56 - 3/4 inch gravel with 7 inch diameter hole
0.64 - 3/4 inch gravel with 6 inch diameter hole

3-inch Diameter Pipe: 1.00 - No Gravel Used (No Caving)
0.44 - 3/4 inch gravel with 8 inch diameter hole
0.47 - 3/4 inch gravel with 7 inch diameter hole
0.51 - 3/4 inch gravel with 6 inch diameter hole

Porchet Method - Tested Percolation Rate Conversion to Tested Infiltration Rate

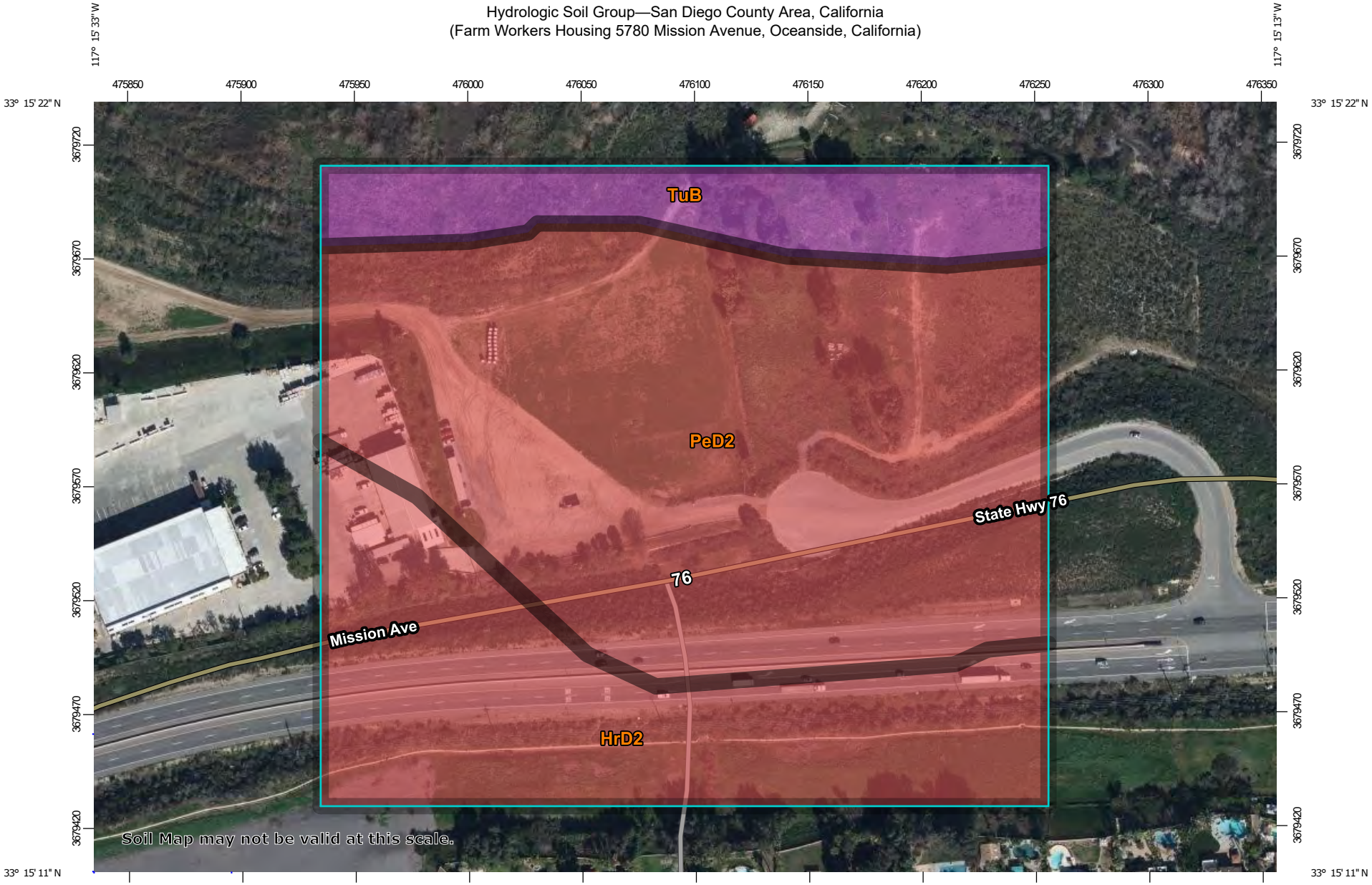
$$I_t = \frac{\Delta H \, 60 \, r}{\Delta t \, (r + 2H_{avg})}$$

I_t = tested infiltration rate, inches per hour
ΔH = change in head over the time interval, inches
Δt = time interval, minutes
r = effective radius of test hole
H_{avg} = average head over the time interval, inches

Appendix D

NRCS Web Soil Survey Map

Hydrologic Soil Group—San Diego County Area, California
(Farm Workers Housing 5780 Mission Avenue, Oceanside, California)



Map Scale: 1:2,390 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

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

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

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

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 16, Sep 13, 2021

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

Date(s) aerial images were photographed: Jan 24, 2020—Feb 12, 2020

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

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
HrD2	Huerhuero loam, 9 to 15 percent slopes, eroded	D	6.5	28.9%
PeD2	Placentia sandy loam, 9 to 15 percent slopes, eroded	D	13.1	58.6%
TuB	Tujunga sand, 0 to 5 percent slopes	A	2.8	12.5%
Totals for Area of Interest			**22.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

CHRISTIAN WHEELER
ENGINEERING

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

SUBMITTED TO

WST COAST TOMATO GROWERS, INC
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA 92054

PREPARED BY

CHRISTIAN WHEELER ENGINEERING
3980 HOME AVENUE
SAN DIEGO, CALIFORNIA 92105

CHRISTIAN WHEELER
ENGINEERING

July 29, 2022

West Coast Tomato Growers, Inc.
5780 Mission Avenue
Oceanside, California 92054

CWE 2210728.02R

Subject: **Report of Preliminary Geotechnical Investigation**
Farm Workers Housing, 5780 Mission Avenue, Oceanside, California

Ladies and Gentlemen:

In accordance with your request and our proposals dated January 7, 2022, we have completed a preliminary geotechnical investigation for the subject project. Our findings and recommendations are provided in the attached report.

It is our opinion and judgment that no geotechnical conditions exist at or in the vicinity of the subject property that would preclude the construction of the proposed housing project, provided the recommendations included in this report are implemented.

If you have any questions after reviewing this report, please do not hesitate to contact our office. This opportunity to be of professional service is sincerely appreciated.

Respectfully submitted,
CHRISTIAN WHEELER ENGINEERING

Daniel B. Adler, RCE #36037
DBA:dbe:djf
ec: terry@plowdenco.com

REGISTERED PROFESSIONAL ENGINEER
DANIEL B. ADLER
No. 36037
CIVIL
STATE OF CALIFORNIA

Daniel J Flowers, CEG #2686

CERTIFIED ENGINEERING GEOLOGIST
DANIEL J. FLOWERS
No. 2686
STATE OF CALIFORNIA

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ENGINEERING

REPORT OF PRELIMINARY GEOTECHNICAL INVESTIGATION

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

INTRODUCTION AND PROJECT DESCRIPTION

This report presents the results of our geotechnical investigation for a proposed housing project to be constructed at 5780 Mission Avenue, Oceanside, California. The location of the project site is shown on the following Figure Number 1.

We understand that the subject project will consist of the construction of 2, two-story housing buildings, a two-story multi-purpose building, and a single-story kitchen building. Associated improvements will include a play field, a basketball court, asphaltic concrete access driveways, and Portland concrete cement sidewalks. It is our understanding that the buildings will be of metal construction. It is assumed that the structures will be supported by conventional shallow foundations. As part of the storm water management for the project a biofiltration basin is proposed. Grading to accommodate the proposed improvements will consist of cuts and fills up to about 8 and 5 feet from existing site grades, respectively.

To assist us in the preparation of this report, we were provided with a conceptual grading plan prepared by Snipes-Dye Associated, revision dated July, 2022. A copy of the conceptual grading plan (sheet C-3) was used as base map for our Site Plan and Geologic Map, and is included herein as Plate No. 1. We have also created a geologic cross section to depict the existing and proposed topography as well as the subsurface soil conditions. The geologic cross section is presented herein as Plate No, 2. In addition, we have reviewed our report titled "Report of Geotechnical Investigation, Singh Property, 5780 Mission Avenue, Oceanside, California", CWE 2150046, dated February 25, 2015. The report includes the subject property. Data from the report was used in the preparation of this report and is included in Appendix F.

This report has been prepared for the exclusive use of West Coast Tomato Growers, Inc., and its design consultants for specific application to the project described herein. Should the project be modified, the conclusions and recommendations presented in this report should be reviewed by Christian Wheeler Engineering for conformance with our recommendations and to determine if any additional subsurface

SITE VICINITY

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FARM WORKER HOUSING
5780 MISSION ROAD
OCEANSIDE, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2210728.02R
BY:	SD	FIGURE NO.:	1

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investigation, laboratory testing and/or recommendations are necessary. Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted engineering principles and practices. This warranty is in lieu of all other warranties, express or implied.

PROJECT SCOPE

Our preliminary geotechnical investigation consisted of surface reconnaissance, subsurface exploration, obtaining representative soil samples, laboratory testing, analysis of the field and laboratory data, and review of relevant geologic literature. Our scope of service did not include assessment of hazardous substance contamination, recommendations to prevent floor slab moisture intrusion or the formation of mold within the structures, evaluation or design of storm water infiltration facilities, or any other services not specifically described in the scope of services presented below.

- Drill 2 small-diameter borings (maximum depth of 20 feet) across the site to explore the subsurface conditions of the site and to obtain samples for laboratory testing.
- Backfill the boring holes using a grout or a grout/bentonite mix as required by the County of San Diego Department of Environmental Health.
- Evaluate, by laboratory tests, our past experience with similar soil types, the engineering properties of the various soil strata that may influence the proposed construction, including bearing capacities, expansive characteristics and settlement potential.
- Describe the general geology at the site, including possible geologic hazards that could have an effect on the proposed construction, and provide the seismic design parameters in accordance with the 2019 edition of the California Building Code.
- Discuss potential construction difficulties that may be encountered due to soil conditions, groundwater or geologic hazards, and provide geotechnical recommendations to mitigate identified construction difficulties.
- Provide site preparation and grading recommendations for the anticipated work.
- Provide foundation recommendations for the type of construction anticipated and develop soil engineering design criteria for the recommended foundation designs.
- Provide this preliminary geotechnical report presenting the results of our investigation including a plot plan showing the location of our subsurface explorations, excavation logs, laboratory test results, and our conclusions and recommendations for the proposed project.

Although a test for the presence of soluble sulfates within the soils that may be in contact with reinforced concrete was performed as part of the scope of our services, it should be understood Christian Wheeler Engineering does not practice corrosion engineering. If a corrosivity analysis is considered necessary, we recommend that the client retain an engineering firm that specializes in this field to consult with them on this matter. The results of our sulfate testing should only be used as a guideline to determine if additional testing and analysis is necessary.

FINDINGS

SITE DESCRIPTION

The subject site is located at the western terminus of Singh Way, in the City of Oceanside California. The site comprises the eastern portion of a property that is presently utilized for agricultural packing purposes. The area subject of this proposal is presently vacant and is bounded on the north, south, and east by vacant land. Topographically, the site slopes very gently to the north. According to the aforementioned grading plans average site elevation is about 133 feet.

GENERAL GEOLOGY AND SUBSURFACE CONDITIONS

GEOLOGIC SETTING AND SOIL DESCRIPTION: The subject site is located in the Coastal Plains Physiographic Province of San Diego County. Based upon the findings of our subsurface explorations and review of readily available, pertinent geologic and geotechnical literature, it was determined that the project area is underlain by artificial fill, subsoil, alluvium, and granitic rock. These materials are described below.

DOCUMENTED ARTIFICIAL FILL (Qdaf): Documented artificial fills exist along the southern and northwestern boundaries of the site. These fills are associated with the widening of the northerly portion the packing facility building pad and the extension of Singh Way. Our firm observed the previous grading operations associated with the fill placement and performed observation and testing. The documented fill materials consist of silty sands (SM) which were judged to have a very low expansion potential (EI<20),

UNDOCUMENTED ARTIFICIAL FILL (Quaf): Undocumented artificial fill has been mapped on the western edge of site from previous grading operations associated with the packing and storage facility and agricultural activity. Our previous investigations (CWE, 2007) noted the artificial fill to consist of reddish-brown to dark reddish-brown, dark grayish-brown, and light brown to brown, silty

clayey sand (SM-SC), clayey sand (SC), clayey sand/sandy clay (SC/CL), and silty sand (SM) that were noted to be generally damp to moist and medium dense/stiff in consistency. The sandy portions of the artificial fill were judged to have a very low expansion potential (EI<20), and the clayey portions of the artificial fill were judged to have a low to moderate expansion potential (EI between 21and 90).

SUBSOIL: Subsoil was encountered within the southerly portion of the site in our previous subsurface explorations and grading operations associated with the extension of Singh Way. These materials are not depicted on Plate Nos. 1 or 2. These materials were found to extend to a depth of about three feet to four feet below existing grade. The subsoil consists of light brown, dark brown, and reddish-brown, stiff to hard, moist to very moist, stiff to hard, sandy clay (CL). The subsoil was judged to have a medium to high Expansion Index (EI between 51 to 130).

ALLUVIUM (Qal): Quaternary-age alluvium was encountered in each of our subsurface explorations and increases in thickness towards the north. The alluvium is anticipated to extend to depths ranging from approximately 35 feet to 80 feet below existing site grades. In general, the alluvium generally consisted of light brown, brown, grayish brown, olive brown, and reddish brown, very loose to very dense, silty sand (SM), well-graded sand (SW), clayey sand (SC), and soft to stiff, sandy silt (ML) and clay (CL). The alluvium was moist to very moist above the groundwater table and saturated below. The sandy portions of the alluvium were judged to have a very low expansion potential (EI<20), and the clayey portions of the alluvium were judged to have a low to moderate expansion potential (EI between 21and 90).

GRANITIC ROCK (Kgr): The site is expected to be underlain by granitic rock at depth. CPT-1 and CPT-5 appear to have encountered granitic rock at approximately 38 feet and 50 feet below existing grades, respectively. From our previous work in the general site vicinity, it is anticipated that the granitic rock consists of well-graded sand/silty sand (SW/SM) that is very dense in consistency.

GROUNDWATER: Seepage was encountered in boring B-1 (CWE 2022) at a depth of 19 feet corresponding to an elevation of 107 feet. Previous CPT data indicated groundwater at 14 feet corresponding to an elevation of 105 feet (CWE, 2150046.01). In addition, we reviewed available groundwater data in the vicinity of the site to determine the historic high groundwater elevation. The main resources utilized were Geotracker and California Department of Water Resources websites. Reports for the Cleanup Program site titled San Luis Rey Restoration/Mitigation Bank located north of the site were reviewed. The highest recorded water level was at an elevation of 104.5 feet (Geocon, 2014) corresponding to approximately 20 feet below existing site grades. The depth to seasonal high groundwater beneath the site is expected to fluctuate

seasonally and is estimated to be as high as 20 feet below the existing site grades based on nearby monitoring well information (Geocon, 2014). We do not expect any adverse groundwater related conditions after the proposed construction. However, it should be recognized that minor groundwater seepage problems might occur after construction and landscaping are completed, even at a site where none were present before construction. These are usually minor phenomena and are often the result of an alteration in drainage patterns and/or an increase in irrigation water. Based on the anticipated construction and the permeability of the on-site soils, it is our opinion that any seepage problems that may occur will be minor in extent. It is further our opinion that these problems can be most effectively corrected on an individual basis if and when they occur.

TECTONIC SETTING: It should be noted that much of Southern California, including the San Diego County area, is characterized by a series of Quaternary-age fault zones that consist of several individual, en echelon faults that generally strike in a northerly to northwesterly direction. Some of these fault zones (and the individual faults within the zone) are classified as active while others are classified as only potentially active according to the criteria of the California Division of Mines and Geology. Active fault zones are those which have shown conclusive evidence of faulting during the Holocene Epoch (the most recent 11,000 years) while potentially active fault zones have demonstrated movement during the Pleistocene Epoch (11,000 to 1.6 million years before the present) but no movement during Holocene time. Inactive faults are those faults that can be demonstrated to have no movement in the past 1.6 million years.

A review of available geologic maps indicates that the nearest active fault zone is the Newport-Inglewood-Rose Canyon Fault Zone, located approximately 13 miles to the west of the site. The offshore location of the Newport-Inglewood- Rose Canyon Fault Zone near the site is based on marine geophysical surveys and according to the USGS the slip rate is not fully constrained, but appears to be approximately 1.0±0.5 mm/yr in the north, increasing to 1.5±0.5 mm/yr in the south. Other active fault zones in the region that could possibly affect the site include the Coronado Bank, San Diego Trough, and San Clemente Fault Zones to the southwest; the Palos Verdes Fault Zone to the northwest, and the Elsinore, Earthquake Valley, San Jacinto, and San Andreas Fault Zones to the northeast.

GENERAL GEOLOGIC HAZARDS

GENERAL: The site is located within an area that possesses the potential for soil liquefaction in the event of a significant and proximal seismic event due to such factors as shallow groundwater, and the presence of loose to medium dense, cohesionless sediments beneath the site.

Other than the potentials for seismically induced ground shaking, soil liquefaction and the subsequent seismic induced settlements, and flooding as described herein, the site should be safe from geologic hazards at the conclusion of construction, provided the recommendations contained herein are implemented and sound construction practices are followed. It is our professional opinion that the site is suitable for the proposed development. The client should realize that the site preparation and foundation recommendations presented herein are intended to provide a life safety level such that the proposed structures will not collapse during a major seismic event, which could result in loss of life. The recommendations will not necessarily prevent the structures from sustaining structural damage, even to the extent that it becomes uninhabitable. The foundations for the structures should, however, perform in a normally expected manner under static loading conditions for the anticipated life of the structure of 50 to 75 years.

SURFACE RUPTURE: There are no known *active* faults that traverse the subject site; therefore, the risk for surface rupture at the subject site is considered low.

SLOPE STABILITY: The Relative Landslide Susceptibility and Landslide Distribution Map of the Oceanside Quadrangle prepared by the California Division of Mines and Geology indicates that the site is situated within Relative Landslide Susceptibility Area 2. Area 2 is considered to be "marginally susceptible" to slope failures; Area 2 includes gentle to moderately sloping terrain, where slope failure and landsliding occurrences are rare. We have also reviewed the publication, "Recent Slope Failures, Ancient Landslides, and related Geology of the North-Central Coastal Area, San Diego County" by Weber, 1982. This publication does not indicate any slope instability at the subject site.

Based on our findings and the relatively flat topography on and surrounding the subject site it is our opinion that the potential for slope instability or landsliding can be considered very low.

FLOODING: As delineated on the Flood Insurance Rate Map (FIRM), number 06073C1065G prepared by the Federal Emergency Management Agency, the northerly approximately ¼ of the site is located in a "moderate flood hazard area." Moderate flood hazard areas are between the limits of the base flood and the 0.2-percent-annual-chance (or 500-year) flood. The remaining portions of the site are located in an "area of minimal flood hazard." Areas of minimal flood hazards are located outside of the boundaries of both the 100-year and 500-year flood zones.

TSUNAMIS: Tsunamis are great sea waves produced by submarine earthquakes or volcanic eruptions. In reviewing the Oceanside/San Luis Rey Quadrangle of the Tsunami Inundation Map for Emergency Planning

(CEMA, 2009) it was determined that the subject site not located within a projected tsunami inundation area. Due to the site's elevation and location, it will not be affected by a tsunami.

SEICHES: Seiches are periodic oscillations in large bodies of water such as lakes, harbors, bays or reservoirs. Due to the site's location, it should not be affected by seiches.

LIQUEFACTION

GENERAL: The subject site in an area considered susceptible to liquefaction. In order to be subject to liquefaction, three conditions must be present: loose sandy or cohesionless silty deposits, shallow groundwater, and earthquake shaking of sufficient magnitude and duration. Based on our site-specific study, it appears that relatively shallow groundwater is present at the site and strong earthquake shaking may affect the site. Additionally, as described in the Geologic Setting and Soil Description section of this report above, the materials below the shallow water table in the project area consist of Quaternary-age alluvial deposits that contain layers of sand, silty sand, and low to medium plasticity silts that are expected to have soil properties conducive to liquefaction.

It should be noted that the following discussion is in no way a guarantee that the analysis will accurately predict the liquefaction potential at the site. The analysis provides general information only on the site liquefaction potential. It should be noted that many of the parameters used in liquefaction evaluations are subjective and open to interpretation, and that much is yet unknown about both the seismicity of the San Diego area and the phenomenon of liquefaction.

DESCRIPTION OF ANALYSIS: Our analysis was performed using the Cliq (version 3.0) software developed by Geologismiki in conjunction with Dr. Peter Robertson, in which the results of our CPT soundings were input and evaluated in accordance with the procedure recommended by the *National Center For Earthquake Engineering Research* (NCEER, 1998). Our analyses were limited to the upper 50 feet of the existing soils below the proposed improvements. Liquefaction of soils at greater depths is expected to be less likely based on the age of the deeper soils. Additionally, an algorithm was applied within the software to make corrections for thin stiff layers embedded within softer zones (Robertson, 2009). The results are presented in Appendix E of this report.

EARTHQUAKE PARAMETERS: As permitted in Section 1803.5.12 of the California Building Code, our calculations were performed using a peak ground acceleration (PGA_M = 0.48g) as determined using the procedures set forth in Section 11.8.3 of ASCE 7-10. We have also performed a seismic hazard deaggregation

using the interactive program available on the U. S. Geological Survey website. Within the USGS program, the site coordinates were entered and a deaggregation was performed based on the peak ground acceleration with two percent probability of exceedance in 50 years (0.4g) for soil with Vs^{30} = 259 m/s (Soil Site Class D). For the subject site, this yielded a mean earthquake magnitude of 6.4. Based on this result and the proximity of the site to the Rose Canyon and Coronado Bank Fault Zones, we have used an earthquake magnitude of 7.0 in our liquefaction evaluation.

POTENTIAL FOR LIQUEFACTION: Using the parameters described above, the results of our liquefaction analyses indicate that layers of saturated silty sand below the water table have factors-of-safety against soil liquefaction of less than 1.0 and are therefore considered liquefiable. The soils above the water table are not potentially liquefiable due to a lack of saturation.

POST LIQUEFACTION RECONSOLIDATION SETTLEMENT: The potential amount of total vertical settlement due to reconsolidation of the liquefied soils was estimated within the Cliq software using the methods presented by Zhang et al, 2002 with a depth-weighted dynamic settlement profile (Cetin et al, 2009) as recommended by Dr. Peter Robertson (2014). The estimated settlement within the five CPTs ranged from about ¼ inch to just over 1 inch, with an average of approximately ½ inch. It can be noted that, for sites with relatively small lateral displacement (i.e. less than one foot), predicted settlements are typically within a factor of 2 relative to those observed (Seed et al, 2003).

In terms of differential settlement, CGS Special Publication 117 notes that considerable difficulty exists in trying to "reliably estimate" the amount of differential settlement at a site caused by soil liquefaction. As such, a conservative estimate of differential settlement at any given site can be assumed to be two-thirds of the total liquefaction-induced settlement (CGS, 2008). Considering this criterion combined with the relatively thick crust of non-liquefiable material between the foundations and the liquefiable layers, the differential settlement is estimated to be on the order of ½-inch over 500 inches for continuous foundation systems.

LATERAL SPREADING: Lateral ground spreading can occur when viscous liquefied soils flow downslope, usually towards a river channel or shoreline. Based on the depth to ground water and potentially liquefiable layers, it is our opinion that the risk of lateral spreading is low.

CONCLUSIONS

In general, it is our professional opinion and judgment that the subject property is suitable for the construction of the subject project provided the recommendations presented herein are implemented. The

main geotechnical conditions encountered affecting the proposed project include potential compressible fill soils, subsoils, alluvium, the liquefaction potential of the underlying alluvium, and proposed cut slopes.

Portions of the sites are underlain by undocumented fill soils associated with the grading of the existing packing and storage facility and previous agricultural use. In general, it is estimated that these materials are less than about 5 feet deep. In addition, the alluvium was found to be potentially compressible. This condition will require special site preparation as recommended hereinafter.

Based on our evaluation, we estimate that a potential differential settlement of approximately ½-inch could occur over a horizontal distance of 500 inches (0.001L) as a result of the design-level seismic event. It is our opinion that the risk for lateral spreading, bearing loss, and differential settlement are negligible and that the shallow foundations need not be designed in accordance with Section 12.13.9 of ASCE/SEI 7-16. It should be recognized that this approach will not necessarily prevent the building from sustaining structural damage, even to the extent that they may become uninhabitable in the event of a major, proximal earthquake. Furthermore, underground utilities and associated improvements could also be damaged due to liquefaction.

The proposed cut slopes may expose loose or cohesionless alluvium. This condition should be further evaluated during grading operations and, depending on as-graded conditions, may require buttressing of the proposed cut slopes.

RECOMMENDATIONS

GRADING AND EARTHWORK

GENERAL: All grading should conform to the guidelines presented in the current edition of the California Building Code, the minimum requirements of the City of Oceanside, and the recommended Grading Specifications and Special Provisions attached hereto, except where specifically superseded in the text of this report.

PREGRADE MEETING: It is recommended that a pregrade meeting including the grading contractor, the client, and a representative from Christian Wheeler Engineering be performed, to discuss the recommendations of this report and address any issues that may affect grading operations.

OBSERVATION OF GRADING: Continuous observation by the Geotechnical Consultant is essential during the grading operation to confirm conditions anticipated by our investigation, to allow adjustments in

design criteria to reflect actual field conditions exposed, and to determine that the grading proceeds in general accordance with the recommendations contained herein.

CLEARING AND GRUBBING: Site preparation should begin with the removal of any existing vegetation and other deleterious materials in areas to receive proposed improvements or new fill soils should be removed from the site.

SITE PREPARATION: It is recommended that undocumented artificial fill underlying the proposed structures, associated improvements, and new fills be removed in its entirety and replaced as compacted fill. In addition, subsoil and alluvial soils should be removed to a minim depth of at least 5 feet below existing grade or proposed grade, whichever is more. Lateral removal limits should extend across the entire site. No removals are recommended beyond property lines. All excavated areas should be approved by the geotechnical engineer or his representative prior to replacing any of the excavated soils. The excavated materials can be replaced as properly compacted fill in accordance with the recommendations presented in the "Compaction and Method of Filling" section of this report.

PROCESSING OF FILL AREAS: Prior to placing any new fill soils or constructing any new improvements in areas that have been cleaned out to receive fill, the exposed soils should be scarified to a depth of 12 inches, moisture conditioned, and compacted to at least 90 percent relative compaction.

COMPACTION AND METHOD OF FILLING: All structural fill placed at the site should be compacted to a relative compaction of at least 90 percent of maximum dry density as determined by ASTM Laboratory Test D1557. Fills should be placed at or slightly above optimum moisture content, in lifts six to eight inches thick, with each lift compacted by mechanical means. Fills should consist of approved earth material, free of trash or debris, roots, vegetation, or other materials determined to be unsuitable by our soil technicians or project geologist. Fill material should be free of rocks or lumps of soil in excess of six inches in maximum dimension. Based on our subsurface observations and laboratory testing, we anticipate the soil removed will be suitable for use as structural fill. All utility trenches should be compacted to a minimum of 90 percent of its maximum dry density.

CUT SLOPE STABLILIZATION FILL: Cut slope stabilization may be necessary if cohesionless, friable, or loose alluvium is encountered in proposed cut slopes. This condition should be evaluated during grading operations by our geologist and may require stabilization of proposed cut slopes. A general cut slope stabilization detail is provided on Plate No. 3.

IMPORTED FILL SOILS: Imported fill soils should consist of silty sands and clayey sands that have a low expansive potential (EI between 21 and 50) and contain no chunks over 3 inches in maximum dimension. In addition, imported fill soils should have relatively high strength, good pavement support characteristics, low corrosion potential, and moderate permeability. Imported fill soils should be approved by our firm prior to delivery to the site. At least 5 working days will be required to perform the necessary laboratory tests to approve potential imported fill soils.

SURFACE DRAINAGE: The drainage around the proposed improvements should be designed to collect and direct surface water away from proposed improvements and the top of slopes toward appropriate drainage facilities. Rain gutters with downspouts that discharge runoff away from the structure into controlled drainage devices are recommended.

The ground around the proposed improvements should be graded so that surface water flows rapidly away from the improvements without ponding. In general, we recommend that the ground adjacent to structure slope away at a gradient of at least 5 percent for a minimum distance of 10 feet. If the minimum distance of 10 feet cannot be achieved, an alternative method of drainage runoff away from the building at the termination of the 5 percent slope will need to be used. Swales and impervious surfaces that are located within 10 feet of the building should have a minimum slope of 2 percent. Pervious hardscape surfaces adjacent to structures should be similarly graded.

Drainage patterns provided at the time of construction should be maintained throughout the life of the proposed improvements. Site irrigation should be limited to the minimum necessary to sustain landscape growth. Over watering should be avoided. Should excessive irrigation, impaired drainage, or unusually high rainfall occur, zones of wet or saturated soil may develop.

FOUNDATIONS

GENERAL: Based on our findings and engineering judgment, the proposed structures and associated exterior improvements may be supported by conventional shallow continuous and isolated spread footings bearing in newly compacted fill. The following recommendations are considered the minimum based on the anticipated soil conditions, and are not intended to be lieu of structural considerations. All foundations should be designed by a qualified engineer.

DIMENSIONS: Spread footings supporting the proposed structures should be embedded at least 18 inches below lowest adjacent finish pad grade. Continuous and isolated footings should have a minimum width of 12

inches and 24 inches, respectively. Continuous footings should be connected by grade beams as recommended by the project structural engineer.

BEARING CAPACITY: Spread footings supporting the proposed structures with a minimum depth of 18 inches and a minimum width of 12 inches may be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf). This value may be increased by one-third for combinations of temporary loads such as those due to wind or seismic loads.

FOOTING REINFORCING: Reinforcement requirements for foundations should be provided by a structural designer. However, based on the expected soil conditions, we recommend that the minimum reinforcing for continuous footings consist of at least 2 No. 5 bars positioned near the bottom of the footing and 2 No. 5 bars positioned near the top of the footing.

LATERAL LOAD RESISTANCE: Lateral loads against foundations may be resisted by friction between the bottom of the footing and the supporting soil, and by the passive pressure against the footing. The coefficient of friction between concrete and soil may be considered to be 0.30. The passive resistance may be considered to be equal to an equivalent fluid weight of 300 pounds per cubic foot. These values are based on the assumption that the footings are poured tight against undisturbed soil. If a combination of the passive pressure and friction is used, the friction value should be reduced by one-third.

FOUNDATION EXCAVATION OBSERVATION: All footing excavations should be observed by Christian Wheeler Engineering prior to placing of forms and reinforcing steel to determine whether the foundation recommendations presented herein are followed and that the foundation soils are as anticipated in the preparation of this report. All footing excavations should be excavated neat, level, and square. All loose or unsuitable material should be removed prior to the placement of concrete.

SETTLEMENT CHARACTERISTICS: The anticipated total and differential settlement due to static loads and/or liquefaction is expected to be less than about 1 inch and 1 inch over 40 feet, respectively, provided the recommendations presented in this report are followed. It should be recognized that minor cracks normally occur in concrete slabs and foundations due to concrete shrinkage during curing or redistribution of stresses, therefore some cracks should be anticipated. Such cracks are not necessarily an indication of excessive vertical movements.

EXPANSIVE CHARACTERISTICS: The prevailing foundation soils are assumed to have a low expansive potential (EI between 21 and 50). The recommendations within this report reflect these conditions.

FOUNDATION PLAN REVIEW: The final foundation plan and accompanying details and notes should be submitted to this office for review. The intent of our review will be to verify that the plans used for construction reflect the minimum dimensioning and reinforcing criteria presented in this section and that no additional criteria are required due to changes in the foundation type or layout. It is not our intent to review structural plans, notes, details, or calculations to verify that the design engineer has correctly applied the geotechnical design values. It is the responsibility of the design engineer to properly design/specify the foundations and other structural elements based on the requirements of the structure and considering the information presented in this report.

FOUNDATION EXCAVATION OBSERVATION: All foundation excavations should be observed by the Geotechnical Consultant prior to constructing forms or placing reinforcing steel to determine if the foundation recommendations presented herein are complied with. All footing excavations should be excavated neat, level and square. All loose or unsuitable material should be removed prior to the placement of concrete.

SOLUBLE SULFATES: The water-soluble sulfate content of a selected soil sample was determined in accordance with California Test Method 417. The result of this test indicates that the soil sample had a soluble sulfate content of 0.084. Soils with a soluble sulfate content of less than 0.1 percent are considered to be negligible. However, it should be recognized that the sulfate content of surficial soils may increase with time due to soluble sulfate in the irrigation water or fertilized use.

It should be understood Christian Wheeler Engineering does not practice corrosion engineering. If a corrosivity analysis is considered necessary, we recommend that the client retain an engineering firm that specializes in this field to consult with them on this matter. The results of our corrosion testing should only be used as a guideline to determine if additional testing and analysis is necessary.

SEISMIC DESIGN FACTORS

Seismic design parameters were determined in accordance with Chapter 16 of the *2019 California Building Code (CBC)* and the applicable sections of *ASCE/SEI 7-16 Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. For the subject site, shear wave velocities correlated to measured tip resistances in our CPT-2 indicate that the upper 100 feet of geologic subgrade can be characterized as Soil Site Class D. It can be noted that sites underlain by liquefaction-susceptible soils should be designated as Soil Site Class F, requiring a site response analysis. However, as discussed in Section 20.3.1 of ASCE/SEI 7-16, for structures having a fundamental period of vibration equal to or less than 0.5 second, it is not required to perform a site response analysis and the site classification can be determined based on the code. We understand that the proposed

structure will have a fundamental period less than 0.5 second and can therefore be designed using Soil Site Class D as described above.

TABLE I: CBC 2019/ASCE 7-16 – SEISMIC DESIGN PARAMETERS

CBC – Chapter 16 Section	Seismic Design Parameter	Recommended Value
Section 1613.2.2	Soil Site Class	D
Figure 1613.2.1 (1)	MCE_R Acceleration for Short Periods (0.2 sec), S_s	0.928 g
Figure 1613.2.1 (2)	MCE_R Acceleration for 1.0 Sec Periods (1.0 sec), S_1	0.342 g
Table 1613.2.3 (1)	Site Coefficient, F_a	1.129
Table 1613.3.3 (2)	Site Coefficient, F_v	1.958
Section 1613.2.3	S_{MS} = MCE_R Spectral Response at 0.2 sec. = $(S_s)(F_a)$	1.048 g
Section 1613.2.3	S_{M1} = MCE_R Spectral Response at 1.0 sec. = $(S_1)(F_v)$	0.670 g
Section 1613.2.4	S_{DS} = Design Spectral Response at 0.2 sec. = $2/3(S_{MS})$	0.698 g
Section 1613.2.4	S_{D1} = Design Spectral Response at 1.0 sec. = $2/3(S_{M1})$	0.446 g
Section 1613.2.5	Seismic Design Category	D
ASCE 7-16 Fig. 22-14	Mapped Long-Period Transition Period, T_L	8 sec
Section 1803.2.12	PGA_M per Section 11.8.3 of ASCE 7	0.48 g

In accordance with Section 11.4.8 of ASCE/SEI 7-16, structures on Soil Site Class D or E sites that have a mapped MCE_R spectral response acceleration parameter (S_1) value greater than or equal to 0.2 require a site-specific ground motion hazard analysis or the seismic response coefficient (C_S) must be adjusted to adequately characterize the site response (Exception 2). As noted in the Commentary for Section 11, "In general, this exception effectively limits the requirements for site-specific hazard analyses to very tall and or flexible structures at Site Class D sites." Table I presents the seismic design parameters based on Exception 2 in Section 11.4.8.

Probable ground shaking levels at the site could range from slight to moderate, depending on such factors as the magnitude of the seismic event and the distance to the epicenter. It is likely that the site will experience the effects of at least one moderate to large earthquake during the life of the proposed improvements.

RISK CATEGORIES

The project structural engineer and architect should evaluate the appropriate Risk Category and Seismic Design Category for the planned structures. The values presented herein assume a Risk Category of II and a Seismic Design Category D. Table II presents a summary of the risk categories in accordance with ASCE 7-16.

TABLE II
ASCE 7-16 RISK CATEGORIES

Risk Category	Building Use	Examples
I	Low risk to Human Life at Failure	Barn, Storage Shelter
II	Nominal Risk to Human Life at Failure (Buildings Not Designated as I, III or IV)	Residential, Commercial and Industrial Buildings
III	Substantial Risk to Human Life at Failure	Theaters, Lecture Halls, Dining Halls, Schools, Prisons, Small Healthcare Facilities, Infrastructure Plants, Storage for Explosives/Toxins
IV	Essential Facilities	Hazardous Material Facilities, Hospitals, Fire and Rescue, Emergency Shelters, Police Stations, Power Stations, Aviation Control Facilities, National Defense, Water Storage

ON-GRADE SLABS

GENERAL: The floor system of the proposed structures may consist of a concrete slab. The following recommendations are considered the minimum slab requirements based on the soil conditions and are not intended in lieu of structural considerations. These recommendations assume that the site preparation recommendations contained in this report are implemented.

INTERIOR FLOOR SLABS: The minimum slab thickness should be 5 inches (actual) and the slab should be reinforced with at least No. 4 bars spaced at 12 inches on center each way. Slab reinforcement should be supported on chairs such that the reinforcing bars are positioned at mid-height in the floor slab. The slab reinforcement should extend down into the perimeter footings at least 6 inches.

UNDER-SLAB VAPOR RETARDERS: Steps should be taken to minimize the transmission of moisture vapor from the subsoil through the interior slabs where it can potentially damage the interior floor coverings. Local industry standards typically include the placement of a vapor retarder, such as plastic, in a layer of coarse sand placed directly beneath the concrete slab. Two inches of sand are typically used above and below the plastic. The vapor retarder should be at least 15-mil Stegowrap® or similar material with sealed seams and should extend at least 12 inches down the sides of the interior and perimeter footings. The sand should have a sand equivalent of at least 30, and contain less than 10% passing the Number 100 sieve and less than 5% passing the Number 200 sieve. The membrane should be placed in accordance with the recommendation and consideration of ACI 302, "Guide for Concrete Floor and Slab Construction" and ASTM E1643, "Standards Practice for Installation of Water Vapor Retarder Used in Contact with Earth or Granular Fill Under

Concrete Slabs." It is the flooring contractor's responsibility to place floor coverings in accordance with the flooring manufacturer specifications.

EXTERIOR CONCRETE FLATWORK: Exterior concrete slabs-on-grade should have a minimum thickness of 5 inches and be reinforced with at least No. 4 bars placed at 18 inches on center each way (ocew). All slabs should be provided with weakened plane joints in accordance with the American Concrete Institute (ACI) guidelines. Special attention should be paid to the method of concrete curing to reduce the potential for excessive shrinkage cracking. It should be recognized that minor cracks occur normally in concrete slabs due to shrinkage. Some shrinkage cracks should be expected and are not necessarily an indication of excessive movement or structural distress.

PRELIMINARY PAVEMENT RECOMMENDATIONS

GENERAL: The following pavement recommendations should be considered preliminary. A Traffic Index of 5.5 was assumed for driveways to receive trash truck and fire engine traffic. A Traffic Index of 4.5 was assumed for parking and light traffic areas. These Traffic Indexes and an assumed R-value=30 was used in conjunction with the Caltrans design method to design the minimum structural pavement section. Based on the above parameters, the following minimum pavement sections are recommended. These recommendations do not supersede minimum City of Oceanside requirements. The assumed Traffic Index should be confirmed by the project's civil engineer.

TABLE IIII: ASPHALTIC CONCRETE (AC) PAVEMENT SECTIONS

Proposed Use	R-Value	Traffic Index	Asphalt Concrete	Base
Driveways With Trash Truck and Fire Engine Traffic	30	5.5	3.0	7.0
Parking and Light Traffic Areas	30	4.5	3.0 inches	4.5 inches

Grading for the proposed pavement areas should be performed in accordance with the recommendation provided in the "Site Preparation" section in the referenced geotechnical report. Prior to placing the base material, the subgrade soils should be scarified to a depth of 12 inches, moisture conditioned and compacted to at least 95 percent of its maximum dry density. The base material could consist of Crushed Aggregate Base (CAB) or Class II Aggregate Base. The Crushed Aggregate Base should conform to the requirements set forth in Section 200-2.2 of the Standard Specifications for Public Works Construction. The Class II Aggregate Base should conform to requirements set forth in Section 26-1.02A of the Standard Specifications for California Department of Transportation. As an alternate, the base material for the pavements may consist of Crushed

Miscellaneous Base (recycled base material) that conforms to the requirements set forth in Section 200-2.4 of the Standard Specifications for Public Works Construction. It should be noted, however, that Crushed Miscellaneous Base material has lower durability characteristics than Crushed Aggregate Base or Class II Aggregate Base, which may result in a shorter pavement life. As such, the owner of the project should approve the use of this material for the pavement base. The base material underlying asphalt concrete should be compacted to at least 95 percent of its maximum dry density. Asphalt concrete shall be compacted to attain at least 95 percent relative compaction.

It is our assumed that Portland Cement Concrete (PCC) pavement in the trash landing area should be at least 7.0 inches thick, and should be reinforced with at least No. 4 bars placed at 18 inches on center each way. Concrete pavement construction should comply with the requirements set forth in Sections 201-1.1.2 and 302-6 of the Standard Specifications for Public Works Construction. The concrete materials should be a Class 560-C-3250 mix. Driveway slabs should be provided with a thickened edge at least 18 inches deep and 6 inches wide. All slabs should be provided with weakened plane joints in accordance with the American Concrete Institute (ACI) guidelines. Special attention should be paid to the method of concrete curing to reduce the potential for excessive shrinkage cracking. It should be recognized that minor cracks occur normally in concrete slabs due to shrinkage. Some shrinkage cracks should be expected and are not necessarily an indication of excessive movement or structural distress.

LIMITATIONS

REVIEW, OBSERVATION AND TESTING

The recommendations presented in this report are contingent upon our review of final plans and specifications. Such plans and specifications should be made available to the Geotechnical Engineer and Engineering Geologist so that they may review and verify their compliance with this report and with the California Building Code.

It is recommended that Christian Wheeler Engineering be retained to provide continuous soil engineering services during the earthwork operations. This is to verify compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

UNIFORMITY OF CONDITIONS

The recommendations and opinions expressed in this report reflect our best estimate of the project requirements based on an evaluation of the subsurface soil conditions encountered at the subsurface exploration locations and on the assumption that the soil conditions do not deviate appreciably from those encountered. It should be recognized that the performance of the foundations and/or cut and fill slopes may be influenced by undisclosed or unforeseen variations in the soil conditions that may occur in the intermediate and unexplored areas. Any unusual conditions not covered in this report that may be encountered during site development should be brought to the attention of the Geotechnical Engineer so that he may make modifications if necessary.

CHANGE IN SCOPE

This office should be advised of any changes in the project scope or proposed site grading so that we may determine if the recommendations contained herein are appropriate. It should be verified in writing if the recommendations are found to be appropriate for the proposed changes or our recommendations should be modified by a written addendum.

TIME LIMITATIONS

The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they are due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Government Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a period of two years without a review by us verifying the suitability of the conclusions and recommendations.

PROFESSIONAL STANDARD

In the performance of our professional services, we comply with that level of care and skill ordinarily exercised by members of our profession currently practicing under similar conditions and in the same locality. The client recognizes that subsurface conditions may vary from those encountered at the locations where our borings, surveys, and explorations are made, and that our data, interpretations, and recommendations are based solely on the information obtained by us. We will be responsible for those data, interpretations, and recommendations, but shall not be responsible for the interpretations by others of the information developed. Our services consist

of professional consultation and observation only, and no warranty of any kind whatsoever, express or implied, is made or intended in connection with the work performed or to be performed by us, or by our proposal for consulting or other services, or by our furnishing of oral or written reports or findings.

CLIENT'S RESPONSIBILITY

It is the responsibility of the client, or its representatives, to ensure that the information and recommendations contained herein are brought to the attention of the structural engineer for the project and incorporated into the project's plans and specifications. It is further their responsibility to take the necessary measures to ensure that the contractor and his subcontractors carry out such recommendations during construction.

FIELD EXPLORATIONS

Two subsurface explorations were made at the locations indicated on the site plan included herewith as Plate Number 1 on January 24, 2022. These explorations consisted of borings drilled utilizing a Ingersol Rand A-300 truck mounted drill rig. The fieldwork was conducted by or under the observation of our engineering geology personnel.

The explorations were carefully logged when made. The subsurface exploration logs are presented in the attached Appendix A. The soils are described in accordance with the Unified Soils Classification. In addition, a verbal textural description, the wet color, the apparent moisture and the density or consistency are provided. The density of granular soils is given as either very loose, loose, medium dense, dense or very dense. The consistency of silts or clays is given as either very soft, soft, medium stiff, stiff, very stiff, or hard.

Relatively undisturbed drive samples were collected using a modified California sampler. The sampler, with an external diameter of 3.0 inches, is lined with 1-inch long, thin, brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a 140-pound hammer falling 30 inches in general accordance with ASTM D 3550-84. The driving weight is permitted to fall freely. The number of blows per foot of driving, or as indicated, are presented on the boring logs as an index to the relative resistance of the sampled materials. The samples were removed from the sample barrel in the brass rings, and sealed. Bulk samples of the earth materials encountered were also collected. Samples were transported to our laboratory for testing.

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ATTACHMENTS

TABLES

Table I Seismic Design Parameters
Table II Risk Categories
Table III Preliminary Asphaltic Concrete Pavement Recommendations

FIGURES

Figure 1 Site Vicinity Map

PLATES

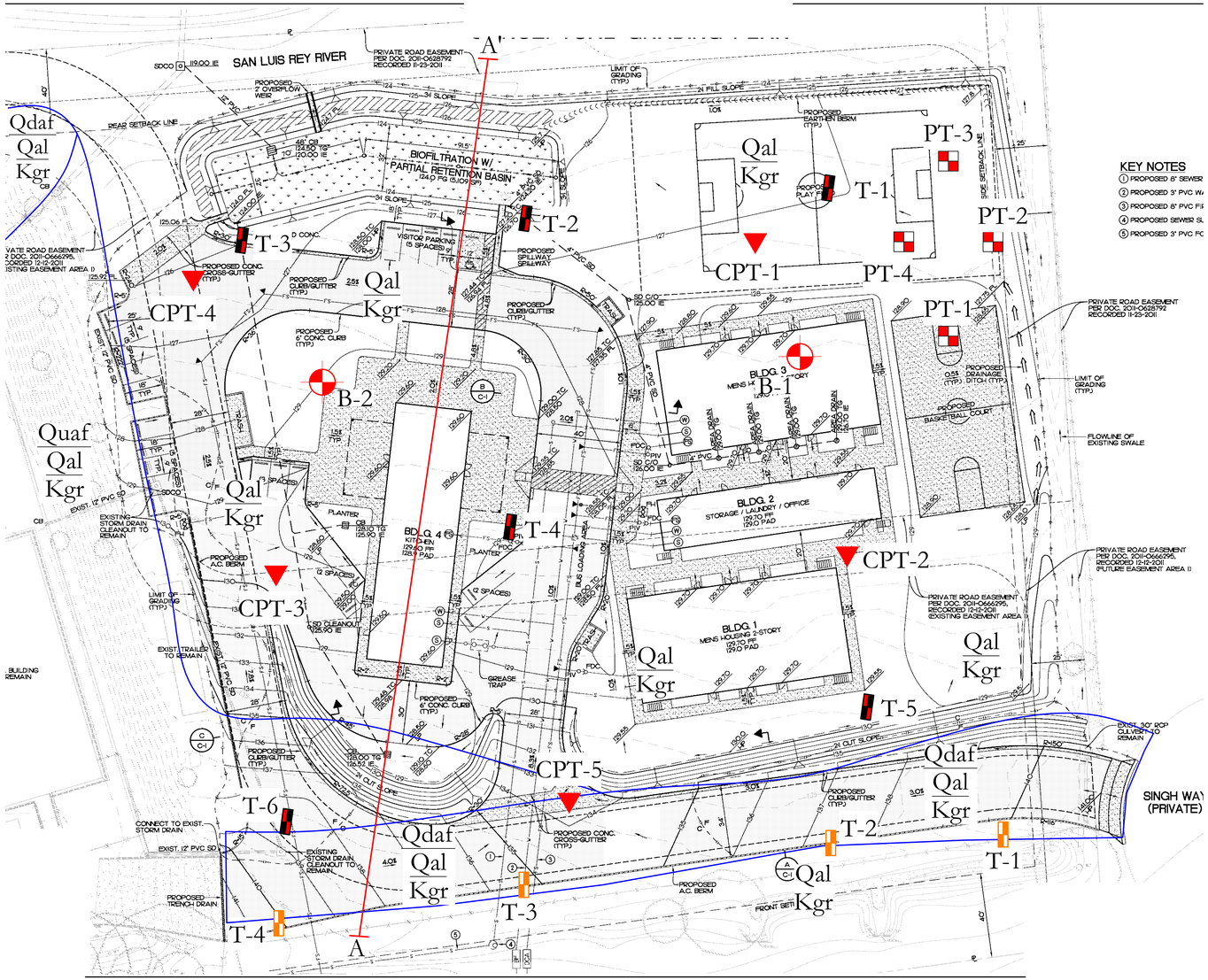
Plate 1 Site Plan and Geotechnical Map
Plate 2 Geologic Cross Section A-A'
Plate 3 Cut Slope Buttress

APPENDICES

Appendix A Subsurface Explorations
Appendix B Laboratory Test Results
Appendix C References
Appendix D Recommended Grading Specifications-General Provisions
Appendix E Liquefaction Analysis
Appendix F Data From CWE 2150046.01R

LABORATORY TESTING

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. A brief description of the tests performed and the subsequent results are presented in Appendix B.



KEY NOTES

1. PROPOSED 8" SEWER
2. PROPOSED 3" PVC W
3. PROPOSED 8" PVC FI
4. PROPOSED SEWER SL
5. PROPOSED 3" PVC FC

CWE LEGEND

B-2	Approximate Boring Location (CWE, 2022)
PT-4	Approximate Percolation Test Location (CWE, 2022)
CPT-5	Approximate Cone Penetrometer Test Location (CWE, 2015)
T-6	Approximate Test Trench Location (CWE, 2015)
T-6	Approximate Test Trench Location (CWE, 2011)
	Approximate Geologic Contact
Qdaf / Qal / Kgr	Documented Artificial Fill over Alluvium over Granitic Rock
Quaf / Qal / Kgr	Undocumented Artificial Fill over Alluvium over Granitic Rock
Qal / Kgr	Alluvium over Granitic Rock
	Geologic Cross Section

0 30' 60'

SCALE: 1" = 30'

CONCEPTUAL GRADING PLAN

FARM WORKER HOUSING
WEST COAST TOMATO GROWERS
6780 MISSION AVE, OCEANSIDE, CA 92057

DESIGNER SPN
DRAWN JGF
CHECKED SPN
DATE 03-23-2022

REVISION DESCRIPTION
NO 1 | DATE 07/--/2022 | BY SDA | REVISE SITE PLAN

SNIPES-DYE ASSOCIATES
8348 CENTER DRIVE, SUITE G, LA MESA, CA 91942-2910 (619) 697-9234, FAX (619) 460-2033

C-3

SHEET 3 OF 3 SHEET

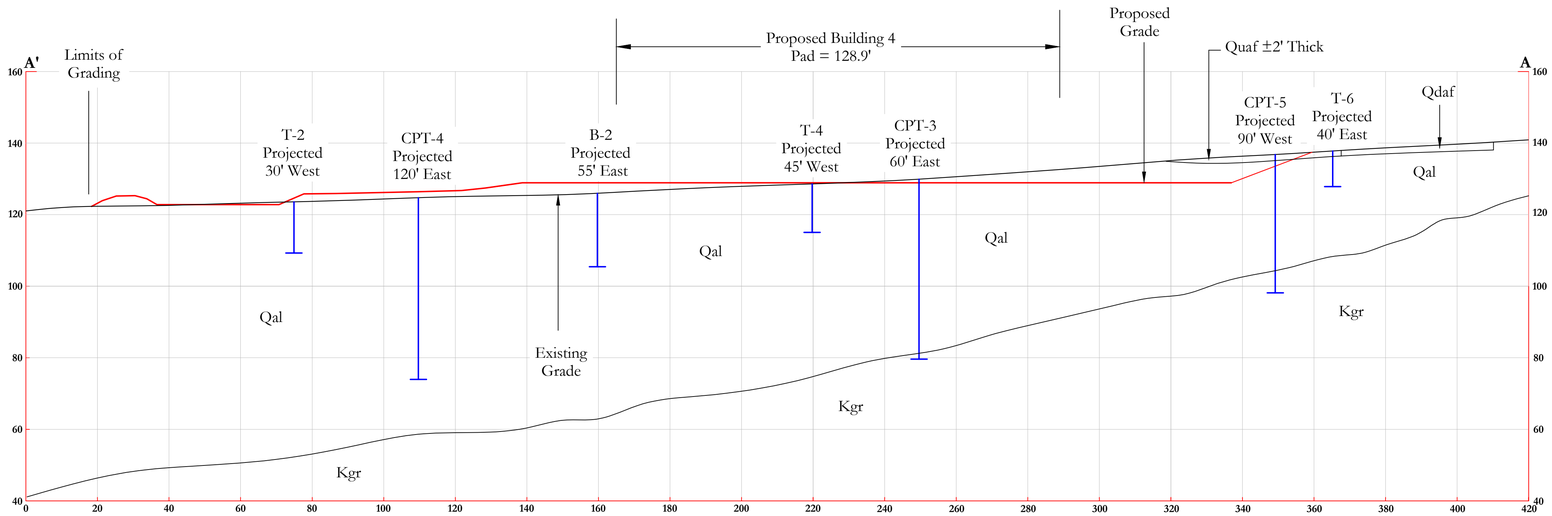
JOB NO. 8SO141

SITE PLAN AND GEOLOGIC MAP

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE: JULY 2022 | JOB NO.: 2210728.02R
BY: SD | PLATE NO.: 1

CHRISTIAN WHEELER ENGINEERING



CWE LEGEND	
Qal	Alluvium
Kgr	Granitic Rock
Quaf	Undocumented Artificial Fill
Qdaf	Documented Artificial Fill (CWE, 2011)

0 20' 40'

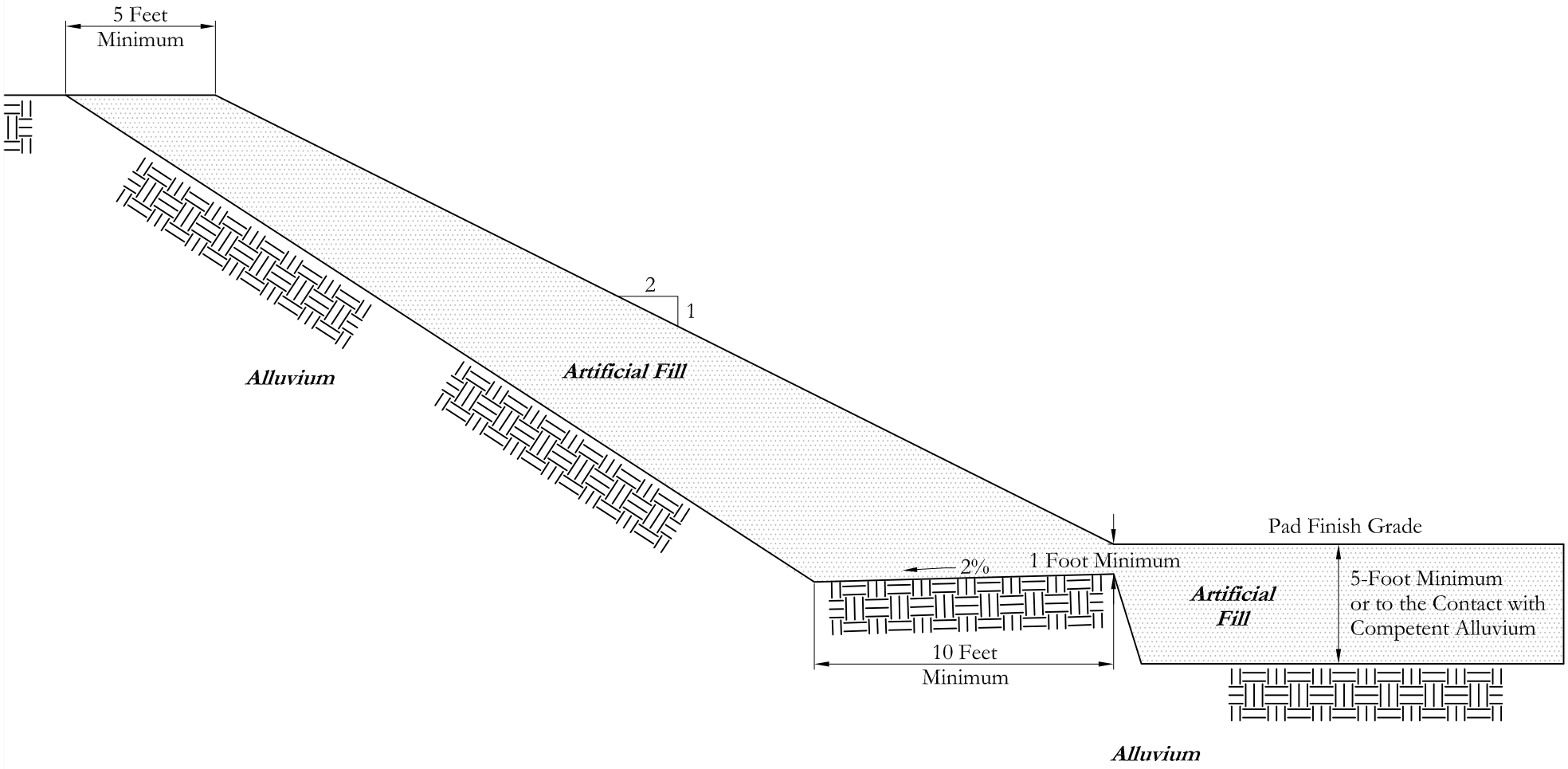
SCALE: 1" = 20'

GEOLOGIC CROSS SECTION A-A'

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2210728.02R
BY:	SD	PLATE NO.:	2

CHRISTIAN WHEELER ENGINEERING



NO SCALE

CUT SLOPE BUTTRESS DETAIL

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2210728.02R
BY:	DJF/SD	PLATE NO.:	3

CHRISTIAN WHEELER
ENGINEERING

Appendix A

Subsurface Explorations

CWE 2011 – Report No. 2110046.01
CWE 2015 – Report No. 2150046.01R
CWE 2022 – Report No. 2210728.02

LOG OF TEST TRENCH T-1

Date Excavated:	11/16/11	Equipment:	Case 580L Backhoe
Logged by:	DJF	Bucket Size:	18 inches
Existing Elevation:	132.0 feet	Drive Weight:	N/A
Proposed Elevation:	138.0 Feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal Modified California Sampler
CK Chunk Sample
SPT Standard Penetration Test
DR Density Ring
ST Shelby Tube

MD Maximum Density
SO4 Soluble Sulfates
SA Sieve Analysis
HA Hydrometer
SE Sand Equivalent
PI Plasticity Index
DS Direct Shear
Con Consolidation
EI Expansion Index
R-Val Resistance Value
Chl Soluble Chlorides
Res pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	132		SW-SM	**Artificial Fill (Qaf):** Light gray, moist, medium dense, fine- to coarse-grained, WELL GRADED SAND-SILTY SAND.							
2	130		CL	**Subsoil:** Dark reddish-brown, moist, stiff, SANDY CLAY, Mottled.		CK		15.0	112.2		
4	128		SC	**Older Alluvium(Qoal):** Light reddish-brown to brown, moist, medium dense, very fine- to medium-grained, SILTY CLAYEY SAND, mottled and micaceous.		CK		13.5	110.3		
6	126					CK		10.9	112.1		
8	124					CK					
10	122		SP-SM	Light brown, very moist, medium dense, fine- to coarse-grained, POORLY GRADED SAND-SILTY SAND, micaceous with gravels.							
12	120			Test Pit terminated at 12 feet. No water or seepage encountered.							
14	118										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY: MAH	DATE: December 2011
JOB NO.: 2110464.01	PLATE NO.: 2

LOG OF TEST TRENCH T-2

Sample Type and Laboratory Test Legend

Cal Modified California Sampler — CK Chunk Sample
SPT Standard Penetration Test — DR Density Ring
ST Shelby Tube

MD Maximum Density — DS Direct Shear
SO4 Soluble Sulfates — Con Consolidation
SA Sieve Analysis — EI Expansion Index
HA Hydrometer — R-Val Resistance Value
SE Sand Equivalent — Chl Soluble Chlorides
PI Plasticity Index — Res pH & Resistivity

Date Excavated: 11/16/11
Logged by: DJF
Existing Elevation: 133.0 feet
Proposed Elevation: 134.0 Feet
Equipment: Case 580L Backhoe
Bucket Size: 18 inches
Drive Weight: N/A
Depth to Water: N/A

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	133		SW-SM	**Artificial Fill (Qaf):** Light gray, damp, medium dense, fine- to coarse-grained, WELL GRADED SAND-SILTY SAND.							
			SC	Dark reddish-brown, very moist, loose to medium dense, very fine- to medium-grained, SILTY, CLAYEY SAND.		CK		21.9	107.0		SA R-Val
2	131		CL	**Subsoil:** Light brown to dark reddish-brown, moist, stiff, SANDY CLAY.		CK		16.7	102.5		
4	129		SC	**Older Alluvium(Qoal):** Dark reddish-brown, moist, loose to medium dense, very fine- to medium-grained, CLAYEY SAND, mottled and micaceous. Upper 1-foot highly porous. Becomes medium dense at 5 feet.		CK		14.1	105.8		
6	127										
8	125					CK					
10	123			Test Pit terminated at 10 feet. No water or seepage encountered.							
12	121										
14	119										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY: MAH
DATE: December 2011
JOB NO.: 2110464.01
PLATE NO.: 3

LOG OF TEST TRENCH T-3

Date Excavated:	11/16/11	Equipment:	Case 580L Backhoe
Logged by:	DJF	Bucket Size:	18 inches
Existing Elevation:	135.0 feet	Drive Weight:	N/A
Proposed Elevation:	135.5 Feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	135		SW-SM	**Artificial Fill (Qaf):** Light gray, moist, medium dense, fine- to coarse-grained, WELL GRADED SAND-SILTY SAND.							
			CL	Dark reddish-brown, moist, stiff, SANDY CLAY.							
2	133		CL	**Subsoil:** Dark reddish-brown, very moist, stiff, SILTY, SANDY CLAY.							
4	131										
			SC	**Older Alluvium(Qoal):** Light reddish-brown, moist, medium dense to dense, very fine- to medium-grained, SILTY, CLAYEY SAND, mottled and micaceous.		CK		14.1	108.9		
6	129										
8	127										
10	125			Test Pit terminated at 10 feet. No water or seepage encountered.							
12	123										
14	121										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY:	MAH	DATE:	December 2011
JOB NO.:	2110464.01	PLATE NO.:	4

LOG OF TEST TRENCH T-4

Date Excavated:	11/16/11	Equipment:	Case 580L Backhoe
Logged by:	DJF	Bucket Size:	18 inches
Existing Elevation:	138.0 feet	Drive Weight:	N/A
Proposed Elevation:	138.0 Feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Sample
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube		
MD	Maximum Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	SATURATION (%)	LABORATORY TESTS
0	138		SM	**Artificial Fill (Qaf):** Light brown, moist, medium dense, fine- to medium-grained, SILTY SAND.		CK		7.7	119.3		
2	136		CL	**Subsoil:** Dark brown, moist, hard, SANDY CLAY, mottled.		CK		15.7	113.9		
4	134		SC	**Older Alluvium(Qoal):** Dark reddish-brown, moist, dense to very dense, very fine- to medium-grained, SILTY, CLAYEY SAND, mottled.		CK		6.6	121.6		
6	132			Test Pit terminated at 7 feet. No water or seepage encountered.							
8	130										
10	128										
12	126										
14	124										

Symbol Legend

- Groundwater
- Apparent Seepage
- * No Sample Recovery
- ** Nonrepresentative Blow Count (rocks present)

CHRISTIAN WHEELER
Engineering

PROPOSED SINGH FARMS DRIVEWAY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

BY:	MAH	DATE:	December 2011
JOB NO.:	2110464.01	PLATE NO.:	5

LOG OF TRENCH T-1

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	125 feet	Drive Type:	N/A
Finish Elevation:	137 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	125	SM	**Younger Alluvium (Qyal):** Brown, moist, very loose, fine- to coarse-grained, SILTY SAND; upper 2' disturbed.							MD
2			SILTY SAND with CLAY.		CK		13.4	120.8		
4		SW	Light brown, moist, loose, fine- to coarse-grained, WELL-GRADED SAND; micaceous, friable.							
5	120									
10	115	SM	Olive-brown, very moist, loose, very fine- to fine-grained, VERY SILTY SAND; micaceous.							
11					CK		18.6	94.0		
14					CK		18.8	99.0		
15	110		Test trench terminated at 15 feet. No groundwater or seepage encountered.							

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	3

CHRISTIAN WHEELER ENGINEERING

LOG OF TRENCH T-2

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	125 feet	Drive Type:	N/A
Finish Elevation:	138 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	125		SM	**Younger Alluvium (Qyal):** Brown, moist, very loose, very fine- to medium-grained, SILTY SAND; upper 2' disturbed.							
1											
2				Very moist.							
3			SC	Light brown, moist, loose, very fine- to medium-grained, CLAYEY SAND.		CK					
4						CK					
5	120		SW	Light brown, moist, SANDY CLAY.							
6											
7											
8			SM	Light brown to olive-brown, very moist, loose, very fine- to medium-grained, VERY SILTY SAND.							SA
9						CK		21.2	97.0		
10	115										
11											
12						CK					
13											
14				Test trench terminated at 15 feet. No groundwater or seepage encountered.							
15	110										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	4

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-3

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	125 feet	Drive Type:	N/A
Finish Elevation:	140 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

CP Collapse Potential

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	125		SM	**Younger Alluvium (Qyal):** Brown, moist, loose, fine- to coarse-grained, SILTY SAND; upper 2' disturbed.							
1											
2				Very moist.							
3			CL	Grayish-brown to brown, very moist, loose, very fine- to medium-grained, SANDY CLAY; mottled.							
4						CK		20.5	103.9		
5	120		SM	Grayish-brown, moist to very moist, loose, very fine- to medium-grained, VERY SILTY SAND.							
6						CK		15.6	113.1		
7											
8			SM	**Older Alluvium (Qoal):** Reddish-brown to orangish-brown, moist to very moist, dense, very fine- to medium-grained, SILTY SAND; micaceous.							
9						CK		18.8	100.2		CP
10	115			Light brown.							
11						CK		15.4	99.9		
12						CK		24.5	94.3		
13				Test trench terminated at 13 feet. No groundwater or seepage encountered.							
14											
15	110										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	5

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-4

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	128 feet	Drive Type:	N/A
Finish Elevation:	140 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	128		SM	**Younger Alluvium (Qyal):** Brown, moist, loose, fine- to coarse-grained, SILTY SAND; upper 2' disturbed.							
3	123		SC/CL	Grayish-brown to reddish-brown, moist, loose to medium dense/ medium stiff, CLAYEY SAND/SANDY CLAY.							
6			SM	Light brown to grayish-brown, very moist, loose to medium dense, very fine- to medium-grained, VERY SILTY SAND.							
13				Test trench terminated at 13 feet. No groundwater or seepage encountered.							
15	113										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	6

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-5

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	133 feet	Drive Type:	N/A
Finish Elevation:	139 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	133		SM	**Undocumented Artificial Fill (Quaf):** Light gray, damp, loose to medium dense, fine- to coarse-grained, SILTY SAND.							
1			SC	Brown, moist, loose to medium dense, fine- to coarse-grained, CLAYEY SAND.							
2											
3											
4			SM	**Younger Alluvium (Qyal):** Brown, moist, loose, fine- to coarse-grained, SILTY SAND.							
5	128										
6			SM	**Older Alluvium (Qoal):** Brown to reddish-brown, moist, medium dense to dense, very fine- to medium-grained, SILTY SAND.							
7						CK		16.4	110.9		CP
8											
9											
10	123			Test trench terminated at 10 feet. No groundwater or seepage encountered.							
11											
12											
13											
14											
15	118										

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	7

CHRISTIAN WHEELER
ENGINEERING

LOG OF TRENCH T-6

Date Drilled:	1/28/15	Equipment:	Case 580L Backhoe
Logged By:	TSW	Bucket Type:	18 inches
Existing Elevation:	137 feet	Drive Type:	N/A
Finish Elevation:	143 feet	Depth to Water:	N/A

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk Density
SPT	Standard Penetration Test	DR	Density Ring
ST	Shelby Tube	NG	Nuclear Gauge Test
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Cbl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential		

DEPTH (ft)	ELEVATION (ft)	GRAPHIC LOG	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	137		SM	**Undocumented Artificial Fill (Quaf):** Light gray, damp, loose to medium dense, fine- to coarse-grained, SILTY SAND.							
1			SC/CL	**Older Alluvium (Qoal):** Reddish-brown to dark brown, moist, medium dense/ stiff, very fine- to coarse-grained, CLAYEY SAND/ SANDY CLAY; mottled, moderately weathered to 3'.							
2						CK		16.9	112.5		
3				Dense/ very stiff.							
4						CK		14.6	113.0		
5	132		SM	Light brown, moist, very dense, fine- to coarse-grained, SILTY SAND; micaceous.							
6											
7						CK		15.6	108.3		CP
8											
9											
10	127			Test trench terminated at 10 feet. No groundwater or seepage encountered.							
11											
12											
13											
14											
15	122										

Notes:

Symbol Legend

- Groundwater Level During Drilling
- Groundwater Level After Drilling
- Apparent Seepage
- * No Sample Recovery
- ** Erroneous Blow Count (rocks present)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL	PLATE NO.:	8

CHRISTIAN WHEELER
ENGINEERING

LOG OF TEST BORING B-1

Date Logged:	1/24/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	126'	Drive Type:	140lbs/30 inches
Proposed Elevation:	±128'	Depth to Water:	Seepage at 19'

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	SM	**Alluvium (Qal):** Dark brown, moist, very loose, fine- to medium-grained, SILTY SAND.							SO4
		Reddish-brown, loose, SILTY SAND with clay.							
5	SM/ SW	Light brown, moist, dense, fine- to coarse-grained, SILTY SAND/well-graded SAND, micaceous.	47	Cal		7.3	115.2		
	SM	Reddish-brown, moist, dense, fine- to coarse-grained, SILTY SAND.	49	Cal		8.3	125.5		
		Olive green, very dense.							
10			50/5"	Cal		16.0	93.1		
		Micaceous.							
15			50/5½"	Cal					
		Seepage at 19'.	50/6"**	Cal					
20		Terminated at 19.5 feet. Seepage encountered at 19 feet.							
25									
30									

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁘ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2210728.02R
BY:	SD	APPENDIX:	A-1

CHRISTIAN WHEELER ENGINEERING

LOG OF TEST BORING B-2

Date Logged:	1/24/22	Equipment:	IR A-300
Logged By:	AJC	Auger Type:	8 inch Hollow Stem
Existing Elevation:	127'	Drive Type:	140lbs/30 inches
Proposed Elevation:	129'	Depth to Water:	Unknown

Sample Type and Laboratory Test Legend

Cal	Modified California Sampler	CK	Chunk
SPT	Standard Penetration Test	DR	Drive Ring
ST	Shelby Tube		
MD	Max Density	DS	Direct Shear
SO4	Soluble Sulfates	Con	Consolidation
SA	Sieve Analysis	EI	Expansion Index
HA	Hydrometer	R-Val	Resistance Value
SE	Sand Equivalent	Chl	Soluble Chlorides
PI	Plasticity Index	Res	pH & Resistivity
CP	Collapse Potential	SD	Sample Density

DEPTH (ft)	USCS SYMBOL	SUMMARY OF SUBSURFACE CONDITIONS (based on Unified Soil Classification System)	PENETRATION (blows per foot)	SAMPLE TYPE	BULK	MOISTURE CONTENT (%)	DRY DENSITY (pcf)	RELATIVE COMPACTION (%)	LABORATORY TESTS
0	SM	**Alluvium (Qal):** Dark brown, moist, very loose, fine- to coarse-grained, SILTY SAND.							
	SM/ SC	Dark brown, moist, dense, SILTY SAND to CLAYEY SAND.	40	Cal		7.2	125.9		
5	SM	Reddish-brown, moist, very dense, fine- to medium-grained, SILTY SAND, micaceous.	59	Cal		8.0	128.4		
10		Olive brown to reddish brown.	50/5"	Cal		15.0	113.5		
		Light gray to olive brown.							
15			50/6"	Cal					
			50/6"	Cal					
20		Terminated at 19.5 feet. No seepage or groundwater encountered.							
25									
30									

Notes:

Symbol Legend

- ▽ Groundwater Level During Drilling
- ▼ Groundwater Level After Drilling
- ⁹⁹ Apparent Seepage
- * No Sample Recovery
- ** Non-Representative Blow Count (rocks present)

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	JULY 2022	JOB NO.:	2210728.02R
BY:	SD	APPENDIX:	A-2

CHRISTIAN WHEELER ENGINEERING

Appendix B

Laboratory Test Results

Laboratory tests were performed in accordance with the generally accepted American Society for Testing and Materials (ASTM) test methods or suggested procedures. Brief descriptions of the tests performed are presented below:

a) **CLASSIFICATION:** Field classifications were verified in the laboratory by visual examination. The final soil classifications are in accordance with the Unified Soil Classification System and are presented on the exploration logs in Appendix A.

b) **MOISTURE-DENSITY: MOISTURE-DENSITY:** In-place moisture contents and dry densities were determined for selected soil samples in accordance with ATM D 2937. The results are summarized in the boring logs presented in Appendix A.

c) **SOLUBLE SULFATES:** The soluble sulfate content of a selected soil sample was determined in accordance with California Test Method 417.

LABORATORY TEST RESULTS

FARM WORKERS HOUSING

5780 MISSION AVENUE

OCEANSIDE, CALIFORNIA

SOLUBLE SULFATES (CALIFORNIA TEST 417)

Sample Location	**Boring B-1 @ 0- 4'**
Soluble Sulfate	0.084 % (SO_4)

Appendix C

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Appendix D

Recommended Grading Specifications – General Provisions

RECOMMENDED GRADING SPECIFICATIONS - GENERAL PROVISIONS

FARM WORKERS HOUSING
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

GENERAL INTENT

The intent of these specifications is to establish procedures for clearing, compacting natural ground, preparing areas to be filled, and placing and compacting fill soils to the lines and grades shown on the accepted plans. The recommendations contained in the preliminary geotechnical investigation report and/or the attached Special Provisions are a part of the Recommended Grading Specifications and shall supersede the provisions contained hereinafter in the case of conflict. These specifications shall only be used in conjunction with the geotechnical report for which they are a part. No deviation from these specifications will be allowed, except where specified in the geotechnical report or in other written communication signed by the Geotechnical Engineer.

OBSERVATION AND TESTING

Christian Wheeler Engineering shall be retained as the Geotechnical Engineer to observe and test the earthwork in accordance with these specifications. It will be necessary that the Geotechnical Engineer or his representative provide adequate observation so that he may provide his opinion as to whether or not the work was accomplished as specified. It shall be the responsibility of the contractor to assist the Geotechnical Engineer and to keep him apprised of work schedules, changes and new information and data so that he may provide these opinions. In the event that any unusual conditions not covered by the special provisions or preliminary geotechnical report are encountered during the grading operations, the Geotechnical Engineer shall be contacted for further recommendations.

If, in the opinion of the Geotechnical Engineer, substandard conditions are encountered, such as questionable or unsuitable soil, unacceptable moisture content, inadequate compaction, adverse weather, etc., construction should be stopped until the conditions are remedied or corrected or he shall recommend rejection of this work.

Tests used to determine the degree of compaction should be performed in accordance with the following American Society for Testing and Materials test methods:

Maximum Density & Optimum Moisture Content - ASTM D1557
Density of Soil In-Place - ASTM D1556 or ASTM D6938

All densities shall be expressed in terms of Relative Compaction as determined by the foregoing ASTM testing procedures.

PREPARATION OF AREAS TO RECEIVE FILL

All vegetation, brush and debris derived from clearing operations shall be removed, and legally disposed of. All areas disturbed by site grading should be left in a neat and finished appearance, free from unsightly debris.

After clearing or benching the natural ground, the areas to be filled shall be scarified to a depth of 6 inches, brought to the proper moisture content, compacted and tested for the specified minimum degree of compaction. All loose soils in excess of 6 inches thick should be removed to firm natural ground which is defined as natural soil which possesses an in-situ density of at least 90 percent of its maximum dry density.

When the slope of the natural ground receiving fill exceeds 20 percent (5 horizontal units to 1 vertical unit), the original ground shall be stepped or benched. Benches shall be cut to a firm competent formational soil. The lower bench shall be at least 10 feet wide or 1-1/2 times the equipment width, whichever is greater, and shall be sloped back into the hillside at a gradient of not less than two (2) percent. All other benches should be at least 6 feet wide. The horizontal portion of each bench shall be compacted prior to receiving fill as specified herein for compacted natural ground. Ground slopes flatter than 20 percent shall be benched when considered necessary by the Geotechnical Engineer.

Any abandoned buried structures encountered during grading operations must be totally removed. All underground utilities to be abandoned beneath any proposed structure should be removed from within 10 feet of the structure and properly capped off. The resulting depressions from the above described procedure should be backfilled with acceptable soil that is compacted to the requirements of the Geotechnical Engineer. This includes, but is not limited to, septic tanks, fuel tanks, sewer lines or leach lines, storm drains and water lines. Any buried structures or utilities not to be abandoned should be brought to the attention of the Geotechnical Engineer so that he may determine if any special recommendation will be necessary.

All water wells which will be abandoned should be backfilled and capped in accordance to the requirements set forth by the Geotechnical Engineer. The top of the cap should be at least 4 feet below finish grade or 3

feet below the bottom of footing whichever is greater. The type of cap will depend on the diameter of the well and should be determined by the Geotechnical Engineer and/or a qualified Structural Engineer.

FILL MATERIAL

Materials to be placed in the fill shall be approved by the Geotechnical Engineer and shall be free of vegetable matter and other deleterious substances. Granular soil shall contain sufficient fine material to fill the voids. The definition and disposition of oversized rocks and expansive or detrimental soils are covered in the geotechnical report or Special Provisions. Expansive soils, soils of poor gradation, or soils with low strength characteristics may be thoroughly mixed with other soils to provide satisfactory fill material, but only with the explicit consent of the Geotechnical Engineer. Any import material shall be approved by the Geotechnical Engineer before being brought to the site.

PLACING AND COMPACTION OF FILL

Approved fill material shall be placed in areas prepared to receive fill in layers not to exceed 6 inches in compacted thickness. Each layer shall have a uniform moisture content in the range that will allow the compaction effort to be efficiently applied to achieve the specified degree of compaction. Each layer shall be uniformly compacted to the specified minimum degree of compaction with equipment of adequate size to economically compact the layer. Compaction equipment should either be specifically designed for soil compaction or of proven reliability. The minimum degree of compaction to be achieved is specified in either the Special Provisions or the recommendations contained in the preliminary geotechnical investigation report. When the structural fill material includes rocks, no rocks will be allowed to nest and all voids must be carefully filled with soil such that the minimum degree of compaction recommended in the Special Provisions is achieved. The maximum size and spacing of rock permitted in structural fills and in non-structural fills is discussed in the geotechnical report, when applicable.

Field observation and compaction tests to estimate the degree of compaction of the fill will be taken by the Geotechnical Engineer or his representative. The location and frequency of the tests shall be at the Geotechnical Engineer's discretion. When the compaction test indicates that a particular layer is at less than the required degree of compaction, the layer shall be reworked to the satisfaction of the Geotechnical Engineer and until the desired relative compaction has been obtained.

Fill slopes shall be compacted by means of sheepsfoot rollers or other suitable equipment. Compaction by sheepsfoot roller shall be at vertical intervals of not greater than four feet. In addition, fill slopes at a ratio of

two horizontal to one vertical or flatter, should be trackrolled. Steeper fill slopes shall be over-built and cut-back to finish contours after the slope has been constructed. Slope compaction operations shall result in all fill material six or more inches inward from the finished face of the slope having a relative compaction of at least 90 percent of maximum dry density or the degree of compaction specified in the Special Provisions section of this specification. The compaction operation on the slopes shall be continued until the Geotechnical Engineer is of the opinion that the slopes will be surficially stable.

Density tests in the slopes will be made by the Geotechnical Engineer during construction of the slopes to determine if the required compaction is being achieved. Where failing tests occur or other field problems arise, the Contractor will be notified that day of such conditions by written communication from the Geotechnical Engineer or his representative in the form of a daily field report.

If the method of achieving the required slope compaction selected by the Contractor fails to produce the necessary results, the Contractor shall rework or rebuild such slopes until the required degree of compaction is obtained, at no cost to the Owner or Geotechnical Engineer.

CUT SLOPES

The Engineering Geologist shall inspect cut slopes excavated in rock or lithified formational material during the grading operations at intervals determined at his discretion. If any conditions not anticipated in the preliminary report such as perched water, seepage, lenticular or confined strata of a potentially adverse nature, unfavorably inclined bedding, joints or fault planes are encountered during grading, these conditions shall be analyzed by the Engineering Geologist and Geotechnical Engineer to determine if mitigating measures are necessary.

Unless otherwise specified in the geotechnical report, no cut slopes shall be excavated higher or steeper than that allowed by the ordinances of the controlling governmental agency.

ENGINEERING OBSERVATION

Field observation by the Geotechnical Engineer or his representative shall be made during the filling and compaction operations so that he can express his opinion regarding the conformance of the grading with acceptable standards of practice. Neither the presence of the Geotechnical Engineer or his representative or the observation and testing shall release the Grading Contractor from his duty to compact all fill material to the specified degree of compaction.

SEASON LIMITS

Fill shall not be placed during unfavorable weather conditions. When work is interrupted by heavy rain, filling operations shall not be resumed until the proper moisture content and density of the fill materials can be achieved. Damaged site conditions resulting from weather or acts of God shall be repaired before acceptance of work.

RECOMMENDED GRADING SPECIFICATIONS - SPECIAL PROVISIONS

RELATIVE COMPACTION: The minimum degree of compaction to be obtained in compacted natural ground, compacted fill, and compacted backfill shall be at least 90 percent. For street and parking lot subgrade, the upper twelve inches should be compacted to at least 95 percent relative compaction.

EXPANSIVE SOILS: Detrimentally expansive soil is defined as clayey soil which has an expansion index of 50 or greater when tested in accordance with the American Society of Testing Materials (ASTM) Laboratory Test D 4829.

OVERSIZED MATERIAL: Oversized fill material is generally defined herein as rocks or lumps of soil over six inches in diameter. Oversized materials should not be placed in fill unless recommendations of placement of such material is provided by the Geotechnical Engineer. At least 40 percent of the fill soils shall pass through a No. 4 U.S. Standard Sieve.

TRANSITION LOTS: Where transitions between cut and fill occur within the proposed building pad, the cut portion should be undercut a minimum of one foot below the base of the proposed footings and recompacted as structural backfill. In certain cases that would be addressed in the geotechnical report, special footing reinforcement or a combination of special footing reinforcement and undercutting may be required.

Appendix E

Liquefaction Analysis

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San Diego, California 92105

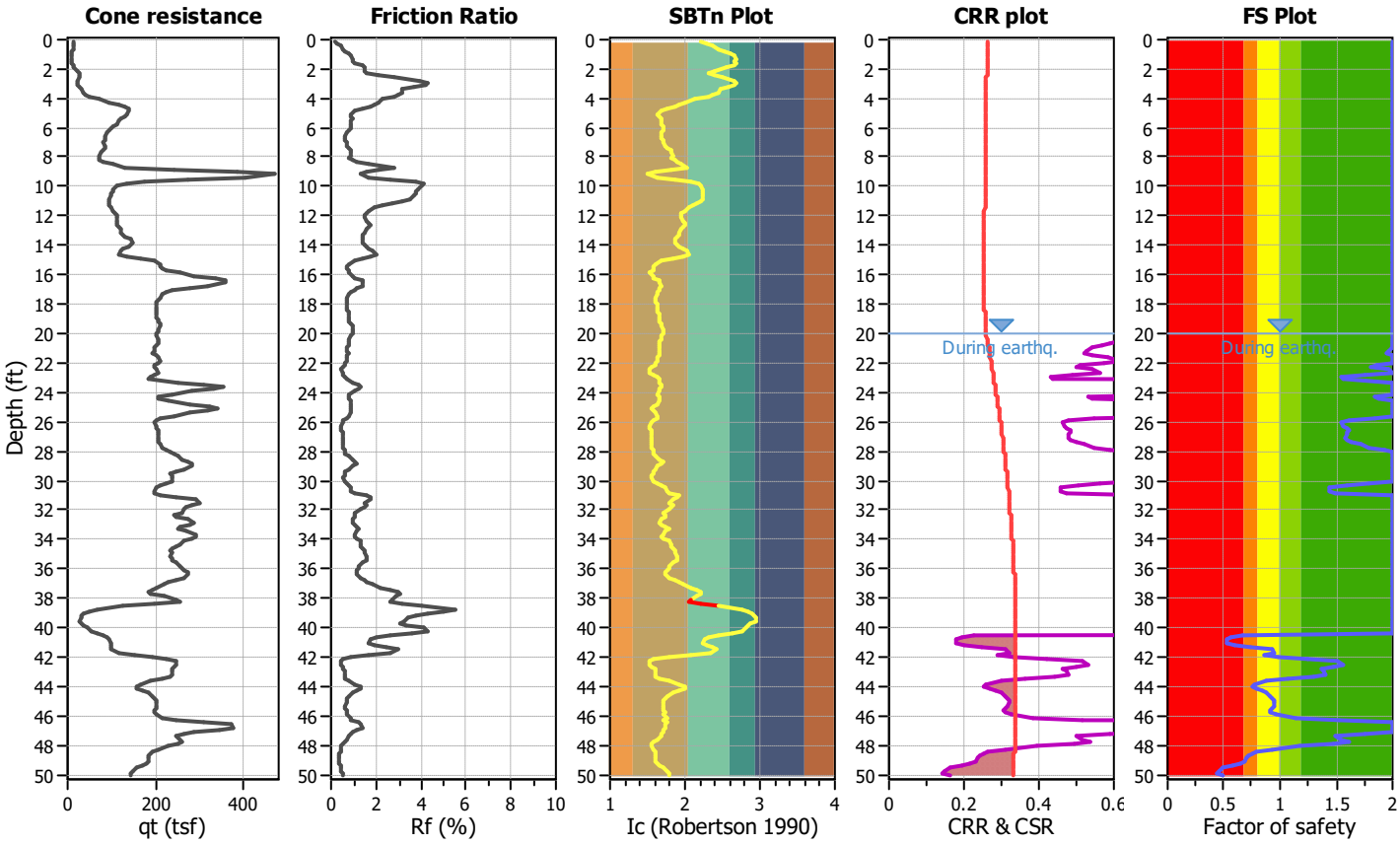
LIQUEFACTION ANALYSIS REPORT

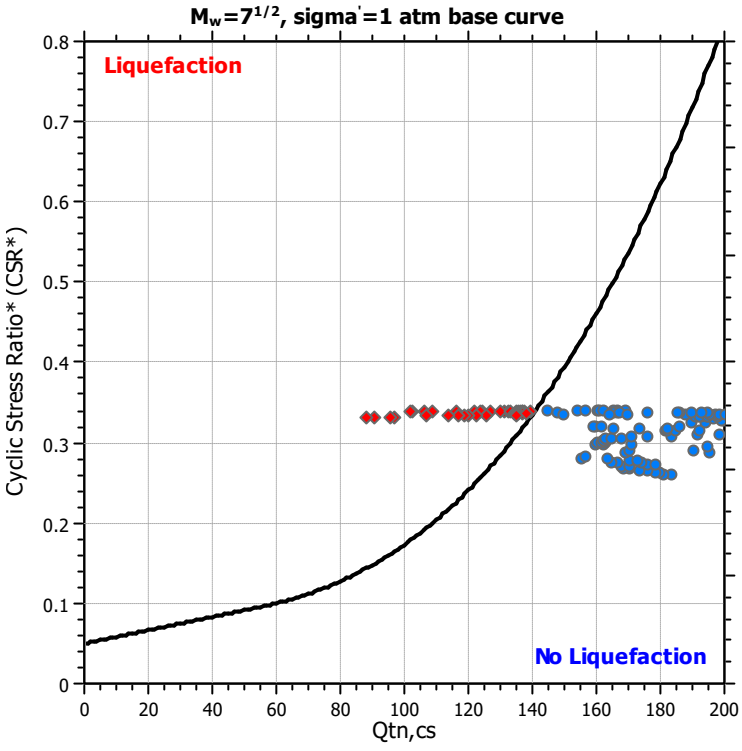
Project title : Singh Property **Location : 5720 Mission Avenue, Oceanside, California**

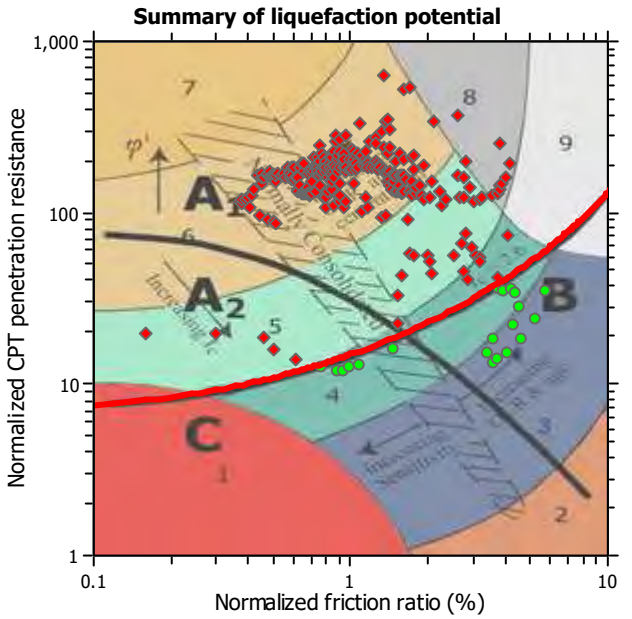
CPT file : CPT-01

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

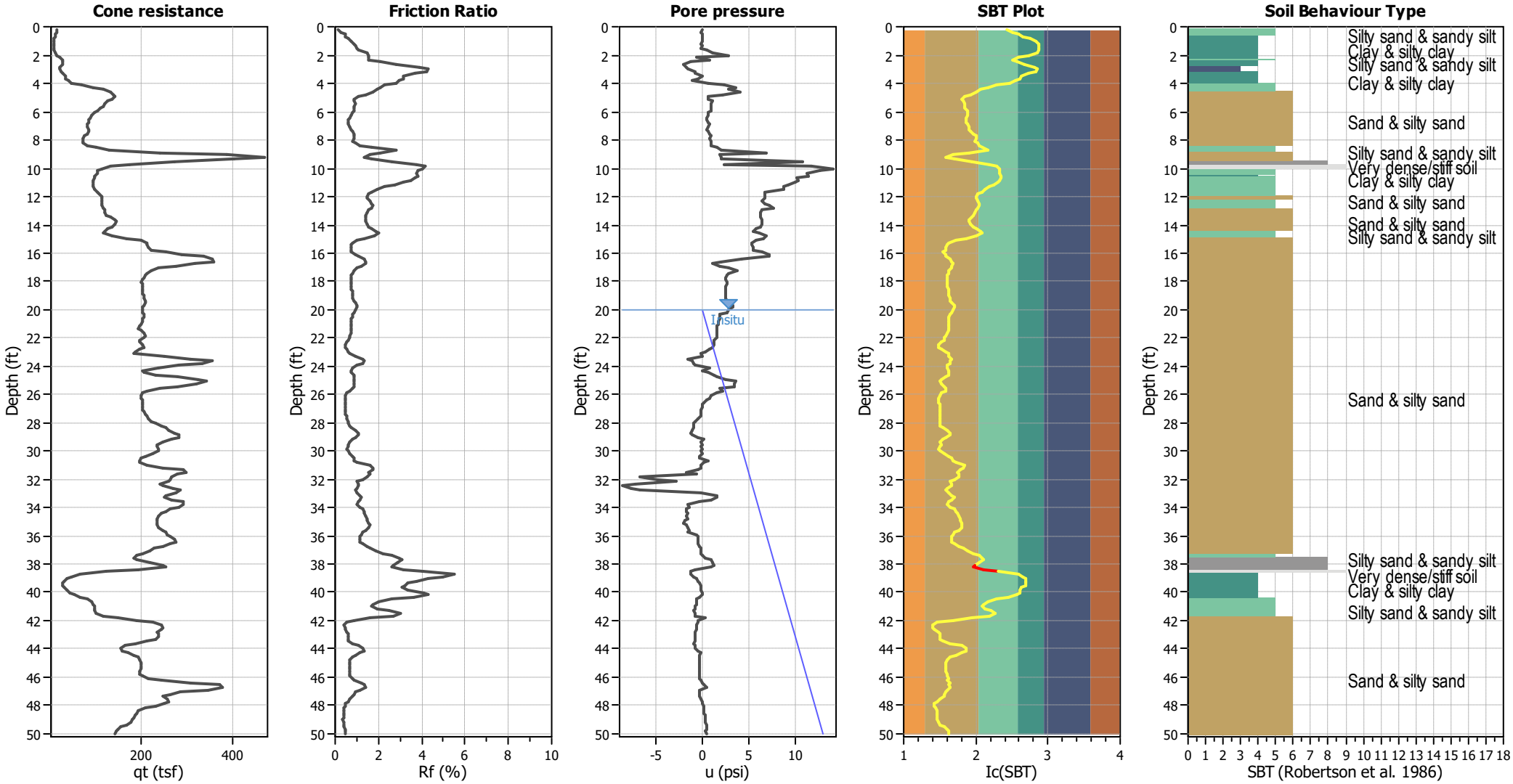






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



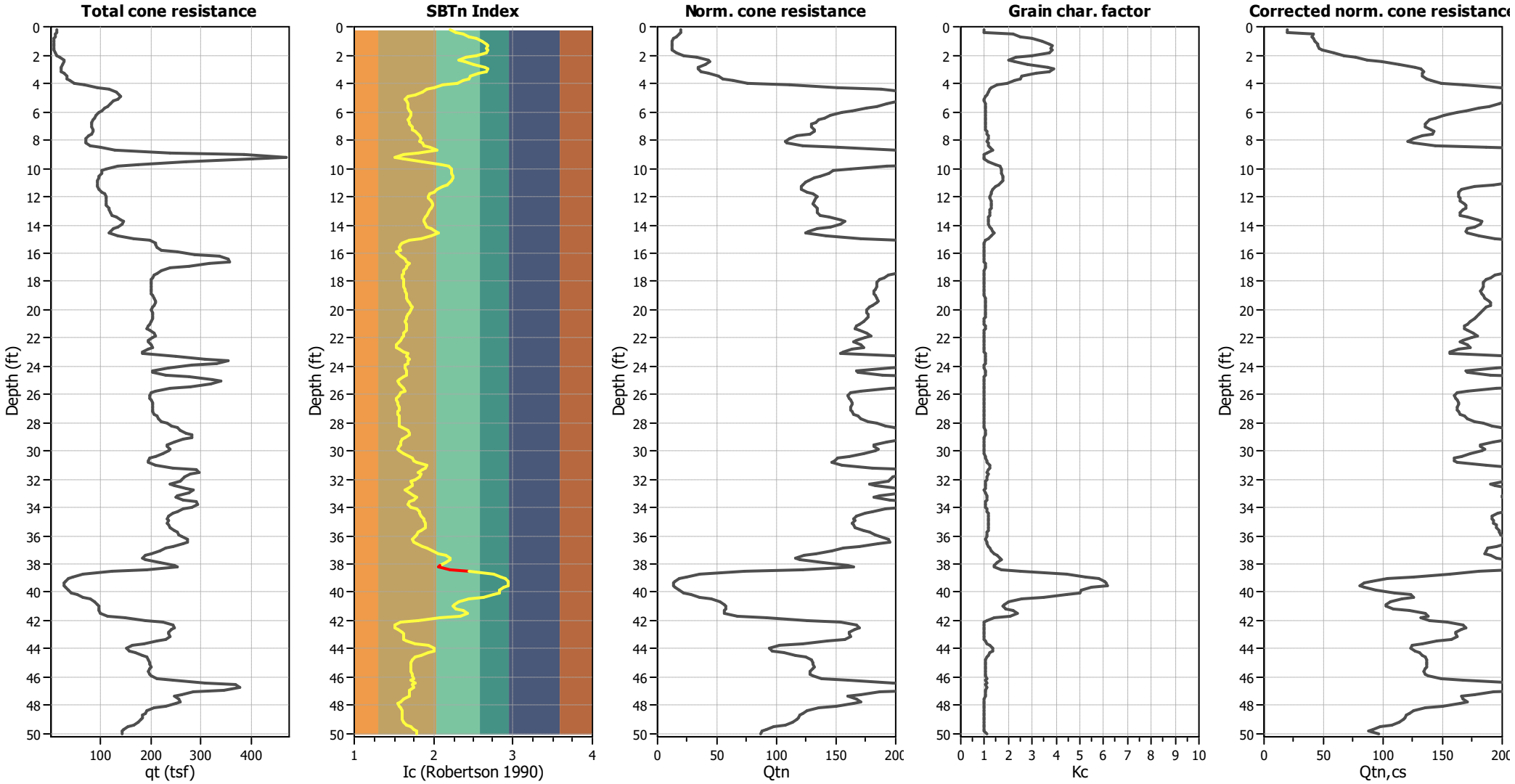
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

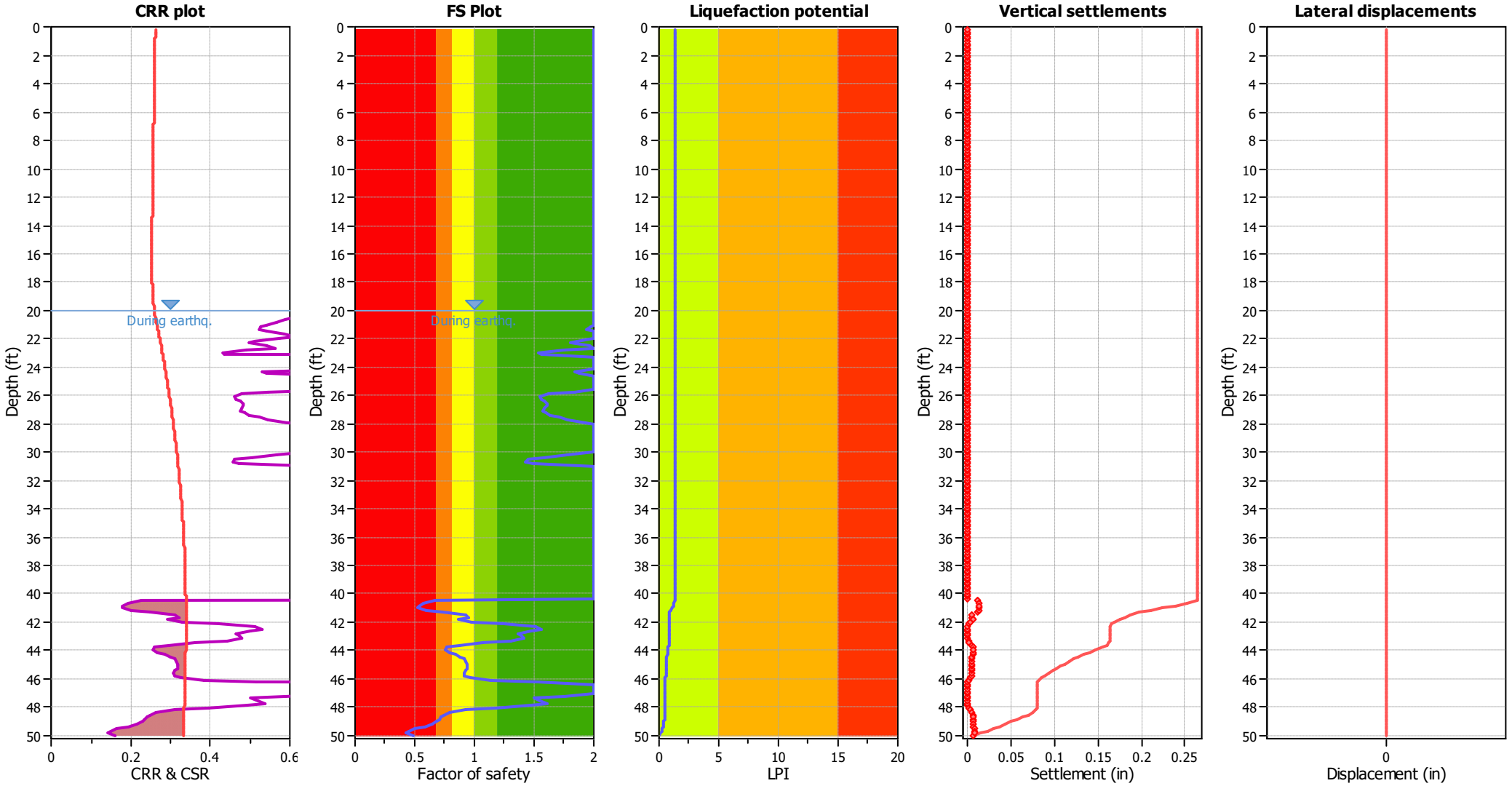
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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San Diego, California 92105

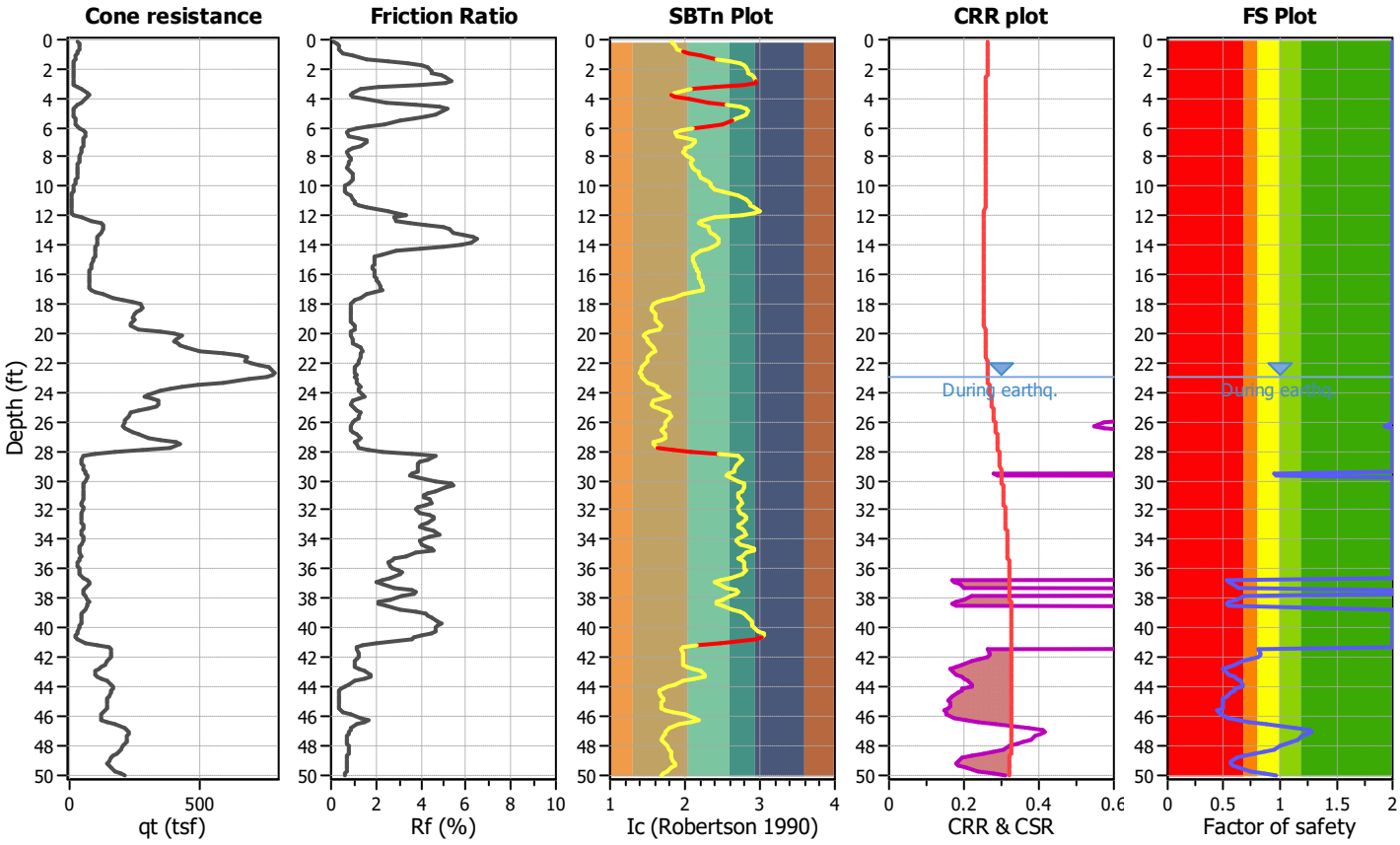
LIQUEFACTION ANALYSIS REPORT

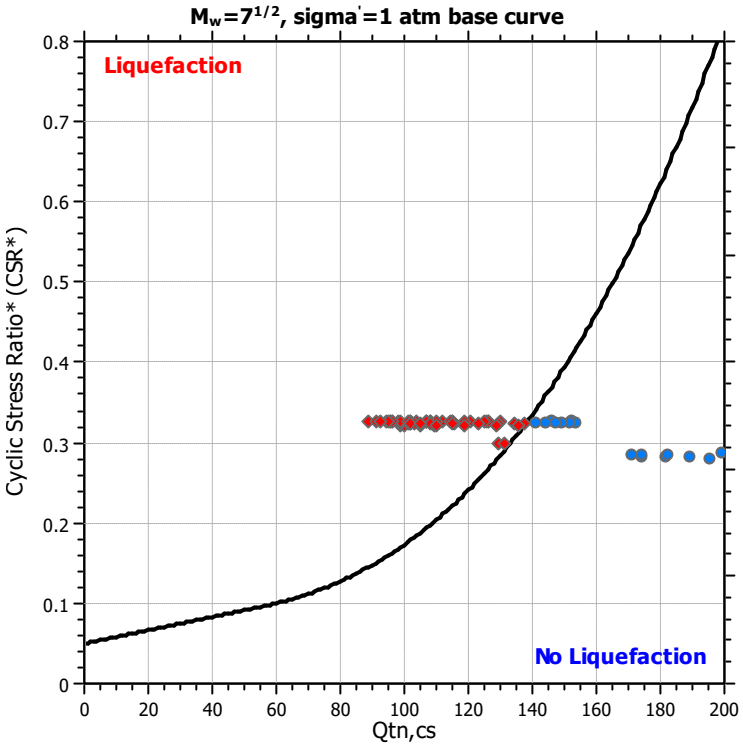
Project title : Singh Property **Location : 5720 Mission Avenue, Oceanside, California**

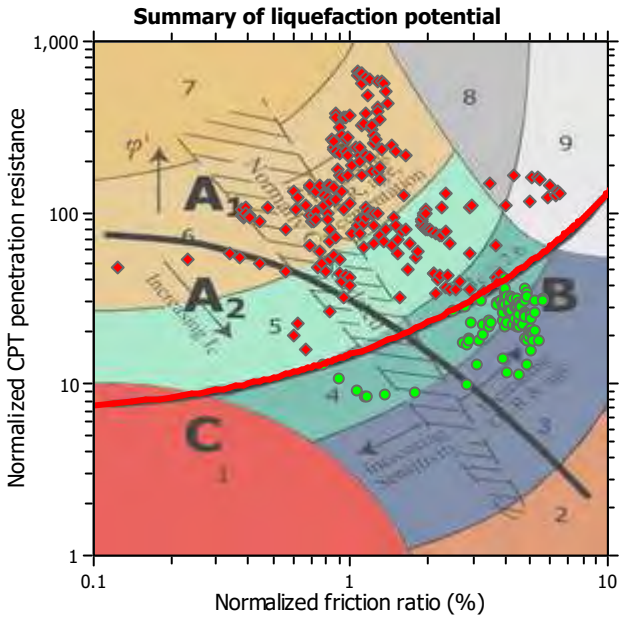
CPT file : CPT-02

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	23.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	23.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

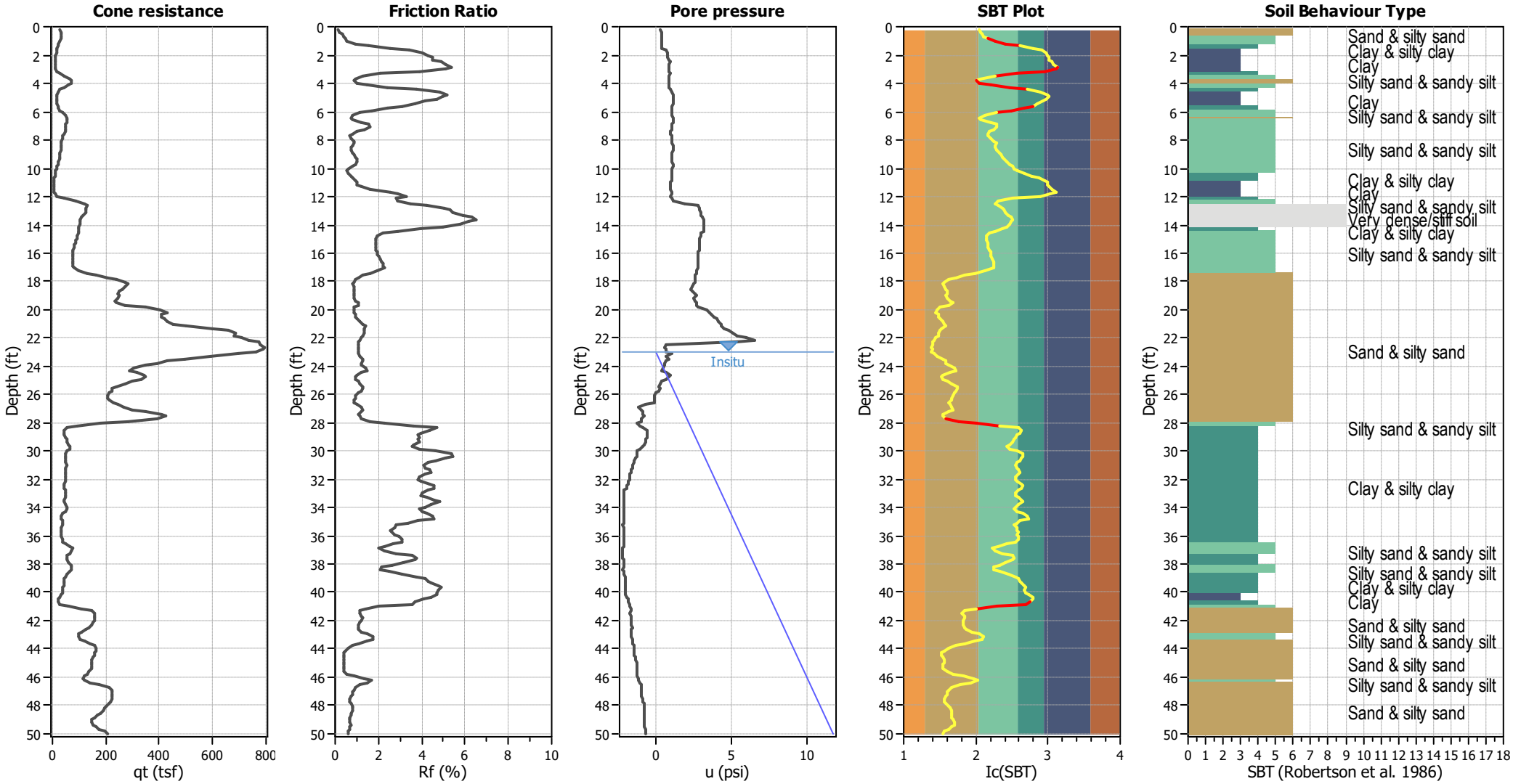






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



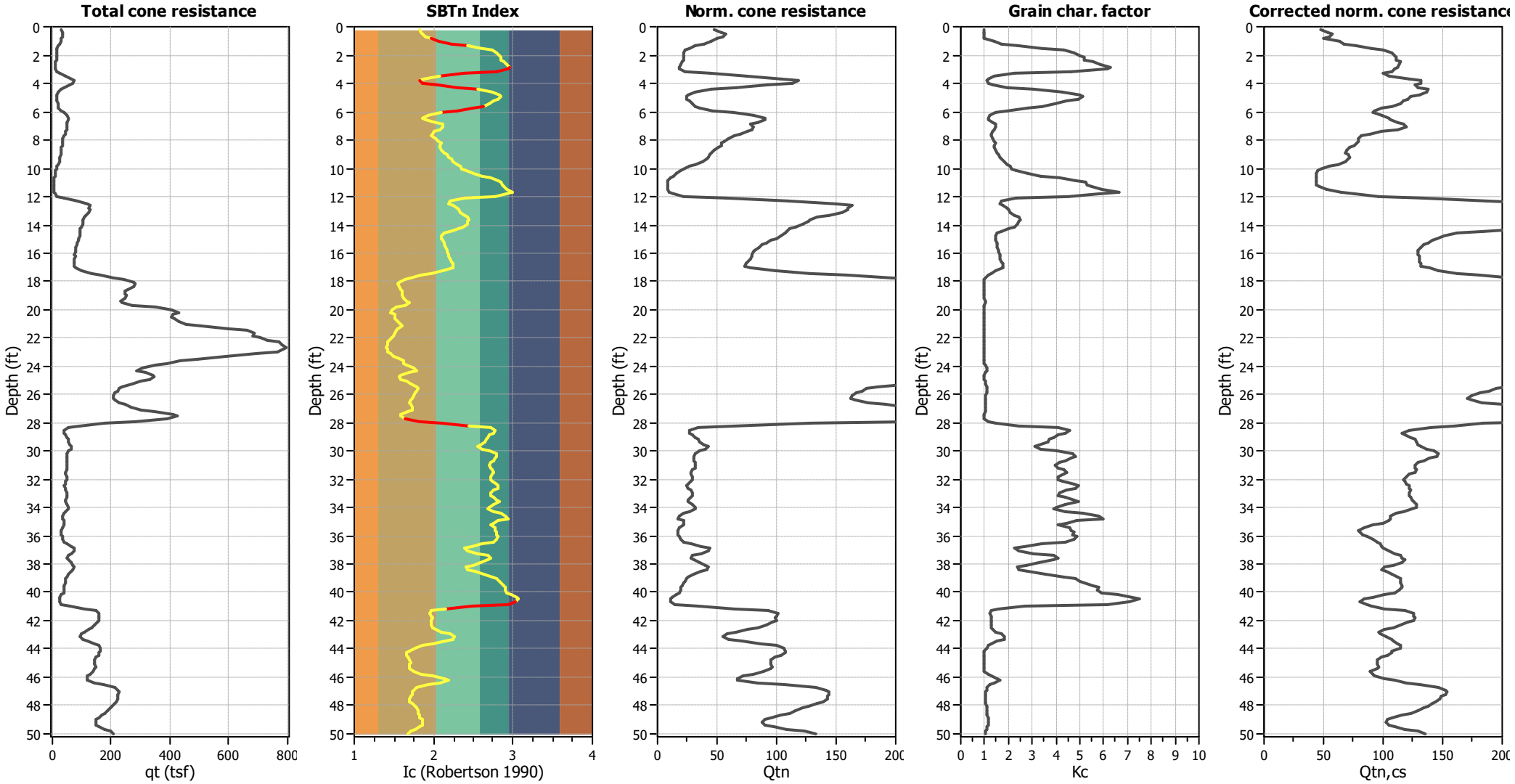
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	23.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	23.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

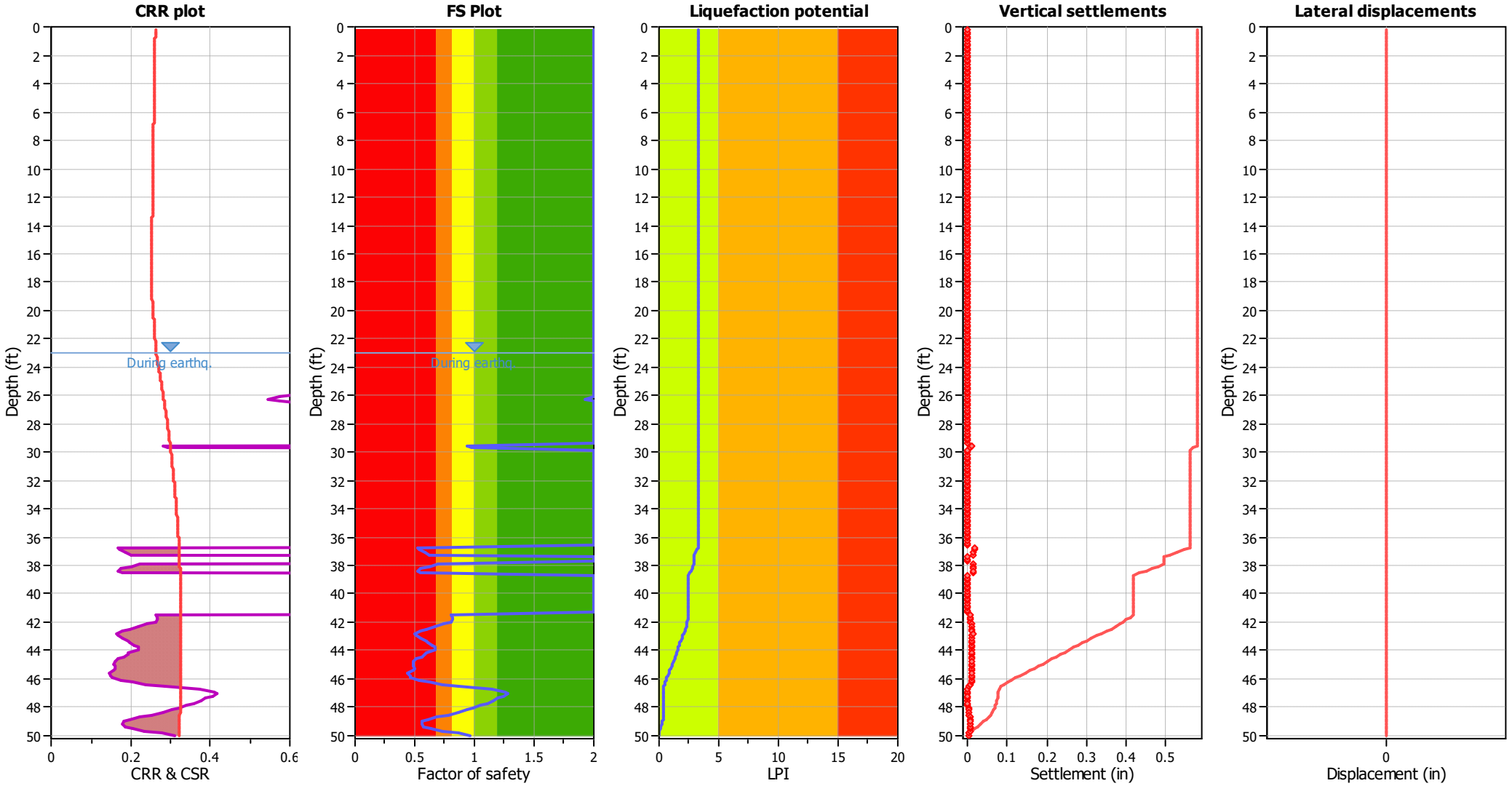
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	23.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	23.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	23.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	23.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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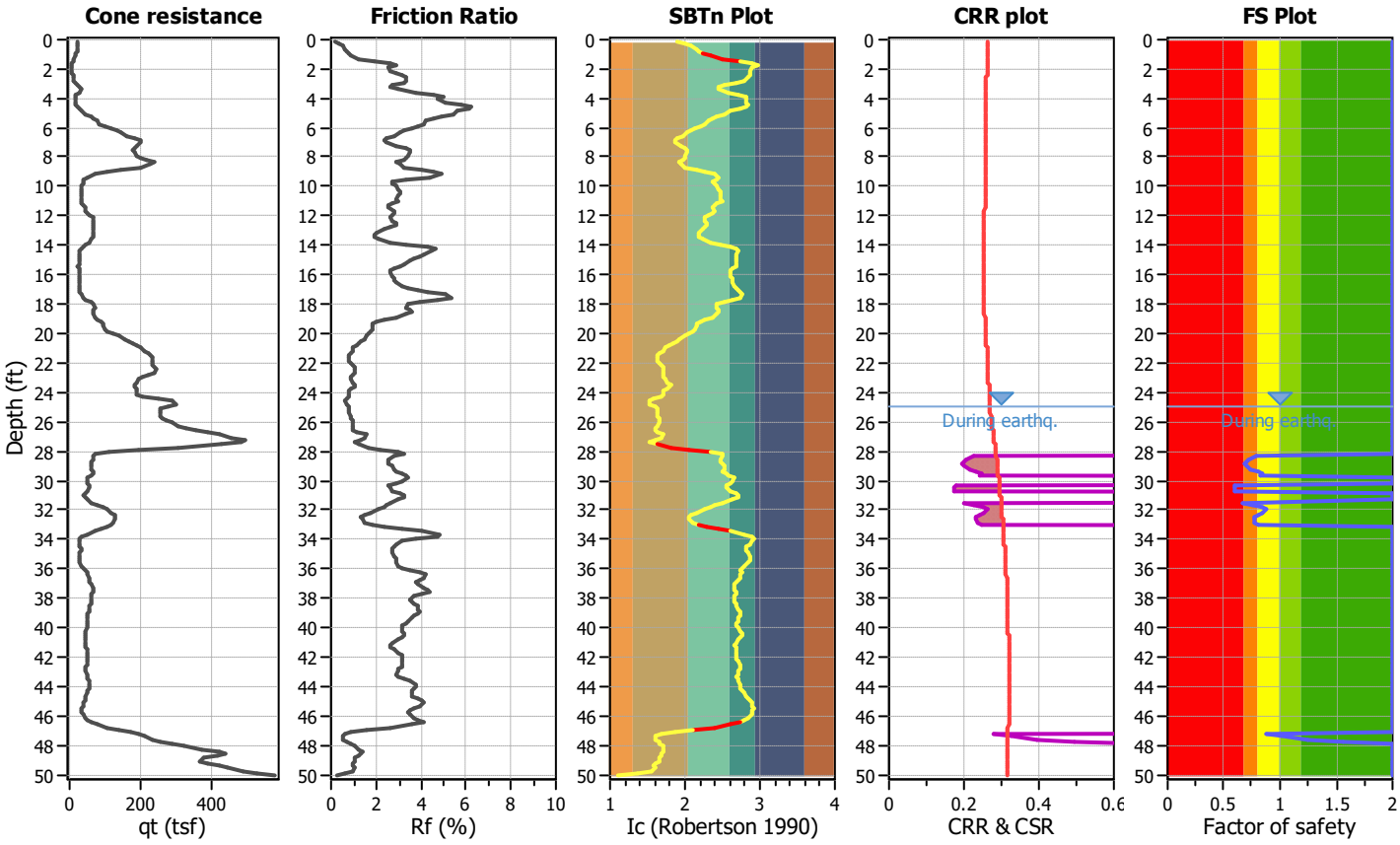
LIQUEFACTION ANALYSIS REPORT

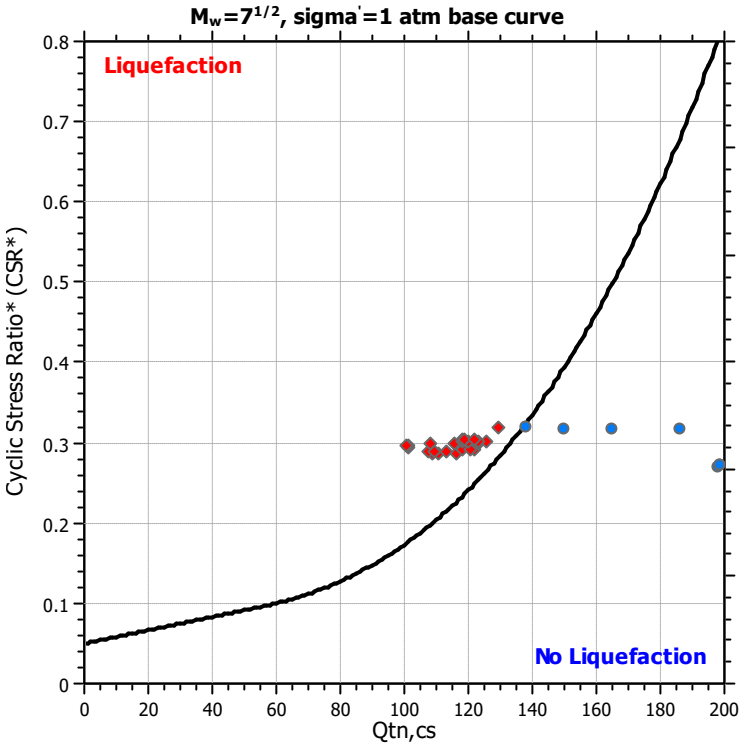
Project title : Singh Property **Location : 5720 Mission Avenue, Oceanside, California**

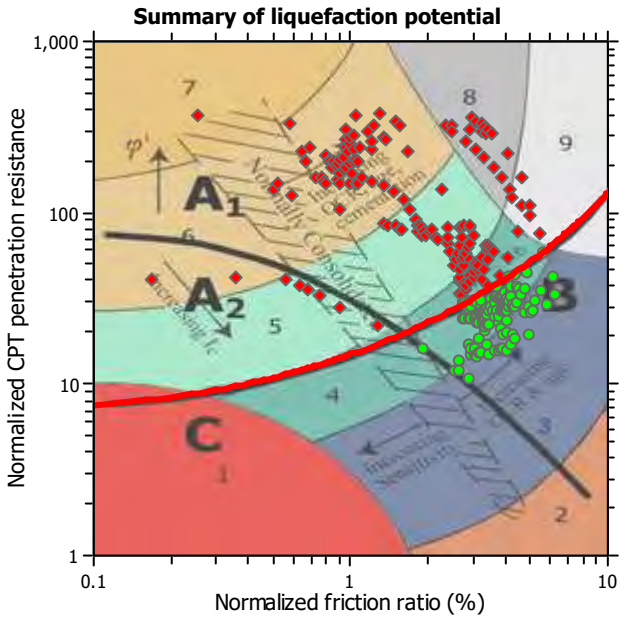
CPT file : CPT-03

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	25.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	25.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

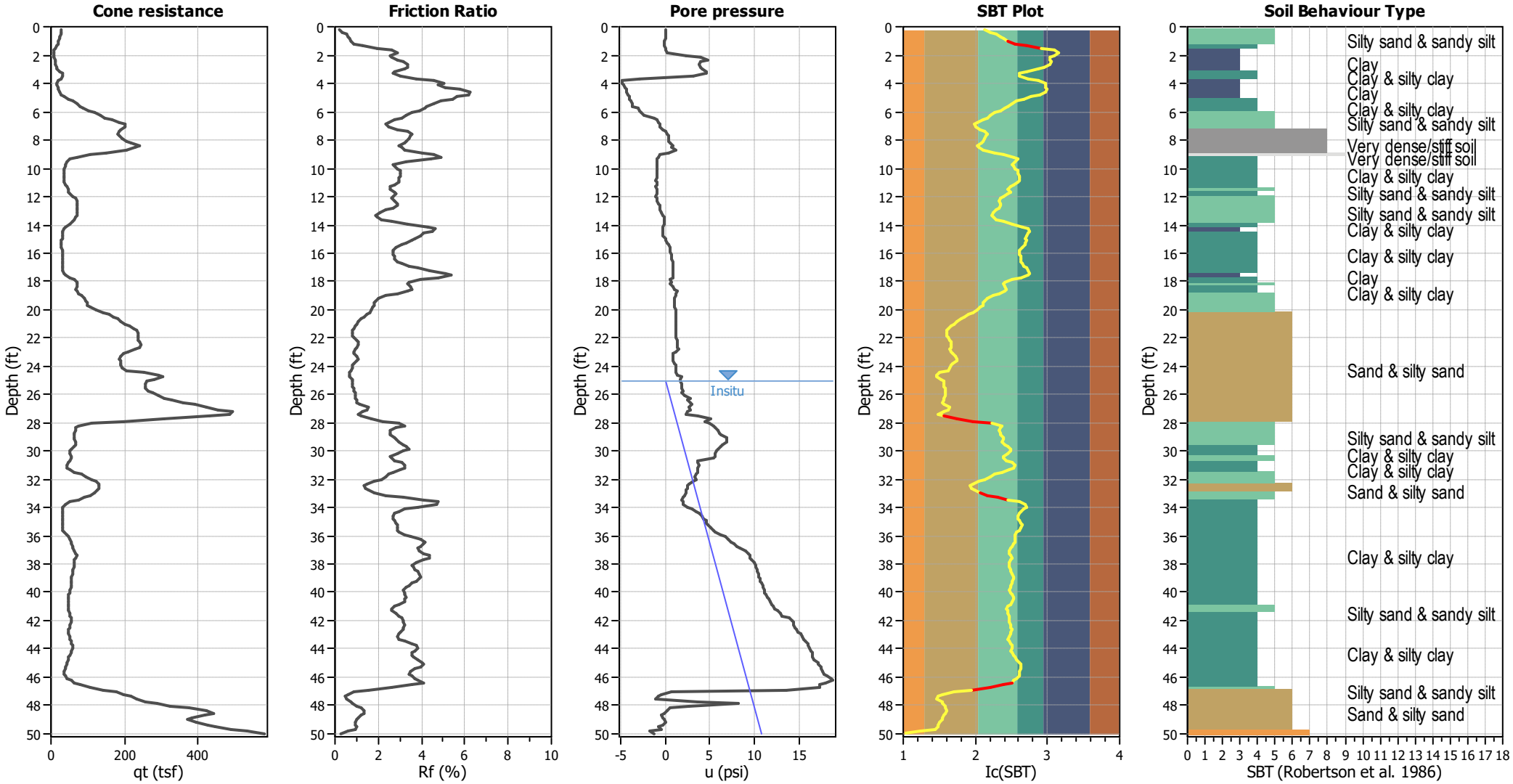






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



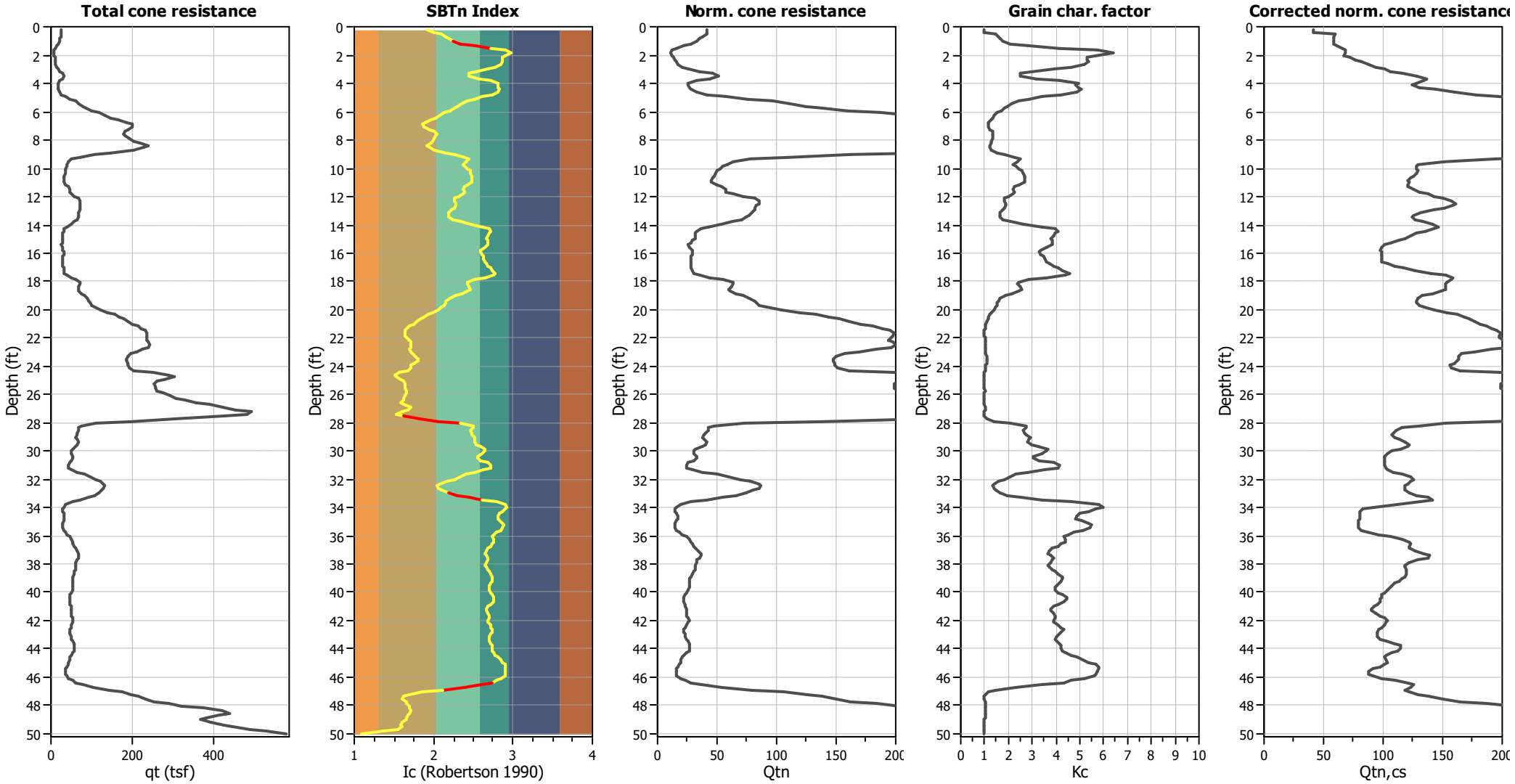
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

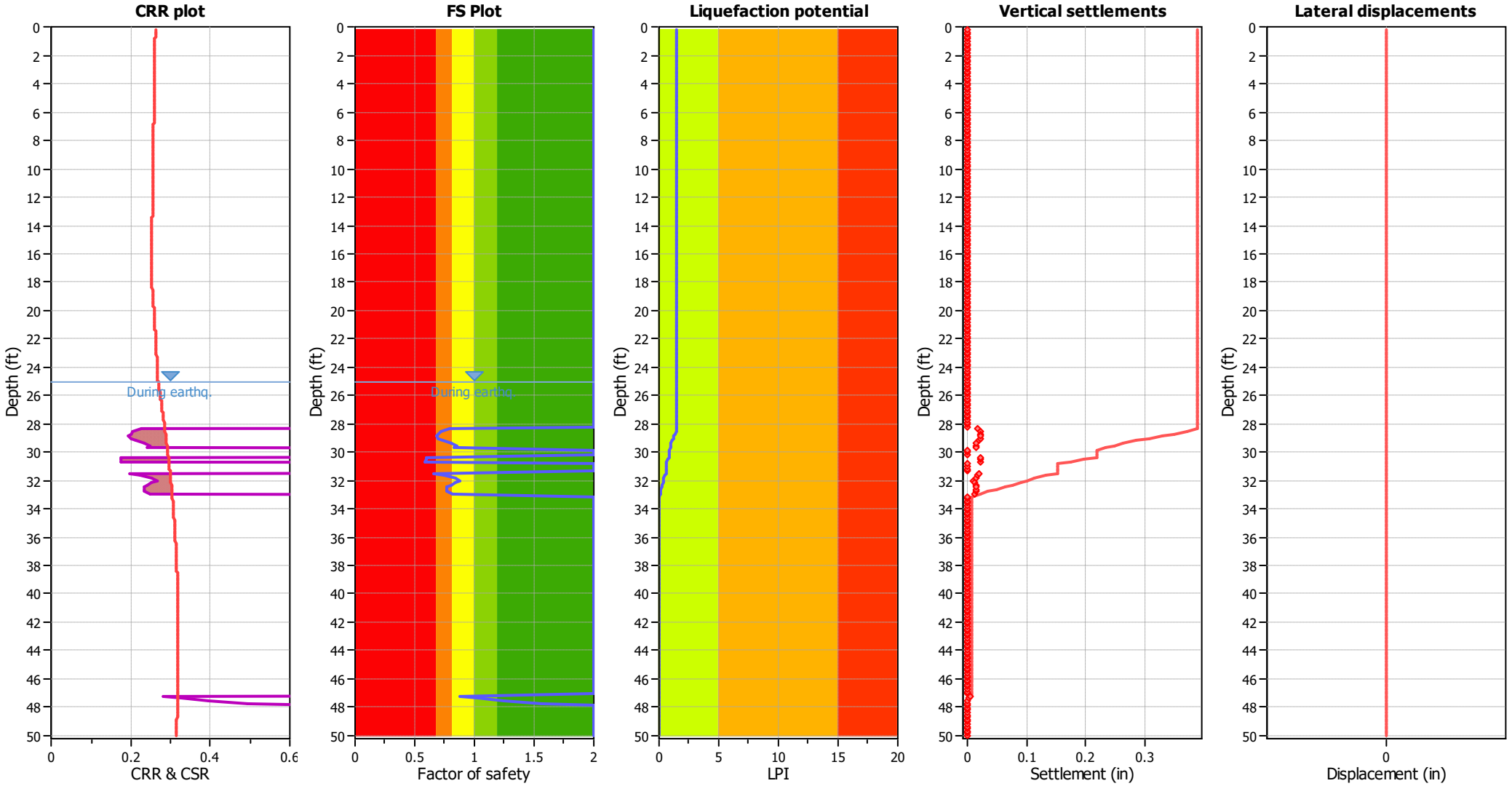
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	25.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	25.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

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San Diego, California 92105

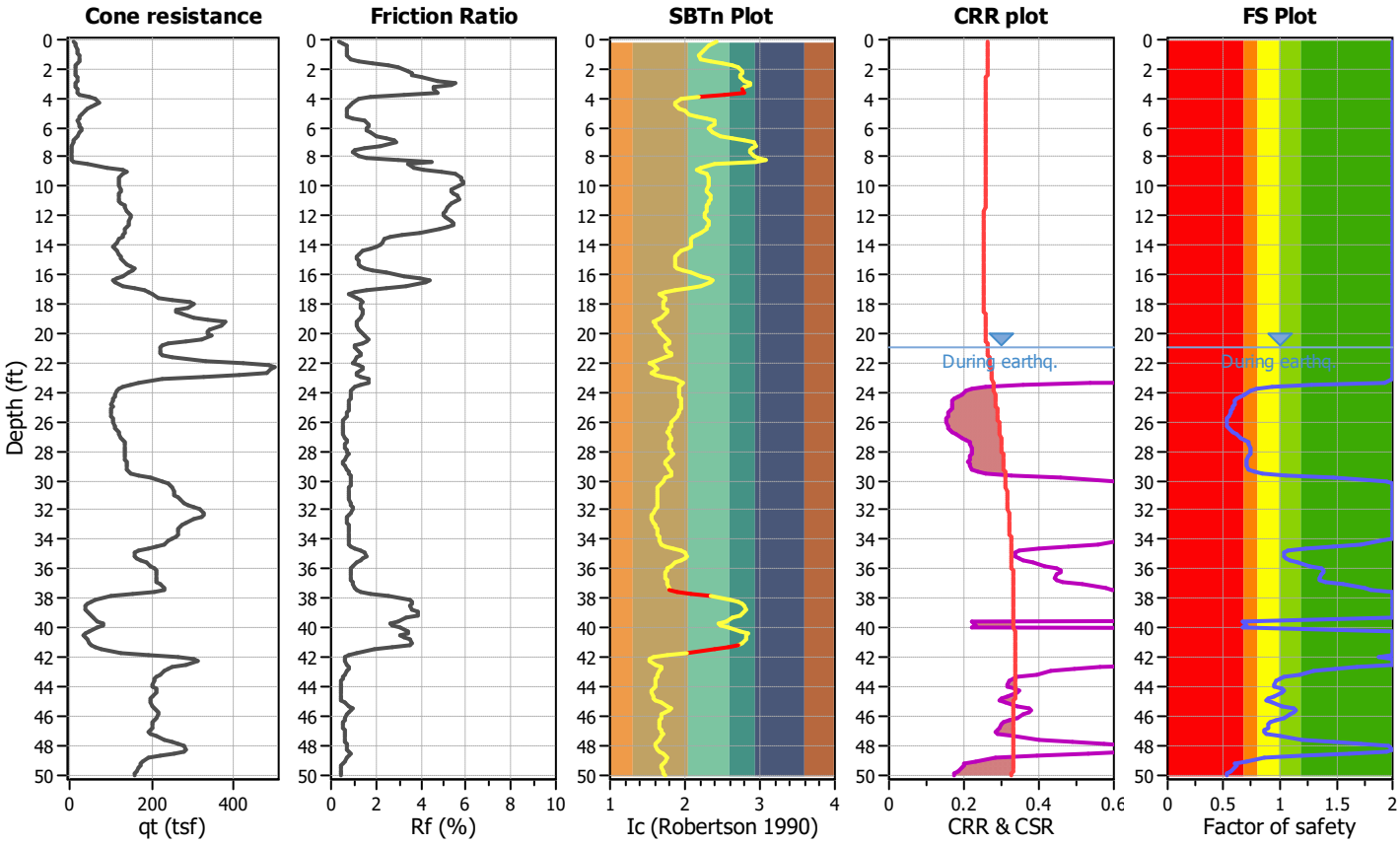
LIQUEFACTION ANALYSIS REPORT

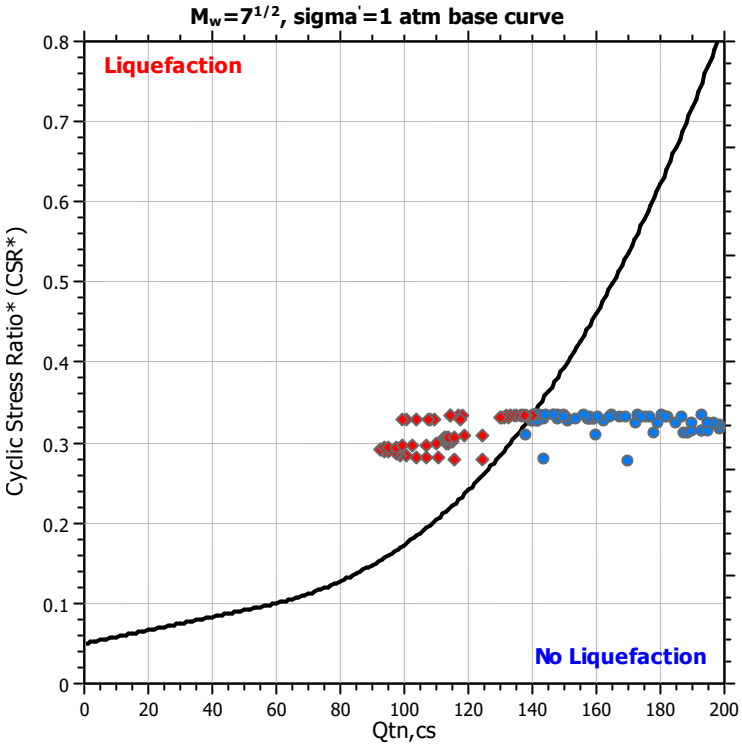
Project title : Singh Property **Location : 5720 Mission Avenue, Oceanside, California**

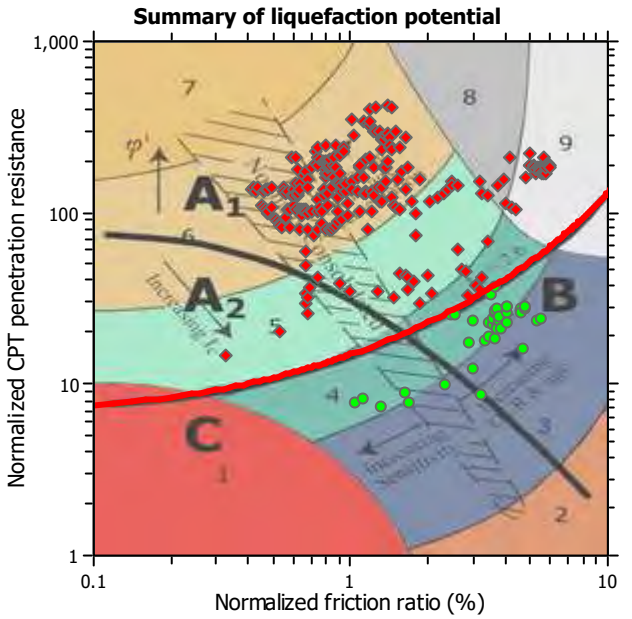
CPT file : CPT-04

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	21.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	21.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

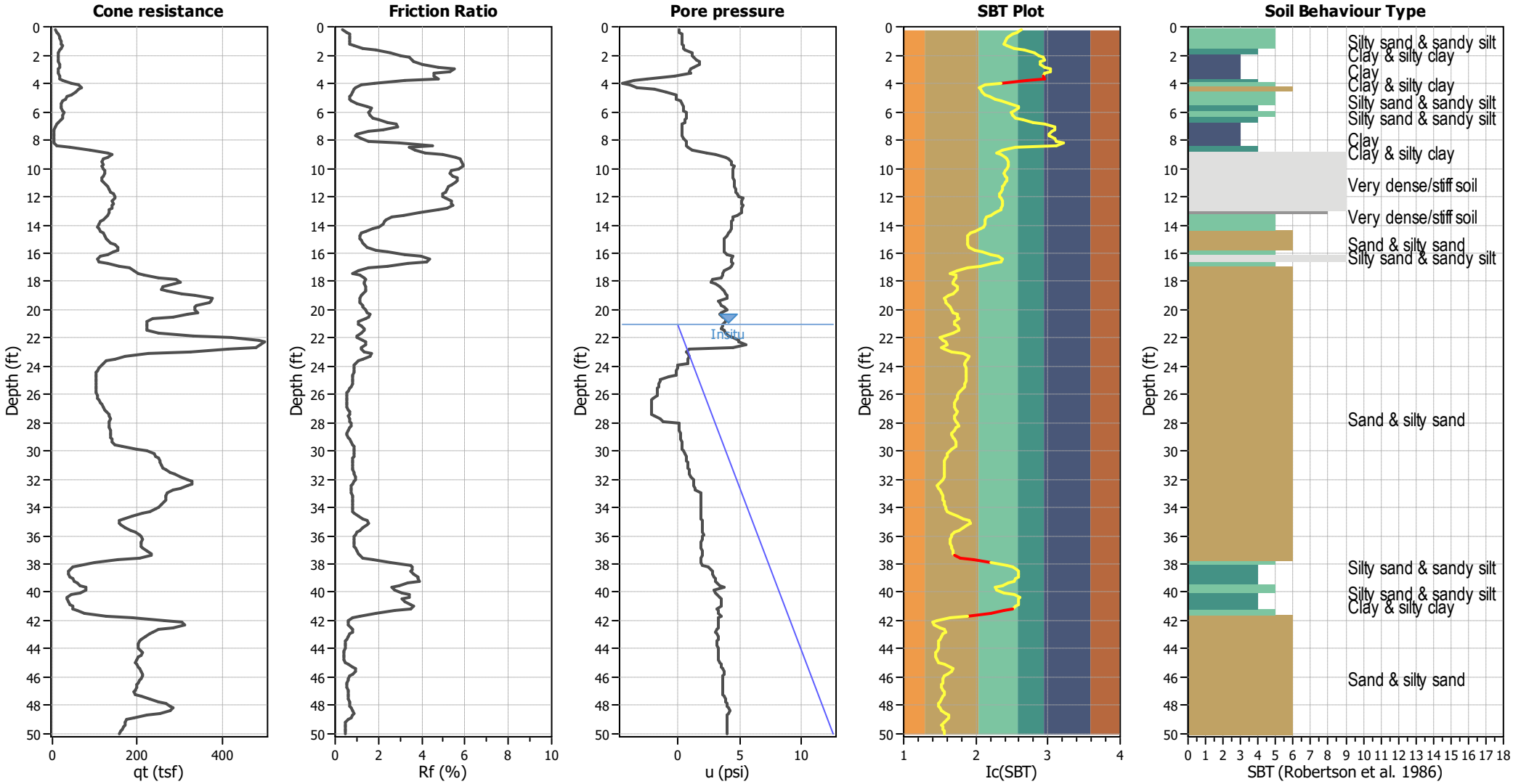






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



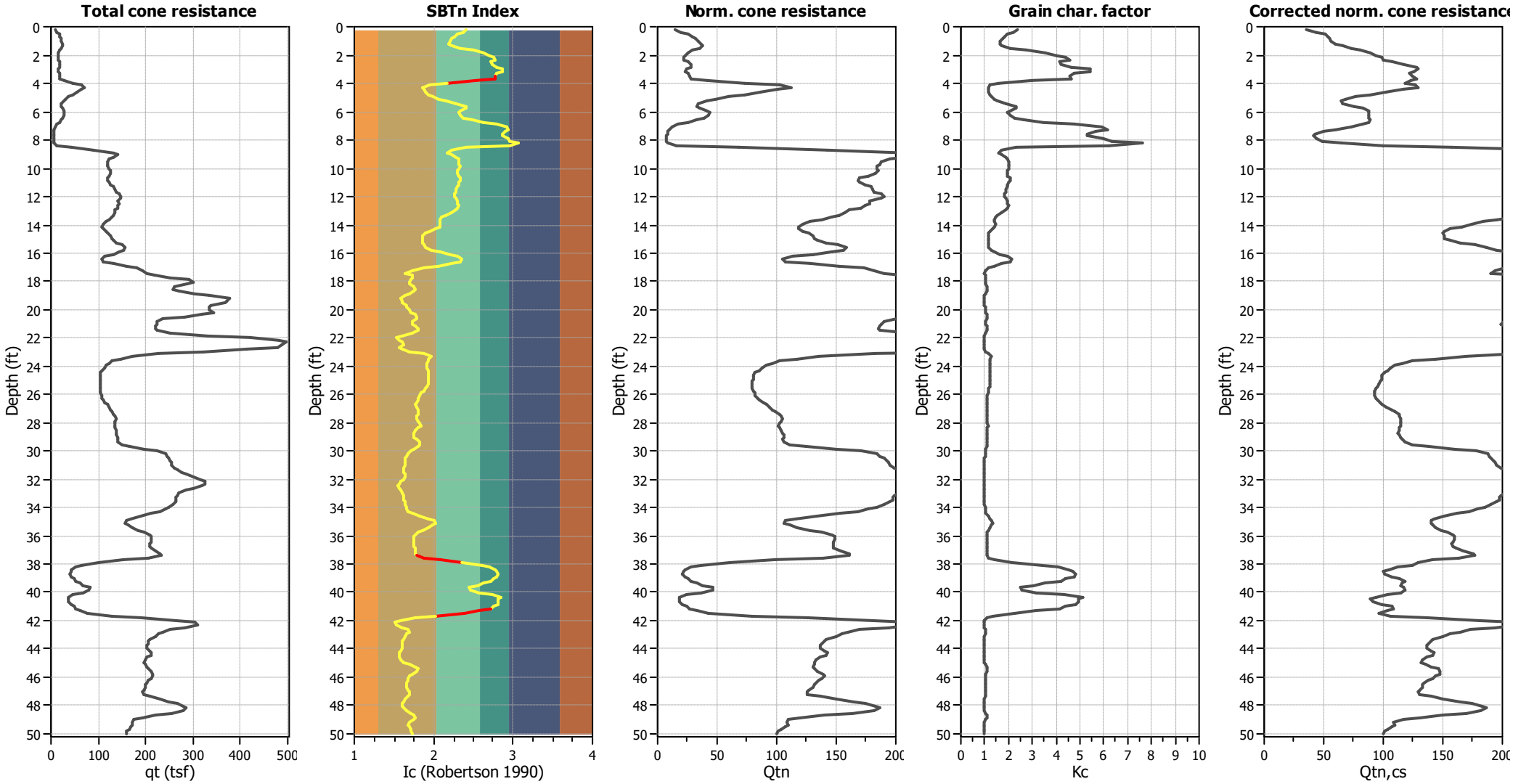
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	21.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	21.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

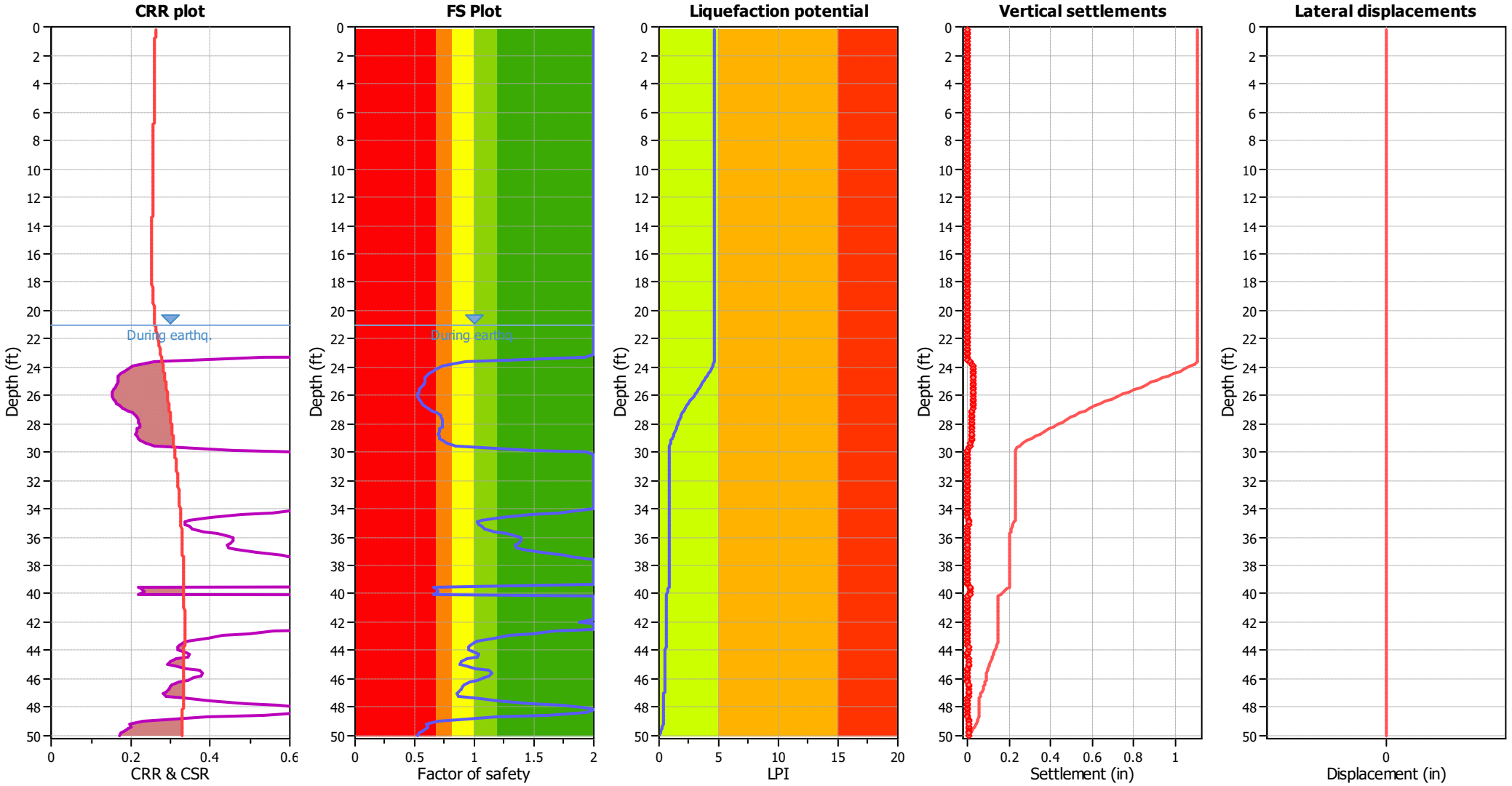
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	21.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	21.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	21.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	21.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Christian Wheeler Engineering
3980 Home Avenue
San Diego, California 92105

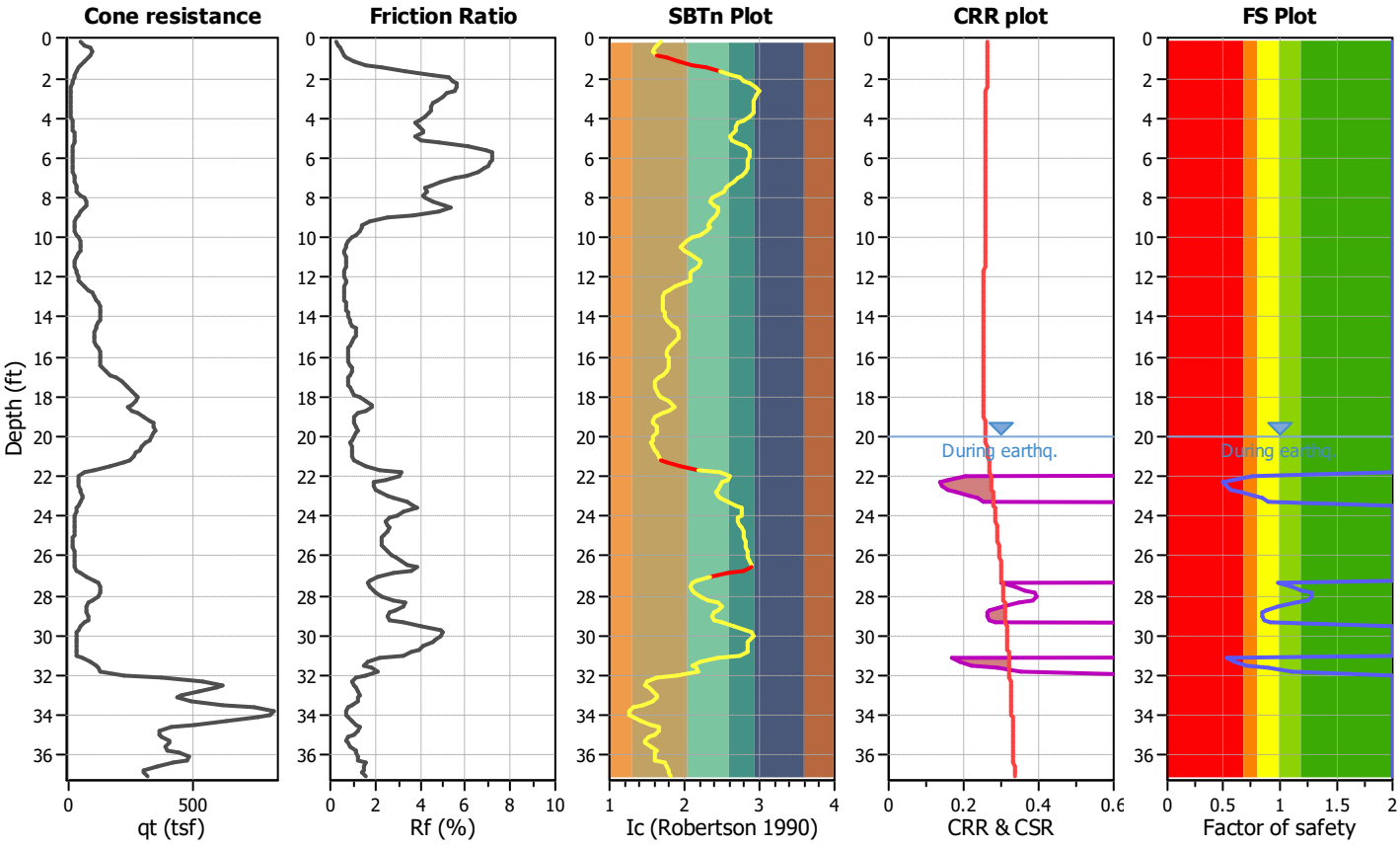
LIQUEFACTION ANALYSIS REPORT

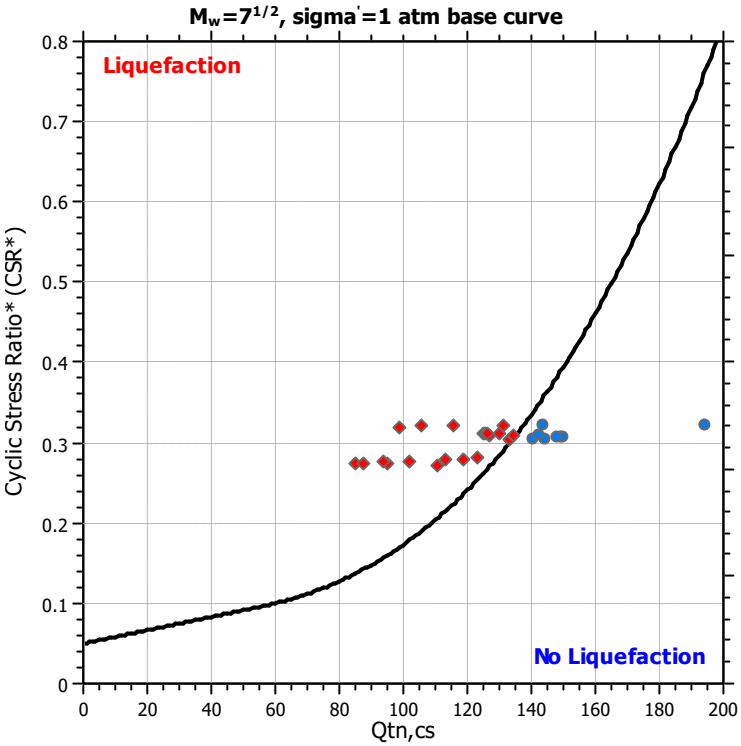
Project title : Singh Property **Location : 5720 Mission Avenue, Oceanside, California**

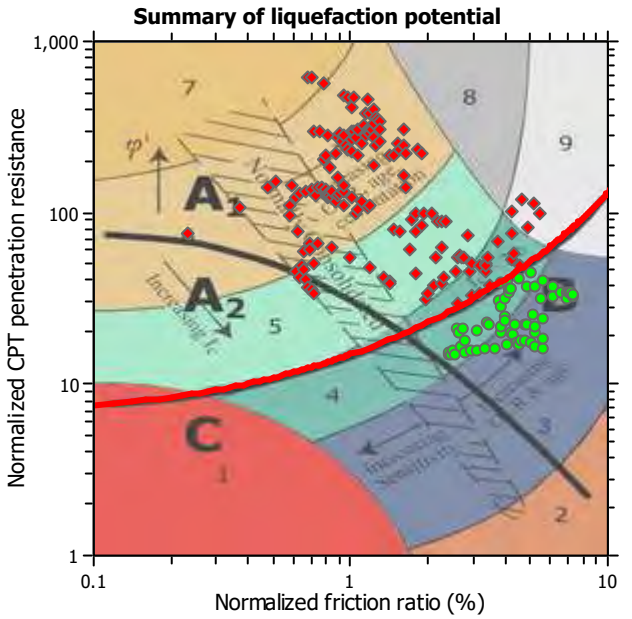
CPT file : CPT-05

Input parameters and analysis data

Analysis method:	NCEER (1998)	G.W.T. (in-situ):	20.00 ft	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	NCEER (1998)	G.W.T. (earthq.):	20.00 ft	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.00	Ic cut-off value:	2.60	Trans. detect. applied:	Yes	MSF method:	Method based
Peak ground acceleration:	0.48	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

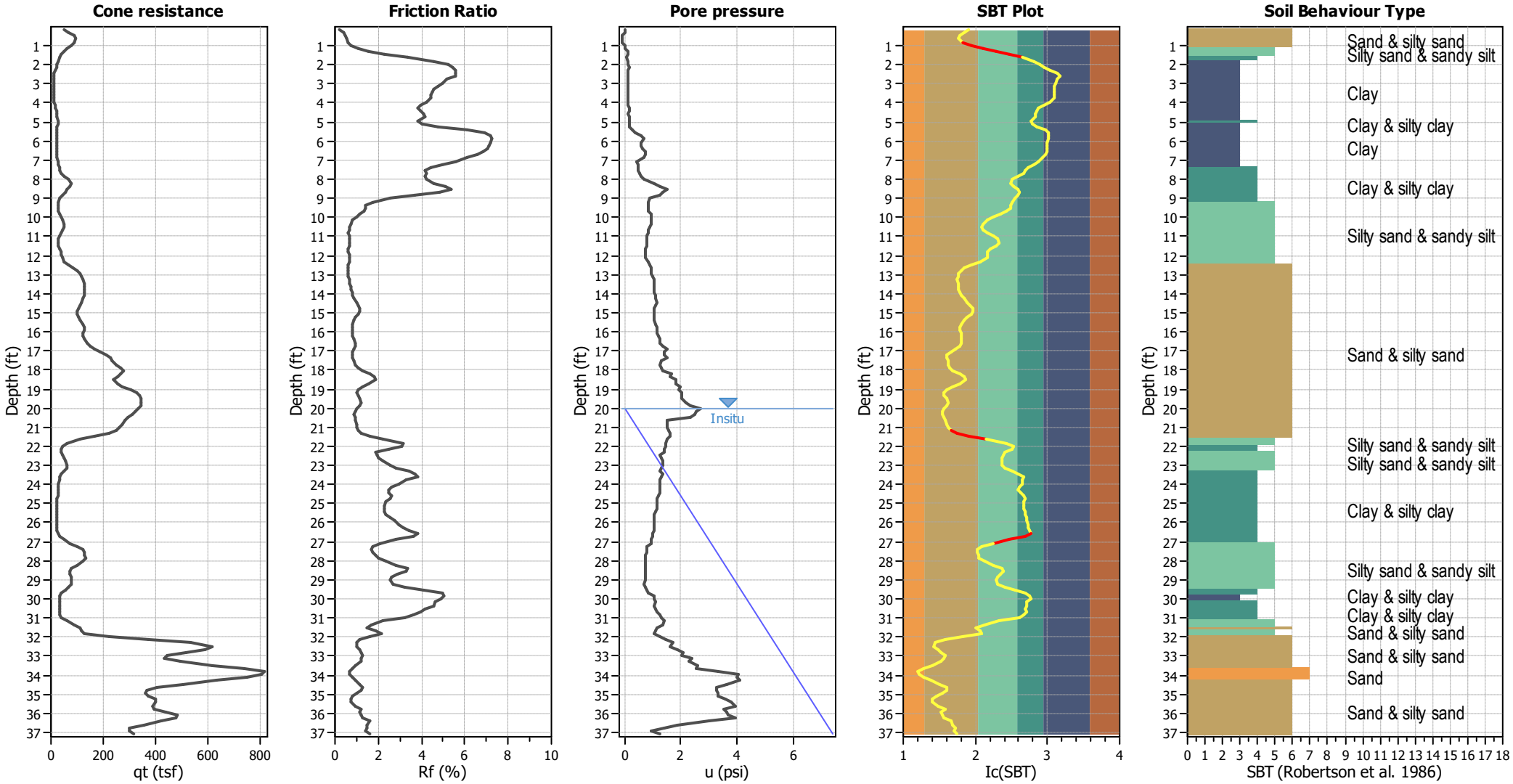






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

CPT basic interpretation plots



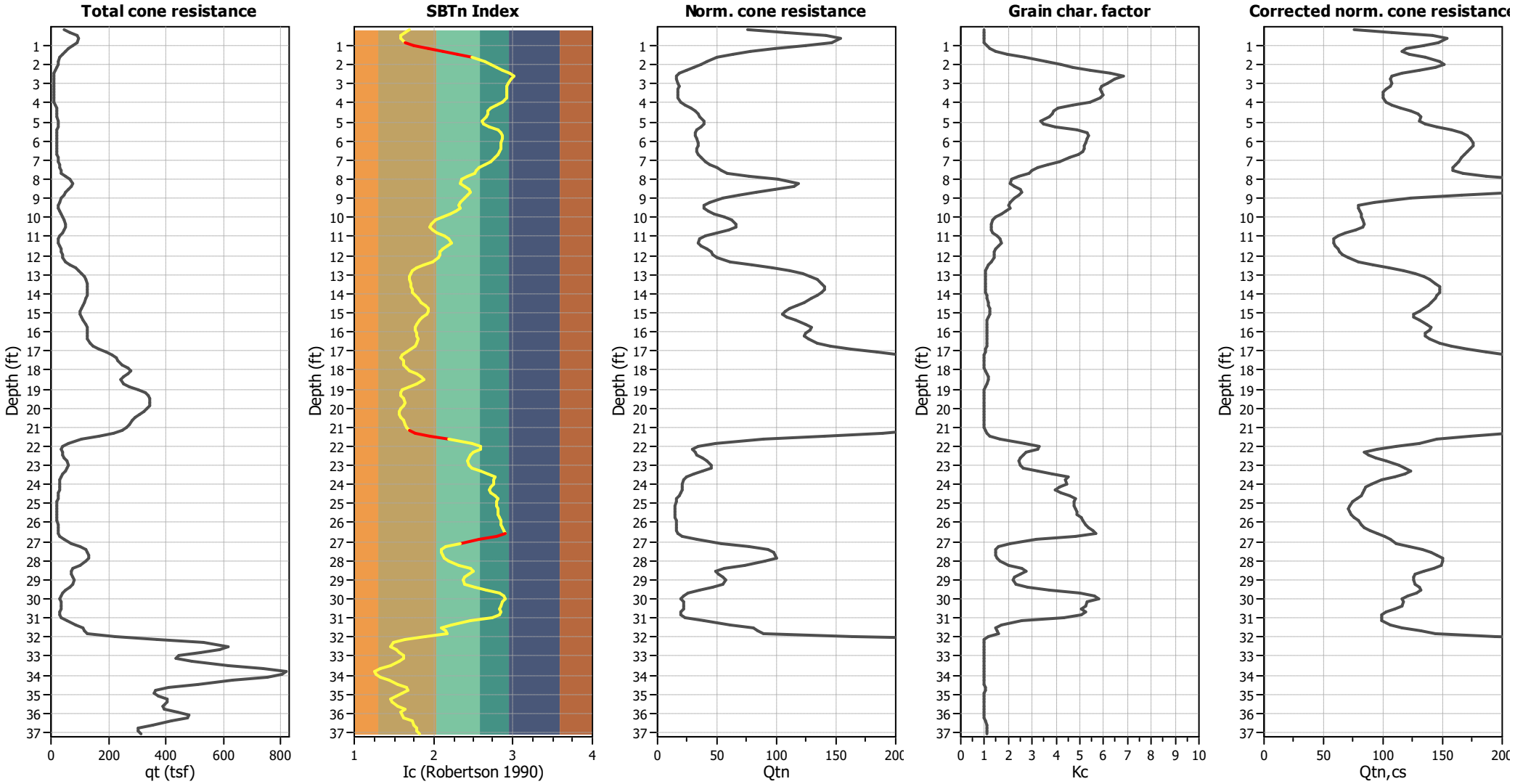
Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

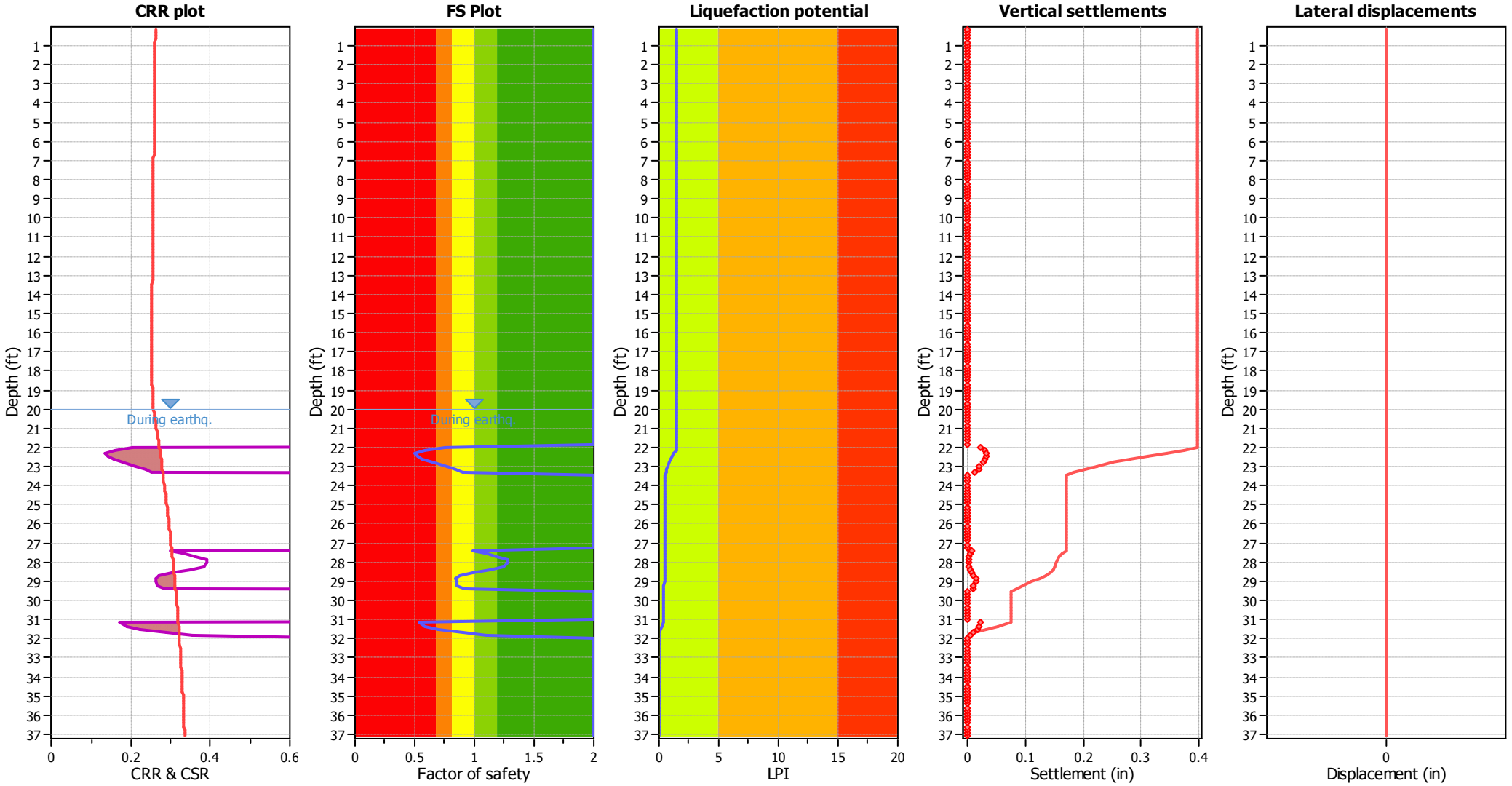
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

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Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	NCEER (1998)	Depth to water table (erthq.):	20.00 ft	Fill weight:	N/A
Fines correction method:	NCEER (1998)	Average results interval:	3	Transition detect. applied:	Yes
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.48	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	20.00 ft	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

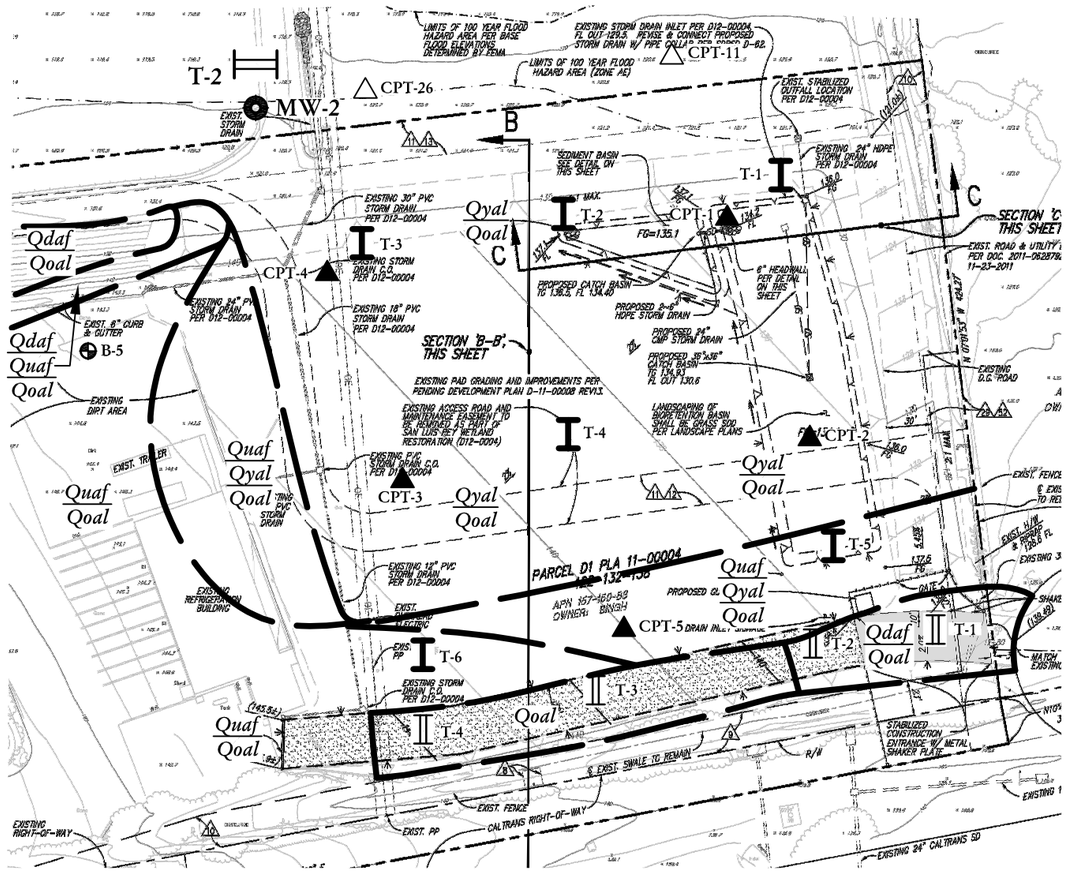
Appendix F

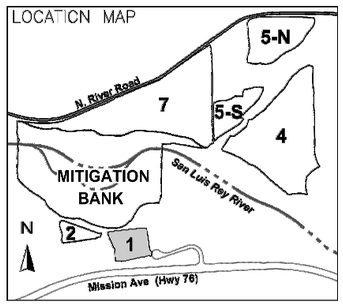
Data from Report 2150046.01R

CWE LEGEND

▲ CPT-5	APPROXIMATE CONE PENETRATION TEST LOCATION (CWE, 2015)
T-6	APPROXIMATE TEST TRENCH LOCATION (CWE, 2015)
△ CPT-26	APPROXIMATE CONE PENETRATION TEST LOCATION (GEOCON, 2011)
B-5	APPROXIMATE BORING LOCATION (CWE, 2007)
T-6	APPROXIMATE TEST TRENCH LOCATION (CWE, 2011)
~	APPROXIMATE GEOLOGIC CONTACT
Qdaf / Qoal	DOCUMENTED ARTIFICIAL FILL OVER OLDER ALLUVIUM
Qdaf / Quaf / Qoal	DOCUMENTED ARTIFICIAL FILL OVER UNDOCUMENTED ARTIFICIAL FILL OVER OLDER ALLUVIUM
Quaf / Qyal / Qoal	UNDOCUMENTED ARTIFICIAL FILL OVER YOUNGER ALLUVIUM OVER OLDER ALLUVIUM
Quaf / Qoal	UNDOCUMENTED ARTIFICIAL FILL OVER OLDER ALLUVIUM
Qyal / Qoal	YOUNGER ALLUVIUM OVER OLDER ALLUVIUM

NOTE: SURFICIAL SOIL NOT MAPPED





W+E

0 100' 200'

SCALE: 1" = 100'

REGISTERED PROFESSIONAL ENGINEER TIMOTHY D. CARROLL JR. NO. 55381 CIVIL STATE OF CALIFORNIA

O'Day CONSULTANTS
2710 Loker Ave West Suite 100 Carlsbad, California 92010
760-931-7700 Fax: 760-931-5680 ODayConsultants.com
Civil Engineering Planning Processing Surveying

DESIGNED BY: G.S., B.R. DATE: DEC. 2014
DRAWN BY: G.S., G.M. SCALE: AS SHOWN
PROJECT MGR.: T.C. JOB NO.: 03-1065

ENGINEER OF WORK:

DATE:
TIMOTHY D. CARROLL, JR. RCE: 55381

SITE PLAN AND GEOTECHNICAL MAP (SITE 1)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

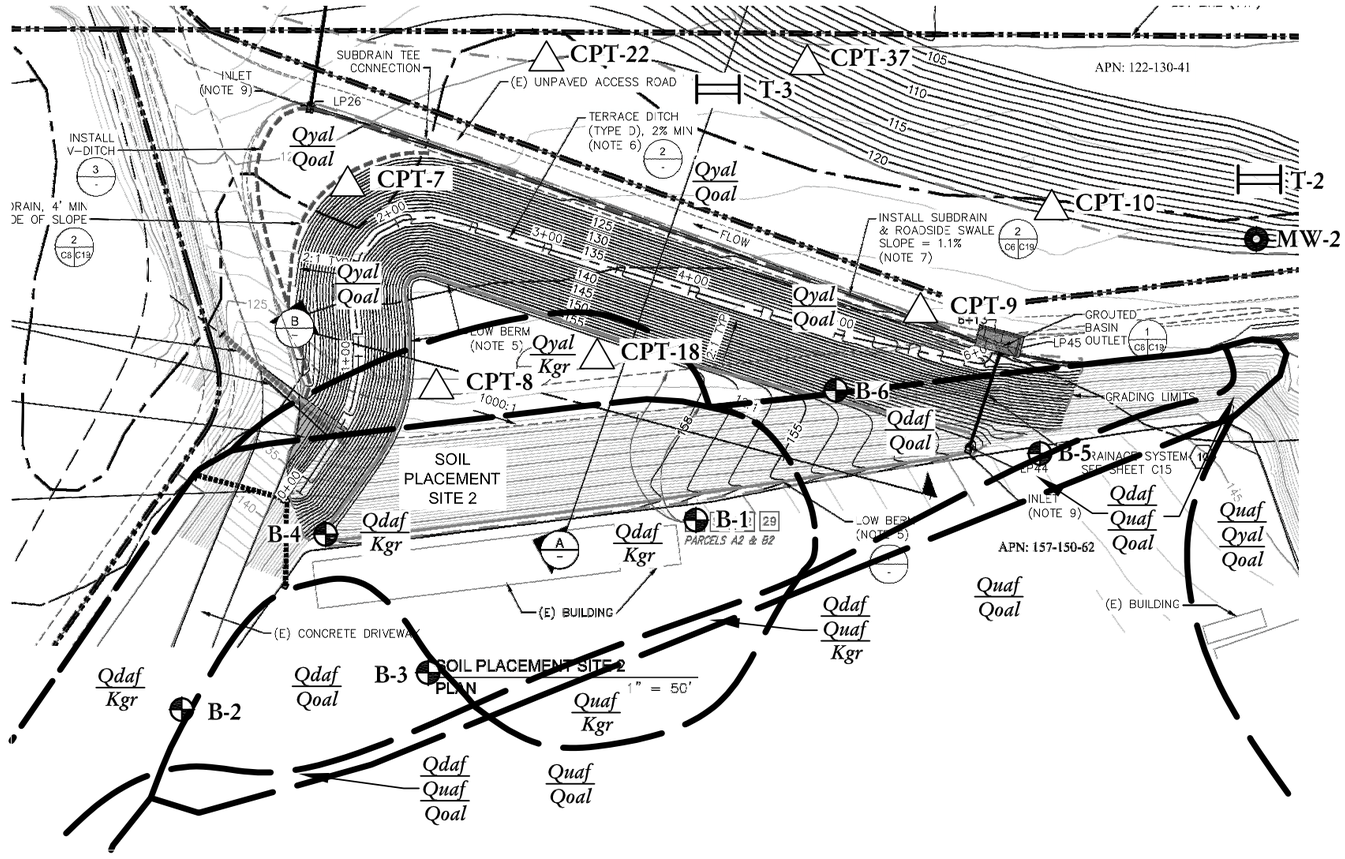
DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL/BGR	PLATE NO.:	1

CHRISTIAN WHEELER ENGINEERING

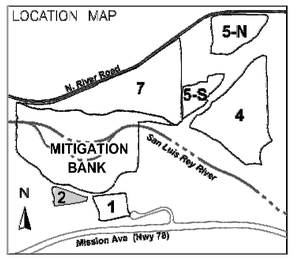
CWE LEGEND

CPT-26	APPROXIMATE CONE PENETRATION TEST LOCATION (GEOCON, 2011)
B-6	APPROXIMATE BORING LOCATION (CWE, 2007)
MW-2	APPROXIMATE MONITORING WELL LOCATION (GEOCON, 2011)
T-6	APPROXIMATE TEST TRENCH LOCATION (GEOCON, 2012)
	APPROXIMATE GEOLOGIC CONTACT
Qdaf / Qoal	DOCUMENTED ARTIFICIAL FILL OVER OLDER ALLUVIUM
Qdaf / Quaf / Qoal	DOCUMENTED ARTIFICIAL FILL OVER UNDOCUMENTED ARTIFICIAL FILL OVER OLDER ALLUVIUM
Quaf / Qoal	UNDOCUMENTED ARTIFICIAL FILL OVER OLDER ALLUVIUM
Quaf / Qyal / Qoal	UNDOCUMENTED ARTIFICIAL FILL OVER YOUNGER ALLUVIUM OVER OLDER ALLUVIUM
Qyal / Qoal	YOUNGER ALLUVIUM OVER OLDER ALLUVIUM
Qdaf / Kgr	DOCUMENTED ARTIFICIAL FILL OVER GRANITIC ROCK
Qdaf / Quaf / Kgr	DOCUMENTED ARTFICIAL FILL OVER UNDOCUMENTED ARTIFICIAL FILL OVER GRANITIC ROCK
Quaf / Kgr	UNDOCUMENTED ARTIFICIAL FILL OVER GRANITIC ROCK
Qyal / Kgr	YOUNGER ALLUVIUM OVER GRANITIC ROCK

NOTE: SURFICIAL SOIL NOT MAPPED



SOIL PLACEMENT SITE 2 PLAN 1" = 50'



W+E

0 100' 200'

SCALE: 1" = 100'

APPROVED CHANGES:

NO.	DESCRIPTION	APP'D	DATE

BENCHMARK: CITY OF VISTA STATION V2028
Description: SET 2" DIA ALUMINUM CAP ON A 5/8" DIA REBAR, FLUSH WITH AC PAVEMENT STAMPED "HUMPHREYS & ASSOC. GPS CONTROL POINT 2028 1992."
Location: LOCATED AT THE APPROX. CENTER OF CUL-DE-SAC AT THE EAST END OF ALBRIGHT STREET, NORTHEAST FROM GUADOME LANE (E).
Record From: CITY OF VISTA SURVEY CONTROL
Elev.: 200.37 Datum: NGVD 29

ESA PWA
550 KEARNY STREET, SUITE 800
SAN FRANCISCO, CALIFORNIA 94108
PHONE (415) 262-2300

SHEET 13 (C8) | CITY OF OCEANSIDE ENGINEERING DIVISION | 26 SHEETS

PRECISE GRADING PLAN FOR
SAN LUIS REY MITIGATION BANK
GRADING PLAN AND SECTIONS
SOIL PLACEMENT SITE 2

APPROVED
CITY ENGINEER: SCOTT D. SMITH RCE-58695 DATE:

ENGINEER OF WORK
PHILIP L. LUECKING RCE 68113

Checked By:
Approval Date:

PLAN NUMBER
G14-00015

SITE PLAN AND GEOTECHNICAL MAP (SITE 2)

SINGH PROPERTY
5780 MISSION AVENUE
OCEANSIDE, CALIFORNIA

DATE:	MARCH 2015	JOB NO.:	2150046.01R
BY:	MWL/BGR	PLATE NO.:	2

CHRISTIAN WHEELER ENGINEERING

ATTACHMENT 7
Storm Water Quality Assessment Form

This is the cover sheet for Attachment 7.

City of Oceanside – Engineering Division – Clean Water Program

STORM WATER QUALITY ASSESSMENT FOR PLANNING, ENGINEERING, AND BUILDING PERMIT APPLICATIONS

All applications for Planning, Engineering, or Building Division permits are required to complete this assessment form and include it as part of the initial permit application submittal. Staff will review the permit application content to determine the applicability of State and City storm water requirements. Please note a storm water assessment cannot be provided without a complete permit application package.

Section 1 – Project Information	
Applicant Name: Brad Ebright	Phone Number: (619) 993-5121
Project Name: West Coast Tomato Growers Farm Worker Housing Grading Plan	Project Site Address: 5780 Mission Avenue Oceanside, CA 92057
Permit Applications Number(s):	Assessor Parcel Number(s): 157-150-63-00
Project Description: Grading for the development of housing for guest program farm laborers	Project Disturbed Area (square feet): 168,153 SF
Existing Impervious Area (square feet): 778 SF	Created or Replaced Impervious Area (square feet): 83,839 SF

Section 2 – Identify Applicable Priority Development Project Categories (Check All Boxes that Apply)	
☒	**New Development Project** – A project that creates 10,000 square feet or more of impervious surfaces (collectively over the entire project site). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☐	**Redevelopment Project** – A project that creates and/or replaces 5,000 square feet or more of impervious surface (collectively over the entire project site on an existing site of 10,000 square feet or more of impervious surfaces). This includes commercial, industrial, residential, mixed-use, and public development projects on public or private land.
☐	**Restaurants** – Category is defined as a facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812); where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Hillside Development** – Category includes development on any natural slope that is twenty-five percent or greater; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Parking Lots** – Category is defined as a land area or facility for the temporary parking or storage of motor vehicles used personally, for business, or for commerce; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☒	**Streets, Roads, Highways, Freeways, and Driveways** – Category is defined as any paved impervious surface used for the transportation of automobiles, trucks, motorcycles, and other vehicles; where new or redevelopment projects that create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☒	**Water Quality Environmentally Sensitive Area** – New or redevelopment projects that create and/or replace 2,500 square feet or more of impervious surface (collectively over the entire project site), and discharge directly to a Water Quality Environmentally Sensitive Area (WQESA). "Discharge directly to" includes flow that is conveyed overland a distance of 200 feet or less from the project to the WQESA, or conveyed in a pipe or open channel any distance as an isolated flow from the project to the ESA (i.e. not commingled with flows from adjacent lands).
☐	**Automotive Repair Shop** – Category is defined as a facility that is categorized in any one of the following Standard Industrial Classification (SIC) codes: 5013, 5014, 5541, 7532-7534, or 7536-7539, where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☐	**Retail Gasoline Outlet (RGOs)** – Category includes RGOs that meet the following criteria (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day; where new or redevelopment projects create and/or replace 5,000 square feet or more impervious surface (collectively over the entire project site).
☒	**Development Projects greater than one acre** – New or redevelopment projects that result in the disturbance of one or more acres of land and are expected to generate pollutants post construction.

STORM WATER QUALITY ASSESSMENT FOR PLANNING, ENGINEERING, AND BUILDING PERMIT APPLICATIONS

Section 3 – Identify Projects Not Subject to Permanent Stormwater Requirements (Check All Boxes that Apply)	
☐	The project consists of work entirely within an existing structure.
☐	The project consists of construction of overhead or underground utilities (no new impervious surfaces).
☐	The project consists of routine maintenance.
☐	The project consists of less than 50 yards of grading and presents no opportunities to improve water quality.
Section 4 – Project Category Determination	
☒	**Priority Development Project**: If any item in Section 2 is applicable, the project is a Priority Development Project. **Please prepare a PDP SWQMP for the project.**
☐	**Standard Development Project**: If none of the items in Section 2 or 3 are applicable, the project is a Standard Development Project. **Please prepare an SDP SWQMP.**
☐	**Project Not Subject to Permanent Stormwater Requirements:** If any item in Section 3 is applicable, the project is not subject to Permanent Stormwater Requirements. **Please submit the project plans with this form.** **Note:** Projects in this category are subject to typical pollution prevention measures outlined by the pollution prevention checklist on the following page.

Section 5 – Applicant Certification	
Name of Responsible Party: Brad Edbright	Title: Owner
Email Address (optional) brad@westcoastvineripe.com	Phone Number: (619) 993-5121
I understand and acknowledge the City of Oceanside has adopted minimum requirements, as mandated by the San Diego Regional Water Quality Control Board – Order No. R9-2013-0001, as amended by Order Nos. R9-2015-0001 and R9-2015-0100 (NPDES NO. CAS0109266) for mitigating impacts associated with urban runoff, including storm water from construction and land development activities. I certify this assessment has been accurately completed to the best of my knowledge and is consistent with the proposed project. I acknowledge that non-compliance with the City Best Management Practice (BMP) Design Manual, Grading Ordinance, and Erosion Control Ordinance may result in enforcement action by the City, the California State Water Resources Control Board, and/or the San Diego Regional Water Quality Control Board. Enforcement action may include stop work orders, notice of violation, fines, or other actions.	
Applicant Signature: Brad Edbright	Date: 2/10/22

Stormwater Pollution Prevention Measures for Projects Not Subject to Permanent Stormwater Requirements

Project Activity	Yes	No	Required Pollution Prevention
Trash & Waste Generation *****REQUIRED FOR ALL PROJECTS*****	☒	☐	• Train/inform all employees of pollution prevention requirements • Collect and contain all construction trash, waste, and debris • Promptly contain and clean any spill on site • Routinely inspect site, remove loose trash and prevent spills • Properly dispose of any hazardous materials • Do not wash down surfaces unless water is collected or directed to landscape • Permanent trash collection areas require full structure/enclosure
Digging of Dirt – excavation, trenching, or grading	☒	☐	• Do not allow dirt to migrate into street, sidewalk, or storm drain • Preserve existing vegetation where feasible • Perimeter site controls such as silt fence or straw wattles • Cover exposed dirt using mulch, tarps, or erosion control devices • Install and secure tarps over dirt piles • Routinely sweep site to remove dirt
Landscaping and Irrigation Systems	☒	☐	• Do not store landscape materials in street • Do not allow dirt to migrate into street, sidewalk, or storm drain • Test irrigation system and prevent runoff/overspray • Install and secure tarps over piles of mulch or soil • Routinely sweep site to remove mulch or soil • Do not wash down surfaces unless water is collected or directed to landscape
Concrete, Paint, Mortar, or Stucco Work	☒	☐	• Contain wet mixing areas within confined area • Do not allow material to travel into site soil, street, or storm drain • Properly dispose of waste material
Temporary Storage of Materials Outside	☐	☐	• Elevate material off ground where possible, such as on pallets • Install and secure tarps over materials
Demolition of Structures	☐	☐	• Follow Required Pollution Prevention for “Digging of Dirt”
New Structure – house addition, shed, etc.	☒	☐	• Follow Required Pollution Prevention for “Digging of Dirt” • Direct downspouts to landscape, where feasible • Consider rainwater harvesting • Preserve existing vegetation and drainage patterns, where feasible
Patio, Driveway, or Sidewalk	☒	☐	• Consider use of pervious pavers or pervious concrete (refer to Section 3 of page 4 for routine maintenance information) • Direct runoff to landscape areas, where feasible
Re-Roofing	☐	☐	• Contain removed roof debris in waste containers • Follow Required Pollution Prevention for “Temporary Storage of Materials Outside”
Washing of Material, Equipment, or Surface	☐	☐	• Do not wash down surfaces unless water is collected or directed to landscape
Draining of Water Heater, Pool, or Spa	☐	☐	• Direct drain water to landscape areas where possible • Contact Stormwater Division if considering draining to sanitary system cleanout or storm drain system (760-643-2804)
Storm Drain at Industrial or Commercial Property	☒	☐	• Install “No Dumping” or similar signage at each storm drain inlet

Completion Guidance

Please note – the Applicant is required to complete and submit this form as part of the project application. For definitions and additional information, please refer to the City of Oceanside BMP Design Manual. For assistance, please contact Development Services Staff at (760) 435-4373.

Section 1 – Project Information

1. Applicant Name – provide name of Individual completing form, i.e. Owner or Owner Representative
2. Phone Number – provide phone number of Individual completing form, i.e. Owner or Owner Representative
3. Project Name – provide project name (consistent with project application)
4. Project Site Address – provide a physical address for the proposed project, or nearest cross street
5. Permit Application Number(s) – provide all applicable permit application numbers
6. Assessor Parcel Number(s) – provide Assessor Parcel Number(s); refer to title documents or contact City Staff for assistance
7. Project Description – provide a brief project description (e.g. single-family dwelling, retail business, repair shop, etc)
8. Project Disturbed Area – provide the disturbed area for the entire project, including onsite and offsite work
9. Existing Impervious Area – provide the total existing impervious area within the property and project boundary
10. Created or Replaced Impervious Area – provide the total area of all newly created or replaced impervious surfaces within the project area

Section 2 – Identify Applicable Priority Development Project Categories

1. Review each category and check the appropriate boxes that apply to your project.
2. General identification of Automotive Repair Shop SIC (Standard Industrial Classifications) as follows:
   5013 – Motor vehicle supplies and new parts, 5014 – Tires and tubes, 5541 – Gasoline service stations, 7532 – Top and body repair, and paint shops, 7533 – Auto exhaust system repair shops, 7534 – Tire retreading and repair shops, 7536 – Automotive glass replacement shops, 7537 – Automotive transmission repair shops, 7538 – General automotive repair shops, 7539 – Automotive repair shops-not elsewhere classified
3. Contact Staff for assistance in determining applicability of the Water Quality Environmentally Sensitive Area (WQESA) category

Section 3 – Identify Projects Not Subject to Permanent Stormwater Requirements

1. Please refer to Page 1-6 of the City of Oceanside BMP Design Manual for a complete list of routine maintenance activities.
2. Activities that expose native subgrade in the process of replacing impervious surfaces, are not considered routine maintenance.

Section 4 – Project Category Determination

1. PDP SWQMP – Priority Development Project Stormwater Quality Management Plan
2. SDP SWQMP – Standard Development Project Stormwater Quality Management Plan
3. Contact Staff for assistance in determining the Project Category

Section 5 – Applicant Certification

1. Name of Responsible Party – provide name of Owner
2. Title of Responsible Party – provide responsible party's title, if applicable
3. Phone Number – provide phone number of Owner
4. Email Address (Optional) – provide email address
5. Applicant Signature – provide signature of Individual completing form, i.e. Owner or Owner Representative
6. Date – provide date current date

[Insert other supporting documentation here]

SUPPORTING DOCUMENTATION FOR BMP'S

E.11 PR-1 Biofiltration with Partial Retention



Location: 805 and Bonita Road, Chula vista, CA.

MS4 Permit Category
NA
Manual Category
Partial Retention
Applicable Performance Standard
Pollutant Control Flow Control
Primary Benefits
Volume Reduction Treatment Peak Flow Attenuation

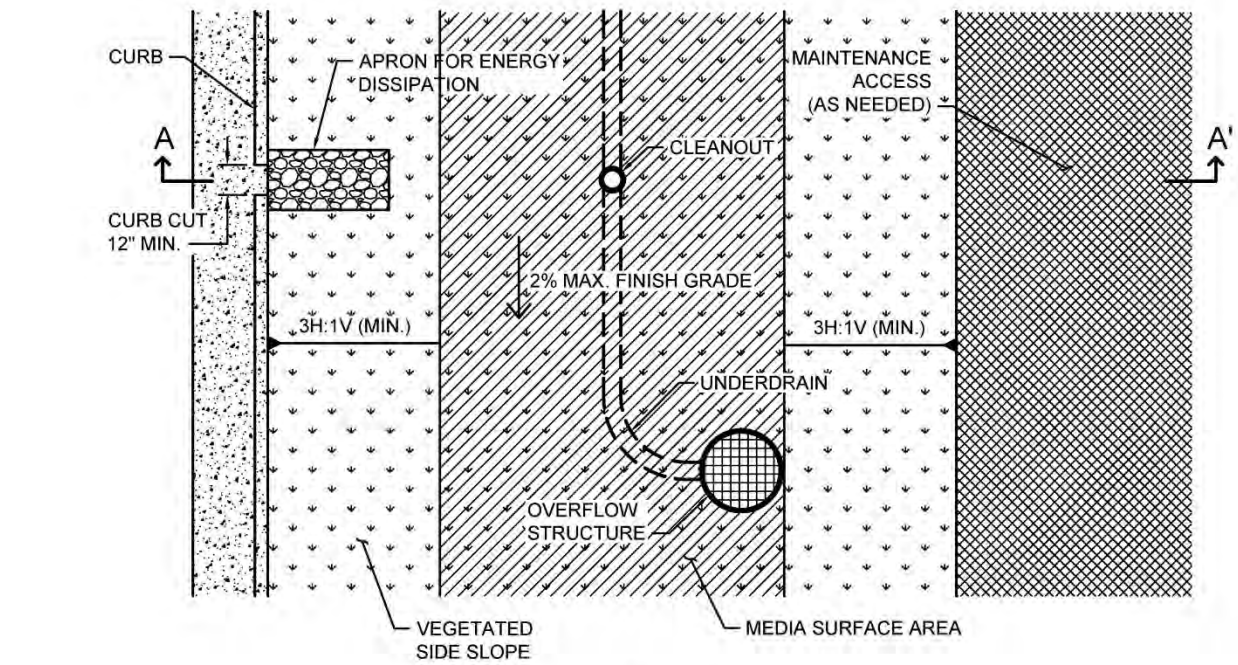
Description

Biofiltration with partial retention (partial infiltration and biofiltration) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to infiltrating into native soils, discharge via underdrain, or overflow to the downstream conveyance system. Where feasible, these BMPs have an elevated underdrain discharge point that creates storage capacity in the aggregate storage layer. Biofiltration with partial retention facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. They can be constructed in ground or partially aboveground, such as planter boxes with open bottoms to allow infiltration. Treatment is achieved through filtration, sedimentation, sorption, infiltration, biochemical processes and plant uptake.

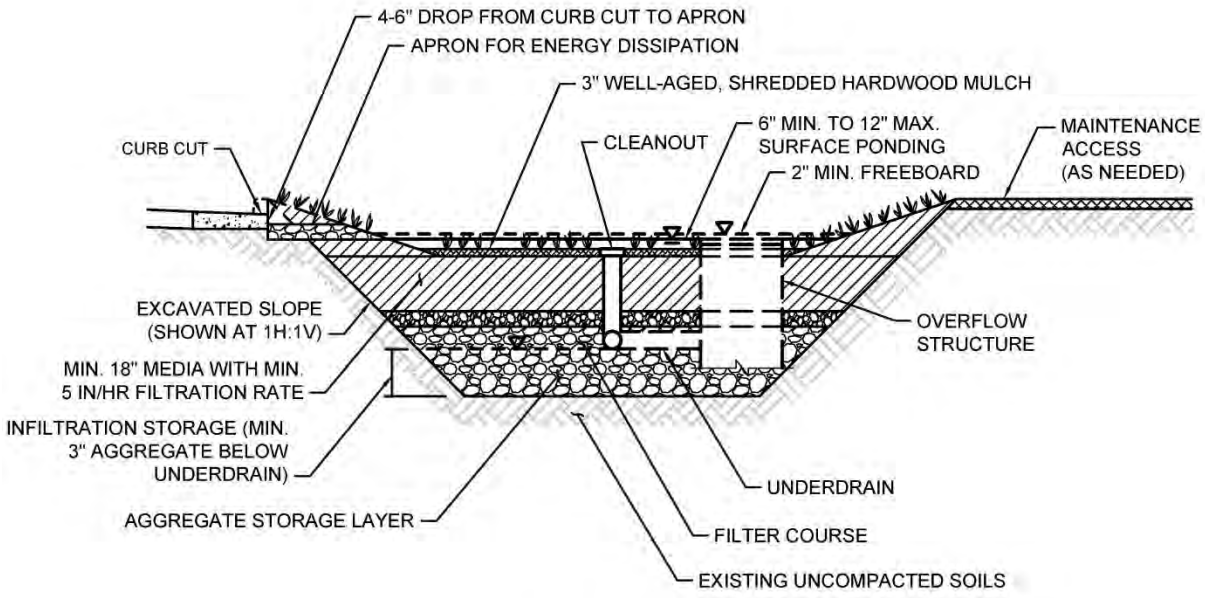
Typical biofiltration with partial retention components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side Slope and basin bottom vegetation selected based on climate and ponding depth
- Non-floating mulch layer
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the optional aggregate storage layer
- Aggregate storage layer with underdrain(s)

- Uncompacted native soils at the bottom of the facility
- Overflow structure



PLAN
NOT TO SCALE



SECTION A-A'
NOT TO SCALE

Typical plan and Section view of a Biofiltration with Partial Retention BMP

Design Adaptations for Project Goals

Partial infiltration BMP with biofiltration treatment for storm water pollutant control. Biofiltration with partial retention can be designed so that a portion of the DCV is infiltrated by providing infiltration storage below the underdrain invert. The infiltration storage depth should be determined by the volume that can be reliably infiltrated within drawdown time limitations. Water discharged through the underdrain is considered biofiltration treatment. Storage provided above the underdrain within surface ponding, media, and aggregate storage is included in the biofiltration treatment volume.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer. This will allow for significant detention storage, which can be controlled via inclusion of an orifice in an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Biofiltration with partial retention must meet the following design criteria and considerations. Deviations from the below criteria may be approved at the discretion of the City Engineer if it is determined to be appropriate:

Siting and Design		*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	Selection and design of basin is based on infiltration feasibility criteria and appropriate design infiltration rate (See Appendix C and D).	Must operate as a partial infiltration design and must be supported by drainage area and in-situ infiltration rate feasibility findings.
☐	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the City Engineer if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to

Siting and Design		*Intent/Rationale*
		minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the City Engineer for proper performance of the regional BMP.
☐	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
Surface Ponding		
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hours for plant health. Surface ponding drawdown time greater than 24-hours but less than 96 hours may be allowed at the discretion of the City Engineer if certified by a landscape architect or agronomist.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the City Engineer if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 12 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.

Siting and Design		*Intent/Rationale*
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20	Plants suited to the climate and ponding depth are more likely to survive.
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided. Mulch must be non-floating to avoid clogging of overflow structure.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour.	A filtration rate of at least 5 inches per hour allows soil to drain between events, and allows flows to relatively quickly enter the aggregate storage layer, thereby minimizing bypass. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Storm Water Standards Appendix F.3 (May 2021, unless superseded by more recent edition) **or** County of San Diego BMP Design Manual: Appendix F.2 Biofiltration Soil Media Composition, Testing,(September 2020, unless superseded by more recent edition). Alternatively, for proprietary designs and	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with Appendix F.1 ensures that adequate treatment performance will be provided.

Siting and Design		*Intent/Rationale*
	custom media mixes not meeting the media specifications contained in the 2021 City of San Diego Storm Water Standards or County BMP Design Manual, the media meets the pollutant treatment performance criteria in Section F.1.	
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater. Unless demonstrated that the BMP surface area can be smaller than 3%.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels, impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.

Siting and Design		*Intent/Rationale*
Aggregate Storage Layer		
☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	Maximum aggregate storage layer depth below the underdrain invert is determined based on the infiltration storage volume that will infiltrate within a 36-hour drawdown time.	A maximum drawdown time is needed for vector control and to facilitate providing storm water storage for the next storm event.
Inflow, Underdrain, and Outflow Structures		
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every	Properly spaced cleanouts will facilitate underdrain maintenance.

Siting and Design		*Intent/Rationale*
	250 to 300 feet as required based on underdrain length.	
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point. Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Nutrient Sensitive Media Design

To design biofiltration with partial retention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design biofiltration with partial retention and an underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.
3. Generalized sizing procedure is presented in Appendix B.5. The surface ponding should be verified to have a maximum 24-hour drawdown time.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention and/or infiltration storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If biofiltration with partial retention cannot fully provide the flow rate and duration control

required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.

4. After biofiltration with partial retention has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

E.13 BF-2 Nutrient Sensitive Media Design

Some studies of bioretention with underdrains have observed export of nutrients, particularly inorganic nitrogen (nitrate and nitrite) and dissolved phosphorus. This has been observed to be a short-lived phenomenon in some studies or a long term issue in some studies. The composition of the soil media, including the chemistry of individual elements is believed to be an important factor in the potential for nutrient export. Organic amendments, often compost, have been identified as the most likely source of nutrient export. The quality and stability of organic amendments can vary widely.

The biofiltration media specifications contained in the County of San Diego BMP Design Manual: Appendix F.2 Biofiltration Soil Media Composition, Testing,(September 2020, unless superseded by more recent edition) and the City of San Diego Low Impact Development Design Manual (page B-18) (July 2011, unless superseded by more recent edition) were developed with consideration of the potential for nutrient export. These specifications include criteria for individual component characteristics and quality in order to control the overall quality of the blended mixes. As of the publication of this manual, the September 2020 County of San Diego specifications provide more detail regarding mix design and quality control.

The City and County specifications noted above were developed for general purposes to meet permeability and treatment goals. In cases where the BMP discharges to receiving waters with nutrient impairments or nutrient TMDLs, the biofiltration media should be designed with the specific goal of minimizing the potential for export of nutrients from the media. Therefore, in addition to adhering to the City or County media specifications, the following guidelines should be followed:

1. Select plant palette to minimize plant nutrient needs

A landscape architect or agronomist should be consulted to select a plant palette that minimizes nutrient needs. Utilizing plants with low nutrient needs results in less need to enrich the biofiltration soil mix. If nutrient quantity is then tailored to plants with lower nutrient needs, these plants will generally have less competition from weeds, which typically need higher nutrient content. The following practices are recommended to minimize nutrient needs of the plant palette:

- **Utilize native, drought-tolerant plants and grasses where possible.** Native plants generally have a broader tolerance for nutrient content, and can be longer lived in leaner/lower nutrient soils.

- **Start plants from smaller starts or seed.** Younger plants are generally more tolerant of lower nutrient levels and tend to help develop soil structure as they grow. Given the lower cost of smaller plants, the project should be able to accept a plant mortality rate that is somewhat higher than starting from larger plants and providing high organic content.

2. Minimize excess nutrients in media mix

Once the low-nutrient plant palette is established (item 1), the landscape architect and/or agronomist should be consulted to assist in the design of a biofiltration media to balance the interests of plant establishment, water retention capacity (irrigation demand), and the potential for nutrient export. The following guidelines should be followed:

- **The mix should not exceed the nutrient needs of plants.** In conventional landscape design, the nutrient needs of plants are often exceeded intentionally in order to provide a factor of safety for plant survival. This practice must be avoided in biofiltration media as excess nutrients will increase the chance of export. The mix designer should keep in mind that nutrients can be added later (through mulching, tilling of amendments into the surface), but it is not possible to remove nutrients, once added.

- **The actual nutrient content and organic content of the selected organic amendment source should be determined when specifying mix proportions.** Nutrient content (i.e., C:N ratio; plant extractable nutrients) and organic content (i.e, % organic material) are relatively inexpensive to measure via standard agronomic methods and can provide important information about mix design. If mix design relies on approximate assumption about nutrient/organic content and this is not confirmed with testing (or the results of prior representative testing), it is possible that the mix could contain much more nutrient than intended.

- **Nutrients are better retained in soils with higher cation exchange capacity.** Cation exchange capacity can be increased through selection of organic material with naturally high cation exchange capacity, such as peat or coconut coir pith, and/or selection of inorganic material with high cation exchange capacity such as some sands or engineered minerals (e.g., low P-index sands, zeolites, rhyolites, etc). Including higher cation exchange capacity materials would tend to reduce the net export of nutrients. Natural silty materials also provide cation exchange capacity; however potential impacts to permeability need to be considered.

- **Focus on soil structure as well as nutrient content.** Soil structure is loosely defined as the ability of the soil to conduct and store water and nutrients as well as the degree of aeration of the soil. Soil structure can be more important than nutrient content in plant survival and biologic health of the system. If a good soil structure can be created with very low amounts of organic amendment, plants survivability should still be provided. While soil structure generally develops with time, biofiltration media can be designed to promote earlier development of soil structure. Soil structure is enhanced by the use of amendments with high humus content (as found in well-aged organic material). In addition, soil structure can be enhanced through the use of organic material with a distribution of particle sizes (i.e., a more heterogeneous mix).

- **Consider alternatives to compost.** Compost, by nature, is a material that is continually evolving and decaying. It can be challenging to determine whether tests previously done on a given compost stock are still representative. It can also be challenging to determine how the properties of the compost will change once placed in the media bed. More stable materials

such as aged coco coir pith, peat, biochar, shredded bark, and/or other amendments should be considered.

With these considerations, it is anticipated that less than 10 percent organic amendment by volume could be used, while still balancing plant survivability and water retention. If compost is used, designers should strongly consider utilizing less than 10 percent by volume.

3. Design with partial retention and/or internal water storage

An internal water storage zone, as described in Fact Sheet PR-1 is believed to improve retention of nutrients. For lined systems, an internal water storage zone worked by providing a zone that fluctuates between aerobic and anaerobic conditions, resulting in nitrification/denitrification. In soils that will allow infiltration, a partial retention design (PR-1) allows significant volume reduction and can also promote nitrification/denitrification.

Acknowledgment: This fact sheet has been adapted from the Orange County Technical Guidance Document (May 2011). It was originally developed based on input from: Deborah Deets, City of Los Angeles Bureau of Sanitation, Drew Ready, Center for Watershed Health, Rick Fisher, ASLA, City of Los Angeles Bureau of Engineering, Dr. Garn Wallace, Wallace Laboratories, Glen Dake, GDML, and Jason Schmidt, Tree People. The guidance provided herein does not reflect the individual opinions of any individual listed above and should not be cited or otherwise attributed to those listed.

WCTG Farm Worker Housing
5780 Mission Avenue, Oceanside, CA 92057

Home ▾ 85th Percentile Rainfall

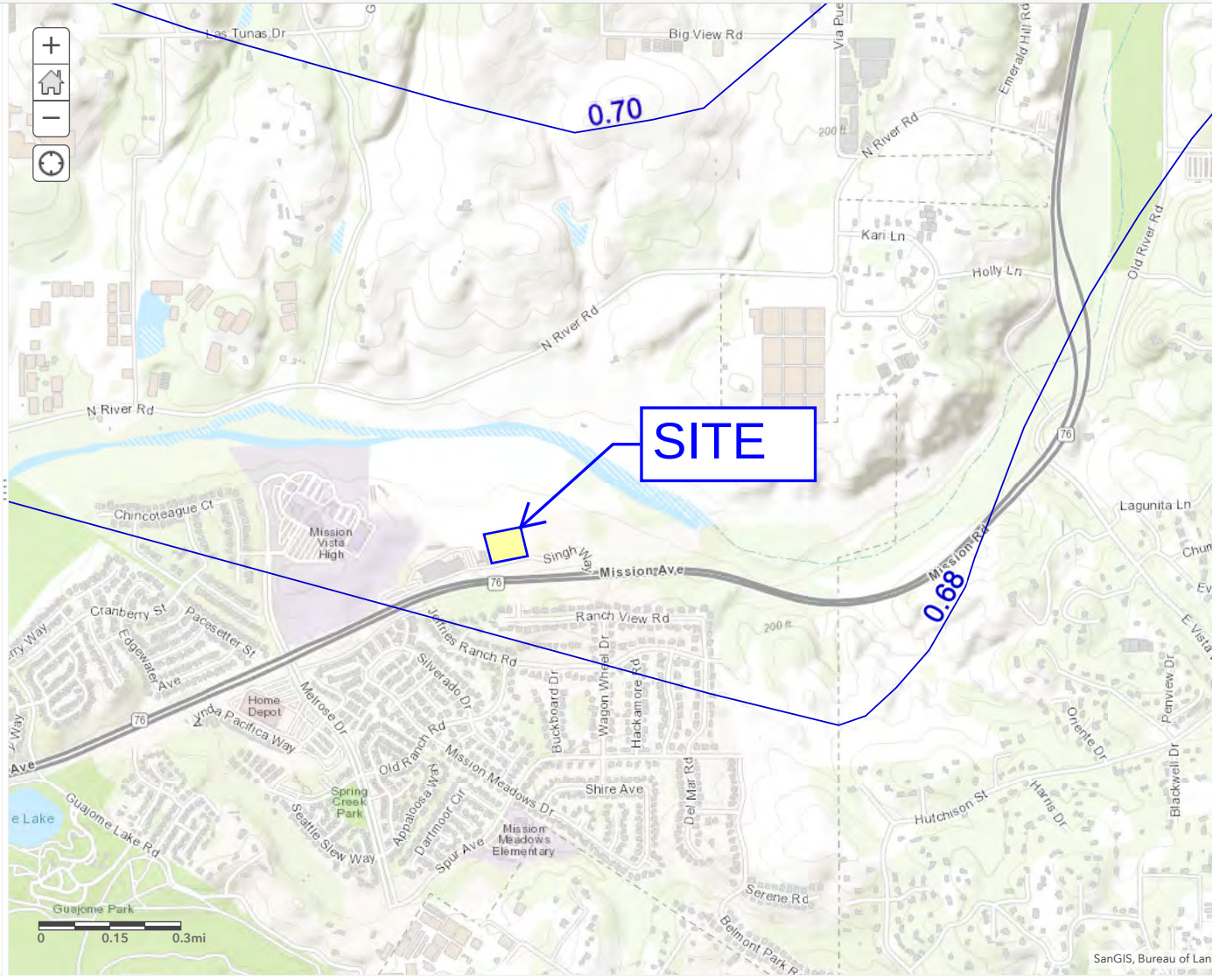
Details | Basemap | Share | Print ▾ | Meas

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Legend

85th Percentile Rainfall

85th Percentile Rainfall= 0.69 inch



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Storm Water Pollutant Control Hydrologic Calculations and Sizing Methods

Runoff Factor

Equation B.1-2: Estimating Runoff Factor for Area

$$C = \sum CxAx / \sum Ax$$

where:

Cx = Runoff factor for area
Ax = Tributary area X

These runoff factors apply to areas receiving direct rainfall only. For conditions in which runoff is routed onto a surface from an adjacent surface, see Section B.2 for determining composite runoff factors for these areas.

Table B.1-1: Runoff factors for surfaces draining to BMPs – Pollutant Control BMPs

Surface	Runoff Factor
Roofs	0.90
Concrete or Asphalt	0.90
Unit Pavers (grouted)	0.90
Decomposed Granite	0.30
Cobbles or Crushed Aggregate	0.30
Amended, Mulched Soils or Landscape	0.10
Compacted Soil (e.g., unpaved parking)	0.30
Natural (A Soil)	0.10
Natural (B Soil)	0.14
Natural (C Soil)	0.23
Natural (D Soil)	0.30

DMA ID.	Pervious Surface	$C_{pervious}$	$A_{pervious}$ (SF)	Impervious Surface	$C_{impervious}$	$A_{impervious}$ (SF)	$C=\sum CxAx/\sum Ax$
1	Natural (D Soil)	0.30	63,895	Concrete	0.90	83,473	0.64